Can Humans Being Machines Make Machines Be Human?

Steve Mann

Abstract

The concept of "cyborg" has been in existence for more than a million years. Vessels were the first cyborg prosthesis, long before the invention of clothing, or even the existence of homo sapiens. Fundamental to the essence of cyborgs is freedom, freedom to explore, and to cross borders of land, ocean, skin, clothes, and body. This thinking leads to a cyborg taxonomy/ontology based primarily on the concept of "border" as defined by skin, clothing, vessel, or fluid boundary ("interface" in both its meanings). A Type I cyborg arises when an organism enters a vessel and a Type II cyborg arises when a vessel enters an organism. The primordial essence of cyborg is fundamentally connected to border/interface, and therefore remains deeply connected to its nautical origins even as it evolved to the more cosmic/cosmonautical (i.e., from sea-ship to space-ship).

Consider the idea of "superhumachines" = human-machine "cyborgs" with superhuman intelligence. The concept creates a multitude of promises, pitfalls, benefits, and risks. Consider as a "grand challenge," the idea of negative oppression, negative slavery, negative vulnerability, etc., as explored 20 years ago in a paper entitled "Can Humans Being Clerks make Clerks be Human?". These concepts are perhaps akin to Stallman's concept of negative copyright (which he calls "copyleft"), Taleb's concept of negative fragility (which he calls being "antifragile"), and Niaudet and Ayrton's concept of negative resistance.

The capacity for self-determination and mastery over one's own destiny (whether exercised or not) is the single most important tenet of a code of ethics for human augmentation, leading us to extend morphological freedom from the body to also the mind, and to a kind of embodied unconcealedness (alethism) rooted in sousveillant systems, while at the same time preserving a capacity for negation of oppression, a nuanced element that will be the single most important grand challenge.

Cyborgs Existed a Million Years Ago

Cyborg is a word that denotes a symbiosis between a living mind+body such as a human, and a machine, such that the machine may be operated as a natural extension of the mind and body. This interaction is so natural that the machine can be operable without conscious thought or effort. The word was coined by Manfred Clynes (Clynes & Kline, 1960) as a

portmanteau of the words “cybernetic” and “organism.” His favorite example is that of a human riding a bicycle in the sense that after a while, the machine is operable without conscious thought or effort, and in fact eventually functions as a true extension of the mind and body (Clynes, 1996; Gray, 1995).

The bicycle was invented approximately 200 years ago (Scally, 2017). The wheel was invented approximately 6000 years ago (Holm, 2019). But the boat was invented more than a million years ago (Johnstone, 2013), long before the invention of clothing approximately 100,000 years ago.

“Waterborgs”: Water Human Computer Interface (Water HCI)

It has been suggested that a boater is as much a cyborg as a cyclist (Mann et al., 2021a), i.e. that cyborgs have existed for more than a million years, long before homo sapiens emerged in Africa around 300,000 years ago (Stringer, 2003; Mann et al., 2021a).

Recognizing the importance of water (i.e., the world’s first cyborgs were water-cyborgs), the Water-HCI (Water-Human-Computer Interface) Deconference has taken place for 23 years. See Fig. 1 and Fig. 2 for WaterHCI-2021.

