Interflow-Architectures

The body is a flow architecture in continuous interactive motion, embedded within constructed architectures and the environment. It is a semi-mutable and mobile environment nested within a larger set of environmental flows. A series of architectural flows pivot, bridge, become layered, and intermingle enabling a set of physical/conceptual domains to arise in the flow of thought.

All communication needs a physics of instantiation with varying qualities of change to derive bodily affective (sensual) properties. The articulation of these physics of flow constitute a layered set of architectures that function in dynamic interactive relation. The thought arises as the sum of all change producing flows through interaction with this enfolded set of architectural flows. The intermingling fields of perception form a continuous flow of state changes in the thoughtbody. The layering of patterns of sensual perception with internalizations and introspection related to those perceptions, intermingle within this ongoing enfolded space of flows. Thus a single oneness is formed from the layered domains of interflow-architectures:

The architecture of constructed spatial flows.
The architecture of material flows.
The architecture of sense-flows.
The architecture of a physics of flow.
The architecture of body flows.
The architecture of electro-chemical flows.
The architecture of linguistic flows.
The architecture of semiotic flows.
The architecture of spatio-temporal flows.
The architecture of thought flows.
The architecture of biological flows.
The architecture of chemical flows.
The architecture of functional flows.
The architecture of mathematical flows.
The architecture of gravitational flows.
The architecture of liquid flows.
The architecture of waste flows.
The architecture of energy flows.
The architecture of information flows.
The architecture of media flows.
The architecture of electronic flows.
The architecture of optical flows.
The architecture of digital flows.
The architecture of manufactured nano-flows.
The architecture of code flows.
The architecture of aesthetic flows.
The architecture of sexual flows.
The architecture of political flows.
The architecture of social flows.
The architecture of virtual flows.
The architecture of the flow of time.
The architecture of flows of feeling.
The architecture of desire flows.
The architecture of flows outside of our perceptual range.
The architecture of intermingling fields of flow.
The qualities of differing viscosities.
Negotiating the force of these flows.

The inter-subject< --- >object of these flows I will call Interflow – Architectures.

The contemporary re-understanding of the memory theatre and memory/thought augmentation devices shall now be called the Theatre of Interflow Architectures.

The Theatre of Interflow Architecture: An Exploration into a Poetics of Machinic Sensing, Multi-modal Searching and Thought Augmentation Approaches within Networked Architectural Spaces.

Our senses present to us a lifelong set of elaborate patterns. Often our senses work in tandem to put forward a "multi-dimensional" perception of the world. The role of memory can not be underestimated in terms of making meaning out of these perceptions. An Interest in augmenting memory, perception and thinking has in the past been embodied in memory techniques and memory theatres. This paper will present a survey of some of these different memory augmentation approaches. In addition I will discuss a number of contemporary ideas surrounding the practice of "modeling" and/ or abstracting thought processes for application in computer-based environments. Search engines are one means of augmentation, enabling us to access vast stores of information distributed across the internet. Here, human memory and computer memory work in tandem in the service of thought. As we move to more complex media environments that include dynamic patterns of image, sound and text forming computer-based contexts, it becomes important to articulate new multi-modal search techniques. Machinic sensing of environments is significantly different than the capacity of human perception and can give us an abstracted and/or augmented perception of chosen spaces. As an artist, one begins to explore a poetics of both machinic sensing, and multi-modal searching. I will briefly show two works in progress that explore these issues — The Poly-sending Environment and Sentient R-Map.

Key words: memory, memory theatre, multi-modal searching, machinic sensing, machinic perception.

In the book *The Evolution of Technology,* George Basalla speaks about "technological dreams":

Technological dreams are the machines, proposals and visions generated by the technical community, whether in the Renaissance or the present time. They epitomize the technologists' propensity to go beyond what is technically feasible. Fanciful creations of this kind provide an entry into the richness of the imagination and into the sources of the novelty that is the heart of Western technology. They also challenge the conventional depiction of the technologist as a rational, pragmatic, unemotional person dominated by a utilitarian outlook. [1]

So we will begin with a technological dream. Sitting in a conference at Duke University a year ago, I was in a position to plug key words and names into "Google", a particularly useful search engine, and augment my perception of a live event by looking simultaneously at related data, diagrams, and different forms of digital media that entered my field of vision. In a related way to our ability to sift through vast sets of differing memories to inform our perception of current events, I was beginning to imagine the poetic potentials of a 'machinic perception' system that might augment ongoing human perception. The vision I had incorporated the ability to call forth all forms of digital information— images, sound, text, virtual environments, video streams, etc. I imagined a machinic perception that was "paying attention" to my "surrounding environment" by searching for streams of information in a "relevant" manner, enabling me to work in concert with such a system and to foreground any aspect of this environment of data flows to augment my perception and/or communication about a particular context.

Needless to say, many people over the ages have had related visions exploring memory and thought augmentation. Some exploring analogue mechanisms and others thinking about the potentials of computers and networked situations. The deepest intellectual questions concerning this vision deals with our ability to learn, share knowledge, do research, and share expressive media-based experience via technological systems. The goal of developing a form of a multi-modal "machinic perception" that is linked to a memory augmenting space, has a deep history. Our senses present to us a lifelong set of elaborate patterns. Often our senses work in tandem to put forward a "multi-dimensional" perception of the world. The role of memory is central in terms of gleaning meaning from the patterns that make up each of our worlds. An interest in augmenting memory and meaning production has from one perspective been embodied in memory techniques and memory theatres. [2] I will here briefly present a set of quotes related to some of

these different memory/perception augmentation approaches, as well as relevant historical quotes related to human/computer interaction. Later in the paper I will present a number of contemporary ideas surrounding the practice of "modeling" and/or "abstracting" perception and thought processes for application in computer-based environments. This represents a pointed extension of my interest in Recombinant Poetic systems, in particular I am interested in how multi-modal machinic sensing can inform a dynamic new interface paradigm. Multi-modal sensing is a form of machine sensing that brings together a number of different sensors to work in conjunction with each other to potentially bring about a "machinic perception" of the environment. One way to imagine this is to substitute different machine senses that model our own senses i.e. video for sight, pressure for touch, heat sensing for skin, etc. Yet, machine sensing opens out new kinds of perceptions. We have all seen night vision glasses – this sensing technology augments vision. The idea here is to link a series of different sensing systems together to give us a higher order impression of a chosen environment than any singular sensor could give.

