ARTIST'S ARTICLE

Bird Watching: An Introduction to Amateur Satellite Spotting

Kathy Marmor

ABSTRACT

Space satellites are invisible instruments of globalization that influence governmental policies. This paper examines remote sensing satellites as optical devices capable of redefining human cognition. They represent accessibility and openness through the more agreeable paradigm of transparency. However, transparency, like surveillance, is based on the interconnection between power, knowledge and perceptual experience. Artists use a variety of tactical practices, including amateurism, to tease apart these connections. Amateurism dedicates itself to the politics of knowledge. The author concludes, based on examples of her work and that of others, that the potential for political intervention exists when knowledge is paired with action.

Space satellites are a potent symbol of the information age, and their versatility makes them a compelling technology. Yet satellites remain somewhat mysterious. Their invisibility puts them out of mind, but the data they collect and transmit in the form of images and communications greatly influence political, economic and social practices worldwide. Indeed, space satellites are often discussed as vital components of globalization. What is interesting about satellites, specifically remote sensing satellites, is the dialogue they initiate between the observer and the observed. This dialogue is often translated into a discourse on the manifestation of power in surveillance. Remote sensing satellites are also optical devices, and as optical devices they shape visual perception and cognition. Thus, the dialogue between an observer and the observed is complicated by the interconnection between visual experience and perceptual understanding.

Even though we have access to both the commercial and the noncommercial products of satellites, such as media broadcasting, weather maps or, more recently, their images via Internet applications such as Google Earth, we are no closer to understanding how satellites work or how their data is interpreted. Their scientific functions and sophisticated technology and their history of espionage keep satellites inaccessible to the layperson and perpetuate the idea that satellite images objectively document the earth and sky.

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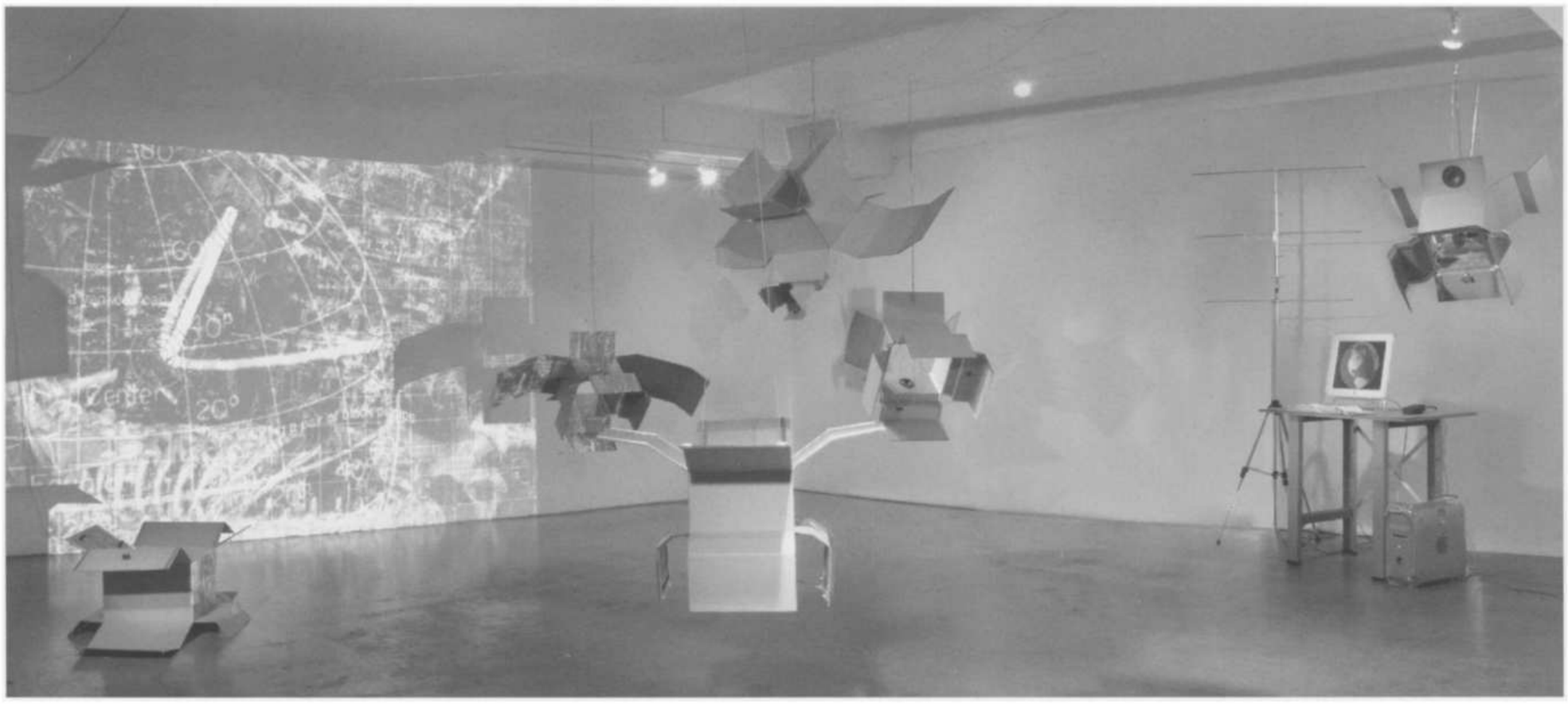
With these concerns in mind, I have created a multimedia installation called *Bird Watching* (Fig. 1) that represents remote sensing satellites as interactive homemade cardboard boxes. I use sound and interactivity in the installation as a means for determining location and representing the interconnection between local and global. *Bird Watching* engages an amateur version of remote sensing and satellite spotting to make the satellite's technology visible and their relations to us comprehensible. While researching satellites for my installation, I realized that the old equation of technology equals power and control has been supplanted by a rhetoric that extols the democratization of technology and global transparency.

