Sousveillance and Cyborglogs: A 30 year empirical voyage through ethical, legal and policy issues.

ABSTRACT:

This paper describes the author's own personal experiences, experiments, and lifelong narrative of inventing, designing, building, and living with a variety of body-borne computer-based visual information capture and mediation devices. The emphasis is not just on the devices themselves, but on certain social, privacy, ethical, and legal questions and challenges that have arisen from actual experiences with lifelong video capture, processing, transmission, and dissemination in a variety of different everyday cultural settings over the past 30 years. The most interesting of these accidentally-found questions pertain to:

- inverse surveillance (body-borne audiovisual and other sensor capture, storage, recall, and processing, known in the research literature as "sousveillance"); and
- the epistemology of freewill and metaphysics of choice that seems to arise from an apparent reversal of the now pervasive and ubiquitous notion of surveillance.

Extrapolating from these lessons, several hypotheses are presented, including: (1) sousveillance, like surveillance, will be driven by rapid development of new technology, leaving legal frameworks lagging behind technology; (2) the growth of sousveillance will accelerate greatly when implementations come with other non-sousveillance uses (e.g. camera phones because of their strategic ambiguity with regards to whether they are being used to take a picture or for just a voice call); (3) legal frameworks will tend to support, rather than oppose sousveillance; (4) such legal protections will favour video sousveillance over video surveillance just as they now favour audio sousveillance over audio surveillance; (5) such legal protections will emerge first for the disabled (e.g. the visually impaired); and will then expand to encompass other legitimate and beneficial uses of sousveillance (personal safety, evidence gathering, etc.); (6) a person wishing to do lifelong sousveillance is deserving of certain legal protections liabilizing others who might attempt to disrupt continuity of evidence.

INTRODUCTION:

Mediated Perception: An adventure to see the world in a different light

There has recently been a great deal of interest in virtual reality, mediated reality, mixed reality, augmented reality, and the like. **Mixed reality**, for example, covers a continuum between graphics enhanced by video and video enhanced by graphics to include virtual reality and augmented reality as two special cases. [Tamura et. al. 2002]. However, there are important categories of visual information processors that do not fit within this taxonomy or continuum, giving rise to the need for a more general framework.

One of the earliest and most important such examples was the eyeglasses George Stratton built and wore. His eyewear, made from two lenses of equal focal length, spaced two focal lengths apart, was basically an inverting telescope with unity magnification, so that he saw the world upside-down [Stratton 1896, Stratton 1897]. These eyeglasses, in many ways, actually diminished his perception of reality. His deliberately diminished perception of reality was neither graphics enhanced by video, nor was it video enhanced by graphics, nor any linear combination of these two. Moreover it was an example of optical see-through that is not an example of registered illusory transparency, e.g. it problematizes the optical see-through versus video see-through dichotomy because both the mediation zone, as well as the space around it, are examples of optical-only processing. With such optical processing, the real dichotomy should be (and actually is, in this case) mediated see-through versus unmediated see-through. More generally, we can also have a partially mediated reality, where there is some of both mediated and unmediated see-through together or superimposed (i.e. a partially mediated reality).

Others followed in Stratton's footsteps by living their day-to-day lives (eating, swimming, cycling, etc.) through left-right reversing eyeglasses, prisms, and other optics [Kohler 1964, Dolezal 1982] that were neither examples of augmented reality nor augmented virtuality (and for which the optical see-through versus video see-through distinction fails to properly address important similarities and differences among various such devices).

Because of the existence of a broad range of devices that modify human perception, **mediated reality**, a more general framework that includes the reality virtuality continuum, as well as devices for **modifying as well as mixing** these various aspects of reality and virtuality has been proposed [Mann 1994, Mann 2001].

Mediated Reality, therefore, refers to a general framework for artificial modification of human perception by way of devices for augmenting [Starner et. al. 1997], deliberately diminishing, and more generally, for otherwise altering sensory input.

Indeed, mediated reality has been shown to be useful in deliberately diminishing reality, such as by filtering out advertisements [Mann and Fung 2002]. Such **diminished reality** systems can filter out billboards and other advertising material, replacing them with blank spaces or other, more useful material [Mann with Niedzviecki 2001]. Mediated reality relates to Feiner's distinction of virtual reality and augmented reality as follows: ''whereas virtual reality brashly aims to replace the real world, augmented reality respectfully supplements it.'' [Feiner 2002] whereas **mediated reality** modifies it.

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 bearable (wearable, implantable, or combination) computer [Mann 2001].

Early on, the author recognized the utility of computer mediated perception, such as the ability to see in different spectral bands (Figure 1 below) and to share this computer mediated vision with remote experts in real time (Figure 2).

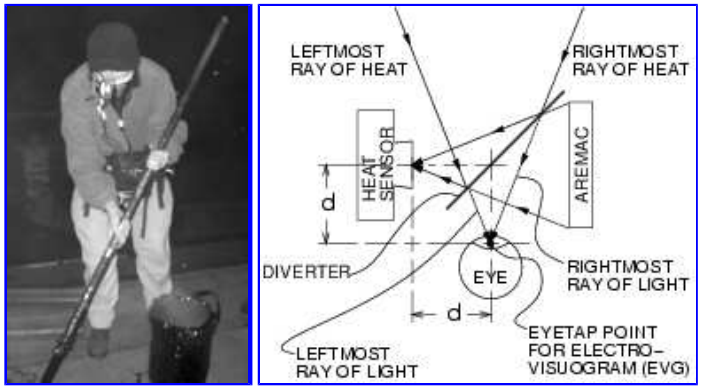


Figure 1: There was no doubt that Mediated Reality had practical uses. (at left) Author (looking down at the mop he is holding) wearing a thermal EyeTap wearable computer system for seeing heat. This device **modified** the author's visual perception of the world, and also allowed others to communicate with the author by modifying his visual perception. A bucket of 500 degree asphalt is present in the foreground. (at right) Thermal EyeTap principle of operation: Rays of thermal energy that would otherwise pass through the center of projection of the eye (EYE) are diverted by a specially made 45 degree ''hot mirror'' (DIVERTER) that reflects heat, into a heat sensor. This effectively locates the heat sensor at the center of projection of the eye (EYETAP POINT). A computer controlled light synthesizer (AREMAC) is controlled by a wearable computer to reconstruct rays of heat as rays of visible light that are each collinear with the corresponding ray of heat. The principal point on the diverter is equidistant to the center of the iris of the eye and the center of projection of the sensor (HEAT SENSOR). The light synthesizer (AREMAC) is also used to draw on the bearer's retina, under computer program control, to facilitate communication with (including annotation by) a remote roofing expert.

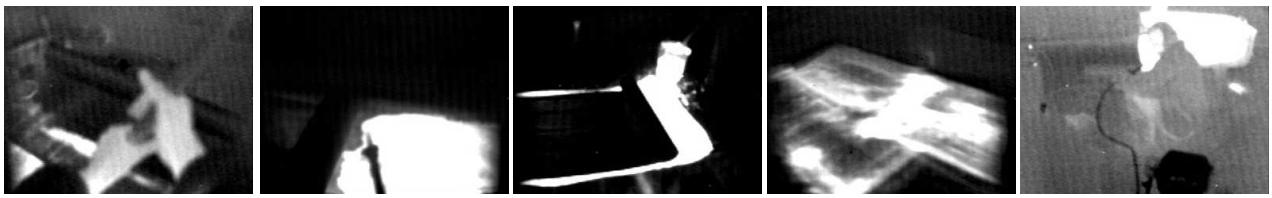


Figure 2: Practical application of collaborative Computer Mediated Reality: (leftmost) First person perspective as captured by the EyeTap device. Author's hands are visible grasping the mop. (left of middle) Mop and hot asphalt as viewed through bearer's right eye. (middle) After mopping hot asphalt onto the roof surface, a base sheet is rolled down (bucket of hot asphalt shows as white in the upper right area of the frame). (right of middle) The thermal EyeTap is useful for ''seeing through'' the top layers of felt or fiberglass, to determine heat flow underneath. (rightmost) The kettle (upper right of frame) shows up as white (approx. 500 degrees) whereas the propane cylinder (bottom of frame) and the propane hose supplying it show up as black, because the cylinder and hose are cold due to the expansion of the propane gas. The thermal EyeTap was also useful when the kettle caught on fire because of its ability to see through smoke. Kettle fires are easy to extinguish (simply by slamming the lid shut) if the kettle can be seen through the thick black smoke given off by the burning asphalt.

