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Autonomous Art Systems

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Media-N, the Journal of the New Media Caucus, invited submissions for this issue about the use of Autonomous Art Systems, tethered and untethered systems of making, autonomous vehicles, and related programming in creative fields of study. Relevant subjects included: artworks that address concepts of drones or surveillance as subject or form; the influence of emerging technologies on studio art practices; or critical/historical analysis of the entanglement of art and technology.

While offering insight into how artists are working with these evolving and emerging systems, especially in an ever-changing environment of current and pending legislation, this issue draws parallels between autonomous art systems and the impact of portable video recorders on the arts in the late 1960s and early 1970s. In looking back on specific histories of art and technology, this issue's contributors reference immediacy and shifts in artistic production but perhaps more importantly, pose the question: how will these new abilities, access, perspectives, and possible restrictions on technology be reflected in art practice of the future?

By offering artists new visual perspectives and production values previously unattainable without substantial funding, autonomous art systems offer access to both reference and production imagery which have significantly impacted the speed and scope of answered questions and desired research in the artists' studio. The immediate ability to explore our physical world untethered and share this information is both empowering and overwhelming to the artist, unbounded, albeit for the span of the battery life.

We received many excellent submissions and writings from our peers with the original call for proposals; we carefully curated this issue's selection to share a variety of experiences, techniques and pitfalls with you.

Echoing the speed of image acquisition and technology, the development of this specific issue has seen autonomous art systems carry prominent weight in international news with use by humanitarian groups, terrorists, activists, educators and artists alike. Multiple versions of commercially available "unmanned" and autonomous air systems have been released with constantly shifting legislation in the United States regarding privacy and legality of these devices. In the fall of 2018, Chinese UAS manufacturer DJI announced its first product that will carry a Hasselblad camera lens after their purchase of a majority stake in the Swedish camera company we

recognize as creating the medium-format film cameras that were used in the Apollo missions to the Moon by the United States.

The following readings were presented as a report of the current state of autonomous or "unmanned" art systems in February of 2017. They now exist as a time capsule of this societal moment as the field continues to fluctuate and evolve with increasing speed. We believe, at this point, it can be stated that as these systems mature, they become more autonomous, and we're aware that they start to look back on us. We wonder, how does this change our approach to art making, to living with surveillance, to the political? With each of these essays, the point-of-view shifts and considers the possible implications of this new tool being integrated into the fabric of our lives. This writing covers a fraction of current activity concerning autonomous art systems; as these new tools become more accessible, prevalent, and pervasive, we will continue to track the conversations.

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Drone On
Reconsidering Art2Drone

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ABSTRACT

Drone On considers artistic and scholarly responses to the evolution of drones from military machines to consumer toys. The author traces the changing meaning of the term "drone" by implementing the metaphor of "domestication" while discussing the artworks and essays from the 2015, Art2Drone exhibition and catalog, curated by the collective, v1b3. This essay is focused on works which critically address drones; consequently, the works discussed represent diverse forms including tactical media performance, image interventions, objects made from data generated by military drones and works which use functioning drones.

INTRODUCTION

As I write this in late fall of 2017, I have just skimmed another online tech news post asking for tips for a new "drone pilot." This ritual, repeated annually for seven years as we head into the holiday buying season, shifts the expected context: drones are toys and it is understood that the pilot in question is not military. He is an enthusiast, a civilian, looking to play, master and control its ability to fly, and perhaps capture images. Child's play, sixteen years after the 1st drone kill by the United States government on October 7th of 2001.[1]

The terms and labels we use to talk about this technology are used interchangeably, whether discussing toys or military tools of war. Through sharing of these labels, we engage in a process of domesticating tools originally meant for the battlefield. Caren Kaplan, in her essay, *Drone-O-Rama,* identifies this process as a kind of remediation which removes "most traces or connections to the past and thereby misdirecting historical, ethical, and political analysis and critique." [2] The toy drone modifies and pacifies the root term; drone.

By 2010, "drones" had begun their semantic migration from governmental and DIY hobbyist communities to the public at large. That year, the Parrot Ar.Drone, a very popular toy, was announced to much fanfare online. Interestingly, in one early review, the Parrot was referred to as a WIFI Helicopter,[3] an emphasis on its connectivity and control system versus it's "droneness." The Parrot was designed to be controlled by a mobile application, and was marketed to amateurs. One of the features of the Parrot is its ability to hover in place and its relative stability, which makes it far easier to control. This in contrast to the enthusiast drones which require special controllers, like those used for advanced radio-controlled airplanes, cars and boats; far more manual in their control.

As these toy drones became more accessible and the DIY drone community grew, artists began to experiment with them as a symbol and a material. Artist's projects emerged from multiple areas of the arts including, but not limited to dance, visual art, cinema, performance and new media. This increased activity by artists led to the *Art2Drone* catalog and virtual exhibition, which was produced in 2015 by v1b3: video in the built environment, with support from the College Art Association.[4] v1b3 is an artist-led collective which explores media art's ability to influence and shape the experience of space, while also shaping its sense of place. Since drones, in their military role, serve to control and define geographies and the bodies of those who inhabit those spaces, the v1b3 curators saw a connection to the group's central research interests. The resulting effort includes twenty projects by twenty-four artists and three critical essays. *Art2Drone* was curated by Conrad Gleber, Chris Manzione, myself and Gail Rubini. Included with the artist's projects are critical articles by Meredith Hoy, Abigail Susik and George Monteleone. Works were selected for the catalog to highlight diverse artistic approaches to grappling with the topic of drones as both idea and material. As a result, each of the projects includes the "drone" through implication, the manifestation of drone forms, and/or functional civilian drone platforms.

Drones began as a military technology and evolved and expanded its reach to consumer, business and domestic applications. This transition is akin to the process of *domestication*, a multigenerational development of technologies and cultural pressures which yield progeny able to capitalize on their new ecosystems and contexts. Artist's have used their projects to engage with many moments of shifting meaning and contexts of "drones". It is important to recognize at the outset that *Art2Drone* is not a comprehensive survey of artists working with drones. Important work has been done by numerous artists working prior to the catalog release, and throughout the historical process of the domestication of drones on this subject. The following examples are important reference points outside of the *Art2Drone* project.

Early projects by the German artist Roman Signer are particularly significant in this regard, including his 2008 work, *56 kleine Helikopter*, which is critically prescient as to issues surrounding the difficulty of controlling semi-autonomous and autonomous platforms. Signer's *56 kleine Helikopter* is a performance in which fifty-six radio controlled helicopters are flown in a gallery space. The resulting collisions produce a field littered with inoperable proto "drones"[5].

Martha Rossler's *Theater of Drones*[6]*,* 2013*,* is also significant. An installation of interpretive print materials which functioned to educate viewers about military drones, their use and the (then) new connection to consumer drones, it also included images of protests against American military aggression and drone use. One panel, featuring an Amazon.com page for the Parrot drone, was plainly composed in juxtaposition with a drone command center, a drone sculpture used in a protest, and an image of a pile of bricks; a building destroyed in a drone attack. The project has been presented in public spaces, further functioning to engage the public about the details of drones otherwise perceived as distant governmental activity, disconnected from the everyday life of its citizenry.

James Bridel's 2013, *Watching the Watcher,*[7] showcased the artist's evolving collection of satellite images of drones, excavating images of drones and drone sites from a mass of publicly available data. Similarly, Trevor Paglen's *Untitled Drone Series* is assembled from seemingly pastoral

images of the sky. Yet, within each image, hiding in plain sight, is a drone captured by the artist. The drone, barely perceivable, is easy to miss (and/or ignore).

Transposing Spaces

> It is a constant sound. A set of tones, a complex hum. An ambience, perhaps becoming part of what we perceive as the noise floor of our environment. Eventually, it might cease to be differentiable: the refrigerator, outside traffic, midnight sewer maintenance, urban helicopter rotors, cicadas. It also works visually: a field of gray as the gestalt product of a random array of millions of bits of black and white, an undetectable signal.
>
> *Liminal Airspace!,* George Monteleone[8]

George Monteleone's *Art2Drone* essay presents a litany of contexts in which we engage the term "drone." These span music theory, the entertainment industry, biology, commerce, utopian science fiction, and war machines. In his process of presenting short text fragments, he enacts the slippage around the term drone; the semantic drift. As the meaning jumps its tracks, we are presented with more and more examples of drone culture from our daily lives, where the deadly intent is obfuscated, and the defining of such terms as "friendly" and "enemy" obscure the implications of bodily harm, which are likewise lost. This is the harmless and desirable promise of a drone pizza delivery service, one faster than Uncle Enzo's speeding black cars in the seminal cyberpunk novel Snowcrash.[9] However, one only needs to search YouTube for "Epic Drone Crash" to see video after video of pilot and technology failures.

As a collection of works, the projects in Art2Done represent responses to the many issues raised on the continuum from military drones, to commercial drones as production tools to drone toys. This continuum traces a non-linear change in our use of the term, drone as well as a process of domesticating the drone as an object. One of the principle ways in which the artists of *Art2Drone* engage drone cultures is by imagining its implications for western populations by transposing location and landscape. This tactic realigns the site for experience of drones to supposedly unaffected populations, transforming the subject, a public used to hearing about (military) drones as something that happens "over there." It is now a domestic issue[10].

Domestication, is understood as "a sustained, multigenerational, mutualistic relationship in which humans assume some significant level of control over the reproduction and care of a plant/animal in order to secure a more predictable supply of a resource of interest and by which the plant/animal is able to increase its reproductive success over individuals not participating in this relationship, thereby enhancing the fitness of both humans and target domesticates."[11] In the case of domesticating animals, society gains more stable and proximal resources: grain, meat, pollinators. Through selective breeding and artificial selection, desirable traits are reinforced or enhanced to generate an advantage. These changes can radically change the ecosystems into which they are introduced. Similarly, the introduction of drone nomenclatures and technologies into the public sphere transforms the techno-social ecosystem, shifting forms and function of "drone-like objects" while modifying public perception. The ability to utilize the broader definition of drone and consumer technologies affords artists unique opportunities to engage in metaphor and material.

Abigail Susik, in her essay, "The Drone in Social Imaginaries," connects the use of drones by artists as a means of both interpreting this seemingly new technology as an imaging and locational extension of the body; a cyborg's component.[12] Artists are thus able to integrate this extension into their practices while choosing whether to address the militarized parent of these consumer children.

> …the drone distinguishes itself in its unusually disparate applications as an amusing hobby toy, a banal commercial tool, and a terrifying prosthetic weapon. The drone encompasses a double affective potential to appear as both laughable, endearing, and pet-like— or— as nightmarish, uncanny and symbolic on a primal level. If the drone itself currently possesses a riven identity given these wildly divergent applications, then it is no surprise that social imaginaries about the drone are likewise fragmented.[13]

Susik rightly argues that this current cultural moment, in which artists are investing in new technologies, is one of diversity. The drone has evolved and in its movement towards domesticity, it has adapted to a plurality of ecosystems and functions. However, a consideration of drone use and critical artistic practices must begin with military drone use within theaters of war.

Within loosely defined war zones, the presence of drones and the sound of their buzzing overhead is a method of defining geographies and of using fear and intimidation tactics to control the movement of bodies living in in these contested territories. Derek Gregory calls these zones "*spaces of exception*" and defines them as a space "… in which a particular group of people is knowingly and deliberately exposed to death through the political-juridical removal of legal protections and affordances that would otherwise be affordable to them.[14]" The presence of drones in military contexts affects the treatment and definition of the rights of those inhabiting these spaces through a negotiation and enforcement of internal laws and policies. As we consider domestication within a conceptual frame, it makes sense to discuss a set of artist's projects that distinctly addresses the militaristic function of drones, in order to drive home the introduction of this technology into such a diversity of social and cultural contexts.

A number of projects included in *Art2Drone* imagine a scenario in which domestic locations are spaces of exception. These works seek to intervene and interrupt our privileged distance from the tangible outcomes of the drone wars. *Drone Crash Incident* by Ricardo Dominguez, Ian Allen Paul, and Jane Stevens is a multimodal project the artists describe as "disturbance theater." Acting as consultants for the fabricated UC Center for Drone Policy and Ethics, the stated mission of the (UCOP) is as follows:

> The UC Center for Drone Policy and Ethics (UCDPE) is a new research institution founded by the UC Office of the President (UCOP) to explore the emerging implications of drone research, use and production within the UC system. Bringing together a group of interdisciplinary scholars and researchers from across the UC campuses, the center is involved in several collaborative research projects involving students, faculty and policymakers at the cutting edge of Unmanned Aerial Systems studies.[15]

Figure 1. ***Drone Crash Incident by Ricardo Dominguez, Ian Allen Paul and Jane Stevens. Courtesy of the artists.***

The artists distributed evidence of a domestic drone crash through UCOP in the form of documentation and press releases, and hosted a public town hall meeting. Press outlets including, *The Blaze*, *The Huffington Post*, NBC San Diego and *Boing Boing* picked up the story and further distributed the troubling image of a fractured drone in front of the UC San Diego Library, as well as context which revealed the UCOP as a critical art project. As part of the Town Hall Meeting, organizers stated that they wanted to *"teach basic drone safety techniques that can be practiced on a daily basis to keep ourselves and others safe."*[16] *Drone Crash Incident* presents a plausible fiction as a means to generate a dialog about the use of drones as remote war machines by erasing the distances between there and here and forcing us to confront these technologies in our own spaces.

The tactic of both transposing location and preparing, training or sensitizing local populations to the "new reality" of drones is shared in a number of other *Art2Drone* projects. *Drone Conditioning,* by Simon Remiszewski is a satirical web-based work which spoofs self-help aesthetics and language, while subjecting the viewer to the ever-present sound of a drone's buzz. The piece deftly plays with codes of pop psychology and infomercials; a script-type heading signifying the personal, a nearly transparent image of a loving couple in the blue sky background (the file name is family_fun.png), a call to"learn more" and a narrative text that talks about sound conditioning as a therapeutic counter to the anxiety living under the constant buzz of overhead drones will evoke. Once the web page loads, a sound file of a drone is activated and loops endlessly, thus beginning the conditioning process. One of the unavoidable implications is the privilege of the ability to end the drone's assault on the viewer's senses by simply closing the page.

Figure 2. ***In Drones We Trust, Joseph DeLappe. Courtesy of the artist.***

The push into public space, as demonstrated by *Drone Crash Incident* or the shareability of *Drone Conditioning* are strategies for prompting an otherwise inattentive American public into awareness and dialog about these issues. Joseph DeLappe's *In Drones We Trust*, moreover, locates the site of intervention to the personal and the politically symbolic space of currency. The artist has made available a series of stamps which allow the user to modify the pastoral landscapes on the back of the one dollar bill with a MQ1 Predator drone. Delappe says he noticed the empty sky on the bill and felt that "It seems appropriate, considering our current use of drones in foreign skies, to symbolically bring them home to fly over our most notable patriotic structures."[17] Once stamped, the money is released back into circulation to be found by an unsuspecting public. The project hacks our system of currency by creating the viral opportunity for the drone, in this case a political and critical image, to hitch a ride on the bill as it travels through our economic system.

In a similar vein, albeit with an upbeat imaginary drone payload, *AR Drone "Love Bomber" Over Bushwick*, by Patrick Lichty and Mark Skwarek, uses a mobile augmented reality application to place images of quadcopter drones into "real" environments. Users experience the piece on their smart-phone, which displays an image of the world as seen through its camera. Onto that image, and using gyroscopic and gps data, the augmented reality graphic is mapped onto a space, thus appearing as if it exists in the "real world." Lichty and Skwarek's project embraces popular culture aesthetics. The drones graphics are clearly based on consumer models and they are depicted dropping a payload of internationally cute and nostalgic 8-bit hearts reminiscent of 1980's video

games. The piece was first shown as an intervention during the Occupy Wall Street protests, and used the ubiquity of smartphones and social media to distribute the work.

Flyover 16 by Jim Jeffers, similarly positioned as a web-based work and thought experiment, inverts the socio-cultural context of a military drone and turns it into what the artist calls a "peace drone." In its new role, the drone follows a predetermined path and surveilles 16 locations important to the artist's personal history. The resulting ephemera is a map of the locations and pathways coded not based on their narrative or cultural significance, but instead coded using GPS coordinates (perhaps another level of protection).

Other artist's projects explore the political and ethical ramifications of military drone programs using a variety of strategies within gallery contexts. Nicholas Sagan's, *For the Love of...,* is an installation that combines live and prerecorded video projected surveillance feeds of the audience. The video is meant to root observers' bodies firmly within the space; capturing the subject. Overhead, one hundred and forty-six drone models of various small scales hang suspended from the ceiling of the gallery and create a distant and unmoving swarm.

In contrast to simulating the sense of being seen and observed, with *Flight Simulator*, Lile Stephens presents an experimental recreation of drone flights over Pakistan, Yemen and Somalia. Instead of relying on drone iconography, such as a military Predator drone, Stephens transposes the drone with an eagle; a pervasive symbol of American identity and power. The installation presents the underlying technical systems, the computer and monitor, as integral components and a matter-of-fact transparency made literal, both mounted in Lucite enclosures. Mounted in front of the monitor is a Lucite eagle, with airplane inspired led lights on the wings, which adds the first person/animal subject we imagine flying through the video landscapes.

Most drone missions operate outside the awareness of American civilian populations. However, military drone missions leave behind indications of their occurrence in the form of satellite images. Landscapes and built environments are altered after the explosion of missiles and bombs, and at times also include evidence of drone crashes. *ASM_frag,* by Nathaniel Hartman makes tangible the results of these "live fire" missions through the use of image translation and 3D printing. His source images are from smuggled photographs of air to surface Hellfire missile strike fragments. These images are translated into 3-dimensional forms and made into sculptures that act as evidentiary totems of these often secret events.

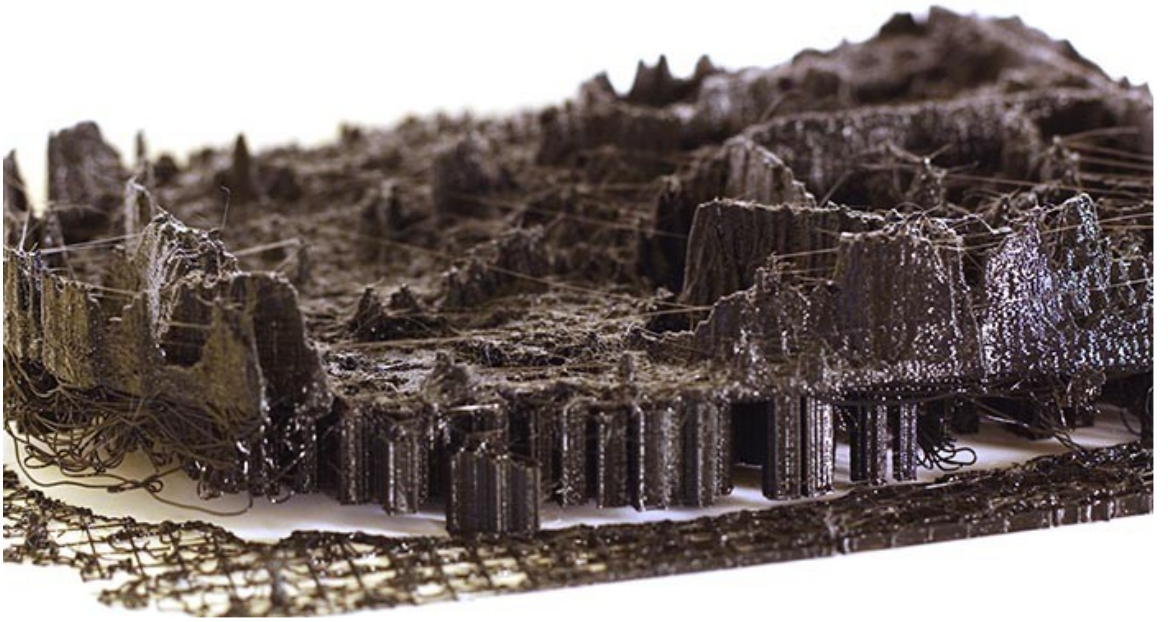

Figure 3. ***ASM_frag, by Nathaniel Hartman. Courtesy of the artist.***

For *Landscape Acquisition,* Scott Patrick Wiener uses a scale model Reaper RQ-1 drone to capture video footage of landscapes and contrasts this footage, presented on a wall-mounted monitor, with stills of archival military surveillance photography from unknown locations. Wiener's work aestheticizes the source material in an effort to have the audience's initial response relate to the artifacts as "beautiful" landscape photography and video. After reading wall texts, one can imagine disorientation upon recognizing the military and utilitarian origin of the footage.

Grappling with unseen operators, and the use of aerial surveillance technologies as a component of a larger system of controlling populations in protest, is central to the concerns of another gallery work, *Sanguine: Crowd Colorations* by Abelardo G. Fournier. Fournier appropriates ground level documentation of protests in Istanbul's Taksim Square and obscures the images of crowds with colored flower petals. Using an overhead projector, shadows of drones overlay photos of the protesters being hit by water cannons; the drone is the all-seeing eye, the conduit between the actors (police and protesters) and governmental power.

One of the military advantages of drone use is the lack of physical risk to the operator (not to detract from the emotional trauma that pilots experience.) Humans can pilot drones from halfway around the world. Yet, these drones can sometimes still suffer catastrophic failures resulting in dangerous crashes. According to the Washington Post and the Drone Crash Database, over 400 large U.S.

drones have crashed worldwide since 2001. Of those, 25% have occurred in the United States on training missions, and 33% of them occurred in Afganistan.[1819]

Failure is metaphor and a technological reality in a number of the presented works. Meredith Hoy says, "The malfunction of the drone, instantiated by the crash, is also the very thing that establishes its existence and renders it visible. The crash disrupts the capacity of the drone to control a territory through, first, disembodied vision and second, the brutal deployment of firepower."[20]

Domestications

Joseph Beuys' 1974 performance *I like America and America Likes Me* is instructive here. For the performance, Beuys interacted with a coyote, brought in from the wild, in a closed room for eight hours over a period of 3 days. The coyote had varied responses to the artist, who was wrapped in felt, throughout the duration of the performance. By the end, Beuys was able to wrap his arms around the coyote, possibly a sign that the animal no longer feared Beuys. This performance has a number of complex metaphors, but at its core it was placing a human agent in close proximity with a wild, undomesticated animal. The tension of coming face to face with the wild conveys an underlying danger. The rules and norms of social interaction are suspended when one actor is not part of or restricted in their behavior by the norms and values of the society in which it participates.

Long before dogs were considered welcome members of our family units, they were domesticated as work animals. They would protect, herd and hunt. A set of projects in *Art2Drone* similarly explore the drone as a semi-wild or semi-domesticated agents within the specifically domesticated cultural spaces of the gallery and performance theatre. The drone's visibility and close proximity, in their consumer guises, provides the opportunity to use the drone's semi-autonomy, its coded-in ability, to respond to inputs like sound, motion and data. Thus transforming the drone into a useful and responsive actor in its own right.

Charon by Sterling Crispin is a performance piece and sculpture that places a human in tension with an autonomous robotic agent. The drone is programmed with multiple interactive modes based on social conventions of aggressiveness, defense and playfulness. The human and drone appeared to dance with one another as the human attempts to read the "semi-wild" drone's "mood," and act accordingly. The resulting flight path and movement data was translated into a 3D printed sculpture as a means of documenting and preserving the interaction.

Another work which uses performance as a critical framework, and situates the drone as an autonomous actor within it is *Ophan*, by Nadav Assor. The piece is centered on a restrained and tethered drone that sings using the modified audio of a Jewish cantor singing chapter one of the book of Ezekiel. Assor explains,

> Ezekiel 1 is one of the main roots for a branch of Jewish Mysticism called "Merkabah mysticism". This name refers to the esoteric tradition concerned with achieving visions of the chariot of god and its component angels, usually via a shamanic out-of-body experience. …The Ophan as described by Ezekiel is essentially a mechanical being, a flying entity that is a wheel within a wheel, both of whose rims are covered with eyes. It is

remotely driven by the spirit of an anthropomorphic angel, the Cherubim, that is "within it.

Thus, the form of the drone, a hexacoptor with six arms extending out from a central core, combined with the drone as a sensor platform, resembles the Ophan of scripture. This spiritual aspiration is tempered by the physical restraints placed on the Ophan; it cannot fly free, as well as the interposed live broadcast from Israeli Defence Force radio. This audio snaps the piece from a spiritual state to one rooted in the political reality of contested geographies and the heavy use of drones as a tool of military and civil control. In the arena of the gallery, the piece acts out these complex dynamics.

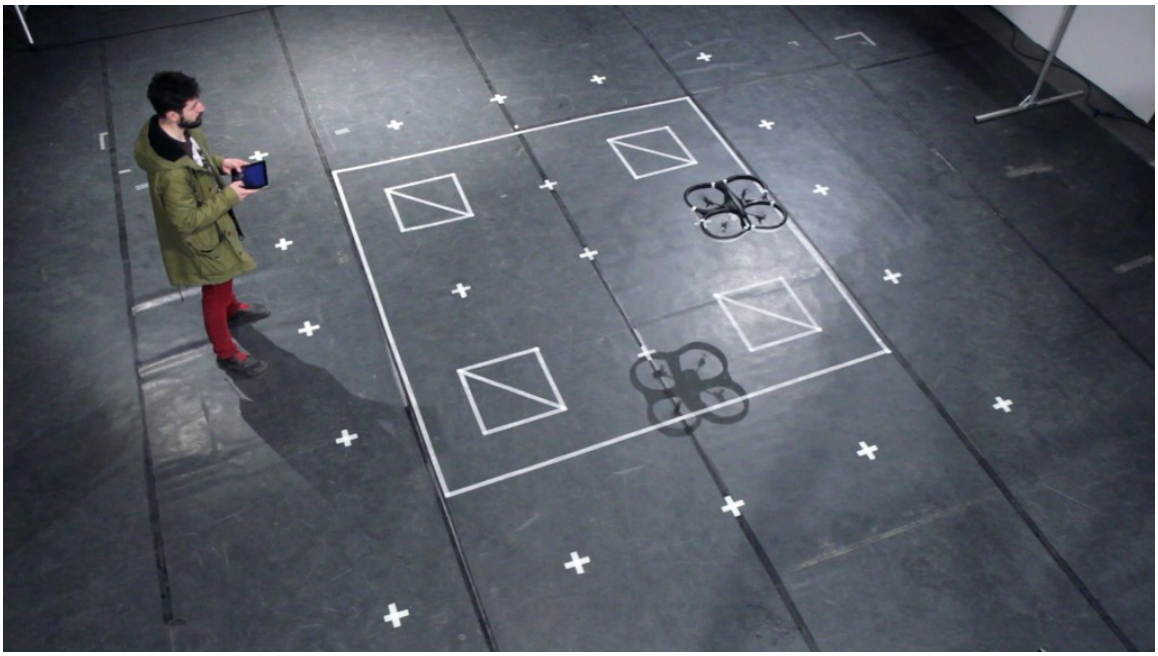

Figure 4. ***Composition for a Drone, Mária Júdová and Andrej Boleslavský. Courtesy of the artists.***

Two works use drones to visualize systems: *Composition for a Drone*, a collaboration by Mária Júdová and Andrej Boleslavský and *Crash!,* a solo work by Andrej Boleslavsky. In them, drones become instruments; tools and visualizers for hidden systems of sound and digital economies. *Composition for a Drone* uses the drone's location in space to activate different musical patterns and sequences. The operator plays the drone instrument by flying it through the performance space, and responding to the sounds and rhythms taking place in it. *Crash!* surrenders any sense of human control and instead patches Bitcoin values into the drone's flight controls, thereby visualizing the volatility of this digital currency, and risking both financial and literal lift or crash.