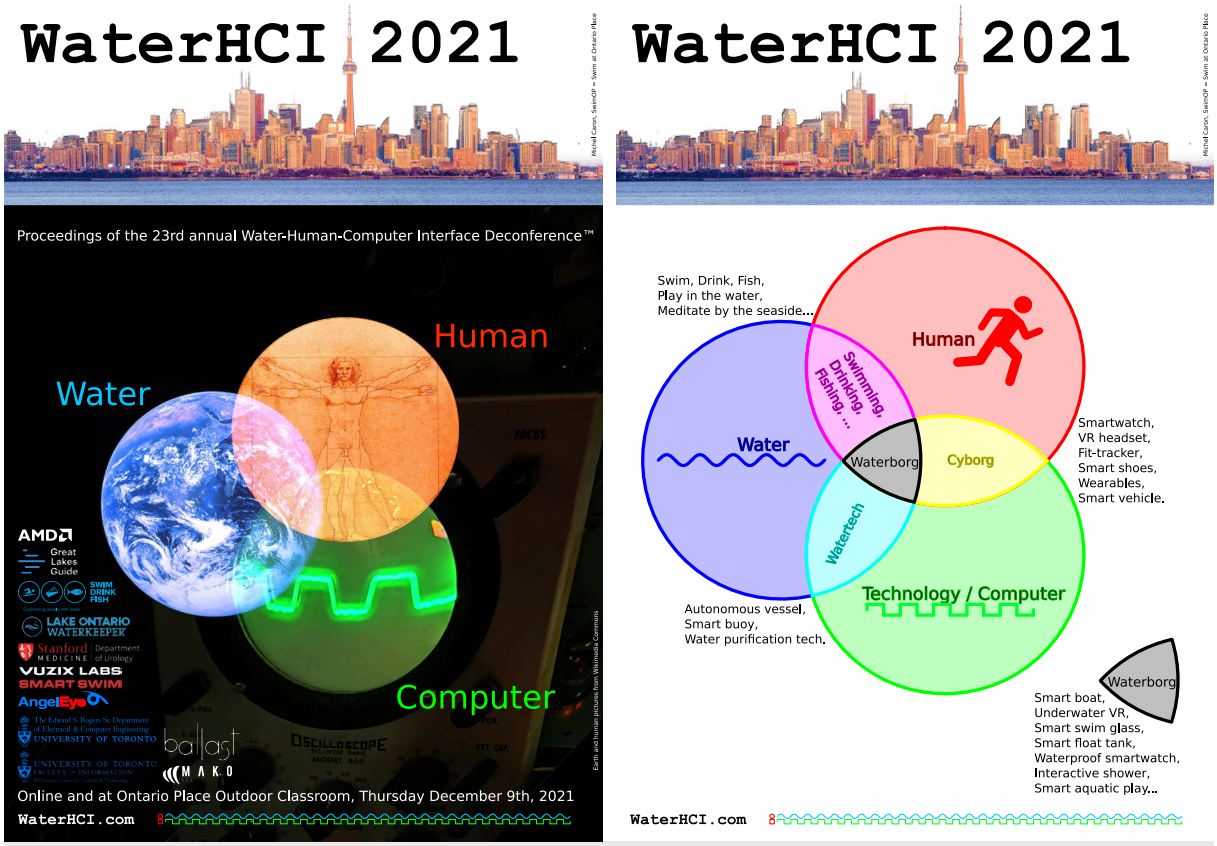

Figure 1. Cover pages from the 23rd annual Water-HCI (Water-Human-Computer Interface) Deconference Proceedings. The Deconference brings together researchers from all over the world working at the intersection of water, humans, and technology. The overlap between humans and technology (e.g., “cyborgs”) is well explored, as is water, but the new under-explored area is where modern cyborgs (modern technological humans) and water intersect.

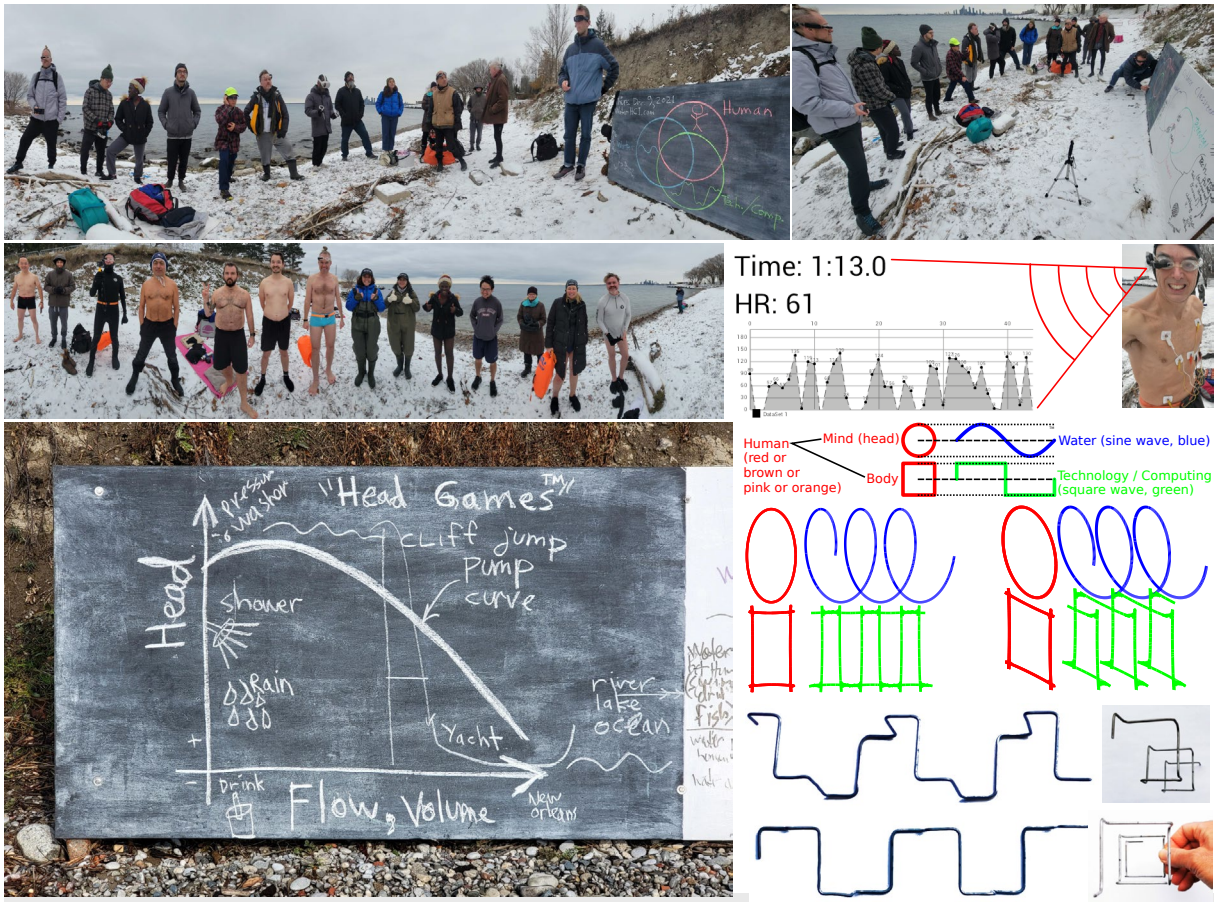

Figure 2. Top row: A small group of SwimOP members doing a presentation for the online WaterHCI audience, led by Cayden Pierce (at the chalkboard), at the TeachBeach™ that we installed at Ontario Place. Middle row: WaterHCI remote demonstration + presentation from TeachBeach as well as including a presenter from Vuzix in the United States, together with icewater swim, showing results of collaboration between C. Travers of Vuzix and C. Pierce at WaterHCI-2021. Bottom row: Presentation by author S. Mann. Pump curves that plot head as a function of flow provide a taxonomy/ontology plane which can categorize many activities and systems such as the bone-conduction drinking fountain (drinking involves suction which is negative head at low flow), showering which is high pressure (head) at moderate flow, and cliff-jumping which is high flow/volume and high head (in terms of kinetic versus potential energy tradeoff). A person who is hydrophobic is one who fears large quantities of water (e.g.,a lake but not a glass). A person who is hydraulophobic is one who fears even moderate quantities of water when it is at high pressure. Compare with (Raffe et al., 2015) which only considers one dimension of this multi-dimensional space. WaterHCI logo design ideas by author S. Mann, including complex square wave sculpture. The human is depicted in red (round head and square body), water waves are symbolized by complex-valued sinewaves in blue, and technology waves are symbolized by M-waves in green (which can, for example, model two-phase electric machines, stepper motors, robotics, etc.)."

