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Dynamics of creativity and technological innovation

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Abstract

This article concerns the struggle between artistic expression and technological innovation. The perspective that is articulated is drawn from the work of the Interactive Cinema group at the MIT Media Laboratory. Situated at the boundary of evolving technologies and media storytelling, research of the group iterates between shaping and presenting cinematic expressions using emerging technologies and developing the required tools and platforms to support its creation and delivery. This dynamic is integral to collaborative expression on large-scale projects, as well as in more individual research endeavours such as a current investigation, which conjoins new tangible display technologies with interactive stories.

Keywords: artistic expression, creativity, elastic movies, research laboratory, tangible displays, technological innovation

Interactive Cinema reflects the longing of cinema to become something new, something more complex, and something more personal, as if in conversation with an audience.
Glorianna Davenport
Founder, Interactive Cinema 1987

1 Artistic innovation, the laboratory and technology

Throughout the ages, storytelling has been a principal mode of human communication. While the narrative act is shaped by sensory observation, cognitive interpretation, and the desire to share our experience with others, narrative expression becomes public and shared through appropriation of technology. Early technologies include picture formation, language, and the imitation of action. More recently optical, electrical and digital technologies have generated new media types and channels for narrative expression and distribution.

For four decades, my work in the expressive arts has been situated at the boundary of evolving technologies. Almost by definition, expressive technologies require a gestation period in order to gain the momentum required if they are going to become culturally dominant. This period is characterised by experimentation, debate and the exploration of economic opportunity. The struggle between expression and innovation, between old forms and new forms, between what has been and what will be, provide defining frameworks that allow a technology to mature. The research laboratory can play a significant role in such a debate. Both theory and the generation

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film school in the world. Offering a Master of Science in Visual Arts degree, the section attracted passionate filmmaking students from around the world who came despite the severe economic cost of tuition and of making their final film project. In addition to the graduate program, the unit ran popular filmmaking courses for MIT undergraduates and pursued a small research activity devoted to the development of a Super-8mm synchronous-sound film rig, a rig I chose to use on several occasions.

As a member of staff and a young filmmaker in this environment, I was acutely aware of the continual struggle between innovation and expression. Most students joined the Film section program in order to make a 'serious' thesis film. For most of them this meant shooting in 16mm format where 10 minutes of processed 16mm film cost about $200; even with a reasonably low ratio of original to edited footage, this was an expensive medium! The intensity of the graduate culture was manifest throughout our laboratory: from excited conversations about the 'best' stock to scenes of students practicing their 'walking shots' with empty cameras on their shoulders, technique was all important. Both the experimental Super 8 rigs and black and white video rigs were available from around 1976 onwards; however, most of the students eschewed these 'experimental' media. For the more adventurous students and staff these media were placeholders for the future.

In 1978, the first CAV optical videodisc player became available in the US; several of these were purchased by the Architecture Machine group at MIT for use in computational media experiments. The player was unique among video devices because it had a built-in serial port. The CAV (constant angular velocity) format allowed the computer to access any individual frame of video. As the Film section transitioned to the Film-Video section, a few of us realised that the future would be a computational video medium. In 1982, after 2 years of personal experimentation with programming these videodisc players, I wrote and was awarded a grant from the National Endowment for the Arts to make a 3-year cinematic case study of a city in transition. The grant specified that two versions of the project which was to feature New Orleans as it prepared for and hosted the 1984 World's Fair would be released: the first, a television documentary, and the second, an interactive computer mediated version for the study of the urban environment. Somewhat ironically, the NEA had almost no interest in the interactive version. Luckily, *Project Athena*, the first large scale experiment to make network computers available to MIT undergrads, was interested and with their support the *New Orleans in transition* project became the first large scale documentary to be delivered over a computer network (Davenport 1987).