Instrumentalizing Social Relations

In less political projects, like Lee Montgomery's *Remote Control*, an exploration of large-scale light drawings of typographic forms, Richard Johnston's music video *Weightless*, and Paul Catanese's *Visible from Space*, we see examples of artists using drones as an aerial platform, affording the placement of cameras and imaging tools in otherwise inaccessible locations. Both Montgomery and Catanese are invested in the act of drawing at large scales. Montgomery uses the drone as a platform for producing long-exposure light drawings of typographic forms. The drone is flown in the pattern of a "Y" and a ground-based camera captures the "Y" as a floating, illuminated form.

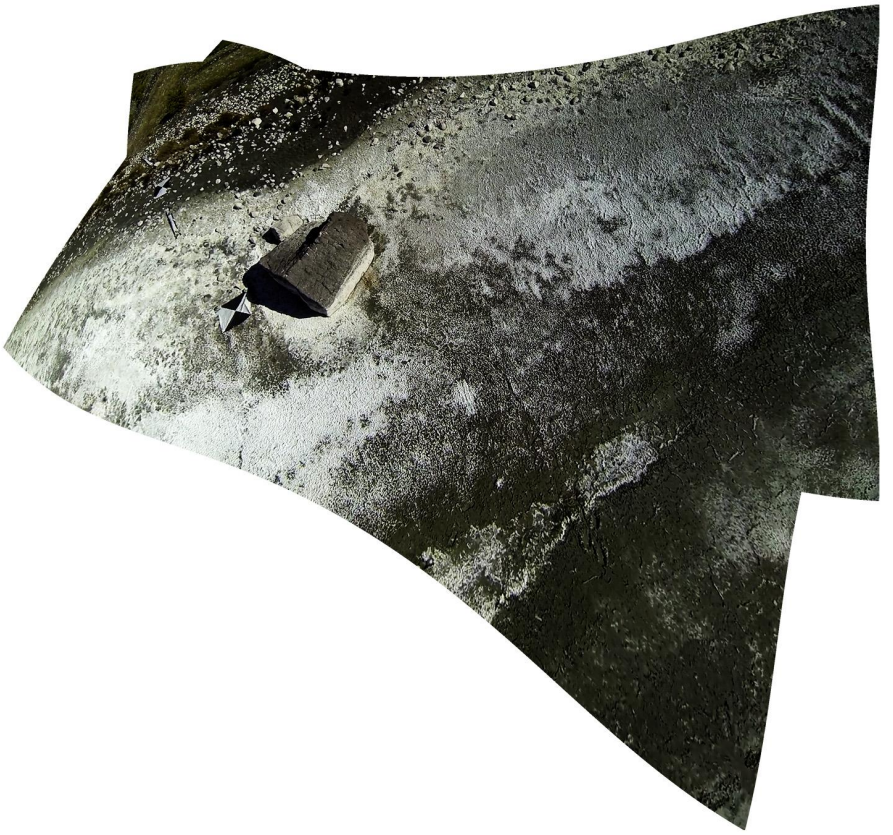

Figure 5. ***Visible from Space, Paul Catanese. Courtesy of the artist.***

Catanese's *Visible from Space* work began as a thought experiment about creating drawings on the earth so large they would be visible from the moon. The drone facilitates access to great distances from the surface of the earth, thereby allowing for documentation of large large-scale drawings and sculptures. The materials used in making the drawing replicate measuring tools used by surveyors, archeologists and curators in both the documentation of landscapes and objects. The resulting works include photographic documentation, sculpture and video that together utilize the visual language of rational documentation and scientific control to explore a decidedly poetic question.

As domesticated animals are brought into the home, a new social framework emerges; one based on companionship, friendship and family. A number of *Art2Drone* projects imagine a fully domesticated drone, one that facilitates relationships and is a significant force for community-building. In some cases, the works may be satirical, yet they are presented as genuine. Popular culture is awash in selfies as both a declaration that (the photographer) exists, and as a currency to be traded. *My First Dronie*, by Kathleen Rogers catalogs selfies made by 1st time amateur drone operators, thereby capturing evidence of this newly defined subcultural community. In a similarly optimistic vein, Carlos Rosas' *Revelry Revealed* is a disco ball mounted to a drone platform, meant to be a party delivery system. *Revelry Revealed* shifts the emphasis from the intense interest in developing drone delivery systems for commercial application, back to the social.

The final *Art2Drone* project, which focuses on social and community-building, bridges multiple popular ideas of how drones exist in domestic life. Liz Wuerffel and Jeff Will have launched *My Drone Brings People Together* as a catalyst for developing and supporting community-based initiatives. They leverage the public's interest in drones as a toy and a tool by offering aerial photography and video services through university-community partnerships. Activities have included documentation of county fairs, festivals and parades, surveys of ecological sanctuaries, constriction sites and the production of artworks which resemble Jackson Pollock paintings. Each of these initiatives uses the public's curiosity about this technology and/or a public need as an excuse to engage in social interactions.

CONCLUSION

Access and habituation are socio-cultural forces that have acted to domesticate the drone in contemporary society. Initially a military tool for surveillance, drones took on the role of munitions platforms providing a means to conduct military operations without physical risk to their operators. As the critiques and visibility of drones in our military and foreign policy grew, we began to witness artists engaging critically with the policies and impact these technologies have on redefining and controlling geographies and human bodies alike. As drone technologies have slowly been adapted to civilian applications, both as entertainment and in industry, artists have engaged critically and creatively with these tools. *Art2Drone* is a manifestation of curatorial field work which documents the wide spectrum of work being produced by artists and scholars at an important transitional moment wherein drones as term and technology are being absorbed into domestic use across multiple military, law enforcement, industrial and creative agendas.

AUTHOR BIO

Mat Rappaport's is a Chicago based artist, curator and educator. Rappaport's art work has been exhibited in the United States and internationally in museums, galleries, film festivals and public spaces. His current work utilizes mobile video, performance and photography to explore habitation, perception and power as related to built environments. Rappaport is a co-initiator of V1B3 [www.v1b3.com], which seeks to shape the experience of urban environments through media based interventions. He has published essays on media art in public spaces and artists critical responses to the drone wars in the Media-N journal, the iDMAa Journal and a chapter in the book *Beyond Globalization: Making New Worlds in Media, Art and Social Practices* by Rutgers University

Press. Rappaport's photographic work is included in the Midwest Photographer's Collection at the Museum of Contemporary Photography Chicago and in and at the Newberry Library Protest Art Collection. He has received fellowships from the School of the Museum of Fine Arts Boston, Howard Foundation, the Mary L. Nohl Fund, the Montgomery County Ohio Cultural District, and University of Wisconsin Milwaukee's Center for 21st Century Studies. Rappaport received his MFA from the University of Notre Dame and is an Associate Professor at Columbia College in Chicago.

ENDNOTES

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Drone Filming: Creativity versus Regulations in Autonomous Art Systems. A Case Study.

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ABSTRACT

This article explores the impact of drone regulations on the narrative potential of drone filming. The central focus of this exploration is a Case Study analysis of the production of a multi-screen audio-visual digital installation, *The Crossing* (Patel, 2016). *The Crossing* [1], filmed in central London, utilized the use of a heavyweight Unmanned Aerial System (UAS) also known as a drone with a 5-kilogram weight load capacity with the Alexa Mini WCU-4. Combined with the CForce Mini lens control system, the UAS gave unparalleled camera and lens control at extended ranges, providing complete pan, tilt and lens control and allowing dynamic moves in the air. The result was the ability to navigate through spaces to give intimate and playful shots that give the viewer 'alternate' versions of reality that only a machine can provide. Artists, performers and filmmakers are finding new kinds of beauty through automated programming where the drones are not just capturing the story but the machines themselves become the story. However, the operational scope of drones is limited by legal and health and safety regulations, particularly within built up urban environments. These regulations govern the vertical and horizontal distance from objects and people, line of sight, time constraints, weather conditions as well as security implications. Further restrictions include requiring a trained and fully licensed crew with permission from the relevant aviation bodies. This article seeks to answer whether these restrictions limit the creativity of the artist or challenge the creator to consider alternate ways of using these Autonomous Art Systems to inform the aesthetic scope of the captured image. This article will draw on a combination of original filming and broadcast examples to examine how legal and security restrictions on UAS inform the narrative and aesthetic realization of the final art form and subsequent emotional and physical response of the spectator.

This article explores the impact of drone regulations on the narrative potential of drone filming. The central focus of this exploration is a Case Study analysis of the production of a multi-screen audio-visual digital installation, *The Crossing* (Patel, 2016). *The Crossing* [1], filmed in central London, utilized the use of a heavyweight Unmanned Aerial System (UAS) also known as a drone with a 5-kilogram weight load capacity with the Alexa Mini WCU-4. Combined with the CForce Mini lens control system, the UAS gave unparalleled camera and lens control at extended ranges, providing complete pan, tilt and lens control and allowing dynamic moves in the air. The result was the ability to navigate through spaces to give intimate and playful shots that give the viewer

'alternate' versions of reality that only a machine can provide. Artists, performers and filmmakers are finding new kinds of beauty through automated programming where the drones are not just capturing the story but the machines themselves become the story. However, the operational scope of drones is limited by legal and health and safety regulations, particularly within built up urban environments. These regulations govern the vertical and horizontal distance from objects and people, line of sight, time constraints, weather conditions as well as security implications. Further restrictions include requiring a trained and fully licensed crew with permission from the relevant aviation bodies. This article seeks to answer whether these restrictions limit the creativity of the artist or challenge the creator to consider alternate ways of using these Autonomous Art Systems to inform the aesthetic scope of the captured image. This article will draw on a combination of original filming and broadcast examples to examine how legal and security restrictions on UAS inform the narrative and aesthetic realization of the final art form and subsequent emotional and physical response of the spectator.

The Crossing is an experimental cross-platform film that explores the story of a young girl trafficked into a multibillion dollar organized industry through the use of a 'lover-boy' technique (where a man seduces then grooms a young girl for trafficking through the promise of love or a better life). Within the film, the young girl's story unfolds through interconnected screens using intense sound design and perspective shifting visuals, including long floating drone shots. The film takes as its starting point the concept of 'hope' and its gradual unfurling reality into an exploitation of trust to perpetuate a $150 billion world trade in 21 million people, a third of which are children [2]. The result is an intense and immersive exploration of the destructive consequences of human trafficking through a heightened audio-visual experience.

I designed the project to enable the viewer to experience the disorientating and disturbing world of a trafficked woman through perspective shifting visuals and sound design. We used several creative tools to create this feeling including visual effects, graphics and sound design experienced through individual Bluetooth headphones. Another key element in constructing this world was the movement and speed of the camera, and in particular the UAS.

The UAS, or drone as it's more widely known as, is high on the UK Government agenda in terms of health and safety. The current Civil Aviation Authority (CAA) regulations [3] state that camera-equipped drones should stay within line of sight, maximum height of 400 feet (122metres), 50m away from a person, vehicle, building or structure not owned or controlled by the pilot and should not be flown within 150m of a congested area or large group of people. Recently imposed Government regulations mean that unlicensed drone users will be forced to sit safety tests as the number of near misses with planes increases by 60%. Police have been given greater powers to prevent unsafe or criminal use of the machines while new technology could be used to create no-fly zones for drones. This followed a near accident in July 2017 by a UAS flying directly over the right wing of an Airbus A319 whilst approaching the landing strip at Gatwick Airport, UK, putting 130 lives at risk according to the UK Airprox Board. However, the government recognized that drones have great potential and are committed to utilizing the full potential of the technology [4]. The government is also working with drone manufacturers on geofencing technology, to produce virtual barriers preventing machines from operating in restricted areas.

We worked with a fully licensed crew to film the drone footage within the film at four specific locations in central London - defined as a congested zone. This article focuses on two specific

scenes within *The Crossing* filmed with an UAS, and examines how the legal and security restrictions on UAS inform the narrative and aesthetic realization of the final art form and subsequent emotional and physical response of the spectator. The two scenes were filmed at the following locations, the grounds of St Pancras Old Church, Kings Cross, London and Potters Fields Park, Tower Bridge, London.

The proposed filming at both sites involved filming with an experienced crew with a UAS Operating Safety Case (OSC) of 10m, which allowed the licenced pilot to fly within 10 metres of people and property not under their control. Our film crew included: the director (myself), cinematographer, the pilot (UAS OSC 10m) drone supervisor (maintains the operational, health and safety communication with stewards, crew and CAA), Gimbal operator (controls the movement of the camera) and six stewards. The machine used was a heavyweight (20kg) UAS with a 5 kilogram weight load capacity with the Alexa Mini WCU-4. Combined with the CForce Mini lens control system, a MoVI 15 gimbal.

A Health and Safety plan had to be submitted to the CAA for full approval before filming permission was granted. The plan required the date, location and details of the proposed operation, the flight plan, stewarding and consultation plan and finally a risk assessment and method statement.

Our proposed operation involved aerial General Views (GV's) contained within defined boundaries with a 10m cordon implemented from the public at all times and 50metres from railway lines. Our pilot held Small UAS licence to fly UAS 7-20kg within congested areas. During any flight within a congested area or control zone, the aircraft was legally bound to operate an anti-collision strobe light with a minimum crew of two persons (pilot and spotter/photographer), at a height exceeding 600 feet above ground level at a distance beyond the visual range of the person in charge of the aircraft, or a maximum range of 500 metres. The aircraft could not fly within 10 metres of any person, vessel, vehicle or structure not under the control of the pilot. The aircraft was equipped with a mechanism that would cause the it to land in the event of disruption to or a failure of any of its control systems including the radio link. The pilot was liable for checking the air-worthiness of the machine, the camera was properly secured and that the flight could be safely be made considering the wind and other significant weather conditions. This particular UAS had a wingspan of 01.56 metres operating flights capable of 6-8 minute durations. The flight plans show a flight zone within the red perimeter and flight impact zone, and notification of any public transport areas (e.g. Network rail in the case of the St. Pancras location). All stewards were bound to attend safety briefings led by the pilot and act accordingly. The stewards were appointed on location wearing high visibility clothing and placed at access points for where the public or members of staff may come through the flight zone. Physical barrier tape was used where necessary. All communication occurred via mobile phone and hand visual signalling. The UAS carried a Teradek Bolt 2000 Pro HD downlink for monitoring ground station. If anyone required access or strayed into the flight cordon (public incursions) - then the pilot had to move the UAS away or land until safe to continue. As part of the consultation plan - notifications were made to the Met Police, Camden Film Unit, Adjacent residents and offices, Network Rail and NAS. A generic Risk assessment for Congested Area UAS detailing flight redundancy and aircraft system safety was submitted prior to filming.

The rationale for filming at Potters Field, London close to the Tower Bridge was to capture the financial sector at Bank on the other side of the river to reinforce the black market economy that

drives trafficking, and to capture this at the 'magic hour' -sunrise. When we arrived there was thick fog and mist. Up until that point we did not know what the weather would give us. Usually that would have caused substantial issues for filming, but drone shots can be much more interesting when the elements give you something much more interesting to play with. Flat, bright light doesn't actually look that beautiful from a drone's perspective, but drama and shadows do. The stewards were placed at key points around the perimeter of agreed location to control movement in and out of the line of sight of the drone. We felt that at that time of the morning there would be very little issue, however, it was the morning after Halloween, and there were some drifters from the festivities from the night before which made for interesting additions to the landscape. The stewards communicated via mobile phone to either hold passer-by's back until we had completed a shot, or to land the drone until movement had stopped. The mist made it really magical. And when the drone was taken up - it offered a new perspective on the landscape. The banking quarter wasn't visible, but the necklace of lights along the boardwalk and on Tower Bridge, provided track lines that the drone could play with and capture. The drone could gently track and drift over the top of the head of our young girl and create a real sense of isolation, foreboding and hyper-reality. It's an extraordinary plane just 400 feet up. A few hours later in the same environment would have been completely different. The legal restrictions on filming forced us to consider very early in the morning at such an iconic location, which a few hours later would have been absolutely packed and filming impossible.

Dziga Vertov's 1923 manifesto, asserts of the camera 'I am the kino-eye, I am the mechanical eye. I, a machine, show you the world as only I can see it'. Vertov's observations continued in his 1929 essay, From Kino-Eye to Radio-Eye, 'Kino-Eye means the conquest of space… the possibility of seeing life processes in any temporal order or at any speed'[5]. Our UAS gave us unparalleled camera and lens control at extended ranges, providing complete pan, tilt and lens control and allowing dynamic moves in the air. The weight the machine holds takes it to a new dimension, enabling beautiful stability with its weight and the use of a higher calibre camera, the Alexa Mini for more impactful material to be shot achieving the quality of ground based cameras, rather than limited to the weight capacity of the lightweight drones. Its Kino-Eye captured beautiful, ethereal and impactful shots. One spectator commented "The movement of the film in relationship to myself made me feel like I was moving through the story" [6].

Our second location examined for this article focuses on the St Pancras Gardens, Kings Cross, a small enclosed park overseen by the Parish of St. Pancras, with a road to one side, hospital to the end and the Kings Cross railway line over its walled borders to the side. We were restricted to filming in the late afternoon after the parishioners had left after the Sunday service. We placed safety notices around the park, and leafleted the nearby residences, hospital and notified National Railway that we would be filming with contact numbers for those that had queries or objected. There were a few visitors walking their dogs in the park, controlled by our human ring fence of stewards. The park was chosen for its proximity to the railway line, an element of the narrative within the story illustrating the journey of our trafficked girl. We were once again open to the elements having filmed in the mist and fog a few hours earlier - we were unsure what the afternoon would bring us, we hoped not rain or wind. We were faced with the autumnal hues of fallen leaves and the afternoon sun slicing through the trees casting dramatic shadows. Here we used the drone to capture the environment, with the propellers of the drone pushing the leaves forward which filmed at 100 frames per second draws the audience into the hypnotic movement of the leaves extending the hyper reality of the narrative. We used the drone to travel from our young isolated

girl up through the trees, panning and tilting, utilising the full range of the 360 gimble as it moved upwards through the magic of the trees until reaching the top revealed the harsh ugliness of the railway line and the reality of the dirty city she had given up her family for. The grounding stability of the camera, with the drone's extraordinary stabilization allowed these circular movements to swirl seamlessly capturing beautiful floating footage. The movement was similar to that of internal human stabilization - e.g. the way we move our heads or when we move our bodies. In effect, as humans we can see in beautifully smooth cinematic terms rather than an awkward jerkiness. Similarly with drones, there has to be an invisible movement that doesn't disturb the smooth hyper-reality of the shot. The more recent UAV's have been developed and adapted to counter the jerkiness and the heaviness of the camera and the gimbal supports the balancing and movement, though this is still subject to weather conditions.

The 'gaze' is a key element within this film. The gaze of our young girl connects, doesn't flinch and draws the spectator to her eyes, her story and to understand the narrative from her perspective. John Berger's considers the spectators gaze as 'voyeuristic' when viewing art or film [7]. The idea of the gaze focuses upon the viewer and their relationship with what they see, we are invited by images to see in a particular way, but we also come to them with already existing relationships to what we see. Duncum [8] suggests that 'this means that considering the gaze is a way in which to understand ourselves as individual and as a society'. The gaze means reflecting on whether the very act of our looking implicates us in a violation of the subject of our gaze and throws a spotlight on us, as viewers and our context. Fundamental to Berger and Duncum's approach is the presumption that while knowledge is integral to vision, the relationship between knowing and seeing is complex and unsettled.

Feedback from a visitor at the Ruskin Gallery, Cambridge exhibition underlined this approach,
"I felt the 'artistic' visual aesthetics played an important role in humanizing the storyteller. They acted as a sort of partial barrier, disallowing me to objectify (de-humanize) her with my pity. This contrasts with the type of images which would accompany this type of story usually in documentary/news reporting online or on TV. It also worked to connect me to her as a 'normal' person', 'someone like me', connecting me to the idea that his can happen to anyone."... It makes me think about my role as a BYSTANDER. If I know what is happening, why don't I take action?' [9]

To capture this gaze, the pilot flew the drone as close as he reasonably could within the legal limit of 10m. The aircraft, could not be flown in winds above 15 miles per hour, and the craft we used had dual-redundancy flight control which means if one goes wrong it can be switched to another, and it includes a ballistic parachute etc. to satisfy the CAA that the team had the necessary control to bring the drone down with a control descent from 600 feet to within a 10m radius.

I would argue that that the health and safety regulations placed upon the use of UAV's challenge the creators to consider alternate ways of using the drone to inform the aesthetic scope of the captured image, rather than restrict their creativity. Drones can now handle much bigger cameras, which is having a significant impact in terms of how it is used and by whom (e.g. features, drama, commercials, etc.). Cameras such as the Alexa Mini or the Red give unparalleled camera and lens control at extended ranges, providing complete pan, tilt and lens control and allowing dynamic moves in the air. This means that instead of the usual 12mm fixed wide lens of the Sony G8 or the Panasonic GH4, which give uninteresting 'factual' looks to film, we are able to experiment with

different lens combinations that open up numerous possibilities. The very nature of the concept of *The Crossing* i.e. to create an immersive experience for the spectator provided the drone operators with a much more interesting proposition - i.e. the ability to experiment with the space giving intimate and playful shots which were not defined or constrained by a specific narrative. The UAS is a very different tool to a conventional camera because of its ability to float through the air, operating on different conventions to a jib or a crane that carries a camera. The director's vision combined with the knowledge and skill of an experienced drone operator can produce exciting imagery based upon the communication of the team and how that vision is interpreted via the combined disciplinary expertise. The UAS facilitates working in a space that before the drone goes up, we wouldn't have had access to before, and dependent on the movement and trajectory of travel brings a different perspective on the captured space. The director can integrate the intimacy and the aesthetic, combined with the other elements of the filmmaking process, such as voiceover and sound design. Adam Gee, Commissioning editor, *Forbidden Zones* [10] emphasizes the role of the soundscape in driving a hyper real perspective on films using drones in particular, particularly within the films he commissioned and combined with voiceovers (similar to The Crossing) can really give you an intimate insight into the narrative layers embedded within the film.

Drone supervisor, Emma Boswell, *The Helicopter Girls* [11] emphasizes the importance of the recce prior to filming to consider how the drone can 'play' in the environment given the operational scope limited by health and safety regulations, particularly within built up urban environments. When considering the vertical and horizontal distance from objects and people, line of sight, time constraints, weather conditions and security implications - the recce is vital. However, when first entering an environment for filming, the team should consider what can be drawn from the environment rather than just the restrictions. Apart from looking for objects that the drone may fly into - look for foreground objects and what they can reveal. Identify the narrative within the movement of the shot itself. The key is to consider 'how can we play' with the environment and to also be prepared for changes in the weather and environment that will impact on what is captured and how safely.

Drones are still a niche interest but they have reached a mass market tipping point where a drone can be bought quite cheaply and readily on the high street. They have captured the collective imagination because they can enhance the recording of our experiences in the natural world in a way that had never previously been dreamed of without huge expense. This new landscape can give you an extraordinary view of a place that we can't visit - but the machines can, e.g. *Postcards from Pripyat, Chernobyl* [12]. It can reveal truths that can't be denied and that pictures from the ground cannot. There are many ways of playing with perspective and narrative e.g. Tim Sessler's *Balance* [13] playing with the contra-zoom and the roll-axis filmed producing shots that enhance the narrative.

The rules and regulations may be seen as constricting creativity, but when operating with a fully licensed pilot and UAS crew, you are able to pioneer flights in congested areas where drones aren't generally able or allowed to go. It does mean a massive undertaking for the pilot who has built the aircraft to record every single detail, right down to the torque on the screws to prove to the CAA that every single point of failure on the aircraft has been addressed. But by working with experienced crew the health and safety regulations can be developed to reduce redundancy from the normal 150 meters right down to 10m, reducing the safety bubble around the aircraft down to 20m, which make a lot more things possible. The key to creating innovative, creative visual content

is knowing what the boundaries are, playing within them and maximising the full potential of these extraordinary machines.

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The Future's Ecology (to mothers)

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ABSTRACT

We collect data about our environment at an unprecedented scale and the surveillance of individuals on a global scale goes hand in hand with it. Global public surveillance has constricted human rights, human bodies, lives, work, and human relationships with others. Privacy as we know it has vanished *de jure* and *de facto*. To disappear from the grid – for instance to recover from *privacy loss* - is almost impossible. We live in a state of persistent surveillance and identity theft. Can one live outside of this kind of state system without becoming a criminal?

People are, as cognizant beings, truth seekers, and sometimes even depraved counterfeiters. They look at both old and new sources. They produce new knowledge with or without disregarding the old. Some dream about break-through achievements. Others prefer to share their feelings and thoughts, ask more prosaic questions, or just create works of art. Since history doesn't repeat itself, it is difficult to construct a comprehensive account of the different leftover ephemera from the relationships, art, books, conversations, or even food we have experienced.

In Chris Marker's film, *La Jetée*, the main protagonist' is subjected to a nightmarish chemo-experiment and "travels" in space-time. In one of the film's profoundly symbolic scenes, during his journey into the past he points beyond the last ring of trunk of a redwood tree and says to a woman, "This is where I came from."

In philosophy, *hylopathism* is the belief in the derivation of *sentience* from matter. Trees grow, age and die without a central nervous system.[1] They don't have a human kind of "mind." They grow along a biological clock and very noticeable planetary seasons.[2] They do possess hormones and are capable of localized information processing. They respond to their exteriority in a very slow way, which - if combined with dendrochronology[3] - makes them extraordinary *analogue instruments,* taking note of *analogue events*. Dendrochronology is also used for the calibration and checking of radiocarbon dating (carbon-14 calibration).[4] While admittedly dissimilarly organic, all organic and synthetic bodies (technological instruments) function within the same ecological sphere and its systemic influences and are attuned to produce true outcomes.

DUELING WITH TECHNOLOGY

Unmanned Aerial Systems (UAS) belong to one of the fastest growing industries. Currently the Federal Aviation Administration (FAA) requires small UAS owners and operators to register

them.[5] Although FAA safety guidelines generally coincide with other countries, they can vary - with or from country to country, city to city, even from area to area. Furthermore, an entire country or city could be declared a no-flight zone to satisfy a religious leader or political authority almost overnight.[6] On the other hand, UAS manufacturers levy upon UAS users frequent software and firmware updates enforcing technical - and often not so technical - changes to UAS operability. Often those updates are enforced without warning, which can severely conflict with a video production schedule.

In addition to registration, logistics and keeping up with the most current firmware, a UAS aviator is expected to have sufficient flying expertise, and an artist-aviator is expected to be additionally concerned with all art-motivated objectives: a sense of timing, composition, and feeling, to name only a few. Without doubt, the choice of exteriority is fundamental, as it is concerned with location, flying range, environmental and social conditions. All things considered, one of the most important features of the current small UAS's operability is its convenient portability; one of the biggest limitations - despite ongoing improvements - is the instability of the navigation signal and the longevity of the battery charge.

