

Cloud Mapping Project (Cloud Room)

by

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OVERVIEW

In the past, all our artistic creations, scientific dis-
coveries, and technological innovations – including
computers (including the raw data and software to
run them) – have been designed by individuals, but
this is changing.

Intelligent machines are now beginning to design
things themselves, independent of our input, and addi-
tionally can communicate with each other without our
guidance. When machine-learning computers and the
'Internet of Things' (a term coined by Cisco Systems)
continue to provide us with "a telescope and a micro-
scope into the once invisible world between people,
machines, and physical objects" ¹ through our con-
nected devices, will this lead to not only the obsoles-
cence of individual privacy and the need for personal
observations (including those necessary for art making
and scientific discovery), but also the obsolescence of
the individual?

In some cases, this is already happening: jobs are elim-
inated because they are now computer-automated,

ABSTRACT

The cloud is hard to pinpoint, in its very nature nebulous, and in all its manifestations, it is continually shifting, changing, and evolving. It has always been an obsessive idea in the arts and has inspired works by well-known artists and musicians including Claude Debussy, John Constable, and Alfred Stieglitz.

Loss of privacy brought on by certain aspects of cloud computing has increased the potential for unauthorized data-mining of our personal information and decreased our freedom of expression, along with the value of personal observations. This has had a direct effect not only upon scientific discovery, but also on artistic creation, which is increasingly done using software, the design of which controls the nature of our output.

Cloud Mapping Project is a 21st-century project that employs remote sensing devices used in scientific applications, such as meteorology and governmental surveillance, to generate artistic images. This is in direct contrast to artists and scientists in the past, whose works were created by their own hand via personal observation.

This paper seeks to explore the differences between contemporary artworks that use technology to create works of art (using Cloud Mapping Project as an example) and artworks of the past that were made by individuals, and it will use the subject of ‘the cloud’ in all its manifestations, from meteorology to computing, as its focus.

replaced by machines. Robots are already assisting in microscopic surgery. As ABI research explains in a recent paper, titled “The Internet of Things vs. Internet of Everything”:

As the controlled Things become smarter, enabled by machine learning and artificial intelligence, it is likely that the need for human input will gradually decrease. The Things that today require such guidance to be aware of what the human user prefers will in the future be immersed into the environment

in which they operate. ²

How will this development affect personal observation and art making as we increasingly tune out our environment in order to attend to our connected devices instead? As software applications increase in sophistication, complexity, interactivity, and contextual awareness, will software itself generate creative output (that is, art, music, movies, and literature) for us, and will we ourselves lose our urge, curiosity, and ability to create anything of value, in any discipline, without the aid of

machines?

In *Programmed Vision*, Wendy Chun states: “software has become a metaphor for the mind, for culture, for ideology, for biology, and for the economy,”³ which indicates a growing cultural acceptance of the fact that software is replacing our thinking. The question is: who or what is designing the software, and what are its underlying purposes?

It seems, at minimum, that if machines and software are going to stand in for us in greater and greater capacity, in a multitude of ways, then we should at least pay more attention to and, perhaps in some situations (such as privacy and human rights), limit the scope of their design and the effects of their usage. According to Samuel Greengard in *The Internet of Things*,

*For companies building products and systems designed to operate within the framework of the IOT, there's a critical need to understand when personal data are required and it's necessary to strip out personal identifiers.*⁴

Contemporary art installations like *Cloud Mapping Project* are examples of digital-first, machine-generated art (in which digitally created tools make digitally created art without human observation or interpretation) that stand in sharp contrast to past works created by innovators such as John Constable, Alfred Stieglitz, and Claude Debussy, whose non-digital tools did not design nor determine the meanings of their works, but were instead subordinate to the direct observations, analysis, and revelations made by the experienced individuals who guided their use.

This article provides some historical perspective as to the development and meaning of ‘the cloud,’ from arts to technology (including painting, photography, music, meteorology, and computer-generated design), along

with some personal observations made by those individuals who helped define its meaning in its infancy that compare this to the complexity of what it means now.