Even as I began shooting the film with Richard Leacock, I dove into the design and construction of a computational environment for cinema. At the time, no relevant exemplars or software existed. In order to provide the viewer with the ability to pro-actively explore, view, and contribute material, we specified an entirely novel application architecture and interface. This involved purchasing a rare and expensive video card ($12,000), evaluating commercially available databases (in the end, we implemented our own), developing a selection algorithm that maximised thematic continuity, and building our own random access video editing software so that students could edit video from the case study as part of their planning argument. In 1987 we ran a version of the project as part of an introductory course on urban planning. Students had access to 6 hours of video, 50 memorable characters and 5 interwoven story lines as well as to significant text resources (Figure 1). The reaction to the 5-year effort was favourable, but the audience for the 'interactive' version was extremely limited.

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Figure 3. Created in 1988–9, *Elastic Charles: a hypermedia magazine*, provides an environmental perspective on the Charles River, a landmark that defines the geographic boundary between Cambridge and Boston, and invited the audience not only to navigate but also to create their own links using the *Elastic Tools* designed by Hans Peter Brondmo in *Hypercard*™.

Figure 4. *The Wheel of Life*: an interactive transformational environment, invited the audience who took on the role of either 'explorer' or 'guide' to traverse three mythic spaces—water, earth and air. The production was open to the public for 10 days in January 1992. (Photo Credit: David Tames)

My first research assistant, Hans Peter Brondmo, who joined Interactive Cinema in February 1988 was a Macintosh aficionado and introduced me to an early version of *Hypercard*™. Together we decided that his research project would be to build a video friendly tool set in *Hypercard*™ for use in my fall class. In order to build tools, the developer needs to know what the tools will be used for. Partially inspired by *News in the Future*, a recently formed sponsor consortium, we determined that the class project would be a 'hypermedia magazine'.

Some time in the summer of 1988, I settled on the Charles River as a focus for the hypermedia magazine. This would allow me to draw on my New Orleans experience, and would expose students to an environmental perspective of Cambridge, Massachusetts: what happens when a parking lot is placed on a flood plain? Why are there highways down both sides of the Charles River? Who actually runs the locks? As many of the students would have no prior experience in shooting video, I was also optimistic that the Head of the Charles race, which is held every year in October, would provide a content hook and would allow all the students to gain experience videoing. As the semester got underway, I gave another of my research students, Alan Lasky, the task of organising the coverage of this event.

The *Elastic Charles*, as it came to be called, remains a fun, content-rich example of early 'interactive' media (Brondmo 1990). HP's *Elastic Tools* (which ran on Apple™'s System 5) were groundbreaking. They allowed video sequences to be indexed by theme. Micons or motion picture icons, on which we hold a patent, provided a very early example of computationally displayed motion images. (*Quicktime*™, which was part of Apple™'s System 6 was released almost 9 months after the first demonstration of the micon!) By displaying a 3 second loop of video, the micon proposed an exciting solution to the limitation of using a single-image icon to represent a video clip or sequence. The tools allowed the audience to create as well as follow video hyperlinks, thereby introducing the theme of audience as co-creator that remains one of the salient topics in much of today's media research (Figure 3).

While the tools were used to make several other projects, *Elastic Charles* became internationally recognised. Its popularity arose from the combination of 'wow' tech-

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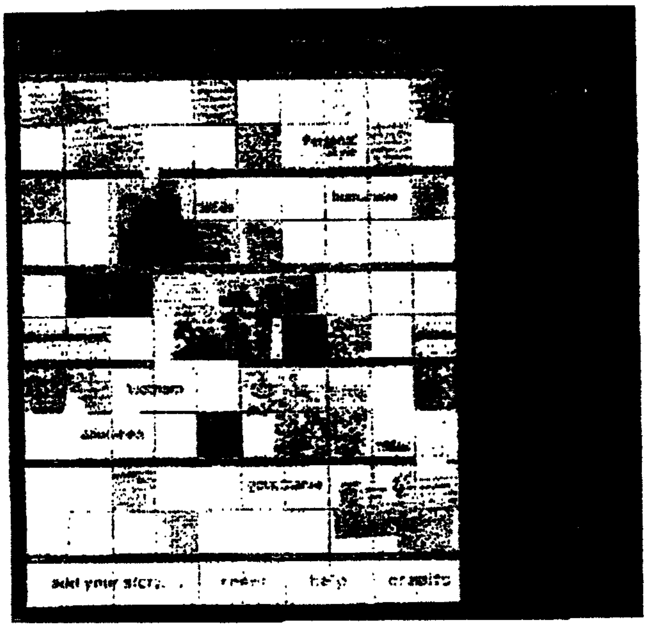

