# Art and Other Anxieties: Steerable Stories

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> *"He looked into the water and saw that it was made up of a thousand thousand thousand and one different currents, each one a different colour, weaving in and out of one another like a liquid tapestry of breathtaking complexity; and Iff explained that these were the Streams of Story, that each colored strand represented and contained a single tale"*
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> *---Salmon Rushdie, Haroon and the Sea of Stories*

In this children's story, Salmon Rushdie aptly portents a world in which narrative is no longer defined by the single, perfectly articulated linear strand but rather by a rich web of interconnected strands of story that float together in a "tapestry of breathtaking complexity." For the past 25 years, many researchers, artists and designers have worked to realize a dream of creating complex narrative experiences using the computational tools and input devices. While resulting work -- as seen through realized artifacts such as web-based documents, electronic games and place-based installations – has shown promise, no narrative language has yet emerged which can be used for a wide variety of content and which can communicate emotionally with any audience, anywhere in the world. Making narrative artifacts at this moment in history -- in the midst of rapid shifts of technology -- is exciting but daunting. In this first Sutra publication, it is appropriate to examine trends that seem to be moving us ever forward in our quest for a new narrative medium and to ask whether this new medium can foster narratives that are "more personal and complex, as if in conversation with the audience."

At its core, the new medium is computational and heuristic. While it draws from the language of film, print, sculpture, architecture and live performance, the computational narrative uses explicitly constructed levels of behavioral abstraction that allow the system to monitor not only the progress of the narrative but also the state of the perceiver as expressed by local and global ambient conditions.

In reality, this new medium poses enormous aesthetic and technological challenges to its creators. By its very nature, the story is "steerable:" it presents an ocean of content and provides some audience-controllable mechanism for navigating though it. To be successful, the model for what makes a story arc must be adjusted to include complexity, interruptability and a multiplicity of narrative potentials. It also requires that the authors engage the narrative imagination of the audience via some interface that is at once intuitive, metaphorical and unique.

**The Heuristic Narrative**

For millennia, human storytellers have tried to infuse life into their tales through their style or quality of telling as well as through the careful crafting of characters and actions situated in place and time. In live performance, storytellers mediate their telling in response to subtle and overt feedback from the audience. From the spontaneously recited tall tale to the most thoroughly rehearsed grand opera, a talented performer will ride the waves of audience reaction with impeccable timing and adjust her performance accordingly.

With the introduction of mechanized production -- first for print media and later for film, musical recordings and television -- authors were required to become more structured and critical in their approach to telling. The experience of producing and consuming content in a particular medium quickly revealed that each has its own characteristic powers and constraints which must be understood and honored if every aspect of a good story (the characters, the settings, the action, and the timing or flow of the media itself) are to work seamlessly with all the other aspects of the production.

In the mass media, commerce and artistry often collided. The scale of the potential audience and the scarcity or expense of the delivery channel determined how available a particular piece of content would be. In the case of recorded media, the released product was usually crafted to appeal to the largest possible audience. In the 1970's and increasingly into the 1980's, the idea that there should be only one cut of a movie was revisited. Disagreements between a producer and a director (each of whom held particular rights to the intellectual property) led to the release of the "Director's Cut" alongside the general release. As the film market segmented, other "cuts" appeared: the airline version, the South American version, etc. Experience proved that a limited inventory of shots could be recombined to create different movies for different audiences.

Early mass media used a one-to-many model where a monolithic transmitting device (such as a TV or radio tower or a movie projector) broadcast chunks of fixed content across a passive medium to a large population of "dumb" receivers. However, the invention of networked computers created a new kind of communications channel: one with computational logic at the transmitting and receiving ends, and often at places in-between. Its switching logic makes it intrinsically capable of routing different content to different audiences, and its computational logic allows considerable manipulation (locally or globally) of the content that it carries. In addition, the networked computer can maintain extensive two-way "back channel" communications among audience members even as it carries and displays the primary content. These extra capabilities caused a major paradigm shift in the way that stories can be made, told, and consumed.

