KinoPuzzle:
Grasping Realities through Tangible Tabletop Documentaries

Susan J. Robinson[1], Daniel Razza[2], Bent Christensen[3], Andy Wu[4], Ali Mazalek[5]
Synaesthetic Media Lab, Digital Media Program
Georgia Institute of Technology

Introduction

Computationally-enhanced tabletops featuring tangible objects for participant interaction hold promise for the creation of new forms of media, including documentaries and stories constructed by individuals or small groups in distributed or face-to-face settings. Many computer-aided storytelling systems feature either algorithms to arrange story elements automatically or story structures to guide authors in presenting their tales. In contrast, the KinoPuzzle system affords a high degree of freedom for authors in constructing tabletop experiences and for participants in exploring multi-viewpoint narratives. This format for story-telling combines the representational depth and flexibility of the digital database with the expressive power of the collage surface, offering advantages in terms of open-ended dialogic juxtapositions and the collaborative exploration of reality-based material.

The inspiration for the KinoPuzzle system comes from the fields of social and ethnographic documentary-making and conceptual lenses from ethnography and ethnomethodology. The values embedded in these approaches to recording life are reflected in the code, data structures (or lack therefore), and visual strategies of the system. The primary goal of the system is to enable authors and readers flexibility to explore, interpret, and reinterpret multiple viewpoints within differing contexts. Our adoption of the collage tradition for organizing the display and interaction of visual and tangible content provides an open-ended framework for the composition and manipulation of viewpoints and stories. Collage as a spatial representational form may be better-suited to the presenting the conflicting "actualities" that are the subject of contemporary documentaries than narratives presented in sequence based on traditional story structures in the Aristotelian tradition.

Influences

A number of applications in recent years have focused on the advantages of the tabletop and tangible computing form factors for the support of group story-telling (Shen 2002: 324-333; Mazalek 2003: 105-109; Stock 2008: 1583-1592). Properties of tabletop systems include large display surfaces, synchronous manipulation of content by two or more individuals, and the ability to couple multimedia content with meta-data for processing. The latter in particular enables tagging, sorting, filtering, and sequencing of content. This has been explored previously in traditional GUI platforms and other TUI and tabletop interfaces seeking to exploit the procedural advantages of computational media for reality-based stories. (Davenport 1995: 381-389; Davenport 1996: 441-442; Mazalek 2003:

---

[1] srobinson@gatech.edu
[2] djrazza@gmail.com
[3] bentor@gmail.com
[4] andycswu@gmail.com
[5] mazalek@gatech.edu

153-150). These applications combine the use of meta-data attached to content elements, such as sound, pictures, and motion video, with rule-based engines to automate either the clustering of content for visual display, as in the presentation of multiple viewpoints, or the sequencing of content play-out.

The work of the MIT Interactive Cinema and Media Fabrics Group, led by Glorianna Davenport, contributes significantly to the development of KinoPuzzle. Influences in particular are systems from this group designed to enable multiple authors to collaborate in the construction of media works through tangible interfaces that increase ease-of-sharing of individual and group perspectives. Tangible Viewpoints is the most closely related, as it enables multiple participants to contribute video clips about their experiences, which are ordered by the system according to where and when the clips were generated, and also the assignment of the clips to a "character" for the purpose of telling stories. Users of the system access a resulting database of clips on a tabletop interface using "character" tokens that trigger the querying, display, and further processing of the clips (Mazalek 2003: 153-160). However, Tangible Viewpoints combines a set of rules for moving story action forward with the use of a spreading activation network model for the manipulation of meta-data, ostensibly to create more meaningful sequences, whereas KinoPuzzle purposely uses a minimal rule set for generating new scenes and a meta-data scheme built on hand-authored themes and relationships.

KinoPuzzle departs from the technical approaches of rule-based story systems because its rhetorical goals are different. In order to create a tool that offers the maximum flexibility for the interpretation and experiencing of mediated realities, including realities in conflict, we have analysed social and ethnographic documentary works and also practices from the social sciences, ethnography and ethnomethodology. An objective of all these practices is to reduce observer bias in documenting and understanding situations from the points-of-view of those involved in situations. Ethnographic filmmakers such as Jean Rouch promoted the capture of events directly by participants as a form of cultural self-determination, and direct cinema filmmakers, such as D.A. Pennebaker and Richard Leacock, recorded events with as little interference as possible in order to reduce interpretive influences. Ethnomethodology in particular seeks to represent realities in ways that offer the highest degree of fidelity to the lived experiences of participants as possible by focusing on the interpretive procedures used by people in particular settings, including the analysis of conversation.