Figure 5. Using the World Wide Web as a distribution channel, this 1995 hyper-portrait invites viewers to explore the twentieth century through an extensible collection of stories and recollections about Jerome Wiesner.

4 Evolution of the channel

Public exposure to these early experiments in interactive cinema was constrained by available technology. Therefore it is not surprising that when the early WWW browsers were released, much of the energy of Interactive Cinema turned to focus on the WWW as a new channel for productions. Two works for the WWW from mid-1995 serve as hallmarks for different reasons.

Ever since the *New Orleans* experiment, I had searched out a computational approach to a story engine that could use keywords to select and present sequences from a large cinematic database of 'life as it happens' in a manner that ensured perceived narrative continuity. Unlike fiction, observational documentary is emergent and therefore not necessarily constrained by a dramatic arc paradigm. How could we translate this idea into an interface?

In 1994, Michael Murtaugh used a spreading activation network to browse a database of sequences and descriptors that students had created around Boston's Big Dig. This proved extremely effective in maintaining thematic continuity. In 1995, Murtaugh recast this system so that it could run with video on the WWW. Like the *Elastic Tools* of an earlier era, *Dexter* became a popular tool for people wanting to present video documentaries on the WWW (Davenport 1996). As *Dexter* was developed, Jerome B. Wiesner, former President of MIT and co-realiser, with Nicholas Negroponte, of the Media Laboratory, passed away. I was able to raise some funding which allowed me to create with Mike and other students a portrait of this well-revered figure. Over three months, I videoed many of JBW's former friends and colleagues as they recalled short JBW narratives. The sequences were edited by Freedom Baird and in the fall of 1995, the hyper-portrait *Jerome B. Wiesner: a random walk through the 20th century* went live on the WWW where it continues to be viewed today (Davenport 1995b) (Figure 5).

That same year, a Master's student, Lee Morgenroth realised *Lurker*, a fictional 'thinkie' designed for the WWW (Morgenroth 1995). The work was experienced by groups of 6 audience participants who had signed up on the WWW to be 'lurkers'. The participants are dropped into a fictional scenario about a group of 'hackers' at a certain unnamed institution of higher learning. The primary mode of interaction between the author and audience members and between audience participants is through the exchange of e-mail and posted video clips (Figure 6). This asynchronous mode of interaction allowed distributed participation but also required the story playout to take place over 5 days. The first video posting on the WWW lays out a mysterious disappearance. From then on the audience of 'lurkers' were asked to help the hackers solve the

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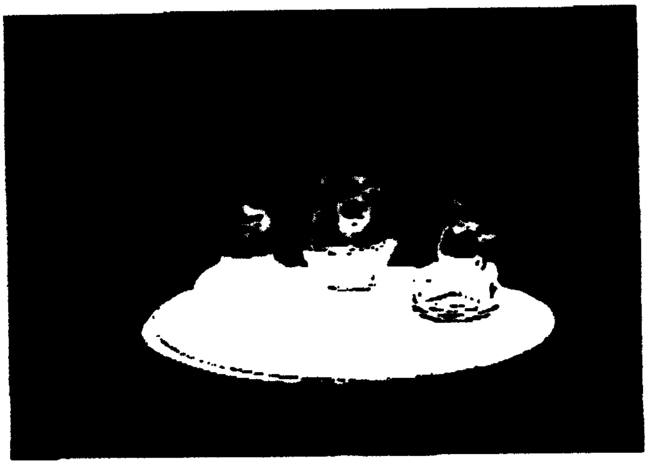