Heuristic narrative shatters our model of story as a fixed, final presentation. While the craft of telling is as exacting as ever, the story is created as a "grab bag" filled with sequences and other small story elements which are uniquely identified by attached metadata tags. The computer uses these metadata tags, contextual information, a handful of heuristic storytelling algorithms, and feedback from the audience to select and arrange these chunks of content into a coherent whole. The resulting story is constructed on the fly, and plays out as needed on individual machines or shared installations.

In heuristic narratives, the audience is provided with a steering mechanism through which they can signal their desires to the storytelling engine. The steerable interface may be as cerebral as clickable icons on the screen or as intuitively active as a stationary bicycle that transmits the speed and force of cycling to the content presentation algorithm that then sends the output to the surround video screens for a surrogate travel experience. Today, the interface may even fade entirely from the audience's direct awareness; for example, different pieces of content might appear based on time or proximity to a specific landmark as someone walks through a city. The role of the computer is then to match the desire of the audience (as expressed through an

interface) to an appropriate selection of content. The speed of computation enables this process of selection and delivery to occur in close to real time. Stylistically, however, the authors must evaluate tradeoffs in how perceptible the granularity of the content is to the audience: is the story received as a continuous stream of imagery, or will it be delivered discontinuously? Will it be consumed in a single session, or will it play out as a series of sporadic encounters over time?

The story interface is a crucial new element of the heuristic narrative and many novel explorations have been produced in recent years. One notable example is the genieBottles project developed in Hiroshi Ishii's Tangible Media Group in 1999. Here, a beautiful collection of old bottles were equipped with sensors to become a physical interface to a body of audio content. Originally, each bottle "contained" musical phrases; when uncorked, they released orchestral elements which were then layered upon one another as additional bottles were opened or re-corked. The question then arose: what else could these bottles hold?

In 2000, Ali Mazalek attempted to combine the idea of the steerable narrative with the idea of the tangible interface. The physical actuality of Hiroshi's bottle interface begged for a special story that would reference our common mythic knowledge about genii and bottles.

Before developing the story, the action at the interface needed careful analysis. The initial state of the story would occur when all three bottles were sealed and the genii were all silent. As the audience removed the top from the first bottle, its contained genie would begin to speak -- but to whom? When two or more bottles were open, the genii could speak to each other. This activity at the interface suggested a state model for the story. The logic of the interface suggested that in the case where only one bottle is open, the genii give monologues; when more than one bottle is open, the genii dialog among themselves. Finally, a decision needed to be reached about the temporal flow of the story. In order to avoid repetition and to insure that the bottles could be opened and closed in any order, Ali decided that story time should continually move forward throughout any one session or encounter. Because the genii tell each other different things when in different states, there is enough potential for a audience enjoy multiple encounters: each visit provides a new, altered version of the omniscient story depending on which bottles are opened and when.

"genieBottles" provides a powerful demonstration of a simple metaphoric interface that surprises and delights us. It uses a two-layered state-machine approach that maximizes authorial control over the presentation of content. Its simple yet robust storyline guards against lapses in continuity, any spurious repetition of experience, and any uncomfortable faltering of story voice.

In contrast, "Flights of Fantasy," an interactive installation developed for the Boston CyberArts Festival of 2001, extended the tangible approach by incorporating both a tangible sequencing interface and a tangible receiving interface. In this work, the "story engine" layered three levels of authorial control for the creation of movie messages. The primary authors were the design team that created all the video and audio segments (as well as the metadata and control program) in advance of the installation. Visitors also became authors by constructing video messages via a playful physical interface: an elegant wooden table equipped with a grid of sliding blocks reminiscent of a child's pocket-puzzle. Each block in the grid was marked with a story-related icon linked to a fragment of pre-made content and its associated keyword metadata via electrical contacts. Visitors collaborated with the machine by repositioning the sliding icon-blocks into patterns representing short video messages containing characters, places and actions represented by the icons. The machine also exerted authorship by selecting a piece of audio associated with the first location in the sequence and overlaying it on the video. The co-constructed video message then "flew" to a nearby bird cage and was displayed on a video "bird" within. The poetic whole suggested a narrative and worked to pull our audience into the emotional space of story without restricting future potential for new story combinations.