The Politics of Transparency

A combination of scientific and military aims has resulted in the production of over 2,000 space satellites in orbit, and the

Fig. 1. Installation overview of *Bird Watching*, showing seven box satellites, computer projection, UHF/VHF radio antenna and tracking computer. (© Kathy Marmor. Photo © Michael Heeney.) FireHouse Center for the Visual Arts, Burlington, VT, 2007.



United States government funds more than half of them. Remote sensing satellites, which are the primary focus of this article, acquire information about the Earth through electro-optical sensors. The data is then transmitted to ground stations, where it is typically converted into a visual form for analysis. This process of synthetic imaging underscores the paradox of remote sensing: Satellite images are often perceived as indexes of the earth, and as such they substantiate reality; yet, in the words of Lisa Parks, "The satellite's image's aesthetics of remoteness and abstraction make its status as a document of truth very uncertain and unstable" [1].

The history of remote sensing satellites reinforces the construct that a satellite image *is* the data transmitted from the satellite's instruments. The conversion of electromagnetic radiation into a visual form fuels the idea that satellites depict what they independently "see." The fact that remote sensing satellites see what a human being cannot makes them appear as if they are capable of autonomous vision. The earth and its atmosphere seem transparent to us due to their unique perceptibility. This meaning of transparency: to be seen through clearly, could be applied to the spy satellites and their ability to reveal another country's secrets. In 1958 President Eisenhower ordered the CIA to replace U-2 spy-planes with reconnaissance satellites in response to the USSR's launch of Sputnik (Fig. 2). The Sputnik was the world's first orbiting satellite, and its success posed the possibility that the Soviets could also launch intercontinental ballistic missiles. Eisenhower's new satellites, the Discover series, code named Corona, were equipped with Keyhole cameras that took pictures of the USSR. The Corona project ended in 1972 and was replaced by Landsat, a series of earth-observing remote sensing satellites. The Corona images were declassified and made public in 1996.

