Mindfrog

Leaping from Mind to Mind

www.mindfrog.net

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Mindfrog's goal is to use technology to explore time, space, relationships, and communication theory through computer-aided communication tools utilizing wireless sensors, video, audio, and streaming technologies. As computers gain mobility and social order is adjusted more rapidly by technology, the members Mindfrog, Rane Sessions, Tomonori Yamasaki, Siggi Matthiasson, and Christian Grossmann, believe that fundamental changes will take place in how people interact with one another. Our thesis project will utilize emerging technologies in order to analyze and substantiate how the evolving state of digital communication is most effectively affected.

To understand the concept and it's relevance to this Multimedia Graduate Program, we will first discuss the underlying technologies which both focus and enable this discussion with a set of parameters. These parameters are mobile and wireless computing, streaming video and audio, and interactivity and feedback. These three pairs of parameters confine the scope of our thesis project without limiting the nature of the emerging technologies. Also, we have decided to implement these three pairs of parameters through a mobile, point-of-view interaction between two or more participants in a hyper-realistic digital communication process. Although our initial decisions on technology may encompass a vast array of emerging technologies, their implementation as follows is solely as carriers of the underlying conceptual discussions found later in this paper.

Wireless and mobile computing has seen vast improvements in bandwidth, power and range. Our ultimate goal is to use the Internet as the medium for our thesis project; however, current bandwidth limitations in wireless Internet access have forced us to consider simulating future wireless Internet bandwidth through the use of wireless local area networking (wireless LAN) technology. As of the Fall of 2000, wireless LAN offers multi-nodal, broad bandwidth (11 Mbps) at affordable prices. Although the range is only several hundred feet, we feel the increased bandwidth over expensive wireless Internet (128Kbps) significantly out weighs wireless LAN's somewhat limited range.

Mobile computing has also witnessed a surge in progress in the last 5 years. Wearable computing has pushed the boundaries of mobile computing by increasing processing power to nearly that of desktop machines. With so much mobile processing power combined with vast bandwidth, content creators can begin to utilize much more than simple text exchange. Audio and video will soon play a dramatic role in the mobile computing industry.

Our second technological parameter pair is that of streaming audio and video. Although bandwidth has increased substantially, digital compression is still a key element of successful video and audio transfer. Our thesis project utilizes point-of-view (POV) cameras (the audience sees video as if looking through someone else's eyes) attached to a wearable computing device. This device generates a video stream which is fed through the wireless LAN to an audience.

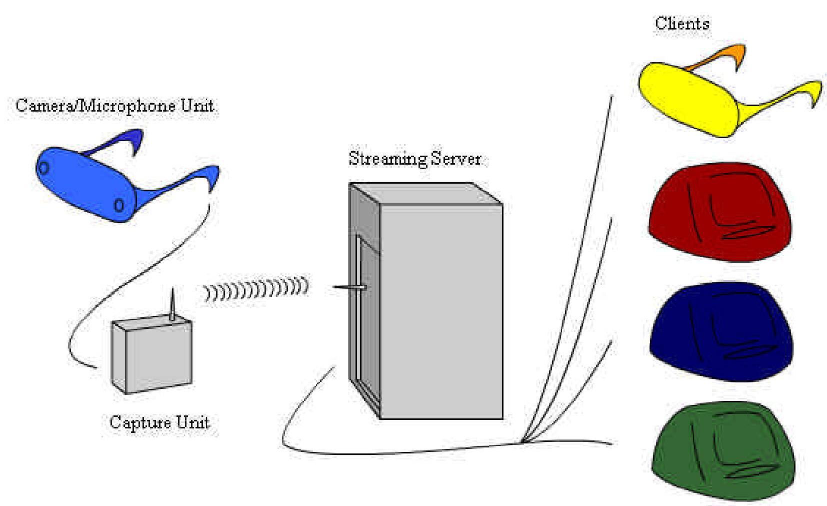

Figure 1: This diagram gives a high level overview of the technology involved. The camera/microphone unit sends video and audio and receives audo via a wirelessly connected streaming server. The clients receive video and audio while sending audio via their internet connection.

