Visions of Reality

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Abstract: Contemporary digital media have so far centred on human beings, from the development of computer graphics and virtual reality systems that replicate and extend our sense of vision and spatial perception, to social networks that enhance human interaction. Today, we are part of a complex physical and digital ecology that includes diverse world cultures and the natural environment. This talk will discuss the development of visual and multimodal media with a look forward in time, and some of the potentialities and limitations in the context of current world conditions.

Introduction

When I think of the future, 20 years ahead, there are two possible approaches to thinking about Virtual Reality: the pragmatic and the speculative. From a pragmatic point of view, my assumption is that much of the research done today in Virtual Reality and new media will be commercialized and democratized, and be available to many people all over the world.

From the speculative point of view, there are trends that still can be explored and heeded, as well as new arenas for innovation imagined. I will discuss some historical trends, contemporary concerns, and then speculate on where we might go.

Many of you already know what media technology delivers today: spectacular computer graphics that dazzles our senses, medical imaging, scientific and engineering visualization that let us see in colourful detail the insides of our bodies, social networks that allow us to share our home videos, cell phones with GPS and video conferencing so we can see our loved ones, multiuser computer games that stimulate, among other responses, high levels of adrenaline during trigger fast reaction, and, of course, widely available on-demand HD films of all kinds, and now stereoscopic entertainment.

History

In the West, the history is built on long traditions of imaging that go back to antiquity, if not the prehistoric time of the cave dwellers. Sculpture, painting, and architecture are antecedents of virtual reality because they immersed the occupants in a world made up of real things and representations. Frescoes painted on all 4 walls of rooms in places such as Pompeii and realistic paintings on the ceilings of churches in Europe created a compelling illusion of presence in another world, the latter being heaven.[1] They led over time to the invention of perspective in painting and the camera obscura, the fixing of light onto an image plane or photography, the invention of stereography and the panorama, the addition of mechanical technology that allowed movement of individual frames and film, the beginnings of the stereoscopic film, the invention of electronics that put moving images and sounds into a stream of electrons and allowed them to be broadcast to homes all around the world, the addition of digital technology that transformed the image stream into a series of numbers that could be manipulated individually, the development of the internet, the miniaturization of devices and the proliferation of wireless and embedded systems, and now convergence and the updating of stereography through virtual and augmented reality glasses to wear as we watch TV and movies today.

Our technology has a progression that explores the senses, adds coordination and interaction, builds the individual mind, connects with others and adds socialization, explores memory and is supposed to develop some wisdom, and then lives forever, following if not mirroring the growth and maturation of human beings. It promises omniscience, omnipotence, and immortality. Or as J. Walt Adamczyk, 3-D computer graphics performance artist and animator called it, "the God dream."[2]

As visual media, it has also allowed for unprecedented techniques for layering data of all kinds, an aggregation of all the images and films that can be digitized. They can be put into 2, 3 and 4 dimensions and into expanding digital archives for fast access by users all over the world. This is a way of collapsing time, space, and memory into a seamless meta-archive, and making it available over the internet to networked citizens. It is making their home theatres into a distributed planet-sized theatre in the round. The number of connections, and their possible combinations, are so many and increasing so fast that it has become what is called an "emergent system."

It is also viewed by some as a chaotic situation, an uncontrolled growth which necessitates order. There may be an existing order in a complex system that is beyond easy comprehension. Scientists as empiricists, use their senses, logic and mathematics to look for larger patterns and rhythms in nature and the universe in order to acquire knowledge. Today computers with sensors, programs, and algorithms do this work even faster, and on a very large scale. Their motivation is to discover truth, and in this pursuit consider the discovery or the conformation of an algorithm, or model of the thing being investigated, a verification of truth. The idea is for the model to apply generally to a class of phenomena (rather than a unique instance) found in nature. Now, computers are being used to model and predict social and political phenomena in the social and political sciences as well.