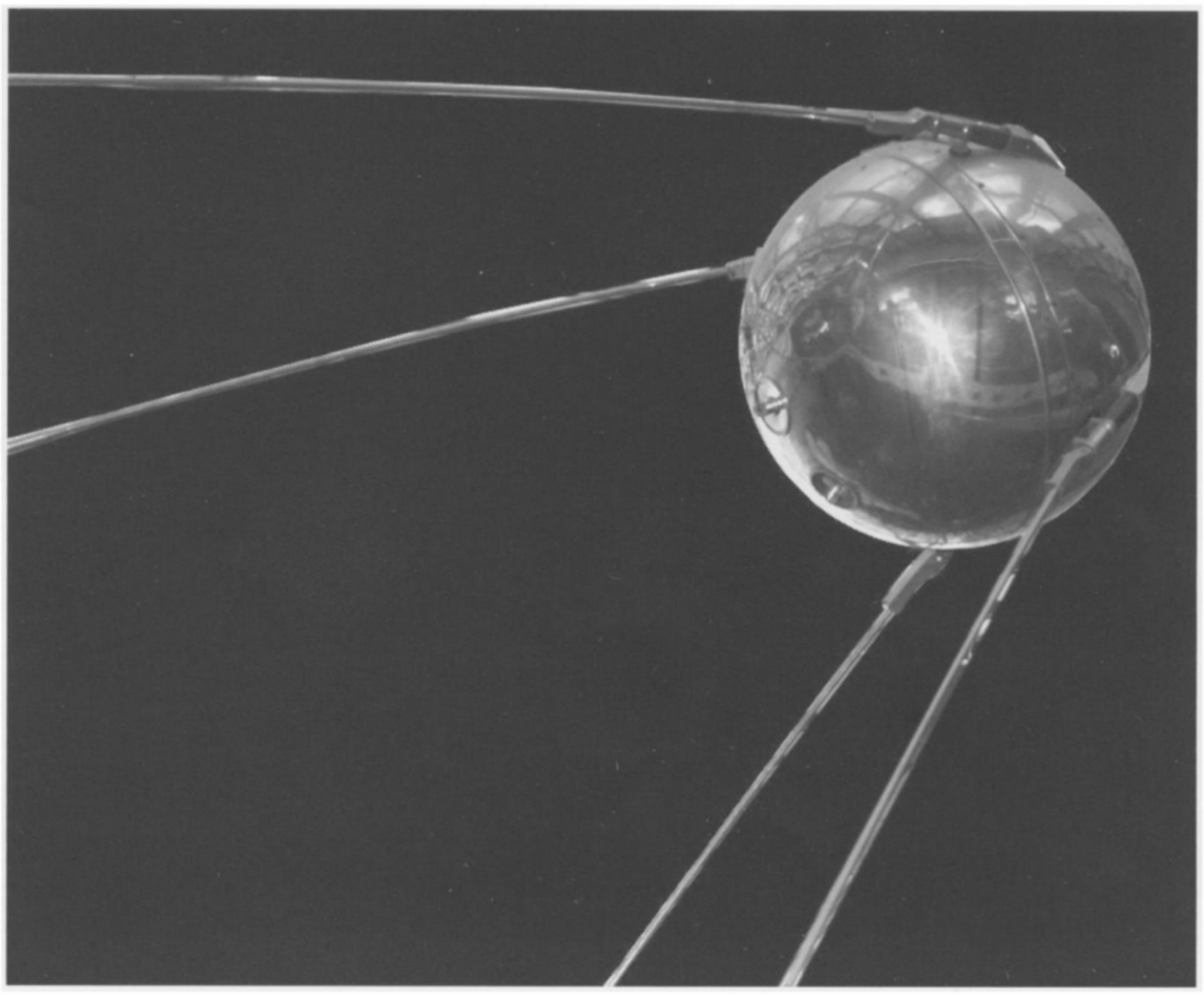
The rhetoric of transparency surrounding the use of remote sensing satellites has changed as satellite technology has advanced. Satellites, once highly specialized military and scientific apparatuses, are now thought of as universal tools promoting openness. The digitization of satellite data and the convergence of digital media have increased public and private access to satellite imagery. Today, Keyhole is the name of a company that provides a 3D digital model of the Earth created from satellite images that can be accessed via the Internet. Google purchased Keyhole in 2004. As Jonathan Rosenberg, Google's vice president of product management, said, "With Keyhole you can fly like a superhero from your computer at home to a street corner somewhere else in the world. Keyhole is a valuable addition to Google's effort to organize the world's information and make it universally accessible and useful" [2]. In fact, in 2007, the U.S. Holocaust Memorial Museum joined with Google to add a new layer called Crisis in Darfur over Google Earth's satellite images. This overlay allows users to see devastated villages and to quickly access information about the region. Crisis in Darfur is in a folder called Global Awareness, and these informative overlays provide the general public with concise information about the workings of governments, humanitarian organizations and corporations. This form of transparency offers the promise of shared power and responsibility. I suggest that today global satellite surveillance by governments, corporations or NGOs is just a matter of fact, in contrast to the late 1950s, when satellite surveillance was a closely guarded secret. Transparency does not connote power the same way that surveillance does. The term is benign, and its meanings and connotations facilitate the public's acceptance of an overt surveillance that is remote and global in scope.

Satellite images are virtual images. The complexity of the earth and its peoples is filtered through an assortment of sensors to produce a vast array of information. It is important to note that information is not the same as knowledge. As Nico Stehr states in *Knowledge Politics*, "knowledge is conduct" [3]. To have a complete understanding of a satellite image there must be both data and context. It is the filtering of data and the manipulation of the context that makes it easy to politicize the veracity of a satellite image. The allegations of the Cold War missile gap and Iraqi weapons of mass destruction (WMD) clearly demonstrate this. In 1957 and 1958 the U.S. was in the midst of an economic recession and President Eisenhower was planning to reduce defense spending. Senator John F. Kennedy claimed after the launch of the Soviet satellites that there was a growing arms disparity between the U.S. and the USSR. Kennedy emphasized the purported missile gap during his campaign, even though he had access to Corona satellite pictures of the USSR that indicated no such disparity [4]. The alleged gap tapped into a public fear and helped Kennedy defeat Vice President Nixon in the 1960 presidential election.

In 2003 Colin Powell, then U.S. Secretary of State, addressed the U.N. Security Council about Iraq. During his presentation he stated,

> Let me say a word about satellite images before I show a couple. The photos that I am about to show you are sometimes hard for the average person to interpret, hard for me. The painstaking work of photo analysis takes experts with years and years of experience, poring for hours and hours over light tables. But as I show

Fig. 2. Sputnik 1 satellite, launched 4 October 1957. It orbited the earth in 98 minutes, <http://www.nasa.gov/>.



you these images, I will try to capture and explain what they mean, what they indicate to our imagery specialists [5].

He then proceeded to use the satellite photos as evidence that Saddam Hussein was moving banned materials from a number of Iraqi WMD facilities. These two examples show the opacity of satellite images and how their meanings are manipulated in the name of economics and national security.

The visual imagery from remote sensing satellites is similar to that of medical imaging. Both are based on the premise that to see through something is to uncover the truth—a truth provided through expert analysis. The idea that truth is a universal, fixed phenomenon is given more validity than the notion that the process of analysis and interpretation, measuring and categorization gives meaning to what is seen. The notion that transparency gives rise to a discernible object or fact, I argue, is a cognitive construct that instructs one *how* to see.

Optical Technologies and Visual Perception

Remote sensing satellites are technological devices that provide us with a radically different view of the earth and have altered our perceptions of the world. Satellites are thus optical devices that, like the telescope and the camera obscura, provide new models of cognition by redefining visual experience. The interconnection between optical technologies and vision can be traced as a trajectory from subjective vision to synthetic vision through the writings of the philosopher Descartes and theorists Jonathan Crary and Paul Virilio.