Crossing Borders: Cyborg Passports as Morphological Freedom

We often see in the media a proclamation that someone still living today (i.e., not a million years old or even 200 years old) is "the world's first cyborg," e.g., Harbisson claimed to be the world's first cyborg because of a 2004 passport photo showing his cyborg state, as widely reported in the media (Davies, 2004; Donahue, 2017; Wendykowska, 2014).

Earlier passport photos by Mann (1995) underwent a similar process of recognition by government entities (See Fig. 3), but for other reasons, the media had widely reported

that Mann is the "world's first cyborg" as of the 1970s (Shinn, EDT, Nowak, 2003). The author has argued, however, that no person living today could possibly be the world's first cyborg, because the concept itself is older than prehistoric times. What's important here, though, is not so much being a cyborg as the specific concept of morphological freedom, i.e., the freedom to modify one's own body in regards to its form and function. If the passport is to show a true and accurate image of the body, it must do so while retaining this morphological freedom, i.e., the freewill to choose one's own physical expression. This morphological freedom is a central tentet of transhumanism (Bostrom, 2005; Bradshaw & Ter Meulen, 2010).

Figure 3. Crossing Borders and morphological freedom: Neil Harbisson's passports since 2004 and Steve Mann's passports since 1995 have featured cyborg technologies. Although Harbisson makes a "first cyborg" claim based on his 2004 passport as a form of official recognition, the author has held that cyborgs have been in existence for at least a million years and have nautical origins—indeed traveling to distant lands, but long before passports were required for travel. Bottom row: 26 years of cyborg travel by air, water, and land. What is fundamental here is not so much "being cyborg" as, more importantly, the concept of morphological freedom!

From Nautical Cyborg to Astronautical Cyborg

A living being in a vessel would likely have been the world's first "cyborg" and, therefore, there is an inextricable intertwining between cyborgs and water. Thus began the world of cyborgs with the nautical cyborg.

More recently the concept of "astronaut" has emerged. The word derives from the Greek words *ἄστρον* ("astron"), meaning "star," and *ναύτης* ("nautes"), meaning "sailor." Thus "astronaut" means "sailor of the stars." In this way a spaceship or even a spacesuit is a kind of vessel much like a boat in the sense that it defines a boundary or "border" between the astronaut and the environment around the astronaut. More profoundly, the spaceship or spacesuit forms a complete airtight seal that makes the boundary between "inside" and "outside" the vessel much more well-defined.

Vessel and Vironment

A vessel creates a boundary between us and that which is around us. The word "environment" means "that which surrounds us," e.g., the "classroom environment" or the "natural environment," etc., and the term "invironment" is that which is not the environment, i.e., the invironment is us, ourselves.

The border between the environment and the invironment is called the "vironment" (Mann et al., 2021b). The vironment is a generalization of the concept of "vessel" and is a necessary new word because there is no other word that can describe all the related items like boats, spaceships, cars, trucks, clothes, etc., and in this sense "vironment" can mean vessel or vehicle or suit or the like.

This provides a convenient definition of cyborg. A cyborg is a living being together with that being's vironment, e.g., a human plus clothes, or a human plus augmented reality eyeglass, or a boater plus their boat, or a driver plus their car.

Vulnerability and Vironment

A central tenet of transhumanism, the existential cyborgian self-determination and mastery over one's own destiny, is based on the principle of morphological freedom. This is the freedom to choose one's own "shape" (Greek μορφή), i.e., physical freedom of the body. We proffer that this freedom should extend to a freedom of mind, which we might call "myalogical freedom."

Central to this tenet is agency and freewill. This does not mean that we need to maintain control at all times. Indeed, part of freedom is the capacity to temporarily suspend it, by choice, e.g., we might choose to fall asleep in a self-driving car or boat, temporarily relinquishing our control to an AI (Artificial Intelligence) system. In this sense we might still be regarded as a cyborg, i.e., we are still "clothed" in the car or vessel or other vironment.

Ulysses Pact or Contract

In Greek mythology, sirens (*Σειρῆνες*) were beautiful but dangerous creatures, with beautiful singing voices. By way of mesmerizing music and singing they lured sailors to jump into the sea to their death, or to crash their ships into the jagged rocks around the islands where the sirens lived.

Odysseus (*Οδυσσεύς*), whose name is spelled "Ulysses" in Latin (e.g., in legal documents) was a sailor who wanted to hear the siren's song without risk, so he asked his crew members to tie him to the mast of the ship and also to pour wax in their own ears so that only he, but not they could hear the song of the sirens. In this way he could hear and be mesmerized by the music but not act upon it, as he'd instructed his crew to not untie him

until after the ship was safely beyond the audible range of the music. In legal documents such a form of agreement is referred to as a "Ulysses pact" or "Ulysses contract."

In an amusement ride, for example, riders are typically restrained in the ride so that they cannot escape from the ride until the attendant releases them at the end of the ride. In this way the riders are safely contained in the ride.

Waterball Ride: A Vessel with a Very Well Defined Boundary

One popular amusement ride is the waterball (Fig. 4) which we will use as a canonical defining example of a vessel that provides a clearly defined boundary between us and our surroundings.

A waterball is a transparent spherical vessel into which a rider is placed. The vessel is made of a very tough and strong kind of plastic (TPU, typically 1mm thick). The rider is then free to run on the surface of a body of water.

Riders enter through a watertight and airtight zipper that is closed from the outside by a ride attendant or operator, as the ball is filled with air from an electric air blower. An important safety feature of the waterball is that it is designed so that it cannot be opened from the inside. Otherwise, if the rider were to attempt to open the ball, the air would quickly escape and the plastic wrap would suddenly collapse upon the rider, shrink-wrapping the rider who could easily then drown in the water.

In this sense the rider is in the custody of an attendant for the duration of the ride. For safety the ball is tethered to a rope that is usually tied to the attendant who is in or near the body of water. In this way, the rider has temporarily suspended some freedom of movement until such time as the attendant pulls the ball back onto dry land and lets the rider out of the ball.

