A Cultural Perspective on Mixed, Dual and Blended Reality

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ABSTRACT

This paper is an anthropological perspective on the impact of Dual, Mixed Reality and 'PolySocial Reality' (PoSR) on Location Awareness and other applications in Smart Environments. We intend to initiate a friendly inter-disciplinary discussion on the interaction aspects and cultural implications surrounding these new forms of integrated technologies. Anthropologists examine human group behavior in the context of culture. Because the LAMDa workshop is addressing 'group behavior,' we will contribute to the workshop with our understanding of humans, culture and group behavior and to learn from others what type of group behavior is expected as new technologies and their subsequent experiences are created for human use. When we discuss human group behavior, we refer to the definition of a social group: a collection of humans who repeatedly interact within a system.

Humans can, and do switch context between environments and blend traces of one into the other in a socially unconscious manner often seemingly simultaneously. We propose that the cultures and behaviors of humans are increasingly actively permeating Internet and network-based applications, as well as those that are geolocal. With the future Internet of things, Dual Reality and Mixed Reality, the opportunity for humans to extend their own blended reality, as well as to create new ones is unfolding. That said, because humans interact within groups, the multiplexing of their mutual blended realities rapidly creates a PoSR. Sorting out the relationships between realities as well as between synchronous and asynchronous time and geolocal space can create a condition where realities are simultaneous and the idea of 'x' can be perceived as equaling 'not x.' We explore this new type of interoperability between virtual and physical, ideational and material, representations and objects and culture.

Author Keywords

Time, Space, Asynchronous, Ubiquitous, Pervasive, Dual Reality, Mixed Reality, Blended Reality, Polyreality, PolySocial Reality (PoSR)

ACM Classification Keywords

H.1.2 [Human Factors]: Human information processing; J.4 [Social and Behavioral Sciences] Anthropology; B.4.3 [Interconnections (Subsystems)]: Asynchronous/synchronous operations; K.4.1 [Public Policy Issues]: Transborder data flow; K.4.3: [Organizational Impacts] Computer-supported collaborative work

INTRODUCTION

The Internet was developed as a framework and architecture with a fairly specific way for the world to interact within its constructions. We argue that the world has found a way to imbue itself within, around, underneath and on top of the Internet, and is indeed, currently in the process of expanding the Internet well beyond that which resides in machines.[1] New technologies based on sensor and actuator networks are enabling the future Internet (the Internet of Things) with Dual Reality and Mixed Reality as present candidates for providing further ways for people to interact and dialog with, adapt to, and adapt their environment, combining and experiencing real and virtual space in new ways. As anthropologists, we suggest that people's adaptations of technologies will themselves create new ways to use those technologies which will then lead to new adaptations and new uses, etc.

A new heuristic for human experience now blends physical and virtual space in personal, asynchronous time and physical and virtual space in group oriented, synchronous time. At present, the Internet has modified our experience of both space and time, within its domain rendering time as asynchronous and spatial locations as ubiquitous. When the Internet was composed of fixed servers and clients, these two views of time and space were contextually moderated. With the advent of ubiquitous mobile devices, and the sensor rich environments of Dual Reality, Mixed Reality, and the Internet of Things, new capabilities and lived experiences will lead to a convergence of those views.

This will free people to adapt their interpretation to more closely correspond to old or new group specific cultural beliefs and expand the number and size of social networks that they can usefully participate in. As the technology of blending multiple realities improves, the capacity for people to make substantive changes to the world will be greatly enhanced. It is important to note that this condition is true only if the new and future technologies increase peoples' capacity to continue to make and share rather than simply depend upon these for consumption. People need to help create and inform the applications in which they participate, and to create new paradigms and new capabilities--otherwise humans are in danger of functioning more as data generating objects than as active integrations of a physical and virtual reality.

RELATING THE WORLD

Trying to map the Internet and its successor adaptations to the real world is a complex process. As people use the Internet, they are increasingly mixing their online behavior with their 'real life' behavior. This has resulted in new

forms of behavior transference that include detachment, impatience, fixed linear knowledge, and an expectation that other people will respond with not only the depth of data of a computer - but with its immediacy.

