Putting the i in iDTV

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Keynote address for media course on:
Interactive Television Authoring and Production
Universidade Lusofona de Humanidades e Tecnologias
Lisbon, Portugal April 17, 2002

"The structure of expression is shaped at the intersection of technology and culture"

Today I have been invited to talk to you about "interactive" television. What is "interactive" television? Is it culturally driven? Is it technology push? In order for you as content creators to shape dreams and programs for an "interactive" delivery channel, you must discover ways to model story content that drive active engagement by the audience in ways that take advantage of appropriate and available technology.

What is iDTV? In the commercial and policy vernacular of today's broadcast media dialog, Digital Television often references the current allocation of digital spectrum for high-definition broadcast television. For the purposes of this course and this lecture, I prefer to focus on interaction and its implication for content creation and media consumers, rather than restricting the discussion to the future of Digital Television broadcast. I will first discuss the elements that will define iDTV. I will then discuss navigational paradigms as they have emerged over the past 20 years, with particular consideration to three early examples of the interactive medium. Finally, I will present some newer works that suggests the future of iDTV will not be in the living room but will be in delivering television to mobile/portable devices equipped with sound and image capability.

Using a broad definition, we can say that iDTV presumes that video/audio content has been created for transmission over a 2-way (broadband) digital channel, and that the form of its content assumes that the end receiver or audience will use the two-way capability of the channel for activities related to the program content. More simply, I suggest that iDTV assumes the integration of TV, Computation and the Net.

Let us look at each of these elements individually. TV, broadly speaking, refers to video content that uses broadcast, cable or satellite technology to reach a broad base of consumers. Alternatively, we think of TV as a rather large device that sits in a prominent position in many living rooms around the world.

Computers are machines we can program to carry out particular procedures. When we combine television programs with computers we can process digital images and we can simultaneously use a 2-way communication channel to call up other information or to send messages. With certain computing devices such as TiVO, we can store incoming video content thus allowing us to time-shift program content to avoid advertising or to allow us to watch several simultaneously broadcast programs according to our own schedule.

The Net is an emerging distributed channel that has no central or hierarchical architecture. The net is a self-organizing network formed as signals from computationally enabled devices in geographic proximity find and use each other to pass messages and share power. The net is not owned by a commercial carrier; rather, it is owned by consumers who own the devices and who choose to share or make these devices available to devices owned by other people. The net provides us a very new way of sharing media whose precedents we have already seen in architectures such as Napster.

iDTV, in whatever form it is realized, will capitalize on the convergence of these three technologies: TV, computation, the net because they are available and more importantly because they all play a critical role in today's culture of media consumption. Therefore, as you develop the concept and shape the stories for this course, you must develop them with an understanding of how the concept can invite participation, how the shape can incorporate the 2-way capability of the network, and what the value of the 2-way channel is for this traffic.

Research toward iDTV

For the past 20 years, researchers have explored the potential of a new medium that would bring together TV and computers. The precedents of the net were sufficiently present to provide us with some directions and insights of how interaction would affect the structure of video content.

Ironically, in the early days, the only way to explore iDTV was to segment and represent content material. This made it immediately evident that iDTV would not have the characteristic which TV had inherited from film: the constraint of being continuous. Film, as it was invented at the turn of the last century, is continuous because a long, unbroken strand of celluloid carrying sound and image was integral to the invention. With the computer, different configurations became possible.

Before digital video was even invented, analog video could be stored on videodiscs. Computers controlling the videodiscs could rapidly search and traverse its entire capacity for the next segment to be shown without having to stream past substantial lengths of tape. This technique solved two problems. First, it enabled efficient switching between sources based on input from the viewer and a nearly seamless efficiency of playback. Second, it provided the facility needed to create a digital editing system, a system in which the editor could search for a particular shot by frame number or by content descriptor, a system which could switch shots in real-time such that the editor perceived a continuous presentation where there were only fragments.

Already in the early 1980's, experiments in interactive television content included three fundamental story structures: "the journey," "the old and the new," and the "who-dun-it."

These story types would be repeated with newer technology going forward; however, it is always useful to know about the original models, so I will show them to you now.