The apprehension of a truth or knowledge is widely considered aesthetic, and the experience of pleasure associated with concepts of beauty, order, rhythm, proportion, and harmony widely considered fundamental to nature. As discussed by Gregor Paul in his article on the *Philosophical Theories of Beauty and Scientific Research on the Brain* stated:

> Contemporary philosophers still agree that traditional concepts of beauty involving proportion, harmony, coherence and unity are still indispensible and transcend culture. People experience beauty as a gestalt independent of the individual characteristics. Examples from Indian, Chinese, and Japanese aesthetics, which indicate that beauty is characterized in the same way as in Western aesthetics, i.e. as a gestalt, which in principle causes pleasure in every contemplator, abound. The Chinese philosopher, Zhuang Zi (fourth century B. C.) told of a woodcarver who had created a work of heavenly beauty, which was generally admired. Asked about his methods, he explained that he started carving only after having found the right tree, i. e., a tree which, in its natural shape, already contained a preformation of the sculpture. The principle of artistic creation addressed in this anecdote could be called the 'harmonious interpretation of the natural material' or the 'principle of natural preformation.' This principle has been put forward and applied by numerous aestheticians and artists, among them Leonardo da Vinci, Michelangelo, Max Ernst, and Adorno. The Chinese painter, Song Di (12th century), and Xiao Tong (501 – 531) in his poetics demanded that beautiful pictures or literature should constitute a harmonious whole. Such outstanding Japanese writers as Murasaki Shikibu (about 1000), Seami (1363-1443), Chikamatsu (1653-1725), and Soseki (1867-1916) all claimed that beautiful literature is characterized by its natural structure.

There are those who feel that knowledge, experienced aesthetically, is gained by empiricism, and that it depends on the senses. Others feel it results from rationalism, or mere thought and reason. But as most of us know, just because something is logically possible does not mean it is actually possible. In Platonism, the mind recognizes objects and the world outside itself as imperfect copies of the idealized forms existing only in the mind. But if the mind loses the object, it ceases to exist in the real world. A third idea is that knowledge is "limited to the realm of experience but depends on and is structured by mind" called transcendentalism. In transcendentalism, as developed by Kant, the mind is active and creative, and recognizes the body and senses. Nietzsche went further, and proposed a biological basis to aesthetics. This comes closer to contemporary concepts which view notions of beauty as a product of evolutionary adaptation.[3]

As we all know, religion concerns itself with knowledge and truth, and with the relationship between body, mind, and nature. In particular, it deals with larger existential questions of why we are born and what happens when we die. Some people view everything that exists as the work of a God-like higher entity or some kind of greater organizing force in the universe. Some also think that as human beings they have been especially chosen to receive this knowledge and therefore have the moral obligation to use it to change nature. Inside these large domains, the artist and technologist are workers doing their part to further 'God's work.' These are powerful concepts and they have changed the world. As my late mother Doris Sorensen, a professor whose education was in language, ethics and philosophy, once said to me when as a child I asked her why I had to go to church, "You don't have to believe it, but you have to know what other people think because the history of religion is the history of the world." I began to look forward to going to Church (Unitarian) to learn about the history of world religions. I welcomed every opportunity to meet people and learn about their beliefs, and this continues to today. I became aware that there are many similarities among them, and also differences. Images depict the complex questions addressed in religion and not everyone agrees on the meaning of these images, some of which are still contested today.

World of Forms and Plato's Cave

There have been some dreams and goals in the West that underlie the disagreement about the role of images in religion and knowledge. I already mentioned the Platonic idea that there is an ideal world apart from the real world, and that this could be accessed only through thinking and mathematics. The "world of forms" or the "world of ideas" contains ideal shapes and forms that serve as references for everything we see. Only knowledge of these forms is considered real knowledge. Objects exist only in the mind, and the physical world is full of imperfect copies, and they are both varied and replaceable. Our minds recognize these imperfect forms in the world around us because we hold the perfect in our mind and compare them.