**Narrative models**

All stories need an active principle that keeps them moving forward. For Aristotle, narrative spoke to an heroic temporal progression of human existence. Related in time present, this narrative unfolded as a unified sequence of plausible human actions and reactions. The window of action was made comprehensible through the reflections of various characters which revealed past events. Today -- largely due to the conventions of cinema -- we are familiar with narratives that "jump cut" from place to place and from character to character. Heuristic narrative will be no different; however, decisions about how, when and where to jump must be orchestrated by the computational engine in concert with the "steering" mechanism used by the audience. Location, time, character point-of-view and thematic threads are typical axes of navigation within a complex heuristic narrative.

One frequently-repeated axiom is "every story is a journey." Interactive art often exploits the paradigm of location as a tool for negotiating the attractions of an interactive space. However, the aesthetics and modeling used to move through the continuous space-time of 3D worlds is quite different from the jump cuts used in 2D cinematic worlds. In continuous 3D worlds, the participant viewer moves seamlessly through a continuum of space and time. As she does, she may be immersed in the general action of the contextualized place; or, she may partake in special activities isolated in certain locations; or, she may invoke an embedded icon and drop into a "content hole" which temporarily takes her out of the current space-time to perform other tasks.

In cinema, spatial context is often used to maximize continuity, while jump-cutting from location to location is a stylized convention used to cut out needless parts of the journey, emphasize important aspects of the tale, focus on the actions or reactions of a particular character, or signal the beginning of a new event or episode. Temporal manipulations such as flashbacks and flash-forwards are often used to assist the audience's discovery of character intention, motivation and circumstance. These discontinuous jumps in story time are perhaps the most difficult to manipulate algorithmically because, to be purposeful and effective, the storytelling system needs to reference some understanding of contextual continuity and must interpret the history of what the audience has already seen in order to decide what to show next. This requires a more complex model of the story arc than simple chronological order.

Finally, most storytellers use the traits, behaviors, and state-changes of characters as primary forces to steer and develop the tale. While drama tends to be built around a single heroic narrative arc, heuristic stories can be more easily modeled using multiple narrative threads and multi character point-of-view, techniques that substitute texture and complexity for focused unity. In cases where many characters and many locations are involved, an heuristic engine could be used to selectively tailor the story experience more narrowly (on a few characters) or more broadly (on many characters).

The ultimate heuristic narrative is perhaps best modeled around human psychology as it juxtaposes desire and realization. This brings us to the all-important interface paradigm: the interface functions as a nexus where story and audience activities converge and merge through a metaphoric control panel fused into the play space. A rich, dynamic interplay of characters, situations, activities and contexts at the interface reinforces the surrogate experience of lingering memory and the making of choices. The "genie in a bottle" metaphor of genieBottles exploits the expectation that you can let the genie out of the bottle. But the metaphor also carries other expectations: a genie is a mythological creature that does your bidding. How does the audience engage when it discovers that this character has breached our expectations? What technologies could be used to understand what the audience is wishing for, and then deliver it?

**Cultural specificity and reflection**

"Every story is told by someone for someone"
-- R. Kearney, On Story

Stories are made to be shared cultural objects. Their meaning is negotiated as they are perceived and interpreted by more than one person. A story can be shared in a live, face-to-face human encounter or it can be embedded into some kind of technology-based container -- a painting, a book, a film, an icon-table, a set of genie bottles -- that allows it to be viewed and reviewed.