Meteorological Visual Representation of Clouds and their Structures

The metaphor of the hierarchical structures of the cloud has its origins in weather, as most clouds form at specific altitudes due to particular weather conditions that also determine their structural shapes. Over 200 years ago, the British chemist Luke Howard first defined (and illustrated through watercolor sketches) the four main cloud structures that are still in use today (cumulus /heap, stratus /layer, cirrus /curl and nimbus /rain).

In *On the Modification of Clouds* published in 1802, Howard describes the structure of clouds and how they differ from each other:

*By modification is to be understood simply the Structures or manner of aggregation, not the precise form or magnitude, which indeed varies every moment in most Clouds. The principal Modifications are commonly as distinguishable from each other as a Tree from a Hill or the latter from a Lake; although Clouds in the same modification, considered with respect to each other, have only the common resemblances which exist among trees, hill, or lakes, taken generally.*⁵

While Howard's preliminary research exposed the relationship between different atmospheric conditions and defined the basic cloud structures, 21st-century art projects like *Cloud Mapping Project* incorporate modern meteorology methods that can also include surveillance and data-mining capabilities by using Radar, LiDAR, satellites, and Self-Organizing Maps (neural networks that use pattern recognition, cluster-

ing and that can improve their performance through machine learning) used to produce high-resolution maps and to classify climate and clouds. Digital remote sensing is used for a variety of applications including meteorology, mapping, news analysis, illustration, and military surveillance. It allows us to observe the environment or a situation from afar by analyzing specific, measurable information and presenting it in visual and/or acoustic format. Even though this approach is done remotely, it is not entirely unlike Howard's writings and watercolor representations of cloud structures and meteorological conditions (made through direct observation), which resemble weather forecasting, albeit on an infinitely smaller scale, using the tools of the day.

According to Robert Schowengendt, remote sensing is:

*The measurement of object properties on the earth's surface using data acquired from aircraft and satellites. It is therefore an attempt to measure something at a distance, rather than in situ. Since we are not in direct contact with the object of interest, we must rely on propagated signals of some sort, for example optical, acoustical or microwave...[Additionally it can] provide a repetitive and consistent view of the earth that is invaluable to monitoring short-term and long-term changes and the impact of human activities.*⁶

While Howard was busy defining the structure of clouds, his contemporary, John Constable, was able to take Howard's classifications and descriptions and create more visually arresting, meteorologically realistic representations of them in the form of oil paintings (he completed over 100 sky sketches from 1820 to 1822). Constable was deeply interested in and knowledgeable about meteorology, including then-current theories on the formations of clouds, rain, and rain-

bows. He owned Thomas Foster's *Researches About Atmospheric Phenomena*, published in 1813, one of the first meteorological texts to attempt to explain weather. According to John Thorne in his essay, *Constable's Meteorological Understanding and his Painting of Skies*:

*Detailed analysis of Constable's dated weather inscriptions has shown that he systematically produced a series of sky sketches that covered all times of the day, were meteorologically accurate, and were clustered around noon. The 'pure' sky sketches in particular were painted close to noon to help Constable complete his large skies in the favored noon setting of his finished work. The accuracy of the sky sketches is such that it is even possible to date with some certainty, using historical weather records, fifteen sky sketches that have incomplete dates.*⁷

Contemporary weather forecasts use techniques to collect quantitative data about the current state of the atmosphere and make predictions. Some of Constable's paintings from over 200 years ago so accurately represented weather conditions that they can be considered the predecessors of such weather forecasting and meteorological mapping techniques.

In *Cloud Mapping Project (Cloud Room)*, three-dimensional cloud images are downloaded via *Google Earth* or open-source applications in real-time, located by x, y, and z latitude and longitude coordinates. Cloud structures form at different altitudes and positions in the sky, so this is an aesthetic as well as a scientific and cartographic decision. Each of the four walls simulate the earth's globe in 3D by continually posting computer-generated surveillance – like picturesque cloud images from a specific direction/location (north, south, east, or west) as day turns into night around the world (figure 1).

CLOUD MAPPING PROJECT © DEBRA SWACK PERA MUSEUM, ISTANBUL 2014



Figure 1. *Cloud Mapping Project*, multimedia immersive installation, schematic view © Debra Swack, 2014. Used with permission.