The salient processes I am currently focusing on involve the following:

• Multi-modal sensing technologies — this includes multiple "views" or "machinic perceptions" of a chosen space as visualized or made sonic;

• Wireless communication schemes enabling human/machine sensor / server / media relations;

• Wired communication schemes to enable networked interaction;

• Servers functioning both as collectors and facilitators (focusing the machinic perception) as well as distributing and sharing it among connected communities;

• The storing of the multi-modal data streams for cross referencing;

• The ability to search for particular multi-modal "neighborhoods" or "sets" of relevant multi-modal data;

• The storing of databases of particular media elements and/or processes with specific encoding methodologies and meta-data schemes;

• The visual and/or spatial representation of particular sets of data with the potential to cross-reference that data and access it via different means;

• The ability to set in motion focused machinic processes;

• The ability to display and navigate the augmenting data as well as choose from alternate sets of data representations;

• The ability to involve multiple forms of output for general environmental augmentation.

Search engines are one means of thought augmentation, enabling us to access vast stores of information distributed across the Internet or in more local databases. Here, human memory and computer capabilities work in tandem in the service of thought and knowledge production. As we move to more complex media environments that include dynamic spatial patterns of image, sound and text forming computer-based contexts, it becomes important to articulate new multi-modal search techniques and strategies for advanced distributed connectivity. As we begin to collect information related to parallel data streams, defining multi-modal search methodologies for such databases becomes a central interest. In the long run one can imagine joining together a network of expert systems, employing multiple machinic sensing devices, as well as parsing the multiple streams in the service of augmenting human perception and congnition. Certainly Roy Ascott and others have been thinking about a form of distributed consciousness as brought about by computer networks for decades. In Art and Telematics Roy Ascott states that "Networking produces an interweaving of imaginations that gives the term 'associative thinking' the most amplified interpretation".[3]

Machinic sensing of environments can give us an abstracted and/or enlarged perception of chosen spaces. As an artist, one begins to contemplate a poetics of machinic sensing, as well to explore the potentials of developing abstract associations between particular physical environments and generative media spaces as driven by multi-modal sensing and searching methodologies, working in tandem with specifically related if | then statements. The basic premise is as follows: "if" the machine senses a particular "event" through machinic means then call up this stored media or search for related media or drive an alternate digital or physical process.

Here are a series of relevant cultural, historical, and scientific passages that point toward an initial set of ideas that inform the project:

Guilio Camillo's Teatro Del Mundo was designed as a "memory theatre" working with associational connections between symbolic images and memory. A spectator would sit at a central location inside a portable wooden structure, which contained seven groupings of information, each accessible from seven different levels. The viewer would engage with an environment designed to reveal secrets about the structure of the universe, from the microcosmic to the macrocosmic. [4]

Turing's description of the *ACE (Automatic Computing Engine)*, the first digital computer, saw the potential for a machine with programmed responsive, "operative" input and output "organs." [5] He described this system as being analogous to the mind, suggesting the machine would have "A finite set of states of mind," with the possibility of exploring "groups." We can think of this idea as an initial glimpse into the metaphors surrounding a machinic perception. In building out a network of metaphors surrounding perception, the notion of navigation also becomes central. It is interesting to note that the word Cybernetics actually stems from aspects of navigation:

Cybernetics, a word coined by Norbert Wiener to describe the complex of sciences dealing with communication and control in the living organism and in the machine. When Wiener introduced the term, which is derived from the Greek ... meaning governor or steersman, he was unaware that it had already had a considerable history and that it had been used more than a century before by Andre Ampere to cover the purely governmental side of such a theory, in the positivistic classification of scientific theories…

As a matter of fact not only Ampere... but Plato had used the word... (which would be transliterated as "cybernetics") in *Gorgias*. Although Plato used the word more or less in relation to the art of navigation, it is highly interesting, as pointed out by Watanabe, that Plato compared cybernetics with rhetorics because he viewed both as concerned with influence and control entirely different in nature from knowledge of some fixed reality such as astronomy or geology. [6]

Certainly "steering" is a metaphor for reactive environmental thinking, which is here abstracted into a set of computer–based processes. The correlation between thinking and the functioning of computers has been historically linked to a set of metaphors. The notion of "control" can be seen to be operative in both a literal and metaphorical manner, defining a form of symbiotic steering. Licklider, in "Man-Computer Symbiosis" states:

Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers. It will involve very close coupling between the human and the electronic members of the partnership. The main aims are, 1) to let computers facilitate formulative thinking as they now facilitate the solution of formulated problems, and 2) to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking. Preliminary analyses indicate that the symbiotic partnership will perform intellectual operations much more effectively than man along can perform them." [7]

We have seen this kind of partnership explored to a great degree in expert systems including computer chess playing systems. Expert systems are complex computer systems that attempt to augment high level

decision processes like diagnosing disease. Turing, in 1946, was already speculating about a computer playing chess in the *Proposal for Development of an Automatic Computing Engine*. [8] This document suggested the potential of imbuing a machine with intelligent behavior by exploring machines that function through the "sensing" of user input, which would then "respond" with appropriate output. Currently humans employ expert systems across a number of fields. One can begin to speculate on the potentials of multi-modal sensing and search mechanisms as potentially providing a thought augmentation realm. Licklider states “One of the main aims of man-computer symbiosis is to bring the computing machine effectively into the cumulative parts of technical problems.” [9]

As we become increasingly dependent on cybernetic systems as part of the "posthuman" condition, we often employ assemblages of metaphors, or a layering of metaphorical language to orient ourselves to new approaches to media, science, technology and the emergence of new hybrid fields. Multiple metaphors related to Human/machine interaction are eloquently discussed by N. Katherine Hayles in *How We Became Posthuman: Virtual Bodies in Cyberspace, Literature and Infomatics.* Hayles herself often draws on metaphor as a means to help us come to better understand human/machine relations.