The allegory of Plato's Cave tells the story of prisoners in a cave who are chained in front of a wall. They are only allowed to look at the wall. Behind them is a fire and between them and the fire is a walkway where people and things pass by. Shadows are cast on the cave wall, and echoes of the sounds and voices from the walkway seem to come from the same walls. The prisoners only see the shadows in front of them and think they are the real thing, for they can never see or know what is behind them on the walkway. One day a prisoner is freed and ventures out of the cave. He comes back later to tell his fellow prisoners about what he has

seen. He is on the walkway and the other prisoners see him as a shadow. They do not believe his story, and resist being freed. But that doesn't mean that the things outside and those casting the shadows do not exist.[4]

The philosopher is like the prisoner freed from the chains that limit perception, who is then able to apprehend the true form of reality instead of only the shadows.

Templates, forms, and images in the mind and in memory, and in our media, are like these shadows, people perceive them as reality. The more that people are isolated from reality, the less they realize that the real world exists.

2 and 3D computer graphics systems based on digital image libraries are in a way Platonic, they use the idea of "perfection" to create a mathematically perfect world. It's also interesting that there is also no gravity in the empty space of computer graphics systems. Computer graphics worlds are pristine and orderly. The real world is messy and chaotic.

In scientific visualization, it is held that if we can simulate the real world in a way that it conforms in some basic way to shadows and visual models, not only does that prove that the models are correct, but that by extension our understanding of nature and the world is correct too. This is a kind of visual proof and it is very important. But there are limits. Understanding nature better does not necessarily mean that it can be controlled. The biggest problem is confusing the metaphor with fact, and the tendency to retreat into the world of electronic illusions because they are more controllable. But there are also dangers in assuming that the messiness and chaos of the real world and nature can and should be tamed. Today, our ecosystem has been so altered as a consequence of our pursuit of a more perfect state of nature that we are in danger of mass extinction of life, including human life. This is a human induced mass extinction and our technologies, including our wars, are largely to blame. The problems humanity has created are so large and so complex, so difficult to solve that it is likely that solutions, if there are any, will come from teams of people from a range of fields, working literally in the fields outside, and not just specialists working independently on their own private computers in their home labs.

So who defines the "ideal" that would tame the chaos of the physical-digital world today? Is the notion of the "ideal" even a relevant concept? The priesthood, the holder of the secrets of how to model and simulate the world and nature, and thus in the Western sense, how to change and control it, has rested for years with technologists who build the tools, and so it is they who have had the power to decide this.

While many artists have been involved, they have been lowered in rank over time, so to speak. Although it is they who actually create the images that inspired the technological advances, and who could see the world outside the cave, they are increasingly treated as mindless illustrators rather than visual thinkers and philosophers. They are often instructed to adhere to narrow notions of beauty and harmony, rather than using their visual intelligence to expand the possibilities and report the truth.

Historically, artists were also technologists, and vice versa. They had to produce the pigments, cut the stone, develop alloys, and render life. Even in computer animation, this was the case

(experimental animators are credited with inventing the field). Today the process has become so industrialized and controlled that the role of artists in industry and research has been reduced to production line work, and because of it they are prevented from understanding the larger work, of grasping the entirety, and of experiencing the gestalt of beauty of the whole.

Paul Klee, the Swiss born modernist painter in the 20th century, who was a Bauhaus artist that the Nazis considered "degenerate," expressed the idea that the artist is part of nature, and that the artist conveys through their actions the natural order of the work of art. But he also felt that for an artist, individual effort is insufficient. The final power of a work of art comes from society and this was lacking in the modern age. Spiritual disconnectedness is one reason for obscurity, and for the problems artists encounter in the world. Social networks can address some of these issues by offering new opportunities for artists to understand their relationship to the larger world.[5]

Experimental artists have pioneered and continue to transfer visual strategies from different cultures to multimedia as a way to innovate culturally, aesthetically and technically. This is still an effective strategy but it requires vigilance. The independent film and animation fields have, through free experimentation, changed the way we see the world and by borrowing, inventing, and synthesizing visual influences, extended the database of the visual mind, so to speak. In particular, the experimental ethnographic film, documentary that embraces both the fine and folk arts of the world in a non-hierarchical way, appeals to our collective humanity, using visual symbols to build bridges of understanding. Education is required to learn about the meanings of symbols across world cultures, for they are highly contextual. For example, white in the West means purity and in the East it means death. We also need to learn about how the brain and mind learns, in order to adapt to our new condition of being global world citizens.