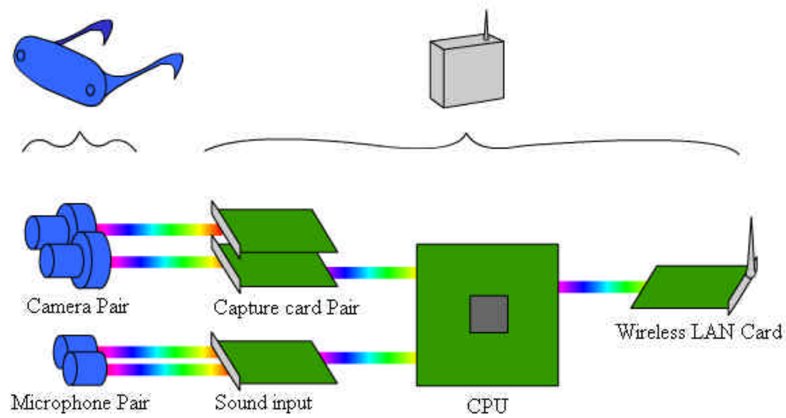

Figure 2: This diagram gives a detailed flow of the POV camera.

As of September 2000, Real Networks is capable of providing broadband (300k) audiences with full-screen, full-motion, VHS-quality video over the Internet. Similar streaming technologies provided by Apple, Inc. and Microsoft, Inc. are soon to follow.

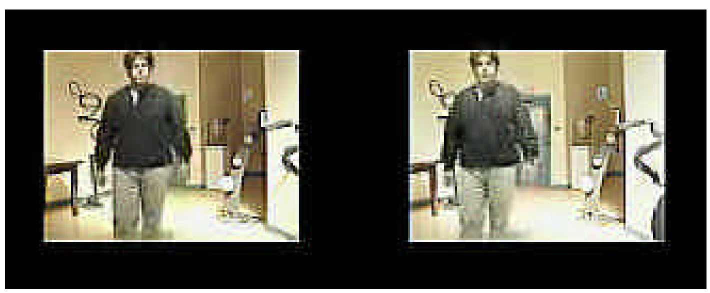

Figure 3: To experience this sample of actual 3D video generated by the POV camera technology requires the “black viewer” submitted with the proposal.

The differences between this thesis project and simple video conferencing goes well beyond the three-dimensional audio and real-time, stereoscopic, POV, video experience. A fundamental divergence from mainstream technologies comes in the unique interactivity between the video source and the audience. The online audience, the “viewers”, which may be on standard desktop computers but preferably using the head mounted displays which we will promote, will engage the person recording the video through voice feedback. The person recording, the “recorder”, will have two channels of audio projected virtually into space roughly 5 feet in front and several feet to either side of their position. The “recorder” will be able to select which “viewers” will reside in the two audio channels. In effect, the “recorder” can choose travelling companions through the two voices as accompaniment.

Since two “viewers” will have the same visual and auditory experience as the “recorder” and be able to respond to those perceptions with voice driven interaction, a complete cycle of communication is available to the participants. Since the individual “viewers” do not directly communicate with one another and more than two participants are interacting, a communication process is generated which is slightly different from both small group experiences and peer-to-peer communication.

As of September 2000, the proposed form of communication has not been created by any other medium; not film, television, or the current Internet. We believe that experiencing the world through someone else’s eyes and ears, while being able to communicate with that person will have profound impact on how we view our surroundings. We will need to determine what content best utilizes the technology and more importantly how the technology can be expanded to include the content we envision.

Due to the fact that no one has every attempted this form of communication, we can only derive from similarities in other research as to the final outcome of the experience. Similarities are readily found by generalizing the digital experience several generations back to video conferencing, film, e-mail, or even telephone interaction.

Similar to all these technologies, at its root, this thesis project delves into the practice of communication. To successfully understand a communication process several key elements must be considered. At the foundation of this understanding exist the somewhat obvious but non-the-less crucial concepts of time and space. Immersive technology alters the perception of time and space. Not only is the “viewer” subjected to someone else’s visions, but the “recorder” is encompassed by other people’s interpretations of those visions. This perceptive duality fundamentally augments reality for all of those involved. Also anticipated by this thesis group is the fact that live, unedited video may cause extreme lapses of boredom in the viewers. The adjustment to our implementation of time and space will carry a whole new meaning for definitions of ones surrounding environment.