In one instance she references *Metaphors we Live By* stating: “As George Lakoff and Mark Johnson have shown in their study of embodied metaphors, our images of our bodies, their limitations and possibilities, openings and self containments, inform how we envision the intellectual territories we stake out and occupy.” [10]

In part, the collaboration between the arts and the sciences which is vital to my work deals with the creation of language structures which bridge those fields. Metaphor becomes central to the construction of these bridges. Many artists are interested in exploring biological metaphors surrounding sensing technologies. The definition of Neuromorphic Engineering from Dr. Leslie Smith is here salient:

Neuromorphic systems are implementations in silicon of systems whose architecture and design are based on neurobiology. This growing area proffers exciting possibilities such as sensory systems which can compete with human senses, pattern recognition systems that can run in real-time and neuron models that can truly emulate living neurons. Neuromorphic systems are at the intersection of neuroscience, computer science and electrical engineering. [11]

Yet, such areas of study like artificial intelligence, and artificial perception are particularly thorny — we can point at thinking but it is a very difficult realm to articulate with any clarity without being caught up in both the limitations of language and of observation. In *Thinking Machines, The Search for Artificial Intelligence* by Igor Aleksander and Piers Burnett, the authors state:

Rather than becoming embroiled in the controversies which surround the nature of human intelligence, the practitioners of artificial intelligence have generally chosen to define their goals in empirical or operational terms rather than theoretical ones ... The researcher simply chooses a task that seems to require intelligence (playing chess say or recognizing visual images) and tries to build a machine that can accomplish it. [12]

Similarly, ‘machinic perception’ could be approached through “operational terms”. Thus, my interest is not to try to define ‘machinic perception’, but to operatively explore it through a poetic, artistic, expressive lens. There is great interest in articulating the expressive potentials of computer systems and I am here interested in a techno-poetics that expands on Recombinant Poetics. Associative thought processes are explored via this poetics, through interaction within computer-based environments that potentially become linked in a dynamic manner to particular physical environments and human behavior in those environments. Central to thought and the ability to come to understand our environment are associative processes. In their study of Vannevar Bush’s *As We May Think*, Nyce and Kahn comment:

Computer and information scientists today recognize Bush’s article as containing the earliest description of a machine designed to support the building of trails of association through vast stores of information. Bush’s writings on the Memex can be viewed as a proposal for an actual machine and as a body of essays that explore the potential utility and application of new kinds of machines for managing information and representing knowledge. [13]

In this case I am working toward poetic systems that might enable us to manage information, represent knowledge, and also present differing forms of media elements and environmental experience. Roy Ascott early on saw the potentials of behavioural human/computer relations in terms of works of art. In his paper entitled *Behaviourist Art and the Cybernetic Vision*, published in 1966, Ascott presented the following concept:

Behaviourist Art constitutes, as we have seen, a retroactive process of human involvement, in which the artefact functions as both matrix and catalyst. As matrix, it is the substance between two sets of behaviours; it neither exists for itself nor by itself. As a catalyst, it triggers changes in the spectator's total behaviour. Its structure must be adaptive implicitly or physically, to accommodate the spectator's responses, in order that the creative evolution of form and idea may take place. The basic principle is feedback. The system Artefact/Observer furnishes its own controlling energy; a function of an output variable (observer response) is to act as an input variable, which introduces more variety into the system and leads to more variety in the output (observer's experience). This rich interplay derives from what is a self-organising in which there are two controlling factors; one, the spectator is a self-organising subsystem; the other, the art work is not usually at present homeostatic...

There is no prior reason why the artefact should not be a self-organising system; an organism, as it were, which derives its initial programme or code from the artists creative activity and then evolves in specific artistic identity and function in response to the environment which it encounters. [14]

As computer-based systems and technological sensory extensions change our relation to both nature and language, we need to create mechanisms that function at the highest possible level of human/machine interaction, to best reflect upon this complicated plethora of emergent relations. In so doing we change the nature of the organism itself through machinic extension.

Douglas Engelbart wrote "Augmenting Human Intellect" in 1962. He articulated the following: "By augmenting human intellect we mean increasing the capability of man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems." [15]

It is valuable here to acknowledge others who have led the way by developing associative human/machine potentials. The American researcher and visionary Ted Nelson, coined the term "hypertext" in 1965. The salient characteristic of hypertext is that it makes intelligent links between various linguistic components and databases. Nelson came up with the idea for a system (called Xanadu) that would connect all of the world's literature by computer within an environment the viewer could interact with. [16] I am particularly interested in advancing the notion of physical/data/media linking, editing, storage and searching structures.

