The eXtended Uni/Meta/Verse (XV) and the Liminal Spaces of Body, Ownership, and Control

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Steve Mann

This beach was of course built in the form that nature would take it… you can throw stones into the lake which is what the children particularly love doing, and of course, the lake always brings them back.

Michael Hough, landscape architect of Ontario Place

Abstract

The "vironment" is the liminal space and boundary between the environment (our surroundings) and the invironment (ourselves). Examples of vironments include clothing, "wearables" (wearable computing technologies), and veyances (conveyances versus deconveyances), such as wheelchairs, rollerblades, bicycles, e-bikes, cars, paddleboards, and boats. Manfred Clynes, who coined the word "cyborg," held that his favorite example of "cyborg" was a person riding a bicycle. A person navigating a vessel is also a cyborg. The word "cyborg" is short for "cybernetic organism," and the word "cybernetic" originates from the Greek word $\kappa\upsilon\beta\varepsilon\rho\nu\acute{\eta}\tau\eta\varsigma$ ("kybernētēs" = "helmsman" or "rudder," the same root word as in "governor" and "government"). In this way, we define "cyborg" as a closed-loop feedback (cybernetic) symbiosis between human and machine in which the machine is a vironment. The world's first cyborgs existed more than a million years ago, long before the invention of the wheel and clothing, predating the emergence of homo sapiens. Being the first vironments, vessels

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hold a special place in cyborg history, at the nexus of water, humans, and technology. Humans and technology form a liminal cyborg space, and humans and water also form a liminal space. The beach is, in a sociopolitical sense, where we are at the liminal state of undress between clothed and naked, at the social boundary between lacking and demonstrating proper decorum, and at the territorial boundary between public property and private property, where security guards or private property owners often clash with beachgoers over rules, rights, and responsibilities of land ownership versus the navigable waters of maritime law. More generally, the bath, whether it be the beach or the bathtub, or public pool, or spa, is the liminal space between cyborg and non-cyborg, where we shed our vironments and vestments and become one with the waters. Taking to the waters, which most often requires the shedding of our clothes and other technologies, brings us back to a primordial state, akin to the way we were in the womb. The new field of Water-Human–Computer Interaction (WaterHCI) began 54 years ago (1968) as an exploration of this liminal space where technology meets cyborg/non-cyborg liminality. Some of the technologies we have developed over the last 54 years extend the human mind and body in the liminal space between reality, the metaverse, and society, thus defining a new entity we call the eXtendiVerse, (XV) and it is no coincidence that its last seven letters spell "diverse."

Keywords

Water-Human–Computer interaction • Cyborgs • Humanistic intelligence • Metaverse • eXtendiVerse • Veillance • Veyance

1 Introduction: Vestments, Veyances, Virtuality, and the Vironment

The eXtended uni/meta/Verse (XV) is a social (shared) eXtended Reality (XR) space. Its reciprocal is called Body-Ownership-Control (BOC) Space. In this chapter, these two concepts (XV and BOC Space) are presented in the context of humans, the elemental medium (in the sense of elemental media as conceptualized by John Durham Peters in *The Marvelous Clouds*), water, and technology, and their liminal spaces [1, 2].

Liminal spaces exist in the environment around us, as well as between us and the environment. A beach is one of the best examples of the former liminal space. Beaches are often hotly contested spaces, defining geographical boundaries between land, which tends to fall under land ownership laws, and navigable waters, which are often more free (less owned). A beach is where the three states-of-matter—solid ("earth" for the most part, i.e., the ground, whether it be pebbles or sand), liquid (water for the most part), and gas (air)—meet along a line (the coastline). One example, pictured in Fig. 1, is Teachbeach at Ontario Place, which is located within the downtown core of the City of Toronto, in the province of

Fig. 1 Beaches are physically, geographically, socially, and politically liminal spaces at the boundary of "earth," (i.e., sand *or* pebbles) water, and air (the three states-of-matter: solid, liquid, and gas), as well as the boundary between public and private property. Here, adjoining Ontario Place, a province-owned private corporation, is downtown Toronto's only beach, which is also Toronto's cleanest beach. While "NO SWIMMING" signs are posted on the adjoining land, Ontario Place in fact neither owns the water, nor has any jurisdiction over it, thus having no legal right whatsoever to enforce what people do beyond its geographical boundaries. In the photo, a guard from the security company Neptune attempts to be the God of "NO SWIMMING"