Unmanned Aerial Systems are sophisticated material and technological objects but, like the trees mentioned previously, they do not possess a human kind of "mind."[7] Additionally, although they are sensor-reached and operationally advanced they are not fail-safe devices. The use of an UAS is technical and logistic, and requires prior preparation. However, actual flying remains dependent largely on human performance. For instance, with the remote control and the UAS's camera "eye," an operator can see what the camera is looking at in almost real-time. A small delay due to wireless transmission and display lag is disconcerting but negligible to an experienced operator. Further, the experience of flying and recording in the public sphere - with a natural environment or audience around - affects video recording plans and is almost never free from subjective influence (feelings, sensations, human interaction).

In retrospect, almost all significant UAS and non-UAS recordings I have made ended up being a blend of planned and improvised footage. For instance, in August 2008, there was a full solar eclipse in Xi'an, China. My video camera was set on a tripod in front of a local railway station. The area was filled with people, standing, walking or rushing to catch their train connection. People behaved restlessly and I felt the pressure as well - to catch my train to Beijing departing in less than 45 minutes. But above all, I was there to video record the ongoing eclipse. Since my large camera was an anomaly to typical tourist gear, it attracted the attention of the local population almost immediately. Bear in mind, the camera's LCD viewing panel allowed for the observation of the eclipse with the unprotected eye. Time and again, the tripod was shaken by curious spectators and I had no choice but to organize and manage what had become an eclipse observation spot. What was happening in the sky became as important as what was happening on the ground. Over time I noticed that the visualization of this extraordinary sky event took the form of a hyperbole: with the neutral density filter-stop set to its maximum and the iris almost closed, what was super-bright became just bright while what was just dark became blacker-than-black, allowing an unobservable astronomical event to be observable.

OPPORTUNITIES

According to the FAA there are around two and half million Unmanned Aerial Systems that fly within the United States. This number is projected to be three times higher by 2020. The UAS industry is now expanding at a rapid pace worldwide and has become part of the arsenal of the most advanced products in flagship projects in defense, commerce, science and civilian applications. Large or small, they have become equipped with sophisticated instrumentation now widely available to a wider user base, including artists.

How do artists, writers or philosophers respond to scientific and technological advancements? The common nightmare is the idea of a machine becoming cognizant of exploitable human experiences: sensation, belief and will. But hasn't such exploitation already become a fact of life on a global scale? Mankind conquered space but lost its sense of place through excessive promotion of ferocious competitive behavior, by sticking to a "forward" moving narrative at all costs, we locked our-*selves* inside a philosophical bubble that is set to burst.[8] In his *Architecture of Nihilism: On the Philosophy of Modern Architecture*, Massimo Cacciari emphatically observes "The conquest of space is the liquidation of the place as a collection of things, as a mutual belonging of things and dwelling. The conquest of space is the plundering of places: it conceives of space as a void to fill, a pure absence, a lack."[9] I would like to add that a plundering of human privacy occurs as well. "To the Architect belongs precisely this conception of space: space is pure void to be measured-delimited, void in which to pro-duce his new forms."[10] Without sentimentalizing, while looking back at the curve of our techno-scientific trajectory, we chopped up the habitats of every species simply because we could, and we did it with appalling brutality.

In my "50/50*"* video installation, there is an implied balance between space and place in the strictly urban settings presented. The feeling arising from watching this two channel video display is uncanny - it seems that the public and private divide still exists, but barely. On the left there is the non-place of an American highway. On the right is a private residence in an affluent residential neighborhood in Luxemburg. We are watching highway traffic and a swimming pool swimmer's *motion*, delineated within a man-made, designed, manufactured, delivered, and managed environment. What was supposed to be two have almost become one.

In his *Remarks on The Philosophy of Psychology* Wittgenstein asks: "Must I know that I see with two eyes? Certainly not. Do I perhaps have two visual impressions in ordinary seeing, so that I notice that my three-dimensionality visual impression is compounded of two visual pictures? Certainly not – So I can't separate three-dimensionality from seeing."[11] Wittgenstein speaks on ordinary spatial perception, the *50/50* installation offers seeing a pair, two video screens that are not compounded, hence providing for a different kind of reading. Both models operate by a different logic but it is logic all the same. In *50/50*, like in numerous other UAS cases, the camera points its sharp eye down at the ground - a different kind of plow - and offers a reconstruction of the link to it. It attempts to reconnect the signifier with the signified. I argue that, while nothing like flying represents the rapture of the bond between space and place, nothing like flying – even if only with one eye on the ground – can transcend this rapture and reopen the life function of uninterrupted habitation.

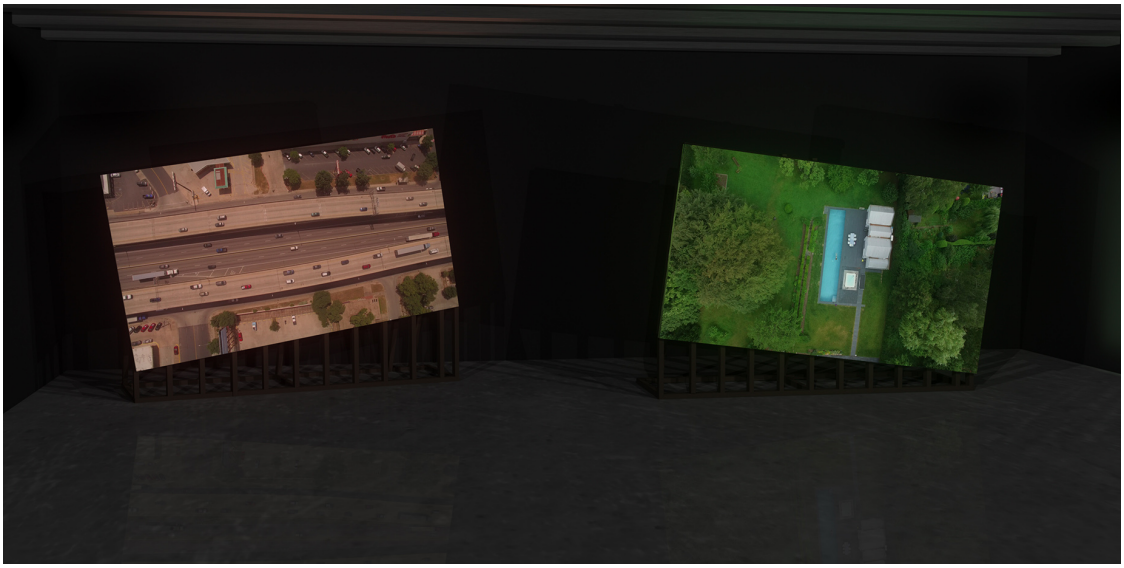

***Figure 1**. Bogdan P.K. Perzyński: "50/50" 2015, Two screen video installation, 31'x10.2'x5'. Courtesy of the artist.*

IN DEFENSE OF THE MIDDLE

"Modern Architecture tends to become autonomous from the earth, to free itself from the earthly roots, so much as annihilation of place," writes Cacciari.[12] Modernism and the contemporary provided for simultaneous upward and downward expansion leaving the middle (the visible-all-too-visible) "untouched." We are actively c o n q u e r i n g the upright (the beyond-bright, space, ultraviolet, seeing above the visible, counting increased radiation including cosmic rays of identifiable origin) and the downright (the below-dark, place, infrared, countering of decreased radiation including an object's thermal body print). As things stand with the world population, with businesses and politicians aggressively dispossessing the habitational opportunities of whoever and whatever they desire, whenever they can, the "middle" might still have its rights but is lacking actual opportunities to live in synch with its innate biological clock.[13]

In war or in peace, the biggest disruptors to the ecological system are people. Catastrophic events happen and undermine the stability of our World. The ability to move freely for humans is no small concern. In the name of theories and ideologies, we inflict on others indescribable losses and suffering about which we even don't even truthfully inform the public. Not only do we conquer, exploit, dominate and control others without remorse but we also permit destructive forces to fester and grow after we retract from our position. When the fact of being (who or what a person or thing is) is viewed as compounded, it (the "true" identity) becomes compartmentalized. Specifically in the case of humans, identity fractures into religious bonds, statehood, race, gender, non-social inner directives, and myriad others. Divide and control, or rather, divide and destroy!

Due to scientific and technological advancements, we collect data about our environment on an unprecedented scale. The surveillance of individuals on a global scale goes hand in hand with this. Global public surveillance has constricted human rights, human bodies, lives, work, and human

relationships with others. Privacy as we know it has vanished *de jure* and *de facto*.[14] For one to disappear from the grid, for instance to recover from *privacy loss*, is virtually impossible. We live in a state of persistent surveillance and identity theft. Is it possible for one to live outside of this kind of state system without becoming, or at least being identified as a criminal?

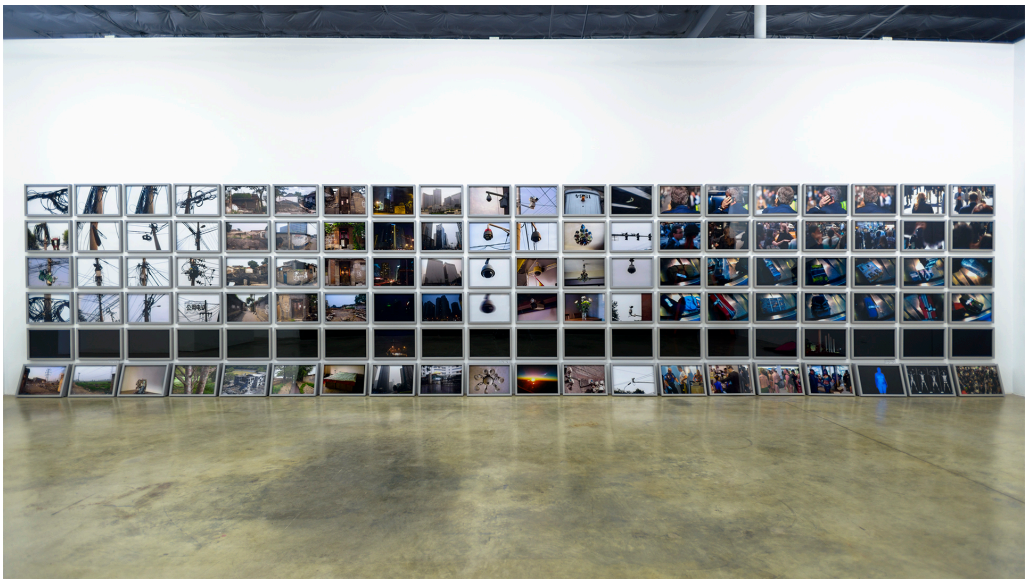

Figure 2. Bogdan P. K. Perzyński "TABLE". 2018, Photographic installation, 35'x7'2" x6". Courtesy of Liliana Bloch Gallery.

I have long been repulsed by airport culture but in 2013 I had the profound sense I would die in an airplane crash.[15] So, I stopped travelling by air and turned my "fear" of flying into a performance. Soon, I decided to take my decision one step further - to not travel at all, even out of town, for as long as possible. I stayed in my hometown. I worked online, worked on a large-scale photographic installation, on video computational fluid dynamics (CFD) and on computer generated imagery (CGI). I turned to working "locally," focusing, like a method actor would, on the nature of *local* and *global* systems, and viewed my *non-action* as a form of resistance. Somewhere outside, there was a system that was turning our lives into a kind of life-space where everything was supposed to be available at your fingertips, devoid of human connection. We stopped questioning it because the materialism of today's capitalism was already replacing the role myth played for our ancestors with the fixtures of augmented reality. Humans traveled widely and the world became a hall of mirrors; *otherness* had become increasingly rare.

I worked on the CFD video (*Test Shots*) and continued to work on *TABLE,* a photographic installation prompted by the periodic table of elements. Its working title was "Grid". *TABLE* is built of over seven hundred photographs of cultural, social, historical and autobiographical subjects all organized in clusters of themes and displayed in rows and columns. Although not photographed from a literal "bird's eye" view, it represents the cartographer's "top" view nevertheless.

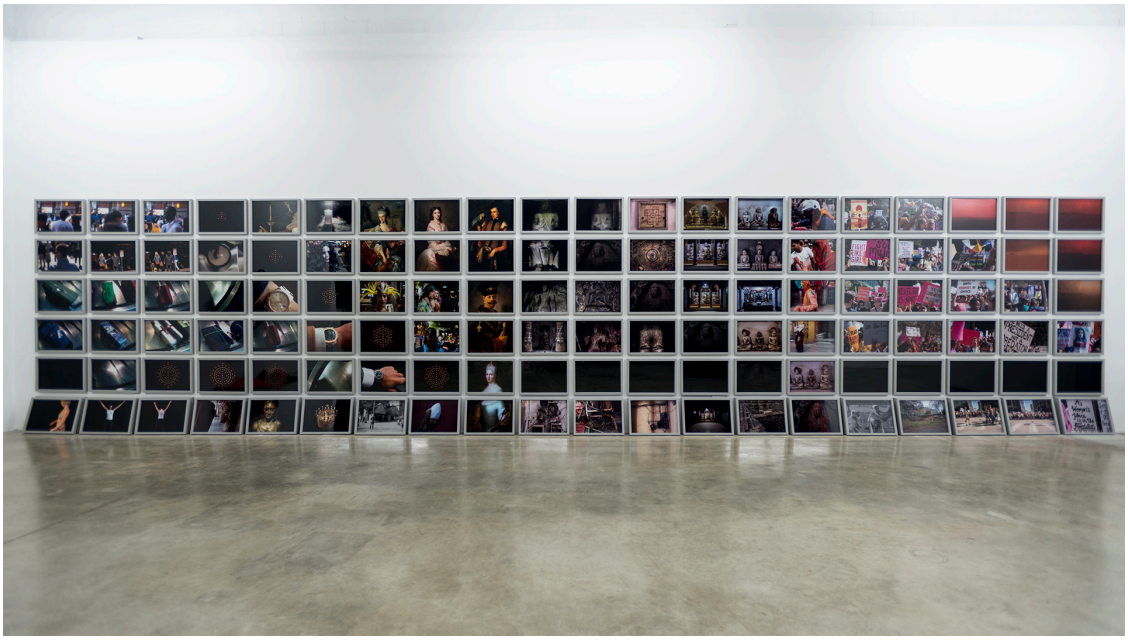

Figure 3. Bogdan P. K. Perzyński "TABLE" 2018, Photographic installation, 35'x7'2" x6". Courtesy of Liliana Bloch Gallery.

Near the floor level, TABLE refers to the most disconcerting conditions: border issues, war, violence, disease and environmental disasters, but also the body cult, mass culture aesthetics and personal fantasies. When first viewed, TABLE gives the impression of continuity.[16] When probed between discrete surface points it proves to be filled with a charge of variable readings. For *TABLE,* I approached photography as an entity controlled by an electric field. That is how the physical fundament of the work holds to its *generic* self but still passes across and though us into art. I have presented TABLE on three occasions: in Austin (2014) and in Dallas (2016, 2018).[17] In 2014 and 2015, it was mounted as a wall-to-wall installation. In 2016, a video on back-to-back motorized flat screens was mounted outside the gallery's main room and functioned like a revolving door. The video was recorded over and around the gallery's location at my preferred altitude of 400 feet (warehouses, roads, high power lines, streets, a creek, hotels and construction sites, as each came into frame.) With 0.2 rotations per minute, per screen, the piece took 5 minutes to make a full turn. In 2018, the wall-to-wall installation was interrupted by *Epimentheus*, a motorized and programmed video installation with powdered pigments placed underneath.

Figure 4. Bogdan P. K. Perzyński "Epimentheus" 2018, Installation: motorized video, silent, pigment, 51"x76"31.25" Curtesy of Liliana Bloch Gallery.

I started to travel again in 2015. It was the year of the *All the World's Futures* 56th Venice Biennale. I visited the Biennale's grounds and saw Giardini and Arsenale in my first few days in the city. The shows were strong. I bought a catalogue. There I found: "The presentations, performances, and discussions of *All the World's Futures* will play a host to what could be described as a 'Parliament of Forms' whose orchestration and episodic unfolding will be broadly global in scope."[18] These were carefully selected words, but the minute I laid my eyes on the "Parliament of Forms" and "All the World's Futures," I knew something was missing. The Biennale celebrated, among other "filters," Karl Marx's *Das Kapital*, yet an important means of artistic production, the UAS, was absent in the "All" of the Biennale. I returned to the Biennale's two main expositions[19] another day and performed and produced a two-part UAS video.[20] In it, I conducted a thought experiment: while performing in an actual public sphere, as in the famous Schrödinger's cat paradox, the artist was present ("alive") and absent ("dead") at the same time. Full disclosure, my participation in the Biennale was not sanctioned. I thought of Martin Luther King Jr.'s "Creative Maladjustment" speech: "Modern psychology has a word that is probably used more than any other word in modern psychology. It is the word "maladjusted."[21]

Shortly after Venice, I travelled to Orvieto. Often referred to as an Etruscan Acropolis, the city is a bit like an island - on the top of the volcanic rock cliff, with its magnificent gothic cathedral and famous St. Patrick's Well, and surrounded by agriculture. When I reached the cathedral there were thirty or more Ferraris parked in front of it, but this congregation of luxury cars and their owners left within an hour, allowing for the return of pedestrians. Streets in Orvieto are narrow, buildings are packed closely and the city seems more assembled than designed. It is rocks stacked on top of

a rock, man hand-made. I chose a spot in front of the cathedral and began shooting my first aerial videos at the site. While I was hovering above, a person observed my actions and eventually approached me to view the video streaming with fascination. "This is fantastic! I have lived in this town all my life, but never saw it in this way." I offered to send him some pictures after returning to the U.S.

The Assumption of the Blessed Virgin Mary represents the belief that the passage of her pure body into Heaven was true, physical and real. The belief claims she never mortally died. Her triumph over death is represented with a depiction of her body being transported up by six Angels, an image that fills the space above the main door to the cathedral in Orvieto.[22] The video depicted the cathedral's perfect beauty, an architectural achievement of the highest echelon. However, that was exactly what began to concern me: Could these images be too significant to be useful to me? In picture perfect irony, indeed they were. I could not clear the Fluxus maxim from my mind: "Concerned With Insignificances."

With very little time left, I rushed to another site, the Well of St Patrick. Here, like a light-fearing Morlock, voyaging in the time machine, I descended to the bottom of its Etruscan past. The site was magnificent, full of the theatrical aura of the past. My strategy was to be visually descriptive, to liftoff the UAS from below and video record the well on its flight up. While walking down was physically taxing it went smoothly. However, flying up turned out to be complicated. My UAS didn't know where it was, and thus could not respond to navigation as expected. The UAS chaotically moved against my instructions and even simple hovering was unattainable. I was standing on the narrow platform above the water of the well and there was no room to improvise. I could feel the power with which the drone ("Angel") tried to pull away from me. I grabbed it by its legs with one hand and turned its engines off with another. With so little time at hand, the experiment could not be repeated to produce better or even the same results, which implies that the original hypothesis (hylopathism) might have been correct or in error.

"This is My Gift to You" (2016) came from another two-fold (descriptive and experimental) strategy and again – like in the case of Orvieto – physically around a volcano formation. I recorded the video at two sites: in Herculaneum and at Mount Vesuvius. Vesuvius has a 20-year eruption cycle and is extremely active but has been quiet since 1944. I could feel the tension everywhere in the way that tsunamis, earthquake tremors, and volcanic eruptions still manage to frighten and humble us. They highjack us back into the prehistory of consciousness with the shock of an actual time machine. I made a recording of Herculaneum operating the UAS from an empty abandoned lot very close to the Mediterranean Sea. Although my spot was quite far away from ancient Herculaneum's coastal line, I was standing literally on earth deposited by the volcano. It was the kind of place that was ideal for flying but extremely hard to find. It was very early in the morning. I completed all my recording within an hour. The next day I travelled by car to the mountain and I climbed to its peak. The rim of the volcano looked much smaller than I had expected, an impression that would soon change. Once at 400 feet, the UAS, like a measuring stick, adjusted my first impression of the scale. There were a dozen or so people around who could not take their eyes off the site. I flew over the area of the crater and eventually descended to its bottom. A man near me whispered: "What a great use of a drone." I didn't know yet how central these recordings would become to *Epimentheus, 2018.* In this footage, there was a beginning with no knowledge of full future potential.

In March 2016, I had been spending some time in London, teaching at the Royal College of Art but also seriously considering video recording in the city. London didn't interest me as a "beautiful" city, even though staying there had its charm. After Orvieto, I sought a location without a face, just a "being there" at near zero "thermodynamics." I needed a non-place.[23] Due to the fame of London's sights, the task turned out easier to declare than to complete, but I did get close to something. I had chosen the Beddington Sewer Treatment Works. The plant was not close by, and after a somewhat long tube ride from North London I arrived at the Borough of Croydon, south of the city. The rest of the journey was spent in a car ride with two British friends.

The plant itself was visually inaccessible, far away and behind a large fence and tall trees. After several unsuccessful passes I found it. The images started to come. I flew around a couple more times to make the best use of my hard-earned recording time. What I didn't know was that there exists an ancient Roman Bath House directly adjacent to the plant's South edge. The video images suggested a direct correlation between the two but could a theory exist that explains their origin and spatial proximity?[24] Bath house-sewer? We don't find dinosaur and human bones "together" – and even if we did, carbon dating would separate them. Not only because they didn't exist in the same space-time, but also because the temporal isolation between humans and dinosaurs is colossal.[25] I thought of Feyerabend's *Conquest of Abundance* and his leading notion that "human senses and intelligence can take in only a fraction of what reality has to offer" and "Against Method" and his argument that there is no such thing as scientific method.[26] After one has exhausted hi/her own methods and reasons and still has not succeeded, one should turn to the abundance where there is no "I" or "mine."[27]

METHOD

The conceptualism, or "terminism," of William Ockham took ancient Platonism to an extreme. Ockham contributed to modern epistemology, but he also posed significant and long lasting problems. Problems caused by "Ockham's razor" are not necessarily like problems caused by contemporary theoretical models that attempt to make an attractive idea right. [28] Theories are picture-like objects, handy utilities that aide human memory but are devoid of the facts and sensual data upon which they are based.[29] Theories can easily become a form of psycho-surgery because a theory can act as variant form of "lossy compression." The question is: can the lossy compression also offer satisfactory data recoverability? For Wilczek, in theoretical work - in science - it is valuable to "truthify" even if the theory eventually "asks" forgiveness when it doesn't pan out. Only unscientific theorizing leaves no sense of guilt! The statement becomes very controversial as soon as we consider any kind of real life application. Firstly, if a theory is applied without one realizing its limitations, it can mutate into something dangerously erronious. Secondly, such an act takes upon itself an additional toxic meaning when used to consciously misinform and manipulate people, causing the outcomes to be profoundly detrimental to their body of rights, life opportunities, and overall well-being.

Consider terminism again. Thomas Nagel, in his celebrated *What is it like to be the bat*?[30] offers a view on the body-mind problem. He strongly recognizes the poor quality of characterization in regard to what constitutes a physical state but also flatly denies that a subjective human can understand the state of mind of an organism such as a bat. Daniel C. Dennett wrote a counter-response[31] to Nagel's essay and pointed out that his argument could be effectively resolved with

a third-person perspective, imagination and the extraordinary cognitive abilities humans have, thanks to the role language plays in shaping their consciousness.

If the first position hints at the pessimistic and second at the optimistic, to what end do we engage in one or the other? Should art and science contain goodness? With a third-person perspective, imagination and the extraordinary cognitive abilities of humans - as of 2018 – have produced more transistors than there are leaves on trees. Are we still living on the same planet? Are we here to kill it? Are we creating a cognizant cultural and civilizational trajectory or it is time to declare we are descending into perpetual despair?

THE FUTURE

A technological nexus is filling life with fully autonomous systems. For the time being, a UAS operator is still a human being. It is an any-person, a generic person-plus, an aviator-artist, on the ground with a remote control invocating the theriomorphic.[32] S/he looks at possible settings. S/he acts and follows or doesn't follow the rules, techniques and laws s/he is supposed to execute, or something else. S/he does or does not take her/his work to an audience. Small or large, the audience comes or doesn't come to a space that can but doesn't have to be an art space, or something else. To produce a work of art s/he needs to communicate with art and it is clear that the work is a mean while art is an end. So s/he now knows that the work of art is a mere utility, no more or less than specified, material or immaterial, indispensable and dispensable, or something else.

It will certainly be more advanced soon enough, but today's digital video offers exceptional clarity and special effects image adjustments even though it is compressed for motion. The quality results from the ingenuity of Group of Picture Structure (GOP or IBBPBBPBBI), which on one hand cuts down on data but also predictably restores it for the sake of playback. This hybrid method is what film-film never has to do, as a medium. Film registers discrete frame after frame as a full picture. A GOP group consists of I, B and P frames where every 10th frame is a full I-frame while B- and P-frames undergo compression and predictable recovery with the "help" of I-frames, at first. However, since the process is serial (from left to right) all early B- and P-frames participate in the recovery of all later B- and P-frames. If coding generates the error, the predictable recovery is impossible and the video glitches. The ultimate achievement is not to satisfy technical goals but human subject goals: reception, transduction, coding, and awareness.

The encoding process, once triggered by remote control recording mode, is fully autonomous but its specific outcomes can be subjectively adjusted and affected through modification of exposure, shutter speed, or lens filters. Autonomous flying is different from autonomous recording. Sophisticated autonomous flying is equipped with learning algorithms (e.g. Hebbian, Kohenen) and contributes to "winner takes all" competitive learning where learning is defined as increased specialization. For instance, the more advanced artificial intelligence (AI) systems can train their subparts. In my work, however, such training doesn't take place. The autonomy present takes the form of *partial automation* in navigation and recording and *full automation* in video display. In the video display, the author is fully detached and passed over via a machine's physical design and its respective machine control technology.

UAS video recording is equipped with a 94-degree angled view and a 2.8 f lens. It produces video at an impressive four thousand-pixel resolution, at 30 frames per second. With additional ND and

polarizing filters it works well with a wide range of visibility. It doesn't offer the stereoscopic view for drone navigation that for instance Virtual Reality systems do; and it is not equipped with infrared, light-sensitive or magneto-receptors. For non-invasive video recording and photography, it offers an unprecedented image per cost product. It registers its own longitude and latitude, barometric pressure, air temperature, and much more. It reads its battery charge level, gives numerous diagnostic and operational warnings and can act on its own, for instance to return "Home" for an emergency landing. Some of the newest small UASs can read their distance from physical obstacles and change their flying path and speed to avoid potential collision. Current artificial intelligence advancement will increase the autonomy of UAS systems even more.

In my studio, I collect video data taken from multiple physical locations and assess them with regard for future video installations. The method could potentially be compared to the observation of invisible spectral lines in "location x" within the visible color spectrum. Art or science have not replaced human observation but have enhanced it with new instruments and data that were previously unavailable. Today's spectroscopy and knowledge of radiation allows for the projection of "invisible" absorption or emission as spectral lines onto a "visible" continuous spectrum and the marking of the identity of atomic or molecular entities. Such spectral lines have been used to virtually fingerprint the atomic and molecular components of stars. Spectroscope or oscilloscope, denotatively, are to scientists what video is to artists. None of these instruments have replaced human observation (visible) but have aided and allowed observation of the phenomena that otherwise would be inaccessible or ever fully understood. Like so many other technologies, video technology and drone technology came from science labs.[33]What makes the use of technology as an art tool different from technology as a military tool is *everything*. Regarding the military use of drones: "What makes drones disturbing is an unusual combination of characteristics: the distance between killer and killed, the asymmetry, the prospect of automation and, most of all, the minimization of pilot risk and political risk."[34]

Perhaps more in art than science, artwork does not become subject to technology and "laws" in the same strict sense that matter does in physics. Artists often voluntarily confine themselves to older norms, instruments and beliefs - which in turn potentially act as a reflecting boundary of a prison cell, or instigate progressive alternative solutions, or even lead to method or flight paths through which one may find refreshing cognizant and aesthetic points of view. Considering the obvious current condition of the world, in the very near future, experimental art will probably become extremely difficult if not totally unattainable. Although the future is unknown, the current availability of Unmanned Aerial Systems continue to offer to artists the unique opportunity to explore and take advantage of it.