KinoPuzzle embeds the values of minimal interpretation in its system by eschewing reliance on rules or structures derived from culturally-specific narratives. Instead, it offers a simple and flexible meta-data structure to support the open-ended thematic coding of content generated from any situation to minimise constraints on users in the construction of meaning from the "text" of any event. Thus, while less reliant on harnessing the power of computing to automate authoring, KinoPuzzle affords authors greater flexibility in using computational media to *present* the complexities of real situations, in which multiple viewpoints and differing versions of stories may be in play and also in conflict.

To match this underlying representational flexibility for coding meaning into content in the form of meta-data, we selected the metaphor of and visual style of collage for the KinoPuzzle

interface, as seen in Figure 1. Collage works well for presenting what can be seen and underlying interpretations, as it is a spatial representation that plays on the tensions of surface and depth. As Greenberg noted "The abiding effect is of a constant shuttling between surface and depth, in which the depicted flatness is "infected" by the undepicted." (Greenberg 1961: 70-83).

Figure 1. A KinoPuzzle composition showing persons interviewed and context.

A rich tradition of collage techniques and purposes can be found in the fine art canon, from the juxtaposition of unlikely elements to disrupt traditional visual practices or to satirise institutions, to arrangements supporting or critiquing ideological positions, or to amplify cultural trends and themes, with many works featuring diverse visual styles. Adding computational elements to traditionally static collage works in order to increase their expressive power is a key strategy of KinoPuzzle.

Implementation

Interface and Story Engine

The KinoPuzzle interface is a collage of irregular "pieces", visual images that can take either digital or tangible form, or both, on a tabletop surface. Participants manipulate KinoPuzzle collages by placing on the table surface tangible copies of the digital pieces and tools that act upon the digital pieces. At present, the tangibles are exact size photo replicates of the digital pieces rendered in acrylic, as seen in Figure 1 or three-dimensional objects as seen in Figure 2.

Figure 2. As KinoPuzzle tangibles are brought together, video clips are triggered on the table surface.

All pieces, digital or tangible, are linked through meta-data to a set of underlying motion picture, still image, and audio materials. The system uses this meta-data not only to associate the collage pieces with media-rich content, but also to generate visual feedback on the collage surface. For example, pieces may be attracted or repelled by other pieces, suggesting to interactors the relationships between the college elements, for example, an attraction or repulsion between two persons' viewpoints. Thus the KinoPuzzle system invites participants to "solve" or make some sense of collage compositions through the rearrangement of its pieces and media content play out.

KinoPuzzle's software modules make use of Java XML-handling libraries. The meta-data schema contained in XML files can be easily understood by people who are not technically-oriented. Both the collage pieces and the underlying media (content) to be associated with the collage pieces have a meta-data file. Collage piece meta-data elements include information regarding size and positioning of the piece for use by a collage manager module, and key information such as the scene number to which the piece belongs and its associated underlying media objects. The key meta-data element in the media (content) XML file is *theme*; every media element has one or more themes. A separate XML file is used by the author to designate the relationships between these themes; the simplest of type of relationship is an association, which must be coded as an attraction, a repulsion, or a null relationship.

The story engine contains modules for reading the XML meta-data, accepting multi-touch input, managing the collage in real-time based on the themes triggered and their relationships, and the ordering and playing out of media content based on themes triggered and temporal position of the media content within a sequence. Processes within the system track whether or not particular media has been played and the extent to which media within a scene has been played, and provide a mechanism for changing scenes. (A scene is a collage, its collage pieces, underlying media, and meta-data.) Visual feedback is provided to users to support interaction via tangibles: if the tangible copy of a digital piece has been placed on the table, the program "fades" the digital piece and aligns it with the tangible copy. To ensure that the video clips are presented at the proper viewing angle for participants using the system at any side of the table, the system tracks the rotation angle of pieces, allowing participants to use pieces to rotate the angle of the video play out to their best view.

