"Sousveillance"

Inverse Surveillance in Multimedia Imaging

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ABSTRACT

This is a personal narrative that began 30 years ago as a childhood hobby, of wearing and implanting various sensors, effectors, and multimedia computation in order to re-define personal space and modify sensory perception computationally. This work involved the creation of various computational seeing aids that evolved into a new kind of visual art, using multimedia cyborglogs. Becoming at one with the machine, the author was able to explore a new humanity at the nexus of cyberspace and the real world. The author presents what was discovered accidentally, as a result of facing "cyborg discrimination". In particular, over the past 30 years, peer discrimination has decreased, while institutional and organized discrimination has intensified. Most notably, it was discovered that cyborg discrimination was most intense in establishments having the most surveillance. Rather than avoid such establishments, the author was able to explore and capture unique aspects to understand surveillance in new ways. The word *sur-veillance* denotes a God's eye view from on high (i.e. French for "to watch from above"). An inverse, called sous-veillance (French for "to watch from below") explores what happens when cameras move from lamp posts and ceilings down to eye level. Finally, it is suggested that new personal multimedia technologies, like mass-produced wearable cameraphones, can be used as tools for artists to explore "equiveillance" by shifting this equilibrium between surveillance and sousveillance with inverse/reverse accountability/recountability/continuability of continuous sur/sousveillance.

Categories and Subject Descriptors

J.5 [**Computer Applications**]: ARTS AND HUMANITIES—*Fine arts*

General Terms

Design, Experimentation, Performance, Theory, Verification

Keywords

surveillance, inverse surveillance, sousveillance, weblog, cyborglog, computer mediated reality, eyetap, equiveillance, terrorism, guerrorism, survey, sousvey, perveillance

What is sousveillance?

SURveillance ("eye-in-the-sky") versus SOUSveillance: bringing cameras from the heavens, "down to earth".

The word "Surveillance" is French for "to watch from above". It typically describes situations where person(s) of higher authority (e.g. security guards, department store owners, or the like) watch over citizens, suspects, or shoppers. The higher authority has often been said to be "Godlike" rather than down at the same level as the individual party or parties under surveillance [Foucault 1977]. In this paper, surveillance is defined as the capture of multimedia content (audio, video, or the like), by a higher entity that is not a peer of, or a party to, the activity being recorded.

The author has suggested "sous-veillance" as French for "to watch from below". The term "sousveillance" refers both to hierarchical sousveillance, e.g. citizens photographing police, shoppers photographing shopkeepers, and taxicab passengers photographing cab drivers, as well as personal sousveillance (bringing cameras from the lamp posts and ceilings, down to eye-level, for human-centered recording of personal experience).

It should be noted that the two aspects of sousveillance (hierarchy reversal and human-centeredness) often interchange, e.g. the driver of a cab one day, may be a passenger in someone else's cab the next day.

Thus a main feature of "sousveillance" as a tool for multimedia artists is effortless capture, processing, storage, recall,

and transmission of an activity by a participant in the activity.

Disclaimer the role of the individual artist and personal passion outside the traditional academic laboratory: Because this paper describes the author's own personal experiences of inventing, designing, building, and living with a variety of body borne computer-based visual information capture, processing, and mediation devices in everyday life, there is a necessary narrative element that would be diminished if it were forced to conform to the objectivity usually found in a scholarly article.

The practice beginning in the author's childhood, involved 30 years of bearable (wearable, implantable/dermaplantable, and body/brain modification) systems and devices. This practice would outstrip a normal ethics review process, so a certain element of this work reaches beyond the traditional manner of scientific explorations, perhaps more into the domain traditionally reserved for the Fine Arts. The arts is one of the few places where there exists an accepted practice of performance art, body art, body modification (like the sex change experiment of Professor Sandy Stone, Eduardo Kac's microchip implanted in the body[1], the "Cyborgian Primitives" movement), and the like.

0.1 Computer Mediated Reality

Since the 1970s the author has been exploring electronically mediated environments using body–borne computers. These explorations in Computer Mediated Reality were an attempt at creating a new way of experiencing the perceptual world, using a variety of different kinds of sensors, transducers, and other body–borne devices controlled by a wearable computer [7].

0.2 Practical Applications

Early on, the author recognized the utility of computer mediated perception (computationally modified presentation of sensory data). For this kind of work, the author invented a device that intercepted rays of eyeward bound light, and resynthesized (typically with a computer-controlled laser) substitute rays so that the resynthesized rays could be collinear with the measured rays. This resulted in a device where three elements existed at the same point in space: (1) the effective center of projection of a camera or other sensor; (2) the convergence point of the above collinear rays of light; and (3) at least one eye of the wearer. Thus the device is equivalent to putting both a camera and a display inside the eye. Such a device, fitted to one or both eyes, is called an EyeTap device [7].