CONTRADICTIONS

My fundamental reason to use a UAS for the sake of art (even if it may be somewhat disturbing) is not to enact the phobic or the counter-phobic with regard to commonplace fears of flying, to study the 'architecture of fear' in public spaces, or to effectively counteract military use. Simply, I believe the system is not about becoming effectively freed from the effects of industrialization, quite the opposite: in my work I expect more than the occasional ingestion of a particular technology's instruments. The consumption is not going to be automatic but selective, contingent upon a stimulus brought observation, derived from the entirety of the environment: human

workplaces, significant and not-so-significant locations, phenomena and facts of non-technology and technology. All of these factors evoke their own kind of *yantra,* as long as they are still around to be evoked. Gandhi based his hopes on a society of autonomous local farming communes. For today's artist, freedom of thought and expression is still localized in "inherent" right but as actual opportunity, it is already profoundly endangered by a weak sense of place against the strong force of space.

Machine vision is not synonymous with ordinary human vision. In a literal sense, machine vision uses less physical means than the human eye. Further, I have in practice reduced lens vision to one perpendicular angle, always looking down to describe but also to stir an emotional reaction. Camera vision follows a flight path that is random – it is like a flash of lightning. Kazimir Malevich identified straight down aerial looking, as opposed to an oblique angle, as an important paradigm in art of the twentieth century. Moreover, in his view, travelling by air, specifically aerial photography, led to a broad change in consciousness. I would argue that in humanities this consciousness was already there, waiting on the bench to be re-materialized. Think of Prometheus and his brother Epimetheus.[35] It has been said that both mythological figures invoke a shortened (not shorthand) version of human essence and destiny. However, in today's context the story begs to be unpacked differently, even reinvented. Prometheus would be the one who is endowed with intelligence and ability in the arts and machine-making. He would also signify superiority over his inventions. He would pass the Imitation Game.[36] Epimetheus, would become the one who instills obedience, with lack of precision and will. He follows commands and he signifies the absence of the ability to think and act clearly. He would fail the Imitation Game in this reinvention. If we industrialize human memory (almost achieved) and industrialize the reproductive system (on its way), we will achieve a state of perpetual despair. This is not some sort of *sheisse-fiktion*, as my mother used to call science-fiction, but as certain as the forthcoming weather.

> "'So I left the TV sound off and sat down on my mood organ and experimented. And I finally found the settings for despair." Her dark, pert face showed satisfaction as if she achieved something of worth.
>
> 'So I put it on my schedule for twice a month; I think that's a reasonable amount of time to feel hopeless about everything, about staying here on Earth after everybody who's smart has emigrated, don't you think?'"[37]

REFERENCES AND ENDNOTES

1.Peirce explains: "Wherever there is a feeling there a nerve-cell is in action" and "Feelings correspond to nerve-cell activity. Charles Sanders Peirce, "Of Thinking as Cerebration" in *Writings of Charles S. Peirce: A Chronological Edition* - Vol. 4, (Bloomington and Indianapolis) Indiana University Press, 1982), 38.
2.It takes a season to harvest food and decades to grow a tree. Empirical evidence of how growth at the level of protein is connected to cosmic scale has thus far escaped human research results. In October of 2017, Jeffrey C. Hall, Michael Rosbash and Michael W. Young received the Nobel Prize for their discoveries of molecular-level mechanisms controlling the circadian rhythm.
3.Theophrastus (ca. 371 – ca. 287 BC).
4.Martin J. Aitken, *Science-based Dating in Archaeology*, (London: Longman Archeology Series, 1990).

5.Consider definitions and guidelines addressing UAS, Section 107 or 336, FAA.
6.When Pope Francis declared 2016 to be a Holy Year of Mercy, the city of Rome issued a ban on UAS for that year. In 2015, Paris became a no-drone city in reaction to the January 7, 2015 Charlie Hebdo shooting. By 2018, India, which is notorious for substandard highway traffic infrastructure, had already in place UAS laws making the use of them practically impossible, especially to foreigners and non-business owners.
7. In the philosophy of mind, the human mind is not subject to "law" in the same strict sense that matter is in physics and biology. Consider materialistic psychology and the body-mind problem in the passage: "Now, the fact that science dominates certain areas of knowledge does not by itself eliminate alternative ideas. Neurophysiology provides detailed models for mental processes; yet the mind-body problem is being kept alive, both by scientists and scientifically inclined philosophers." Paul Feyerabend, Conquest of Abundance. A Tale of Abstraction Versus the Richness of Being" (The University of Chicago Press, Ltd., London, 1999) 140.
8.Consider acceleration and deceleration: the green economy was never a part of Marxist economics. Data shows that rolling the cost of environmental damage into the cost of productions is insufficient. To stop surface-temperature change of this planet, economic growth would have to net zero. At least the per the type of growth that we practice today.
9.See Cacciari on Adolf Loos in *Massimo Cacciari Architecture and Nihilism: On the Philosophy of Modern Architecture*, trans. Stephen Sartarelli (New Haven and London: Yale University, 1993), 167.
10. ibid., 167.
11.Ludwig Wittgenstein, *Remarks on The Philosophy of Psychology*, Vol. 1, trans. G.E. Anscombe, ed. G.E. Anscombe and G.H. Wright (Chicago 60637 Basil Blackwell, Oxford: The University of Chicago Press, 1980), 83e.
12.Cacciari, *Architecture and Nihilism: On the Philosophy of Modern Architecture*, 168.
13.Previously mentioned Jeffrey C. Hall, Michael Rosbash and Michael W. Young.
14.United States National Security Agency (NSA) and its international partners' global surveillance.
15.This sudden fear was "irrational" but independent from the fact that I was invited by Singapore National University to be an artist in residence; I had to decline this appointment for a different reason entirely.
16.Consider radioactivity. It is resulting from subatomic chemical change. Today science calls it, "decay," and have detailed knowledge of how and what it produces: uranium becomes thorium, radium decays into radon and radon into polonium which ultimately becomes lead. The other way of looking at it came from electronics especially from field-effect transistors (FETs). Paul Horowitz and Winfield Hill. (Cambridge University Press. Third Edition 2015) 131.
17.Museum of Human Achievement, Austin and Liliana Bloch Gallery, Dallas.
18.Okwui Enwezor, *Introduction* in *La Biennale di Venezia. 56th International Art Exhibition. All the World Futures* (La Biennale di Venezia, 2015), 18-19.
19.Many were outside of them for instance Ukrainian pavilion was located right outside of Arsenale and Giardini grounds.
20.Published online.
21.Dr. Martin Luther King Jr., *Creative Maladjustment,* speech, (Western Michigan University, Dec. 18th, 1963), last modified Jan 21, 2013, http://thepossibilitypractice.com/martin-luther-king-jr-on-creative-maladjustment/.

22.Today a replica. The original was taken out, sold, and reassembled and today is in possession of the Victoria and Albert Museum. Original mosaics created by Fra Giovanni Leonardelli and Ugolino di Prete Ilario. (American Journal of Archeology, Vol. X., 1906).
23.See Marc Augé, *Non-Places: An Introduction to Anthropology of Supermodernity*, trans. John Howe, (London: Verso, 2009). For Augé an anthropological space of transience is such where the human beings remain anonymous and that does not hold enough significance to be regarded as "places".
24.On the deficiency of archeology as philosophical method see Michael Foucault, *The Order of Things*, and *The Archaeology of Knowledge*.
25.The dinosaurs lived approximately 230-65 million years ago; man evolved around 200,000 years ago; social man evolved around 6,000 years ago.
26.Previously mentioned Paul Feyerabend, *Conquest of Abundance. A Tale of Abstraction versus the Richness of Being,* The University of Chicago Press, Ltd., London, 1999, and *Against Method*, London: Verso Edition, 1975.
27.Consider Andrew Wiles famously reaching outside his expertise to the Taniyama-Shimura conjecture. Simon Singh, *Fermat's Last Theorem* (Harper Perennial, 2005)
28.About difference between "everything" and "anything" see Paul Feyerabend and Franz Wilczek: "The worst kind of theory is a theory that doesn't even try to make mistakes-a theory that is equally ready for anything."
29.Erwin Schrödinger: "Every scientist knows how difficult it is to remember a moderately extended group of facts, before at least some primitive theoretical picture about them has been shaped." Erwin Schrödinger, *What Is Life? & Mind and Matter* (New York: Cambridge University Press, 1974), 163.
30.Thomas Nagel, "What is it like to be the bat?" *Philosophical Review*, 1974.
31.Daniel C. Dennett, *Consciousness Explained* (Boston, New York, Toronto, London: Back Bay Books, 1991), 441.
32. Theriomorphic in this case does not put in conversation the scientific with the religious but rather brings to mind Bronisław Malinowski's study of totemism (originally from dodem, India), Wierzenia Pierwotne, i Formy Ustroju Społecznego. Pogląd na Genezę Religii ze Szczególnym Uwzględnieniem Totemizmu (Kraków: Akademia Umiejętności, 1915). See specific reference to Binesi (Thunderbird) clan and Ajijaak (Crane or "Thunder", echo-maker) clan, which - in Anishinaabe clan system - is considered to be the most vocal among, therefore charged with external communications. "Anishinaabe clan system," last modified 14 November 2017, https://en.wikipedia.org/wiki/Anishinaabe_clan_system/.
33.Constantin Perskyi, "Television By Means Of Electricity," International World Fair, 1900.
34.John Sifton "A Brief History of Drones," The Nation, Feb. 7, 2012.
35.See also Bernard Stiegler, Technics and Time, 1: The Fault of Epimetheus, trans. Richard Beardsworth and George Collins (Stanford: Stanford University Press, 1998).
36.A better term for the Turing Test.
37. Philip K. Dick *Do Androids Dream of Electric Sheep* (Ballantine Books, New York, 1982).

AUTHOR BIO

Perzyński is a professor of art and co-founder of Transmedia (UT Austin) one of the first interdisciplinary arts programs in a US university context; he was trained in law at the University of Adam Mickiewicz, and in architecture and fine arts at the University of Fine Arts in Poznań, Poland; he taught at the University of Fine Arts, Poznań, University of California, Santa Barbara, and Royal College of Art, London. He authored experimental video, photography-based installations, performances, and photography; more than one hundred works completed and published since 1987. Perzyński has explored and developed themes in video, interactive code, computer vision and positioning, and physical interaction with architectural settings. These works and newer pieces have been performed and presented in Argentina, Brazil, China, Germany, Greece, Israel, Italy, the Netherlands, New Zealand, Poland, Thailand, the United Kingdom and the United States.

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To See Without Being Seen: Critical Concepts and Curatorial Approaches Informing the Exhibition on Contemporary Art, Drones, and Surveillance

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ABSTRACT

This article revisits the curatorial concepts informing *To See Without Being Seen: Contemporary Art and Drone Warfare*, a group exhibition we co-curated for the Mildred Lane Kemper Art Museum at Washington University in St. Louis in 2016. The exhibition comprised works by twelve international artists, including James Bridle, Tomas van Houtryve, Trevor Paglen, and Hito Steyerl. Starting from the observation that some of the most compelling positions on matters of drone warfare and the attendant political, conceptual, and ethical issues are being explored in an artistic context, our curatorial take on the topic presented the drone as a political object with aesthetic ramifications and trajectories. It drew on the notion of the drone as a vision machine and engaged warfare and surveillance on the level of their visual conditions, asking how certain images come into being while others stay hidden from public sight. With the aid of previously unpublished installation photography, we approach this article as an opportunity to reexamine the exhibition project with a self-reflective glance meant to draw attention to its successes, blind spots, and areas left open for future development.

INTRODUCTION

To See Without Being Seen: Contemporary Art and Drone Warfare (on view at the Mildred Lane Kemper Art Museum at Washington University in St. Louis, January 29, 2016 to April 24, 2016) presented a group of artworks engaged with the geopolitical, perceptual, and societal aspects of drone warfare and surveillance. [1] (Figure 1) As co-curators of the exhibition we embarked on the project with the understanding that some of the most compelling positions on matters of drone warfare and the attendant political, conceptual, and ethical issues are being explored in an artistic context. Drawing on the notion that the drone is a vision machine that is intended to remain invisible and hence possesses the power to see without being seen, our curatorial concept engaged warfare

and surveillance on the level of their visual conditions. One of the key questions we asked concerned the distribution of the sensible, specifically how certain images come into being while others stay hidden from public sight. In a discourse driven by secrecy, obfuscation, invisibility, and deniability, visual artists offer a multiplicity of means for making these abstractions visible while also probing the limits of the visible.

Figure 1. ***Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.***

The exhibition prompted critical self-reflection of us as curators as well—cultural agents directly implicated in decisions concerning what is made visible to a larger public—when formulating a checklist of works to include and how to frame and interpret them. Some of the key questions we had to ask ourselves were: How can the museum act as a forum to enter into public debates on important issues of local and global significance? Which representations will be present, which issues and types of images remain absent? Where do we draw the line between art and activism? On this last point, Thomas Keenan, Director of the Human Rights Project at Bard College, has argued that "the aesthetic finds itself in extreme proximity to the ethico-political now; the proximity is perhaps discomforting to some, but it is also the condition of any serious intervention."[2] Keenan champions approaches that conceive of intervention in aesthetic terms, therefore not only utilizing the disruptive and affective power of the aesthetic, but also working towards an ethics of the image and an ethics of viewing. As curators, it was important to us to add to this perspective an ethics of curating, which is concerned with making urgent socio-political issues perceptible through the framework of art and the public space of the museum.

Since the exhibition was first mounted in early 2016 much has transpired in the development and critique of drone warfare in the realms of politics, technology, and the art world. Curators and artists have taken up the topic and developed it in a variety of directions, probing the emergent notion of a new media culture of warfare and surveillance as it pertains to machine vision and questions of representation.[3] Coinciding with *To See Without Being Seen,* for instance, journalist and filmmaker Laura Poitras's first art exhibition *Astro Noise* opened at the Whitney Museum in New York.[4] *Astro Noise* showcased a series of immersive installations that built on topics including mass surveillance,

the war on terror, occupation, torture, and the U.S. drone program, including newly released documents and images leaked by the whistleblower Edward Snowden.[5] Poitras's blurring of the lines between art, journalism, and activism is one high-profile example within an emergent field of contemporary artistic practice concerned with examining and exposing the visual cultures of warfare and surveillance.[6]

The advancement of drone technologies, both militarized and recreational, continues to stoke such investigations. More and more countries in addition to the US, UK, and Israel are currently in the process of acquiring or developing drones. At the same time, the recreational drone market has grown exponentially and an increasing number of aerial views are populating documentary and fiction films alike. The once spectacular view from above is hence on the verge of becoming a staple sight. While drones are becoming ubiquitous in our daily lives, the laws regulating their usage remain largely nebulous and the workings of the broader network in which they participate continues to be opaque and obscure. One recent instance that made this abundantly clear was the revelation of the U.S. Department of Defense's use of Google's artificial intelligence technology to analyze drone footage.[7] What happens when a private company running the most dominant internet search engine enters into collaboration with the world's most powerful military to optimize computer vision and machine learning? How might the long-standing ties between industry and the military, which advance technology through warfare, be deployed in a political climate dominated by an increase in nationalism, populism, and antagonism? Our exhibition was driven by these concerns and by our desire to understand something about our present moment through the visual politics of the drone, which the developments of the past two years have only amplified. Convinced that the questions we asked then are even more urgent today, in what follows we revisit our 2016 exhibition project, examining, through the aid of previously unpublished installation shots, our concept and its realization in order to draw attention to the project's successes, blind spots, and areas left open for future development.

CONTENT

To See Without Being Seen squarely addressed contemporary discourses regarding drones and surveillance, which first started to evolve around 2012 and were pushed further with the initial Snowden revelations about the National Security Agency' s comprehensive spying program in 2013. Recognizing that in today's age of advanced technological warfare the act of perception is manipulated by governmental, military, and cultural entities that further politicize our relationship to images and the realities they represent, we chose to tightly focus our exhibition on works that present unique critical perspectives on image-making that confront specifically the military realm. The trade-off of breadth for concentration was a necessity that allowed for a sharpened curatorial thesis. That being said, while the drone was the specific point of departure for this exhibition, the various artistic projects on display illuminated the ways in which it embodies a much broader discussion about the networked systems that shape our daily existence, our ideological beliefs, and emotional responses.

We came to this material from two respective fields—art history and cultural studies—that express complementary yet distinct approaches concerning how to work and think with images. Cultural studies invited a thinking-through of the material in terms of concepts, which did not always prove to be translatable into the object-oriented experience of an art exhibition; and sometimes the images that might represent certain ideas were simply missing, or at least not on our radar. The art historical

approach was informed by a thinking-through of the material based first on the art objects we encountered. What was a given practitioner doing that was interesting from an artistic point of view in addition to what a work might express from a political or theoretical standpoint? The approach that evolved from our conversations was both visual and conceptual. The images selected could not be used as mere illustrations to visualize a specific idea or political position, but had to compellingly combine art, activism, and theory.

Taking art as the central organizing principle for compiling a checklist, we had to define just how broad our definition of art would be. Would journalistic photography be included? What about documentary images and films? There are many artists who creatively engage with online platforms. How could we represent the virtual spaces of Instagram or Twitter in the gallery space to convey the original interface and experience with such works? Or should we strive instead for a translation from the digital realm into the museum space?

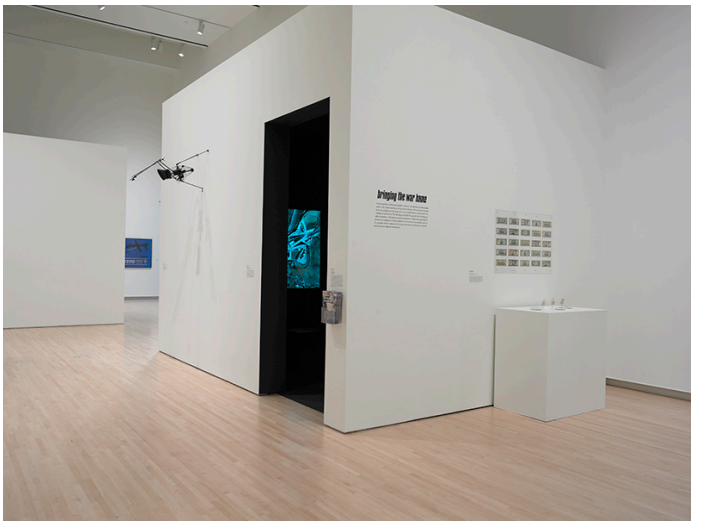

***Figure 2.** Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.*

The final checklist we arrived at comprised works by twelve international artists including James Bridle, Tomas van Houtryve, Trevor Paglen, Harun Farocki, and Hito Steyerl. It reflected our discussions concerning the balance between theoretical incisiveness, political purchase, and aesthetic significance while encompassing a wide variety of media, including photography, video, installation, web-based projects, and games, as well as site-specific and participatory projects. (Figure 2) The roster of works combined positions from within a decisively art-world context with projects that straddled the line between art and activism, and art and photojournalism. This meant that we decided against showing more straight-forward journalistic and evidentiary-activist works, such as the powerful photographs that Pakistani activist and journalist Noor Behram has been taking of the site of drone attacks in Waziristan since 2008. The images depict portraits of victims and family members and shrapnel that bears the mark of US American manufacturers.[8] Other compelling works in this vein include the online campaign *#Not A Bug Splat* (2014) that the Foundation for Fundamental Rights and Reprieve initiated in Waziristan in order to focus attention on the civilian victims of drone attacks. Photographs of child victims were blown-up to such an

extreme that they would be large enough for a drone pilot to see, not as an anonymous dot on a screen, but as an individual face.[9] Other noteworthy projects include the investigations carried out by Forensic Architecture and the study *Living Under Drones* (2012) undertaken by the International Human Rights and Conflict Resolution Clinic at Stanford Law School and the Global Justice Clinic at NYU School of Law.[10]

Although these projects were not present in the gallery, they certainly informed our thinking about the field and the concept of the exhibition. A central idea shaping our curatorial agenda was that drone warfare is built on asymmetrical views and can hence be discussed in terms of seeing and not being seen. Eyal Weizman, Forensic Architecture's principal investigator, has astutely framed this asymmetry:

> The ability to hide and deny a drone strike is not an insignificant side effect of this technology, but a central part of a campaign that relies to a great extent on secrecy and deniability. The violence inflicted by drone warfare is thus typically compounded by the perpetrators' negation: the violence against people and things redoubled by violence against the evidence that violence has taken place.[11]

While the title of the exhibition, *To See Without Being Seen*, first and foremost functioned in reference to the viewing conditions afforded by the drone—i.e. the operator's ability to see everything while being kept from sight him/herself—Weizman's assessment of the situation points to another form of invisibility. It is the invisibility of the situation on the ground and the people affected by drones flying over their heads and potentially targeting them and their social communities. Their experience is largely absent from view in North American media and the Western art world. As geographer Derek Gregory has pointed out, "The media coverage in North America and Europe has focused on the spaces of the extended network, particularly Creech and the CAOC [Combined Air Operations Center], while the space of the target has been radically underexposed."[12] The dominant Western perspective corresponds to the drone's scopic regime, which makes unfamiliar spaces familiar through its technological framing. "High-resolution imagery is not a uniquely technical capacity," notes Gregory, "but part of a techno-cultural system that renders 'our' space familiar even in 'their' space—which remains obdurately Other."[13] Following Gregory, the drone's view is hence organized to present Otherness in a familiar frame without allowing the Other the right to look and to look back. Drone warfare thus reenacts a deeply colonial discourse that organizes power and vulnerability through visibility.

Western artists engaging with drone warfare are largely aware of this dynamic, striving to expose or counter it through their artistic production. Yet, the methods employed often entail a focus on one's own point of view in order to uncover one's culpability. In avoiding the equally problematic attempt to speak for someone else's suffering, the imbalance in image production and dissemination is perpetuated. When researching artistic positions, we found a number of works dealing with the North American experience but very little that spoke to the experience of people affected by the presence of drones in the Middle East. Our inability to find these works is likely the result of an art world still privileging Western positions. And although we were not able to counter this tendency, we were acutely aware of it. Looking at our checklist and noting the prevalence of white, male artists with a Western background, we had to ask ourselves: In what ways are we replicating positions we set out to critique? And how can we counter such asymmetries by explicating a work's situatedness?

One way to do so was to make the absence of these images and viewpoints palpable. Among the few works in the exhibition that gestured towards representing the experience in the target regions was James Bridle's *Dronestagram* (2012-2015), a feed on Instagram, Tumblr, and Twitter that provided satellite images from Google Maps of the approximate sites of US drone strikes shortly after they occur based on reports from the Bureau of Investigative Journalism and other confirmed sources. (Figure 3) Bridle annotated each image with a caption about the strike, including known casualties, but the images were only abstracted aerial views of the landscape; they showed neither people nor evidence of destruction. The work thus leaves to the imagination what has happened on the site depicted. In this way Bridle's use of satellite and surveillance technologies and social media platforms suggests their distancing or dehumanizing aspects while at the same time making information readily available and generating empathy for people who live a world away.

***Figure 3.** James Bridle (British, b. 1980), Dronestagram, 2012–ongoing. Social media accounts and digital imagery. Courtesy of the artist. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.*

The absence of people in Bridle's satellite views make visible what haunts the counter-forensic works attempting to collect visual evidence about drone strikes. As Weizman stresses:

> The media siege limiting documentation and testimonies from the ground is effective because the only available photographic perspective—that of commercial and publicly available satellite images—is of a resolution in which the damage caused by a drone strike is hardly visible. This has to do not only with the technical resolution of satellite imagery, and the laws that limit it, but with the physical dimension of the architectural damage that these strikes bring about.[14]

The resolution with which publicly available satellites transmit images from the target regions used to be 50 x 50cm per pixel.[15] That scale was originally chosen for reasons of privacy, because "it is aligned with the dimension of the human body…Half a meter square is the frame within which the human body fits when seen from above. The size of the pixel is designed to mask the body and make it disappear."[16] For Bridle's *Dronestagram* this means that in his attempt to make visible, the human dimension can only be hinted at as a figure referenced in his captions. Its absence stands for a larger absence that is indicative of the current state of the field.

We chose to organize the exhibition into three thematic sections—"Bringing the War Home," "Tracking and Targeting," and "Countersurveillance"— and collaborated with the architects Frank Escher and Ravi Gunewardena of Escher Gunewardena Architecture, Los Angeles to design the installation, images of which are published here for the first time. Consisting of a series of open hallways punctuated by four enclosed video spaces positioned in the north, east, south, and west areas of the gallery, the tightly conceived installation and its preponderance of white walls conveyed a palpable sense of sparseness. This choice complemented the sharp focus of the exhibition and the formally rigorous and conceptual qualities of much of the artworks on view, but also subtly underscored the fundamental probing of relationships between absence and presence, obfuscation and clarity running throughout each section of the exhibition.

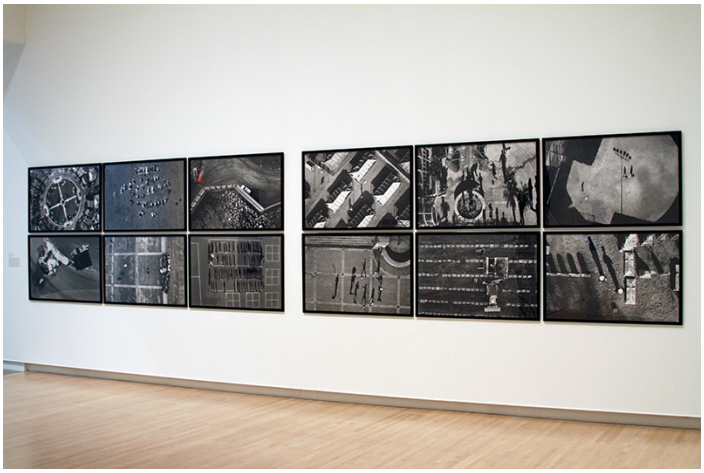

Figure 4. *Tomas van Houtryve (Belgian, b. United States, 1975), selections from Blue Sky Days, 2013–14. 12 gelatin silver prints on baryta paper, 26 × 40" each. Courtesy of the artist. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Dave Smith.*

Figure 5. *Tomas van Houtryve (Belgian, b. United States, 1975), Suspect Behavior, 2014, from Blue Sky Days. Gelatin silver print on baryta paper, 26 × 40". Courtesy of the artist.*

Section one "Bringing the War Home" drew attention to the domestic context by establishing relational links between the US and different sites of war. With the drone operators located remotely in the US—living and working on US soil while the wars they are waging are far away—drone wars are changing, blurring, and in some cases dissolving the civilian-military divide, turning the idea of "home" into a site from which war is waged. By looking at the US the way the US is looking at other countries—through a drone's perspective—and contextualizing the drone as an element of daily existence, these works provoke interest, empathy, and possibly paranoia in the viewer who is asked to consider what it means to live under the drone's ubiquitous presence and its presumably all-seeing eye. A selection of black and white photographs from Tomas van Houtryve's *Blue Sky Days* (2013-2014), a project that grew out of the observation that "there is no visual narrative in the public mind's eye to go along with this war," dominated one of the main walls upon entering the gallery.[17] (Figure 4) The images are of American landscapes and social situations seen from above, captured for their resemblance to those in which people have been targeted by drones abroad or in which drones are already used domestically, including a wedding, a funeral, an outdoor yoga practice, a school courtyard, a prison, and part of the US–Mexico border. (Figure 5) The series thus brings the war home through a certain way of looking at the world defined by verticality and ambiguity. In order to do so, it was important to van Houtryve to photograph the scenes from the point of view of a commercially available quadrocopter drone. When asked whether he thought that "it was necessary to communicate what [he] wanted to communicate using a drone," he responded:

> Well, it allows me to talk about more. The pictures allow you to talk about U.S. military policy on drones abroad; they allow you to talk about U.S. government drones that are flying over U.S. territory… It allows you to talk about the accessibility of this technology. If somebody like me can use it and hobbyists can use it, then you can talk about that, too. Using a drone rather than a helicopter allows you to talk about the broad spectrum of drones changing our lives.[18]

Van Houtryve's response reveals at least three key ideas that underscore his project. First, he follows a modernist approach that is concerned with medium-specificity, thereby asking viewers to consider exactly what is unique about the drone. Second, he makes reference to increasing civilian drone usage and how that might alter the ways in which military drones are perceived and how daily life is affected by the presence of drones. And third, van Houtryve alludes to the fact that artists are increasingly employing drones as art-making tools although they may not engage with the scopic regime of the drone in its military application.