NORTH

SOUTH

EAST

It will incorporate an atmospheric, binaural soundscape incorporating field recordings of weather, and possibly will use specialized eyeglasses incorporating Tobii eye-tracking or other technologies to enable viewers to manipulate cloud images with their eyes.

Cloud Mapping Project combines the structural qualities discovered by Howard with the painterly qualities expressed by Constable (minus personal observation), with the addition of digital remote sensing. Through this synthesis, it suggests that the loss of personal observation, which is not needed to make machine-to-machine art, can diminish the value of personal observations, and also suggests the potential for misuse in the form of unauthorized surveillance and data-mining. For example, such surveillance could lead to the deployment of commercially available remote-

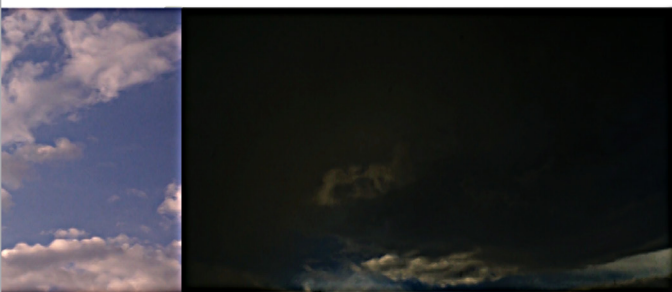
controlled drones (unmanned air vehicles) equipped with remote-sensing devices that are available to anyone, including potential terrorists. As Greengard states in the Internet of Things:

While legitimate uses exist in areas as diverse as agriculture, mining, environmental monitoring, industrial security, weather forecasting, package delivery, and commercial photography, there's also the danger of drones being used for less noble purposes such as spying on celebrities or political leaders, stealing objects, and dropping highly targeted bombs or payloads such as anthrax, synthetic viruses, and other bioweapons. ⁸

The Sound of Clouds

While Howard and Constable opted for scientific clari-

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T WEST

ty in their representation of the hierarchal structure of clouds in the beginning of the 19th century, by its end, artistic representation of the cloud took an impressionistic turn toward abstraction. For example, in the late-19th century, French composer Claude Debussy was influenced by paintings of the 1870s such as *Nocturne in Blue and Silver* by James Abbott McNeill Whistler. He applied these impressionistic principals to his depictions of clouds in his musical composition, titled *Nocturnes*, which he completed in 1899. This hazy concept of clouds allowed for greater variability and movement in its representation of atmospheric conditions by capitalizing upon the vague, rapid comings and goings of events and sounds. Yet, at the same time, Debussy (and Whistler) were trying to capture the feeling of the 'whole' or the 'essence' at any given time. This view allowed for more complex and dy-

namic events to occur simultaneously, and for these to be acoustically and visually represented; however, the view of the whole tended to diminish any individual details, which were never retrievable and were themselves continually in a state of flux.

Debussy described the atmospheric effects in *Nocturnes* as transitioning from periods of stability, as reflected by "the unchanging sky and the slow, solemn movement of the clouds dissolving in grey tints lightly touched with white," to periods of volatility caused by the "restless, dancing rhythm of the atmosphere interspersed with sudden flashes of light."⁹ The realism of his sound is akin to binaural field recordings (discovered about 20 years prior to the completion of *Nocturnes*), such as those of weather and wind chimes used in *Cloud Mapping Project*. *Cloud Mapping Project's* soundscape is based on *95 Chimes*, an immersive, sculptural-sound art installation using binaural recordings of wind chimes that was first presented at the ASCI Sci-Art Symposium at the Museum of Natural History in 2002 (figure 2).

Binaural recordings can convincingly replicate a sound's location by taking advantage of the fact that we are capable of locating sounds in three-dimensional space and perceiving their proximity to us (including their distance and direction). Binaural recordings can also provide a wealth of information for surveillance tracking, including temporal data.

