Historical look at Telepresence

Epistemologists have long coupled experience with being present, and abstraction with being distant. With the advent of technologically mediated knowledge, the experience and abstraction coupling serves as a foundation for change.

In the past, people thought that the 'here' was the world of perception and action, and that the 'away' was the world of things that were not 'here' such as angels, sea monsters, the dead, Gods, etc. The things that were 'away' were told in stories, in religious rituals, in memories, and in philosophy. They were viewed as real, but unable to participate in the 'life-world'.

This mode of thinking has been eroded through technological development. We now know that the moon is not made of cheese, rather it is rock with topographic formations. Now surgical operations can occur over a large distance, and human flesh is healed from afar. The world of technology and the human world have a lot in common. Experience and direct agency are part of both.

It is no longer true that the real world and fictional worlds are emotionally, psychologically, or morally insulated from one another. Our everyday lives are imbued with the fictive in television, access to communication with others, films, and mediated viewing. Commonly people challenge the notion of reality by questioning whether or not something is "really happening".

Even with technological developments, the Internet has distance. Although delays in transmission of information are lessened, distance remains a feature of our Internet-based interactions with others. Our sensory engagement is primarily visual, and is augmented by auditory, tactile and olfactory sensations, yet it is still very different from the way we engage in the things around us. Telepresence strives to bring those things that are far away from us near to us. It may be possible to come closer to our experience with those things near to us through Virtual Reality.

Things on a screen are not 'there' in the way the monitor is or a keyboard, or whatever interface we use. The computer gives us a representation of the objects that are presented on a screen. They are not really there. The monitor screen is the screen, not a representation of one.

The medium has to disappear in order to properly interact with another. Essentially, we need to overlook the medium and when we are able to do that, we are able to attain the 'appearance' of objects and things detached from the place bound world we inhabit. If a technology existed where we could be re-embodied electronically in the space we were observing, without the need of mediated engagement, the distant place would be the 'here'. Telepresence does not yet offer this

"Virtual reality is generally understood as hyperreality that has no referential origin." Yet, people who don a glove and a headset to enter Virtual Reality are at times able to construct the world they enter. The result is more than passive acceptance of a simulated world, it instead plunges the user into a place and time that is seemingly different from the one they left to enter the Virtual world. It isn't opposed to the real or the material, but to the actual. This is an in-between world, it isn't just pure presence and it isn't just a simulated fantasy.

Telepresence, rather than a technology or tool for obtaining knowledge, can be viewed as a deception, allowing users to engage in lies rather than truths.

Representational technologies have been used throughout history to enable action and to deceive the viewer, so that the viewer is able to manipulate reality through the representation that is possible in the technology.

Film or fictional cinema is based upon lying to a viewer. An example of this is the studio set where viewers are led to believe that an actual space exists where a story takes place. The viewer is placed inside the space and to identify with the characters and to experience the story from their point of view.

Editing and montage is the mainstay of these artificial realities in film. Montage can be temporal as experienced within a driving scene where rear projection images are used in the background to "move the car". Temporal montage is more common as it can cause a sense of present in a virtual space.

Electronic keying is an advance in technology and allows one to combine fake realities such as a weatherman in front of a map. In addition to electronic keying, computer imaging makes layering images possible and allows for the creation of moving images of non-existent worlds. The focus is no longer on creating an illusion of reality, but one where the importance is blend virtual and reality together.

Virtual reality provides a subject with the illusion of being present in a simulated world and being able to actively change this world. The user is given control over an artificial reality. Telepresence is different. Telepresence allows the subject to control the simulation and the reality itself. It enables one to remotely manipulate physical reality in real time through its image. The body of a teleoperator is linked in real time to another location in order to affect reality at its location. Through telepresence one can repair a space station, bomb a military base, or perform surgery.

Essentially telepresence is about anti-presence or acting over distance in real time. Telepresence involves electronic transmission of video images, so the construction of the representations allows for this to take place at the same time, or 'on the fly'. It therefore allows action to be adjusted on the fly. The ability to receive information about a remote place in real time allows us to manipulate physical reality in that place by our being able to affect that place. The power of a "real-time remote control" has not previously existed.

The Robot in the Garden: Telerobotics and the Telepistemology in the Age of the Internet, edited by Ken Goldberg, page 158.