Such devices can be used to modify the visual perception of reality within certain mediation zones (e.g. only one eye rather than both eyes, or only a portion of that eye), giving rise to partially mediated reality[Mann 2001]. Moreover these devices can also be worn with prescription eyeglass lenses, or even have prescription eyeglass lenses incorporated into the design. Prescription eyeglasses are themselves partial reality mediators, having a peripheral zone, a transition zone (frames or lens edges), and one or more mediation zones (one or more lenses, or lens zones as in bifocal, trifocal, etc., lenses).

Ecological origins of mediated reality

An important element of Stratton's work was that he wore the device in his ordinary everyday life. If performed on other subjects, such work might have far outstripped the ability of university ethics committees, the protocols required of ''informed consent'', and the tendency for many academics to work in labs, controlled spaces, and existing literature. Unlike traditional scientific experiments that take place in a controlled lab-like setting (and therefore do not always translate well into the real world), Stratton's approach required a continuous rather than intermittent commitment. For example, he would remove the eyewear only to bathe or sleep, and he even kept his eyes closed during bathing, to ensure that no un-mediated light from the outside world could get into his eyes directly [Stratton 1896, Stratton 1897]. This work involved a commitment and passion on his part, to devote his very existence -- his personal life -- to science. Much like Einstein, who once said "Love is a better master than duty", Stratton's passion and personal interest in science, rather than his duty or professionalism, was his main reason for continuing his practice.

Stratton captured a certain important human element in his broad seminal work, which laid the foundation for others to later do carefully controlled lab experiments within narrower academic disciplines. Moreover, his approach was one that broke down the boundaries between work and leisure activity, as well as the boundaries between the laboratory and the real world.

The author has also been driven by a personal desire to explore new ways of seeing, but through the use of computation rather than optics. The past 30 years of inventing, designing, building, and the last 25 years of wearing computerized reality mediators in everyday life has provided the author with some insight into some of the issues that would not normally have been discovered in a controlled lab setting. These issues include not only the long-term effects of such devices, but also some sociological and humanistic factors such as how others react to such devices [Mann with Niedzviecki 2001].

For example, the adverse reaction by others had initially given rise to a the author's desire to build (and the author's success at building) reality mediators that do not have an unusual appearance (Figure 3).

Figure 3: Evolution of author's bearable computer mediated reality system.

However, subsequent realization that covertness stigmatizes the activity, has led the author to no longer see covertness as essential.

Reality Mediators for everyday life

Typical virtual reality headsets, and other cumbersome devices are not well suited to ordinary everyday life because of the bulky constrained and tethered operation, as well as their unusual appearance.

Indeed, it is preferable that commonly used reality mediators, such as hearing aids and personal eyeglasses must have an unobtrusive (or sometimes a hidden) appearance, or (perhaps more preferably) be designed to be sleek, slender, and fashionable. Figure 4 shows the difference between an openly visible EyeTap and a concealed system.

Figure 4: (at left) EyeTap devices, such as this infrared night vision computer system, when the components are visible, tend to have a frightening appearance, owing to the ‘‘glass eye’’ effect, in which optics, projected to the center of projection of a lens of the tapped eye are visible to others. Here we see the image of the infrared camera located in the center of the author’s right eye. (at right) Author’s recent (1996) reality mediator design with systems built into dark glasses tends to mitigate this undesirable social effect. The eyeglass lenses are also transparent in the infrared, allowing the night vision portion of the apparatus to take over in low light, without loss of gain. In the visible portion of the spectrum, a 10dB loss of light sensitivity is incurred to conceal the color sensor elements and optics.

The author’s wearable computer reality mediators have evolved from headsets of the 1970s, to eyeglasses with optics outside the glasses in the 1980s, to eyeglasses with the optics built inside the glasses in the 1990s [Mann 2001] to eyeglasses with mediation zones built into the frames, lens edges, or the cut lines of bifocal lenses in the year 2000 (e.g. exit pupil and associated optics concealed by the transition regions).

Reality mediators that have the capability to measure and resynthesize electromagnetic energy that would otherwise pass through the center of projection of a lens of an eye of a user, such as shown in Figures 1, 2, 3, and 4, are referred to as EyeTap [Mann 2001] devices. These devices divert at least a portion of eyeward bound light into a measurement system that measures how much light would have entered the eye in the absence of the device. Some eyetap devices use a focus control to reconstruct light in a depth plane that moves to follow subject matter of interest. Others reconstruct light in a wide range of depth planes, in some cases having infinite or near infinite depth of field.

EyeTaps having the appearance of everyday bifocal eyeglasses

Even a very small size optical element, when placed within the open area of an eyeglass lens, looks unusual. Thus eyeglasses having display optics embedded in an eyeglass lens, such as those made by Microoptical (http://www.microopticalcorp.com), still appear unusual. In normal conversation, people tend to look one-another right in the eye, and therefore will notice even the slightest speck of dust on an eyeglass lens.

Therefore, the author has proposed that any intermediary elements to be installed in an eyeglass lens be installed in the transition zones, e.g. as transfer functions between peripheral vision and the eyeglass lens itself (e.g. in the frames), or as the transfer functions between different portions of a multifocal (bifocal, trifocal, etc.) eyeglass lens.

Consider first the implementation of a reality mediator as part of transfer function of the glass to glass transition region of bifocal eyeglasses.

In the case in which a monocular version of the apparatus is being used, the apparatus is built into one lens, and a dummy version of the diverter portion of the apparatus is positioned in the other lens for visual symmetry. The author found that such an arrangement tended to call less attention to itself than when only one diverter was used for a monocular implementation.

These diverters may be integrated into the lenses in such a manner to have the appearance of the lenses in ordinary bifocal eyeglasses.

Where the bearer does not require bifocal lenses, the cut line in the lens can still be made, such that the transfer function simply defines a transition between two lenses of equal focal length.

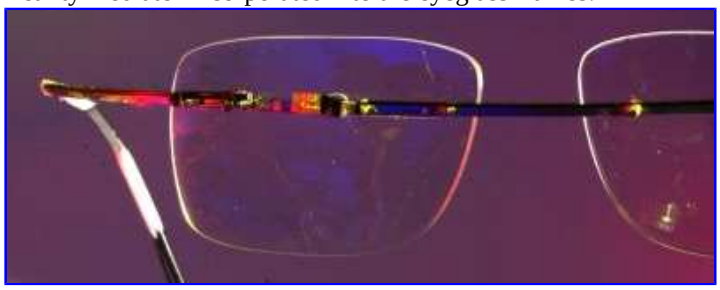
Transition zone reality mediators: Reversal of the roles of eyeglass frames and eyeglass lenses

The size of the mediation zone that can be concealed in the cut-line of a bifocal eyeglass lens is somewhat limited.