In *Claude-Achille Debussy: Living Masters of Music*, Debussy's first biographer, Louise Liebig, describes the binaural effect of his music in her comparison of Debussy to the 19th-century painter Millet:

The great interpretative painter of rural life, J. F. Millet, expressed the wish to make others hear "the songs, the silences, the rustling of the air." He longed to make them see all that he saw. Through

the medium of sound Debussy has accomplished a little of what the French painter aspired to and in a way achieved. ¹⁰

Liebich's observations in 1908 speak volumes about her admiration for Debussy's ability to realistically capture and invoke the sounds of nature, making us feel that we are there experiencing it along with him. However, this view is in direct contrast to our contemporary daily life: we not only ignore nature – we don't even know it's there. We are often too busy tuning into our connected devices, which contribute to the loss of our ability to sense, feel, and act. As Francesg Dyson states in *The Tone of our Times*,

Isolated in houses and buildings with cities domed by data clouds, we have become deaf to the sounds of the earth, and as a consequence we lack the ability to sense, and this is pivotal to the substance of common sense. All we hear, all we can listen to is the racket of our own voices – arguing, legislating, pronouncing, warring and transferring power. What happens when “the racket” substitutes for the environment? ¹¹

Additionally, the construction of *Nocturnes* is pre-scient of the augmented reality used within the cloud today, blending the virtual with the real and intertwining the throughput of actual events, data, and computer-generated information presented in a perpetual stream. Debussy's dizzying view of clouds and their perpetual activity can serve as a metaphor for the complicated issues surrounding privacy and security: where is all this audiovisual data – consisting of imaginary displays “mingling with the aerial revelry” amongst a background of music that blends with the “luminous dust participating the universal rhythm of all things” ¹² – coming from, and where is it going?

The fact of the matter is that the legal system itself

is having difficulty enacting laws that keep pace with technology, and what is legal in one country may not be legal in another. This all adds to the nebulousness of the cloud.

The challenges and problems grow exponentially as data moves across servers, clouds, and devices. Attempting to understand where data reside and who has claim over data is a next to impossible task. ¹³

Machine Captured Images of Clouds

At the beginning of the 20th century, the depiction of clouds reverted to the scientific view first espoused by Luke Howard and John Constable. But this time, the representation was a little different, as it encompassed the use of a machine – a camera – in order to make images. Throughout the 19th century, photography was not considered an art form, but rather a means to scientifically document information. The camera was considered a machine and, therefore, incapable of making art. Starting in 1902, the photographer Alfred Stieglitz, by promoting the activities of his Photo Secession group, Camerawork, through publications and exhibitions, was able to help establish photography as an art medium on par with painting.

In his *Equivalents* series, Stieglitz's innovative approach to photographing clouds through personal observation was scientific, not impressionistic like Debussy's. While Debussy aimed at depicting a zoomed-out worldview snapshots of events, Stieglitz's view was zoomed-in and detailed, a perspective that was embraced by many artists and photographers at the time as being more objective and scientific.

He made close-up, cropped, abstracted, satellite-looking photos by using a small 4x5 handheld camera pointed at the sky at different angles, which gave them an atmospheric, meteorological effect. In 1923,

“95* CHIMES”