In the late 1970"s, Nicholas Negroponte, Andrew Lippman, and a team of researchers belonging to the then Architecture Machine Group at MIT decided to implement a research project focused on virtual travel through the streets of Aspen, Colorado. Funded by DARPA, "Aspen" became a classic, inspiring work in virtual reality as well as storytelling. Aspen in its 1980 configuration provided the interactor with a graphical interface which moved them through a surrogate travel experience. Navigating the city using an iconic menu - turn left, stop, turn right, go in there - the interactor could occasionally travel back in time, seeing the same building's facade in the context of the previous century. Very occasionally, the interactor could enter a building and be confronted by human interaction and a personality -- a fashionable lady amuck in a chic clothing store or a gruff greeting from the sheriff in the local police station. While these glimpses of story were tantalizing, the overall experience of raw surrogate travel lacked any kind of drama or narrativity, any reason to learn from others and any option to share one's experiences with others.

Whatever its limitations, "Aspen" placed the viewer in the center of a journey, a first person odyssey which some of us sensed could someday -- with the right teller -- generate an experience that equaled or bettered Homer's original odyssey or -- dare I suggest -- the great 20th century classic, Ulysses by James Joyce. In addition to the idea that by action the interactor embarked on a personalized journey, Aspen offered critical insights into technical architecture of future media content. From "Aspen" on, video would be granular and designed for interuptibility. At the time, Negroponte even argued that all future content would be loop based; later, Brondmo/Davenport raise issues about relation of audio to interruptable video. "Aspen" creators were the first to argue for the need to imbue the system with limited "look-ahead," meaning that the system needed to constantly anticipate what the interactor might choose next and be able to queue it up so that the interactor would not be left in the lurch. Finally, the experience must give the participant the feeling of infinitude while being able to gracefully degrade or exit from a circumstance that it could not realize.

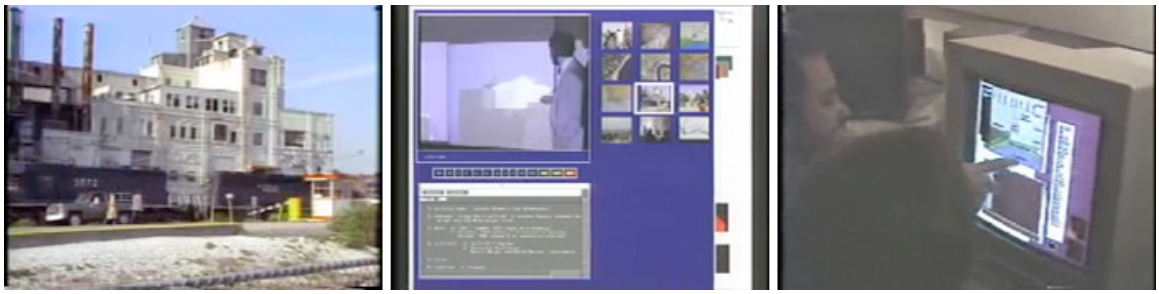
Aspen, M.I.T Architecture Machine Group, 1980: Andrew Lippman navigates using touch controls

"Aspen" was soon followed by my own documentary production, "New Orleans in Transition: 1983-86." The concept for "New Orleans" was based on the "new and old" story model. Having witnessed as a child the effect of pulling down the El (an elevated streetcar system) in Manhattan, I was fascinated with urban change: who held the vision? Who realized the required action? And who profited? On an academic visit to New Orleans in 1982, I was introduced to some of the people who had a stake in bringing the 1984 Worlds Fair and Exposition to the city. From the first introduction, I smelled risk: the idea was to use the Exhibition to refurbish the urban infrastructure of

the historic French Quarter. Already the city was immersed in controversy. I wondered: could they pull it off? Could we capture the process by which they did or did not? Could this controversial vision provide us with material for a large scale, interactive documentary program?

At the end of 4 years, 38 visits to New Orleans and 50 hours of filmed footage, I reduced the material to 3 hours of tightly edited sequences, annotated each sequence with "who, what, when, where" information, and designed a hypermedia interface which allowed the interactor to visit a map, look at the biographies of individual characters and groups, navigate a time line and other attributes relative to the story, request a compiled a set of sequences based on their history, and delve deeper into the details behind any particular sequence. Each sequence or "chunk" of content was designed to present a full dramatic unit; they were always arranged to progress forward in time, thus helping to alleviate any ambiguity. The filmmakers took an observational approach, shooting interviews only when clarification was needed; very few scenes were shot with a person talking directly to the camera. This means that the interactor is generally placed in the position of a voyeur; however, from time to time, immersion is dramatically focused.