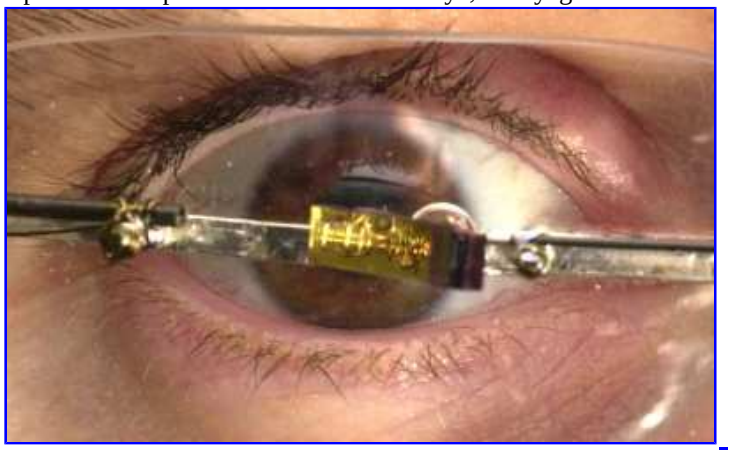
The peripheral transfer function (e.g. at the edges of the glass, or the eyeglass frame boundaries) provides a more ideal

location for a partial reality mediator, because the device can be concealed directly within the frames of the eyeglasses, as shown in Figure 5 below.

Reality mediator incorporated into the eyeglass frames:



Upon close inspection with the unaided eye, the eyeglasses do not show the presence of an obvious EyeTap.



Using a magnifier, macro lens, etc., we can see the diverter when magnified in an extreme close-up.

Side view shows sleek and slender design, where the computer, battery, and other apparatus can be hidden in hair, at back of bearer's head.

In view of such a concealment opportunity, the author envisioned a new kind of eyeglass design in which the frames

would 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 four places on the right eye, to accommodate a break in the eyeglass frame along the right eye (the right lens being held on with two miniature bolts on either side of the break). The author then bonded fiber optic bundles concealed by the frames, to locate the camera and aremac in back of the device.

This research prototype proves the viability of using eyeglass frames as a mediating element. The frames being slender enough (e.g. two millimeters wide) do not appreciably interfere with normal vision, being close enough to the eye to be out of focus.

But even if the frames were wider, they can be made out of a see-through material, or they can be seen through by way of the illusory transparency afforded by the EyeTap principle [Mann 2001]. Therefore, there is definite merit in the design of systems that allow both unmediated see-through and mediated see-through to co-exist on light passing through eyeglass frames.

In particular, the eyeglasses of Figure 5 were crude and simple. A more sophisticated design could use a plastic coating to completely conceal all the elements, so that even when examined under a microscope, evidence of the EyeTap would not be visible.

Accidental encounters with the Fine Arts: From Lightvector Painting to Discovering "Sousveillance"

Among the interesting discoveries found in long-term adaptation to computer-mediated reality was a new way of seeing. Because of the constant view of the world from a photographic perspective, the EyeTap became a way of blurring the boundary between cyberspace and the real world, and appreciating the range of light and shade in everyday life. Throughout the early 1980s, this led the author toward a new kind of visual art based on seeing how everyday scenes and objects responded to light (Figure 6).

Figure 6: Computer mediated reality as a form of visual art, Summer of 1984.

Moreover, the long-term adaptation to seeing through the device 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, which involves long-term adaptation to the new way of seeing.

One aspect of the new way of seeing involves learning to see in image-stabilized coordinates, in which a new kind of

photographic vision emerges (Figure 7). This work has also been made into a 35mm motion picture film (http://wearcam.org/cyberman.htm).

Figure 7: Computer mediated reality as a new way of seeing: longterm adaptation to stabilized image coordinates results in a unique photographic vision of the world.

Moreover, a living and permanently installed/instilled photographic perspective allows the bearer to capture the birth of a newborn, or to capture baby's first steps (Figure 8), as, perhaps foretold by the 1945 paper of Vanever Bush [Bush 1945], but with everyday life instead of the laboratory record that Bush proposed.

Figure 8: Birth of a newborn, and a little over a year later, Baby's First Steps, captured by way of longterm adaptation to stabilized image coordinates. Because of continuity, EyeTap captures, for example, a newborn, and later, the baby's first steps.

Microsoft (Bell, Gemmel) has also proposed a similar project, called "MyLifeBits", to capture an entire lifelong personal experience record. Using approximately one terabyte per year, lifelong recording, e.g. 16 hours a day of high speed motion, and 8 hours a day of not too much movement (sleeping), with 41Khz 4channel audio (suitable for phased-array post processing) depending on compression ratio, etc., so that wearing an Apple Xserve RAID (3.5 terabytes) one can store more than 3 years of lifelong capture on the body. By the time that is full, there will exist something with even more storage capacity, and by the exponential law, one need never delete anything. See also Continuous Archival and Retrieval of Personal Experiences, http://research.microsoft.com/CARPE2004/

Accidental discovery of sousveillance as ethnomethodological inquiry:

Electric seeing and visual memory aids have resulted in various forms of opposition. Reasons for opposition to sousveillance have ranged from legitimate concerns regarding the apparatus itself, and its possible adverse effects on other

devices, e.g. an obvious need for a security check while boarding an aircraft, often reasonably worked through with medical and security staff, to a more perplexing concern regarding the videographic memory functions of the system. The latter concern creates an interesting set of challenges for privacy, legal, ethical, and policy issues and an understanding of the world of ubiquitous surveillance in which we already live. Those in opposition to sousveillance can be divided into two broad categories: other individuals (e.g. concerned citizens, homeowners, etc.) acting in opposition out of their own volition; members of larger organizations acting, or alleging to act, as a representative of a larger organization that they do not control, or that they allege not to control.

An unexpected reversal of fourth amendment concerns (homeowner objections versus a larger organization's objections to sousveillance):
Over the past 25 years of wearing various embodiments of the system in a variety of different everyday cultural settings, the author has observed that the most frequent objections to the video capture possibility have been raised not by individuals acting in a role as an individual, but, rather, by representatives of organizations where surveillance is used extensively.

There appears to have been a direct correlation between the number of surveillance cameras in an establishment, and the likelihood of objections being raised to the video capture possibility of the EyeTap apparatus. For example, people who invited the author to their private homes seldom complained about the capture of video, even when shown the video. Most homeowners were quite happy to see themselves and the interiour of their homes on the World Wide Web. Those who owned, operated, or managed commercial buildings or public establishments, however, were far more concerned than homeowners. This finding was surprising, given that the Fourth Amendment specifically mentions "houses" as a place where greater protection is afforded. For example, a hidden surveillance camera in a person's home would be seen as far more egregious than one in a public building. Perhaps part of this finding has to do with social customs, e.g. guests often carry handheld video cameras into the homes of others, and videotape birthday parties, or the like, but to do so in a public or semipublic building (such as a restaurant) often results in quick negative action from staff (e.g. Lessig's observation that it is forbidden to take pictures in any Starbucks coffee shop).

In part, the author has addressed this problem of complaints in public and semi-public buildings, by making more normal-looking versions of the apparatus, e.g. EyeTaps that look like ordinary eyeglasses.

However, the author also desired to understand the nature of the objections. Some of the objections were based on alleged "security". However, it is well known that so-called "security through obscurity" is weak security. For example, if a robber could gain an advantage by knowing the layout of a jewellery store, there is a problem with the security in the same sense that if a person could pick a lock by knowing its principal of operation, the lock is poorly designed. For example the old skeleton locks (no longer widely used) can easily be opened with a bent piece of coat hanger wire, but the new medeco locks are said to be unpickable despite the clear disclosure (in the brochures, patent literature, etc.) of their principle of operation.