EyeTap devices can be used for electric seeing aids, or when used together with a similar device called the EarTap, for converting the body, in effect, into a camera phone.

0.3 Personal Safety Device

The author's mediated reality devices also included the capability of lifelong capture and transmission of physiological signals together with the EyeTap signal. Capture of the data can allow such a system to function much like the "black box" flight recorder in an aircraft that provides evidence as to why an accident or deliberate violent act occurred.

To protect the data of the "black box" life recorder from accidental or malicious damage, the data has generally been transmitted and recorded at remote locations. Additionally, for example, transmission of synchronized timestamped ECG data allows a remote physician to observe not only the electrical heart activity, but also the visual environment which may provide clues as to environmental causes of ECG irregularities such as arrhythmia.

When it is worn continuously (e.g. out of medical necessity to capture valid data) the long-term adaptation to seeing through the device also provides a unique opportunity to capture, process, store, and recall visual memories. Unlike a mere wearable camera, the EyeTap, because it becomes a manner of seeing, captures exactly what the bearer does see. This results in a new kind of EyeTap cinematographic vision, together with a serendipitously generated logfile that happens without conscious thought or effort.

A cyborg (in the Manfred Clynes sense of a technological synergy that doesn't require conscious thought or effort), can thus generate a lifelong logfile for personal experience capture. Such a logfile is called a cyborglog (http://en.wikipedia.org/wiki/CyborgLog).

Later with the advent of the World Wide Web cyborglogs also became weblogs [Ito 2004], an example of which is shown in Fig 1.

Ironically, the coverage of the East Campus fire (Fig 1) resulted in negative press
Wearable Web Camera Goes Too Far, Anders Hove, Executive Editor,
www-tech.mit.edu/Issue/V116/N28/mann.28c.html from the very paper that might have used the pictures captured in the cyborglog. It is interesting to note that Hove's first main objection was the strange physical appearance (to use his words it's "worse than Spandex, tweed, and bell-bottoms combined"), rather than the privacy issues. This was an objection also raised when the author had driver's license pictures and passport pictures taken, and finally succeeded in making a legal argument as to why self-modification of physical appearance must be accepted, after which a number of passports and driver's licenses were issued with the author's newly created physical appearance.

In particular, living within a permanently installed/instilled photographic perspective allows the bearer to capture precious yet serendipitous moments in life, such as the birth of a newborn, or baby's first steps.

0.4 Related work

Despite the initial negative reactions, a lot of good came of the explorations in web-based cyborglogs (time-stamped diaries of serendipitous personal experience recordings made available to the world). Others are also now proposing similar projects. Industry is also recognizing the importance of inverse surveillance. For example, the Hitachi Design Center in Milano recently sponsored an event entitled *"Applied Dreams Workshop 3: 'Surveillance and Sousveillance'"*.

Nokia is planning a "life 'blog" (lifelong weblog) product similar to the author's life 'glog (lifelong cyborglog) project. Microsoft's "sensecam" and "MyLifeBits" projects (http://research.microsoft.com/CARPE2004/) and Hewlett

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[1]Others, such as Kevin Warwick, have also followed in Kac's footsteps, some for artistic reasons like Kac, and others for more utilitarian reasons.

wearcam.org as roving reporter; (c) Steve Mann, Feb. 1995

feb. 22, 1995: most of my day quite boring, walking to lab, pizza at food trucks etc. around 10pm
i see a fire hose; i'm following it now

looks like must be a fire, fire trucks, shall i go to right for view? (email or talk me in@.. or tnc)

isn't it cool, those on mosaic, world wide web for first time see news as it happens?

no, but i could envision this as a new form of news gathering. i go to make lookpainting of fire truck