"New Orleans Interactive" was designed as an invitation that allowed students to have as complete a view of urban change in New Orleans, just as the filmmakers themselves had done by the end of the filming. The intention of the project required the architects to augment the hypermedia aspects of the system with a substantial database of digitized photographs, newspaper articles, maps, documents and blueprints.. The interface also included non-linear editing tools and enhanced word-processor tools which allowed students to "cut and paste" multimedia snippets into their own writings and theorizings about the material. Thus in 1987, the system collected histories of the interactors and allowed interactors to message between themselves with media messages.



Davenport, "New Orleans in Transition: 1983-86," MIT Interactive Cinema Group Film with Richard Leacock

The "who dun it" has been another favorite model for early interactive experiments. Drawn to the story through the experience of empathy and engagement in mystery stories, the well-appointed interactive who-dun-it places the audience at the scene of the crime; whether it has to do with pride or curiosity, the audience will follow threads they find most interesting. In 1981, Marty Perlmutter picked up the gauntlet with the "Murder, Anyone?" videodisc.

The opening scene of "Murder, Anyone?" is suggestive of any television drama: a dinner is in progress. The family patriarch sits at the head of the long table, describing how he has reallocated his vast fortune in his most recent will. As he describes the new allocation, he underscores how each family member may be more or less pleased with the outcome. Finished, he excuses himself, requesting that anyone with a complaint come and meet with him in the drawing room above. He rises from the table and leaves

the room; seconds later, we -- and all the members of the dinner -- hear a gunshot. A detective soon enters the scene of the who-dun-it and begins to question the guests who have been quarantined on the estate. As voyeurs, we are invited to look over the shoulder of the detective or to navigate the suspects according to our fashion.

Taking advantage of the limited technology of the time, the videodisc controller allowed the programming of scene start and end frames and controlled which of two alternate audio tracks would be played for the particular viewing of the scene. Building on idea that TV watching was a social engagement, the author structured the story as a network of nodes; the metaphor was that of a TV parlor game. At the end of a scene, the disc player would pause and await direction to the next node of choice.

Perlmutter designed his game to stimulate discussion and collective decision-making by the local viewing audience. Alas, the idea of hanging out with groups of friends around the TV faded at about the same time the disc came out. I for one watched two segments in the intended way and then watched the whole disc straight through in an attempt to understand the clever way in which the author had used the sound tracks. Nevertheless, the dream of creating a popular who-dun-it for the audience to actively explore their intuition as if they were the detective remains in favor.

This electronic form found a physical analogy that same year, when John Krizanc's play "Tamara" opened in a house in Montreal. This large-scale drama -- over 100 scenes, with several playing out simultaneously in different rooms of the house -- forced the audience to choose which parts of the action they would see and, by default, what they would not. The audience began their quest together, but as each scene played out each member would choose whether to follow an actor who left the room or to stay with the actor in the room: physical movement in space provided the "action selection" mechanism for this story's "interface." Soon, the audience was distributed throughout the house, each with their own view of the guilt or innocence of various parties. Halfway through the show, the audience gathered for an elegant dinner; during this intermission, the audience had a chance to hear accounts and gossip about what they had not seen, speculations about what may happen next, and personal opinions about which characters were worth closer scrutiny. After dinner, the audience continued their individual pursuits of story.

Tamara ran for four years in New York, a few months in Lisbon, and ten years in Los Angeles -- it was "the longest running play in Hollywood." Oddly enough, the most difficult part of keeping the production going was finding new cast members: actors do not like being abandoned for another.

What interface? The critical issue of viewer navigation

The age-old story of the journey must inevitably lead to a world that knows about its spatial self. In modern terms, the echoes of Aspen have been transformed into the navigational systems of automobiles. As we ask how spatial sensing technologies such as GPS, field-sensing, wireless triangulation and IR communications can be used to developed mobile, location-based stories, we need to recognize that while it is difficult to predict the mental trajectory of a traveler, their path through space is continuous. One might describe Aspen, or other geographic projects, as the penultimate in branching structure.