Other objections were based on privacy. But it's hard to comprehend how this objection would still correlate with the amount of surveillance, e.g. the more surveillance there is, the less privacy a person has, so the less they should object to an additional camera. In a department store with 100 surveillance cameras, what difference does a 101th camera make? Yet it was the places that had the most surveillance cameras, where the privacy concerns of the author's eyeglasses were most often raised. Thus such arguments seemed specious at best.

Other concerns included a fear of "comparison shopping" i.e. shopkeepers were afraid the author might be recording prices. For example, when speaking to the manager of the MIT bookstore, the author was informed that permission was required to make note of any prices. When asked if it was permissible to write down prices with pencil and paper, the manager also said "no". When asked if it was permissible to remember prices, the manager also said "no", and that permission was required in order to look at prices and remember them. Then when asked if it was permissible to measure the dimensions of the store (e.g. the size, number of square feet, etc.) the manager said "no". It was pointed out to the manager that the standard ceiling tiles were 2 feet by 4 feet, so it would be easy to figure out the number of square feet of retail space present, by simply counting the ceiling tiles and remembering the number of tiles present. The manager said that permission would be required in order to be allowed to remember how many ceiling tiles across the store was, or how many ceiling tiles wide it was. (Another advantage of having a lifelong audiovisual record of such interactions is that the absurdity of the whole matter can be brought to light by way of a motion picture film, or the like, which itself serves some public good.) Such absurd "forgetting" requirements are quite reminiscent of casino and money laundering establishments where claims that a person is counting cards (remembering numbers) are grounds for different treatment. Such internal process-based discrimination (discrimination based on what is going on in a person's mind, and thus the privacy of personal thought) puts the clerk, manager, or functionary of these establishments into the role of being thought police.

The author believes that it is (or will soon be) futile to make a distinction between thinking and computing, or between remembering and recording, once the technology becomes so inextricably intertwined with the mind and body. Already, we are on the verge of replacing failed parts of the brain with silicon. Does that mean that a person thinking of the square root of two, while bearing a thought prosthesis, could be violating a patent on a particular algorithm for computation of

same?

Along similar lines, the author was physically assaulted by guards in an art gallery and pushed out of the gallery simply for doing nothing more than wearing eyeglasses that the gallery curator did not like. When corresponding with the curator, it was found that the reason for this action was the mere possibility of copyright infringement.

The author proposes that the only reasonable work-around for this sort of situation is for officials to stop trying to police what goes on inside somebody's mind and body. The only right of an official should really be to police only the external actions and not probe the internal state of the self. In other words, the prosthesis of the mind cannot be regarded as separate from the mind. To do otherwise, whether to try to probe the workings of the mind and body, or to try to change these workings, will incur liability.

Moreover, requiring someone to close their eyes and ears when they come into a certain space seems like a stretch beyond the reasonable. For example, one of the author's students was asked, while passing through customs, not to take pictures of the officer, and since the EyeTap is the means of seeing, this resulted in being required to look at the floor during the time that the customs officer was asking questions of the student.

Audio versus video, surveillance and sousveillance:
Video surveillance is a technology that has proliferated by way of an industry that has grown quickly, before legal frameworks have had time to catch up with it. Audio recording is a technology that evolved and was adopted more slowly, where laws were able to keep pace with it. In particular, the telephone presents us with a unique look into laws regarding technologically mediated communication. Laws concerning the recording of telephone conversations may therefore be relevant to future laws of realtime computer mediated communications capture. Unlike email or telephone voice mail (both of which are recorded media by way of the necessity of recording the media to time-shift it), realtime telephone conversations are more akin to realtime computer mediated capture, processing, storage, recall, and transmission of audiovisual experience. In fact, the word "cyberspace" (coined by science fiction writer William Gibson) is often first described by way of the telephone as a defining example: "cyberspace" is the space that exists between two people talking on the telephone.

In the United States, federal law allows the recording of a phone conversation in which at least one party consents to the recording [Callcorder 2003]. State laws vary from state to state. Thirty-eight states and the District of Columbia permit individuals to record conversations to which they are a party without informing the other parties that they are doing so. These laws are referred to as "one-party consent" statutes. Here it is legal for a person to record his or her own telephone conversations without the knowledge or consent of the other party or parties.

Calls crossing state lines present unique challenges. The most famous example involved Linda Trip recording the telephone conversations of Monica Lewinski concerning her relationship with President Clinton. Trip was in Maryland and Lewinski was in DC. Maryland is an all party consent state while DC is a one party consent state. The law turned out to be quite fuzzy on these issues.

What is particularly insightful, is that the notion of one-party consent is quite pervasive in many different countries around the world, where greater leeway is often given to a person wishing to record a conversation of which they are a party.

Surveillance, French for "to watch from above", typically describes situations where an individual, often of higher authority, (e.g. often a security guard, department store owner, or the like) watches over citizens, suspects, or shoppers from above. 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]. For this reason, the word "surveillance" is perhaps better suited to describing the capture of audio, video, or the like, by a higher entity that is not a peer of, or a party to, the activity being recorded.

An audio, video, or similar recording made by one party to a group activity is known in the literature as "sousveillance". The word "sousveillance" is derived from "sous" (French for "from below") [Mann, Nolan, Wellman 2003], and has often been described and presented as an inverse to surveillance.

Using the above definitions, we have that audio sousveillance is often more permissible than audio surveillance. This difference in permissibility may in part be due to the fact that it is less likely to lead to widespread "fishing expeditions". Indeed, warrants, court orders, and the like, issued for allowing wiretap attempt to keep it focused on specific situations where there is "reasonable cause", so that society does not become a surveillance nation, police state, or "prison planet". Sousveillance is less likely to result in such centralization of power, because the need for one party's involvement in each instance of the recording process helps to limit it. Conversely, without laws and safeguards, surveillance could allow one person, at least in principle, to record every phone conversation in the world.

Sousveillance, on the other hand, requires some number, say, N, people to record N conversations. This one-to-many versus one-to-one mapping helps distinguish surveillance from sousveillance.

It has been argued that video sousveillance should enjoy greater acceptance than video surveillance, for similar reasons [Mann 1995]. For example, since there must be a real human eye attached to the EyeTap for it to function properly, the EyeTap recording (sousveillance) does not intrude as severely as surveillance video, because with sousveillance a person can never be recorded when they are alone (except by themselves, e.g. as when looking in a mirror). In this way, surveillance constitutes a greater potential for violation of privacy because of its ability to capture (e.g. through hidden cameras installed by police in a toilet stall to capture criminal activity) a person who otherwise might have a reasonable expectation of privacy when alone.

Video surveillance has enjoyed a greater acceptance than audio surveillance i.e. courts have allowed video recordings of nannies, elder care employees, and other types of video recordings made with covert cameras without the subjects consent [Losey 1998]. Accordingly, the author hypothesizes that video sousveillance should also enjoy a more widespread acceptance than audio sousveillance, which itself is already more accepted than audio surveillance. As a related example, compare the case of a person taking pictures at a rock concert, to that of a person making an audio recording. Suppose that both were unauthorized. The photographer might be able to get away with selling pictures, but the audiographer would certainly be considered to be infringing on copyright if selling unauthorized audio recordings. Evidently the mapping from the three dimensional world to the two dimensional image space is seen as a derivative work, whereas the audiographer is not seen as as much of an artist, i.e. the audiographer is seen as a duplicator whereas the photographer is seen as an artist, adding creative input. In fact if the musicians themselves tried to use the photographs without the photographer's permission, the photographer might even be able to sue them successfully, even though they were the subjects of the pictures. Thus it appears that visual sousveillance is more owned by the data collector, and audio sousveillance is more owned by the data creator (subject).