Beyond the environmental definitions of a communication process, participants interact differently depending on the relationships established through a communication process. This thesis project will answer questions of how we use interactive audio and video to impact the users of our technology? And more over, what that impact is. These questions cannot be answered with any accuracy until a working prototype is built. Scheduled for the fall quarter of 2000 (for more milestones see included Appendix A), our prototype will offer insight into how content can be generated; how video can be processed, in order to achieve maximum or minimum effect. We anticipate a continuum of content which as in other technologies grows in favor with the technology or quickly diverges from practical implementation. As television soon discovered after its inception, simply broadcasting a radio performance did little to justify the video broadcast. Similarly, we hope to expand our understanding of the technology in order to cultivate new forms of relationships.

The initial concept for our content surrounds the highly complex generation of relationships, including boundaries throughout those relationships between machines as media, people and machines, and interpersonal communication. Privacy and intimacy will also be redefined by our technology and in so doing we expect the imperfections of humans to generate a new organic environment unlike that of the natural world.

Beyond intimacy, exist a multitude of layered interactivity, reflection of that interactivity and ultimately reflexivity. Reflexivity offers a new perception and understanding through augmented awareness. By adjusting modern concepts of privacy and intimacy, the aforementioned relationships between person and machine strive to evolve unpredictably.

The Mindfrog Project is constructing transformative linkages that will allow a community network to provide a sense of place. The Mindfrog Project uses the freedom of cyberspace to create a new kind of participation in community life. Mindfrog combines interactivity between a 3-D virtual reality with augmented reality. A transformative linkage is a connection that may or may not be accessed through language or text. The link transforms the way something is perceived or experienced. It could potentially become a paradigm shift in terms of experience or relationship. Mindfrog's transformative linkages are employing 3D sound (verbal communication), and stereoscopic video (vision).

Cyberspace is a vehicle for computerization. Computerization is the process of a domain of human activity becoming substantially mediated by electronic, programmable devices for rapidly storing and manipulating data in order to extract or transmit data. The transformative nature of Cyberspace lies in the new ways of manipulating information. The popular discourse about computerization and cyberspace are in two different camps.

The first camp, "Computopians", claim that the general adoption of Advanced Information Technology (AIT) improves people's lives by increasing leisure time, stimulating economic activity, freedom from drudgery on the job and at home, and providing better material objects. The second camp, "Compputropians", claim that computers harm social life by disrupting existing work and undercutting self-identify formation.

Mindfrog believes that technology is implicated profoundly in all human eras and that social change is both a cause and a consequence of technology. In the 1970's and 1980's, futurists worked from the premise that the computer was such a powerful machine that massive social change was inevitable. This position was a technicist position. Technicism assumes that technologies are created in laboratories and affects social process. The Computer Revolution view is also technicist in that in only can see social changes, as consequences not causes of technological change.

The popular discourse over knowledge in cyberspace implicitly assumes both that knowledge in cyberspace is a vastly expanded version of previous forms of knowledge. That knowledge production is automated, technologized and that it is de-centered, almost a hallucination that gives pride of place to paradigm shifts in the very character of knowing, and that cyberspace rethinks knowledge in profound, fundamental ways.

Mindfrog claims that it is our understanding of knowledge, rather than knowledge itself that changes in cyberspace. This in direct conflict with both the Modernist and Postmodernist discourse. The Modernists assume that knowledge in cyberspace is socially transformative because change follows from new disembodied knowledge. Postmodernists assume that knowledge is differently embodied in the new.