In contrast, the "old and the new" story model requires a different type of continuity (and choice). Stories about people highlight "conflict and resolution" models; order is not mapped to geography but to the mind, the emotions, and idiosyncratic memories of personal experience. How do we represent to the machine the underlying phenomenon that drives this story type -- the old ever resists the new and the new wants to clobber the old?

What interface characteristics allow us, the audience, to position our selves at the heart of the story world and make our way forward? What is "forward" in a story space? We cannot navigate toward our desired destination when we do not know that destination; we can only pick and choose from options that present themselves. If the audience lacks a sense of context and direction -- an overview -- use of these options can become quite arbitrary and short-sighted.

Over the past 20 years, only a few options have been presented that allow us to navigate interactive story worlds or webs: on-screen navigation, physical navigation, polling, direct interaction with a character, and tangible interfaces.

Briefly, on-screen navigation allows the audience to choose a direction from a menu of options. In Aspen, we could choose to turn right or left or stop or go inside; in New Orleans we could choose from a palette of context-dependent icons that updated itself regularly. With on-screen navigation, the audience must make an active, thoughtful choice whether or not they know where the choice will lead.

Physical navigation through space provides a more subtle approach. Here we can embed segments of the story web in real physical places, such as streets and buildings or the individual displays of a museum. As we move through a place, our proximity to these embedded information artifacts allows them be viewed immediately or collected for later use. Sometimes, our motion through a room is driven by an express desire to engage with its attractions and affordances; sometimes, it is an incidental by-product as we carry out the tasks of everyday life.

Polling or voting provides a more sociable interaction: we are part of a community; we are asked; we answer; we experience according to the opinion of the larger group. Typically, polling requires some discussion, some use of a communications network. This approach gains from the collective knowledge and experience of a broader audience, but suffers from the dilution of individual desire.

Tangible interfaces have long been a staple of interactive machine control. The panels of knobs and switches on the front of radios and TV sets have spawned a portable, hand-held doppleganger: the wireless Universal Remote. Many race-car video games offer plastic steering wheels and foot pedals -- which mimic the function of their real-world counterparts -- as physical, literal interfaces to the simulated game world. Tangible interfaces can also be highly figurative and poetic; for example, when the cork is removed from one of Hiroshi Ishii's first beautiful glass bottle the local Internet traffic at that moment plays out as pleasing sounds. Later one bottle became a three, and a new tangible interface to narrative was born in the "Genie Bottle" story.

Ishii/Mazalek, “Genie Bottles,” MIT Tangible Media Group, 2000

Navigating Physical Space: an evolving story channel

The way we move through a real physical space can also be used as an input to story construction and playout. Installations in public spaces can give story a sociable characteristic; so can stories that invite viewers to communicate and share materials over the Net. This approach to story navigation can take advantage of a wide variety of sensing devices -- such as pressure-sensitive floormats, mini-radars, sonars, field sensors, vision systems, and GPS -- which are used to detect whether an audience is present in a space, determine their position, and report specific aspects of what the audience is doing

In the early 1990s, we began to explore how a full-body navigational paradigm could be used to extend story interaction and make navigation of the story space more transparent. Borrowing on sensor technologies developed in particular by Joe Paradiso and a multimedia scripting language developed by Stefan Agamanolis, we began to explore spatial navigation as the principal control system for interactive artworks.

In Sammy Spitzer's "Birds," an array of tiny sonar sensors detects whether someone has entered the space; if they have, the pigeons are "startled" and fly away. The most remarkable thing about this first, simplest experiment is that everyone who saw it laughed. This lead us to wonder whether we could create more complex short stories for public space that would generate emotional reactions in the audience.

Spitzer/ Agamanolis, “Birds”, MIT Interactive Cinema Group,1996.

In this piece, "Jayshree Dances," a classically-trained Indian dancer scans the room for an audience. When sonar or radar sensors detect that someone is nearby, she begins preparations for her performance by applying make-up and costume. If the audience stays, they are treated to a dance of welcome. If they leave early, the sensors detect the direction of their movement, and Jayshree glares ferociously at them. We were inspired

to network a number of these stations throughout the world and use dancers of several nationalities in an interconnected piece; this is a project I would still like to pursue.