Laws are often enacted to uphold the public good. Sousveillance (i.e. in the form of citizens recording police) can often lead to uncovering corruption, such as in George Halliday's videotaping of the Rodney King incident, or the videotaping of city workers who were violating quarantine and safety regulations [NBC2 News Online 2004]. There is also a "public good" that can come from sousveillance, so it deserves a favorable legal framework.

More recently, a New Mexico couple was brutalized by 85 police officers and soldiers in a wrongful "war on drugs" raid because their sunflowers, were mistaken for "marijuana-like plants". The couple sued for $1 million, but the case was thrown out because the judge said that "unless they could identify individuals involved in the raid, which they could not, then they had no recourse".
--http://www.ndsn.org/nov95/newmexic.html

In such a situation sousveillance might have helped them identify some of the perpetrators of the wrongful raid, as well as to serve a certain public good by exposing police and military brutality.

Of course officers and soldiers have been known to oppose sousveillance. Had the officers beating Rodney King seen the videographer, they might have confiscated his videotape for reasons of "national security", or as part of an alleged desire to do thorough "evidence gathering". There have been numerous cases of perpetrators attempting to destroy sousveillance evidence. This is not to suggest all officers are corrupt, but simply that there exists the occasional corrupt officer, and that sousveillance may help capture this corruption and bring it to the attention of the honest majority of noncorrupt officers. Likewise, a shopkeeper who has something to hide (e.g. fire exits that are illegally chained shut, or other unlawful activity) will oppose sousveillance.

Indeed, the author has been physically assaulted by a Shell Gas station owner who demanded the "film". When informed that there was no film, and that images were stored at remote sites, the author was unlawfully detained, and the author called the police to file a police report. (One advantage of a wearable system is that it functions as a telephone, making it easy to immediately place a phone call, without others knowing that a phone call is being placed, and in this way, sousveillance technology can function as a Personal Safety Device.)

The sur/sousveillance distinction does not necessarily enforce a top-down or bottom-up hierarchy. Indeed, one surveillance camera may be pointed up at another surveillance camera, and similarly, sousveillance does not necessarily limit itself to citizens photographing police, shoppers photographing shopkeepers, and taxicab passengers photographing cab drivers. Indeed, the driver of a cab one day, may be a passenger in someone else's cab the next day. Instead, "sousveillance" refers to human-centered capture, processing, storage, recall, and transmission of sensory information. Roughly speaking, if a camera is mounted on a building or in the environment (e.g. on a lamp post) it is a surveillance camera, whereas if it is mounted on a person, especially if it's an eye camera (or EyeTap that captures exactly what that person sees), it's a sousveillance camera.

Surveillance is already the subject of more than 4000 peer reviewed scholarly article references on Citeseer (the leading online repository of publications, freely cached and available without subscription charge or registration of any kind, http://citeseer.org), and is also the subject of an IEEE international conference. For a good survey article, see Gavrila [Gavrila 99], who summarizes surveillance as the art, science, and technologies of "Looking at People". Indeed, there is a Computer Science course, at Rutgers University, CS676 entitled "Looking at People"

(http://www.cs.rutgers.edu/~elgammal/cs676.html).

Likewise Sousveillance is the art, science, and technology of "People Looking at". Sousveillance does not immediately concern itself with what the people are looking at, any more than surveillance concerns itself with who or what is looking at the people. Instead, sousveillance typically involves miniaturized person-centric imaging technologies, whereas surveillance tends to be architecture or enviro-centric (cameras in or on the architecture or environment around us).

Surveillance tends to objectify or subjectify people as objects or subjects (or suspects) of scrutiny, whereas sousveillance allows people to be creators of data. Sousveillance allows people to be lifelong photographic artists rather than merely subjects. It is this "human-centric" rather than architecture-centric view that gives sousveillance much of its humanistic value.

Perhaps this distinction explains the author's finding that sousveillance is far more acceptable in the warmth of a person's private home (e.g. when done by an invited guest) than sousveillance in many commercial or so-called public or semi-public buildings (e.g. when a patron in a department store engages in sousveillance activities and is typically immediately asked to leave the store or face trespassing charges).

Yet with surveillance the opposite is true (for example, police installing hidden cameras in a shopping mall without the owner's consent would not be nearly so egregious as police installing hidden cameras in a person's home without the homeowner's consent). Certainly it is well known that the home enjoys greater protections from surveillance than does a commercial public or semi-public space [UMKC 2004].

For this reason, perhaps it is the more human element of sousveillance that tends to associate it more favorably with the home, and the more architectural element of surveillance that tends to associate it more favorably with commercial buildings. Or perhaps it is simply the fact that it's alot easier for individuals with sousveillance to negotiate among one another and come to a reasonable consensus, than it is for a person to negotiate with a surveillance camera: it's alot easier to talk to another human being who is bearing a camera than to have the same real heart-to-heart conversation with a lamp post upon which a surveillance camera is mounted.

Moreover, it has also been argued that the wearable computer is a person's highly mobile home (e.g. "clothing is a building built for a single occupant") [Mann with Niedzviecki 2001]. In this person-centric (human-centered), rather than archicentric (architecture-centered) doctrine, new legal challenges are sure to evolve, because now, we will have castles in contention (e.g. if two or more such highly mobile "homes" come close enough that their sphere of influence begins to intersect, then we have ambiguous boundaries or "property lines").

Sliding scale of sousveillance severity

From time to time, the objections to sousveillance have hinged on whether the device records data, and if so, the distribution of the sousveillance data. Moreover, the acceptability of sousveillance increases when the captured data aligns with personal sensory capabilities. For example, it is more acceptable to capture data from the eye, than it is to capture "upskirt video" from a shoe mounted camera. Laws, however, vary in this regard. California law holds that if a person can't be identified, "there is no harm". For example, Tyler Takehara, 50, of Pearl City, was charged with using a concealed camera to shoot video up the skirts of unsuspecting women riding escalators at Ala Moana Center, but his attorney argued successfully it was not against the law [Dunford 2003].

This position has been upheld by Washington state Supreme Court, overturning convictions of two men who took "upskirt" photos to sell on the Internet.

New laws are being considered to address this problem. Nevertheless, designing for acceptability of sousveillance may lead us toward designs that capture the senses in modalities similar to the way in which they are experienced.

Liabilization doctrine: Assuming liability by requiring a person to modify his or her mind and body:
Because of the ecological/ethnomethodological (i.e. "everyday usage" in "ordinary life") element of sousveillance, there have arisen a number of incidents where the author was asked to remove the computational seeing and memory aids, but was unable to comply with such requests.

Because of the way in which some apparatus can be inextricably intertwined with how the mind and body work, through long term adaptation, requests for removal of the apparatus amount to requests that the mind and body be modified. Such requests must incur, at the very least, liability on the part of the requester.

There are unique issues in Mediated Reality that often make it difficult or impractical to discontinue usage. In this way, Mediated Reality, unlike Augmented or Mixed Reality, creates a unique set of privacy issues in the legal and ethical domain, with regards to those who might request that the bearer refrain from video capture. These issues have become particularly challenging when there has been an articulable need for the bearer to capture video (e.g. in order to be able to

continue seeing properly).

In this paper, the author departs from the broader Warren and Brandeis "right to be left alone" [Warren and Brandeis 1890] definition of privacy, and instead the author uses the more narrow definition of privacy that relates only to sensors and not effectors (i.e. that sensors violate privacy whereas effectors such as loudspeakers, television displays, and junk mail violate solitude but not privacy).

Although there is no literature on truly longterm (e.g. many years) effects of mediated reality devices, there is a large body of literature on related issues such as mid-term (e.g. many hours) effects of virtual reality. Among the adverse effects are so-called "virtual reality sickness" that includes adverse effects that arise from the discontinuance of use (e.g. so-called "after effects" and "post adaptation phenomena"). Edelman has studied how adaptation takes place by loss of overproduced neurons and synapses throughout early development (which he refers to as "neural darwinism"), as well as how plasticity in the visual system results from synaptic patterns (maps) that emerge from learning (Tononi et al., 1992). Bach-y-Rita et. al. further describe adaptation aspects of computer-mediated reality (Bach-y-Rita et. al., 2003).