For Descartes, the telescope perfectly described the relationship between visual experience and cognition. The image perceived through the telescope was a sensory illusion created through light, mirrors and lenses that required the mind to make sense of it. Thus, vision could not be equated with knowledge. According to Descartes, vision was technical and knowledge was acquired through a consciousness of self and the certainty of God. This model emphasized the individual as a subject separate and distinct from the physical world. Descartes' view was reified by the camera obscura (Fig. 3) until new physiological studies indicated that the body was the site of visual production. Simultaneously, new optical apparatuses like the stereoscope, which required the viewer to wear special equipment, made the viewer part of the machine [6]. Incorporating the body as the site of visual perceptivity collapsed the distinctions between inner and outer worlds. This helped to establish vision as subjective and temporal and enabled the observer to partake in the processes of modernization.

According to Paul Virilio, vision is a variable of space and time that has been affected by what he describes as the phenomenon of acceleration. He claims that the telescoping lens of the optical device replaces the human body as the basis of vision. Thus, optical devices reconfigure vision by delocalizing it, and when vision is severed from the body it can be institutionalized within a machine. The computer's unification of the factual and the virtual is the foundation for synthetic vision and automated perception. Computer graphics represent a "paradoxical logic . . . when the real time image dominates over the thing represented, real time prevailing over real space, virtuality dominating actuality" [7]. This is particularly true of remote sensing satellites. Their real-time systems provide a continuous view of the present and the possibility of foreseeing the future. It is this ability to both prevent and predict that makes the satellite useful as a restraint.

Satellites are but one type of many digital and global communication technologies, privately and publicly owned, whose capacity for image production, reproduction and dissemination enables a constant stream of visual material to enter the public realm. However, public access to scientific representations does not make scientific knowledge more available. In fact, global technologies bring people "together long distance around standardized opinions and behaviors" [8]. Hence the very technologies that produce and distribute communications also provide a conduit for surveillance between peoples.

An overload of visual information also leads to a form of hyper-visuality that creates its own paradoxical logic, suggesting that the more we see, the less we see. For instance, today the picture of the earth taken from Apollo 17 and the DNA helix represent scientific ingenuity. Both of these images are divorced from their original context and meaning and instead function as ideological icons in popular culture. Representations such as these make science accessible only on a very superficial level. The icon of the helix represents to many people an impenetrable system of knowledge whose ramifications affect daily life.

A Creative Tactical Response: Amateurism

As producers of culture, contemporary artists grapple with the issue of visual saturation and homogenization of meaning in society. These artists, like the Dadaists and the Situationists before them, are responding to specific social, political and economic conditions. Art collectives such as the Institute for Applied Autonomy, Critical Art Ensemble and biotech hobbyists Natalie Jeremijenko and Eugene Thacker, and individual artists such as Marko Peljhan, Steven Holloway and myself implement a variety of tactics that expand upon the Situationists' *détourne* (appropriating and rearranging cultural signs to create new meaning) and *dérive* (a merging of psychology and geography—to drift without a goal) [9] or define new strategies such as "amateurism: a willingness to try anything" [10].

The amateur's approach—a shared interest, a willingness to try, and genuine curiosity—has influenced the content and methodology I employ in my artistic practice. My work stems from a desire to understand the scientific principles

Fig. 3. Camera obscura in Athanasius Kircher, *Ars Magna Lucis et Umbrae*, 1646.