"JayShree," Davenport/Agamanolis, Interactive Cinema Group, 1996.

About this time, Joe Paradiso had developed a "magic carpet" sensor which used a grid of piezo-electric cables to sense the X,Y coordinates and the strength of each footstep upon it. We fused it with a simple non-linear editing system and a database of video clips to create the "Cinemat;" by walking on this mat, the audience edited story fragments together in real-time

At the Rotterdam International Film Festival of 1997, we ran the Cinemat a stand-alone kiosk. While watching people use it, we realized that passing observers had no way of knowing what story the players thought they were constructing as they methodically paced the rug.

A few months later in Mexico City, we installed the Cinemat center-stage in a theatre and hired a Master of Ceremonies to frame and guide the interactive activities. Here, we gave someone from the audience a microphone and asked them to narrate the story told by the images appearing on the screen as a second volunteer walked on the carpet. We also added two new interactive scenarios to the Cinemat: chasing a thief who has stolen your sandwich (by Arjan Schutte and Stefan Agamanolis), and the travails of keyhole-peeping voyeur on a creaky staircase (by Brian Bradley). The primary participants were immersed in their first-person tasks, while the rest of the audience could join in the fun through observation and shouted meta-commentary. The result was a shared communal experience rather than a solitary journey.

The [I want] More Button:

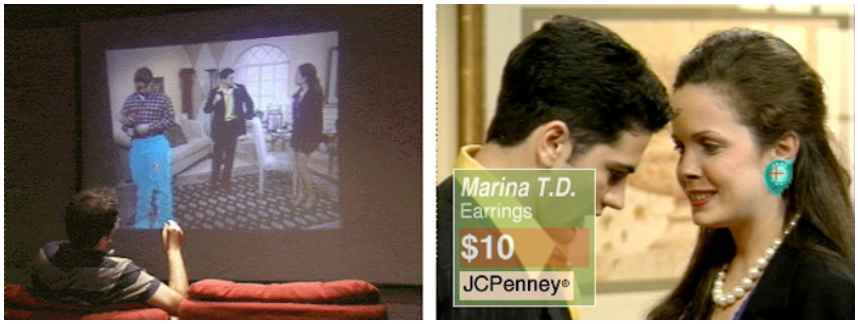
The most ubiquitous concept related to interruptible navigable content is the "[I want] MORE" button. The more button conceptually signifies the desire to acquire more information. the challenge of the MORE button is contextual: in one case, it might just mean to continue the program; in another case, it might mean "give me some background information and then return to the main program;" in yet another case it might allow me to follow the most personally compelling program option. The problem is that MORE is a contextually dependent desire.

MORE must be realized systematically and by examining what it might mean in different situations we can begin to understand the need for combined sensor input, programs that manage personal history, and programs that learn from past interactions with other users. These interactions are generally implemented using scripted, responsive, or behavioral programming approaches.

The simplest case of MORE assumes that there is only one choice available and that this choice has been pre-scripted to be visible to the interactor either by means of active selection from a graphical menu or a hyperlink. This level of interaction can work well for

Interactive Television systems today which have only a very narrow band upstream capability. "Interactive Julia", a collaboration between Boston's WGBH-TV and Michael Bove (plus his student collaborators, Stefan Agamanolis and Jonathan Dakss) provides a useful example of content recycling using a MORE button. The show opens as Julia Child, a legendary chef and TV personality, sweeps grandly a room of guests announcing: "Dinner is served." At this point the curious viewer might wonder: "What's on the Menu?" MORE takes the light-pen-wielding interactor to the Menu. From here, the interactor want to know about the entrée; MORE takes the interactor to Julia's discussion of how to select a filet of beef. Minus the more button, the interactor goes back to the main program content.