This paper does not address these effects, other than to simply recognize the fact that after adapting to certain mediated reality systems, over a period of many years, there are certain instances when and where the discontinuation of use can have adverse effects.

George Stratton observed an inability to see properly for approximately one full day after removal of the eyeglasses (having worn the glasses for one week), until an "inverse adaptation" time had passed.

The author has observed longer inverse adaptation periods, and some effects that are only temporary and short lived, whereas other effects that produce permanent or very long-term changes after the eyeglasses are removed.

Certain people who have viewed the author’s work negatively, have suggested that the author has become visually impaired through a self inflicted brain modification (by way of certain long term adaptations). Such brain modification is viewed by these certain people with the same kind of pejorative terms as the fringe cultures of body modification (deliberate self-inflicted branding, body piercing, tattoos, and the like).

But all of humankind has adapted itself, in certain ways, to a lesser or greater degree, through clothing, shoes, and mental prosthetics such as pocket calculators.

In this way, we are unable to survive naked in the wilderness, or compute the square root of two to ten decimal places, without the help of shoes, clothing, or calculators.

Thus, in some ways, the author’s "visual impairment" is not unlike the "impairments" we have all foisted upon ourselves in the technological age in which we live. Thus the author sees such adaptation (change) as learning a new way of seeing, rather than impairment.

Notwithstanding the debate as to whether these permanent changes constitute brain damage, or merely learning to see in a new way (because all learning involves a more or less permanent change to the brain, which need not necessarily be considered damage), it should simply be noted that a bearer of an EyeTap system may or may not be able to (or want to) discontinue usage without some advance warning.

Moreover, certain implantable portions of the device (e.g. optionally, the author’s occipital lobe electrode implants, and the like) require proper procedures for removal, or disconnect, which requires some advance notice, so that injury or death due, for example, to infection of unsealed electrode sites, does not occur.

The purpose of this paper is not to get sidetracked too much on the specific implementations, but, rather, simply to understand that there are situations where the bearer is unable to remove or de-activate the system, and that this inability leads to important philosophical, ethical, and legal questions.

To work around these problems, the author has often implemented a low battery alarm, and carried a spare battery, so as not to be far from home or another suitable place of rest and repair when and if the system should go down. Certainly with sufficient advance notice (e.g. a weekly swim schedule, like swims at noon every Thursday), it may be possible to be unadapted at these times, but there may arise situations where it may not be possible, desirable, or practical to remove the apparatus without sufficient advance notice.

Therefore, because of the ecological/ethnomethodological (i.e. "everyday usage" in "ordinary life") element of this practice, there have arisen a number of incidents where the author was asked to remove the device, but was unable to comply with such requests.

Physiological signal doctrine:

Nobody objects to a person recording their own heartbeat (heart monitor, ECG recorder, Holter monitor, or the like), even though the heartbeat is affected by others (e.g. heart rate could increase when stimulated by meeting someone). In keeping with this doctrine, a recording of the EyeTap signal has often been referred to as an "ElectroVisuoGram (EVG)" as it is one of the many physiological signals captured from the body. It just so happens that when looking at a person's EVG (e.g. video from, for example, the right eye), that other people seen by that eye will be clearly recognizable in the EVG recording. In particular, the author has created a Video Holter recorder, that captures ECG and EVG together, so that remote physicians can get to the root cause of heartbeat irregularities by examing video that is time-stamped to the ECG signal. For example, it has been possible to link electrocardiographic irregularities with stress. Because it is of the utmost importance to know what the patient was doing at the time of the heart's irregularities, the author believes laws can and will be enacted to protect patients outfitted with Video Holter monitors from discrimination or harassment. Even if we are unprepared to accept the similarities between the quite different aspects of EVG and ECG, we must at least acknowledge the rights of an individual to capture his or her own environs in order to diagnose a medical condition. Once this is acknowledged it opens the door for a more general right to one's own experiences, as captured by the self, whether to track down and provide evidence of exposure to dangerous situations, or simply for personal epistimology.

Discrimination:
Laws already exist to protect certain classes of individuals from discrimination. One of these classes of individuals is the disabled. In one case, for example, it was held that a professor cannot prohibit a blind student from making an audio recording of his lectures to facilitate learning. This is an example of a law that upholds the right to practice audio sousveillance.

Benefit to the sousveilled doctrine:
Moreover, when a sousveillance device, such as a seeing aid, benefits those being sousveilled, the sousveillance is more acceptable. For example, if the eyeglasses help a shopper see better, so that the shopper can buy more merchandise, the shopkeeper has less objection to the sousveillance.

Even if the device requires the capture and storage of images (e.g. to correct for visual confusion disorder, through image stabilization which requires recording of images), a seeing aid that helps the visually impaired purchase more merchandise is hardly something to object to.

As an exercise in understanding the extreme case, the author created a project to assist patients who were confined to their beds, in shopping for merchandise. Patients could remotely control the author's body, and see remotely through the author's eyes, so that they could go out shopping.

The author found that the same jewellery stores that had previously barred him from entry were all delighted to have him webcast their store's wares over the Internet to assist in making a purchase. Some of the shopkeepers even tried on the jewellery and posed in front of the author's camera, to get a good picture to the remote patient/customer. This happened in all cases, despite rules and store policy prohibiting photography of any kind in the jewellery stores. None of the shopkeepers in any of the stores objected when presented with the concept, simply titled "webramps" (wheel chair ramps through cyberspace). (See http://wearcam.org/webramps.htm.)

Indeed, the author believes that the same laws that make wheelchair ramps mandatory could be used to make acceptance of sousveillance mandatory in all public buildings.

Dissemination of sousveillance recordings:
Those opposing sousveillance have often begun by trying to prevent the capture of sousveillance data. Upon failing to do that, their next attack has typically been control over dissemination of the data, by trying to limit the usage of the sousveillance to being only a personal digital diary, inaccessible to others. One of the author's projects that creates unique challenges to privacy law is the "Seeing Eye People" project. This project allows EyeTap wearers to share visual experiences with others who might also help them see better. Volunteers provide remote visual assistance, over the Internet, to persons who are wearing sousveillance systems. By its very nature, the system involves a widely broadcasted vision, to a wide range of potential volunteers. This system can be synergistic, e.g. a person confined to a hospital bed may be delighted to have the chance to move around, virtually, through the able body of a blind participant, in return for providing some visual advice such as:

> "the building in front of you is the Art Gallery of Ontario, and I remember what that building was like when I was a child... if you go to the back of the main floor it is connected to a nice old house called The Grange which was the origins of the gallery... if you'd like to go there now, walk forward and be mindful of the five stairs that are in front of you now...".

Seeing Eye People also raised some interesting privacy issues. For example, what is the gender of a blind man who is visually guided by his wife. Should he use the men's or women's room?

Arts doctrine:

With the advent of the World Wide Web, the author began an experiment, while a student at MIT, in 1994, transmitting continuous live video to the Internet. This resulted in a certain professor (not the author's advisor, but another professor in the same group) demanding that the author not transmit images to the Web. The professor did not have an objection with the author's original system in which the author captured video, but the problem arose when the video was disseminated onto the Internet. The author wanted to continue transmitting, but agreed not to set foot in the building, if necessary. The professor still objected, citing concerns that someone walking down the street might sue MIT for transmission of the image on the MIT network. This argument seemed specious at best, and led to considerable debate, but the author responded by finding another network, and continuing the experiment through a different service provider (i.e. one other than MIT). Meanwhile, owing to some moral support from other professors, including the Director of the Lab, the professor tried to organize a group to discuss why this experiment should be terminated. The professor also brought in Mitch Kapor, co-founder of the Electronic Frontier Foundation, to assist with explaining to other professors how the author's work infringed on the rights of others. While not as official as a courtroom proceedings, the committees and groups had some enlightening discussions.