Telepresence and Art

Telepresence Art is a subset of electronic interactive art. It is based on telecommunications, the human-machine interface, and computers. The stress is not on composition, but on choice and action and bringing the audience into the foreground of the piece. The audience becomes the 'user' or the 'participant'. The context of the work is more open-ended and unfolds as the user participates within the framework of the piece.

Telepresence is viewed as a new art form or medium. In this form of artwork the wordage that is often used is cyberspace, virtual reality and telepresence. The common use of these words causes confusion. Time and space are intimately involved in telepresence.

William Gibson first introduced the word cyberspace to the public in his book, "Neuromancer". When he used it he introduced it's meaning as "a graphic representation of data abstracted from the banks of every computer in the human system." Cyberspace is a man-made space where people who are equipped with hardware can engage with a digital environment and other people in an environment based upon vision, hearing, and sometimes feedback devices. The ability to interact in this environment is dependent on hardware and software.

The phrase "virtual reality" was first used by Jaron Lanier, and is more generic than the word cyberspace. "Virtual reality" is a field of activity where humans engage and interact in a man and machine made environment. Images are used that represent computer data. The metaphor used to clarify the term "Virtual" is referring to the image of a person 'inside' a mirror. Similarly, the space that is behind the flat surface is a "virtual space". The same thing occurs in the screen of our computer monitors. The surface of the mirror or of the monitor is the boundary between the surface of the "virtual" and the "real". "Virtual reality" combines the ideas of 3-dimensional space and the person entering into a virtual image, where the participant is immersed in cyberspace.

Until recently, telepresence has been the focus of the scientific community giving us access to worlds that are too dangerous for us to visit: operating lunar vehicles from afar; robotic arms underwater and in space. Telepresence in the art world does not have the same goal as its use in the scientific. Scientists are interested in control of action in an environment that is remote. In the art world telepresence focuses on communication. In painting and sculpture the communication is unidirectional. The painting or sculpture broadcasts to the viewer. This communication structure is the same in mass media where the television or radio transmits information to the viewer. Telepresence art questions this form of communication and highlights the act of engagement with a piece.

Telepresence art looks at the cultural changes that are coming about as a result of remote control, remote vision, telekinesis, and the real-time exchange of visual and audio information. It challenges the interface or relationships that exist with the help of technology. It creates a unique context or field where participants enter the artwork to experience invented remote worlds. This can bring such things as scale and perspective into first-hand experiential realms for the viewer. The viewer becomes the participant. The amount of immersion is often dependent upon the interfaces used to link the networking machines that drive the remote world, the more intuitive they are, the more immersive they are.

The palette of the artist is the computer network, the interface, and the remote environment. The 'brush strokes' are the communication and relationships that are built between the palette and the participants.

Telepresence brings into art a new communicative experience. The sender/receiver model isn't complex enough to deal with the multimodal nature of networked, collaborative, and interactive events that are possible with telecommunication. In telepresence links, images, video, and sound are transmitted but there are no senders that are attempting to convey particular meanings to the receivers. It's an individualized bi-directional experience.

According to Buadrillard, communication is "an exchange, … a reciprocal space of speech and response. Telepresence allows for feedback, and action that can create change in the remote environment. Therefore, it is bi-directional.

The ability to remotely manipulate distant objects, including remotely located people raises questions about our relationship to the objects, how can we know those objects, and about our relationship to ourselves, our minds and our bodies. Telepresence art explores these issues by presenting experiences and situations that test our conceptions of presence and absence, seeing and being seen, and manipulating and being manipulated.

Being here and now means being present with your own physical body. Jackson Pollock used to give art performances using his body. He was confronting the issues of the art of presence rather than the absence.

Digital technology has brought us the idea of the disembodied presence. Telecommunications art goes back to the late 1970s. Two artists, Kit Galloway and Sharry Labinowitz, created a piece called "A Space with No Geographical Boundaries" in 1977. Artists performed virtually on one

screen from different continents. In 1980, they created a public interactive performance entitled "Hole in Space", that used large screens and cameras to virtually link two streets in NYC and LA. People who walked by figured out how the screens and cameras worked and started using them.

With the ability for real-time action in one's present and physical space able to affect change in a remote environment, the idea of distance is undergoing a revolutionary change focused on the irrelevance of time on global scales. What is interesting about this is looking at and attempting to understand how these changes will alter social and cultural norms and how it will create new ones, what unpredictable things will come out of this, and what contexts will be created in art forms.