Islip Art Museum Carriage House Proposal

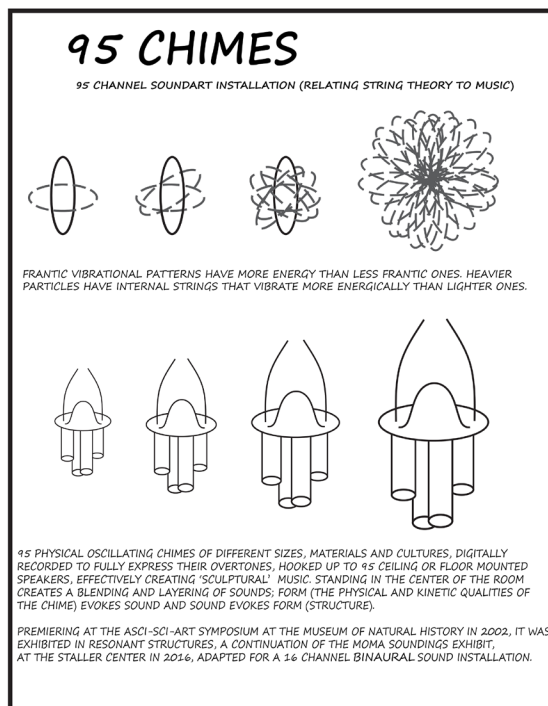
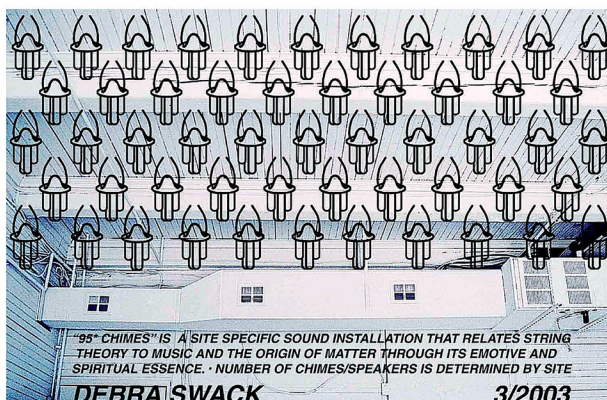


Figure 2. 95 Chimes Sound-art Installation, schematic, adapted for the Ceiling of the Islip Art Museum © Debra Swack, 2002. Used with permission.

Stieglitz published an article called *How I Came to Photograph Clouds*, in which he explained the difficulty he experienced in photographing clouds due to the technological limitations of ortho-plates, which, at the time, did not register the color blue very well. In it, he says:

Thirty-five or more years ago I spent a few days in Murren (Switzerland), and I was experimenting with ortho plates. Clouds and their relationship to the rest of the world, and clouds for themselves, interested me, and clouds which were difficult to photograph – nearly impossible. Ever since then clouds have been in my mind, most powerfully at times, and I always knew I'd follow up the experiment made over 35 years ago. ¹⁴

What is interesting is that, though he was aware of both macro and micro views, having stated that he was interested in depicting both “clouds and their relationship with the world” and “clouds for themselves,” he ultimately decided to depict only the latter; that is, to provide a micro view. It is also interesting that, while the technology for satellite photography was not available until 1960, aerial black and white photography had been used for military surveillance since World War I (and is still used for surveillance now). Perhaps Stieglitz did not want to convey any military association.

Sarah Greenough, who wrote the catalogue for the *Key Set* assembled by Georgia O’Keeffe, writes of Stieglitz’s *Equivalents*:

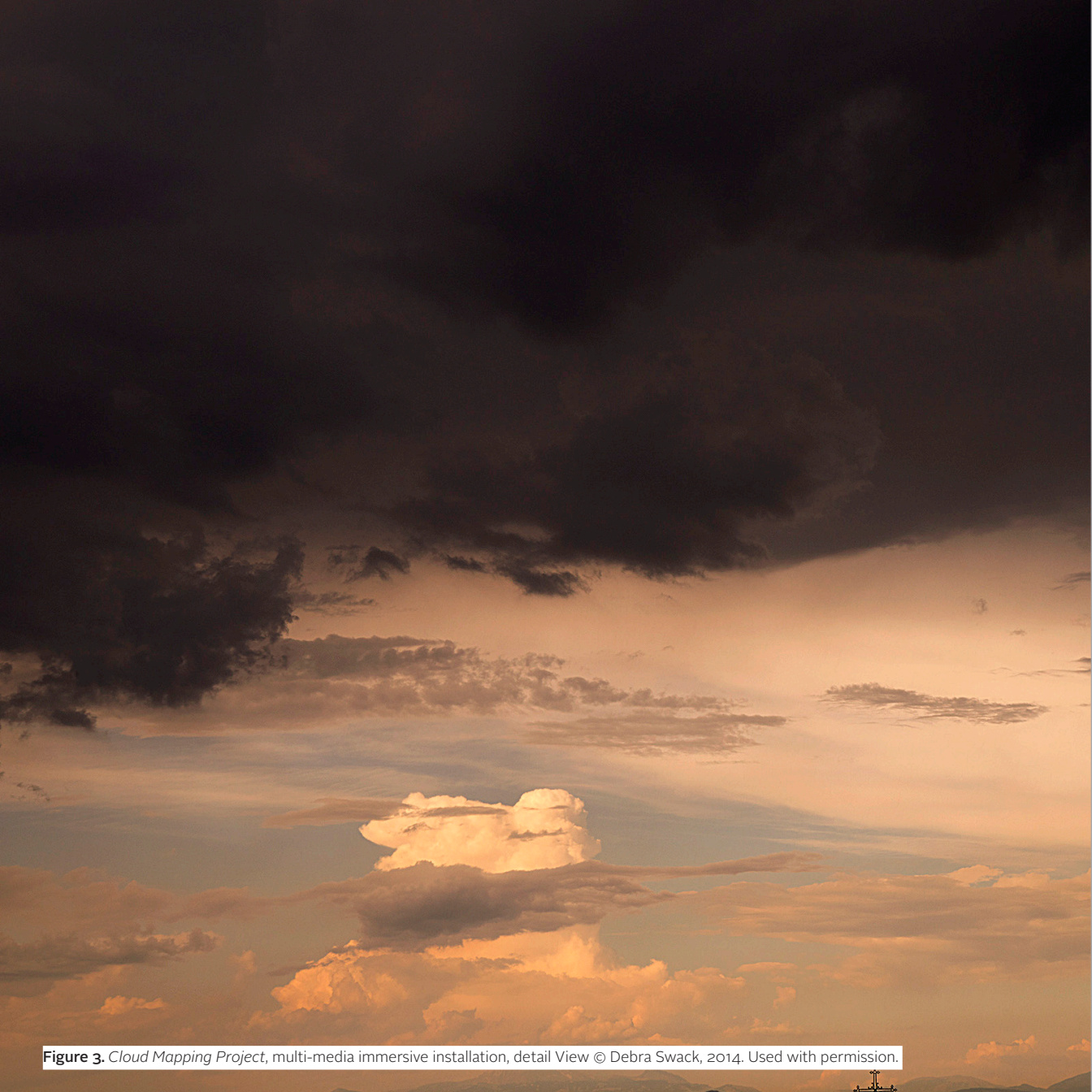


Figure 3. *Cloud Mapping Project*, multi-media immersive installation, detail View © Debra Swack, 2014. Used with permission.

With no objects depicted other than clouds, they have no sense of scale, establishing an odd tension between the vastness of their nominal subject – the sky – and the smallness of the photograph itself. **15**

Her statement further demonstrates this growing awareness of the macro/micro view of the world that was a precedent for the digital age and observations of its corresponding data. In contemporary times, al-

most one hundred years after Stieglitz's *Equivalents* was created in the 1920s, our technology (even our cell phones) allows us easy access to, and the flexibility to alternate instantaneously between, these views by connecting us to applications on the internet. Additionally, we are able to distinguish and value the particular information that each view affords while always remaining cognizant of the other.

Both methods of representing data in the cloud – the macro and the micro (i.e., the impressionistic gestalt and the detailed scientific view), with the addition of



locational software that maps our whereabouts, as well as remote sensing devices (such as satellites) – are in practice today. However, contemporary computer-assisted locational views allow for sometimes-unwarranted monitoring/tracking/surveillance. As Greengard notes:

When beacons, sensors, cameras, and smart glasses become ubiquitous and the data they collect stream into a networked world, it's suddenly possible to identify where a person is and what they are doing at any given moment. Behavior and

consumption patterns – everything from food to entertainment – could become public knowledge. Moreover, as computing advances and algorithms become more sophisticated, systems will become better at anticipating behavior. ¹⁶

While Stieglitz used his camera to create micro views through personal observation, *Cloud Mapping Project* uses remote sensing devices to digitally capture macro views of live weather satellite imagery, without the aid of personal observation and interpretation. The intention is to display completely machine-generated, picturesque cloud images (figure 3) reminiscent of painting or impressionist photography, yet independent of human interpretation.