While these questions are geared towards the drone's visual frameworks, van Houtryve's work is equally concerned with drone warfare's geographies. Works by the Center for Land Use Interpretation (CLUI) and Trevor Paglen, also included in the exhibition's first section, circle around these geopolitical concerns, addressing them by pointing to, or mapping, the blank spots in our vision. CLUI's database, *Notable Drone-Related Sites in the USA* (2015) uses satellite images taken from Google Earth to pinpoint and make visible the domestic locations where drones are tested, launched, and developed. It therefore visualizes sites withdrawn from public visibility with the help of a publicly available mapping tool, using cartography as a method of intervention. In his *Untitled (Reaper Drone)* (2010), Paglen captures an image of a drone in the sky above the Nellis Range Complex in Nevada, an area reserved for classified military operations. (Figure 6) The drone is intentionally placed at the limits of the visible, appearing like a speck of dirt within a field of

luminous sky. The lack of clarity in the photograph adds an element of uncertainty and opacity that acts as a metaphor for the examination of this cloaked world.

***Figure 6.** Trevor Paglen (American, b. 1974), Untitled (Reaper Drone), 2010. C-print, 5 / 5, 48 x 60". Mildred Lane Kemper Art Museum, Washington University in St. Louis. University purchase, Bixby Fund, 2012.*

All of the works in this first section—the complete roster included positions by E. Adam Attia (Essam), James Bridle, CLUI, Joseph DeLappe, Tomas van Houtryve, and Trevor Paglen— intentionally reverse the drone's view and mirror it back onto itself or rather onto its point of origin. This kind of reversal is a powerful and discernable trend in art dealing with drone warfare. One of its intentions is to make visible what is often hidden from sight and to map out responsibility, which is why cartographic methods and the shape of the drone itself play an important part in this body of work. The two convene in James Bridle's *Drone Shadow* (2016), a 1:1 representation in outline of a drone, which was installed on the sidewalk outside of the Museum's main entrance. (Figure 7) Following the instructions in Bridle's *Drone Shadow Handbook* (2012), we placed the *Drone Shadow* in this prominent position to make the drone's image immediately visible to the visitor in the form of a physical mark while emphasizing one of the main currents running throughout the exhibition, how artists are challenging ideas of invisibility, transparency, and geopolitical dissemination in modern warfare. Although the single *Drone Shadow* represents the outline of one drone transferred back to the country that maintains it, it is actually part of a larger network. In the case of Bridle's project, it is the global network of everyone who takes it upon him/herself to draw such a shadow following the instructions outlined in the handbook. And in the case of war, it is the global network of operators, data links, intelligence analysts, maintenance crews, and troops on the ground.[19] It is a war that does not operate along the lines of battlefields, nation states, or armies. Rather, it is defined by single targets that are an amalgamation of body and data. As a result, warfare becomes dispersed and concentrated at the same time. It can go wherever the target goes; it is hence "simultaneously local and global."[20]

***Figure 7.** James Bridle (British, b. 1980), Drone Shadow, 2016. Site-specific installation, approx. 36 × 66'. Courtesy of the artist. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.*

The drone's function of tracking and targeting framed the second section of the exhibition, which included works by Bridle, Harun Farocki, Molleindustria, Paglen, and Björn Schülke. This section focused on the heightened interest in machine vision and human–machine relations. Drones are often perceived as vision machines, a concept introduced by Paul Virilio as early as 1988.[21] Stressing the connection between flying and seeing and the god-like view from above, his concept of the vision machine was also geared towards the technical image that is no longer tied to the human body but instead stands for a supposedly objective yet simultaneously objectifying view. Virilio describes it as a "sightless vision"[22] that can potentially lead to an "automation of perception"[23] and a "splitting of viewpoint[s], the sharing perception of the environment between the animate (the living subject) and the inanimate (the object, the seeing machine)."[24]

The concept of the vision machine was expressed in the exhibition through Harun Farocki's two-channel film installation *Eye / Machine III* (2001). With *Eye / Machine* Farocki introduced the notion of the "operative image," which works in tandem with Virilio's notion of the vision machine. (Figure 8) Operative images are images produced by machines for machines. They are not geared towards human vision; they are not meant to be looked at aesthetically or reflectively, but rather to be studied as objective, technical tools inciting action. In other words, instead of merely representing things in the world, machines and the images they produce "do" things in the world.[25] While created slightly before the onset of the current wave of technological warfare, Farocki's film insightfully explores the advent of a new visual regime based on image-making machines and algorithms. It translates the invisibility of machine vision into a visible register that allows viewers to see and think about this new type of image.

Figure 8. ***Harun Farocki (German, 1944–2014), Eye / Machine III, 2003. Double-channel video, 25 min. Harun Farocki GbR, Berlin. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.***

Art has the unique ability to translate the invisibility of machine vision into a register that can be picked up by human senses, i.e. of translating operations into aesthetics. This can mean making visible what was hitherto hidden from human sight, but it can also mean finding forms to visualize the enigmatic and obstructed qualities of machine vision. *Drone Vision* (2010), a five-minute video by Paglen cut from feed intercepted from a military drone's camera on a training mission, enacts precisely this double move. (Figure 9) On the one hand, it lets viewers briefly experience what drone operators see—a view that has rarely been made available to the public. On the other hand, its images are, in part, not what one would expect to see. The video offers obscure views into the sky and fragmented images of the machine itself as it catches glimpses of its own wing. The work is spatially unsettling because of its shifting points of view and thus functions in a manner similar to Paglen's photographs of drones, which are also about the uncertainty of vision and the attempt to disconnect seeing from knowing.

Probing the uncanny dimension of the drone is also what drives Björn Schülke's artistic practice. His *Spider Drone #4* (2015), a motion-activated, spider-shaped sculpture, consists of a camera and several moveable tentacles. (Figure 10) It turns on when it detects a visitor in the gallery space and then swivels its camera to track the visitor's movements. Because of the way in which we situated the layout in the gallery it was impossible not to walk by Schülke's piece mounted at the top of a ten foot wall. The playful sculpture does not actually record what it sees, but we felt strongly about including it because of the way it touches on growing fears and suspicions of surveillance machines and those who control them. Interestingly, Schülke's *Spider Drone #4* became one of the most-photographed objects in the show, as it allowed visitors to take a remote selfie of themselves via the video-screen in the center of the robotic sculpture. Apart from being a good image-op, this constellation drove home the point that when you look at surveillance, you may actually be looking at yourself and your own creations. It makes for a contemporary instance of reverse perspective, in which your images are looking back at you.[26] This mechanism is most notable in the field of commerce, where offers are made based on previous searches, clicks, and purchases. The offers are geared towards individuals that are generic. They address people as (potential) targets.

The philosopher Grégoire Chamayou has suggested that we are currently moving into a new stage of society, the "targeted society." After surveillance and control, he believes it is targeting that is the contemporary paradigm "shared today among fields as diverse as policing, military reconnaissance, and marketing."[27]

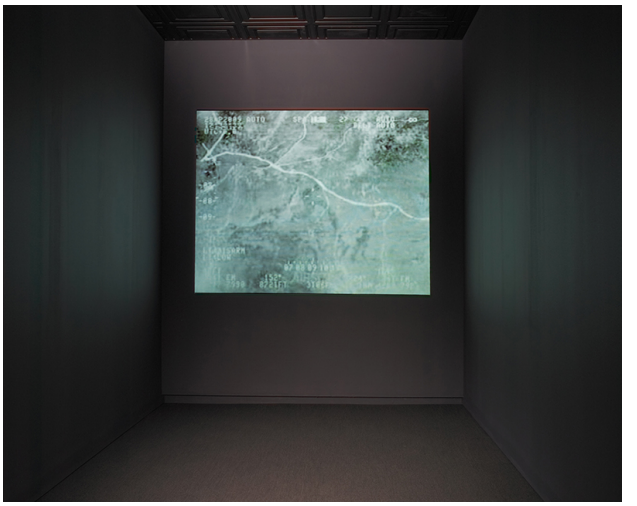

Figure 9. *Trevor Paglen (American, b. 1974), Drone Vision, 2010. Video intercepted from a communications satellite (edited), 5 min. Courtesy of the artist and Metro Pictures, New York. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.*

Figure 10. *Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno. Foreground: Björn Schülke (German, b. 1967), Spider Drone #4, 2015. Brass, wood, carbon fiber, 2 cameras, TFT video display, motors, motion sensors, custom*

circuits, and paint, 21 5/8×17 11/16×37 3/8" (installed). Courtesy of the artist and bitforms gallery, New York.

***Figure 11.** Hito Steyerl (German, b. 1966), HOW NOT TO BE SEEN: A Fucking Didactic Educational .MOV File, 2013. Single-channel HD digital video and sound in architectural environment, 15:52 min. Courtesy of the artist and Andrew Kreps Gallery, New York. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.*

If targeting is the means by which societies are currently organized and by which perceptions are policed, then figuring out how to avoid becoming a target is increasingly concerning. Strategies facilitating a need to disappear visually or to go off the grid were taken up in the exhibition's third section titled, "Countersurveillance." While the first two sections were primarily concerned with unveiling what is unseen, works by Adam Harvey, Shinseungback Kimyonghun, and Hito Steyerl addressed the issue of how to become invisible, hide, and conceal. Steyerl's video installation *How Not to Be Seen: A Fucking Didactic Educational .MOV File* (2013) teaches us how to hide from constant surveillance in a humorous, but also deeply serious way**.** (Figure 11) As Steyerl describes it, the idea for the video grew out of:

> …the real story that [Steyerl] was told about how rebels avoid being detected by drones. The drone sees movement and body heat. So these people would cover themselves with a reflective plastic sheet and douse themselves with water to bring down their body temperature. The paradox, of course, is that a landscape littered with bright plastic-sheet monochromes would be plainly visible to any human eye—but invisible to the drone's computers.[28]

Steyerl explores this notion in her video by pitching human vision against machine vision. The forms of disappearance she performs are about hiding in plain human sight. She shows how you

can disappear by being visible and becoming a picture, which not only forms a counterpoint to the invisibility of operative images and machine vision, but also prompts questions regarding the changing status of the image and forms of representation. While identity politics was for a long time concerned with creating certain images and negating others, there now may be a turn towards a new political valence in invisibility and going unseen. This is also suggested by Adam Harvey's project *CV Dazzle* (2010) that offers strategies for applying makeup and hair styling as a form of camouflage designed to thwart facial recognition software. (Figure 12) Just as in Steyerl's video installation, its target is computer vision (CV), addressing the face as the anchor of identity and humanity. In the case of Shinseungback Kimyonghun's *Cloud Face* (2012), the face also plays a prevalent role in countering machine vision. (Figure 13) Their photographic series of cloud formations arranged in a large grid on the gallery wall were each mistakenly identified as human faces by facial recognition software run by the artist duo and directed into the clouds. The work imaginatively employs the glitches of machine vision to reveal its functioning, but also to suggest that any recognition may be subject to misrecognition.

Figure 12. Adam Harvey (American, b. 1981), selections from CV Dazzle, 2013. Giclée prints on Hahnemühle fine art rag paper, 21 x 21" each. Courtesy of the artist. Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Dave Smith.

In their creative appropriation of the new vision machines resulting from the development of drone warfare and mass surveillance, these works exemplify the kind of critical adaptation described by political scientist P.W. Singer: "every new technology always produces new countermeasures, sometimes just as sophisticated, sometimes quite simple."[29] These countermeasures demonstrate how war continues to produce technological advancements that in turn affect the distribution of the sensible. Or as Jan Mieszkowski has put it, "every war asks its audience to learn to read the sociocultural landscape all over again."[30] The works in *To See Without Being Seen* do just that, provoking new ways of thinking about how to recognize, critique, and subvert while also alerting us to the fact that we are in the midst of a change in perception that will ultimately affect not only the way we see, but also the way we live and relate to each other.

Figure 13. ***Installation view, To See Without Being Seen: Contemporary Art and Drone Warfare, Mildred Lane Kemper Art Museum, Washington University in St. Louis, 2016. Photo by Jean Paul Torno.***
Left: E. Adam Attia (ESSAM) (American, b. 1983), Drone Campaign 1, 2012. Giclée print on styrene, 37×77". Courtesy of the artist.
Right: Shinseungback Kimyonghun (South Korean, founded 2012), Cloud Face, 2012. 32 archival pigment prints, 19 11/16×19 11/16" each. Courtesy of the artists.

ENDNOTES

1. The exhibition was accompanied by a catalog. Svea Braeunert and Meredith Malone, *To See Without Being Seen: Contemporary Art and Drone Warfare* (St. Louis: Mildred Lane Kemper Art Museum, 2016).
2. Thomas Keenan, "Mobilizing Shame," *The South Atlantic Quarterly*, 103 (Summer 2004): 447.
3. Notable exhibitions that both precede and succeed our project include *Age of Terror: Art since 9/11*(Imperial War Museums, London, 2017); *Open Codes: Living in Digital Worlds* (Center for Art and Media, Karlsruhe, 2017); *James Bridle: Failing to Distinguish between a Tractor Trailer and the Bright White Sky* (Nome, Berlin, 2017); *Watched! Surveillance, Art and Photography*

(Hasselblad Center, Gothenburg, 2016); *Public, Private, Secret* (International Center of Photography Museum, New York, 2016-2017); *Laura Poitras: Astro Noise* (Whitney Museum of American Art, New York, 2016); *Nervous Systems: Quantified Life and the Social Question* (Haus der Kulturen der Welt, Berlin, 2016); *Covert Operations: Investigating the Known Unknowns* (Scottsdale Museum of Contemporary Art, Scottsdale, 2015); *Heaven and Hell: From Magic Carpets to Drones* (Foundation Boghossian, Brussels, 2015); *Panopticon: Visibility, Data, and the Monitoring Gaze* (Utah Museum of Contemporary Art, Salt Lake City, 2015); *Permanent War: The Age of Global Conflict* (School of the Museum of Fine Arts, Boston, 2015); *Fire and Forget: On Violence* (KW Institute for Contemporary Art, Berlin, 2014); *Decolonized Skies* (Apexart, New York, 2014)*; A Screaming Comes Across the Sky: Drones, Mass Surveillance and Invisible Wars* (Laboral Centrao de Arte y Creación Industrial, Gijón, Spain, 2014); *Smart New World* (Kunsthalle Düsseldorf, Düsseldorf, 2014); *and Visibility Machines: Harun Farocki and Trevor Paglen* (Center for Art, Design and Visual Culture, University of Maryland, Baltimore County, 2013).

4. Poitras won the 2015 Academy Award for Best Documentary Feature for *Citizenfour* about Edward Snowden. *Laura Poitras: Astro Noise* was on view at the Whitney Museum of American Art in New York from February 5, 2016 to May 1, 2016. The exhibition was accompanied by a catalog. Laura Poitras, ed., *Astro Noise: A Survival Guide for Living Under Total Surveillance* (New York: Whitney Museum of American Art, 2016).

5. The files attest to the existence of a program called *Anarchist*, for which the British GCHQ and the American CIA intercepted feeds from Israeli drones. Cora Currier, Henrik Moltke, "Spies in the Sky: Israeli Drone Feeds Hacked by British and American Intelligence," *The Intercept* (January 29, 2016): https://theintercept.com/2016/01/28/israeli-drone-feeds-hacked-by-british-and-american-intelligence/; Cora Currier, Henrik Moltke, "Anarchist Snapshots: Hacked Images From Israel's Drone Fleet," *The Intercept* (January 29, 2016): https://theintercept.com/2016/01/28/hacked-images-from-israels-drone-fleet/.

6. Hito Steyerl and Trevor Paglen have written some of the most compelling contributions concerning machine vision as a new visual culture defined by invisibility. Trevor Paglen, "Invisible Images (Your Pictures Are Looking at You)," *The New Inquiry* (December 8, 2016), https://thenewinquiry.com/invisible-images-your-pictures-are-looking-at-you/; and Hito Steyerl, "A Sea of Data: Apophenia and Pattern (Mis-)Recognition," *e-flux,* 72 (April 2016): http://www.e-flux.com/journal/72/60480/a-sea-of-data-apophenia-and-pattern-mis-recognition/.

7. For a summary of the collaboration between Google and the Department of Defense see Mark Bergen, "Pentagon Drone Program Is Using Google AI," *Bloomberg* (March 6, 2018): https://www.bloomberg.com/news/articles/2018-03-06/google-ai-used-by-pentagon-drone-program-in-rare-military-pilot.

8. For images of Noor Behram's work see: https://www.wired.com/2011/12/photos-pakistan-drone-war/

9. See https://notabugsplat.com/. The project was part of French street artist JR's campaign titled *Inside Out*, a global platform intended to give "everyone the opportunity to share their portrait and make a statement for what they stand for. See http://www.insideoutproject.net/en.

10. Forensic Architecture is an independent research agency based at Goldsmiths, University of London. http://www.forensic-architecture.org/. For their investigative work on drone warfare, see http://www.forensic-architecture.org/case/drone-strikes/; *Forensis: The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 361-482. See also Eyal Weizman, *Forensic Architecture: Violence at the Threshold of Detectability* (New York: Zone Books, 2017), 22-30. For more information on the *Living Under Drones* project, see International

Human Rights and Conflict Resolution Clinic at Stanford Law School and Global Justice Clinic at NYU School of Law, "Living Under Drones: Death, Injury, and Trauma to Civilians from US Drone Practices in Pakistan," 2012, http://chrgj.org/wp-content/uploads/2012/10/Living-Under-Drones.pdf.
11. Eyal Weizman, "Introduction, Part II: Matter Against Memory," in *Forensis: The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 370.
12. Derek Gregory, "From a View to a Kill: Drones and Late Modern War," *Theory Culture Society*, 28 (2011): 204.
13. Gregory, 201.
14. Weizman, "Matter Against Memory," 370.
15. In one of his most recent publications on drone warfare, Weizman specifies that in "June 2014, the 0.5 meter limit was changed to 31 centimeters per pixel after an appeal from a commercial satellite company to the US Department of Commerce convinced them that a person could still not be recognized at this resolution–a change that…applied in all places but Israel." See Eyal Weizman, *Forensic Architecture: Violence at the Threshold of Detectability* (New York: Zone Books, 2017), 29.
16. Ibid., 371.
17. Tomas van Houtryve, in "Interview: Tomas van Houtryve," *Center for the Study of the Drone* at Bard College, May 13, 2014, http://dronecenter.bard.edu/interview-tomas-van-houtryve/.
18. Ibid.
19. For a discussion of the global network of drone warfare, see Dan Gettinger, "Drone Geography: Mapping a System of Intelligence," *Center for the Study of the Drone* at Bard College, February 19, 2015, http://dronecenter.bard.edu/drone-geography/.
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22. Virilio, 59.
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24. Virilio, 59-60.
25. Trevor Paglen, "Operational Images," *e-flux journal* 59 (November 2014), http://www.e-flux.com/journal/operational-images/. See also Harun Farocki, "Phantom Images," *Public* 29 (2004), http://public.journals.yorku.ca/index.php/public/article/view/30354/27882.
26. For more on the idea of a reversed look and what it has to do with our complicity in self-surveillance, see Paglen, "Invisible Images."
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28. Hito Steyerl, "Techniques of the Observer: Hito Steyerl and Laura Poitras in Conversation," *Artforum* 53, (May 2015): 308.
29. P.W. Singer, *Wired For War: The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin Books, 2009), 201.
30. Jan Mieszkowski, *Watching War* (Stanford: Stanford University Press, 2012), 33.

AUTHOR BIO

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The Sensing I/Eye: Bringing The Drone Down To Earth

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ABSTRACT

This paper draws from art, activism, and other critical practices to examine the question of whether one can speak of an aesthetics of drones, or indeed what sensory registers even make knowledge of drones possible. Given that drones themselves are typically sensing devices that depend for their functionality on remaining obscured, a variety of practices are required for understanding how drones operate as instruments of political and social life.

INTRODUCTION

Although diversely constituted across a wide array of practices including but not limited to photography, film, performance, installation, geo-locative mapping, and sound art, drone art often foregrounds issues of presence/absence, visibility/invisibility, among other sensory and psychological oscillations, or the destabilization or "un-fixing" of perspective resulting from the multiplicity of sensing devices and the datafication of vision performed by sensing, gathering, and transmission of data, and its subsequent reconstitution into images.

Drone aesthetics investigate the construction of technologized ocular regimes governed by remote sensing and aerial visuality. From one angle, the materiality and mythology of the drone are approached from an extrinsic perspective, focusing on human observation of the drone, and the reverse condition–when in the act of looking or searching, we also become subject to observation from above. Painter Kathryn Brimblecombe-Fox describes the conceptual framework underlying her series of paintings entitled *Dronescapes* thusly:

> "[P]eople, who live in places where drone surveillance and potential attack are persistent threats, are afraid of the sky - often too fearful to venture outside. I wonder about what kind of world we are living in, where on the one hand cosmological research delves into the vastness of the universe, but on the other hand some people are afraid to look up at the sky." [1]

We see, or fail to see, and are concomitantly seen, and potentially targeted.

Drones are instruments that are both known and visible (they sometimes can be seen overhead), and unknown and invisible. Trevor Paglen, a researcher, artist and writer, is known widely for his

photographic investigations of the land and skyscapes of the post 9/11 U.S. military-industrial complex, exemplified by hidden military bases and test sites, and of course by the numerous "black ops" conducted with drone technology. Commenting about the recent history of drone deployment, he recalls that as early as 2003, "if you were driving through Nevada you would sometimes see them." However, "that base is on complete lockdown now." [2] The early visibility of the technology has been suppressed, and drone operations have become increasingly covert.

Just as technology precipitates tectonic shifts in existing scientific paradigms, epistemologies, and scopic regimes, Paglen forecloses idealism by aiming his camera from the outside in. When the drone becomes the object to be seen, not the agent of seeing, it retreats into shadow–evidence of its presence most often indicated by sound or by the wreckage left when it falls from the sky–finally not such a reliable technology after all, its systems subject to glitches, not unlike human error. As an example of drone-sighting, rather than drone sightedness (and the homology, or lack thereof, between human and drone seeing), Paglen's work takes the extrinsic approach (looking from the outside) to drone aesthetics to the extreme, pushing the image past legibility. In capturing "what it looks like when your physical capacity to see collapses," he continues to remind his viewer of "thereness"–the certainty of "thereness," whether or not it is legible to the eye, through the lens. Drone sightings, however partial or unsatisfied, allow the agency of the human viewer and "seeing" itself to remain relatively unproblematized.

In another modality of drone aesthetics, the viewer is released from her vulnerability; no longer targeted, she is incorporated into the act of targeting. When seeing and sightedness are framed in the context of drone-mounted recording devices, broader philosophical questions arise regarding, for example, point-of-view or the aesthetic characteristics of flight recordings. This model of drone visuality re-orients (or perhaps disorients) the viewer, positioning her within the drone, inviting convergence of the viewer's visual cortex and drone's sensors. Whether visual convergence is accepted or rejected, the internal situatedness of the viewer provokes a confrontation with the very idea of "seeing." First-person viewing of images recorded by drones not only undermines traditional perspective and orientation, but also introduces the notion of drone anthropomorphism, which brings to bear the numerous philosophical issues underlying the notions of human and drone "seeing," "autonomy" and "intelligence." Here, the human subject and the drone look out into the world in unison. But how closely does the activation of sensors for the purpose of collecting data approximate human visual information-gathering? Is this linguistic homology merely a false friend, and the analogy between sightedness and sensory apparatus of the drone a vivid but insubstantial metaphor?

While drone art nominally confines itself to a seemingly narrow range of technical specifications, "[w]hat we believe to be a straightforward narrative of invention is really multiple inventions that collapse into a single unit, with competing designs that coexist for a time, with the intended use of a technology supplemented by a completely different, unexpected use." [3] Thomas Stubblefield has addressed the ethical complications of faithful adherence to "subversion" suggesting that this stance presupposes the progressive potential of intervention from the outside through such strategies as detournement, appropriation, repurposing, or remixing. Is it possible to place drone art under the umbrella of "activist art"?

Stubblefield contends that drone artists frequently "eschew the distance of critique, seeking instead to initiate blockages and intensify existing relations." [4] Beginning with the idea that "there is no

longer any outside to capitalism [and by extension, its mechanisms of warfare]…the primary way to derail its inner workings is by amplifying its own powers for deformation and self-destruction." [5] In so doing, these artists employ a strategy of immersion instead of distance, engaging as directly as possible, with the mechanisms and properties of drone "seeing," and consequently, how drone visuality participates in the construction of a world picture extending far beyond the boundaries of the military-industrial complex and into the public domain.

DRONE AESTHETICS

Drones provide ample fodder for artistic inquiry into the ramifications of drone technology in a wide array of contexts. To speak in terms of drone "aesthetics" might seem to tread onto dangerous ground–the aestheticization of war and acts of violence. If aesthetics is peeled from its too-narrow affiliation with judgments of taste and beauty, its critical and theoretical potentiality broadens significantly. Reconstituted etymologically, aesthetics is coextensive with sensory apprehension, or the processing of sense perception. Framed in this context, drone aesthetics are concerned with sensing–sensing the drone from below, or embodying and taking on the sensory modality of the drone.