Ontario, Canada. Ontario is home to Lake Superior, the world's largest freshwater lake by surface area. The Great Lakes hold about 80% of North America's freshwater, and in fact about 21% of the world's freshwater, so it has been argued that Ontario is the "water capital of the world," and that, as far as cities go, Toronto being the capital of Ontario is, as a city, the world's water capital [3]. Ontario Place is a venue in Toronto that was designed as a kind of public cottage for people who did not have their own cottages. It consisted of an amusement park (now abandoned) and futuristic aquatic buildings, which I affectionally call the "OPods." Each OPod is anchored by four central columns that extend 105 feet off the lake, and are fixtured into concrete caissons deeply buried into the lake bed, while also being suspended from above by steel cables. Some form of barrier was needed to protect the OPods from the harsh effects of being in the open water. The barrier was provided by three artificial islands. One of them, the West island, became a popular spot for swimmers, where a beach formed unintentionally, never becoming official. Over time, the lake has deposited pebbles on the beach, and since there is no sand and the mainland is remote, the water is crystal-clear there. In a sense, ideal beach conditions (the cleanest, clearest water, shelter, solitude, etc.) arose here for a number of reasons. Besides the purity and clarity of the water, the

beach faces South, so it is sheltered from the noise of the city and boasts a natural microclimate that is calm and warm. As a number of the buildings at Ontario Place became abandoned, the Ontario government established a private corporation called Ontario Place Corporation to maintain the space which is often rented out for private functions. However, swimmers have continued to use the beach there, and a large community has grown around this space. Interestingly, the official Ontario Place website states: "Swimming is not allowed anywhere at Ontario Place." "NO SWIMMING" signs are posted throughout, and security guards are present to tell people not to swim. However, the lake is not part of Ontario. Lakes are generally under the purview of the Port Authority (municipal) or of federal agencies. Thus, the Province (Ontario) has no legal jurisdiction over the water. Consequently, over the years, there has been a steady tension between the officials of the Ontario Place Corporation and the swimmers. For example, on 1 July 2020, when a number of swimmers were in the water and a guard came by to demand that they come out of the water, one of them said: "What are you going to do, give me a fine?" and just stood her ground. The guard called for backup, and more guards came, but the swimmers refused to get out of the water. As the guards had no legal jurisdiction, they left after some time [personal observation made by the author]. In this way, the swimmers won an important landmark battle. On another occasion, the Corporation rented out the parking lot for a concert and also decided to close the entire 155 acres (approx. 60 hectares) of parkland, which the parking lot serviced. At this time, the author and a number of others resolved to swim to the beach from the mainland, which meant getting there without passing through the heavily guarded bridges and foot paths. Initially hostile when the swimmers arrived at the beach, the Ontario Place staff became very polite as they realized that the swimmers were wearing video cameras recording and live-streaming the entire interaction. It is widely held that the beach, up to the high water mark, is public property, and that it is fair and reasonable to access it from the water. Nobody can own the beach! On a defining third occasion, the lake was "closed" to vessels for the annual air show, with boats not allowed into the part of the lake around downtown Toronto. However, a number of paddlers (including the author) were able to paddle in the water, close to the shore. None of the police or other personnel attempted to stop us.

Paddleboards are an example of a liminal veyance. Legally, paddleboards have been defined as "vessels" so that paddlers can be required to carry a lifejacket, a whistle, a rope, and the like, as safety equipment. But, mathematically, a paddleboard is not a vessel since it is, as a rule, a convex hull incapable of holding water. This legal limbo can work both ways, though. This is exemplified by the case of a paddleboarder in a "NO SWIMMING" area. Because a person can never be "in" a paddleboard, there is a loosely defined idea of being on or near the board. Since much of paddleboarding involves falling off the board and swimming back to the board, the legal designation "vessel" actually works to allow swimming in a "NO SWIMMING" area. Also, anywhere that vessels are allowed, swimmers must also be allowed if they are with a paddleboard. In this way, one official narrative (paddleboard = vessel) works to reverse another official narrative ("NO

SWIMMING"). Thus, we have constructed the concept of Minimum Viable Vessel (MVV) [4], a sociopolitical analog to the philosophical concept embodied in the ship of Theseus paradox. The MVV is, in a sense, a reciprocal to the Cyborg Rights movement outlined in the Code of Ethics on Human Augmentation [5], as the struggle is now going on for the right to entry (into the lake) with no cyborg prosthesis (i.e., without a vessel), while the original fight is for the right to wear cyborg technology. In this way, we now realize that "cyborg rights" need to be two-sided and secure the right to choose the amount of technology, that is, the right to choose to be or not to be a cyborg.