It wasn't until a sophisticated editing system was created that the principles for hypertext could be implemented for a real-world purpose. In 1967 the Hypertext Editing System and FRESS (File Retrieval and Editing System) were built at Brown University, Rhode Island, under the leadership of Andries Van Dam, a contemporary of Nelson. FRESS was the first step to create a functioning user controlled computer-based language augmentation system. [17]

In 1987 Apple introduced Hypercard (authored by Bill Atkinson) which quickly became an ideal hypermedia program for the average computer user. Hypertext employed the metaphor of an electronic card filing system that gave the user instantaneous access to specific kinds of information. Hypercard was a system that empowered a user to make an elaborate set of links between elements of language, image and sound. It provided people who did not write computer code with a means to create elaborate interconnected structures in a non-linear fashion. [18]

A linked set of virtual pages has become the ubiquitous metaphor that one relies on to access text based data. Yet, architectural metaphors were also in the air early on. Gordon Pask, in *The Architectural Relevance of Cybernetics* discusses "Symbolic environments in architecture". He states "Many human activities are symbolic in character. Using visual, verbal or tactile symbols, man 'talks with' his surroundings. These consist in other men, information systems such as libraries, computers or works of art

and also, of course, the structures around him." [19] Pask here suggests the kind of multi-modal information world that is now quickly taking form. He explores an architectural media metaphor that clearly ties in with earlier notions of Memory techniques expounded by Frances Yates in her illuminating book *The Art of Memory*. He also employs the metaphor of "talking".

What is the architecture of thought? To my mind it is valuable to contemplate how the mind works by attempting to abstract its processes. In Varella, Thompson and Rosch's *The Embodied Mind,* they call this activity becoming "mindfully aware". They state: "We believe that if cognitive science is to include human experience, it must have some method of exploring and knowing what human experience is." [20]

We have come to understand that articulating matters of mind can only ever be a form of elaborate "pointing". The scientist Casti, writing about Wittgenstein and complexity, speaks about this problem:

The main claim of Wittgenstein's picture theory is that there must be a link between the logical structure of a given language and the logical structure of a real-world fact that a statement in that language asserts. Since the link is itself a relationship in the real world, it's reasonable to suppose that there is some way to express the character and properties of this link using the grammatical rules of the language. But after years of struggling with exactly how to do this, Wittgenstein came to the conclusion that the link between the real world and its expression in language cannot be "said" at all using language; rather it must be "shown." We can't express everything about language using language itself; somehow we must transcend the boundaries of language. Thus Wittgenstein says that we cannot really speak about the world, but only "point." [21]

Computer language is employed, not to describe thought but to re-embody it through an elaborate layered network of metaphors, codes and representations. Yet, computer-based environments exploring machinic perception can potentially provide us with new insights into the functioning of human perception, as well as change and extend the ways we come to know the world. Thus, we begin to articulate elaborate "pointing" mechanisms informed by memory and thought processes. My own works often explore such self-reflective territories — they seek to provide a space to think about thinking — to observe observation. Daniel C. Dennett, in *An Empirical Theory of the Mind: The Evolution of Consciousness*, says the following:

Since any computing machine at all can be imitated by a virtual machine on a von Neumann machine, it follows that if the brain is a massive parallel processing machine, it too can be perfectly imitated by a von Neumann machine. And from the very beginning of the computer age, theorists used this chameleonic power of von Neumann machines to create virtual parallel architectures that were supposed to model brainlike structures. [22]

This may someday be the case, but for the moment we can only begin to explore such ideas, taking baby steps in the direction of such a system. "The Age of Spiritual Machines" by Raymond Kurtsweil explores this territory in detail. Statements related to von Neumann's have been made concerning Turning Machines. Turing's notion of the "Universal Machine," contemporary with von Neumann, is one of the central principles exploring the open potential of computers. The idea was that a computer might simulate thought processes and exhibit a alternate form of intelligence. Hodges, Turing's biographer, here describes certain aspects of the "universal machine:"

...underneath here lay the same powerful idea that G˚del had used, that there was no essential distinction between "numbers" and operations on numbers. From a modern mathematical point of view, they were all alike symbols. With this done, it followed that one particular machine could simulate the work done by *any* machine. He [Turing] called it the *universal* machine…It would be a machine to do everything, which was enough to give anyone pause for thought. [23]

We must remember that at the time Turing defined his concept of the universal machine, 'computers' were 'people' working on various 'problems' or 'computations'. We might now say that the varying symbolic properties of computer code can function as a pun on symbolic logic, both operative as symbolic logic while simultaneously operating on media elements and exploring media-processes (constructed through this symbolic logic), that enables us to here explore techno-poetic processes via machinic sensing, searching and associating mechanisms. Thus, we have mapped and abstracted a set of thought processes that enable

us to perceive the world, remember our past perceptions, and make associations that are relevant to our current context. In this case we still need to keep the mind in the cybernetic loop, such that these processes augment thinking but do not replace it.

So if we begin to use a form of "machinic perception" to augment thought, how can we recognize the limits of our attempts to map thought-like activities and simultaneously utilize the strengths of our generated machinic abstractions?

Many different metaphors become central – sensing, searching, storing, navigating. Along with these thought-oriented metaphors, other more ubiquitous metaphors may potentially be employed. Certainly the "desktop" metaphor is something we all live by. Yet we may be on the cusp of a more spatial metaphor engendered through thought abstraction — again a return to the spatial relations that inform the creation and employment of a theatre of memory. When we close our eyes, what is the space of our thought? How is it that we make associations and explore spaces in our memory?