During colonial times, a conquering culture destroyed the symbols of the vanquished culture and replaced them with their own symbols. This was especially effective in pre-literate cultures. The T of Tor's Hammer became a Cross during Christian expansion into Denmark, and similar transformations that fused religious images took place elsewhere, resulting in syncretic images such as those of Santeria in Cuba. This was a strategy for survival. The same process is taking place today, using networked visual computing. Morphing and Photoshop software make this easier. Perhaps we are now becoming *post-literate.* While it may seem that media are inclusive of all of the world's people, this is not the case. It is a romantic idea based on the promise of media, which is still largely unrealized.

The process of cultural conflict and destruction that took place in past centuries, during colonial expansion, is continuing. There is a war of cultures through images. It is actually more defined now than it was previously. Images in the media are used to frighten and attack people and nations. The images of the World Trade Centre on 9-11 are indelible, and changed the world. As in the cliché, 'seeing is believing', images are also commonly used as evidence and proof. As in the Nuremburg Trials after WWII, this is very important. Today visual evidence on any side of an argument can be much more easily fabricated and manipulated, so it has to be verified. The best thing about so many cell phones with cameras is that corroboration of facts becomes easier. Just as with text news, confirming reports are needed. Visual evidence also needs corroboration, to be verified. The 'twitter revolution' described during the last Iranian Presidential election flooded the internet with texts, photographs, and videos of the street protests, using social media to confirm that they took place despite official government censorship.[6]

Perhaps you know about the altered image in the news of the Egyptian Prime Minister with US President Obama? This shows how easy it is to manipulate both the images and people.[7]

I am sure most of you know about the Danish Cartoon Crisis and the conflict over the images of the Prophet Mohammed depicted by the Danish cartoonists in the newspaper. It underscores the difference in role of the image across cultures. Some believe the image is the real thing and others believe they are representations, apart from the real. The idea of using images as a way to question the beliefs and world views of others shows how difficult the problem of visual culture really is, and how serious the consequences of misunderstanding really can be. The threats against the lives of the cartoonists and the deadly violence that followed demonstrate how cynical or at least unprepared the world is for addressing problems that increasingly involve visual media.[8]

While all this is going on, we still have a problem with respectful inclusion of world cultures in our global visual media. Although many more people have cell phones than ever before, the majority of the world's people, most from ethnic cultures, do not have access to the internet, Facebook, etc.

The ease with which images can be altered, with the aid of digital media, is astounding! The speed with which they can fly around the world, through the networks, is unprecedented. Their effects are immediate, and our lack of understanding of world cultures is challenging the potential of global understanding through media.

The promise is still a promise: the rise of visual technologies and global visual culture using the internet has allowed human beings to collectively contemplate their perception of reality, to analyze, deconstruct, and reconstruct it. This allows for new ways of expressing ideas, for telling stories, and for imagining and planning a better future.

The same need as in colonial times for the control of images, symbols, two and three dimensional space and time, for remote control of movement through it all and thus communication from afar, so central to empire building, is still active today. We are still improving our maps and advancing dimensional (including stereoscopic) representations, we still need to better predict large scale dynamic natural events such as weather in far away locations, and we still need to communicate messages and instructions from a distant government headquarter to workers who may never see their employer or leader. We may be some hundreds of years later than the height of colonial expansion, but in the field of visual media technology, we carry almost unconsciously along the very same path. The difference today is that the observed and controlled can look back and control their own image. They can put themselves into the moving pictures, contemplate and imagine their own narrative, and plan their own future. This is what happened in Shadow Magic, when the filmmaker put the local people in front of the camera so they could see themselves as they never had before.