At a low physiological level, all people experience roughly the same basic information from their local environment. We ideally have similar sensors and at a low level our nervous system interprets sensory information in the same way. There are some natural or accidentally caused variations, but mostly, the same light, sounds, odors etc. are part of a consistent human sensor actuator framework. Within a cultural group, people practice blended reality. Blended because they share general and specific knowledge not available to other groups which changes the way they classify and interpret sensory data. For example, almost all humans can make the same distinctions in comparing light at different frequencies. But there are many group specific color terminologies that reflect different experiences of light. Although everyone has roughly the same sensors, they have selectively different experiences that give them different contextual approaches to knowledge. In a way, then, before we even add electronics to the equation, people are already in a dual reality of their own making. [2]

We suggest that this is the social form of the idea of Blended Reality--without its specific call for a mixture of real, rendered, and sensory environments (or rather, minimally based on human senses though accommodating sense augmentation). This addresses the way that humans switch context between environments and blend traces of one into the other in a socially unconscious manner, often seemingly simultaneously.

HUMAN RELATIONS AND NETWORK CAPABILITIES

Although historically people have had standards to facilitate analog interaction and communication, humans have not typically related to each other using formal logic protocols similar to those found in the machines on the Internet. Through culture humans continuously change the landscape of their life (and their world in the process) by creating hardware, software and the relevant associated protocols required to use them. People adapt their world, rather than struggle to adapt 'as is' to changes thrust upon them [3].

The Internet, combined with mobile technologies, and increasingly with sensors and actuators as in Dual Reality and Mixed Reality, is the latest human 'landscape changing' adaptation. Initially, the Internet was adapted as a means of personal communication through email via desktop computers. Public news feeds, FTP sites and 'bulletin boards' were early tools for sharing information. As the Web became more widespread, and as software became more available for humans to contribute personal data, more and more humans came online and interacted with each other by playing games, trading information, and sharing advice as well as stories. They also created

personal content within the context of those activities, thus contributing to the creation of 'virtual worlds,' 'virtual societies,' avatars, and broader applications for human self-representation, societal affiliation and direct communication. The new networked environment is slowly surpassing the analog structure of fantasy, books, radio, film and television, by containing those elements within its structure and making them malleable--and with mobile and sensor capabilities--portable and contextual. We suggest that the Internet as human adaptation has changed the landscape of life by supporting new behavior potentials with unexpected consequences. These new behavior patterns are revealed as some people spend more time on the Internet and networked mobile devices, than locally with each other, and/or may have behavior that changes as a result. New consequences infiltrate daily life as a by-product of the cognitive, physical, and social systems that humans switch between as they communicate with others.

The network space that humans have begun to occupy poses some interesting paradigms for human group formation, culture, and the associated expressions through the usage of the new technologies' various user experiences. With the addition of sensor networks, a future Internet (the 'Internet of Things') based on Dual Reality, Mixed Reality and other technologies, will allow for a more synchronous, albeit networked, simultaneous human experience. The future Internet will not only encompass a single person and their laptop, computer or mobile phone, but will reside as an intermediary between whatever virtual and 'real' (culturally constructed and experienced) worlds a person happens to be multiplexing at any given time. Because of this, within the context of the Future Internet, using terms like 'Augmented reality,' 'Dual Reality' and 'Mixed Reality' ('Virtual Reality' is omitted for lacking interactivity with other worlds) may be limiting in scope. Those terms do not currently address the multiplexing scenario that will be commonplace amongst groups of humans using the future Internet simultaneously. As an alternate, at least for the human interaction group perspective, we suggest the term PolySocial Reality (PoSR).

PoSR is the way that humans will be using the Future Internet. Within a sensor/actuator connected environment, humans will be generating data in the physical world that will simultaneously interface with any one of multiple environments. This means that one action in the physical space, could trigger results in numerous applications such as Second Life, Facebook, foursquare, Twitter, Massive Multi-player Online Role Playing Games (MMORPG), geotracking, or any one of many that haven't yet been implemented such as health records or some type of family notification program.