The MORE button found its extreme commercial example in "Hypersoap," a melodramatic soap opera which substitutes clickable on-screen product placement for advertising breaks. By pointing and clicking on any object in the scene -- a chair, a vase, the actor's sweater -- the viewer could call up a catalog page and ordering information for that item. After the video material was shot, it was extensively post-processed with special software which tracked, segmented, and hyperlinked each clickable object. The resulting interface was an invisible overlay of clickable target zones -- an interesting alternative to overlaid text menus. The experience of creating these two programs inspired Jon Dakss to found a company, Watch Point Media, whose mission is to provide a visual software authoring package that ill allow media editors to easily program simple instances of the MORE button.



"Hypersoap," Bove/Dakss/Agamanolis, MIT Object-Based Media Group, 1998.

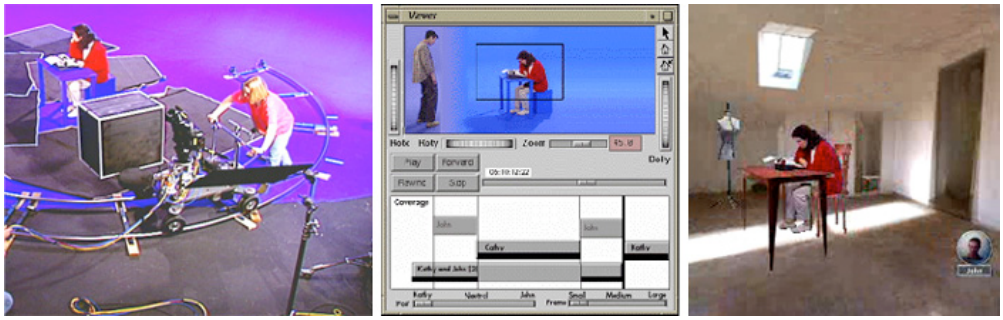
Can a MORE button engage us in a deeper level of story interaction? Will iDTV give rise to stories that really change our knowledge about ourselves and our world? Will it allow us to learn as we view? Will it allow us to participate in the creation as well as in the consumption of narrative?

Multi-point-of-view narrative

New Orleans in Transition, the documentary discussed earlier, introduces us to almost 50 characters; these characters represent diverse attitudes towards development in New Orleans. By developing a story engine that could select only the interactions of one of the major characters, we were able to give the audience a sense of a world without diversity of opinion. By intertwining many of these stories, diversity was an emergent property of the system and the content.

Kevin Brooks, whose work you will get to know shortly, developed a program called Agent Stories to explore a systemic approach to multi-viewpoint narrative. This story approach seems to resonate with tangible narratives as well as in participatory narratives. In a production of "Yellow Wallpaper" we explored what it would mean

technically and in terms of programming for a set-top box to dynamically deliver very different points of view of the same narrative action. Our approach centered on "object-based video," a powerful paradigm which allows audio and visual elements to be mixed, matched and composited as needed within the frame as well as within sequences. The many possible recombinations provide a limited database of content with exponentially expanded usefulness, adding to a "sense of infinitude" of the underlying materials. In this case, the program can be considered responsive: that is, it is interpreting a variable input and outputting a coherent, dynamically adaptive story cobbled together from a finite inventory of pre-made audiovisual content.



"Yellow Wallpaper," MIT Object-Based Media Group with Interactive Cinema Group, 1993.

What if IDTV is something different all together?

What if Interactive TV is not ergonomically what TV has been in the past? What if the miniaturization of technology, the availability of net wise channels and our own peripatetic lifestyle transform the whole idea of cinematic storytelling to accommodate mobile environments? What if the cable box and the large TV in the corner of your living room were to disappear because we begin to carry our iDTV terminals with us as we move through space and time? Could we, under those circumstances, arrive at the creation of dynamic, inspiring navigable stories?

In order to deliver a coherent story in space and time, we need a system that can present content based on multiple variables: what content has the audience seen before, what content is appropriate to present at this time in this place, what is the receiver's context. Unlike the simple branched narrative structure moderated by the MORE button described above, location-based narratives need some way of determining the intention of the interactor, perhaps even predicting where she will go next.