The waterball is a noteworthy example of a vessel/vironment for two reasons: (1) the precarious state of vulnerability that the rider enters into, i.e., the complete trust in, and reliance upon, an attendant; and (2) the very well-defined physical boundary between invironment and environment. See Fig. 4.

The principle of morphological freedom allows us to choose to enter into the ball, and temporarily become a cyborg, even though we have temporarily suspended our freewill to the ride attendant. In this way we consider the ball to be part of us, rather than part of the environment.

If, on the other hand, a person were to be placed inside such a ball against their will (e.g., a diseased or contagious subject imprisoned in a ball against their will, so they do not spread disease, perhaps in a dystopian world), then the bottom row of Fig. 4 would be redrawn with a solid blue circle leftmost and a dotted red circle rightmost, to indicate that the ball is part of the authorities and not part of the subject inside the ball. The term "brig" as a jail cell aboard a vessel derives from the term "brigantine," a small dual-mast

fighting ship, and from “brigand,” “brigare,” “to fight.” Thus, we proffer that if the ball or other vessel operated as a brig, that it no longer operates as an extension of the occupant’s freewill, and thus is not part of the occupant’s vironment, and that therefore the occupant is no longer a cyborg in the manner in which we envision “cyborg.”

Thus, we need to make a clear distinction between temporarily relinquishing of one’s freedom (as in using an amusement ride, an elevator, public transit, or the like), and a more systemic loss of morphological freedom.

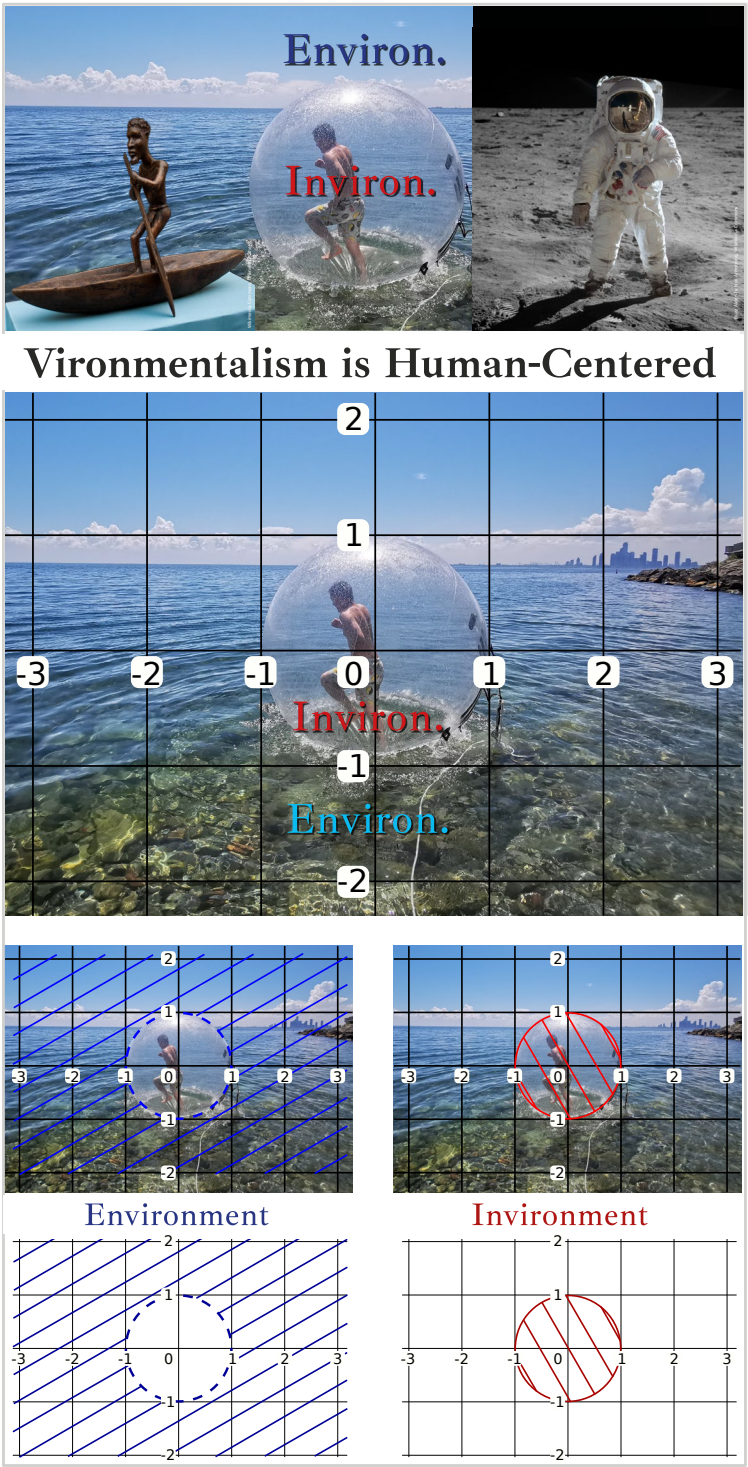

Figure 4. Vessels and Vironment: Waterball ride as case-study. The environment or environs (abbreviated “Environ.”) is that which surrounds us, whereas the invironment or invirons (abbreviated “Inviron.” is that which is not the environment, i.e., us, ourselves. In a boat that boundary is a fuzzy edge that one might imagine whereas in the waterball (or a spacesuit) that bondary is airtight and very clearly defined. Interestingly waterballs are usually 2 metres in diameter (i.e., have a 1m radius), so that if we position the ball upon a grid/graph, with 1m spacing, it creates an almost canonical study in social-distancing where are kept at least 2m apart. We proffer that morphological freedom mandates that the vironment (boundary or vessel) be part of the invironment rather than part of the environment, as shown in the bottom row.

Galley Waterborgs

The early days of cyborg technologies were days of freedom and liberation, i.e., being able to travel to distant lands. The early visions of the galley slave, chained to the oars of a ship, are largely an historical inaccuracy (James, 2001). However, it is perhaps useful to think of the concept of a "freeborg" (free cyborg) versus technologies that "empower" or disempower prisoners in service of others, e.g., to ask whether a galley slave is a cyborg or not, given that the vessel is an extension not of their own freewill, but that of another person or persons or entity (e.g., perhaps an autonomous or machine intelligence).