With our media, there does not have to be an ideal view controlled from afar, it does not have to be sculptural and architecturally ordered according to the rules of perspective, and the narrative structure does not need to be based on conflict and resolution with the major conflict taking place two-thirds of the way to the end. The democratization of media allows for new forms to arise from the synthesis of other forms, through creative invention and collaboration.

The film medium has its own inherent possibilities, but this does not mean that all films have to look the same. Visual mixing, juxtaposition, and transformation possible in film allow people to try out new ways for cultures to interact, following in the syncretic tradition. This challenges old forms of colonialism and provides a conceptual laboratory for experimenting with multicultural images. This activity is partly the outcome of the breakdown of colonialism as a result of ethical problems associated with inequality, exploitation, and domination, perceived and reported by people with a conscience who witnessed the horrors and tragedies taking place at the time. Some of the breakdown of colonialism can be credited to film, as shown at the Nuremberg Trials, International Military Tribunals held in December 1945, just after World War II that used documentary film recordings of Nazi Holocaust war crimes to prove that they took place, and that Nazi denials were not true. There are two new documentaries about the Nuremberg Trials which have been released recently.[9]

Artists such as DzigaVertov innovated film documentary to imagine a different future for humanity. During the Russian revolution, in the mid-1920s, he experimented with the new film technologies to make the audience aware of its potential for constructing reality. In Man With a Movie Camera, he changed angles, speeded up and slowed down the film, made superimpositions, tracking shots, animation, jump cuts, and took the camera to many surprising locations.

The ruptures in the control of order, often imposed by technology, are where the people and other cultures enter. This democratizes the media, important for the public to insert their points of view, and to apprehend and comprehend the world in which they live, so as to make better decisions, to improve life.

Shadow Magic describes a disenfranchised European at the end of the 19th century, who takes the first moving picture technology to China. In keeping with ideas at the time, he was on a quest to start a new business, to record the world so he could bring it back to the ruling elite so that in the safety of their parlours they could experience the world without actually going there, collecting and cataloguing the world in a succession of images, like an encyclopedia, and providing a virtual voyage. But the real world crept in through the ruptures with the aid of artists and inventors, who as social misfits altered forever the Western concept of perfect order.

In this film, Chinese people did not think that European culture was superior, and why should they? And why should the European in China not be more interested in Chinese opera than Italian opera? It was possible to have more than one face, more than one point of view, more than one kind of opera, more than one way to experience time, place, and space. The curiosity of man about man did not have to result in oppression and domination, but in building new kinds of bridges between cultures. Chinese people saw the Europeans not only as warriors and armies, but as people with feelings that laughed and danced. And the Europeans could better see China as a complex culture with sophisticated and refined tradition in the arts with a long and rich history.

In film, we see the dream of shared worlds, of shared dreams. In neuroscience, the purpose of the dream is to use memory in a predictive way, so that we can try out future scenarios in the mind while we are resting, so that when we awake we can make better decisions, and take

more responsible actions that help us to survive. The same is true of all memory-based media, including films, video, computer animation, interactive games, telepresence, and Virtual Reality. Fundamentally, it brings together the real worlds that we live in, with the imagined space in our minds. It is a kind of miracle that we can externalize our minds so that we, together with other people, can contemplate them. And more than that interact with them in real-time. Our dream, ultimately, is to be more connected with life and nature and for life and nature to be more like our dreams.

All of this is informing computer animation, Virtual Reality, and Artificial Reality. Like in dreams, anything is possible in VR. Currently, it is mainly working on the simulation of natural phenomena, virtual humans, so as to better *simulate* nature and the visible, physical world. Some people are talking about consciousness as separate from physicality. Neuroscience says that actually, consciousness is the product of cells and biochemistry. With this in mind, the idea that human thought and consciousness can be transferred to an inorganic machine, and in this way the person can have immortality, is at best a misconception. Even using biological computing the individual organism that dies loses its own consciousness. Perhaps memory can be transferred, but this is not the same thing as consciousness, and the original organism once dead, is still dead.