As an instrument of warfare, the drone's existence is inextricably tied to material destruction. But its role in covert operations necessitates its effacement, its dematerialization and relegation to the shadowlands. "The drone exists, taking to the skies above our heads every day. But it also doesn't exist, because it is shrouded in fantasy." [6] It is in the continuous shifting between existence and non-existence that the aesthetic potential of drone art is most apparent. "Most people by now have a picture in their mind's eye of the drones themselves. The silver-gray planes have a signature bulbous nose and inverted V tail fins, while the planes' lack of windows lends them an eerie air of sealed-off blindness." [7]

The public has some idea of their presence, but they become shadows of themselves, seemingly immaterial because they go unnoticed. In *Drone Shadow*, James Bridle etches chalk outlines of drones on the ground similar to those inscribed around the bodies of murder victims by law enforcement, but at a scale too large to resolve into a coherent image unless viewed from an aerial perspective. "[T]he drone appears as an incomplete object in Bridle's work, a shadow that is in expectation of future activation via the image and the network." [8] Drones' functionality depends on the continuous maintenance of a feedback loop between drone and controller, or more often a network of controllers. This project sketches the outline of an imagined shadow of a hovering drone, calling attention to the having-been or yet-to-be manifest the physical presence of drones in the skies above, as well as our propensity to ignore or simply not perceive signs of that presence. Drones circulate in the shadows, both literally and metaphorically. For example, as surveilled subjects, we "live under the shadow of the drone," but approximations of drone sightings occur in the "accidental drone shadows captured by Google mapping satellites." [9]

In the introduction to an interview with Paglen at Bard College's Center for the Study of the Drone, Lenny Simon's description of Paglen's drone photography aptly demonstrates an external, observation-based approach to drone aesthetics, centering on the dialectic between presence and absence, visibility and invisibility, knowledge and its obfuscation:

> [Paglen's] interest in 'the line that separates vision from knowledge' led him, inevitably, to drones. Paglen's photographs of drones have become canonical. One image in particular, a blurred photograph of a Reaper drone at an Air Base in Indian Springs, Nevada, captures exactly what it is about drones which has taken such a firm hold of our imaginations. Although the image is extremely distorted, the hulking Reaper is immediately recognizable as a drone. By creating an image of a drone that is highly obscured and abstracted, and yet eminently recognizable, Paglen has represented the space that drones inhabit in the public imagination. Paglen has also pointed his telescopic camera lens at government drones in mid-flight; in the resulting images, the drones appear as tiny specks in the sky, further highlighting the tension between their outsize presence in mass media and the fact that they are rarely, if ever, physically seen. But Paglen's interest in drones extends beyond the aesthetic paradox that they present. He maintains that his work is 'not so much trying to fill in these metaphorical blank spots as it is trying to understand how they're produced and what sort of state capacities and powers have to be developed in order to create and sustain such a system.' [10]

Drones are rarely seen, sometimes heard, always at the margin or beyond the periphery of apprehension. They are revealed merely as Paglen's "tiny specks" or as the shadows accidentally captured on Google maps invoked by Bridle's *Drone Shadow* project. Instead of satisfying the imagination with finely-resolved, high-dimension images, Paglen's images remain indistinct. Sight, then, is reduced to the glimpse. Drone aesthetics are characterized by incompleteness–little to no information is garnered from shadows or specks.

THE HUM OF PRESENCE

Appraisal of drone aesthetics need not be limited to visual, optical, or scopic regimes. Tactility and haptics, proximity and intimacy are as much at issue as remoteness. The fact that the drone gathers information by sensing invokes a range of possible investigations–for example, experiences of intimacy and invasion precipitated by remote sensing–into the phenomenology, cultural mythology, and politics of drones and remote sensing technology. Although drones are largely imagined as technologies that extend the human threshold of visibility, many drone artists appropriate auditory phenomena potentiated by drones. If there is a phenomenology of drones, it is most strongly borne out by sound. The absence or presence of a drone, and its physical proximity, is ascertained aurally, the ear functioning as the organic "sensor" corresponding to the sensing device on the drone.

But this fear of looking is often precipitated by sound, rather than visual perception. "The first one flew overhead humming, followed by another…then another and then…the sky was a singing swarm. Were they flocking? Could this become more than a mere experiment?" [11] Numerous studies have "gathered substantial evidence regarding the psychological toll exacted by living with this presence of the drone. A young father told interviewers that the drones 'are always on my mind. It makes it difficult to sleep. They are like a mosquito. Even when you don't see them, you can hear them, you know they there.'" [12] In this case and countless others, the certainty that you are always watched is no delusion or wartime-induced paranoia. It is a fact, ascertained by the sound of the drones hovering overhead. Drones are not silent predators; as weapons or spying mechanisms, they inflict more than physical trauma. To those living not only under the shadow of the drone but within the range of its sonic resonance, drones are never absent.

Simon Remiszewski's *Drone Conditioning* presents the sound of drones far more literally. In this case, the sound produced by the drone is not generated by outside data or *detourned* towards an abstract musicality. As drones fly above Pakistan and Yemen, inhabitants experience the ever-present buzzing of the devices overhead. They are both terrified by the sound and become conditioned to it, perhaps becoming accustomed to a life of fear. Remiszewski's intervention brings the drone home to the U.S., asking U.S. citizens to place themselves within the experiential threshold of the distant and often faceless 'other' constructed within the popular imagination. Riemiszewski brings attention to the perpetration of violence by the unmanned vehicles to those who might rather ignore it. In his artist's statement, Riemiszewski invokes the power of satire, turning a potentially acerbic critique towards humor. "By introducing you and your loved ones to the sound of the drone long before they're hovering above your neighborhood, you can preemptively eliminate such stress and anxiety!" [13] This ironic tone serves to dispel a purely fearful reaction to the buzzing sound of overhead drones, instead provoking a more reflective view not only of the outright destruction perpetrated by drone technology, but also its more subtle effects.

In Richard Johnston's music video for the song *Weightless*, physical actuation of audio signals on the body (specifically reduction of stress and heart rate) are augmented by the creation of a visual component–an abstract video compiled using drone technology in which the flight of the drone creates a three-dimensional choreography (which the artist calls a dance) to illustrate the movements within the song. In a project exploring the generation of sound through movement (instead of the generation of visual movement (by sound), Maria Judova's *Composition for the Drone* transforms the drone into a sonifying instrument by collecting data and converting it into sound.

Nevertheless, drone artists utilizing sound, for example, must also navigate the terrain of data visualization and the prevalence of rendering data legible through images. Rothstein notes that "there is one feature we see in almost every situation–the presence of a camera." [14] The production of images by drone-mounted cameras and other remote sensing technologies, including video, radar, infrared, and thermal imaging, manifest different "ways of seeing" that seem to undercut the primacy of the image, now reconceived as mere output of data-processing. "The Predator and Reaper drones used in U.S. counterterrorism and targeted killings are equipped with infrared sensors…. Once this radiation is detected, it is encrypted and converted into data and transmitted to earth stations where it can be processed by computers and rendered as rasterized displays that correlate pixel qualities with temperature values." [15] To align thermal imaging with a way of seeing also compels us to reconsider or redefine the image: What constitutes an image? Does the identity, or definition, of the image shift when its substrate is invisible to the human eye, translated into visual legibility through collection, processing, transmitting, and rendering data?

Interrogating the visual world of the drone–how it sees and what it sees–reveals the network of power relations in which the drone travels and on which its existence is predicated. Drones, as remote sensing devices, have become the contemporary icon of dataveillance; as in traditional modes of surveillance, they observe and monitor their mark from a distance, but their process of detection, datafies the surveyed subject–observation transforms into data collection, processing, and storage. Drones rely for their survival on a ceaseless autopoetic feedback loop of data collection and transmission. "They fly through the air, but they are only able to do so because they have sensors constantly collecting data, which is then fed back to the algorithms helping to control

the aircraft for the operator." [16] First and foremost, then, drones exist as aerial data collecting "agents." If the system ceases to gather data, it fails in its data-gathering "mission." This failure to execute data-delivery renders the drone non-operational; a system crash is quickly followed by a physical crash-and-burn.

NETWORKED CONTROL

Remote sensing technology steps toward a reconfiguration of what it means to see, and toward the formation a new visual paradigm. While McLuhan theorizes technology as a prosthetic extension of man, the prosthetic device is notionally singular, extending the capacities of a singular subject. Remote sensing operates at a further remove from McLuhan's technological prosthetic, unfolding into the dynamic multiplicity of the network. The drone, in James Bridle's words, is a "prosthetic of the network" in which "certain forms of warfare" are precipitated, or at least facilitated, not by the drone as an individuated entity but by the fundamentally networked conditions on which its functionality depends. [17]

Drones, then, are located in a field of networked technologies including the Internet; they perform as one set of "eyes" of the network of satellite imagery and communications, as a contributor to the constantly aggregating mass of Big Data as well as the proliferation of coding/programming. Bridle has concurred with this estimation, stating that "one way of looking at drones is as a natural extension of the internet in terms of allowing sight and vision at a distance. They're avatars of the network for me." [18] Drones function as nodes in a network of location-aware surveillance technologies that are guided by and deliver information about their activities via satellite. They are instructed to attack if their compiled data identifies an eliminable target, but outside of the military, no one knows exactly how information is gathered about or determines targets.

Moreover, as Nadav Assor has remarked, drones are constructed not as a singular technological entity, but rather as a conglomerate of individual mechanisms including code, motors, mechanics, and electronics. "We use metrics, fed back to us from our devices, in order to make decisions on whether or not to continue using that technology." [19] Both in their individual physical makeup and in relation to one another, they act across a wide distribution of internal and external linkages, collecting, processing, and transmitting the data that is fed back into the algorithms instructing them to engage the target that it initially identified.

Unmanned Aerial Vehicles–the name immediately conjures a science-fictive future in which machines have replaced the need for soldiers in the field, possibly a world in which systems have become truly autonomous, no longer relying on (error-prone) human actors to shout commands from a dangerously proximate hilltop. We have entered the age of unending war waged covertly and remotely. The drone's directive to sense from a distance and its "unmanned autonomy" add a particular form of terror to the physical havoc it ultimately wreaks. However, the political and military-industrial complex is far from eliminating human decision-making, specifically the decision to fire, from drone warfare in favor of wholesale automation. Maintaining the authority of a human controller, or many controllers, to initiate tactical engagement, contravenes against the fantasy of fully autonomous weaponized drones.

In his reflection upon the fear and fascination engendered by the drone, its pride of place in a symbolic hierarchy of automated weaponry, Rothstein hypothesizes that "it is more about the idea

that choosing whether or not to fire is a decision that *could* be automated." [20] However, picturing a one-to-one relationship between a drone controller at the trigger and a drone ready to fire on command would be a misapprehension. It becomes quickly apparent that the continuous functionality of the drone relies upon more than a single feedback loop between two actors, because the drone is only one actor in an extended network that constitutes the "kill-chain." [21] As the Predator drone used by the U.S. military "requires around 185 personnel to operate, this expansive network does not simply remove the operator from the vehicle but rather intertwines its operation with a dispersed collectivity." [22]

From this point of view, claiming that drone technology effects a radical shift in contemporary visuality might lose momentum given that any reframing of what constitutes sight and seeing, any destabilization of perspective, vantage point, or point of view are in fact an epiphenomenon of the drone's primary task: the collection and transmission of data, *tout court*. Nonetheless, the "convergence between the operation of the drone and image production" does point to a laying-bare of representational techniques/technologies, as well as theories of representation itself, that have achieved transparency in Western visuality." [22] "Utilizing edge detection, motion capture, auto-tagging, and facial recognition, drones supplant the perspectival, Albertian image with a catalog of distances, volumes, heat signatures, and behavioral patterns." [23]

Trevor Paglen has, throughout his career to date, emphasized consistently the aesthetic and conceptual significance of obscurity in his practice; that which is obscured is notionally present, it shies away from absence or nothingness, despite its unavailability to sense perception. His images thus stake their claim on the proposition of "thereness." But after pointing "there," the image abruptly ceases to divulge further sensory data, offering up a nearly featureless surface of textures that refuses to impart knowledge or understanding. Traces of visual information haunt some of his images, but the resolution of the photograph is fixed, frustratingly, just before the point of visual resolution.

GLITCH/FAILURE AS CRITICAL STRATEGY

As we have seen, Trevor Paglen ties his photographic aesthetics to his theory of the limit-case of vision. "The images are taken from so far away, through so much dust and haze and heat, that while it's a photograph of a site, it's also a photograph of what it looks like when you've pushed the physical properties of vision as far as they will go. It's a photograph of a place, but it's literally a photograph of what it looks like when your physical capacity to see collapses, or begins to collapse." [24] According to the traditional standards of "successful" photography, in which the subject is captured with clarity, repleteness of detail, and density of "evidentiary material, these would be classified as failed" attempts.

Seemingly contradictory attitudes toward drones exist even within the military institutions in which they are deployed. The co-existence of, on the one hand, fantasies of increased efficiency and elimination of human error in automated weapons technology, and on the other, fear of total automation, are immediately and urgently manifested in high failure rates, not of human operators, but of drones themselves. Contrary to the notion that human error decreases proportionally to its replacement by autonomous or semi-autonomous systems, drones remain, as we have seen in the military's refusal to invest drones with automatic firing capability, quite intentionally subject to human command and control. Furthermore, the "co-constitution of 'drone' and 'human'" that has

occupied the discursive center of the development of drone technology, from post-WWII experiments to the present, is haunted by the specter of mental, not merely technological breakdown. [25] Peter Asaro's research on the topic reveals that despite attempts to decrease inefficiencies in drone operators, "[o]ne of the primary accounts of stress…involves the relationship between human operators and the technological interfaces with which they must interact…that are frequently subject to malfunctions." [26]

Guarding against false idolization of automated drone weaponry, drone artists have taken up the strategy, adopted by the broader (rather amorphous) community of new media artists, of appropriating and exploiting the 'glitch' as a critical practice. By making art that points to or performs the inevitability of systemic glitches in allegedly reliable, if not failsafe drone technology, drone artists debunk the (prophylactic) illusion of hyper-advanced military technology.

The myriad possibilities inherent in drone technology could, and might, result in an expansion of its utility beyond covert and overt acts (see, for example, recent Amazon commercials for drone-delivered packages) of (declared or undeclared) war. However, drones built for and used in the private sector often mimic and fetishize the military operations for which drone technology was developed, more firmly embedding the drone as a dominant trope in a culture of fear–specifically, a fear of the unpredictable devastation ostensibly unique to "acts of terrorism." Drone artists have, often adding lightheartedness to acts of protest, utilized failure and the glitch to propose alternative uses of the drone in art, to contest the seeming inviolability of the drone, and to undercut its symbolic entanglement with fear and acts of terror.

In the private sector, glitches, while annoying, inconvenient, and sometimes personally disastrous, are regarded as an unavoidable byproduct of technological development. Lee Montgomery's experiments with the Parrot.AR drone and Greg Riestenberg's with the SCOTUS drone perform calls to awareness of the reality of catastrophic crashes in military drones. In a moment of serendipitous failure, Suzanne Treister was forced to buy a new drone when her first crashed during the opening for her piece the *Drone That Filmed the Opening of its Own Exhibition*.

In its military application, the malfunction of the drone, instantiated by the crash, is also the very thing that establishes its existence and renders it visible. The crash disrupts the capacity of the drone to control a territory through, first, disembodied vision and second, the brutal deployment of firepower. A particularly well-known piece that not only presents the phenomenon of the drone crash but also, more importantly, addressed the social and institutional responses to collisions in public sphere with drones themselves and their symbolic valences. Ricardo Dominguez, Ian Alan Paul and Jane Stevens' *Drone Crash Incident*, staged on the UC San Diego campus, was conceived "as a form of critical fiction or disturbance theater." [27] The tenor and force of the reactions to the "crash" varied, unsurprisingly, from accounts to account, from initial publicization to subsequent investigations and reports within and outside the University.

The artists created and distributed "hard evidence" of the drone's existence, including press releases, documents, photographs, and other communication mechanisms as a clever "cover-up" for the fact that the crash was entirely staged. "I'm sure some of [the students] probably did think it was real," Dominguez said of the drone crash, "but that's one of the practices of new media art—what we call a minor simulation. It creates an event that is difficult to understand as either real or non-real." [28] The status of the crash as simulation rather than actuality did not fail to produce

responses amongst officials within the University of California system, frequently citing the unlikelihood of drone malfunction, while also offering classes in "drone safety." Dominguez contends that, in the end, while he "is concerned about the use of drones and how it may impact people's privacy,[…]the staged drone crash is more of a conversation-starter than a protest piece." [29]

REMOTE SENSING BEYOND THE DRONE

Paglen's work with drones constitutes only one small part of his research and practice concerning the physiological threshold of human vision and its epistemologically circumscribed limit-cases. In the cultural imagination, the view from above, the vantage point of aerial remote sensing technology, is most closely associated with satellite technology. "Our contemporary view of the world is actually and conceptually constituted, to a great extent, from the vantage point of satellites in orbit around our planet." [30]

Clearly, the viewpoint of drones, their perspective on the terrain they survey, cannot begin to approach the capacity of satellites, and thus the perception of their visual mastery. Notwithstanding the attachment of descriptive terminology of the "God's eye view" variety to drone vision, satellites and drones fulfill radically different functions, despite their classification as remote sensing technologies. "To the degree that digital satellites seem to directly picture the Earth as a globe, they conceal a visual regime that would assert the global as a particular way of picturing the world: a "global perspective" put forth less as a politically and technologically mediated representation than as a real, objective, and transparent manifestation of the world itself." [31]

Unlike satellites, drones do not construct a "global" scopic regime of totalized visibility. As vehicles whose existence is predicated on their ability to amass data, drones are fundamentally in process, and as such, characterized by partiality. Satellites, likewise, continuously aggregate, process, and transmit data, but their "global perspective" implies both totality and scopic mastery. The "global" view aggregated from satellite data strips locality and situatedness (both highly significant to drone vision, if unfortunately utilized for the purposes of targeting). A global perspective implies not only the overall or total image of the earth itself, but both macro- and microscopic visibility, in which the data compiled in the overall image reveals its density in the zoom, the plunge towards the earth's surface that reveals further and further degrees of fineness as the image refreshes. The complex technological mediation underlying the production of satellite imagery is both tacitly acknowledged but unproblematized–satellite imagery (when we conveniently forget or ignore the darker implications of its military operations) has, in its everyday application (e.g. for daily navigation), enfolded into quotidian life.

This diversion into an analysis of satellite imagery provides a counterpoint to the model of drone visuality and "seeing"–the scopic regime it simultaneously engenders and inhabits–that I have proposed here. Notionally, satellites orbit in a qualitatively and quantitatively (phenomenologically) unknown space. Satellites do not occupy the "Space," say, of *Star Wars*, the Space which has become both an inhabited place and a proper name. Exceeding the range of knowability, they are projected into an abstract space of non-relationality.

However, siting satellites in a zone of pure abstraction proves inaccurate. "Satellites take place within the world they presume to picture. …[A] satellite view is situated within the perceptual

world." [32] Satellites are only *notionally* unsituated, and do not in fact float in a frictionless nowhere. Both satellites and drones expand and reconfigure the range, scope, potentialities, perspective, and vantage points that have defined the parameters of human vison and the act of seeing.

Nevertheless, the technological parameters and symbolic resonance of drone sensing differ from the remote "viewing" performed by satellites. Placed in conversation with the inhumanly scaled space roamed by satellites, the aerial domain in which drones hover becomes proximate. They disrupt and defamiliarize human vision by dint of this closeness, this sudden immediacy and relationality. The greater proximity of drones to the earth, to human (ap)perception, and the resultant oscillation between presence/absence, visibility, overlays the psychological and physical effects of being surveilled, or invaded, with a pronounced haptic quality–of being touched, heard, or, of course sadly, plunged into excruciating pain.

To end on a cautionary note: as engines of collateral damage, drones often kill hundreds within their blast radii. The body count that rises daily as a result of drone attacks not only adds *gravitas* to their deployment in art practice, but necessitates extreme mindfulness and care in both the production and the reception of drone-related artworks as well as raising the question of how to meaningfully enact resistance against and critically intervene not only in the culture of fear engendered by militarization/weaponization of drone technology, but also in the institutions, power relations, and models of cultural control that subtend this fear.

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The Machines Wave Back

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ABSTRACT

This paper examines notions of autonomy and agency in the context of understanding artist and rules system relationships within an Autonomous Art System (AAS). The concept of Create / Read / Update / Delete is borrowed from computer engineering as a metaphor for a role-based (rather than medium-based) framework for classifying AASs and, combined with the discussion of autonomy and agency, forms the basis for a new taxonomic system of Autonomous Art Systems for analysis, categorization and comparison.

> "A chipped pebble is almost part of the hand it never leaves. A thrown spear declares a sort of independence the moment it is released."
>
> – Isaac Asimov, "The machine and the robot" in Robot Visions

> "The machines aren't very smart yet, but we're teaching them this stuff all the time. We're giving them eyes and ears and we're giving them access to our world. We're sharing our social spaces with them increasingly. They increasingly live like the render ghosts, on the borders of our world, and they're starting to share it with (us).
>
> – James Bridle, "Waving at the Machines"

INTRODUCTION

The purpose of this paper is to propose a way to describe degrees of autonomy and agency in Autonomous Art Systems (hereafter, AAS) to aid in analysis, categorization and comparison of such systems, and to consider their boundary conditions in an art-making context. Along the way, I will tell a few stories, share some observations, and shamelessly poach terms and concepts across a range of unrelated disciplines. The broad goals of this investigation are to develop and present a new way to frame discussions of autonomous art systems, to complicate generally accepted notions of artist-AAS relationships and to a propose a new model of taxonomy for AAS.

The true challenges of this last goal, have become clearer through research. On one hand, a cross-disciplinary review of literature has exposed that, although the urge to create a descriptive or generative taxonomy of AAS seems strong, the expression of this tendency results in many schemes that break either too nebulous to be actionable, or so formally and/or disciplinarily tight as to be of limited interest to artists who are not also so inclined. [1] [2] [3] [4] This gap seemed to present an

opportunity to move forward. On the other, in terms of surveying existing work, it became apparent that artists have myriad approaches to documenting and communicating their processes in general (and perhaps AAS practices in particular) from complete opacity to illustrated step-by-step how-to and source code repositories, and from earnest interrogations of process to wild confabulations after the fact. This range of approaches presents an obstacle to generalizable classification through examination of existing work, and the situation is sometimes exacerbated by curators who lack experience with, or scholarship in, AAS. [5] None of this precludes saying something that I hope some will find useful, even if that something is headier and not as deeply engaged with the grain of actual practice as I might have wished.

SITUATING AUTONOMY

The English word 'autonomy' derives from the Greek αὐτονομία (autonomía) in turn, from autonomos, meaning something like "having its own laws." The current, commonly understood, meaning points to someone (or something) having the capacity to make independent decisions, without outside involvement or control, about their own actions. This general way of understanding of autonomy—as a capacity—leads easily to notions of degrees of (if not of kinds of) autonomy, such as semiautonomous cars or semiautonomous geopolitical regions.

In an early (1978) sketch of autonomous systems in the context of remotely-operated undersea vehicles, Thomas B. Sheridan and William L. Verplank, developed a ten-point model of human-machine collaboration based on degrees of machine autonomy. The text of the manually-typed, hand-annotated and much-mimeographed chart, LEVELS OF AUTOMATION IN MAN-COMPUTER DECISION-MAKING, reads as follows:

1. human does the whole job up to the point of turning it over to the computer to implement.
2. computer helps by determining the options
3. computer helps determine options and suggests one, which human need not follow.
4. computer selects action and human may or may not do it.
5. computer selects action and implements it if human approves
6. computer selects action, informs human in plenty of time to stop it.
7. computer does whole job and necessarily tells human what it did.
8. computer does whole job and tells human what it did only if human explicitly asks.
9. computer does whole job and tells human what it did and it, the computer, decides he should be told. (sic)
10. computer does whole job if it decides it should be done, and if so tells human, if it decides he should be told. [6]

One can almost imagine a Bakelite dial on a control panel labeled 'autonomy' being turned from 1 to 10, shifting the decision-making capacity proportionally from human to machine. But looking closer, there is a definite asymmetry in the level descriptions: at no point does the human 'help' the computer, nor is the computer given an opportunity to approve human action. Instead, the human is imagined to have full autonomy—until the computer removes it in level seven by excluding the human from the process. This asymmetry may be an effect of framing these levels in terms of 'automation,' but I find it notable for what it suggests about ideas of shared autonomy (which I will return to shortly). The point of highlighting this list from the early days of implementing

autonomous systems is to demonstrate that system autonomy, from the beginning, was conceptualized as being a matter of degree. For reasons that aren't clear, the description for level ten ("computer does whole job if it decides it should be done, and if so tells human, if it decides he should be told.") is somewhat hilariously cited by later investigators as "The computer decides everything, acts autonomously, ignores the human." [7] [8]

Of course, Sheridan and Verplank were concerned with operating submersibles, not making art. They were also already using computers; so, allow me to back up a little.

As Philip Galanter notes, autonomous art systems (or 'generative' systems, as he prefers, although I will argue generation is only one possible role for such as system) do not necessarily entail digital technology, computers, or even sophisticated tools or machines. [9] [10] The ancient divinatory system of the I-Ching, for example, relies on nothing more advanced than casting yarrow stalks or flipping coins. Although arguably not an 'art' outcome, the system does function to algorithmically generate graphic symbols with no decision-making from the human consulting it (beyond, of course, the initial human decision to use the rules-structure and the continuing decision to honor that rules-structure). In this sense, the system is fully autonomous, even if it is profoundly lacking in 'agential sophistication' or power (more about that soon).

THE ARTIST-STRUCTURE RELATIONSHIP

Autonomous art systems have been persuasively described as an "indirect production method" for artists. [11] This method entails a relationship between an artist and a system in which autonomy, understood as the capacity to make decisions, is somehow shared along a spectrum between an artist and a system, with each entity separately bounded. I argue that the notion of 'system' in AAS necessarily includes both the artist and a rules-structure; a structure which may or may not be an extension or projection of the artist involved. In the example of the *I-Ching*, to derive hexagrams as output the human must animate the rules-structure. These two, human and rules-structure, taken together, then constitute an autonomous system.

The notion of autonomy, within the context of a relationship, is not a completely straightforward proposition. It does not, as articulated by the submariners, necessarily result in a zero-sum condition since autonomy in any domain could be understood both this way (as proportionally shared) or as expressed independently in either a synchronous or asynchronous mode.

This "peculiar situation" may not rise to the level of organizational closure demanded by Varela's formal definition of an autonomous system, but his observations of the implications of both specifying and being enmeshed in a system are useful in thinking about the artist as always part of the rules-structure, unable to get outside it: "In the characterization of organizational closure, nothing prevents the observer himself from being part of the process of specifying the system, not only by describing it, by being one link in the network of processes that defines the system. This situation is peculiar in that the describer cannot step outside the of the unity to consider its boundaries and environment simultaneously, but it is associated with the unity's functioning always as a determining component." [12] From this perspective, the 'system' in an AAS cannot be thought of as something apart from the artist, but rather as container for a spectrum along which both artist and rules-structure negotiate autonomy. Conditions toward the opposite end points of this spectrum may appear to support a zero-sum interpretation, since at one extreme of this relationship the rules-

structure is largely excluded from the system, and, at the other, the rules-structure not only plays the game alone, but decides its own rules (and, perhaps, even which game to play).

Putting the rules-structure on an equal footing with the artist within an AAS instead of seeing the artist in a supervisory role outside the system is not necessarily a nod towards 'flat ontology,' but is an acknowledgement that we are not so separate from our systems, structures and technologies as we may think. [13] To be clear, though, in this notion of AAS I am laying out, the human artist must cede some degree of autonomy to the rules-structure as the price of admission to the AAS.