The right to swim is, in a sense, an inverse cyborg right, meaning that vessels are almost always allowed in the water, but people—that is, non-cyborgs—are not. For example, to get to Toronto Island, one needs to either "pay the ferryman" or be a yacht owner or otherwise have access to a vessel. This is a form of discrimination against non-cyborgs, since a place is designated from which non-cyborgs are barred. Interestingly, when swimming from Ontario Place to Toronto Island, the nearest beach is Hanlan's, which is one of only two official nude beaches in Canada (the other being 4269 km away in British Columbia). A related question one might ask is how far one can swim from Hanlan's before its clothing-optional aura fades out. Bathing attire (and maybe a swim cap plus a tow-float) may in a sense be regarded as a Minimum Viable Vessel (MVV). Obviously, we would want brightly colored swimsuits, swim caps, and supersize tow-floats for safety. Most of us actually use a paddleboard as a tow-float, because it is big enough to be noticed by other vessels, and we never swim alone. In practice, we have several eye-catching swimsuits, swim caps, and paddleboards, all moving together, so as to be safely visible to navigating vessels. The argument here is really about freedom to choose one's own boundary between the environment (our surroundings) and the invironment (self). Our proposal is to define a new branch of human rights generally pertaining to the right to use or not to use one's cyborg protheses. The simple example of the right-to-swim touches on the most fundamental aspect of cyborg being, namely morphological freedom, that is, the right to choose one's technological prostheses *or the lack thereof*.

Crucially, non-cyborg rights go beyond mere human rights. The right to swim benefits everyone, including people who have no desire to ever set foot or toe or body into the lake. For instance, swimmers' rights actually protect our supply of clean fresh drinking water. Swimmers are known to be the best line of defense against pollution, because the lake itself has no rights, and fish have no rights either, but humans do. Consequently, as soon as humans are in the water, the water has rights, and pollution must stop.

Environmentalism and the environment in general are receiving a great deal of attention in the literature and everyday life today. This attention focuses on the natural environment and other environments, such as the classroom environment, the urban environment, the prison environment, the home environment, and so on. Broadly speaking, the environment is that which surrounds us: everything that is not us is the environment. Much less-discussed is the "invironment." The invironment is defined as us, ourselves. Although there is a rise in the field of "wearables,"

"mindfulness" (e.g., InteraXon Muse), and health technologies, these are seldom presented as the counterpart to environmentalism, and explicit comparisons across the boundary between the environment and the invironment are rarely explored in the literature.

Let us consider the liminal space between the environment and the invironment. Such spaces range from completely enveloping boundaries, such as a space suit, which separates an astronaut from outer space, one of the most extreme environments in existence, to less fully enwrapping ones, such as a raft, which only partially separates a paddler from the aquatic environment. This liminal space between the environment and the invironment, whether sharply, or somewhat fuzzily, or only partially demarcated, is called the "vironment." Examples of vironments include clothes, cars, boats, wheelchairs, bikes, and an array of other cyborg implements and appliances.

While even less-discussed than the invironment, the vironment is an extremely important aspect to consider in the study of cyborgs and liminality. We, as humans, tend to think of the vironment as part of us. This inclination is vividly reflected in two familiar examples: (1) when there is a collision or allision between two vessels, we commonly hear "You hit me!" rather than "Your boat hit my boat," and the response is similar with cars, bikes, and other vironments. Indeed, pedestrians would also not likely say "Your clothes hit my clothes," when they bump into one another; (2) in cinema and storytelling, when hypothetical machines that transport people through time or space are featured, the protagonists' clothes generally travel with them, whereas other items in their environment do not. Sean Keogh writes in "Bottoms Up: A Cheeky Look at Life": "Very funny, Scotty. Now beam me up my clothes." Thus, instances abound in which we think of the vironment as part of us, that is, as part of the environment, rather than part of the environment. At the same time, there are counter-examples, including handcuffs, leg irons, the Oregon boot, and straitjackets. In these counter-examples, agency is not with the wearer, and consequently these vironments may be regarded as part of the environment, such as a prison environment, a police environment, or a custodial environment.