The trend today to pursue machine consciousness as the logical next step in our technological trajectory is a kind of determinism that implies that individual life is not as valuable as the machine, which will be immortal. Although one could say that this vision of the machine reflects an inclusive vision of a kind of global mind, without supporting real life and living human beings in the real world, it has little ethical purpose or value. As mind augmentation, it can be valuable. But as a *replacement* for any human being it, by definition, devalues life and human beings. This devaluing of life can be easily exploited by totalitarian regimes, for neo-colonial purposes. This is supported by research done in Japan after the introduction of the robot dog showing a rise in animal abuse by children who had first had the robots. The robots didn't really feel and the children learned this. Unfortunately the real dogs did feel.

Uncritical romanticism that inspired much of new media utopianism still informs the shaping of media technology today. Yes, it has led to beautiful abstract films, amazing and inspiring visual effects films like Avatar, that have an ecological message. And they are inspiring. But real-time wars waged today use immersive computer game technology so that the "player" can drive home to their condo safe in their own country after dropping real bombs on real people in another country. Empathy depends on seeing the other person. If you don't see a person, there is no empathy. Seeing in media is better than not seeing, but it may not be enough, we also need to be there physically. We make different decisions when we cannot just turn off the screen and have to do something about the situation because we are part of it. Simulation is limited in this way. It can also be easily edited or altered so that the horrific disappears.

Research has shown that the most stressful images are those that show violence to the human face or body. This is reinforced by research showing that children seeing violence for the first time are shocked. The second time, it is less shocking. The third time, it is acceptable. With more realistic images in animatronics and visual effects, children are increasingly unable to distinguish between fantasy and reality. When in an animated series the killed person comes back to life

in the next episode or game, they think violence has few if any negative consequences. In fact they see it as a way to solve problems.[10] That is why war games and VR are used to train army personnel. Isolation from real people and the real world makes destroying them not only more easy, but acceptable. *Transhumanism,* the merging of technology and biology, may promise longer life spans and memory improvement, but most of the research in this area is aimed at replacing real people with robots and virtual humans for the purposes of waging war. And this makes killing others easier.[11] It is not an existential problem anymore. The idea that VR can make us more connected to the world, more empathetic, more conscious, and more ethical may be a possible goal. But it is rarely used this way. It can connect, and it can disconnect. It is an illusion to think we are connected when we aren't.

Focusing on distant views of landscapes while engaging in conflict (such as remote controlled weapons, including internet machine guns), where people and other living things are not visible, coupled with overstimulation of the senses and seductively employing refined visuality can lead more easily to unethical and sociopathic behaviour. To prevent this, more media literacy is needed. As makers and academics, we know that media has the same effect on the brain that primary experience does (people cannot remember if something really happened or they saw it in a film), and that the media are highly constructed manipulations of memory and sensory stimulation. We know that it is cynical to use it like propaganda to control the thinking of others, to brainwash so that it is easier and even acceptable to kill other people. It is a crime to kill people, but war games that teach how to do it are legal. Many young people are being mentally prepared for war with these games. They more often rehearse instinctive reactions for shooting rather than playing serious games that involve concentration, deep thought and reflection. So yes, we can use VR for medical procedures and rehabilitation, for scientific visualization, and this is very good. But there are larger ethical issues. Life and death are ethical issues. We want greater intelligence. But if we use visual media to bypass thinking, the opposite is also possible.

The human brain and body is still ahead of VR and interactive media, and it serves as a reference. Understanding how it transforms sense impressions from the eyes and ears, and the surface of the skin into a special representation in the mind, is not known. How it creates a model of space and time that somehow conforms to the real thing, creates a narrative, for prospective imagining, is also not known. If we can discover how this works, it will dramatically affect our technology and what we can do with it. Neuroscience, stereographics and GPS systems, improved sensors, and better storytelling, will be important. Visual and multimodal social networks, game theory, evolution, information theory, and simulation are, and will be, important to the development of new tools.