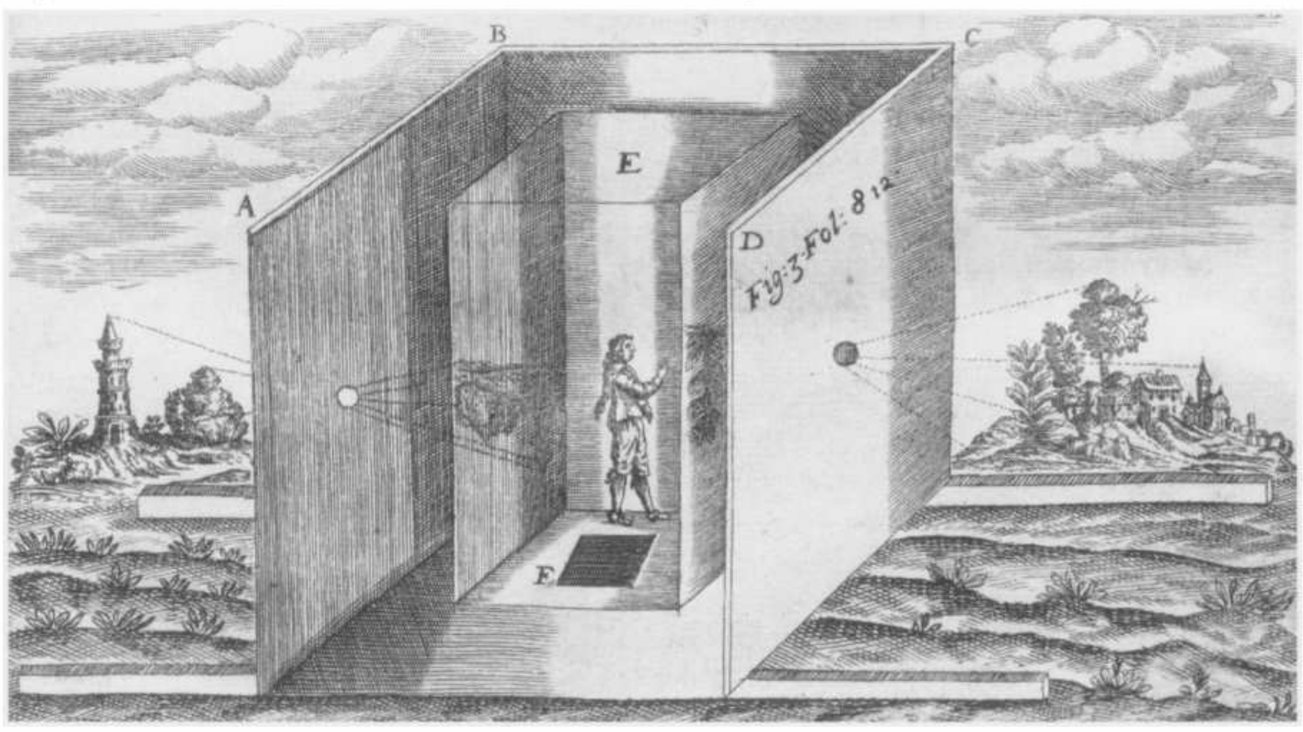


Fig. 4. Promotional image for *The DNA Cookbook*. (© Kathy Marmor. Photo © Lynn Imperatore.) Performed in Burlington, VT, and Baltimore, MD, 2003. This image shows the author with the key household ingredients for extracting DNA from raw wheat germ.

of specific instances of popularized scientific research. I am also interested in the culture of science and science as a cultural construct. Thus, my installations interpret complicated scientific knowledge by inviting interactive participation with humorous forms of "home-brewed" scientific technologies or techniques.

My installation *Bird Watching* consists of a flock of cardboard "boxes" whose elongated flaps resemble the wings of birds and the solar panels of space satellites. Each homemade satellite houses an audio speaker and inexpensive proximity sensors. My choice of materials reflects my belief that approaching science and technology with a do-it-yourself mentality interrupts passive consumerism and acquiescence to authority. The Radio Amateur Satellite Corporation (AMSAT) is representative of this approach. AMSAT is a national organization of amateur radio operators who make and launch sophisticated transmitting satellites from donated electronics. Their first satellite, Oscar 1, was launched as a secondary payload on *Discoverer XXXVI* in 1961. Today AMSAT has approximately 20 working satellites in orbit and a worldwide membership.

The usual definition of an amateur is a person who pursues an interest without pay. However, amateurism is not merely acquiring information or appropriating concepts and skills; it is what AMSAT represents: a diligent commitment to the "politics of knowledge": "knowledge is the capacity for action. Knowledge is conceptual doing" [11]. For the amateur, the acquisition of knowledge requires an investigative stance that results in an act of communal discovery. My use of interactivity to elicit participation in my installations is directly informed by these ideas. For example, in my installation and performance *The DNA Cookbook*, I assisted participants in extracting DNA from wheat germ using common household products and kitchen tools (Figs 4 and 5). The visible strands of DNA enthralled people. This simple activity was effective because the process was removed from the biology lab and set in the familiar surroundings of a kitchen. DNA was no longer a remote abstraction. Instead, I made it concrete and accessible through this communal performance. Later that evening, someone commented that the strands of thick viscous liquid did not look like DNA. For many people DNA is not a molecule found in every living organism; instead it is its representation—the double helix.

A space satellite, like DNA, is a powerful metaphor and symbol. The paradox of satellites is that (as with DNA) they have a palpable presence even though they are not seen. We see satellites because of what they produce. Perhaps it is this paradox of presence through absence that compels the amateur to look for them. I thought that if I could demystify satellites then I could unpack them as instruments of power. I had no idea how many different types of satellites there were and how varied their payloads were. This made it difficult to get an accurate historical overview, and as a nonscientist I found myself stymied by the obscure technical information and dry scientific writing. However, I found the web sites created by satellite aficionados, both amateur and professional, very useful and full of practical information including how to track satellites, communicate with them and decode their telemetry. I even discovered that I could hear data transmissions from satellites on a handheld radio receiver.

The latter piece of information became an integral component of *Bird Watching*.

Fig. 5. DNA extraction performed at Burlington Art Hop, Burlington, VT, 2003. (© Kathy Marmor. Photo © Meg McDevitt.) The author performed twice during the evening, explaining what DNA is and answering participants' questions. Each performance took about an hour and a half.