A CRUDDY REST

Within an AAS, first and foremost, the human artist is always the selector of one or more rules-structures; s/he is also sometimes also their author. Outside the AAS, these two meta-roles combine globally with the features (or methods) of specific rules-structures to offer several non-mutually-exclusive roles for an artist to inhabit. These are the roles that generally come to mind when discussing an AAS as something the artist exists outside of. The most conventional role for the artist is that of creator; in this role, the artist employs some aspect of a rules-structure to express authorship in artistic production. A second role is that of collaborator. This is a role familiar to artists from working with other humans, but shifted, in this instance, to working with a rules-structure instead. A collaborative position implies an adaptable rules-structure that has some capacity to interact, or at least respond, to the artist. A third role-position is that of artist as curator. If the rules-structure is abundantly generative (or particularly opaque), the artist may act primarily (or exclusively) to limit or select from the generative output. Finally, because some rules-structures have the capacity to surprise even their authors, it is entirely possible for an artist to be a spectator or audience to their own work through an automated art system. [14] These roles are outward-facing; explanatory. They tell a story of how an artist might work with an AAS, but not how an artist + rules-structure AAS works. While these roles of the artist distinct from an AAS may be readily understood as variations of or extensions to those found in traditional art practices, I want to go a bit further afield to illuminate the potential operational roles of rules-structures by analogy to concepts and applications from contemporary software development.

'CRUD' is the not-so-charming acronym that represents a widely accepted concept of a set of primitive operations that may be performed on any data. CRUD is short for Create, Read, Update and Destroy/Delete. A related concept is 'REST' (which is short for REpresentational State Transfer), a high-level application programming interface (API) style based on CRUD, and used mostly for the web. So-called 'RESTful' APIs generally have a set of methods (which have 'verbs') like PUT, GET, POST and DELETE. CRUD is the overriding concept, while REST is a specific implementation of that concept for 'live' data of the sort that lives on and makes up the web. (The fine particulars of these definitions are debated and parsed with nearly rabbinical intensity in online forums such as stackexchange.com). [15]

Beyond their narrowly specific meanings in software engineering, though, RESTful methods (with some modified verbs) can be adapted as a useful metaphor for thinking about the range of rules-structure roles inside an AAS. If we render Get as 'gather' (aggregating visual, textual or audio material for instance), Put as 'alter/mutate' (transforming materials, elements or rules in various ways), Post as 'generate' (creating new material, content or rules) and Delete as 'curate' (in the sense of preferentially selecting some elements and rejecting the others), we have a nearly

comprehensive model of the possible methods employed by AAS-based rules-structures. We may round out the verbs by adding a fifth method, 'distribute' (here, also the inverse function of gather), for methods that disseminate material/content without generation or mutation (an example of which is the networked AAS known as the Poietic Generator). [16]

The symmetry between roles of the artist as described apart from the AAS and those of the rules-structure inside the AAS is not perfect. 'Collaborate,' for example does not map to the CRUD concept in a convincing way since, by definition, it implies a negotiated, multipart interaction that must exist between and among the other five. This strictly verb-based classification scheme contrasts with Boden & Edmonds classification of AAS which is based partly on medium or underlying technology, and partly on the role the technology plays: computer art (C-art), generative art (G-art), digital art (D-art), electronic art, (Ele-Art), etc. [17] I argue that a technology-based classification system will, on the leading edge, tend to constantly require new terms as technologies emerge, and, on the trailing edge, may become clogged with less and less used and useful terms as technologies become quaint or obsolete (even in the long tail of art-making contexts). This accumulation of terms, in addition to the difficulty of untangling overlapping classifications leads me to favor a role-based scheme.

AUTONOMY AND AGENCY

Now that we have a potential framework for categorizing operational roles on the rules-structure sides of AASs and have conceptualized some of the methods of structure, I would like to return to a discussion of autonomy to introduce the notion of 'agency' to this developing model. If autonomy entails a capacity to act independent of outside influence, agency is that acting or exerting of power. This distinction is teased out in an anti-consumerism essay this way:

"There seems to be a tension between a certain kind of agency and a certain kind of autonomy, and this is worth thinking about. In particular, there is a tension between autonomy understood as the limitless choice of an unfettered self (let's call this freedomism—the anthropology that is tacit in much advertising) and the kind of agency that is exercised in any skillful performance." [18]

Within each of the various rules-structure methods outlined above, autonomy may be understood as the capacity to act, while agency may be conceived of as acting in a vertical hierarchy in terms of 'agential sophistication.' This represents a gradualist approach (rather than all-or-nothing) to agency that I believe is useful to the model; it is further assumed that the artist has 'perfect' agency. What constitutes a notion of agential sophistication within methods or verbs of a rules-structure inside an AAS?

At its most basic level, agency may be ascribed to almost anything at all: "Such a liberal definition allows agency to be attributed even to fixed, inert objects such as coins, clarinets, and cups" [19] Even art materials can be thought of as stubbornly agential, actively resisting manipulation by an artist. [20]

At the lower end of agential sophistication in rules-structures, we could imagine a rules-structure that proscribes certain actions – prohibitive rules that put limitations on the artist's actions. Examples of this sort might include drawing without lifting the pen, writing a novel without gendered pronouns or designing a typeface without diagonal strokes. Prohibitive rules-structures

like this (with a 'black-list' rather than 'white-list' approach) according to Galanter, do not fall within the realm of generative systems. [21] Let's call this most basic form of agential sophistication (AS) level 0.

Next, at AS level 1, we find step-by-step rules-structures that, like Brustolini's autonomous Regulation Agents "always know what to do." [22] Rules-structures in this tier do not test, learn or adapt, but have in-built, invariable imperative rules. The class of AS level 1 rules-structures are those that apply single transformations, actions or operations. Examples might include rules like scaling each object in a series by its position in the series, deleting every third record in a database, swapping the red and blue components of each pixel in an RGB image, dropping the next digit of pi number of pebbles at each step along a path, running from the camera, etc. [23]

Making up the second tier, AS level 2, are rules-structures that perform some sort of evaluation or testing, usually by employing logic-based conditional rules. These sorts of conditional statements, implemented as 'if/then,' 'while' or 'case-switch' commands in many coding languages, may be driven by the outcomes of chance operations or used to provide branching behavior based on some other sort of criteria for the rules-structure. Examples might include: if the drawing robot senses a wall ahead and the generated random number from 0–9 is less than 5, turn right 90 degrees; otherwise, turn right 90 degrees. The previously mentioned I-Ching would fall into this category of sophistication; even at AS level 2, a computer or other digital technology is not required.

The next higher agentially sophisticated tier, at AS3, consists of rules-structures which learn and adapt. At their simplest, this class of rules-structure combines conditional rules and branching behavior with memory of prior inputs and/or decisions. These rules-structures can 'learn' by recalling (or even simply tallying) the results of previous conditional statement tests or environmental, artist or other inputs. This type of behavior can lead to direct results/outputs or in the formation of meta-rules, sets of rules to select or activate/deactivate other rules or even other meta-rules. [24]

Beyond the ability to merely learn from previous experiences, AS4, or constraint-based rules-structures, have the additional capacity to evaluate the relative 'fitness' of a solution. This powerful leap in sophistication of agency endows rules-structures with a kind of goal-seeking behavior. This puts the artist in the position of defining the parameters of preferred outcomes rather than performing, selecting or generating step-by-step procedures for the rules-structure. The most familiar examples of constraint-based systems are genetic-based evolutionary solvers that breed solutions and check for fitness against desired outcomes generationally, discarding divergent solutions and preserving convergent solutions for continued breeding until either a close enough fit is found or a preset generational limit is reached. Note that this approach restricts the role of artist-as-spectator because it limits the degree of surprise for the artist (since s/he must know at the outset what preferred outcomes are), but the means of achieving those goals (and the failed attempts along the way) may still be gratifyingly novel.

At the apex of agential sophistication for rules-structures, AS level 5, is the capacity for rules-structures to not only derive rules and meta-rules and evaluate fitness, but to also generate their own constraint-based, goal-directed behaviors. This capacity to generate one's own criteria for fitness is a hallmark of what Franklin and Graesser deem a fully autonomous agent. [25]

In addition, this ability to modify the rules has an analogous in a term in sociology known as 'meta-power.' "Meta-power entails the capacity to shape and determine, to a greater or lesser extent, social and material structures: to change basic relationships, processes, rules, procedures, definitions of appropriate (and inappropriate) agents, their rights and responsibilities, conceptions of appropriate methods, options available (and not available) and some of the values, costs and benefits as well as risks for agents engaged in interaction situations." [26]

As previously mentioned, the artist is assumed to have perfect agency; s/he may cede autonomy in one or more methods inside the AAS, but always acts with full agency. The decision to restrict consideration of agential sophistication to the rules-system is a pragmatic one, because the notion of sophisticated agency is bound up in the initial decision for a human artist to share autonomy at all. The full repercussions of this assumption are an area for further study.

STARFISH DIAGRAMS

To better visually grasp and graphically compare different AASs, I have developed a simple five-lobed radar plot or starfish style diagram. Each lobe of the starfish represents one of the five rules-structure methods: gather, alter, generate, curate, distribute.

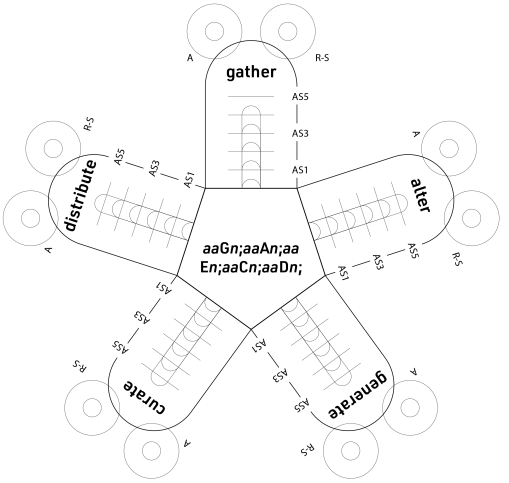

***Figure 1.** Blank starfish diagram*

The outer bubbles, left and right, at the ends of lobes in diagram reflect the autonomous capacity of the artist (A) and the rules-structure (R-S). The possible conditions are no bubble (no capacity for autonomy), a small bubble (semi-autonomous capacity) or a large bubble (full autonomy). This relationship is not necessarily proportional, nor is it a zero-sum game since both the artist and the rules-structure could each operate independently in any one method (without the necessity of this situation carrying over into other methods). For instance, both the artist and a rules-structure could 'gather' images with complete autonomy (two large bubbles), but afterwards the artist could 'curate' with complete autonomy without any input from a rules-structure (one large bubble, one absent bubble). Furthermore, if the diagram represents an iterative AAS process (rather than a

single event in which a combination semi-autonomous and fully autonomous combination would not make sense together), any combination of autonomies is possible.

The graduated marks within the five lobes indicate the level of agential sophistication of the rules-structure within that method. A bar radiating outward terminates at a specific mark to indicate the AS level.

In the center of the starfish is a string that encodes the entire diagram that might be used for digitally storing, searching, sorting and comparing diagrammed AASs. The structure of the string is as follows: Each lobe first has an autonomy character pair (aa). The first character in the pair represents the artist's level of autonomy in that method and the second character, the rules-structure. Possible values for each character are 'n' for no autonomy, 's' for semiautonomous, and 'f' for full autonomy. The next character pair starts with the method identifier for that lobe: G (Gather), A (Alter), E (gEnerate), C (Curate), or D (Distribute) and is followed by the agential sophistication level (n) with a semicolon for the method terminator. The whole AAS can thus be encoded as:

*aa*G*n*;*aa*A*n*;*aa*E*n*;*aa*C*n*;*aa*D*n*;

Figure 1 is an example of a blank diagram showing all possibilities simultaneously. Figure 2 shows an AAS in which the artist first takes a series of photographs with no formal rules-structure in play. Next, a computer program uses the images, without alteration, as seeds for a genetic solver (AS4) that generates a multitude of three-dimensional tower structures. Finally, both the artist and the rules-structure have a role in the curation method for the generated 3D forms. The rules-structure performs a simple check (AS2) on the resulting geometry to determine the technical suitability for the structures to be 3D printed (with full autonomy), while the artist selects the most aesthetically or thematically interesting objects to print (semi-autonomously). In this case the artist's autonomy is partial within the method since the rules-structure's determination of feasibility for printing may override the artist's determination of interestingness.

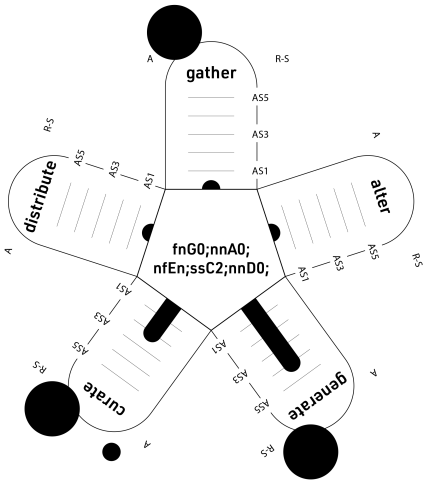

Figure 2. ***Example starfish diagram***

The practical utility of the application of these diagrams is yet to be seen, but as a scaffolding for from which to hang thoughts about AAS, I believe they are already modestly successful.

CONCLUSION

At the far end of an axis of shared autonomy, what might the most extreme example of rules-structure autonomy look like? A science-fictional example of extreme agential sophistication combined with total rules-structure autonomy in an AAS is the artificial intelligence boxmaker, Wintermute, featured in William Gibson's 'Sprawl' trilogy. In the story, the rogue AI eventually slips human control to not only makes its own rules, but to decide what game to play and when. [27] This example is particularly interesting because the 'artist' in this AAS is imagined only after the fact; the assemblages that Wintermute builds from the debris field in the Villa Straylight are initially mistaken for the work of Joseph Cornell. With no role for an artist with the capacity to act (even as curator), a pure rules-structure AAS seems unappealing, but, with apologies to Arthur C. Clarke, is a sufficiently agentially sophisticated rules-structure distinguishable from an artist? [28] In a sense, this is the bogeyman (bogeymachine?) of the singularity: a highly agential, fully autonomous system that turns its production interests to better and better AASs.

At the other end, is it the case that an artist is always already part of an AAS? If autonomous art systems are as old as art itself, as Galanter asserts, and techno-social rules-structures are pervasive to the point of ubiquity, to what degree can all rules-structures be excluded from an artistic practice? [29] Is it even possible, as a contemporary artist, to avoid the influences of systems and the autonomous impulses they threaten/promise to bring to an art practice? In other words, is it possible to not be part of an AAS? How would extreme autonomy in an AAS differ in degree and kind from a human practitioner who intended to eschew systems altogether?

Even in the middle, there is some muddiness. A landscape photographer may exert only a small effort in the transformational 'alter' method (although photographer Edweard Muybridge claimed to have cut down dozens of trees for a better composition) and primarily a curatorial effort working with the utterly inhuman rules-structure of wind, water, light and vegetation. [30] Or is it the case that the wet-plate photographer is also sharing autonomy with a physical rules-system of chemical processes, which, s/he arranges, sets in motion and then arrests at just the right moment to produce an image?

Other objections may well be raised. This line (or tangle!) of reasoning has been ripped from any sort of socioeconomic and cultural context, and does not consider real limitations on human autonomy due to the action of states, discipline imposed by laws, customs, traditions, etc. There is also the issue of individualist bias; I suspect a consideration of collectivist impulses (and perhaps even market forces) could enrich the model in terms of expanded roles.

Why do the machines wave back? In 2011, James Bridle seductively posited a parallel pixelated world, bleeding over into ours, becoming real, wishing to communicate; "Technology wants to be like us, and we kind of want to be more like it." [31] I think he's right, but I'd short-circuit that logic. We wave at the machines, and the machines wave back, because we are the machines. Technologies (our technologies) and their attendant rules-structures are deeply human expressions. They are also mirrors. As the resolution increases in the optics of our machine-mirrors, I suspect that more and more we will recognize ourselves looking back.

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The Tethered Artist

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ABSTRACT

There is a long history of artists physically tethering themselves in order to draw attention to the lengths to which they will go in their practice, often with the implied message that they are conceptually straining at the tethers of convention. Beginning with a discussion of my recent Arctic underwater photography, this article looks at the use of tethers in my own work, as well as in that of several other historical artists. I argue that by highlighting any method of production within the artwork, and specifically a tether, artists are revealing a Realist impulse.

Looking down into the deep clear turquoise water, the chain attached to the anchor slightly arced away and eventually was swallowed by the dark Arctic Ocean. It was difficult to say how far down the chain descended until it disappeared. The ship's captain had said the chain was many hundreds of meters long, but it probably wasn't fully extended at that moment, and even it if it was, the anchor was beyond the depth I could see. Upon closer looking the chain appeared to change color as it receded. At the surface it was a rusty brown. By twenty feet down it read as grey. Farther, where distance became difficult to gauge, the faint line of the chain was a black wisp fading into the blue.

I have been making underwater photographs for the past ten years. The incredible spectrum of colors created in water as light passes through it has always fascinated me. Water's turbidity, particulate matter, and the angle of the sun work together to render the space described in the photograph in an incredible range of saturations, hues, and shadows.

Other artists, educators, and scientists have shared my interest in water's clarity. The Italian meteorologist, astronomer, physicist, and priest Angelo Secchi, working in the 1860s, fashioned a disk that could be dropped into water on the end of a string to measure the water's clarity. Painted half-black and half-white, the Secchi Disk was thirty centimeters in diameter and is still in use. The Secchi Depth marks the point at which the disk, when lowered in the water, is no longer visible.

In the late eighteenth century, the Swiss physicist Horace-Bénédict de Saussure's invented the cyanometer, which was most famously used by the explorer and naturalist Alexander von Humboldt. It comprises small squares of paper dyed in shades and tints of blue, from nearly black to bright blue to almost white, which are arranged around a circle. Holding it overhead, one can use it to compare the colored papers to the blueness of the sky and thus document the relative color of the sky at any given moment. Though not typically used to register water color or clarity, Saussure's device can be seen as an ancestor of both the Secchi Disk and my project.

In June 2016, twenty-six other artists and I participated in the Arctic Circle Residency aboard the Tallship Antigua as it sailed around the Arctic archipelago of Svalbard. I was there to work on underwater photography, documenting the clarity and color of the water near the glaciers we encountered. I took thousands of photographs under Svalbard's waters, capturing turbidity that ranged from pure white to dusty blue to emerald green. With this specific project in mind, I created a device that would allow me to photograph underwater without spending a lot of time in the frigid ocean. I borrowed a camera that could go to a depth of a hundred feet and then loaded a hundred feet of very strong line onto a collapsible fishing rod. A plastic platform with elastic bands served as the camera mount. Four wires at the corners of the plastic rectangle connected the camera to the fishing line. Because the camera was pointed up, its view included the line as it receded up towards the rod, and the wires. I tied telltale knots at twelve-inch intervals going up the line to give a spatial reference and to register any current in the water. The entire contraption was kept upright by a stone hung below the mount.

Figure 1. The author's fishing rod rig, on which an underwater camera can be mounted

The glaciers all over Svalbard were very actively calving in the relatively warm June weather, meaning that city-block-sized hunks of ice would drop unannounced into the water. Our guide, Sarah Gerat, who is an exceptional artist in her own right, ferried a small group of us in an inflatable boat called a Zodiac. She steered us as close to the face of the glacier as was safe; still more than five hundred feet away.

Figure 2. ***Sarah Gerat driving a Zodiac, 2016, photograph by Fritz Horstman***

As a glacier scrapes across the land, making its way to the ocean, it grinds up and collects an enormous amount of silt and grit. Closest to the glacier's face its meltwater, which carries the silt, is at its most concentrated. Glacial milk – the white silty water associated with melting glaciers – visibly dissipates with distance from the glacier's face as it is diluted by the otherwise crystal-clear Arctic water. Because of the influx of glacial melt, the waters near the Blomstrandbreen glacier provided a particularly varied set of images.

Sarah cut the engine on the Zodiac and brought us to a standstill. I set my camera to take photographs every twenty seconds and dropped it into the water. When there was no more line on the reel, the camera was a hundred feet down and pointing up. I slowly and steadily reeled the camera in. Sarah moved us away from the glacier in increments of a few hundred feet, stopping so I could capture more sets of photographs.

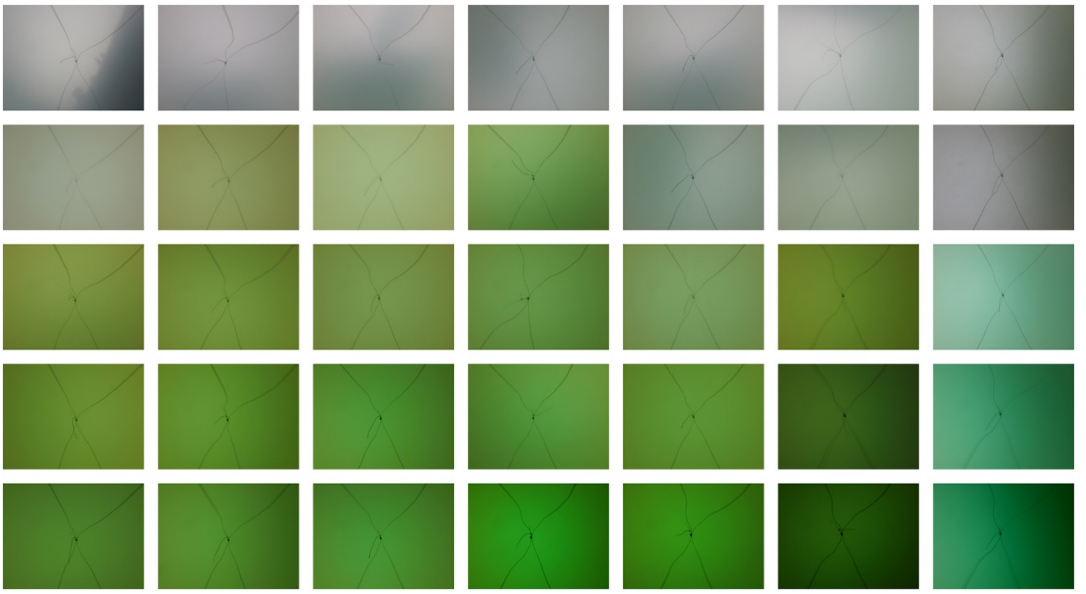

Figure 3. ***Fritz Horstman, Blomstrandbreen, underwater digital photographs, 2016***

The photographs as I've arranged them depict the water closest to the glacier at the far left, moving away from the glacier in the columns to the right. The column at the far right was taken approximately a mile from the face of the glacier. The five images in each column are arranged from the deepest photograph at the bottom to shallowest at the top. The Zodiac can be faintly made out at the top of each column where the camera was just a few feet underwater.

With distance from the glacier, turbidity changed. Overall it decreased, though not consistently. The images in the far-left column show a milky quality that is only present in the shallower images of other columns. There are more minerals suspended in the water closest to the melting glacier, which in the photographs show up as a hazy whitening effect. In general, the deeper photos are more saturated greens, while the shallower photographs display more of the suspended minerals that produce the milky appearance. Curiously, the darkest images in this series are at the bottom of the second column, where I would have expected them to be at the far lower left where the least amount of light would make it through the silt. That may be a result of some change in mineral composition in the water and available light. From a colorist's perspective, I observe that the images at the far left are coolest and that they progressively get warmer in the columns to the right.

The spindly X's in my photographs are fairly consistent. Small changes evince adjustments made between shots. The changing hues of the water are far more visually apparent. The X serves as a register or perhaps as an analogy to a musical staff line. The same could be said of the edges of each individual photograph within the grid, though with the X, it is something that is within the photograph, and so was present in the place where the hue of the water was captured. It is there as a bridge between the moment the photo was taken and the moment it is viewed, linking them and confirming the objective nature of the presentation. Though they in some sense obscure it, the X's registration of the image alters the way the color of the photograph is understood.

The techniques I use are borrowed from science, though a scientist would probably say that I'm not being thorough enough. As an artist, I compare the objective results of photographs taken at different locations with my subjective observations and feelings about color. Psychology and physics are both at play, but ultimately the purpose of the work is to document these colors, not to analyze the results scientifically. Josef Albers gave a series of lectures in the 1960s entitled *Search versus Re-Search,* in which he posits that as an artist he is more interested what comes from searching for something, as opposed to the standardized procedures of research.[1] Driven by curiosity, a search is open and flexible and is an example of active learning. Some of this may be true of research, but it also contains a desire to find or prove a theory, which may get in the way of the open inquiry that Albers espoused. Though my language and techniques may have some elements of science built into them, I wouldn't have pursued this project were there not a poetic level to its realization. My Arctic underwater photography project is an artistic search for evidence.

By traveling to the Arctic, I intentionally made as large a geographical change from my typical studio experience as possible. Few places on Earth are more different from rural Connecticut. Though I saw some incredibly beautiful mountains, glaciers, and waterways populated by whales and polar bears, it wasn't the purpose of my project to bring those images back. Others have done that better than I ever could. I brought back images of the faint light a hundred feet below the surface of the Arctic Ocean, where minerals and shadows mix to create subtle and unique hues. The silt that's been dropped by melting glaciers, which is suspended in the water, is my subject. Taking viewers a hundred feet below the surface in the Arctic Ocean is untenable. Focusing on the wonder of the dirt as it mixes with the water to make blue and green light, allows us to travel down the tether with the camera and rest there in our minds, awash in the murky frigid beautiful color.

Figure 4. ***Fritz Horstman, Blomstrandbreen (detail), underwater digital photograph, 2016***

The Antigua took us past scores of glaciers and eventually far to the north, to the edge of the pack ice. The glaciers groaned and boomed as they slowly eased and tumbled into the ocean. The edge of the pack ice was a slurry of ice chunks sloshing in the undulating Arctic Ocean, creating a cacophony of high-pitched crackling, popping sounds. Conversation aboard the ship often turned to the incredible sounds of the ice. Using a field recorder I asked willing participants to recreate the sounds of the ice using just their voices. Some made the low sounds of the glaciers, many more made percussive sounds like what we'd heard at the pack ice. I compiled the sounds and arranged them with video footage in a composition I call *Ice Voices*.[2]

Participants closed their eyes or looked into the distance in order to better envision the scene. Some tried several vocal techniques before being satisfied that they'd created a good rendition. Few were trained vocalists. Separated from the idea of recreating the sounds of ice, many of the recordings could be mistaken for people clearing their throats or smacking their lips. What would in most recording scenarios be unwanted noise was exactly the point of my composition.

I could have simply made sound recordings of the ice, but there was something much more compelling about the vocal versions. There was slippage between the objective and subjective truths carried in the sound. Everyone tried to the best of their abilities to faithfully render the sounds of ice but were limited by their vocal abilities and memory. The process of making the recordings changed the way we experienced the ice. We were more tuned in to its sounds, and more aware of ourselves being tuned in.

NOISE AND DIRT

Noise in music and dirt in art may simply be what conventionally wouldn't be allowed into the concert hall or onto the canvas. Artists push boundaries. Tastes change. Sometimes boundaries are pushed for theoretical or provocative reasons – to see what would happen or to intentionally rile a complacent audience. At other times, an artist pushes a boundary out of necessity. Robert Rauschenberg created his *White Painting (Four Panels)* in 1951 when he was still a student at Black Mountain College. The painting consists of four completely white square panels arranged in a grid. Light in the room may strongly color, streak, or dapple the canvases. *White Painting* perhaps represents Rauschenberg establishing the opposite extreme of dirt in art. If dirt was to show up on his canvas, it would be immediately obvious and unwelcome. Just a few years after *White Painting*, Rauschenberg created his *Dirt Painting (For John Cage)*. *Dirt Painting* is exactly what it sounds like: a painting made of dirt. It is not a painting made to look like dirt. It is actual dirt. With it, Rauschenberg further established and expanded the edges of his field.