Figure 7. *genieBottles* makes use of real-world objects as portals to a fantasy realm. Audience members release genies from glass bottles, and the story unfolds through their monologues and conversations. (Photo Credit: Ali Mazalek)

ries need to make yet another leap in order to accommodate a new set of constraints. I joined the MIT Media Lab's Tangible Media group in the fall of 1999 to try out some of my ideas. My first experiment in tangible storytelling, a project called *genieBottles*, taught me the basics of tangible story design (Mazalek 2001).

In *genieBottles*, real-world objects are used as portals to a fantasy realm. Like magic, genies are released from a set of glass bottles when you open them. Through their monologues and conversations, they gradually reveal the story of their entrapment, and the ways in which they hope to escape. The piece explores transparent and emotional interactions using physical interfaces that can weave themselves seamlessly into the fabric of everyday life. The glass bottles represent containers and controls for digital information, which is released in the form of audio whenever they are opened (Figure 7).

The *genieBottles* interface is tightly designed for a specific set of characters and a particular story form. This close coupling between the story world and the interaction objects provides a good basis for narrative immersion. However it also imposes limitations on one of the major strengths of the digital medium: the inherent malleability of media content. In this sense, the shift to tangible interfaces represents a step back to a more rigid structure, and reveals a potential tension between the fixed physical form of real-world objects and the flexibility of digital information. As I learned from the *genieBottles*, one of the key principles for tangible story design is to find the correct balance between these two poles: the interaction constraints imposed by the properties of the physical medium on the one hand, and the flexibility of story content enabled by the digital medium on the other.

This search for balance led me to think about a new platform for tangible storytelling. At the time, the concept of an interactive workbench—a 2D augmented surface on which tagged physical objects could be sensed and tracked—was becoming popular in the tangible interface community. By projecting graphics onto the tagged objects using a small LCD projector, a balance could be achieved between the rigid physical forms of the objects and the constantly changing digital information. In this way, the physical objects serve as handles and controls for the manipulation of large sets of dynamic media content. I designed the first version of a storytelling platform based on the interactive workbench concept in the final months of my Master's thesis in the Tangible Media group. This platform, called *TViews*, has several important implications for storytelling. First of all, it supports multiple points of control and has the size and scale of a game-board, allowing collaborative story exploration and co-construction to become a driving force for the narrative. This social component represents a change from traditional screen-based storytelling approaches, which typically consist of either a large, relatively passive audience or a single active participant. Furthermore, the flexible nature of the platform's coupling between physical and digital elements allows it to support a variety of different storytelling applications, each providing a different story environment based on the underlying computational story structure, the projected graphics, and the particular set of physical manipulables.

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Glorianna Davenport is head of the Interactive Cinema group at the MIT Media Lab. Trained as a documentary filmmaker, Davenport has achieved international recognition for her work in new media forms. Her research explores fundamental issues related to the collaborative co-construction of digital media experiences. Her recent work focuses on the creation of customisable, personalisable storyteller systems that dynamically serve and adapt to a widely dispersed society of audiences. Her publications on subjects of responsive media, as well as her prototype works, have been included in many international symposia, conferences, and film festivals.

Ali Mazalek is a PhD student in the Interactive Cinema group at the MIT Media Laboratory. Her research explores how tangible interfaces can be used to engage audiences with interactive digital narratives. She has developed a physical storytelling platform, called *TViews*, which uses wireless graspable pawns on a sensing surface to provide a means of navigating through complex spatially structured and multi-threaded stories. Ali received a Master of Science in media arts and sciences as a member of the MIT Media Laboratory's Tangible Media group, and a Bachelor of Science in computer science, mathematics, and cinema studies from the University of Toronto.

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