My current projects seek to develop tools that enable the linking of physical space, behavior, movement, and other machinic sensed properties gleaned via sensors from a selected environment, and to develop a network of machinic "associations" — to define a rich multi-valent data space of media elements and media processes that can be explored in a relevant manner. This space of media becomes reactive in a pointed way, and the space of thought becomes conjoined with the "associated" media space. Pask, in *The Architectural Relevance of Cybernetics* speaks about a "Reactive Architecture" from a related perspective:

As a broad statement of what is going on, a computer controls the visual and tactile properties of environmental materials (which are available in sufficient diversity for most architectural purposes). These materials contain sensors, tactile or visual as the case may be, which return messages to the computer at several levels of generality. In the absence of a human inhabitant, the feedback leads to stabilization with respect to certain pre-programmed invariants (for example, that a body of material shall maintain mechanical stability and occupy a prescribed value), and to a search process in which the material actively looks for signs of a human being in contact with it. If there is a human being in the environment, the computer, material and all, engages him in dialogue and, within quite wide limits, is able to learn about and adapt to his behaviour pattern. [24]

So here we begin to conjoin thought architectures, machinic architectures and physical architectures. The long term goal is to make a learning system, yet this is still on the horizon of artistic authorship. Sliding across the continuum of differing domains from physical architecture, to virtual architecture, to the architecture of thought, more recently Raphael Lorenzo Hemmer has articulated the notion of Relational Architecture. He states:

(Definition:)

Relational architecture can be defined as the technological actualization of buildings and public spaces with alien memory. Relational architecture transforms the master narratives of a specific building by adding and subtracting audiovisual elements to affect it, effect it and re-contextualize it. Relational buildings have audience-activated hyperlinks to predetermined spatiotemporal settings that may include other buildings, other political or aesthetic contexts, other histories, or other physics. [25]

Augmented reality spaces could potentially fall under this definition of Relational Architecture. The notion of context is subtle, and meaning arises as fields of meaning force inform each other. We might say that Lorenzo Hemmer is articulating an approach to architecture through a form of conceptual "qualification" which is brought about through the layering of additional media elements, connective processes, and potential interactive scenarios. The original meaning of the architecture, "readymade" object, or overall context, is shifted. His notion of employing an "alien memory" to bring about this particular shift of thought enables a dynamic alteration in context to be constructed that augments meaning production. Erik Davis in Techgnosis: Magic, Memory, and the Angels of information talks about the potentials of encoded material for "changing the nature of self":

From the moment that humans began etching grooves into ancient wizard bones to mark the cycles of the moon, the process of encoding thought and experience into a vehicle of expression has influenced the changing nature of self. Information technology tweaks our perceptions, communicates our picture of the world to one another, and constructs remarkable and sometimes insidious forms of control over the cultural stories that shape our senses of the world. The moment we invent a significant device for communication – talking drums, papyrus scrolls, printed books, crystal sets, computers, pagers – we partially reconstruct the self and its world, creating new opportunities (and new traps) for thought, perception and social experience. [26]

It is my intention to get beyond such "traps", to explore a poetics of meta-machinic systems that enable one to observe in a 'mindfully aware manner', the "changing nature of self" as explored in relation to a dynamic set of human/machine interactions. Thus, we become actively aware of the shifting, constructed nature of our perceptions as fields of meaning conjoining physical space with associated computer-mediated perceptual elements are 'called up' into play.

Marcos Novak approaches this field of perceptual augmentation from a different perspective. He keenly explores in his work the limits of perception and the potential of augmenting perception through different approaches to this "augmentation". Novak, in 'Liquid Architectures in Cyberspace' early on described an 'adaptive filtering' approach to generate a form of architecture in cyberspace. More recently Novak has developed a form of layering that informs the existence of a network of particular human / computer / machinic perceptual relations.

In principle, and with the proper architectural knowledge, any pattern can be made into a work of architecture, just as any pattern can be made into music In order for the data pattern to qualify as music or architecture it is passed through compositional 'filters', processes that select and massage the data according to the intentions of the architect and the perceptual capacity of the viewer. This 'adaptive filtering', to use a neural net term provides the beginning of the intelligence that constitutes a cyberspace and not a hypergraph. This, or course, means that any information, any data, can become architectonic and habitable, and that cyberspace and cyberspace architecture are one and the same. [27]

Where Novak speaks of "filter", I employ the word "association". I am particularly interested in how cyberspace and physical space can intermingle through authored/programmed media associations, which in turn potentially generate associative thought in the participant. In my own work I talk about the continuum between the virtual and the physical. Over a decade ago I articulated an exploration of *Hybrid Architectures — Media / Information Environments*, which was subsequently published in the book **Intelligent Environments — Spatial Aspect of the Information Revolution**. I have spoken about a link between Information Architectures and physical environments. In particular I talk about the user of such systems being "informed and transformed":

Architectures - Physical and Conceptual
Witnessing the ever quickening flow of technological invention from the shifting perspective of the present, one can project potential hybrid media/information environments involving state of the art communication systems, advanced Virtual Reality networks, speed of light transfer and retrieval of vast selections of information, as well as entirely new forms of art and entertainment. The city presents a concentration of nodes where users are informed and transformed through the identity and functionality of a series of layered networks, interfacing the physical world with the conceptual space of electronic interchange. The information architectures which facilitate this exchange are becoming increasingly palpable both in terms of "physical" world change and in relation to potential sensual feedback systems which serve to substantiate the illusionistic/metaphorical levels of potential interaction…[28]

Here I begin to articulate the subtle relations between illusionistic/metaphorical levels and the physical ramifications they become intertwined with. In the following two projects I will articulate how I am approaching this "continuum" space between physical, and virtual or media oriented architectures, as well as to provide the conceptual orientation of the research.

This unique team of Ingrid verbauwhede, Mark Hansen and Seaman** brings together expertise in advanced chip design, statistical tools for data analysis and modeling of highly complex data streams, and the generation of novel multimedia environments. The different disciplinary teams will work in an orderly, modular, process-oriented manner to slowly "grow" the potentials of the system through dynamic collaboration and intercommunication. This provides a unique multi-disciplinary learning environment where the research methodology of this project fosters a new model of integrated transdisciplinary scientific, engineering and media inquiry.