A strong influence on Rauschenberg at Black Mountain was Josef Albers, with whom he studied in 1948, and who taught students to manipulate and explore their material as thoroughly as possible to increase their understanding of its potential. For Albers, anything could be treated as a material in this way—paper, wire, sand, or color.[3] This approach can be applied to something less tangible like teaching or to the broad field of painting. In first making *White Painting* and then *Dirt Painting,* Rauschenberg was being a good pupil (a description rarely applied to him) by identifying his material, then exploring its edges.

Dirt Painting is sculptural and brings dirt in its most natural form directly into the gallery. Though specific historical connections between the Earth Artists, who in the 1960s and 1970s left the white

walls of art galleries to make large – sometimes enormous – sculptures, and *Dirt Painting* are tangential, they most certainly share a desire to push the boundaries of how we think about what sort of "nature" is acceptable in art. In simply presenting dried mud on a canvas, Rauschenberg allowed the natural cracking of the mud to be not only present but visually dominant. This is a significant step towards accepting nature itself as a sort of autonomous art system. It establishes that an art practice may consist of simply identifying and elevating interesting aspects of that system.

The Earth Artists realized that with modern transportation and reasonably large budgets from supporting institutions they had a vastly larger geographical range than any previous artists in history. Artists like Walter de Maria, Robert Smithson and Nancy Holt, created monumental sculptures in the deserts and scrub of Nevada, New Mexico, and other sparsely populated regions. Had they been made a few decades earlier, these sculptures wouldn't have even registered as art. They were too far from the gallery and too unlike what was expected and accepted as art. The inclusion and acceptance of dirt and noise in art and music that steadily increased across the twentieth century required a constant readjustment of the boundaries of both what was art and where it could be seen. Further, those boundaries became permeable.

Prior to his large sculptural work, De Maria made an experimental percussion recording. In 1964, De Maria made *Cricket Music*, a twenty-four-minute composition of his performance on a drum kit played in response to and mixed with a field recording of crickets.[4] De Maria never explained why he made this recording, but it can be seen as a duet between a landscape-evoking noise and a traditional musical instrument. The two are equally important. The listener is drawn back and forth between them. De Maria's sculptures would later extend that idea with an actual landscape and his interventions therein. His recording makes this duet completely natural. The crickets are just there to be listened to.

ALAN SONFIST

Alan Sonfist sought to bring nature back into densely populated areas. His *Time Landscape* was begun in 1965 at the corner of West Houston Street and La Guardia Place in lower Manhattan.[5] It is now designated a park by the Parks Department of New York City. The twenty-five by forty-foot plot was cleared of anything that wouldn't have been present when European settlers arrived in the seventeenth century. If dirt is anything undesired in art, Sonfist's "dirt" was any invasive species, foreign species, and any variety of modern rubbish. In its place, he sowed native plants like beech, witch hazel, red cedar, poke weed, and aster. Once planted, *Time Landscape* was left to grow. As in any forest, some plants grew faster, while some didn't survive. Framed by city streets and sidewalks, it is a self-contained, autonomous sculpture.

Figure 5. ***Alan Sonfist, Time Landscape, 1965-present, photograph ca. 1980 courtesy of the artist***

I was Sonfist's studio assistant from 2002 through 2004. What follows is an excerpt from a recent phone conversation.[6]

> FH: You were very young when you first started *Time Landscape*. You were nineteen, right?
> AS: Yep. I grew up next to a primeval forest in the Bronx, a hemlock forest.
> FH: I certainly understand the impetus to recreate that forest, but to do it in the name of art – it seems like there was no one who had done that before and said "this is art."
> AS: Exactly.
> FH: There were people making parks, obviously.
> AS: I didn't see it as art or not art. I just saw it as something I wanted to do. That was the reality of it. I was studying at that time with a gestalt psychologist at Ohio State. He was teaching artists and architects. His idea is, who are you? What are you going to do? It wasn't look in an art magazine and copy it. His idea was search inside yourself to find you.
> FH: Do you remember that psychologist's name?
> AS: Oh yeah. Great teacher. Hoyt Sherman. Everyone in his class came forward with a different solution to what they wanted to do. I just started digging into my childhood for things that made me happy. And the forest was the happiest moment in my life. So, I said why not make more forests? If that's art, to open a different vision of how we see the environment, or how we see the world, I'm very lucky. I just started writing to people, telling them what I wanted to do: create forests and marshes, rivers in the city of New York. It was kind of interesting. The Modern responded saying this is not art. But they did respond

> and I do have the letter. At some point, I'll publish it. They were very nice and said write to the architectural program, and I wrote to the architectural program and of course they said this isn't architecture. I wrote also to the director of parks of the city of New York. He immediately called me in and said we're going to do it. At the age of nineteen.

Sonfist was studying art at Ohio State but didn't yet consider himself part of the art world. Nevertheless, he was sensitive to the possibilities of the wider world in 1965 and ambitious enough to pursue them. The impulse to recreate a primeval forest in lower Manhattan came to him while studying gestalt psychology, which in the simplest terms understands the mind to consist of a global whole.[7] It was a real act of bravado for the teenager to send proposals to major New York institutions. *Time Landscape* can be understood as an application of gestalt psychology to the larger world. Where Sherman's teaching had allowed and encouraged Sonfist to see more fully what drove him, Sonfist was asking the art world to expand what could be considered art—to acknowledge and accept a larger whole.

Time Landscape is both park and sculpture. It continues to permeate the boundary of what counts as art. Sonfist created it when he was really exploring who he was and how he wanted to interact with the world. Later in my conversation with him, when asked about Rauschenberg, he said with real sincerity, "He's one of my heroes, Rauschenberg. He was exploring his own interaction with the environment in different ways." Both artists instinctively looked beyond what was accepted practice. Both brought a raw piece of nature directly into an art context. During this period of expanding definitions of art, some other artists who were focused on the land were going as far from their audiences as possible. Rauschenberg and Sonfist were just as conceptually untethered as those artists but made it their project to bring the dirt of nature directly to the audience.

On our many visits to the parks and forests in and around New York, Sonfist and I often discussed where the line between nature and culture lies. He fostered in me an awareness that I am always pushing at that boundary. Going to the Arctic to make photographs that reveal both the beauty present in the water, as well as the mechanisms required to make the photographs follows that trajectory. I use the camera in such a way that the line between nature and culture fades like the tether leading away from the camera's lens as it disappears into the silt.

OTHER TETHERS

There is a long history of artists physically tethering themselves in order to draw attention to the lengths to which they will go in their practice, often with the implied message that they are conceptually straining at the tethers of convention. Imagine a fifty-five-year-old man tied for four hours on a winter night to the main mast of a steamboat during a snow storm. It was the year 1840 and the man was the great British painter Joseph Mallord William Turner. The artist claimed to have put himself in this position to better observe the meteorological conditions that he wanted to paint. The resulting painting, *Snow Storm – Steam-Boat off a Harbour's Mouth making Signals in Shallow Water, and going by the Lead. The Author was in this Storm on the Night the Ariel left Harwich,* is titled, perhaps overly emphatically, to evoke the artist's heroic observational commitment.

The painting itself is a force. At thirty-five by forty-seven inches it is large enough to fill the viewer's entire field of vision. Painted in oil on canvas, it is composed mostly of shades of grey,

with blue and brown and black, which swirl in a dizzying blur towards the vaguely defined paddlewheel of another steamship. From the short-poem-cum-title of the painting I am right there on shipboard with Turner. It's cold and there's sea water sloshing about the deck. Driven snow stings my face, forcing me to squint. This is the raw sea weather that Turner wanted us to feel.

There is no historical evidence of a ship called the *Ariel* being in Harwich in 1840, nor of the artist being in that part of the country at that time.[8] The oft-told story of Turner tied to the mast of a ship is very likely a fabrication by the artist himself to enrich the myth of his process. Whatever the case, we can, in seeing the painting, imagine what he wants us to imagine—and likely what he also only experienced in his imagination. We empathize with the painter (even a fictional one) tied to the mast of the ship.

The entire escapade first appears to be an earnest attempt at Realism but is actually a very romantic impulse by a decidedly Romantic painter. Realism within the arts is a way of working in which objectivity and truthfulness are upheld. Realism's perennial foil and opposite Romanticism celebrates the individual's subjective view of the world.[9] Where the Realist would have actually been tied to the mast and might even have had an easel there or some method of noting the conditions, the Romanticist is more interested in drumming up the drama of the moment, real or imagined. Since the two terms first became established in the late eighteenth century, most artistic production has leaned towards one or the other. In artists' choices to tether or untether, and whether to call attention thereto, lie Realist and Romantic impulses.

Carolee Schneemann's performative installation *Up to and Including Her Limits* exists today as a rope and harness, as well as a group of videos and drawings, which compile six performances that took place between 1973 and 1976.[10] In the original performances, the artist suspended herself from the ceiling in a tree surgeon's harness. Large pieces of white paper were spread on the floor and adjacent walls. Naked except for the harness, she used crayons to draw on the paper as far as she could physically reach. At some points her eyes were open and she made intentional drawings. At other points her eyes were closed and the drawings became more about the movement of her body in response to the restraint. The resulting drawing is perhaps less important than the act of making it, which is why the video documentation and harness are such important elements of the work. One aspect of Schneemann's nakedness was the attention drawn to a woman making art at a time when women were sorely underrepresented in museums and galleries. Moreover, if a woman was going to be in a museum or gallery, she was usually in a painting, naked, and the subject of the presumed male audience's gaze. Women's Liberation was gaining momentum in the United States, and this work came to symbolize what many were experiencing and pushing against in other professions. Schneemann's contorted body very literally showed how far she could reach while being tethered by the harness.

More than a decade later, Matthew Barney began his *Drawing Restraint* series, which he has continued to enact alongside his other work for thirty years.[11] Deeply indebted to Schneemann's project, Barney's *Drawing Restraints* focus on the physical challenge of making a drawing while tied to an anchor, turning it into a sort of an athletic event. Still a student at Yale when he made his first iteration, Barney tied himself to a point in his studio with a length of bungee that allowed him to reach nearly to the edges of the space. He arranged furniture so that he had other limitations and props. Photographs that survive as documentation show the young artist clinging to a metal bar at the upper edge of a wall, legs splayed at the top of a table wedged as a ramp against the wall. He is

using a long pole to make marks on a piece of paper on the other side of the room. A second table is set as a ramp up which the artist appears to have climbed in order to hang the paper. Subsequent versions of *Drawing Restraint* continue using the key elements of documentation, a tether, the artist, and a drawing implement. The spaces change and the form of tether changes, but the main idea is consistent.

Schneemann used the tether physically, while mining it for metaphor. Barney uses it more literally. His is ultimately a formal exercise. Schneemann's project is conceptually far richer and more provocative. She is physically tethered, protesting loudly for Women's Liberation, and conceptually pushing beyond any previous notion of how a drawing could be made. There is disparity in the renown of the two linked projects. The male artist picked up ideas from a woman's feminist perspective, thus far Barney has achieved much more recognition and art world acclaim than Schneemann.

The performative act of tethering oneself has been used in other ways. Linda Montano and Tehching Hsieh's project *Art/Life: One Year Performance 1983–1984 (Rope Piece)* took place in the titular years, during which time the two artists were tied to one another by an eight-foot rope. They set as a condition that they would never in the course of the year be untied and that they would never touch one another.[12] Again, photographs are the main source of documentation. As the year progresses we see the artists' hair styles and length change, clothes change, and expressions change. It becomes possible to imagine the challenge and exasperation that must have accompanied the artists' dedication and endurance. They did not produce any other tangible or physical art based on this project. The only thing that remains are the photographs and the idea. We are left to consider the various ways we are tied to the people in our lives, our notions of privacy, and how long an eight-foot rope really is. It is an extraordinary and multifaceted project, which like Schneemann's, uses the tether both literally and metaphorically to expand how art can be made and understood.

Robert Smithson completed *Spiral Jetty* in 1970. Set at the outermost edge of Utah's Great Salt Lake, the sculpture is the very epitome of an Earth Artist going deep into nature to make a monumental artwork. Most people who were aware of it just after it was completed had only seen it in photographs the artist took from ground level. Over the years, the level of the lake rose, leaving the sculpture mostly invisible. As the lake level dropped, the sculpture reemerged, and in 2009, Francesca Esmay, Aurora Tang, and Rand Eppich launched a helium balloon with a digital camera attached to document *Spiral Jetty* for the Dia Art Foundation, which had acquired the artwork from the artist's estate in 1999.[13] Not wanting to lose their camera, the three tied a long line to the balloon. In addition to documenting Spiral Jetty the resulting photographs record their efforts in documenting the sculpture's reemergence from the water. Still, their tetheredness in some way highlights the limits that Smithson found as he pushed as far away from the gallery world as possible. He was still terrestrially bound, as were the photographers.

In 1980 Leila Daw, then based in St. Louis, Missouri, made a series of photographs called *Ancient City in the Sky*. She gave specific instructions to a sky-writing pilot to make drawings over the ancient Native American city of Cahokia near present-day St Louis. Where Smithson and others had been tied to the ground, Daw took the remains of the ancient city and drew them in the sky. The photographs are documents of drawings that existed for only the moment before wind blew them away. They are a rather abstract sort of map. Their beauty lies in the simple act of expanding our conception of the historical landscape to include the sky.

Figure 6. ***Leila Daw, Ancient City in the Sky, 1980, photograph courtesy of the artist***

Had Esmay, Tang, and Eppich been documenting *Spiral Jetty* just a few years later, they very likely wouldn't have used the balloon and tether. Batteries and motors have advanced in such ways that what once was the territory of science fiction has become the reality of drones. Cameras can now be attached to tiny helicopters, which are controlled with handheld devices. Documenting the world from above has become remarkably possible. With rare exceptions, the Earth's entire surface has now been photographed or videoed, often in great detail.

Where is the line between this incredible expansion of documentation and art? Does such a seam exist? I think that it does exist, but it's on the move, permeable, and we may be too close to the invention of this new technology to easily see what will be most interesting about the art made with it. Edward Burtynsky, for example, is currently putting drone technology to great use, making incredible photographs from the sky.[14] In a few decades, someone may look back and observe that he found an important edge of the art form upon which to push; that in his exploration of the vast new freedom of untethered cameras he found a poetry that captures this moment in history. It is also possible, though it seems unlikely, that the work he is producing will someday read as a less-art-like documentary. This unknown perspective is the great challenge to artists who choose to engage with any new technology. We will only know whether they've succeeded if they try. Perhaps this challenge and the progress associated with it is one of the main attractions of making art with new technology.

Most of the artists I've highlighted as boundary-pushing practitioners have been compelled by a Realist impulse. Working at the edges of their fields, their discoveries and innovations are so new that to present them in any form other than objective truth would diminish and confuse their importance. Burtynsky, among others working with drones, is much more interested in using the

freedoms of the new technology to establish a deeper and more nuanced view of the world as it is. Even Turner, who was driven by a Romantic notion of how his audience might better appreciate his gesture, framed it as though it was an act of Realism. There may be a larger truth about the evolution of art: art that truly expands a field will tend towards Realism, whereas innovations within an established genre may tend towards Romanticism.

The twenty-seven artists aboard the Antigua came from North America, Asia, Europe and the Middle East. It was a long journey for everyone, and for everyone it was an opportunity to stretch beyond the typical expectations and possibilities of our studios. In the leadup to the trip I sent an email to all of the participants inviting them to bring a small artwork that would be included in an exhibition I planned to organize. I didn't know exactly what or where it would be, and I'd not met any of the other artists, but I trusted that the people who had put themselves forward and had been selected to participate in the residency would muster something compelling. They did. Ultimately, we mounted two versions of the exhibition, which came to be known as *Pole Saw*. The first venue was in a small centuries-old hut on a desolate fjord. The second was in the cantina of an abandoned Soviet coal-mining town called Pyramiden. The extreme limitations of shipboard Arctic travel dictated that most of the objects were small and on paper. There were a few small sculptures. The most ambitious was by Dalal al-Hashash, whose opalescent clear vinyl sheets were configured and reconfigured to evoke the northern lights. Several newly-created additions were submitted between the first and second iterations of the exhibition. The second exhibition in particular captured the spirit of this group of artists, who were by that point far from their usual patterns, feeling and thinking in unusual ways. The faded floral fabric that served as backdrop complicated and heightened the effect. Aquavit was served and songwriter Kate Schutt performed. Something new and unique and incredibly temporary happened. We were out on an edge. Each of us was pushing, straining against some unnamed tether. I will never forget that feeling.

Figure 7. ***Pole Saw, Installation View, Pyramiden Cantina, 2016, photograph by Fritz Horstman***

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Fritz Horstman has shown his photographs, sculptures, drawings and videos in recent exhibitions in France, Russia, Japan, Norway, California, Massachusetts and Brooklyn. He has developed and presented workshops and lectures for institutions such as the Bauhaus Dessau, Dia: Beacon, The Drawing Center, Princeton University, Bennington College, Yale University, Exploratorium San Francisco, the Ecole des Beaux-Arts Paris, and the Lebanese American University in Beirut, as well as numerous elementary, middle and high schools and community centers. He is Artist Residency and Education Coordinator at the Josef and Anni Albers Foundation.

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Generating Art in Symbiotic Systems

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ABSTRACT

This essay reviews the book by Francesca Franco, *Generative Systems Art: The Work of Ernest Edmonds* (London: Routledge, 2018). This illustrated monograph discusses the primarily computer-generated work of Ernest Edmonds (b. 1942) in the context of twentieth-century art in Europe. Franco provides relevant technological history as she analyzes Edmonds' paintings and interactive and digital projects, often created in collaboration. This book is a significant contribution to the history of computer art in which Franco affirms Edmonds' focus on "the human's way of working."

Francesca Franco's well-illustrated monograph, *Generative Systems Art: The Work of Ernest Edmonds*, contributes significantly to understanding art in the U.K. in the latter half of the 20th century, and its connections to other disciplines and locales. While Franco's focus on Edmonds bridges many art historical gaps in knowledge about Edmonds and his generation of artists in the U.K. (including Roy Ascott, Stroud Cornock, Edward Ihnatowicz, the Systems Group [started by Malcom Hughes and Jeffrey Steele in 1969], and Stephen Willats), the book also links developments in computer technologies to art-making. As Charlie Gere notes in the Foreword, these "artists were fully engaged in questions of mathematics, science, technology and code," thereby refuting the two cultures demarcated by C. P. Snow. [1] The 2008 edited volume, *White Heat Cold Logic: British Computer Art 1960-1980*, whetted the appetite for more in-depth studies of this topic and Franco's volume usefully explores this material. [2]

The Career of Ernest Edmonds

Franco traces the career of Ernest Edmonds chronologically from his early formal training in mathematics at Leicester University, through doctoral studies in logic at Nottingham University, and his leadership in academic, computing, and art circles up through 2014. [3] Focusing on ways in which constructivism was linked to generative and interactive art, as well as connections between computer-based art and systems, Franco broadens our understanding of this vibrant time period, both technologically and artistically. She uses Margaret Boden and Edmonds' 2009 definition of generative art as a starting point: "'wherein the artwork results from some computer program being left to run by itself, with minimal or zero influence from a human being.'" [4] Much of the book examines this definition's assumptions, though, given that human beings and computer programs were and are intertwined. Franco notes that Edmonds' "works presented

challenges that helped and encouraged the development of new technologies and methods, making his art practice and his research in technology a persistent mutual relationship that echoes that of a symbiotic system."

Franco's attention to Edmonds' milieu reveals little-known influences and practices at mid-century in the UK, from the theories and art of Charles Biederman to concrete poetry, from sculptors Naum Gabo and Antoine Pevsner to the circle of London Constructivists. What Franco's scholarship clarifies is the continuum in art of this time and place between traditional materials like paint and wood and human-machine creations.

Edmonds' "Nineteen," created between 1967-69, summed up his abstract explorations of that decade; in searching on Leicester's campus for a way to spray paint the twenty squares in that gridded composition, Edmonds met sculptor Stroud Cornock, who became an important collaborator. Edmonds started to program computers in 1967 and realized that these machines could not only help him solve logic problems but also compositional challenges he faced in "Nineteen." Edmonds' relationships with artists in the Systems Group and with Constructivists deepened in the 1970s, as Franco recounts, and Edmonds realized that he could use "a system as a medium to make art, including both static and interactive forms."

Edmonds' interest in systems theory was complemented by his exploration of audience interaction and human communication systems. Franco discusses four artists who delved into similar though independent investigations during this time: Malcolm Hughes; Edward Ihnatowicz; Roy Ascott; and Stephen Willats. Franco quotes Edmonds on his conversations with the older Ihnatowicz when they considered "'issues that are sometimes seen as artificial intelligence subjects or cognitive science subjects which turned out to be important to art, for example the relationship between touching and perceiving, the way in which, by acting, we affect what we perceive….'" This cybernetic idea—the intertwining of the perceiver and the effects of perceiving on further perception—informs much of the book because of Edmonds' fascination with audience responses to his art. Edmonds' works in the early 2000s "learned": the works changed over time in response to interactions with viewers. This adaptability reflected the influence of Ihnatowicz and well as experiments by Edmonds and Cornock in the 1970s.

Franco tells about Edmonds' contributions in the context of computer history, including the increasing availability of personal computers, graphical interfaces, and the World Wide Web. Yet the technological history is only part of the story. The author focuses on themes in Edmonds' art—structure, interaction, time, and color—and how computing assisted his artistic creations, which integrated those concepts: "By…realizing a work directly from the computer, he was able to explore colour, structure and time with no restrictions on length" and without repetition, Franco explains.

Edmonds continued to paint and draw while he built hardware and conceptualized networks in the mid-1970s. For his two-dimensional compositions, he created strict rules that Franco describes as "procedural coding work." His frequent discussions in the 1980s with sculptor and painter, Kenneth Martin, "'pointed toward software art'," according to Edmonds. He posited that software was "a medium that could be used as an aid to human creativity."

In the 1990s, Edmonds' love of music, his connections among other artists, and changes in technology fostered work that integrated sound into his projects. Some of these complicated performances involved musicians who played next to programmed video projections, which determined what notes the musicians played and for how long. Franco quotes a 1990 lecture by Edmonds: "The man-made spaces in which we live and work are no longer defined just by bricks or concrete: information technology, computers and communication systems, is [*sic*] increasingly providing new ways of defining space."

Edmonds responded to new technological developments, which, in turn, he adapted to his artistic requirements, including new possibilities for audience engagement using movement sensors.
In 2002, he relocated to Sydney, Australia, where he continued his collaborative work. Linda Candy and Edmonds' Creativity and Cognition Studios, which they co-founded in 1993, teamed up with the Powerhouse Museum in Sydney on an initiative called "Beta_space" to experiment with interactive art. This living laboratory allowed artists to show an almost-finished work and get feedback from the public to refine it. In 2006, Edmonds displayed a composition ("Tango Tangle") in a public space, Federation Square in Melbourne, which responded to sounds picked up around the square. Edmonds aimed to create "'open systems that develop and change sometimes directly sometimes only subtly or much later in accordance with the interaction with the environment.'" The process here was more important than the final product.

Edmonds continued to alternate between screen-based work and painted surfaces. Franco compares two works by Edmonds, separated by 34 years ("Fifty Two," an acrylic painting of 1980 and "Four Shaped Forms," a four-panel acrylic of 2014). Both of these works were "concerned with the organization and structure of surfaces and colors," according to Franco. She carefully contrasts the composition, the color selection process, the paint application, and relationships to other work by Edmonds. Significant to both works was Edmonds' belief that constraining artistic choices made for more powerful work. Franco notes: "A painting such as 'Fifty Two'—which was created without the aid of a computer but whose products were strongly inspired by computer programming—paved the way to Edmonds' later explorations in structure as they evolved into time-based art."

"The Human's Way of Working"

Following this analysis, Franco then describes the scientific and technological developments that Edmonds forwarded in his art practice, focusing on "the human's way of working." Edmonds' contributions to human-computer interaction include: iterative software design; adaptable user interfaces; and user interface architectures. Out of Edmonds' research came the realization "that interacting with a computer, even by programming it, could stimulate one's thinking…. Edmonds saw AI [artificial intelligence] as an assistant to human thinking, helping the human be more creative, rather than as a replacement for the human." Edmonds remains committed to research that enhances creativity rather than building autonomous systems.

Every reviewer, it seems, wants the book they are reviewing to be other than it is. This book, for me, is no exception to that desire. I welcome the excellent content, but I want more, more about Edmonds and about other artists: a discussion, for instance, of Edmonds' 1971-72 collaboration on "Rover" with Cornock would have provided a further vantage point on these two artists' productive joint research on interactivity with analogue means. [5] Edmonds' ambitious

distributed interactive work, "Cities Tango: Between Belfast and Sydney" (2009), would have benefited from comparisons to other contemporary artwork, such as "The Maraya Project" (2007-13) by Glen Lowry, M. Simon Levin, and Henry Tsang, developed between Vancouver and Dubai. Regarding the content that is included, Franco assumes that the reader knows the significance of the 1968 "Cybernetic Serendipity" exhibit in London and the meaning of "restricted languages," to name two lacunae.

I was frustrated with the book's organization and style. The prose is serviceable but not elegant: Franco's frequent use of passive voice and repetitions indicate the need for further editing. With thematic analyses woven in with chronological treatment, the index is a crucial tool but, unfortunately, it was badly done. (George Mallen is discussed in the text but not listed; Stephen Willats has incomplete entries; the exhibit, "Cybernetic Serendipity," and the Seeheim model are mentioned, but not indexed, for example.) The captions for the images should provide dimensions and media.

What Franco capably does in this book is hard to accomplish: it is no small undertaking to assimilate Edmonds' substantial documentation, archival material at the Victoria and Albert Museum, one-on-one interviews with an extremely busy artist over four years, and secondary literature related to computer technology and twentieth-century art, among other disciplines. Further, Franco for the most part admirably balances technical information with art history in order to appeal to the general reader. Now that she has completed this important book, I look forward to further syntheses and insights about this and related material by this active and thoughtful scholar.

ENDNOTES

1. C.P. Snow, *The Two Cultures and the Scientific Revolution* [The Rede Lecture, 1959] (New York: Cambridge University Press, 1961).

2. P. Brown, C. Gere, N. Lambert, and C. Mason, eds., *White Heat Cold Logic: British Computer Art 1960-1980* (Cambridge, MA: The MIT Press, 2008).

3. In 2017, Edmonds received both the Lifetime Achievement Award in Digital Art from the Association for Computing Machinery's Special Interest Group on Computer Graphics and Interactive Techniques (ACM SIGGRAPH) https://www.siggraph.org//participate/awards/2017-art-award-ernest-edmonds and the Lifetime Practice Award in Computer-Human Interaction from ACM's Special Interest Group on Computer-Human Interaction (ACM SIGCHI) https://sigchi.org/awards/sigchi-award-recipients/2017-sigchi-awards/.

4. M. Boden and E. Edmonds, "What is Generative Art?," *Digital Creativity* 20:1-2(2009), 32.

5. S. Cornock, "The Interactive Art System," in *Ideas Before Their Time: Connecting the Past and Present in Computer Art*, N. Lambert, J. Gardiner and F. Franco, eds. (London: British Computer Society, 2010). http://www.stroudcornock.com/CAT%202010%20Cornock.pdf For more images see: http://www.stroudcornock.com/interactiveimages.html#Rover-08.jpg

6. A. M. W. Jim, “The Maraya Project: Research-Creation, Inter-reference and the Worlding of Asian Cities,” *Third Text* 28:1(2014), 15-31.

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