Cyborg Code of Ethics

To capture these important concept, a panel of seven thought leaders and 18 authors were brought together to debate and draft the "Code of Ethics on Human Augmentation" (Mann et al., 2016) based on earlier work in this area (Mann, 2004) which is ongoing (Morrow et al., 2020).

This Code of Ethics was based loosely on Asimov's 3 rules of robotics (Asimov, 1942; Clarke, 1993), while recognizing that Asimov's 2nd law (a robot may never, through action or inaction, allow harm to a human) would likely lead to tyranny of the worst kind:

> Of all tyrannies, a tyranny sincerely exercised for the good of its victims may be the most oppressive. It would be better to live under robber barons than under omnipotent moral busybodies. The robber baron's cruelty may sometimes sleep, his cupidity may at some point be satiated; but those who torment us for our own good will torment us without end for they do so with the approval of their own conscience.
>
> C.S. Lewis

Cyborg Freedom and Agency

It has been observed that in a free society, the degree of freedom-of-choice varies in approximate proportion to physical nearness, i.e., even when our surroundings are not of our own choosing, at least our clothes generally are. And even if we're forced to wear a uniform while at work, our tattoos or other body markings (which are even closer to the skin) are of our own choosing. This concept appears in Fig. 5, reproduced from Figure 1 (Mann, 2001, p 98).

One freedom that was explored was the concept of equiveillance, and also detection of inequiveillance. An example equiveillance app works by way of object recognition on "no photography" signs which often look quite similar. When these signs are recognized recording begins. A "no photos" sign is an indicator of a high degree of concealedness (low degree of alethia) and therefore an indicator of possible danger, which warrants increased sousveillance (covert recording).

We could envision a future in which cyborgs share their viewpoint, e.g., if you are interested in buying a specific item such as, for example, an avocado, consider the following example. You enter the supermarket and broadcast wirelessly your desire to see where the avocados are sold, while streaming your live video feed for others nearby to receive. The shopkeeper (or maybe another customer) streams back their live video feed to you, so you can see yourself on their camera. Perhaps also an overlay appears showing you where the avocados are, and you can see yourself on their camera and use their camera to help you find your way. This assumes the shopkeeper wants to do business (or that another customer wants to help). More generally a customer can ask whether the shopkeeper wants to declare business (cooperation and sharing of video feeds) or declare war (antagonistic hoarding of separate video feeds). If the shopkeeper decides to declare war, then it makes sense to record video secretly and at full bandwidth because the shopkeeper has decided against a shared alethism-based interaction. See Fig. 6. So, a general principle of cyborg etiquette would be to first offer a live feed (shared point-of-view) and first assume a friendly encounter (collaboration) and only move to an antagonistic encounter (closed and covert rather than open and overt) when another party does so. It should be noted that many vehicles have cameras and that this is seldom challenged.

CAMask™: The Camera Mask

One approach to "normalizing" sousveillance is the author's CAMask™ which combines cameras with respiratory protection, together creating a medical device that provides automatic contact-tracing and situational awareness for safety. In this way sousveillance becomes as necessary and as legitimate as surveillance. Moreover, on a practical level, officials are less likely to ask the wearer to "take that off" as doing so might result in increased spread of disease.

Negative Danger, Negative Oppression, and Negative Slavery

> In the electric age we wear all of mankind as our skin.
>
> Marshall McLuhan, 1965

In 1968 Marshall McLuhan identified the computer as "an extension of our central nervous system" and our "technological clothing" (McLuhan et al., 1968). To the extent that computing can become part of us, as stated earlier, we need to generalize the concept of morphological freedom to also include a freedom of the mind, let's say "myalogical freedom" from the Greek word *μυαλό* ("myalo") for "mind." When we "jailbreak" a smartphone, for example, we're exercising this myalogical freedom, e.g., to run GNU Linux on a computer that might otherwise only run a jail-based operating system.