The transmission of video images and sound over great distances becomes a new place, a bridge in real time that creates the new world of a telelocation. The continuity of time that occurs in video supercedes the integrity of real space. If we experience this daily in an office or studio or lab, what effect will this have on our daily lives, our understanding of things and places, and our relationships. What type of relationships do we have with our answering machines, our cell phones, and our ATM machines?

Prior to the advent of electricity there was a public space that was an important part of daily life. Once towns had electricity, people stayed home more and family life became more private. Now our public space is the public image which includes surveillance, relationship, and memory. Social behavior is changing because of the ubiquitous nature of video surveillance, videophones and the popularity of camcorders and webcams.

The historical development of images creates three kinds of logic. The formal logic of the image occurred in the 18th century with painting, engraving and architecture. The figure was the primary importance, and the flow of time was irrelevant. Time was absolute. Photographs and Cinematography came about in the 19th century and issued in the dialectical logic of images. The images corresponded to events in the past, a different time. At the end of the 20th century we saw the advent of video, computer and satellites. This brings us to the age of paradoxical logic; images are created in real time. This gives priority to speed over space, to the virtual over the real, and so it transforms our idea of reality to something that is constructed. That realization allows us to see that reality has never been given; it has always been either generated or acquired. Images never really copied reality, they just gave it shape. However, the paradox is that it is no longer a well-defined distinction between the duplication and the real.

It used to be that the shortest distance between two points was the straight line; with

telepresence, the shortest distance is real time via satellites. Our understanding of speed or the intensity of time used to be expressed in distance per hour…. Time is now expressed in bauds or bytes per second.

In an art context, remote communication is an exploration of the aesthetic of change. It is about the focus of real time over real space, and the relationship of the artwork and the participants.

Links:
http://www.ekac.org/Telepresence.art._94.html
http://www.ekac.org/dialtelep.html
http://baby.indstate.edu/CU-SeeMe/devl_archives/oct_94/0266.html
http://baby.indstate.edu/CU-SeeMe/devl_archives/oct_94/0266.html
http://www.ekac.org/ornitorrincoM.html
http://www.ekac.org/interactive.html

1 - William Gibson, Neuromancer (New York: Ace Books, 1984), p. 51.

2 - Jean Baudrillard, "Requiem for the media," in Video Culture, John Hanhardt, ed. (New York: Visual Studies Workshop Press, 1986), p.128.

3 - Machiko Kusahara, "Presence, Absence, and Knowledge in Telerobotic Art", The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet, edited by Ken Goldberg, p. 199.

Technological Theories and Models of Telepresence

Slater's & Usoh's Model

In 1993 and 1994 Slater, Usoh, and Steed identified telepresence as the suspension of disbelief, where the user is in a world other than where there real bodies exist. They see two sets of determinants for the sense of presence: external and internal factors.

External factors involve display quality and consistency of presentation that are visible across either the monitors or HMDs as well as the ability to interact between the two environments, and the ability to view onself as the anthropormorphic image utilized in interaction if using an avatar. The other important factor in the external realm is the ability to affect actions in the 'other' environment.

Internal factors are the sense feedback to either construct some new entity within one's mind, an external entity, or remembered. Senses must play the visual, auditory and/or kinestetic representation systems. The other internal factor is perceptual which has to do with the point of view of the user. It may be first person point of view, the point of view of an observer of action, or an abstract point of view, which would be as if the user wasn't present at all.

In order for telepresence to be effective, it must have characteristics that allow for the different styles of communication inherent to the users.

Sheridan's Model

Sheridan describes telepresence as "the ideal of sensing sufficient information and communicating this to the human in a sufficiently natural way that she feels herself to be physically present at the remote site," (Sheridan (1987).

Sheridan also calls telepresence a "compelling illusion" and "a subjective sensation." According to Sheridan, telepresence is a phenomenon where the user loses awareness of the local environment s/he inhabits. To Sheridan, telepresence is an experience, a sort of existential existence where the user becomes convinced they exist in the remote environment.

The strength of telepresence is based upon the richness of sensory information and the amount of control the user has on the distant environment.

Steuer's Model

Steuer says "presence is the sense of being in an environment." Telepresence happens when a user is simultaneously involved or participating in a local environment and in an electronically mediated remote environment and feels they are more a part of the remote environment. Communication mediums are responsible for this 'feeling' of being more a part of the remote environment.