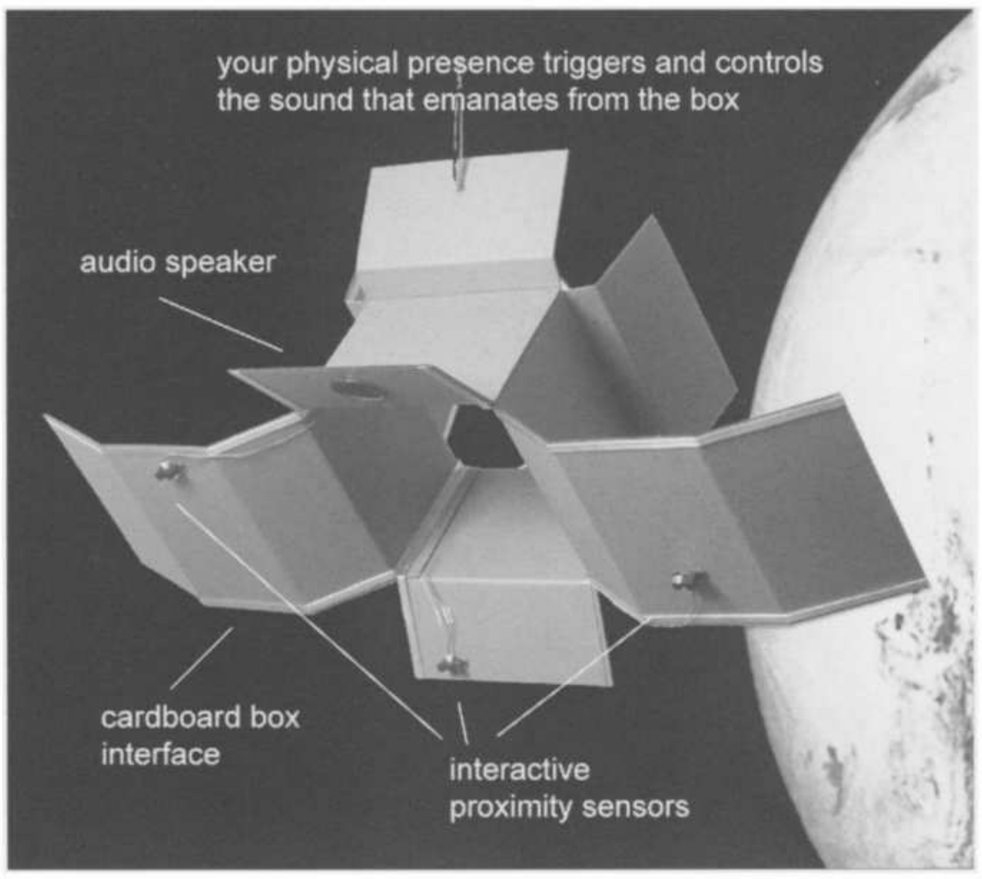


Fig. 6. Promotional image for *Bird Watching*, 2005–2006. (© Kathy Marmor) This image shows the components of each satellite box.

In the installation, hearing dominates over sight to communicate the interchange between the local and the global. The radio scanner emits a low continuous hum until it detects a satellite. The scanner then broadcasts the intercepted space satellite's telemetry through the audio speakers of my satellites. Thus, a distant foreign sound becomes local and personal. Sound also entices the viewer to physically interact with my cardboard satellites. Each bird (satellite) (Fig. 6) is embedded with proximity sensors that respond to the viewer's distance, and when a sensor is triggered the computer plays a recorded sound. If a person is close to the sensors, the sound is like that of a chirping bird, but the sound becomes more comprehensible as the viewer moves away from the sensor. At a certain distance the sound becomes distinctly human, thus referencing the local and immediate. The prerecorded sound of a woman crying or children laughing recalls the satellite's ability to sense human presence. The sound of the scanner's hum establishes a spatial reference point, and the sound from the sensors emphasizes the relationship between the body's geography and the installation space. When combined with the sound from a satellite passing overhead, this cacophony of sound creates an environment that situates the human body in a specific place.

Amateurism represents an opportunity to understand the principles that define a discipline whose knowledge is often under the providence of experts. I willingly immerse myself in these "closed" systems of knowledge to educate myself and use this education as a source of action. Amateurs must be willing to put their awareness into practice, and I suggest that such practice produces new forms of knowledge. For instance, I learned how satellite sensors worked, and this information became knowledge as I devised the installation's interactivity. My knowledge, or "conceptual doing," is passed to the viewer, who in turn reinterprets it as he or she engages with my satellites. It is my wish that participants interacting with the installation "set something in motion" for themselves.

Knowledge requires an active actor who "controls the circumstances of action." Thus, for knowledge to shape reality it needs the means for action. In 1597 Francis Bacon observed that "knowledge is power," and Karen Litfin states, "Imaging satellites function as symptom, expression and reinforcement of modernity's dream of knowledge as power" [12]. Nearly four centuries after Bacon, Foucault suggested "that power produces knowledge" [13]. Surveillance and the power it implies are masked by the supposed benefits of a transparency that denotes openness. The ideology of transparency constructs surveillance as a necessary function of satellites. In *Bird Watching*, satellites and the practice of observation are employed to explore the interconnection between power and knowledge. Power in my installation is perceived as complex overlapping networks that engage individuals, technology and culture as different but supporting mechanisms. Knowledge creates, sustains and transforms these mechanisms. Once viewers discover that my satellites are interactive, they become enthusiastic participants who soon control the sound (Color Plate E). Here, sound defines an exchange of power. However, participants soon realize that the satellites are also monitoring their interactions. The sensors embedded in the "birds" track the participants' movement, and this data is projected back in real time into the installation space (Fig. 7). This visual map makes participants more wary of their interactions with the boxes. The interplay of power between the boxes and participants mirrors the dynamics between actual space satellites and the installation itself. I use satellite tracking software that announces the times and orbits of satellites passing nearby. This automated voice and the ensuing live telemetry inverts the usual relationship of an invisible satellite watching us to one in which the audience is anticipating the satellite's presence. Anticipating the satellite echoes the watchfulness of an amateur satellite enthusiast. "To watch carries with it the connotation of a scrutiny. . . . To watch is to look for something that is not immediately apparent" [14]. Thus, *Bird Watching* asks the participant/viewer to be fully conscious of the power dynamic between the observer and the observed, and by acknowledging this power relationship my installation seeks to disrupt it. I suggest that it is a combination of watchfulness