By comparing two recent productions, we can get a sense of the trade-offs we will encounter with different levels of complexity in computational interactions. Flavia Sparacino's "Museum Wearable," designed as part of her PhD research, allowed visitors to receive video content as augmentation to the objects on view. In order to deliver appropriate content, the museum was outfitted with narrow cone IR sensors; the museum wearable was built using a small micro-optical display, headphones, a small camera and an infrared location IR receiver. The combination of IR and the small camera allowed the system to track here the visitor was standing and to compute how the visitor moved through the space. Using predictive coding, the system dynamically typed the visitors a "busy," "selective" or "greedy." The system could then dispatch appropriate content to the visitor based on their behaviors in time and space.

"Museum Wearable" & "Sto(ry)chiastics," Flavia Sparacino, MIT Interactive Cinema Group, 2001.

"Another Alice" provides a more straightforward narrative using characters that the viewer can intersect with by going to specific locations at specific times. The video is delivered on an IPAQ equipped with GPS location sensing and an 802.11 network card. The GPS tells the system where the user is; the story time is mapped to actual real-world time. As the interactor meets characters, the characters tell the interactor where she might want to go next. The fun of "Another Alice" has something to do with how people who have experienced the story relate their experience to others.

"M-Views," Pengkai-Pan, MIT Interactive Cinema Group, 2001.

Conclusion

The "old culture" of TV was based on the notion that channels are a scarce resource. Pre-made chunks of content -- TV programs -- were distributed to a mass audience via a shared "front-channel." Content flowed according to the schedules of "broadcasters." Any interruption or discontinuity in this monolithic feed was considered a disaster. The audience's control was limited to turning their receivers on or off and selecting which channel to play. A vast divide was created between content makers and consumers, with no provision for direct, real-time audience feedback.

The "new culture" of iDTV will be based on the notion that virtual channels are an abundant resource, that content can come from anywhere in the highly-distributed Net, and that a "back-channel" of related communications (whose traffic may dwarf that of the original TV program) will be intimately associated with the primary "front-channel." Increased switching and routing capabilities will allow programs to be fed out on a shot-by-shot basis, allowing a degree of personalization and customization hitherto unseen. Object-based channels can be streamed and composited into a single scene, greatly expanding the reusability and repurposing of the underlying databases of content.

Throughout the history of art, literature, film, and television, whenever a compelling chunk of content (or an episodic series of them) was published, communities and subcultures gathered around it. The peripheral activities of content providers (such as "behind the scenes" stories and scheduling information) and the activities of "fans" (such as gossip, speculation, and the exchange of relics) have increasingly moved on-line; soon, they may be integrated with the primary channel itself. The limits of community participation may be economic rather than cultural of technological: who will pay for the back-channel? How will the commercial framework constrain access and story form?

In the immediate future, the economics of the iDTV industry will be driven by the reselling and repurposing of pre-made program content. New tools for making and sharing -- which combine the functionality of non-linear editing systems, on-line search and retrieval, and sophisticated person-to-person telecommunications -- will become central to the audience's experience.

In developing an iDTV infrastructure, we need to look at how computation is changing culture and grow an understanding of the true nature of the Net. We also need to ask what stories need telling, and by whom; what story structures are inherently suited to computational media; how computational narrative resonates with the technological progress; and what, if anything, technological fluency means for a marketable product.

As audiences gain substantial experience with interactive interfaces, their learning curve will decrease and their use of the system will become more sophisticated. Their relationship with content will shift from today's relatively passive enjoyment to highly active, idiosyncratic, and context-aware encounters. To facilitate their mastery of control, the audience should be provided with some sort of contextual overview of the available materials; as we learned with the New Orleans project, audiences were happier and more discriminating when first presented with a short version of the story before they dove into the full depth and breadth of the available content. As the primary content-makers, audience, and mediating machinery work together in the co-construction of meaning and shared experience, limited look-ahead will become a crucial mechanism of content navigation and playout.

The era of the Set-Top Box sitting atop a huge, immobile TV set in one's living room will quickly pass as mobile devices become more powerful, ubiquitous, and interconnected with each other and their environment. Then, the excitement will come from creating beloved forms of tangible interfaces for hyperlinking, public screen spaces for planned and accidental encounters, and mobile outreach for new story forms.

When centralized and local computing power is merged across high-speed networks, program content will truly become an "open ended invitation to ethical and poetic responsiveness" (1).

1. Richard Kearney, **On Story**, NY/London, Routeledge Press, 2002, p156.