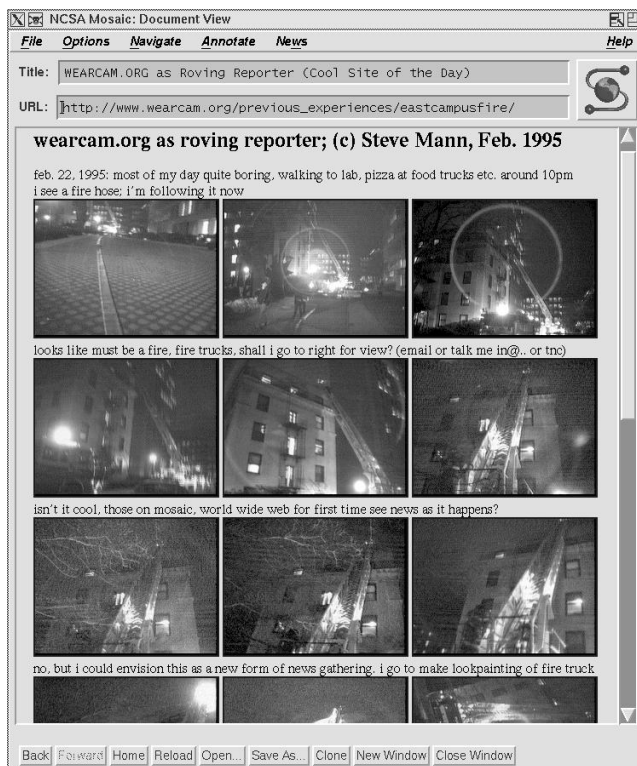Back Forward Home Reload Open... Save As... Clone New Window Close Window

Figure 1: In this cyborglog, the author encountered an event serendipitously through ordinary everyday activity. As it turned out later, the newspapers had very desperately wanted to get this event covered, but could not reach any of their photojournalists in time to cover the event. The author, however, was able to offer hundreds of pictures of the event, wirelessly transmitted, while the event was still happening. Furthermore, a collaboration with a large number of remote viewers enabled a new form of Computer Supported Cooperative Journalism.

Packard's "Casual Capture" project also build upon various concepts of sousveillance.

Sousveillance is related (even if by inverses) to the tradition of surveillance, and to the artistic practice explored by artists, such as Julie Scher, and the Surveillance Camera Players, among others, working in the medium of surveillance.

Organizations such as Future Physical are also "stretching technology a human adventure" and developing "cultural program exploring boundaries between virtual and physical", e.g. "How will the human body interact with digital tools in the future?". See for example, Wearable Computing Links,
www.futurephysical.org/pages/content/wearable/links.html

In relation to the Fine Arts, the continuous nature of sousveillance (i.e. continuous archival of personal experience) is very much like the concept of "living art". Tehching defined "living art" performances as being of one year in duration (e.g. Tehching Hsieh and Linda Montano held opposite ends of a rope but never touched each other for one year), although other durations are possible (e.g. Montano's 14 year long clothing colour experiments, wearing only one colour of clothing for each of the 14 years, etc.). The author's 30 year long exploration and 20 year long actual experiment in bridging the gap between cyberspace and the real world by living day-to-day life through the electric eyeglass is thus an example that might also be considered part of the tradition of "living art".

Moreover, recently there has been a growing sousveillance industry, with three workshops, organized independently, but around the same time:

- International Workshop on Inverse Surveillance (IWIS 2004), April 12th. This workshop is based on 3 years of planning and previous "inverse conferences" entitled DECONference 2001, DECONference 2002, and DECONference 2003. See, for example,
  http://wearcam.org/iwis/ and http://deconference.com

- Memory and Sharing of Experiences, in cooperation with Pervasive 2004, April 20th, 2004, Vienna, Austria. See, for example,
  www.ii.ist.i.kyoto-u.ac.jp/ sumi/pervasive04/
  Sumi, for example, makes the distinction between surveillance (sensors in the environment) and sousveillance (sensors attached to persons) through the use of "the term 'ubiquitous' to describe sensors set up around the room and 'wearable' to specify sensors carried by users"[9]. Some of this work also relates directly to computer mediated reality [4][2].

- Continuous Archival and Retrieval of Personal Experiences (CARPE 2004), New York, New York, October 15th 2004, held in conjunction with the conference in which this paper appears (ACM Multimedia).

The work presented in this paper is distinct from that of the sousveillance industry which is not focused on art, or the related philosophical and technosocial issues. Likewise, much of the existing work in performance art, and body art is not directly connected to the sousveillance industry, in terms of tools for art and **intervention**. Thus there is a largely unfulfilled need for such tools.

While it is well known that technology influences art, (e.g. Scher's surveillance-based art is obviously influenced by surveillance technologies), it is hoped that art will also influence technology [1], and in particular, it is hoped that art will influence the growing sousveillance industry as much as the surveillance industry has influenced art.