The significance of the system as a new integrated interface paradigm with multiple potential uses is unparalleled in its ability to integrate research and education by advancing discovery and understanding across a set of differing yet interrelated disciplinary domains. The long-term goal is the creation of an advanced tool for scientific, cultural and artistic production. Central, is the functional ability of the system to enhance the infrastructure for research, education, the creation of new kinds of machinic sensing research facilities; new forms of instrumentation that arises through visualization and sonification of the "sensed" environment; the networked potential of sharing this information or cultural production, and the potential partnerships arising through the networking capabilities of the environment. Clearly the long-term broader impact of this IT system is immense in that it advances knowledge across a series of disciplines, and becomes a tool that can later be used by each of the researchers for furthering their individual inquiry and practice. Yet the potential benefits for society at large cannot be underestimated in relation to educational, training, learning, cultural and scientific production. Thus, a connected physical space and associated augmented reality environment can be networked, linking individuals from around the globe. The potential of the system is to enable any object, behavior or "sensed activity" in a given space to become an interface to an interactive augmented reality media space and/or the internet. This also suggests potential application for those with disabilities through new adaptive interface design approaches.

A second and related work in progress is **Sentient R-Map**. **R-map** stands for room/region/relation mapping. **Sentient R-MAP** will enable viewers/users to navigate a computer-mediated "sentient" video/virtual environment, as well as to call up related/superimposed virtual media-elements. I initially sought to create an R-map environment over a decade ago.

For this work I am collaborating with a number of people at Duke University including: Scott Lindroth in Music; Steve Feller, Electrical Engineering, Pratt School of Engineering; Richard Lucic in Computer Science; David Brady in Electrical and Computer Engineering; Dr. Edward A. Shanken, Executive Director, Information Science + Information Studies (ISIS); as well as a series of students.

Subsequent research has shown related work in the field. In the book **Advances In Visual Information Systems,** is a paper by Chi-Kuo Chang entitled **The Sentient Map and Its Applications to the Macro University E-Learning Environment.** His observations are relevant to my system.

Maps are widely used to present spatial/temporal information to serve as a guide, or an index, so that the viewer of the map can obtain certain desired information. Often a map has embedded in it the creator's intended viewpoints and/or purposes…

Maps are often used as guides or indexes to convey information…

A web page can also be regarded as a map, with the URLs as indexes to other web pages. In fact, any document can be regarded as a map in a multi-dimensional space.

These two notions, that data can be viewed as maps and that maps can be made active, led us to propose a new paradigm for visual information retrieval – the **sentient map**. In practice, the sentient map is a gesture-enhanced multi-modal interface between the user and the multimedia information system. [29]

Thus this work falls within the presented definition of Sentient Map. The **Sentient R-MAP** system will present a mutable space consisting of a set of computer-based environmental planes of digital media elements that may be superimposed, viewed and or listened to individually, or shifted to be experienced in relation to each other. Thus the participant will encounter a navigable mapped-video and /or virtual poetic

installation space. On one plane the **R-MAP** system will house a dynamic reproduction of sculptural/architectural installation - [a geographic space] that will be presented in such a way as to enable participants to "virtually" move around within the space. Using different gestures with their arms, a participant will be able to simulate turning in any direction, as well as to move toward or away from specific objects or proximities around them in the mapped room. Gesture recognition sensors will enable interaction with the environment as well as potentially add layers of content in relation to particular sensed events and/or behaviors related to the mapped geographical proximity. In particular a related set of audio events will be triggered through interaction. A virtual vertical axis will enable the layering of different related virtual spaces to be accessed. The media element planes consist of 1) the mapped installation space; 2) a virtual space; 3) a set of text "tags"; 4) A set of location triggered music loops; 5) a set of spoken and/or sung texts will be triggered as the participant navigates; 6) a set of Video "tags" that can be called into the space. These worlds can be superimposed or can be encountered individually. A physical interface and/or voice commands will enable the planes to be shifted in relation to each other: pivoting around a central axis enables new vertical relations; compressing layers enabled different planar juxtapositions. Navigation and interaction is triggered by sensor driven feedback related to the behavior of the participant(s) in the physical environment. Thus the term "sentient" is employed – the R-map dynamically responds to sensed data. Thus if a viewer chooses to move forward in one environment - a congruent move is made in any of the other "encoded" spaces. Multiple zones will be made active in a room and multiple participants will be able to simultaneously interact with zone-specific aspects of the work. Multiple sensing systems will be employed to derive a multi-modal "understanding" of behavior in the physical space, and this will have a direct and associative relation to the generated media space.

In Sentient R-map, we are exploring text, image, and sound, through new multi-modal interface relations. Initial multi-modal research in the Architecture Machine Group at MIT is of significance historically. "Put that There" by Richard Bolt 1980, articulates an initial approach to multi-modal interface design.[30] In this work specific poetic signs will be presented and placed adjacent to objects within the constructed physical installation space. (the space that is mapped). The meaning of particular objects will be qualified by these differing media "Tags". The viewer takes an active role in navigating the work, altering the possible choices and results through their behavior in the sentient space. Multiple projection screens will enable access to the differing media environments derived through interaction. The multiple screens will present a set of changing juxtapositions and views. Voice recognition of a presented verbal vocabulary will also call up particular media relations, and enable the recombination of differing media elements (the spinning of the worlds and/or the generation of different juxtapositions). Visual puns, word/image/sound play, experimental music composition, and sense/nonsense relations will all be explored.

Here I will narrate a participant's possible experience. The participant stands in front of a large set of screens. They are also provided with a poetic list of words and small physical hand held device. As they move their arms forward they move in a zoom across a mapped video space. They can pivot off in different directions (driving the video image and /or media environment) and encounter different media and text through arm movement. Poetic text lines are revealed as they navigate. They can point upward and navigate through different "media planes". Leaving the mapped video space they can move up through a virtual environment, a video environment, a textual environment, a sonic environment. These are all visible on the screen in front of them. A small hand held physical interface that represents these differing spaces enables the participant to superimpose different of these planes, or to re-orient them spatially in terms of the vertical axis as well as to bring alternate layers together in a dynamic poetic juxtaposition. A remote version will enable people in different locations to access the work in a virtual/networked form. One area of interest is the potential for developing multi-modal search engines that would enable a user to make a media specific query and the environment would remove all "unrelated" information, presenting a spatial view of related "data" called up through the inquiry.