Discussion of knowledge in cyberspace should establish only one of four possible general claims:

1) *The Modernist Transformity Claim*: cyberspace is a different, knowledge society, because the accumulation of an increasing quantity of knowledge has led to a qualitative social transformation.
2) *The Non-Modernist Transformity Claim*: cyberspace is a different, knowledge society, because recognition of the fragmentation of knowledges and related phenomena has forced a new way of being in the world.
3) *The Modernist Continuity Claim*: there is as yet no distinct cyberspace 'knowledge society' in any important sense, because, while knowledge is accumulating, such accumulations has been characteristic of modern society for some time without leading to fundamental break.

> 4) *Non-Modernist Continuity Claim*: there is yet no distinct cyberspace in any important knowledge-related sense, because while a change in basic understanding of knowledge is characteristic of contemporary society, the character of knowledge has not changed in general, only our understanding of what knowledge is and has always been.

Mindfrog believes that the Non-Modernist Continuity claim (#4) is appropriate for the scope of our project due to the interdependence of computers and society. Additionally, we are viewing knowledge as the potential for situated activity. Knowledge can then be understood as a relation between an individual and a social or physical situation, rather than as a property of an individual.

The Mindfrog Project's attempt at discovering the implication of our technology will be to immerse ourselves in, rather than alienate ourselves from the observer effect. We will attempt to highlight rather than banish the context in an attempt to describe or explain the patterns identified with attention to the human dimensions of co-discovery with our informants/participants.

Identity can be defined on the computer as 'the sum of your virtual presences'. Individuality is invented out of distinctive choices of identity options made available through the options offered by culture. Since cyberspace allows access to various cultures that are not limited to place, this thesis project will create and explore both micro and meso communities. Micro-communities are close social relationships that involve direct interaction. Meso-communities are the intermediate level of social relations and the dynamics of communities. Macro-social relations are at the national and global level.

We are interested in exploring the use of our technology and the creation of relationships and communities. We will pursue the answers to the following questions of relationships and communities:

1) Are cyberspace relationships less group and more network-oriented?
2) What new kinds of intimate relationships are created and how significant are they?
3) What are the social correlates in friendship formation of less face-to-face and more screen-to-screen communication?
4) How will live video streaming and interactive verbal communication impact friendship formation in a hybrid of face-to-face and screen-to-screen communication?
5) How are communities different in cyberspace?
6) Are they substantially more network-oriented, and even less group-oriented?
7) How much does cyberspace speed up the separation of space from place?
8) How does cyberspace act as a go-between the imagination/reproduction of cultures?

The Mindfrog Project is utilizing a 3-D Virtual reality interface, facilitated by high bandwidth that will help create a feeling of 'place' which fosters the development of relationships and community. Humans spend time connected by modem to virtual spaces, and feel they are in a 'place'… a sense of 'thereness'. People in virtual communities usually use words on screens to exchange pleasantries and argue, engage in intellectual discourse, exchange knowledge, share emotional support, make plans, brainstorm, gossip, feud, fall in love, find friends and lose them, play games, flirt, create some 'art', and engage in a lot of idle talk. The Mindfrog Project will use 3-D video streaming with an interface instead of words on screens, which will allow the Virtual Reality participant to interact with the Augmented Reality recorder.

Technologies, like our recorder and viewer, can be thought of as networks of interacting human, organizational, human-made objects and practices. As defined by the theory of Technology Actor Network, or TAN, every element makes up and consists of the networks in which they are part of. Actor Network Theory (ANT) was developed initially to provide a better answer to the question "what is technology"? ANT argues for thinking of technologies as actor networks, which are mixtures of relationships among human and non-human entities. From the perspective of ANT, the construction of a technological network or system is an active process. The more passive elements of a system are “actants”, the more active are “actors”. Actors are active agents in the production and the reproduction of the network. Stable TANs have discernible trajectories. These trajectories are strongly influenced by the operation of those entities that become actors.

In ANT humans can be a type of “actant”. Humans are not more important than others are in terms of their potential and their capacity to be “actors” well as “actant” entities. Therefore, another important ANT basic premise is the potential for non-human agency.

Mindfrog avoids the trap of imagining that discourse is a closed universe. Our project instead recognizes the need to broaden the idea of signification or representation. We recognize that every aspect of the transformative linkage may come in all types of more or less hybrid material forms, which may have little to do with language. We recognize the underlying generative processes can be impacted by new developments. Technologies have real impacts that are informed by the understandings that humans have and influence TAN reproduction.