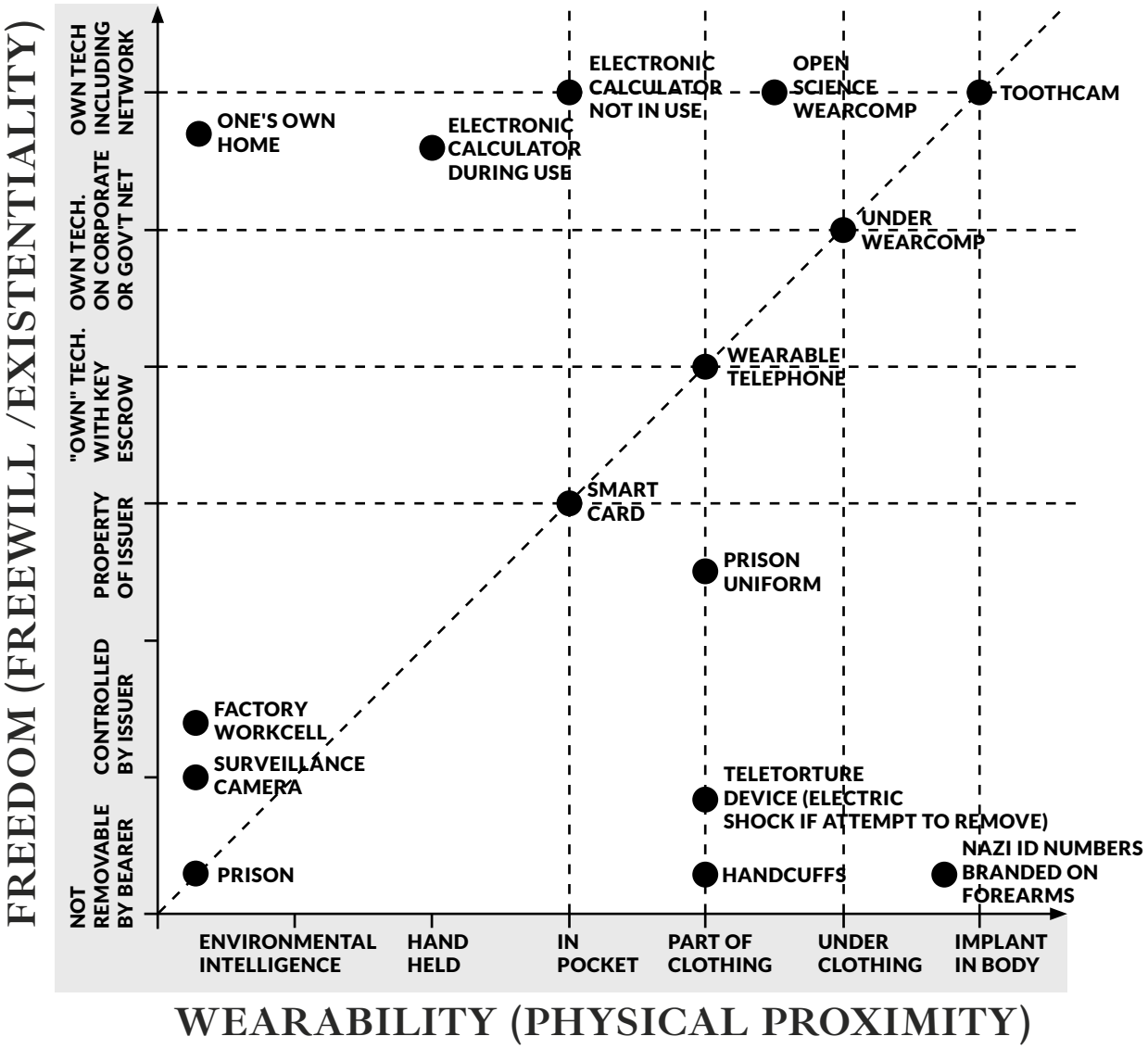

Figure 5. In a free society, we mostly have greater freedom over our invironment than our environment, i.e., things that are physically closer to us are generally things that we have greater choice in. We can conceptualize a graph or plot with two axes: Wearability/Portability/Proximity-to-body: the ease with which they are attached to the body, starting with a continuum from environmental intelligence (cameras and microphones and computers installed in the cityscape or architecture), and then ranging to hand held devices, to wearable computers, and finally to going right inside the body (implantables); Freedom/Existentiality: the degree of self determination and mastery over one's own destiny that they provide, e.g., how much control the individual bearer has over the device. It is evident from this plot, that there are a large number of devices along or near the X=Y (Wearability=Freedom) axis. Examples of outliers away from this axis are shown, but these tend to be less common in the everyday life of a free society. Therefore, we tend to think of portable (hand-held) and wearable devices as being liberating, or freedom-inducing, whereas environmental technology (such as surveillance cameras) are often installed without our knowledge or consent. Examples of technologies in close proximity to our bodies, but in distant locus of freedom (i.e., controlled from afar) include handcuffs. We proffer that technologies like handcuffs are not true cyborg prostheses (at least in the traditional sense), as they are not part of the wearer's vironment. Reproduced from Figure 1 of (Mann, 2001, p. 98).

> Everyone will be permitted to modify and redistribute GNU, but no distributor will be allowed to restrict its further redistribution. That is to say, proprietary modifications will not be allowed.
>
> (Stallman et al., 1985; Stallman, 1990)

This idea that many operating systems are intellectual or mind-based jails or prisons was the main driving force behind GNU Linux and more generally the GNU philosophy of "copyleft," a kind of negation of copyright (Stallman et al., 1985, Stallman, 1990). Rather than merely set copyright to zero, as might be envisioned by a continuum from no copyright to full copyright, the concept of copyleft is a clever construct that reverses rather than zeros-out copyright. The idea that copyright should be abolished was often viewed as an extreme position, but Stallman created an even more extreme notion that complete abolishment of copyright was itself a form of centrism, let's say, at the zero of the numberline (Fig. 7), and that a new construct could be created. Fragility is another variable that was once thought to vary from highly fragile, down to zero fragility (infinite robustness), but has also experienced an unsigned to signed transition through Taleb's concept of "antifragile", i.e., systems that actually benefit from perturbation (Taleb, 2012; Tseitlin, 2013).