Could we now begin to develop multi-modal search engines that would search out "neighborhoods" of related data. How can the study of parallel streams of sense data begin to inform the creation of multi-modal search engines? Might new encryption protocols enable such search engines to find relevant audio-visual material? How can we best make systems to enable multi-modal queries?

I am seeking to explore a poetics of sentient space, although in the process of authoring this emergent space of potential, a number of issues relevant to computer science will be explored. Included in this space will be a series of "translation equations" where a set of metaphors are articulated in the system :

Perception = assorted sensing mechanisms/mapped space

Association = if / then statements

Reflection = (media elements) image, sound, text, video files

Memory = the ability to access these stored reflections

Bodily action = the ability to navigate this space as a topological space and

a hyperspace

The sentient R-map would function as a reconfigurable database driven by particular search criteria. The work would contain a set of media "neighborhoods" that can undergo change. A neighborhood is a configuration of media-elements in a time-based relation and a space based relation. On a lower level these are made of a set of media elements and media processes with related "tags". Because the work is an artwork – a "poetic" stance is taken in relation to both the neighborhoods, the media–elements and the tags that are loaded into the initial state of the media-organism/sentient ecology. A search would initiate a particular "take" related to the set of sets. A [search] would define a smaller set of relevant media-elements. A subtraction would leave a dimensional set of relevant media–elements within the media – geography. Part of the research deals with the creation of non-textual tagging system. Here I imagine a "picture of code" that is searched for media configurations related to a chosen section of code.

The sentient aspects that need developing include:

1) to Define an overall architecture for the multi-layered topographic spaces

2) Define a mechanism of input/output organs — sensors and data transfer

3) Define a template architecture to load the media-elements into the system so they can be explored and recombined.

4) Define a template to load the "tags" for the media elements

5) Define a neighborhood of media-elements or "code shapes" or "code images" or "code configurations" (articulate a quadrant and/or set of media elements and a time space)

6) Define an architecture to store different classifications or particulars related to this "code shape"

7) Define a means to search (make a query) into this set of sets, based on either "tag" criteria or "code shape" criteria or both.

8) Define a means to "abstract" or call forth a new spatial configuration based on a particular query.

9) Define a means to navigate within this set of layers and dimensions.

(Time code markers) or loop, or Actual position in original mapped space

I have here discussed two relevant projects that are currently in progress. The two works are similar in that they will promote dynamically linked physical and virtual interaction. They will also promote associative thinking, potential knowledge production, networked communication, the sharing of data, specific visualization and sonification related "transparently" to a linked physical space, and or expressive/poetic

relations "associated" to sensed behavior in the varying environments. A rich array of hard scientific problems will be researched for both of these works. Our goal in both works is to create "poly-sensing" environments. The unique aspect of these works explores the collection of information from the parsing of an integrated "collaboration" between a diverse collection sensing devices and larger integrated sensing apparatus. Thus these IT systems will integrate research and education by advancing discovery and understanding through the bottom up process of the development of the potentials of the system.

A number of researchers are currently exploring the parsing of individual streams of sense data.

In the Poly-sensing environment our new paradigm will enable every chip to define a "poly-sensing" "neighborhood". Another key feature of the research explores the following: the technology will be created with a flexible and adaptive means of focusing the "attention" of these multiple-sensing devices in recombinant groups of intercommunicating distributed fields. The "Poly-sensing" environment potentially enables the intelligent storage, triggering, and calling-up of media elements and media behaviors, images, relevant libraries, and databases, accessing both local and distributed (Internet based) memory systems as well as operative programs to be elicited by physical events in the "sensed" space. The system enables any object or behavior in the field of "attention" to become an interface through multi-modal sensing. This represents a significant paradigm shift in human/computer interface design.

Sentient R-map explores related research questions from a different set of perspectives. Both works examine the potential of parsing machinic senses, associating particular media-elements and processes to behavior in the space, and augmenting memory and perception in a poly-valent manner. They each present a potential for the study of related multi-modal search engines, drawing from the mining of "neighborhoods" of parallel streams of sense data. It is here interesting to step back and look at the intentions of an earlier Memory Theatre. Camillo states (as quoted in Yates, Art of Memory:

He pretends that all things that the human mind can conceive and which we cannot see with the corporeal eye, after being collected together by diligent meditation may be expressed by certain corporeal signs in such a way that the beholder may at once perceive with his eyes everything that is otherwise hidden in the depths of the human mind. And it is because of this corporeal looking that he calls it a theatre. [31]

So these projects described above, function as poetic memory theatre-like spaces, exploring through computer augmenting systems a particular approach to the unleashing of "pointed" associative thought, as derived through authored associated computer-mediated links to a network of media elements and processes. Thus a set of fields of meaning are entertained. These works explore the continuum between a chosen physical space and a specifically linked media space that augments the perception of that space via "machinic perception" systems and related media "output organs".

[1] BASALLA, G. 1988. *The Evolution of Technology.* Cambridge: Cambridge University Press.

[2] YATES, F. 1966. *The Art of Memory.* Chicago: University of Chicago Press.

[3] Roy Ascott, Art and Telematics in Telematic Embrace : Visionary Theories of Art. Technology, and Consciousness, p. 187

[4] YATES, F. 1966. *The Art of Memory.* Chicago: University of Chicago Press.

[5] TURING, A.M. 1986. A.M. Turing's ACE Report of 1946 and Other Papers. Volume 10, p36. In: B.E. CARPENTER and R.W. DORAN, eds. The Charles Babbage Institute Reprint Series for The History of Computing. Cambridge/London: MIT Press, pp.21-124.