The role of new materials with new properties that are sustainable, will serve many functions as immersive space moves more and more into physical space at all scales. We will be increasingly in the world and in the universe. Not just through augmented reality, or hand held devices, but through better translation and connection between our bodies, minds, and memories, to other creatures, including animals and plants. We will be able to make simulations that include images and sounds, as well as air conditions, temperature, and humidity, so as to compare and make sense out of them.

Smarter materials, more clever embedded systems, better understanding and intervention of light and sustainable energy and materials will be important. But better brain and body sensing, and better translation between languages of all kinds, and the ability to understand what is being said will be the goal.

To have improved meaning from massive amounts of data we need better navigation and sorting tools. We need smarter compression that reduces information so we can tell a story by remembering the most important parts. And as the Danish science writer, Tor Nørretranders points out in his article "What are all these neurons up to?" Reflections on the Para Limes Workshop on Conceptual Neuroscience, we need Artifical Will, not only Artificial Intelligence.[12] Why does the chicken cross the road? The chicken **wants** to cross the road. We know *how* it crosses it. But not why it wants to. This is something in the "old brain" that is still a mystery. We need conceptual tools, to allow creative people to explore the will to move, to create, and to imagine what has not been done before.

We invent stories about the land, weather, and the people and animals around us to explain life. Native peoples of the world do this, and we can learn from them. The land and the sea hold memories. Our memories are closely related to our environments. The evolutionary ability of animals, including humans, to store the past and imagine the future, and thereby avoid dangers and seek pleasure, helps us to survive -- we learn from our ancestors. The arts of the world, including dance, painting, sculpture, music, handcraft, architecture --all of these do this for us too, and so they will be increasingly important in our global visual and multimodal cultures.

Photorealism replicates surface qualities and appearances. But what is below the surface representing feelings, meaning, stories, and poetry? Non-photorealistic rendering will help with this. There is already an increase in the integration of animation and documentary to this end. The history of world art has been flattened and is available as a reference for anyone with an internet connection. The history of art influences new work being made by artists around the world, giving new work new life.

We need improved systems and devices for creative expression that incorporate all of the senses (including smell and touch) so that we can bring the richness of our experience to bear on the creation of new poetic experiences. They should be inexpensive, easy to use, and freely available. We are building cities that are both virtual and real, to inhabit and tell stories about. They become narrative spaces that function as a new kind of literature.

Artists are a window to the future, they makes leaps and offer new possibilities. They think outside the box, but are also deeply connected to the present. They serve as signposts and warning lights. They criticize and suggest ethical alternatives.

Thus aesthetics *is* ethics, and the purpose of ethics is to make a more just world. Today, this means the inclusion of alternative world views. It means to be local and global, multicultural, and concerned with the ecology.

So far, most of what we have made in Virtual Reality has tended towards human centrism. The good thing about this is that we incorporate ethics. The complicated part of this is the essential element of empathy: to care about and imagine what others feel, since normally this is not possible with our limited senses. The distance from the real can lead to a breakdown in perception of living things, and this is a danger. But it is also possible to focus on empathy as a goal.

Sensors allow us to feel what trees feel or what fish feel. Of course there are problems with this, with invasion of those life forms. We need ethics to guide this development so that if it happens, it is done non-invasively. Interaction allows the voice that we didn't know was there, to be heard.

We are all responding to the environment, sensing it and sensitive to it. We know now that animals and plants are just as important to our survival as are other people. Human beings are not the centre of the universe, however amazing they may be. We are part of a highly sophisticated network of complex relationships. We need more and better sensors so we can feel the tree, really. It is an avatar, and it is the real thing. The rain that falls is the real rain.

What we need are more diversified organic graphics systems, or DOGS. In a digital multi-verse, rethinking VR as a place to connect with real life in ethical ways, and with empathy and compassion, is the goal. In Bali, there is no word for art because everything is aesthetic. Everything is art. To me, this means that everything has an ethical dimension. This is the future of VR in the arts and of visual culture. It is a possible utopia, our quest to make a better world at the intersection of digital and material cultures, and the virtual and physical worlds. We need to move from thought controlled systems to thoughtful eco-systems.

Thank you for your attention!

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