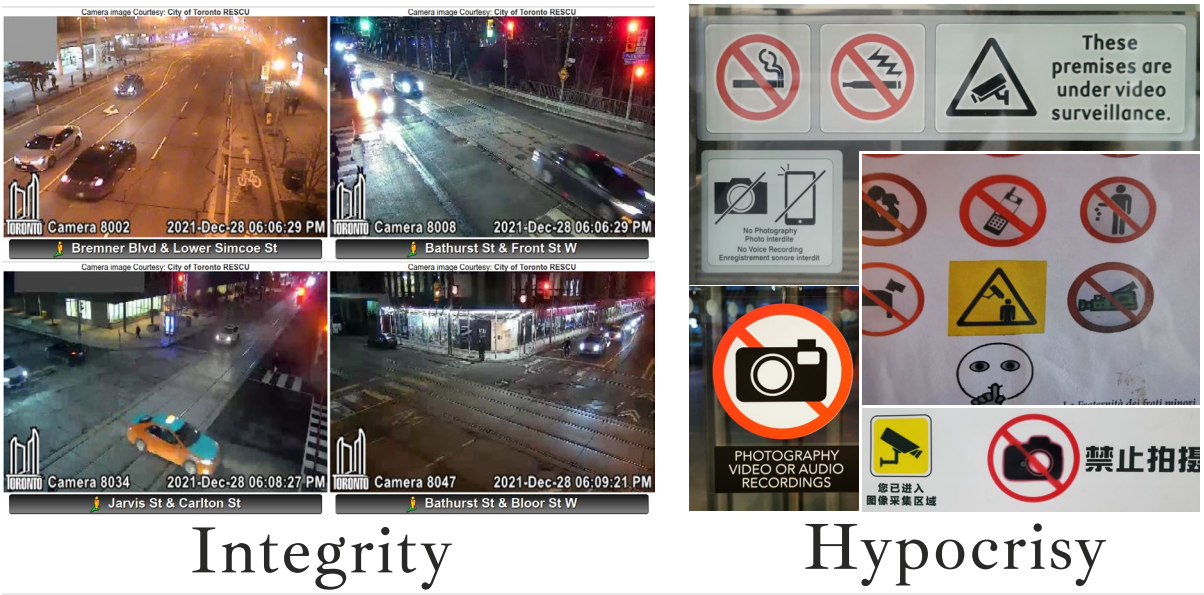

Figure 6. Integrity of surveillance versus surveillance hypocrisy. When people work together they can help each other see (City of Toronto traffic camera feeds are available for public use to help in navigation, situational awareness, etc.). However, with hypocrisy (surveillance while prohibiting sousveillance) we have data hoarding, data collection, etc., combined with concealment. Alethiometric systems detect this hypocrisy and signal danger, alerting individual cyborgs and others to begin covert recordings to protect against the dangers of corruption, hopefully leading to a Streisand effect (Jansen & Martin, 2015). In some sense this hypocrisy could be regarded as a form of information warfare, a response to which might be heightened personal safety measures. Alethiometric apps for example, begin automatically recording when they recognize this "signo" (the "no cameras" sign).

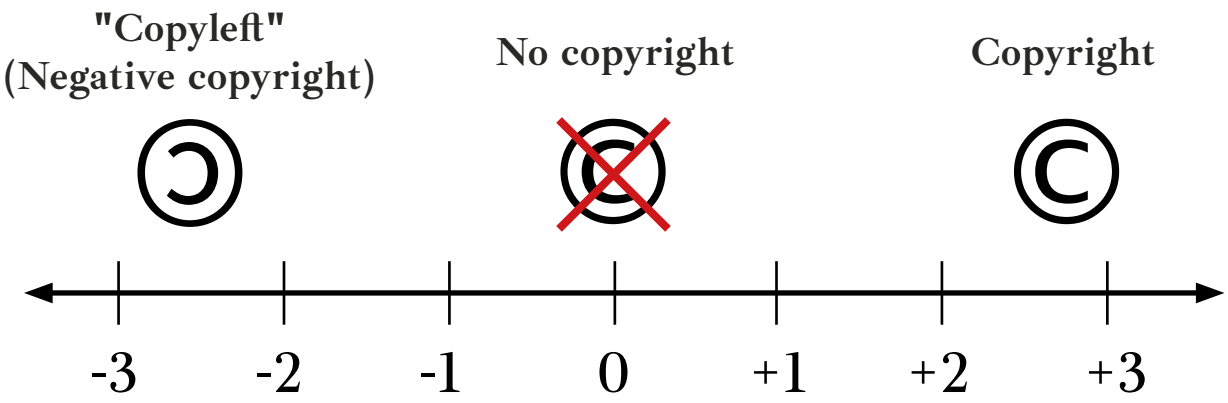

Figure 7. The Copyrightness Axis: the complete abolishment of copyright once seemed like a radical extremist view, but in 1985 the GNU Manifesto arguably puts this idea as centrist, at exactly zero on a numberline that extends in both directions therefrom. The backwards copyright symbol now even has a unicode, (U+1F12F).

Welcome to the Machine

Welcome my son Welcome to the machine Where have you been?
It's alright we know where you've been.

Roger Waters

The word "machine" is often used in the wide sense, to denote a systemic and often inflexible authority (whether a collective human intelligence or an artificial intelligence), or more generally, a "bigness" == big data, big AI (Artificial Intelligence), big banks, big pharma, big government, big science, and "big watching" (surveillance) (Jensen & Draffan, 2004; Bousquet, 2014; Sprague, 2014), or, more generally "The Bigs" (Mann et al., 2021a) as many of these large entities are intertwined in ways too complicated for an ordinary entity of human-scale to understand.

A central thesis of this paper is that in order to interface to big machines, we ourselves as individuals need to become machines, i.e., embody "humanistic intelligence" (H.I.) (Minsky et al., 2013) in which each of us has our own "little machine." What we mean by "little machine" is one that is of our own choosing, design, etc., and functions as our personal agent, with our own personal best interests in mind.

In this sense, if we think of human-machine interaction, i.e., a machine as the vironment, we might ask the question as to whether the machine is part of the invironment (e.g., under the control of the human) or environment (e.g., under control of a separate "master").

Is a member of a collective still a cyborg? Is a galley slave a cyborg? What about two or eight people rowing together? At what point does the vironment cease to be part of the individual? These are all very nuanced questions that need careful consideration and debate. For example, a group of workers might form a union, and we could regard

the union as a "machine," i.e., a large inflexible entity that can resist the oppression of a large inflexible company (can humans being "cogs" in such a machine make corporations be human?). It could be argued that such a construct could function as a form of negative oppression. Thus, if an employee is taking the time to put on the right safety equipment and faces peer pressure or production pressure to skimp on safety, the employee can say "I'd be happy to work in dangerous conditions and sacrifice my life for your increased profits but my union won't let me." Similar constructs have also been suggested for mandating free-open-source computing environments such as GNU Linux (Dr. Steve Mann, Assistant Mailroom Clerk employee number 9432 et al., 2001).

Humans Being Machines Can Make Machines be Human

More generally, humans being machines (e.g. members of an SMO (Mann, 2001)) such as EXISTech Corporation (Dr. Steve Mann, Assistant Mailroom Clerk employee number 9432 et al., 2001) can make machines (e.g., bureaucratic organizations or inhumanly rigid artificial intelligence) be human.

This is the possible essence of negative exploitation, if implemented correctly. That is of course one of the grand challenges of our research efforts.

Sousveillant Systems

OED (Oxford English Dictionary) defines sousveillance as

> Close observation or recording of the government, police, etc., by members of the public, typically using personal devices such as video cameras and smartphones. Also: the recording or documenting by members of the public of their own or other people's activities using such devices. Often contrasted with surveillance.