The artifacts of technology-based media reflect at least two cultures. Their mode of construction reflects a global culture of makers who create with and share knowledge about similar technological tools; thus filmmakers, working in different parts of the world, tend to share knowledge about other film work, film tools, and cinematic technique. In contrast, the design of specific narrative content and steering mechanisms tend to reflect the local culture of the individual maker and the intended audience. However, as William Gibson noted, "the street finds its own uses for things:" as the global audience engages with a computational media artifact, it becomes a nexus around which new subcultures and uses emerge. Perhaps this is not surprising, but it has consequence -- as we shall see -- for both the maker and the audience.

While we often discuss particular cultures as if they had clear boundaries, most cultures today reflect a multiplicity of influences. That is, individuals -- whether makers or receivers -- align across a range of cultural influences and, for the most part, work to maintain their influence and membership in each camp, often adjusting their participation dynamically over some cycle of interaction (such as over the course of a day or a week). It is often useful to think about a specific audience as working under a recipe of influences; for example, one of my current graduate students might be characterized as 30% east coast American, 20% rock, 20% young professional, 20% techno-hip, etc. Today's advertising-based mass media thrives on defining a target demographic and dedicating its resources to pumping "appropriate" content to that selected (and self-selecting) subset of the population.

To an unprecedented degree, most individuals in the world today are exposed to the full spectrum of popular culture: music, drama, food, lifestyle, fashion and computational culture itself. The meaningful distribution of these elements within a culture relies on both word of mouth and the media itself. The "buzz" around popular activities inevitably draws attention away from older works and, as the traditional cultural symbols, values, and activities fade from immediate public prominence, a temporary sense of malaise or nostalgic yearning sometimes emerges from the fabric of society. However, from time immemorial the storyteller's role has involved the invention and introduction of new stories that help in the continual regeneration of the social fabric; and, the old content remains embedded into long-lasting containers, ready to be retrieved, reviewed and adapted as needed.

Computational culture follows in the footsteps of the first wave of global techno-culture. For most of the last half century, television made its way into households around the world, rich or poor; the nature of the signal and the desire to know the world made TV a universal presence. In 1994, Peter Menzel brought together 30 of the world's leading photojournalists to create Material World, a visual portrait of statistically average households in 30 nations around the world. The photographers spent one week with each family, learning about their lives, their work and their attitude toward possessions. Then, the photographers arranged for each family to take all their worldly possessions outside of their dwelling and have a portrait taken with them. In every case, whether the front lawn is filled with carpets, pots and pans, cars or a lone donkey, the ubiquitous TV set is always present somewhere in the frame.

Anthropologists and ethnographers -- trained in techniques that allow them to define and explore the boundaries of a local culture -- are often uneasy when they discover the pervasive effect of global ideas and artifacts on their cultures. Yet, for the most part, these cultures must interact with a multiplicity of cultural views and norms for their own well-being. A video by Liluye Jhala captures the "salt people" from the desert of Rann as they reflect their concern that world aid was given to a very small number of people whose property was destroyed in the recent earthquake in that region. As they point out, their property was equally disturbed but they are not all eligible for aid because some of their homes were not close enough to the epicenter. As we watch these beautifully captured moments on a Macintosh computer screen or projected on-screen in a large hall, Liluye steers the story via a "choice based" interface. As author, she knows which segment most easily sets the stage and should follow the first. She is our storyteller, using her global view to situate the salt people as they struggle to conceptually integrate world aid, the plights of more or less fortunate neighbors, and the realities of reconstructing a damaged village.

Who are these salt-makers telling their story to? In the moment, they are responding to the interest that both J. Jhala shows as he translates their arguments for his daughter Liluye, and for Liluye as she in carefully frames and moves the camera. However, the salt-makers also recognize that J. Jhala is also translating for a wider audience, an audience that may never have been to the desert of Rann and that these images that are being captured may someday be shown elsewhere. Perhaps they are even conscious of hoping, let this be shown elsewhere soon so the lament might become known and some aid might arrive.