Steuer's framework has two major dimensions that are the determining factors of telepresence. These are vividness (which is the ability of a technology to provide a sensory rich environment) and interactivity (the ability to influence the content of the mediated environment). He also states that the experience is personal and the impact of these factors will differ among different people.

According to Steuer, vividness has both breadth and depth. Breadth is the number of sense modes that information is presented. Depth is the amount of information within the available modes. Broadband offers more depth. Breadth would include more channels of information such as visual, audio, and force feedback.

Interactivity has three main categories… speed, range, and mapping. Speed of interaction is response time. Real-time is the upper most limit for speed. Range is the power of the user to interact and manipulate the environment. How much can the user change the environment and to what degree? Mapping is how the user can affect the remote environment, and is determined by the type of controller that is utilized for telepresence.

Schloerb's Model

Schloerb states that telepresence occurs when "the person perceives that he or she is physically present in a remote environment." He makes a distinction between objective and subjective telepresence.

Objective telepresence involves performance in being able to perform a remote task. Subjective telepresence involves the judgement of the user that the user is physically present in the remote environment, it isn't related to successfully performing a remote task. Subjective telepresence is experiential in nature.

Schloerb doesn't look into the relationship between machine and user except to say that the information flow between the two is "the most important type of control/sensory transformation."

Schloerb believes that the most important aspect of telepresence is the abiltity to do work and his work focuses on objective telepresence and also questions the usefulness of subjective telepresence.

Zeltzer's Model

Zeltzer offers a different perspective. He views presence as a "sense of being in and of the world. " His theory is that the important characteristics of graphic simulations include autonomy, interaction, and presence. The degree of human control is autonomy, the ability or capability of real-time control in interactivity and the bandwidth available for sensory feedback is the presence.

He views the degree that the world is capable of simulating the interactions possible in a physical world so that the model is able to respond to real-time inputs from the user. He focuses on the method that interactivity is available.

Zeltzer's three components define his "AIP cube" – Autonomy, Interaction, and Presence. A system that can be mapped to the maximum on all three components is a virtual reality system. He doesn't share the ideas of the benefits of presence that many others hold, he thinks that there is a high likelihood that a high presence would be physically demanding and tiring.

Witmer's & Singer's Model

Witmer and Singer define presence "as the subjective experience of being in one place when one is physically in another", and "a subjective sensation, much like 'mental workload' a mental manifestation."

They are interested in whether or not presence corresponds with fidelity, whether or not there is a relationships between presence, learning and preformance. They look at the question about whether or not presence can be measured.

Witmer and Singer categorized factors that might affect the experience of presence and say that there are four major categories of factors: control factors, sensory factors, distraction factors, and realism factors.

Psychological Approaches to Telepresence

Behavioral Cybernetics Model

During goal directed actions humans respond to information present in the environment by manipulating the enviornment. This changes the feedback and elicits other feed-forward response. Humans conduct feed-forward with the aim of controlling feedback in a continuous or contiuously sampled process that persists until reaching some feedback goal. This give and take of feedback and feed-forward alters the experience and the relationship.

Changes can occur when there are time disturbances when the timing of feedback and feed-forward are unexpected, or when the spatial relationships are different than expected, and in filtering the amount of information is different than expected.

Optimizing the disturbances by finding solutions to these unexpected differences is the goal since Cybernetic telepresence is the degree that these disturbances are avoided.

Telepresence as "Flow" Experience

Flow is a state where the user's attention is so concentrated on some task that outside stimulus doesn't interfere with the experience. This includes the non-awareness of time passing. Immersion is another term for this. Even the awareness of 'self' disappears, this is questioned in terms of whether telepresence is a distinct class or whether or not flow is happening during the user's experience with telepresence. Sheridan suggested in 1992 that even clever storytelling can induce this state.

Telepresence as Distal Attribution

This view begins with a psychological distinction between sensation and construction. Loomis called telepresence "a compelling impression of being at the location by the slave device" and identified this as distal attribution. A person externalizes and creates an identity that is including the external world. Sensation is the awareness of physical energy, and perception is the construction of meaning utilizing sensation.

Telepresence can be seen as the degree the user makes the distal attributions the remote environment. If one were to shif the awareness of self from their own hand/arm to a robotic arm as part of them, then the distal attribution would be effective and successful. The difference

between telepersence and distal attribution is how aware the user is of the linkages (robotic arm). If the user transcends the robotic arm as his own appendage, this is telepresence. If, on the other hand, the user recognizes that the robotic arm is the slave device at all times, then this is distal attribution.