In Realist ANT (RANT), it makes sense to talk about the agency of non-human entities in TANs that such networks can be transformed – not just translated by non-human actors. Technologies are both initially constructed socially, and that reconstruction occurs repeatedly. The relative degree of autonomy of any particular TAN can be analyzed in terms of its manifestations in the various moments of reality (empirical, actual, and/or generatively real) in which it is implicated.

Technologies have material, determinant qualities because they embody the momentum of previous human activity. This momentum is particularly difficult to change in the short run when an actual TAN –integrates widely dispersed practices. It is the limitations on human action enacted by such momentums that justify the classification of ‘agency’ to the non-human components of technology actor networks.

When the problem of how to make information practices in one organization compatible with those in another – a basic problem in creating a broadly accessible network – one begins to see the extent to which the building of large information infrastructures demands both greater autonomy and increased standardization.

RANT can help us see why this is true. Before actual workers will take advantage of the capabilities of such media of communication, they generally need a concrete sense of its value to them, such as access to information in other organizations. Workers in different organizations need the autonomy to explore and develop their work together. Yet machines can only share information if it comes in predictable forms.

The Mindfrog Project is looking at Realist Actor Network Theory in the creation of a prototype that allows a receiver to explore a 3-D, virtual reality environment and to interact with the recorder who is recording the "real" world, augmented by the voice of the 3-D, virtual reality receiver. We are therefore, mixing virtual reality with augmented reality. We are interested in the social relationships that will develop in this transformative linkage.

To achieve a greater understanding of our thesis materials, we have subdivided our research into the aforementioned areas. Although our combined skill sets offer a vast wealth of knowledge in all these topics, a great pool of knowledge still awaits our exploration. To access the appropriate information group members will use traditional research methods in journal and library research as well as non-traditional methods based on online research (i.e. email interviews, listserves, newsnet, etc.), primary prototype testing, and field trips (conventions, corporations, universities, etc.)

The greatest amount of research will initially be based in production methods research. Information collected over the Summer of 2000 will be disseminated to group members through weekly meetings. These meetings will allow members to expand their understanding of the technologies in question. Implementing wireless LAN technologies with streaming media and wearable computing technologies in a fully functional prototype requires an investigation of a multitude of commercial technologies. Our preliminary findings show Cisco Aironet wireless LAN technology as an ideal counterpart to our planned Microsoft Windows production environment. Although Microsoft offers streaming technologies for free, Real Networks offers a more solid solution to media streaming. Research will decide which or even if both technologies can be included in the final iteration of our project thesis work. Using the Internet as a model for our medium, we glean a considerable amount of well tested and understood content generation tools. Our production methods research will require analyzing the current state of Internet development tools in order to assess the appropriate implementations of our content (for more hardware and software requirements see included Appendix B). It is of fundamental importance to understand that our goal is not to generate a web page, but to model our POV wearable technology on the physical infrastructure of the Internet. In other words, we want to use the physical network of the Internet as a model of how to transfer raw data, we don't want current common Internet interfaces to define our experience.

Understanding that our use of the term Internet only implies the physical and protocol layers, not the application layers, begins the discussion of our innovation. Simulating wireless access to an Internet infrastructure by adopting wireless LAN technology as a medium has innovative points. The most obvious innovation is simply in utilizing the wireless LAN technology. Having existed for roughly eighteen months, wireless LAN is an innovative tool which offers new insight into networking models such as the Internet. Also, by using the broad bandwidth of wireless LAN, we can simulate projected Internet bandwidths several years in advance. By simulating future bandwidth today, our thesis work will remain current for several months if not years.

Beyond the hardware innovation, our project introduces new concepts in content creation. Specifically, the emerging technology of three-dimensional audio and its implementation of spatial association of audio is currently only in testing stages by NASA which uses spatially positioned voices to aid astronauts in focused communication. Similar to NASA's implementation our use of positioned voices places "viewers'" voices in a specific location as if the participants were seated around a table. Each voice has a defined space and therefore the "recorder" can access the participants simply by focusing their attention to one side versus another. As with the NASA experiments, our implementation of spatial association of audio will add a significant amount of information to the current body of knowledge.