How do people understand any particular story? Do differences in culture matter? for the taker or the taken? As we build new media experiences, there is a critical need to differentiate what works for whom, and why. How and when do we reflect? Is this culturally dependent? Our tools for collecting and interpreting these impressions are imperfect and our experiences so far are limited. However, as knowledge about these issues evolves, new content models will emerge along with appropriate computational logic that will allow new media systems to be flexibly reconfigured or reprogrammed.

**Navigating the Story Container**

Technology-based media are already quite adept at capturing sound, picture, speech, and motion into some form of synthetic memory for later replay. The story container (as interface) often frames how much and what kind of reflection occurs. Books, paintings and silent films play back their encoded information to the human visual system. Television and the "Talkies" use audio as well as visual channels. Theme park "thrill rides" often add pre-programmed physical jostling to brief audiovisual stories, providing a visceral sense of body motion and transition. "Virtual reality" systems allow actual body movements and gestures to affect our experience of 3D audiovisual worlds.

Other technology-based channels are beginning to enter the expressive toolkit of new media. The concept of "sensor skins" provides one direction in which this idea can mature. Sensor skins allow us to measure body motion or to use the body as a display. In Joe Paradiso's "Expressive Footware" project, seventeen sensors are assembled within each shoe. These sensors are polled and the data fused to tell the system how a dancer is moving. Alternatively, in "Cutaneous Groves," Eric Gunther created a sensor skin made up of small vibrotactile devices embedded in a body suit. When worn, Eric's haptic compositions, designed in parallel with a musical track, play out as intricate, rhythmically structured spatio-temporal patterns of vibration on the surface of the body.

In the 1970's, Myron Kreuger coined the term "Artificial Reality." His goal was to create compelling full-body participation in computer events that would be interpreted as experience. In

METAPLAY, visitors to a gallery space played with silhouettes of themselves that were superimposed onto artist sketches. In this work, viewer and artist responded to each other across a distance.

As the steering mechanism becomes increasingly transparent and gives way to a full-body experience, the potential of the heuristic narrative explodes: I play with my shadow and my shadow plays with me. I open a bottle and enter directly into the world of the genii. I walk around with my cell phone and without thinking navigate time and space. In each case the story is integrally attached to my sense of physical reality.

As we have discussed before, the heuristic narrative fuses a collection of communications channels, content fragments, metadata, audience sensors, story models and computational action-selection algorithms into an interactive storytelling system. These elements allow the storyteller to push the narrative form towards dynamic, adaptive tales of exploration, selectable options and complex decision-making. The heuristic narrative presents the audience with a steering mechanism by which they signal their desires-- explicitly or implicitly -- to the storytelling engine, which alters its performance accordingly. In the most compelling new media work, storytelling algorithms and a delightful physical interface are fused to create a cultural container that brings the audience face to face with local narrative reality.

Physical or screen-based steering mechanisms may be shaped by an obvious cultural metaphor or symbol: a set of images laid out rather like a Western magazine cover; e-mail and a web page posting certain actions by a story's characters; a wild ride in a rickshaw simulator. While at the outset these appear to be very different, they all reference something that is quite common to the local culture of the potential audience. The choice of symbolic reference for the steering mechanism has major consequences for the design and use of the content, just as the specific content influences the choice of interface.

How does the container shape the makers vision and the audience experience? How do we assign meaning to a ride in a theme park or a game? Often, local story experiences are most relevant when they are created by the culture itself. Ironically, we became aware of this method due to a happy accident as we were installing one of our pieces at a conference in Mexico. When "Cinemat" was first installed in the lobby of a large cinema complex at the 1996 Rotterdam Film Festival, people milling around would engage with a sensor-equipped carpet. Zones of the mat were mapped to bins and sub-bins of visual story content; people could choose which piece of story to see next by their footsteps. Some people clearly tried to figure out the mapping; others just had fun. However, in watching many people try the mat out, there seemed to be a disconnect between their activity on the mat and any sense that they could form a story. Look-ahead was a major issue. Instead of telling the participants how footsteps on the mat were mapped to the underlying story content, we left them to figure this out by hypothesis, trial, error and modification of hypothesis. We had high expectations which ultimately were not reciprocated. The audience enjoyed controlling the delivery of the content but rarely seemed to take on and attempt to implement a narrative strategy. Did that mean that the activity of "dancing on the mat" eclipsed the reflection that would turn the activity of selection into story-making? Probably.