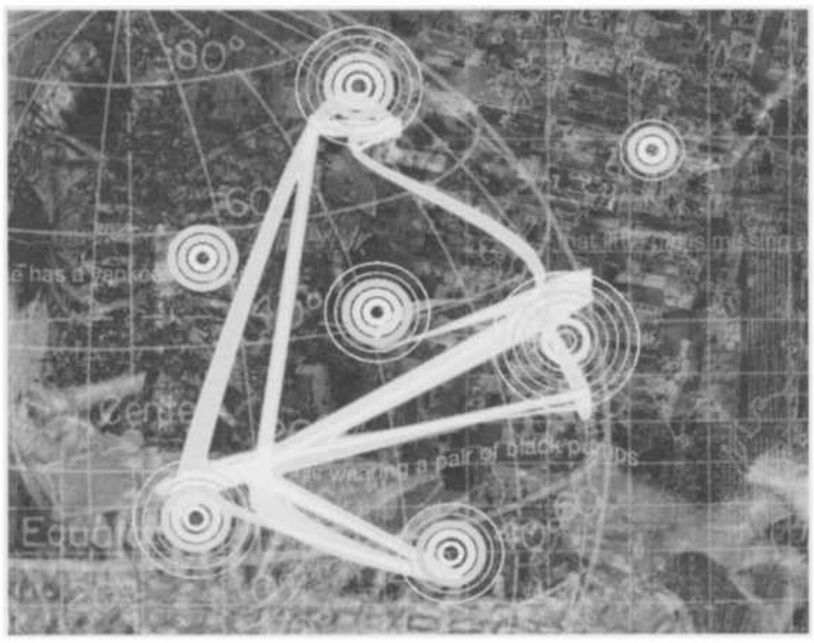


Fig. 7. Image of interactive map for *Bird Watching*, January 2006. (© Kathy Marmor and Jonathan Decker) Custom software created in collaboration with Jonathan Decker.

Fig. 8. Path using *iSee* software. (Photograph courtesy Institute for Applied Autonomy. © Institute for Applied Autonomy.)

and knowledge that politicizes transparency so that it is not a directive for uncovering truth. Instead, transparency is the act of implementing knowledge. Google Earth's layers of Global Awareness provide invaluable information, but it is the citizen who watches and acts on their knowledge that models reality; or, as Jeremijenko and Thacker note, democracies depend on transparency [15].

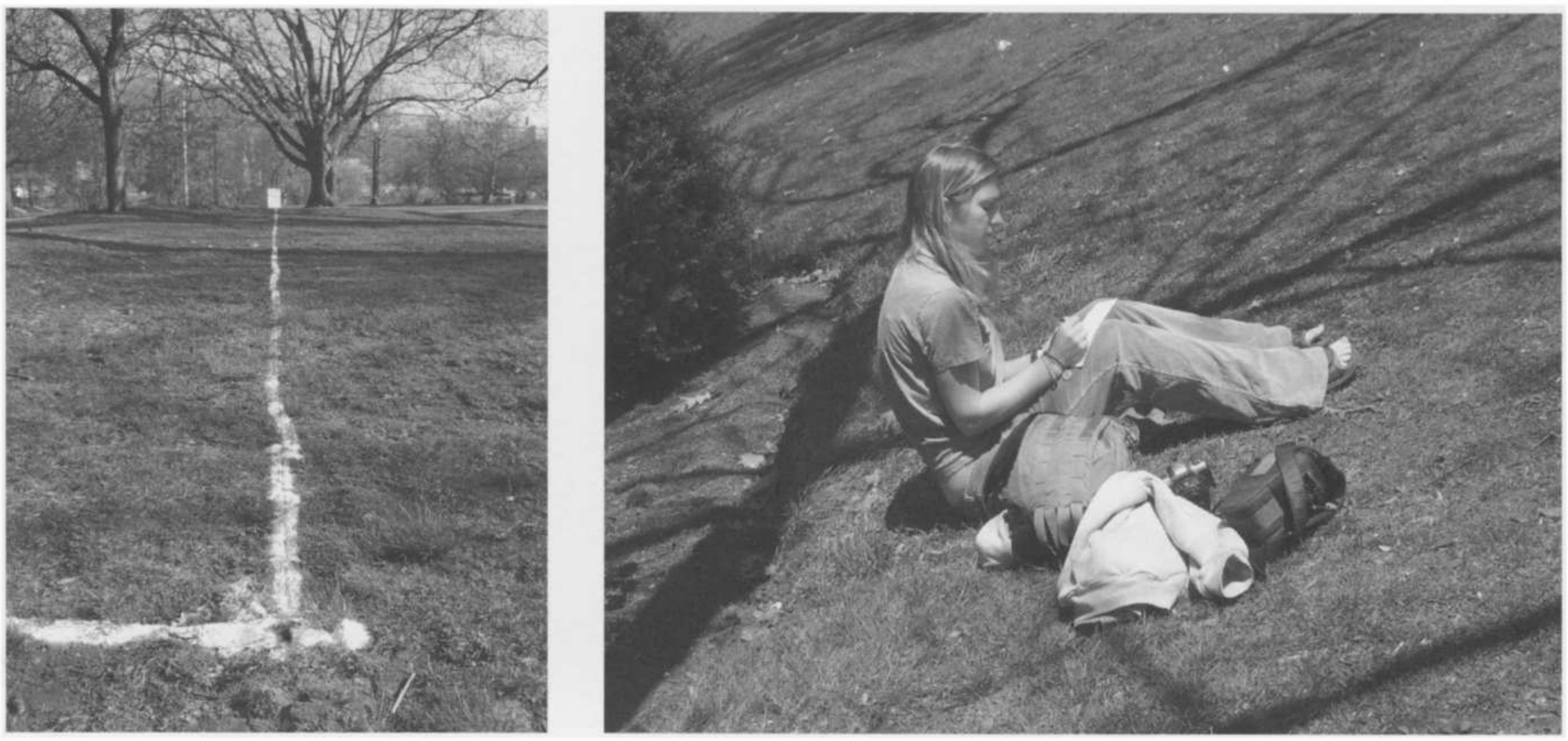
ART AS AGENCY AND ACTION: *ISEE* AND *ONE PIXEL*