The final and possibly most impressive addition to current knowledge of digital media research is the creation of our prototype. Combining software and hardware into a fully functional immersive environment offers research possibilities beyond our thesis work. Other groups and organizations could not only utilize our findings, but access the physical technology to pose and test their own hypotheses. By offering a physical tool and therefore potentially an on going research prototype our thesis project transcends the one year limit of our project and offers a substantial longevity to interactive, mobile computing, communication research.

Appendix A: Mindfrog Milestones:

		Christian	Rane	Siggi	Tomonori
WIRED					
August	2000	Content Research			
		Wireless Research	Camera Prototype		Binaural Audio Prototype
		Web Hosting	Camera Hardware Research	Initial Video Tests	
September	2000	Content Research			
		Wireless Research	Redefine Camera Prototype w/ 3D registration		Develop Smaller Binaural Mic
		Addition of Web Content	HMD Lens Prototype	Run 3D Video Tests	HMD LCD Prototype
October	2000	Streaming Media Development	Minimize Camera		Binaural Integration w/ Camera
		Wireless LAN Integration			Shell Design for Camera
November	2000	Streaming Media (cont.)	Theory Writing	Streaming Media (cont.)	Prototype Camera Shell
		Analog/Wireless LAN (cont.)			Analog/Wireless LAN (cont.)
		Content Research and Theory Writing			
December	2000	Full Duplex wireless/wired d/a	Final Prototype: 3D Color Camera		
		Dynamic Web Content Development including Streaming Media, Flash, Javascript, etc.			
		Research based on Prototype; Theory Writing			
ANALOG WIRELESS					
January	2001	Custom Stream Coding	Content Creation		Custom 3D Audio Coding
		Analog/Wireless LAN (cont.)	Dynamic Web Development (cont.)		Analog/Wireless LAN (cont.)
		Dynamic Web Content Development including Streaming Media, Flash, Javascript, etc.			
February	2001	Custom Stream Coding	Content Creation		Custom 3D Audio Coding
		Analog/Wireless LAN (cont.)	Research based on Prototype; Theory Writing		Analog/Wireless LAN (cont.)
DIGITAL WIRELESS					
March	2001	Prototype Wireless Streaming	Dynamic Web Development (cont.)		Prototype Wireless Streaming
		Initial Stereoscopic Video & 3D Audio Content Acquisition			
		Initial verification of theoretical assumptions via empirically accountable procedures			
April	2001	Final Full Duplex Digital Wireless Streaming Stereoscopic Video & 3D Audio Hardware Implementation			
		Second Round of Stereoscopic Video & 3D Audio Content Acquisition			
		Second Round of verification of theoretical assumptions via empirically accountable procedures			
May	2001	Enable Live Video Streaming	Market and Generate Web Based Portal for Live Events		Enable Live Audio Streaming
		Begin final analysis of technology, content, etc for publication on web site and inclusion with thesis documentation			
June	2001	Finalize report on technology, content, etc on web site and deliver thesis documentation			

Legend:	
(blue)	- 4 Person Initiative
(purple)	- 3 Person Initiative
(green)	- 2 Person Initiative

Appendix B: Hardware/Software Requests

(Prices are accurate as of June 2000)

Hardware

Wireless:
Cisco Aironet Wireless LAN Access Point (AIR-AP342E2C) - $1300
Cisco Aironet Wireless LAN PC Card (AIR-PC342) - $250

Streaming:
Streaming Media Server (based on Real Networks Requirements):
Microsoft Windows NT 4.0 Server, Dual Intel Pentium III 500+, 256RAM, standard hard drive (4+ gig), keyboard, monitor & mouse. - $3000

Access to Bandwidth:
120kpbs stream with 10 streams = at least 1.2 Mbps - CSUH Budgeted

Production Workstations:
2 Windows NT 4.0 Workstation, Pentium III 500+,128RAM. - $3800
2 Apple G3/G4 128RAM. - $4800