2 The Body-Ownership-Control (BOC) Space

There are numerous technologies and research efforts at the nexus of the human and its environment (i.e., at the invironment/environment nexus), and several attempts have been made to develop a taxonomy of these different technologies along the dimensions of the physical body, ownership, and control. For example, the Mann Body-Ownership-Control (BOC) Plane was presented as such a taxonomy in a paper published in 2001 [6] (see Fig. 2). About 20 years later, others have also used the same 2D plane [7], and the red annotation on the leftmost chart in Fig. 2 correlates these contributions. Central to understanding cyborg prostheses is the extent to which we regard such technologies as part of ourselves or of the environment, along the three axes of vironment or the physical scale (reciprocal of "wearability"), veillance (reciprocal of owenrship), and virtuality (reciprocal

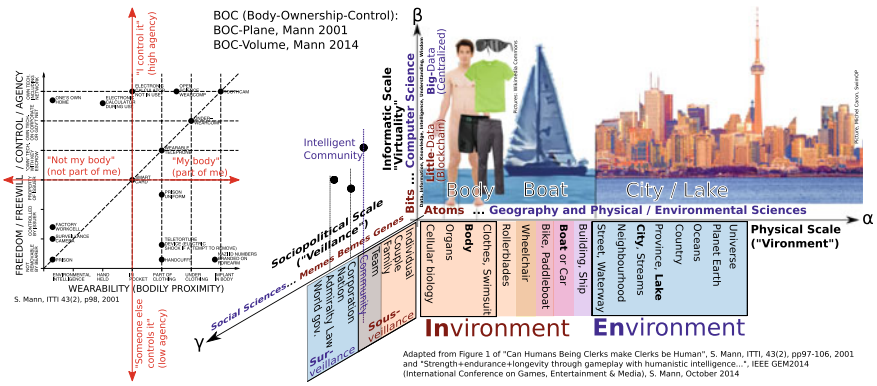

Fig. 2 The Body-Ownership-Control (BOC) plane, volume, and space

of control, for example, the centralized "big data" rights management versus distributed systems that subvert centralized ownership authority, etc.) [8]. Cyborg technologies as a field of study represent a new way of thinking characterized by the outer regions of Fig. 2 in the left (2D) diagram or the inner regions in the right (3D) diagram. (In the right diagram, the axis directions are reversed, as these quantities are the reciprocals of those in the left diagram.) In this scheme, the cyborg technologies that are owned, operated, and controlled by the bearer represent the ideal that we pursue.

Within the space of BOC, we can understand vironmentalism as a human-rights issue, specifically involving the right to wear or otherwise use a prosthetic device such as a camera, whether as a seeing aid, a memory aid, or the like, as well as the right to be free of such prostheses if one chooses so (e.g., the right to swim). This in a sense entails a morphological freedom to choose one's own form. Indeed, much of cyborg art and culture might be better understood if seen through the "lens" of vironmentalism and its close synergy with morphological freedom.

Many cyborg technologies exist in the virtual world and as human augmentation, which fuels an ongoing debate regarding VR (Virtual Reality) versus AR (Augmented Reality). We can think of Physical Reality (PR) as the real world in which we live, made up of atoms. As the Greek word "atom" begins with the letter alpha, we might represent physical reality as falling along an axis labeled by the letter alpha. VR may be regarded as falling along a second axis, say, beta for "bits." "Bits" are meant here in the sense derived from Claude Shannon, as "Binary unITS" of information which can be analog or digital. VR can, of course, be entirely analog and, indeed, when the notion of VR was introduced in the context of theatre by Antonin Artaud in 1938 [9], it was analog. If we think of the plane defined by the alpha and beta axes, the more recent concept of Augmented Reality (AR), launched in the 1960s (e.g., Ivan Sutherland [10]), may be regarded as combining reality and virtuality, that is, not aligned with either of the two axes, but running out in the plane defined there between. Whether something