In a surprising twist of fate, Mitch Kapor spoke out, to the committees and groups, in favour of the experiment, saying that if any place should encourage the creation of totally new research disciplines, it ought to be MIT. Additionally, Kapor described the author as a "performance artist", and described this work was a valid form of artistic expression. This point of view appeared to turn the groups and committees around, and in many ways it was Kapor's wisdom that "saved" this whole effort. Much of this was documented in he 35mm motion picture film Cyberman, which includes discussions between the author, Mitch Kapor, William Gibson, and others (http://wearcam.org/cyberman.htm).

Within the arts doctrine, there is the value of electronic newsgathering, and the public good of capture, transmission, and dissemination of news as it happens. The use of EyeTap and the World Wide Web led to the discovery of the Cyborglog (also known as 'glog for short), which was the predecessor to the weblog (or 'blog for short [Ito 2004]), an example of which is shown in Figure 9.

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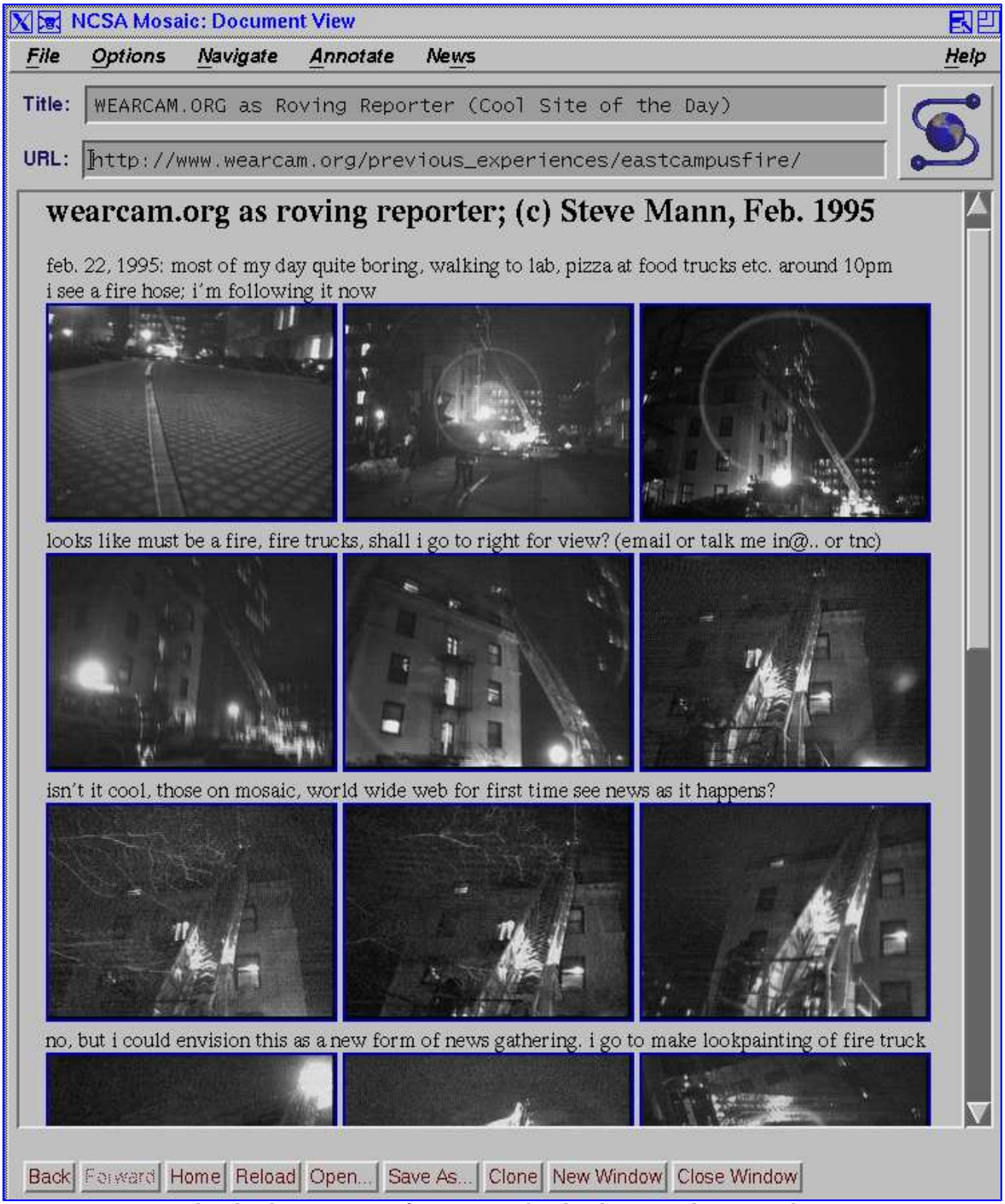

Figure 9: Computer mediated reality's new way of seeing as a cyborglog: longterm adaptation and continuous capture to a circular buffer allows serendipitous retrieval and coverage of newsworthy events. Here are the only pictures of the beginnings of the East Campus fire (the official newspaper photographers couldn't get there in time).

Ironically, the coverage of the East Campus fire resulted in negative press Hove 1996] 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 is 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.

Despite the initial negative reactions, a lot of good came of the invention of the cyborglog (a time-stamped diary of personal experience made available to the world). Others are also now proposing similar projects. For example, Microsoft's Gordon Bell has started a project on capturing lifelong data [Bell, mylifebits], as has Darpa [Gage 2003]. Additionally, investigative journalism has often been upheld as a public good.

The "arts doctrine" pertains closely to issues of public good in the Fine Arts as well, and often supports sousveillance activities that might otherwise be regarded negatively. For example, Katarzyna Kozyra, a 1993 graduate of the Warsaw Academy of Fine Art, filmed two pieces, "Bathhouse" (1997) and "Men's Bathhouse" (1999), at the bathhouses of the Hotel Gellert in Budapest, using cameras hidden in plastic bags and placed on or below benches in the bathhouses, without the knowledge of the participants.

Instead of being arrested, she was given an award at the Venice Biennial (THE 48TH INTERNATIONAL EXHIBITION OF ART, 1999 June 8 - July 1, www.biennaleprogram.org) one of the most prestigious venues for the Fine Arts.

The installations were said to raise important issues of voyeurism and narcissism. While privacy issues were raised in the press, none of the subjects objected when the work was exhibited. The artist felt that the secret filming was the only way to observe public versus private behavior.

To film in the men's bathhouse, the artist disguised herself as a man, using fake body hair, and covering her breasts with a towel.

Thus despite the oppositions of camera phones (seen to have little artistic or prosthetic value) in public baths, art and high culture are seen as providing public good.

Indeed, it has been proposed that cameraphones should, by law, be required to emit an audible sound when capturing an image, and that there should be provision to block them from functioning. But what then of National Geographic ethnographies of public baths in distant lands, as well as Fine-Arts bath images such as those of Kozyra, which would be blocked. Would National Geographic photographers or news photographers buy a blocked or blockable camera? Perhaps there would have been no Rodney King video, because police would routinely block capture of their activities. Department stores would block the capture of evidence that their fire exits were illegally chained shut, etc..