A dominating power maintains power by using surveillance as a method of control. *iSee* by the Institute of Applied Autonomy and *One Pixel* by Steven Holloway are two works of art that address surveillance by undermining the conventional power relationship. *iSee* and *One Pixel* offer a new form of knowledge, and this knowledge provides the impetus for self-agency and direct action. The Institute for Applied Autonomy is a collective of artists who produced a web-based application in 2001 called *iSee* that enables a user to determine a travel route that avoids surveillance cameras (Fig. 8). The application was specifically developed for Manhattan using data collected by the NYC Surveillance Camera Project. *iSee* demonstrates the pervasiveness of public surveillance by making it visible and provides the user with the power and the means by which to act. IAA argues that video surveillance is neither unbiased nor autonomous and in fact reflects state politics, corporate interests and cultural biases. By engaging CCTV technology, the Institute points out that surveillance supposedly equals deterrence, but in reality, when it is refined and linked to networked databases, surveillance establishes and verifies identity.

Steven Holloway's 2005 performance *One Pixel: An Act of Kindness* engages surveillance and satellite technology from a totally different perspective. In this work, he links the virtual: one pixel from a Landsat 7 satellite image—representing an area that is 30 meters by 30 meters—with the real: the physical place represented by the one pixel. For *One Pixel,* Holloway selected a pixel from a satellite image of Boston, Massachusetts, captured in April 2005. His performance consisted of defining the pixel's physical area through a variety of "non-destructive markings" [16]. He then invited the public to visit the pixel space and to record their observations of it (Fig. 9). As Holloway stated in a news release, "*One Pixel* demonstrates that the spirit of a living place cannot be appreciated without direct experience." Holloway's performance implies that knowledge is based on embodied subjectivity and that this form of knowledge is action.

Remote sensing satellites have historically been used as instruments of surveillance because of their ability to transmit data about the earth to ground stations at regular intervals in real time. A variety of interests, corporate and state, invest in satellite technology for the global transparency they provide. Today, the sky does not belong to one supreme observer; instead, satellite imagery makes the earth available to all. Political treaties such as the Convention on the Registration of Space Objects Launched into Outer Space (1976) or the Open Skies treaty for aerial observation (2002), plus worldwide advances in telecommunications, offer greater transparency. Here, the term *transparency* implies openness but also describes a way of looking. Satellite images are thought of as objective docu-

Fig. 9. (a) Markings describing 1-pixel area in Boston Commons for Steven Holloway's *One Pixel;* (b) participant recording observations, 2005. (© Steven R. Holloway)



ments that reveal truth. Transparency, on the other hand, also implies accountability, and accountability is impossible without knowledge. Knowing something does not necessarily lead to the ability to affect a situation, even though knowledge and power are often perceived as interrelated. If knowledge is the capacity for action, then there must also exist power—"the control over some of the circumstances of action" [17]. When these two conditions are met, then there exists the possibility of agency.

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Kathy Marmor has exhibited widely in the United States. Her work has been shown at Ciber@rts Bilbao, Spain, and New Forms festival in Vancouver, Canada. She has been an artist in residence at the Visual Studies workshop in Rochester, New York, and Light Works in Syracuse, New York. She has discussed her work at ISEA and at the 9th Workshop and Symposium on Space and the Arts.

Color Plate E

Kathy Marmor, participant interaction with box satellites, FireHouse Center for the Visual Arts, Burlington, VT, 2007. (© Kathy Marmor. Photo © Jeff Clarke.)