The closest that technology gets to this model in mass commercial use at the moment is when a geolocal app uses the mobile phone as a single sensor. If one has set up the foursquare app (an app based on using a physical location to update status within a network) to both post their location data to Facebook (a social networking site) and Twitter (a microblogging social network site) that is an

example of a one-to-one-to-multiple model, where the human activates the phone-as-sensor by carrying it to some location, which is then transmitted to one point, foursquare, which then distributes it to other applications. The phone can have its sensor location on, however. Indeed, GPS (global positioning system) records can now be used as subpoena evidence, even when a phone has not had its 'location,' 'turned on' by the user. While other programs can sense location on a mobile device, current devices are not simultaneous in usage. People are generally only in one app at one time.

SPACE AND TIME

In the asynchronous nature of social computing, time has become a threshold or window rather than a 'moment to moment,' conception. The shift from the synchronous oral communication used during most of human history to asynchronous Internet communications is rapidly under-way. Humans have more asynchronous capabilities on the Internet and seem to be using them. This has impacted how people conceive and experience the nature of time. Time has become more personalized, and each person's experience of time has become paramount. Needing to be 'somewhere' in order to utilize communication has become moot: one can be anywhere in space, that there is a signal and use time asynchronously.

Broadcast technologies, beginning with the telegraph, promoted capabilities that modified conceptions of space, making some of its aspects irrelevant. With the advent of the mobile Internet, space once again has become modified, and humans are now able to move within communications spaces in new physical ways. Thus, time, space and the Internet have become ubiquitous, and within that, omnipresent, as the potential to communicate, collect and share information is now 'everywhere.' Furthermore, with contextual geolocal services and their extensions into Augmented Reality (AR), the property of ubiquitousness has begun to function as an 'extension of the self' as those services quietly serve, sense, and deliver information in a similar way to the 'self.' In other words, making time and space personal and unique, creates an 'inner ubiquity' alongside that found in geospace.

Lifton [4] discusses the 'vacancy problem' in relation to users of virtual worlds both with respect to their (lack) of presence in their local 'reality' when engaged in a virtual world and the paucity of the virtual world when users are not engaged. He proposes that Dual Reality will potentially addresses the 'vacancy problem' by making both the local reality and the virtual reality interoperable in some respects by mapping information from each to the other using real, or virtual, sensors. This is also a useful concept for discussing social and cultural issues arising from the increased use of technologies to support the user experience for augmented, mixed and blended realities. Despite developing the major part of his example around interlinking a location in Second Life with his lab at MIT,

Lifton does not fully address the social element and aspects of Dual Reality. In part, this results from the rather 'fixed' locations that he is linking, and by his restriction of the social component to those people in the lab who share both aspects of the dual reality. The introduction of mobility via phones and other devices to the context will require a generalisation of the concept of Dual Reality.

Although there are a number of mobile applications that incorporate augmented and mixed reality, there are serious issues even with the simple case of Dual Reality involving one locally mobile person. At its most serious, it is potentially dangerous. One study relating accidents and mobile phone use concluded that using a mobile phone while driving, increased the risk of accidents for up to 10 minutes following use [5]. It is reasonable to assume that maintaining attention to two separate, if interlinked, realities could be, at the very least, distracting. One way to partially alleviate this is by focusing more on linking the virtual world to the local one, with local effects from virtual events through appropriate actuators.

The problem becomes compounded when we consider that once we have truly dual realities, these will in fact rapidly become compounded, as people begin to simultaneously engage in multiple dual realities, or introduce sub-dual realities within a virtual world. The latter case introduces new development concerns, because only one aspect of the sub-dual reality can be represented in the virtual world or we find ourselves having to implement both the virtual aspect and a virtual representation of the other-local physical aspect.

Descriptively, some of this could be subsumed under present concepts of mixed or blended reality, but as Lifton notes, these do not address the same issues as Dual Reality. Dual Reality relates to interoperability between the two realities through sensors and actuators, not simply by rendering one in the other. Furthermore, once we start to consider two or more people interacting in contexts where they share one common virtual world between them, together with different local realities and possibly additional virtual environments, dual or not, inter-operability becomes very complex. To avoid both physical danger as a result of local vacancy in the worst case, and to maintain effective and engaged relationships, enough information about the experienced reality of all the participants must be exposed to each other, and must become a part of their own experience of reality.