One possible work-around, for public baths, is the redesign of baths so that changerooms are dual-ported, and not gender specific. Such designs allow a caregiver of opposite gender to assist a spouse with dressing and undressing. Dual-ported design also provides a clear demarcation between bathing and non bathing areas. Such designs are common in europe, and allow patrons to enter a row of cubicles along one side, and exit along the other side, having lockers in the middle. In this way, personal electronic items such as cellphones are left in lockers, and there is no problem with bathers (i.e. persons in bathing suits or naked) being exposed to nonbathers (i.e. persons who are fully clothed, and who may therefore be in possession of image capture devices).

However, while dual-ported gender-neutral changerooms solve the video sousveillance problem, the use of video surveillance is also becoming common in public baths, with the advent of computer aided drowning detection [Soh, N.]. For this reason, it may be necessary to change public attitudes to expectations of privacy in public baths.

It has also been suggested that sousveillance would lead to voyeurism. But surveillance, which is already in widespread acceptance, can also lead to voyeurism. "people monitoring the cameras ... are not accountable. They are often local people who like watching couples make out in cars, mall owners who can use video evidence to keep out undesirables and probably friends of a friend of any person being watched. We have six degrees of separation -- not just from celebrities, but also from the people who watch the video cameras." [Dyson 2001]

It is the author's opinion that surveillance, by its very nature, in the manner it creates an unbalance of power, is more susceptible to voyeurism. Indeed, attempts at passing laws forbidding police from installing hidden cameras in toilet rooms, baths, dressing rooms, and other private places have been met with considerable resistance. Moreover, the informal nature of sousveillance, with its tendency to distribute recordings widely, will often expose inappropriate use to scrutiny, whereas the secret nature of surveillance will tend to prevent misuse from coming to light [Mann 1995].

Sousveillance Activism: World Sousveillance Day and the Sousveillance Underground

A number of social activists have recently (in the last few years) responded to the cause of sousveillance. Among these, the author initiated a day of surveillance awareness, every December 24th, starting in 1998, in which participants were to photograph surveillance cameras, as well as to photograph the guards who mysteriously appear whenever surveillance cameras are photographed. Presently, World Sousveillance Day (see for example http://wearcam.org/wsd.htm) includes groups in Boston, New York, California, Florida, Japan, Toronto, Vancouver, the United Kingdom, and Scotland. WSD has also expanded from the initial single day of surveillance awareness, into a continuous study of sousveillance. One such group of sousveillance activists, for example, headed up by Dr. Stefanos Pantagis in New York, includes a group of blind poets who photograph surveillance cameras using remote visual assistance, as part of a project entitled ‘‘shooting blind’’. Enabling blind photographers to challenge the panoptic gaze has caused many people to re-think the one-sided nature of an unbalanced surveillance-only society. Carol Wierzbicki from the Association of Computing Machinery (ACM) also wrote a poem about sousveillance, as the introduction to the International Workshop on Inverse Surveillance (IWIS 2004), at the suggestion of Dr. Pantagis. Additionally, Pantagis is initiating the ‘‘Sousveillance Underground’’, a group of activists who continuously photograph in and around the New York subway in defiance of a proposed ban on taking pictures in the subway system.

Conclusions and Going Further: What was learned from 30 years of Computer Mediated Perception, and what will it mean for the future of Legal and ethical frameworks for sousveillance?

With the miniaturization of cameras into portable electronic devices, such as camera phones, there has been an increased awareness of sousveillance (more than 30,000 articles, references, and citations on the word "sousveillance" alone), and we are ready to see a new industry grow around devices that implement sousveillance, together with a new sousveillance services industry.

This 30 year effort is summarized in the following 10 Hypotheses:

1 (techlaw). Sousveillance will become a major force and industry, despite initial opposition. Like surveillance, sousveillance technology will outstrip many laws, and will be another example of technology moving forward more quickly than the legal framework that grows around it. (Maybe technology outrunning law is a bad thing, or maybe it’s a good thing, depending on your point of view.)

2 (privacy). Over the past 30 years, sousveillance practice has raised many new privacy, legal, and ethical issues, and these issues will become central as the sousveillance industry grows.

3 (incidentalism=strategic ambiguity in usage). Sousveillance of the most pure form, is not merely the carrying around of a hand-held camera, but, rather, must include elements of incidentalist imaging to succeed. For this reason, camera phones, pocket organizers containing cameras in them, and wristwatch cameras, for example, exhibit an incidentalist imaging effect not experienced with even the very smallest of handheld digital cameras. A device exhibits incidentalist imaging when it can capture images as well as perform at least one other important and socially justifiable function that does not involve capturing images. This "backgrounding" by another socially justifiable function is a technology that is essential for sousveillance to take root in most societies.

4 (accidentalism=strategic ambiguity in intent). Cameraphones, cameraPDAs, and wristcameras have brought sousveillance to a new level. The next major level is that which affords the user deniability for the intentionality of image capture. This feature may be implemented by a random or automated image capture, or by allowing others to remotely initiate image capture. In this way image capture becomes either accidental, or at least something that’s beyond the control of the bearer, and this accidentalism affords the bearer with a strategic ambiguity when asked such questions as "are you taking pictures of me now"?

5 (nonwillfulness). Accidentalism will be taken to a new level when it can be a requirement of a role player, such as a clerk. Just as surveillance is hierarchical, thus creating an industry that can defend itself from criticism (e.g. "don’t ask me why there’s a surveillance camera in my store, I only work here"), sousveillance will also rise to this same level of deniability. Accidentalism by itself might be regarded as willful blindness. But when combined with, for example, a requirement to participate in sousveillance (e.g. sousveillance technology might, for example, become part of a clerk’s uniform) accidentalism will become nonwillful blindness.

6 (continuity). Various forms of continuous incidentalist imaging will give rise to an industry behind products and services for continuous sousveillance. Continuous sousveillance will make sousveillance the norm, rather than the exception, for at least some individuals in society. For example, longterm adaptation to seeing aid will make continuity of service essential.

7 (protection). Unlike surveillance, sousveillance will require, and will receive, a strong legal framework for its protection, and not just its limitation. Along these lines, certain legal protections will be required (and will be granted) to ensure

access to those who depend on sousveillance. These protections will, for example, build upon the notion of "one party consent" already written into many current laws.

8 (nondiscrimination). These legal protections will first emerge in the form of assistance to the disabled. Just as wheelchair ramps are required, we may also see requirements for "webramps" (i.e. sousveillance). There will also be an increasing hierarchy of protections:

- 8a: sousveillance systems that do not record;
- 8b: sousveillance systems that need to record to work;
- 8c: sousveillance systems that need to transmit to work (and this will raise issues of confidentiality agreements), e.g. the WebRamps project;
- 8d: sousveillance systems that need to transmit to arbitrary volunteer audiences (i.e. unlimited scope) to work (e.g. the "Seeing Eye People" project).

9 (differently-abledness). The space of those considered to be disabled will gradually expand, over time, as the technological threshold falls and the sousveillance industry grows. Ubiquity of sousveillance, in the form of electronic eyeglasses, will become like the old analog eyeglasses of today are now, e.g. we no longer hear of "four eyed freaks" and we now even see widespread use of analog (optical) eyeglasses, and even "pseudo intellectual eyeglasses". Those who wear optical eyeglasses, regardless of whether or not they really need them to see properly, all get the same kind of protection (e.g. "never hit someone who's wearing eyeglasses", even if they have a weak prescription and don't really need to wear eyeglasses). Similarly, the scope of sousveillance will expand to include persons who need sousveillance systems to a lesser and lesser degree. Those who only slightly need such systems will often get the same level of protection as those who really more seriously need such systems.

10 (diffusionism). These legal protections will expand, to encompass other legitimate and reasonable uses of sousveillance, such as artistic and technosocial inquiry, photojournalism, and collection of evidence, as the sousveillance industry further diffuses out into the mainstream culture.

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