CONCLUSION

As with the camera, first conceived of as a mere machine, incapable of elevating photography to an art form until the beginning of the 20th century, we are now entering a new but similar phase in our engagement with digital machines in the 21st century. Even though these machines should function as tools like the camera, we do not completely understand or trust their capabilities. Software was once designed by individuals, but increasingly it is being designed by, and sometimes for, other telemetry tools (that is, other machines). Along with advances in technology that have benefited us – improvements in weather forecasting, Google mapping applications that provide us with satellite images, GPS capabilities to locate streets and drive our cars, AI-enabled devices that think independently of us and create not only art but 3D bio-printing – come reservations regarding the unauthorized use of these tools.

Stieglitz, Constable, Debussy, and Howard provided alternative conceptual views of clouds using personal

observation, views that form the basis for 'the cloud' today. Howard and Constable provided representations of the cloud that were hierarchical, structural, graphic, and meteorologically accurate (clouds generally form at different altitudes depending on their characteristics and environmental conditions). Debussy provided a macro i/o moving cloud complete with acoustic properties, while Stieglitz provided a machine-aided micro cloud using his camera.

Cloud Mapping Project is an example of a new paradigm that exposes dimensions of the cloud different from how Howard, Stieglitz, Debussy, or Constable originally observed and defined it. It is a completely digital cloud, created without human observation or interpretation. It also incorporates all the other conceptual views expressed by these innovators. It includes macro and micro views, an acoustic soundscape, and pictorial images; however, these are not created via human observation or interpretation. The project also addresses the idea that surveillance, loss of privacy, and data-mining are all side effects of using our digital, connected tools. Further, it highlights the possibility that we will lose our capacity for personal observation and individual creation should our digital tools – through machine learning, machine-to-machine communication, and AI – surpass us, evolving from tools into creators and designers.

As Wendy Chun states in *Programmed Vision*:

Computers embody certain logic of governing or steering through the increasingly complex world around us. By individuating us and also integrating use into a totality, their interfaces offer us a form of mapping, of storing files central to our seemingly sovereign-empowered-subjectivity. By interacting with these interfaces, we are also mapped: data

*driven machine learning algorithms process our collective data traces in order to discover underlying patterns (this process reveals that our computers are now more profound programmers than their human counterparts).*¹⁷

In Constable's time, tools were always subordinate to the mind of the individual using them; now, as software is becoming a substitute for the mind, who can say what these tools will do?

AUTHOR BIOGRAPHY

Debra Swack is an artist, writer, Fulbright Specialist and Phi Theta Kappa in computer science who works with immersive and interactive environments. She is mentioned in *Art and Innovation at Xerox Parc* published by MIT (1999) and has received three co-production grants and a Fulbright grant from Banff Centre. While a visiting artist at the American Academy in Rome in 2014, she presented *Cloud Mapping Project* (all manifestations of the cloud from arts to technology) at the Pera Museum in Istanbul. *The Emotions after Charles Darwin* (the universality of emotions on a biological level, in collaboration with the Mind Brain Institute who contacted her through the New Museum, to help them with autism research) was published by *Leonardo Electronic Almanac* in 2013 and has been exhibited internationally. *Animal Patterning Project*; about the role of the displaced animal in the urban environment was projected interactively onto dancers with *New Chimes*, mentioned in *Art Daily*, *Dance NYC* and nominated for a Bessie award in 2016 (commissioned by the West Harlem Art Fund and Pratt Institute). *95 Chimes*; a sound installation relating music to string theory (first presented at the Museum of Natural History in 2002 in conjunction with ASCI-SCI Art Symposium) was presented in *Resonant Structures* (a continuation of the MOMA Soundings exhibit) at the Staller Center in 2016, adapted for 16 channel sound installation. *Creative Capital's On Our Radar 2016* pic Bloom, a collaboration with evolutionary biologist Monica Gagliano about bio-acoustic communication between plants was presented at LEA's *Sound, Images and Data (SID)* in 2015. She just completed a podcast with Ann Landi, contributing editor of *ARTnews* and participated in *Fusion NY's* art and tech panel with Hannah Ghorabshi (*ARTnews*), Erica Kermani (*Eyebeam*) and Jeffery Deitch.

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