Wearable Computers:
Windows NT 4.0, Cyrix or Celeron 166-230, 64-128RAM, 3.2GB Harddrive, Interface, Display. - $3500-8000

Notebooks Computers - One of the two following (or equivalent):
1) Sony VAIO FZ505 Series notebook. It has Pentium III 500, 128 MB RAM, 12GB hard drive, 12" display, is 1" thick and weighs 3.75 lbs, 1 type II card slot (wireless LAN) and 2 USB ports. - $2800
2) VAIO PCG-F490 selling for a PIII 650, 128RAM, 15" XGA TFT Display, 7lbs, 2inches thick, 18GB drive, and 2 Type II card slots 4xDVD. - $4000

Head Mounted Display:
Sony Glastron Glasses PLM-A35 - $500

Video Cameras:
2 Color Surveillance Cameras - 2 * $250 = $500

Audio:
Mic PreAmp - $200
Headphones - $100

Software

Streaming Media Server - Real or Windows Media.
Web Server Software - Apache, UNIX, Netscape.
Visual Content Creation - Photoshop, Fireworks, Dreamweaver, Flash, Premiere, RealNetworks/Windows Media Production Tools.
Audio Content Creation - Soundforge, ProTools, Custom 3D Audio Software

Appendix C: Criteria for Evaluation

Mindfrog anticipates overwhelming success with our project, but realize that technological limitations may impede our progress uncontrollably. We have devised a three-tiered approach to completing our overall goal by subdividing our required accomplishments into three self-contained phases which build off one another.

Phase 1: Analog Non-Live Wired Content Creation:
Do the following things work?
1. Mounting cameras to glasses.
2. Lining up cameras to shoot stereoscopic video.
3. Field of focus and related depth issues are resolved.
5. Binaural mic development.
6. Binaural mic integration with camera.
7. Resolving Binaural line/mic level pre-amp issues.
8. Mic/Headphone feedback issues.
9. HMD Viewer prototype lenses properly focus monitor video content.

Phase 2: Digital Non-Live Wired Content Creation:
Do the following things work?
1. Recording Laptop/Wearable PC can digitize video/audio.
2. HMD Viewer prototype lenses properly focus LCD video content.
3. Our initial hypotheses (defined by the proposal) are supported by empirical research using the prototype as well as validated, influential sources.

Phase 3: Digital Live Wireless Content Creation:
Do the following things work?
1. Minimized recording device captures and streams live stereoscopic video and binaural content via the Internet
2. Our hypotheses are supported by research based on using the prototype as well as validated, influential sources.

Our project is weighted heavily in the technology phases early on and as our understanding of the involved technologies evolves our focus for evaluation criteria transitions to that of new media theory and multimedia content. By focusing on our technology gap initially, we can focus on the true core of our thesis, media content, for the remainder of the project. Our milestones and responsibilities reflect this three-tiered approach to our project.

Appendix D: Member Roles and Responsibilities

Although Appendix A: Milestones alludes to the responsibilities of each Mindfrog member, it is important to detail the individual efforts as well as the collaborative initiatives:

Individual Efforts:

Tomonori Yamasaki - Binaural Audio Design and Development; HMD LCD Design and Development; Camera Shell Design and Development; Animated Web Design; Primary Dynamic Web Development Based in Streaming Audio.

Rane Sessions - Functionality Testing HMD Lens Design and Development; Stereoscopic Camera Development; Content Research and Writing; Graphic Web Design.

Siggi Matthiasson - Functionality Testing of Stereoscopic Camera and HMD Prototypes; Video Content Design and Evaluation; Documentation of Process, Technology and Content Development; Textual Web Design.

Christian Grossmann - Initial Streaming Media Design and Development; Initial Wireless LAN Prototyping; Primary Dynamic Web Development Based in Streaming Video.

Collaborative efforts:

Christian and Tomonori	- Wireless LAN
Christian and Siggi	- Streaming Media Deployment
Rane and Siggi	- Camera Design and Development, Content Acquisition
Rane, Siggi, and Tomonori	- Final Prototyping
All 4 Members	- Research, Documentation and Web Design/Development