

# Interactive Storytelling with Captured Video

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## ABSTRACT

Continuing miniaturization of wearable and ubiquitous computing and video recording technology has made it feasible to digitally record large amounts of experiential video data with context. This paper proposes a storytelling approach to organize, re-use, and share such captured video material, thereby enabling interactive re-experience. A prototype storytelling system is described, based on 3D game engine technology and a tangible user interface.

## Author Keywords

wearable computing, digital storytelling, authoring, experience sharing, re-experience

## ACM Classification Keywords

H.5.1. Information Interfaces and Presentation (e.g., HCI): Multimedia Information Systems

## INTRODUCTION

The continuing miniaturization of computing technology has made it feasible to build wearable and ubiquitous devices which record large amounts of video data, capturing persons' experience onto digital video media. Whereas traditional video media, such as film and tape, were restricted to linear playback of the material, digital video systems do not suffer from this limitation. This allows new ways of organizing and re-using the video material in an interactive and non-linear fashion. Ubiquitous and wearable video experience capture combined with non-linear presentation of the material open up new possibilities for storytelling and experience sharing using the captured video data.

The goal of this project is to enable sharing of experience through reuse of captured video data, using storytelling as the paradigm of experience sharing. The next section describes our notion of storytelling, followed by a description of the current implementation.

## BACKGROUND AND RELATED WORK

There are several different definitions of storytelling with digital media. If we look at storytelling systems from the role of the human storyteller, we see that different systems place a different emphasis on the storyteller. At one end of the spectrum, we have systems where a human storyteller's role is central for communicating a story to an audience (e.g. StoryTrack [1]); at the other end, we have systems where the

audience freely explores a work, without a human storyteller being physically present to "tell" the story (e.g. the morphological function system of Grasbon and Braun [2], which generates story plot changes for a user).

The storytelling approach described in this paper lies between these two ends of the spectrum. We propose an object-centric organizational method for organizing story material which defines structure and action based on video billboard objects which can be activated in a virtual 3D stage space. If a human storyteller is present, (s)he can activate and manipulate the video billboard objects in real-time, using a tangible interface, to execute a storytelling performance for an audience, in a manner related to but more semantically meaningful than the performance of a Video Jockey (VJ) artist. In the absence of a human storyteller, the audience can freely explore the semi-structured object-centric material in a non-linear fashion, activating video objects to see what story parts the story author has made available.

## SYSTEM IMPLEMENTATION

The system implementation consists of three conceptual stages: capture of experience data, arranging story material into object primitives, and telling of the story. These correspond loosely with the activities of knowing as presented in [3]: doing, searching, and abstracting.

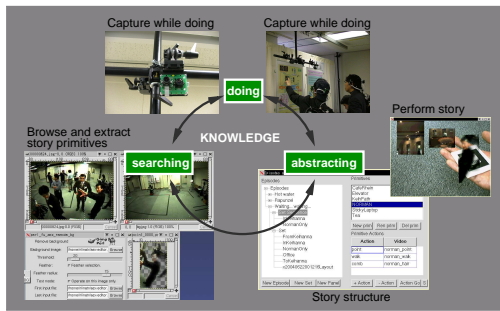
### Ubiquitous and wearable experience capture

Three different kinds of video capture devices have been used to collect experience data. First, we used wearable computer sets with head-mounted video cameras, designed for use by people within a specially instrumented sensor room. These wearable sets capture first-person video, audio, and gazing information. Second, within this sensor room, ubiquitous fixed cameras mounted throughout the environment capture audio, video, and interaction information from third-person perspective. Third, a smaller wearable computer, worn on a strap around the neck and capable of capturing video only, was constructed for general-purpose experience capture use outside the special sensor room.

### Creating story structure

From the raw video data, the story designer must select and organize relevant story material. The organization of story material is object-centric, based around the idea of story *primitives*<sup>1</sup> which can be "activated." The system encour-

<sup>1</sup>We use the word object and primitive interchangeably here.



**Figure 1: Conceptual components of the system for story construction and story telling using video data captured from ubiquitous and wearable capture devices. Knowledge cycle adapted from [3].**

ages the story designer to look for objects or primitives whose video history, as captured by the video capture device, can communicate relevant information about the story. The story designer assigns to each primitive a number of *actions*; each action represents one segment of the object’s video history which is a relevant visual element in the story. The story designer then creates one or many *sets* of relevant video primitives. Each set can be thought of as a stage set in a play; it is a collection of active objects, upon which actions can be invoked and with which the storyteller interacts in order to tell the story. The sets are temporally arranged into a *sequence*, which serves as a time-line for the intended story flow; a set can be used more than once in a sequence. Sets (each containing story primitives) and their temporal sequence comprise a story episode, which is intended to serve as an externalized, story-based representation of an episodic memory.

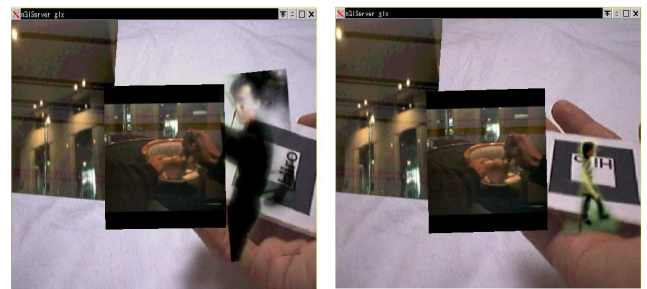
### Telling stories and re-experiencing material

To tell stories, a human storyteller uses this system as an interactive performance tool to represent the visual aspects of the story. The storyteller proceeds through the sets in the storyboard by selecting a set with the mouse in the application GUI. Each story primitive in a set is displayed as a video billboard in a 3D game engine. An augmented reality tangible user interface maps each story primitive to a tangible artifact, using optical video tracking. Physical placement of the tangible artifact in space determines the virtual placement of the video billboard in the 3D game engine, allowing real-time, natural physical positioning of story elements. The storyteller activates actions on video primitives, using a gestural activation interface, in order to visually tell the visual and spatial parts of the story, while simultaneously and as appropriate telling a spoken story about what is being activated on screen (similar to [1]).

Through the use of videos containing text, narration can be built into the story primitives and can be activated like any other action. This allows meaningful yet non-linear exploration of the story space by an audience even in the absence of a storyteller.

### CONCLUSIONS AND FUTURE WORK

We described a storytelling system using video data captured from ubiquitous and wearable sensors which allows object-centric, non-linear story organization and exploration. Future extensions include automatic analysis of captured in-



**Figure 2: Storytelling interface allowing spatial placement and activation of story primitives, represented as video billboards in a 3D game engine and controlled by a tangible user interface. Left: we see three primitives: elevators, a cup of tea, and a standing human character. Right: the “walk” action has been invoked on the human object, triggering playback of the associated video.**

teraction data combined with templates to suggest a starting story structure and story primitives. Also planned is the recording of a storytelling performance and the use of the recorded performance as a source of story material. By treating re-experience (storytelling) as an experiential process and not simply as a playback of material, we hope that we can, to some degree, unify the concepts of experience and re-experience. This would enable evolution and cyclic refinement of experiential knowledge, allow comparison of captured experience and re-experience behaviors, and could reveal insights into the structures of compelling stories, of memory, and of human experience. We envision a future where experience capture equipment is ubiquitous; enabling experiential sharing and re-experiencing of this ubiquitously captured material in story environments will be a compelling and enriching application.

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