1. COMPUTER MEDIATED REALITY AS A TOOL FOR TRANSFORMING EVERYDAY LIFE INTO VISUAL ART

Stepping beyond the obvious practical uses of Computer Mediated Reality, there is a more existential motivation regarding how we, as humans, are able to choose the manner in which we define ourselves [10]. The lifelong cyborglog recorder is more than just a visual memory prosthetic. It is also a new tool for the visual arts.

One of the author's original goals of Computer Mediated Reality was to create a body–borne wireless sensory environment which, although technically sophisticated, would function more in the spirit of an artist's personal notes or a painter's canvas. Thus computer-mediated reality was a form of artistic exploration.

In the early 1980s the author was asked to exhibit his computer mediated visual experiences in various art galleries, resulting in a genre of photographic memory characterized by the computer mediation, capture, sharing, recording, and processing of everyday visual experiences. See Fig 2.

These images were created using a concept of vector spaces made from photographic quantities, that the author called "painting with lightvectors".

<center>(a)</center> <center>(b)</center> <center>(c)</center>

Figure 2: Living in a computer mediated environment as a new way of seeing the world as visual art (a) A mid 1980s view of a corridor at McMaster University, and (b) of the Mann residence. (c) Computer mediated view of a television placed on an easel at the base of a commonly photographed space, Niagara Falls. Reality once mediated through television, is again mediated through the wearable computer, as a form of social commentary on what is reality.

Briefly summarized, lightvector paintings are made by combining differently illuminated exposures of the same subject matter, as illustrated in Fig. 3.

This process of "painting with lightvectors" was also possible with a group of people wearing computerized seeing aids that were tuned to the same virtual channel, so that there was a shared computer-mediated visual reality. In this way, the team experienced a collectively modified view of the world, in the production of visual art. Such early apparatus was more cumbersome, however, and thus perhaps less well suited to widespread use as a tool for multimedia artists. (See Fig 4(a).)

More recently, versions of this system have been made available for others to use, with computer programs that can be downloaded from comparametric.sourceforge.net and run on less cumbersome systems, easily made from mobile (small 12 volt automotive) computers, as shown in Fig 4(b). This new tool for artistic exploration is very easy to use, and can be taught in just a few minutes, to anyone with no prior experience. The new hand-held form factor can also be passed around quickly among a group of individuals, so that they can all feel like they are participating in the use of the tool. The grip, similar to the rubber grip of a hammer, makes the tool easy to pass from one person to another, and thus it is very suitable for teaching large groups of students.

2. CYBORG DISCRIMINATION: ACCIDENTAL DISCOVERIES IN SOUSVEILLANCE

By the summer of 1985 the author had built a wearable computer mediated reality system into a jacket, which he wore in much of his day-to-day life.

This resulted in two kinds of public reactions:

- peer discrimination from individuals, either to the outward appearance while wearing the entire system, or the discrimination that remained when the outwardly visible portions were removed, leaving only the permanently attached electrodes, subdermal and dermaplant[2] portions of the apparatus (e.g. with regards

to the portions of the apparatus that are permanently attached to the body being seen by others during communal change of clothes for high school gym class, the need to wear a full-body bathing suit to cover dermaplants during swims, or the like);

- official discrimination by representatives of large organizations, allegedly acting on the wishes of the organization. This discrimination pertained to both the unusual outward appearance of the apparatus, the functionality of the apparatus (evidence capture, live transmission of visual images of the official and the officials establishment, etc.), as well as the inward appearance of the body even when the main portion is removed (permanently attached electrodes, subdermal and dermaplant portions of the apparatus that might become visible in an airport stripsearch room).

The author discovered these various elements of discrimination by accident, simply through the process of living the bearable (wearable/implantable) computing lifestyle. Of the various forms of discrimination, the author could forsee the day when the apparatus would no longer have an unusual appearance, because miniaturization would some day allow all of the apparatus to be implanted (and concealed) within the body. Ten to twenty years later, this vision was to have been realized simply by the miniaturization of the apparatus into what appear like ordinary clothing and eyewear (Fig 5).

To achieve such a concealment opportunity, the author invented a new kind of eyeglass design in which the frames come right through the center of the visual field. With materials and assistance provided by Rapp optical, eyeglass frames were assembled using standard photochromic prescription lenses drilled in two places on the left eye, and

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[2]Dermaplants refer to devices such as subdermal electrodes, transdermal wound closure, connections on deliberately self-inflicted wounds for purpose of making better connections, and other devices permanently attached to, on, or below the surface of the skin. The author finds that Dermabond (TM) wound closure material manufactured by Closure Medical is often useful for making, growing, or maintaining dermaplants.