[6] WIENER, N. 1985. *Norbert Wiener: Collected Works with Commentaries*. Cambridge/London: MIT Press, p.215

[7] Licklider, JRC, "Man-Computer Symbiosis" IRE Transactions on Human Factors in Electronics, Volume HFE-1, March 196.

[8] TURING, A.M. 1986. A.M. Turing's ACE Report of 1946 and Other Papers. Volume 10, p36. In: B.E. CARPENTER and R.W. DORAN, eds. The Charles Babbage Institute Reprint Series for The History of Computing. Cambridge/London: MIT Press, p. 41.

[9] Licklider, JRC, "Man-Computer Symbiosis" IRE Transactions on Human Factors in Electronics, Volume HFE-1, March 196.

[10] See N. Katherine Hayles *How We Became Posthuman: Virtual Bodies in Cyberspace, Literature and Infomatics* (Chicago, 1999) for an in depth discussion of cybernetic relations.

[11] Dr. Leslie Smith, Department of Computing Science and Mathematics,

University of Stirling, http://www.cs.stir.ac.uk/EWNS2/#Overview

[12] ALEKSANDER, I. and BURNETT, P. 1987. *Thinking Machines – The Search for Artificial Intelligence*. New York: Alfred A. Knopf, p.13)

[13] NYCE, J. and KAHN, P. 1991. *From Memex to Hypertext, Vannevar Bush and the Mind's Machine.* Boston: Harcourt Brace Jovanovich, Inc.

[14] ASCOTT, R. 1966. Behaviourist Art and the Cybernetic Vision. *Cybernetica*, International Association for Cybernetics, Namur, IX, pp.247-264., p.11

[15] Douglas Engelbart, "Augmenting Human Intellect, A Conceptual Framework", 1962 as reproduced in The New Media Reader, Edited by Noah Wardrip-Fruin and Nick Montford, MIT Press, 2003, p95

[16] Danny Goodman, The Complete Hypercard Handbook, Bantam Books, New York, 1987.

[17] ibid

[18] ibid

[19] Pask, Gordon, 'the Architectural Relevance of cybernetics', *Architectural Design,* 1969

[20] Varela, F., Thompson, E. and Rosch, E. 1991. *The Embodied Mind, Cognitive Science and Human Experience.* Cambridge/London: MIT Press. p.23)

[21] CASTI, J. 1994. *Complexification: Explaining an Illogical World Through the Science of Surprise.* New York: Harper Collins., p.7

[22] Dennett, Daniel C., Consciousness Explained, London: Penguin books Ltd., 1993.

[23] HODGES, A. 1983. *Alan Turing: The Enigma.* New York: Simon and Shuster. p.104

[24] Pask, Gordon, 'the Architectural Relevance of cybernetics', *Architectural Design,* 1969

[25] Rafael Lozano-Hemmer, Relational Architecture, <http://www.rhizome.org/artbase/2398/fear/relarc.html>http://www.rhizome.org/artbase/2398/fear/relarc.html

[26] Davis, Erik, Techgnosis: Magic, Memory, and he Angels of Information', *South Atlantic Quarterly* 92:4 (Fall 1993) Durham, NC: Duke University Press, 1993

[27] Marcos Novak, 'Liquid Architectures in Cyberspace', form *Cyberspace: First Steps by Michael Benedikt,* 1991

[28] Bill Seaman, ‘Hybrid Architectures / Media Information Environments’, In Intelligent Environments—Spatial Aspect of the Information Revolution,

Peter Droege, Editor,
<http://www.amazon.com/exec/obidos/ISBN=0444823328/6434>http://www.amazon.com/exec/obidos/ISBN=0444823328/6434 2433211-744357, Amsterdam, Netherlands

[29]Chi-Kuo Chang, ‘The Sentient Map and Its Applications to the Macro University

E-Learning Environment’, in *ADVANCES IN VISUAL INFORMATION SYSTEMS*

[30] Richard Bolt, “Put That There”, 1980 as found in *The New media Reader*, Edited by Noah Wardrip-Fruin and Nick Montfort, 2003, MIT Press

[31] YATES, F. 1966. *The Art of Memory.* Chicago: University of Chicago Press.

* For an abbreviated version of some of the texts I have quoted above and some related texts see also Cyber_Reader Critical writings for the digital Era, edited by Neil Spiller, Phaidon Press, 2002,

**The Poly-sensing Environment and Object Based Emergent Intention Matrix: Toward an integrated Physical / Augmented Reality Space. This is a collaboration between myself, Ingrid Verbauwhede, an electrical engineer from UCLA, and Mark Hansen, from Statistics at UCLA. Two student researchers have also been working on the project: Shenglin Yang, Programmer/Researcher EE Department, UCLA, and Fabian Winkler, Design | Media Arts, UCLA. Initial funding for the research has come from The Academic Border Crossing Fund at UCLA and the Langlois Foundation.

Key words:

• Memory – Space for remembering sensed human activity and/or Computer storage space.

• Memory Theatre — Space to augment memory and thought processes. See YATES, F. 1966. *The Art of Memory.* Chicago: University of Chicago Press.

• Multi-modal searching — Search engines that look for information in multiple media forms – text, image, sound, video etc. and combinations of media.

• machinic sensing — the use sensing devices as input devices for computers.

• machinic perception — the simultaneous use of multiple machinic senses to augment human perception by presenting an alternate set of representations of a chosen space.

The word Machinic means – of or pertaining to a machine. It is found in Deleuze and Guattari's *A Thousand Plateaus* .

DELEUZE, G. and GUATTARI, F. 1987. *A Thousand Plateaus: Capitalism and Schizophrenia*. vol.2. Trans. by Brian Massumi. Minneapolis: University of Minnesota Press

16

--