is AR, VR, or a mixture of these is a perennial object of debates, so the concept of mixed reality has also entered the discussion. However, some technologies cannot be described as a mixture of the virtual and the physical (virtual reality, VR and physical reality, PR). For example, High Dynamic Range (HDR) imaging attempts to reach beyond reality toward something we might call hyper-reality or what provides humans with super-human vision. There are also technologies that allow us to see and photograph electromagnetic radio waves. As these go beyond VR and AR, there is ongoing (and often uselessly confusing) debate about the plethora of various realities. These disputes have been answered by XR (eXtended Reality) as an overarching concept which proffers that cyborg prostheses extend our human senses and capabilities [11]. The idea has sparked a movement of its own, producing organizations such as the Council on eXtended Intelligence (IEEE CXI, of which the author is a founding member). Many of us at the IEEE have decided to embrace the concept of XR as the overarching generalization of which VR, AR, PR, and mixed reality are special cases. In this sense, we regard "X" as a general variable that covers and extends the entire "Atoms-Bits" plane. Thus, XR is a proper superset of each of the other "realities" (VR, AR, PR, and mixed reality), proper in the sense that XR also extends beyond the other realities.

Much recent talk has been of the metaverse as a "digital reality." We insist, however, that it is being-connected, rather than being-digital, that defines or should define our collective experience in a shared XR space. For example, we can realize many of the XR desiderata by analog (continuous) means. Therefore, what we really seek is a shared collective persistent XR, which we name the eXtendiVerse (XV). Just as VR can be implemented by analog technologies, such as wearable head-up displays that use analog NTSC television signals, there is no requirement that the technology be digital. This is not so much a moral/ethical requirement as a taxonomoical/taxonomological/ontological one.

XV is not just virtual. It includes all cyborg technologies that extend our human senses and communication capabilities, such as, for example, when we swim in groups and stay in touch with one another using real-time shared kolympography on underwater head-up swimglass. Such an experience is "undigital" in the sense that it feels very much continuous (non-discrete, non-quantized) in both real and virtual spaces. To restate, we define the cyborg in terms of a closed-loop feedback system with a vironment, and a vessel or a bicycle considerably differs from a tool such as a hammer, which is not part of one's vironment. The long-term adaptation in the course of which a vironment evolves into a cyborg technology is premised not only on the constancy of its use, but also on a more continuous and predictable feedback loop. This feedback loop in the context of cyborg technology and BOC Space produces what is known as Humanistic Intelligence (abbreviated as H. I., HI, HInt, or H. Int.). Minsky et al. [12] define HI as intelligence that arises when a human being is in the feedback loop of a computational process in which the human and the computer are inextricably intertwined. A continuous rather than discrete feedback system is implicit in the design of HI, thus favoring either an analog system or a digital system with enough precision to mimic an analog response.

In Fig. 2, the plot to the left shows the 3-dimensions of Body, Ownership, and Control collapsed down to two dimensions. This 2-dimensional space forms a taxonomy in four quadrants, or, in 3-dimensions, 8 octants. In general, BOC Space with its categories can be employed to sort various technologies. Suppose, for example, that a burglar breaks into a police officer's home, and the officer owns handcuffs and a gun. Suppose that the burglar overpowers the officer, grabs her gun, and puts the officer's own handcuffs on her. He then proceeds to steal the officer's gun and other items while she's handcuffed. In this case, the officer owns the handcuffs, and the handcuffs are wearable. But the officer is not in control of the situation. Thus, the technology in this situation falls into the Body + Ownership + non-Control octant of the taxonomy.

To the right is shown reciprocal BOC Space, where the three axes (alpha, beta, and gamma) denote, respectively, the physical scale (reciprocal of Body), the informatic scale (reciprocal of Control), and the social scale (reciprocal of Ownership). The upper right quadrant of the leftmost figure maps toward the origin of the rightmost figure. The origin is defined as Bits, Atoms, and Genes. Beginning with alpha, the Greek word "atom" means "not divisible," and although we now know that there are subatomic particles, we use this Greek word in accordance with its original meaning, while recognizing that we can continue further toward the origin at a subatomic scale. What matters most, though, is the distinction between the invironment and the environment—that liminal space or boundary called vironment. In the figure to the right, the environment is rendered in shades of blue (corresponding to "blue sky," "blue yonder," or "blue lake"), and the invironment is represented by shades of pink, red, brown, tan, etc. (flesh colors).