Hardware and Display

KinoPuzzle currently runs on a modified version of the reacTIVision system. This system offers a library of unique visual markers one can affix to the base of tangible objects, such as the acrylic puzzle pieces mentioned above (Kaltenbrunner 2007: 69-74). A camera underneath the table surface reads the markers, their angle of rotation, and position, making use of diffused illumination (DI) from infrared lamps against an opaque acrylic surface. To improve the accuracy of system in reading user input by way of tangible objects, there are IR filters on both the camera used for computer vision and the projector which sends content to the tabletop through a series of mirrors. The dimensions of our current table are roughly 3 x 4 feet, with the marker sizes at 2-3 inches. This allows us to create puzzle pieces that fit easily within human grasp.

Current and Future Work

While we intend to produce original works for this experimental media format, our current project remediates a social issue documentary on nuclear weapons manufacturing, featuring a compilation of archival footage. For the "starter" collage interface, we composed an arrangement of digital and tangible collage pieces using visual elements from key film frames. We chose a range of images, some iconic - such as an atom bomb blast, a towering nuclear reactor, hands within a glove box, a dripping waste pipe – and others metaphoric - an armed guard and a steaming stream (e.g. suggesting secrets.)   We associated these pieces with underlying film material and created meta-data, setting up a dynamic interplay among the content as viewers interact with the collage. Thus, when brought together, the nuclear physicist-turned-peace activist is repelled by the former U.S. Secretary of Energy. When the likenesses of these two persons are brought near one another on the interface, their opposing viewpoints, in the form of linked film clips from the documentary, are played. While juxtapositions of viewpoints are common in documentaries, KinoPuzzle enables participants to explore viewpoints and uncover relationships on their own versus passive reception.

Initial participant feedback at periodic demonstrations during development in our lab has been positive. People are intrigued by the idea of discovering relationships in the content by bringing different pieces together. They express delight at the highly visual nature of the KinoPuzzle interface and its lack of text. We also found that as people used the system, if they were explicitly told it was a puzzle to solve, they adopted different behaviors towards the interface. In short, they became more deliberate in their use of the tangibles to reveal relationships between pieces and in the underlying content. However, several people have commented that it could be difficult to interpret relationships if the collage became overly complicated, and also that they are uncertain if novices to such a system would know how to begin using it. This initial feedback suggests the need for a set of tools in addition to the tangibles currently offered (primarily tangible copies of the digital collage elements) that people could place on the surface to offer clues and support for interacting with the collages.

Our current plans are to expand our existing application with content and to conduct testing to formally document feedback and to inform the design of the tools suggested by our initial demonstrations. Secondly, we are very interested in the applicability of this format for different types of documentary genres, and whether or not this format increases in the interactors a sense of engagement with the issues presented, critical reception of viewpoints, and most importantly, interest in contributing viewpoints and stories, perhaps in the form of annotations, to the base of content. Obviously, the level of engagement is likely to be directly tied to whether or not participants fundamentally perceive the content as relevant to them. We also anticipate comparing the use of this system in generating original content from small groups against more the more traditional methods of generation, such as documentary video making, in terms of the richness and volume of the dialogue and the sharing of multiple viewpoints.

References

Davenport, Glorianna, and Michael Murtaugh. <u>ConText: towards the evolving documentary</u>. Proceedings of the third ACM international conference on Multimedia, 1995.

Davenport, Glorianna. <u>Dexter and the evolving documentary</u>. Proceedings of the fourth ACM international conference on Multimedia, 1996.

Greenberg, Clement. "Collage." <u>Art and Culture: Critical Essays</u>. Boston: Beacon Press, 1961.

Kaltenbrunner, Martin, and Ross Bencina. <u>*reacTIVision*: A Computer-Vision Framework for Table-Based Tangible Interaction</u>. Proceedings of the first international conference on Tangible and embedded interaction, 2007.

Mazalek, Alexandra, and Glorianna Davenport. <u>A Tangible Platform for Documenting Experiences and Sharing Multimedia Stories</u>. Proceedings of the 2003 ACM SIGMM workshop on Experiential telepresence, 2003.

Mazalek, Alexandra, Davenport, Glorianna, and Hiroshi Ishii. <u>Tangible Viewpoints: A Physical Approach to Multimedia Stories</u>. Proceedings of the tenth ACM international conference on Multimedia, 2002.

Shen, Chia, et al. <u>Sharing and building digital group histories</u>. Proceedings of the 2002 ACM conference on Computer supported cooperative work, 2002.

Stock, Eisikovits O., et al. <u>A Co-located Interface for Narration to Support Reconciliation in a Conflict: Initial Results from Jewish and Palestinian Youth</u>. Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, 2008.