Quite by accident. we encountered a new situation when we took this piece to Mexico. Our hosts installed the Cinemat in a theater with seats for 100 people; a new audience appeared every hour on the hour to see the show. We were stunned, as the interaction had been designed for direct physical participation by one person at a time rather than as a theatrical entertainment for a seated audience. Our improvised solution provided an important insight: we hired a personable young Master of Ceremonies to choose two participants from the audience, one to step on the mat and one to tell a stream-of-consciousness story based on the images appearing

on the screen. The Mexican audience roared with laughter every time the narrator got stuck trying to keep her story continuous over a particularly difficult "jump cut."

What we learned in Mexico was applied to our Flights of Fantasy installation, but with a significant difference. Using a bins-of-story method similar to that of the Cinemat, visitors could work together to line up icons that provided a general story outline. As they worked, they could see what the system was assembling from their selections. At the moment the visitors finished a sequence that made sense to them and launched it for sharing with others, the computer added a poetic audio fragment. This overarching audio fragment gave the whole a poetic coherence whose effect paralleled the Cinemat narrators in Mexico.

Local story experiences are often most relevant when they are created by the culture itself. In Mexico, we redefined interaction to allow creative expression within the culture and rediscovered that the cultural context was as important as the specific form of the container.

Similarly, would the beautifully shot cinematic sequences of Liluye Jhala and her father benefit from a culturally appropriate interface -- a rickshaw rather than a British bus? What visual tools for reflection will allow her tale of the salt people be effectively played back within the culture and in other cultures?

**Conclusion**

All computationally mediated artifacts reflect two cultures: the global culture of the computer and the local culture of the author's world. The steering mechanism used by the audience belongs to both cultures. On the one hand, it is used to influence the heuristic engine that lives in the global culture; on the other hand, it is often given an explicit form by the author that speaks to the metaphor, context and specific content of the story.

The audience perceives the influence of both cultures. Their interpretation -- realized over time through reflection -- is shared with their contemporaries who may also choose to experience the story. The steerable story, like any story, must generate audience involvement. While the steerable story takes its cue from earlier narrative forms, its unique shapes are forged as a result of its computational properties and the metaphor associated with the steering mechanism.

Sociability has long been a property of cinema. You hear of a show through advertisements, movie trailers, fan magazines, and word-of-mouth; you talk on the phone to someone and decide to go; you might laugh with everyone around you; you leave and want to talk about what you have seen. The social situations encountered in a theater can be very different from those in a stand-alone kiosk, and yet similar patterns of engagement have emerged around other media. A group gathers around an artifact or someone gathers them around it. Acts of sociable interchange, local creation, research, and reflection are elements often worthy of inclusion in the interface. Temporal reality is often as important to the making and sharing of stories as spatial considerations; face-to-face or “live" technological channels can be added to the mix, permitting real-time sharing among the networked audience.

As the art progresses, the steerable story requires not only engineering sophistication but also an aesthetic vocabulary, language and grammar. While these continue to evolve, some aspects of the base-line form are already recognized. In particular, the media of the steerable story needs to created in bite-sized chunks that support a narrative model; each media chunk needs to be attached to meta-data handles before it can be identified and its playout orchestrated by the machine.

Increasingly the steering mechanism for the interactive experience is being designed to involve the audience and to give them a more emotional and natural way to steer the story. When we

encounter genieBottles, our curiosity and sense of play is piqued. When we wear the full-body vibro-tactile suit, our sensorium becomes more fully engaged. As we progress into the future, we can anticipate increasing innovation around what is sensed as well as from the haptic and extra-sensory display of the experience.

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