For each of these 3 axes we can define a "little" end and a "big" end. For example, socially speaking, along the gamma axis, designated near the origin as "Genes" (a word of Greek origin that begins with gamma, the third letter of the Greek alphabet), we have sousveillance near the origin and surveillance further out. Surveillance may be regarded as "big watching," that is, watching performed by large entities, such as governments and corporations, whereas sousveillance is "little watching," that is, watching executed by individuals or small groups, such as a couple or a family unit. It is the right balance between "big" and "little" that leads to a well-balanced society in the sense of equiveillance (equilibrium between surveillance and sousveillance), about which much has been written in the literature [13–15]. There is a meaningful, if fraught, relation between surveillance and ownership. Photography has a special place in the world of ownership. Ownership is a social concept, or social construct, and thus exists along the gamma axis. When one takes a photograph, one generally owns the rights to the photograph, and thus being a photographer, especially continuously (e.g., by means of a continuously recording wearable camera system), produces a great deal of ownership in terms of copyright and the like. This situation generates some balance regarding the Ownership (reciprocal gamma) axis, which is otherwise missing from a surveillance-dominated society.

3 Conclusion

Cyborgs have existed for more than a million years, long before the invention of the wheel and clothes, predating the emergence of homo sapiens. While this is no novelty, what is new is the conceptualization, taxonomy, and understanding of liminal spaces in terms of Body-Ownership-Control (BOC), whether it be the right to wear a camera or any other technological prosthesis, or, inversely, the right not to have to wear such a prosthesis (as exemplified, for instance, in the right to swim and the concept of a minimum viable vessel embodied in a paddleboard).

Central to BOC are liminal spaces, such as clothing, vehicles, vessels, and other appliances of this kind, which are liminally located at the boundary of the invironment and the environment. Whether we add layers or remove them, we enter and interact with other liminal spaces along the same three axes of Body, Ownership, and Control.

We can now move beyond the very-much dated concepts of VR, AR, and metaverse and, instead, consider a not-necessarily digital reality that allows us to live in a shared persistent space mediated by technology. This space is named XV (eXtendiVerse), and a glimpse of it is offered, for example, by a video game played by swimmers who score points for 3-dimensional localization of rocks and other hazards, thus turning safety into a fun game.

Whereas, in BOC terms, the metaverse (shared virtual reality) exists along the beta-gamma plane (virtuality and sociality), and XR (eXtended Reality) exists along the alpha–beta plane (reality and virtuality), XV spans the entire volume. XV is a shared, persistent XR space that involves reality, virtuality, and sociality in any proportion, and thus forms a proper superset of VR, AR, XR, and the metaverse.

Core Messages

- Cyborg technologies have entered almost every sphere of our lives.
- We are all cyborgs, and our ancestors have been cyborgs for more than one million years.
- Cyborg artists, scientists, and inventors, contribute to shaping the ways in which we think of the vironment, that is, the interplay between the invironment and the environment.
- XV (eXtended uni/meta/Verse) is the future.

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Abbreviations

2D	Two-Dimensional
3D	Three-Dimensional
ADHD	Attention Deficit Hyperactivity Disorder
AFADA	Argentina's Association of Professional Lawyers for Animal Rights
AGI	Artificial General Intelligence
AI	Artificial Intelligence
AR	Augmented Reality
ASMR	Autonomous Sensory Meridian Response
AT	Avatar Therapy
ATSAC	Automated Traffic Surveillance and Control System in Los Angeles
AVH	Auditory Persistent Hallucinations
BCI	Brain Computer Interfaces
BOC	Body, Ownership, and Control or Body-Ownership-Control
CAPHE	Communities and Artistic Participation in Hybrid Environments
CAT scan	Computerized Axil Tomography Scan
CoSiHuman	Cooperative Simulated Human
CRISPR	Clustered Regularly Interspace Palindromic Repeats
CRT	Cardiac Resynchronization Therapy
CXI	Council on eXtended Intelligence
DNA	Deoxyribonucleic Acid
EDF	Electricite de France
GI	Intelligence Index
H. Int. = HInt	Humanistic Intelligence
H.I. = HI	Humanistic Intelligence
ICDs	Implantable Cardioverter-Defibrillators
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
MVP	Minimum Viable Product

MVV	Minimum Viable Vessel
NTSC	National Television System Committee
OP	Ontario Place
OPods	Ontario Place pods
PEDs	Performance Enhancing Drugs
POC	Proof of Concept
PR	Physical Reality
STS	Science and Technology Studies
SwimOP	Swim at Ontario Place
VR	Virtual Reality
WaterHCI	Water–Human–Computer Interaction or Interface or Integration
WBE	Whole Brain Emulation
XR	eXtended Reality
XV = eXtended Verses	eXtended meta-omni-inter-multi-uni-Verse

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Monika Michałowska *Editor*

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