PoSR builds on a modification of Lifton's definition of Dual Reality [4:16]: "An environment resulting from the interplay" among two or more dual realities. "While each [reality] is complete unto themselves, they are also enriched by their ability to mutually reflect, influence, and merge into one another." Unlike the base Dual Reality concept, additional hardware is not required (other than infrastructural advancement in network and computing technology), though the underlying sensor and actuator flows must be available within a PoSR architecture for additional processing in creating a consistent environment, and in the case of two or more people's involvement,

mutually consistent. This would not be just a rendering into a composite reality, but result in a new reality, a PoSR, that is simultaneously mutually consistent with each underlying reality. Due to differences in knowledge, the field of sensory awareness and other factors, two people will not experience a PoSR in the same way (just as two people in the same location do not experience exactly the same reality), but their experience will be based on compatible viewpoints on the same PoSR.

For example, presently, geolocal services can be seen as ubiquitous asynchronous services for conceptualizing the world that combine old ways of navigating ('x' marks the spot) with a 'network' experience (not 'x'). People are simultaneously in specific physical places 'x' (due to the physicality of their bodies and the planet) and 'everywhere,' 'not x' (network space). Thus, they navigate a world where spatial location has the potential to be both 'x' and 'not x' at the same time. While it seems logical that ('x' $\neq$ 'not x') -- in a PoSR the perception of ('x' = 'not x') is true with regards to the perception of usage of mobile devices and geolocal applications. For example, if someone is walking down the street whilst talking on a mobile phone, their body is in 'x,' the physical location. However, they are also connecting to 'not x,' the network, an ethereal location where their conversation is taking place. They appear to conceptually be in two locations, both 'x' and 'not x' simultaneously. This is the condition that we suggest when indication that simultaneously "x" can equal "not x." We refer to our notion of ('x' = 'not x'), as a PoSR as it contains a social experience that combines both physical location and virtual non-physical location referents.

Yelp is a localized app that provides a location guide for restaurants, services, and shops as well as reviews and rankings determined by the members of its service. Yelp has has both a web and mobile component. If we apply our heuristic to the Yelp app, when someone is in physical space while simultaneously connecting to Yelp via a mobile for contextual information ('not x'), then we can say they are both in 'x' and 'not x.' Foursquare is an app based on using a physical location to update status within a network. This also allows for 'x' and 'not x' to exist simultaneously, as people "check-in" to a network ('not x') while in a physical location ('x').

Geolocal apps create conceptual frameworks within which people are able to reconcile these potentialities of location equaling 'x' and 'not x' for particular purposes--and to rapidly shift between, and even integrate, these. This frees people to adapt their interpretation to more closely correspond to old or new group specific cultural beliefs as they see fit.

With ubiquitous communication, Mixed Reality and Dual Reality, people are simultaneously in specific physical places (due to the physicality of their bodies and the planet) and 'everywhere' (network space). In summary, people now

navigate a world which is based on free variables in human constructions and PoSR, rather than specifically based on space and time.

CONCLUSION

Concepts such as Dual Reality and Mixed Reality, and their subsequent technological implementations, go some way towards defining the base levels and identifying the onto-logical principles for the creation of what will effectively be a new world. What will be critical is the capacity for people to construct, relate and integrate multiple unique configurations of these under the control of ordinary users.

Innovations in Dual Reality and Mixed Reality will have greater success to the extent that people are able to use them to enhance their ability to inject and extract value from their personal networks and to set up new complex forms of exchange. That is, success will be proportional to the extent that those innovations empower people to be makers, not just consumers.

Dual Reality, Mixed Reality, and other multiple realities depend on the capacity to support complex interactions between and impacts of these (PolySocial) realities. This creates interoperability between virtual and physical, ideational and material, representations and objects and culture. Going forward, this knowledge should be beneficial to any developer wanting to understand, at least in part, the nuances that humans have when interacting with each other within groups and within networks and to prepare for the eventuality of multiple relationships and orientations with the real world, and all virtual spaces.

The potential for change is incalculable as Internet technologies become more connected to the world through sensors and are able to uniquely adapt to and be adapted by the the people who use them. Although people have always, through their culture, occupied a blended reality, the capacity for large scale integration of ad hoc arrangements of these as a resource for living greatly expands the range of new technologies and new ways of life to develop.

ACKNOWLEDGMENTS

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