The concept has recently been generalized as "sousveillant systems" to denote systems that are designed to facilitate close observation by end users of these systems, e.g., explainable AI that has the explainability built-in so that end users can easily understand its inner workings. See also (Broekhuis, 2014, Freshwater et al., 2013; Fletcher et al., 2011; Ganascia, 2010; Weston & Jacques, 2009; Mann, 2002; Mann et al., 2018).

The fundamental principle of auditability is that systems are designed to facilitate auditability even though they are not necessarily audited. An example is the use of free-and-open-source (FOS) computer programs. FOS benefits all those who use it. It is not necessary that all users will want to, or even be able to, look at or understand the source code, just that the possibility exists. This is the Greek concept of truth as unconcealedness (*αλήθεια* or "alethia" which means that which is not hidden).

More generally, we wish to construct and live in sousveillant cities, buildings, and other systems that are founded on the Greek principle of unconcealedness.

What is most disturbing is the loss of interoperability that once existed, e.g., we hear people say "He skyped in" or "She's joining us by Zoom" or "Join us on a Teams (Microsoft) meeting." We never used to say "He Belled in" in response to use of the Bell Telephone network. To "Bell" someone never became a verb because the telephone was interoperable, and a person with a Bell telephone could place a call to anyone with any other make or model of telephone.

Yet to call someone now, we need to be running the same, usually closed-source app such as Zoom if the other party is using Zoom, or Skype if the other party is using Skype, and so on

We call for an end to this, and advocate FOS standards like Jitsi which is a free-open-source (FOS) video conferencing program compatible with WebRTC, an open standard for Web communication.

As technologies become more intimate and move from the desktop to our pockets and to our bodies, we must stand for FOS as a required element.

Inverse Ulysses Pact

As we develop cyborg technologies, we might wish to consider a kind of inverse of the Ulysses pact, i.e., a situation in which an individual may be "bound to freedom" without sacrificing freedom to an entity that might co-opt that structure. This would be implemented through a form of blockchain (or other distributed "little data" rather than centralized "big data") technology.

Alethism and Openscience

The author created the concept and coined the term "Open Science" in 1998/1999 and sold the openscience.com domain to degruyter.com in 2011 (Mann et al., 2015), for what science should be, i.e., unconcealedness. Such openness can be extended to other fields such as engineering, computers, AI, machine learning, etc., for which "alethism" (*αλήθεια* or "alethia" which means that which is not hidden) could be implemented more broadly than just within the scientific community. This idea is at the core of the third law, in the Code of Ethics on Human Augmentation (Mann et al., 2016).

"NullBorg": Minimum Viable Vessel

A discussion on cyborg ethics would not be complete without mention of the freedom to not be a cyborg. Increasingly technology is not just being made available to us, but is being required. Shoes and shirts, and more recently, masks, must often be worn in certain

establishments, and increasingly identification must be carried. Ducks and geese enjoy greater freedoms, in some ways, than humans, e.g., in regards to being able to cross borders without being required to show any identification or paperwork. Certain places can only be accessed by those in cars or boats, e.g., no pedestrians, no swimming, etc., whereas a healthy ecosystem and environment is one that is pedestrian-friendly and swimmer-friendly.

A non-cyborg (e.g., a person not in a vessel) is not allowed to go to Toronto Island, as it is forbidden to swim there. In previous work, the philosophical and technological concept of MVV (Minimum Viable Vessel) was explored in this regard (Mann et al., 2021a). The MVV asks the question "What is the minimum required amount of technological clothing needed to access certain cyborg-only spaces?"

The DCR (Department of Conservation and Recreation) banned open-water swimming in Walden Pond after some drownings. This forced swimmers to swim within a small crowded roped in area. A professor who was also the chair of the Department of Philosophy at University of Massachusetts Lowell defied the ban and swam anyway (Kaag, 2021b), and more generally, a petition with more than 11,000 signatures reversed this ban (Kaag, 2021a). Swimmers still wear a safety-visibility marker called a "towfloat," which in some sense could be regarded as a MVV for safety.

Conclusion

Humans being machines can make machines be human. The grand challenge here is in how to implement the concept of an SMO (Safety Management Organization) that is not co-opted by the same forces that act against humanity. Moreover, there is an intricate and nuanced balance that must be struck between alethism (unconcealedness) such as free-open-source (computers, machines, openscience, humanistic intelligence, etc.) and the right of privacy for individuals. Given the forces that large machines can apply against the individual, there is a pressing need, now more than ever, to create a kind of inverse machine, a machine that holds machines in check.

> If there is a hard, high wall and an egg that breaks against it, no matter how right the wall or how wrong the egg, I will stand on the side of the egg. Why? Because each of us is an egg, a unique soul enclosed in a fragile egg. Each of us is confronting a high wall. The high wall is the system which forces us to do the things we would not ordinarily see fit to do as individuals (...) We are all human beings, individuals, fragile eggs. We have no hope against the wall: it's too high, too dark, too cold. To fight the wall, we must join our souls together for warmth, strength. We must not let the system control us—create who we are. It is we who created the system.
>
> Haruki Murakami,
> Jerusalem Prize acceptance speech, JERUSALEM POST, Feb. 15, 2009

How best to implement such a machine, be it a free-open-source wearable computer, or similar alethist system, remains an important area of research.

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Steve Mann (PhD, MIT '97, P. Eng.), is widely regarded as "The Father of the Wearable Computer" [IEEE ISSCC 2000], and invented wearable computing as well as the hydraulophone (as both an acoustic instrument and as water-human-computer interaction) in his childhood in the 1960s and 1970s. In the 1980s he invented HDR (high dynamic range) imaging. In the 1991 Mann and Charles Wyckoff invented, and coined the term, X-Reality (XR as eXtended Reality). Mann is a founding member of the IEEE Council on eXtended Intelligence (CXI), and a tenured full professor in the Department of Electrical and Computer Engineering at the University of Toronto.

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