Moving Pictures: Looking Out / Looking In

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Abstract

In this paper, the authors present *Moving Pictures: Looking Out/Looking In*, a robust, tangible, multi-user system that invites young users to create, explore, manipulate and share video content with others. Moving Pictures enables a meaningful, spontaneous and collaborative approach to video creation, selection and sequencing. The authors discuss their motivation in relationship to research in the domain of video editing. Their contribution in the domain of tangible interfaces for constructionist learning has been introduced with the implementation of participatory design sessions. They discuss workshop studies with 10-12 years old children from Sweden and Ireland playing with the Moving Pictures system.

Keywords: Tangible User Interface, Tangible Media Tokens, Digital Media, Mobile Technology, Video Jockey, Storyboard, Constructionism, Perspective Taking, Collaborative Media, Communication Tools, Networks for Media Stories.

1 Introduction

Inter-personal interaction around the production of media has until recently been the domain of teams creating formal media artifacts such as movies and TV shows, while personal media making has been largely a solo engagement. Can the depth of engagement and fun that is typically part of the formal "team" approach be designed into systems for everyday engagement with media? We are looking into the design of tools for supporting inter-personal production of digital media, as well as being a scaffolding technology for cultural exchange. We see this as new and important means of understanding relationships with others, their communities, their rules, their habits, and their references to the world. Further on, we believe that collaborative creation of digital media can lead to unexpected experiences and shifts in perspective by encouraging exchange of knowledge between communities.

In this paper, we present Moving pictures: Looking Out/Looking In, a robust, tangible, multi-user system that invites young users to create, explore, manipulate and share video content with others. The Moving Pictures concept consists of a video station containing a set of two cameras, a number of tokens, a screen and an interactive table. Moving Pictures enables a spontaneous and sociable approach to video creation, selection and sequencing. The station supports multiple input devices and group interaction, encouraging collaborative creation.

Moving Pictures extends our previous work on *Textable Movie* [Vaucelle et al. 2003] a graphical interface which takes text as input and allows users to improvise a movie in real time. By improvising movie-stories and displaying them for others, we hypothesized that young people are challenged in their beliefs about other communities' environment and their own. During our observations of teenagers using video in workshops, we noticed that the complexity of traditional video tools presented several drawbacks for communication and collaboration. We hypothesized that Textable Movie would be more powerful if we could construct a physical device that would allow teenagers to easily understand and create videos using traditional cinematic language. In Moving Pictures, we explored the natural affordances of everyday artifacts and integrated spatial components in the design of a tangible interface.

2 Motivation

Temporally sequenced media – film, animation (2D and 3 D), radio, TV – are usually created in two or more distinct phases: original recording of media segments and the subsequent editing of these segments into a coherent media artifact or story. Generally, media for a given artifact is first generated using a physical or virtual camera or a 3D modeling package. In current practice, these segments are then viewed, digitized (if not already digital), labeled and placed in a database or bin for future retrieval. Typical labeling systems include time-code which references recorded time, segment name as in a unique number issued by the camera or a verbal name which is given to the segment by the human after the media has been captured, and keywords. Sometimes the media segment is also identified in a digital system by means of an image icon or "micon" [Brondmo and Davenport 1990]. In the editing phase, one or more of these labels are used to retrieve particular media segments. In digital systems, a time-line is often used to position these segments into a linear temporally sequential

arrangement or media realization. Once saved, this realization or artifact can then be viewed on individual desktop screens, on TVs, or projected on a large screen. It can also be sent as a digital artifact to others or transformed into a film artifact.

While this sequential approach has been suitable for professional production of media like cinema, it has several drawbacks for collaborative video creation. For instance, people who are not technically well versed and/or have short attention spans are averse to spending the time required to digitize and label their media. Even when labeled and placed in a bin, the labels do not help the average person relate these bits and pieces of media to the "story" they had in mind when they began to record the media. For those people who manage to overcome initial hurdles, reformulating the time-line is difficult not only for novice editors but also often for professionals.

3 Related Work

Reform movements in education [AAAS 1990] have encouraged a shift from didactic instruction to methods resembling real-world problem solving. Visual media are proven to be an excellent medium for such shift [Smith and Blankinship 2000], indeed "visual events provide many opportunities for students to pose questions and reflect on behaviors and process" [Bransford et al. 1990]. On the industry side, Apple has presented its research on iMovie™ in the classroom. However by using video editing tools such as iMovie[1] in previous video experiments, we found that young users were particularly unfocused while editing; they would prefer to capture with the camera rather than to edit, analyze and evaluate their footage. Our previous research on real-time movie making using a personal database of video clips revealed to us the usability advantages of tangible interfaces [Vaucelle and Davenport 2004]. Textable Movie facilitated the process between capturing and editing for young users, however the interrelationship between capturing and editing needed to be entirely re-designed to convert the information being captured into personal meaningful content in real time.

In our thinking on designing a Tangible User Interface (TUIs) [Sharlin et al. 2004] we have been inspired by the pioneering work on "tangible bits" [Ishii and Ullmer 1997]. "Tangible User Interfaces" combine operations on physical objects with digital data. In these interfaces, digital data can be overlaid onto physical objects in a display space, e.g. "SenseTable" [Patten et al. 2001].

More specifically we have been influenced by previous work on MediaBlocks [Ullmer et al. 1998], and previous tangible interaction approaches taken to move digital media clips around, arrange digital information physically [Jacob et al. 2002], and use tangible bits to create multimedia stories [Mazalek and Davenport 2003]. Tangible artefacts have also been linked to video as a way to support collaborative exploration of a video collection [Sokoler and Edeholt 2002].

Our work on Moving Pictures builds upon and contributes to previous work done on designing interactive an tangible tools and toys for children [Frei et al. 2000; Montemayor et al. 2004] by focusing on the design of a tangible movie-making machine for children thus complementing previous work on supporting children's fantasy and storytelling [Cassell and Ryokai 2001] Our proposition of using multiple view points in digital media stories is based on tangible toys designed for taking multiple perspectives in storytelling [Vaucelle et al. 2002]. Tangible interfaces have also encouraged collaboration between children [Africano et al. 2004; Ryokai et al. 2003].

A tangible table-top was constructed as an element in Flights of Fantasy [Davenport 2001] which allowed everyday visitors in a gallery to move blocks around to edit sequences based on icons that represented story elements. Philips Design [Rizzo et al. 2003] has developed a system that allows replaying visual sequences using tangible objects, however in this system a stationary computer has to be used for capturing and associating media to objects, limiting the interaction to a specific location. Various tangible mixing tables have also been designed to enable a more performance-oriented approach to media construction [Lew 2004].

Finally, we believe that our work on Moving Pictures as described in this paper contributes to some recent attempts made on supporting human-human interaction with ubiquitous computing. For example the work done by Salvador et al. [2004] and some recent research conducted on ubiquitous computing devices for sharing pictures at a distance [Truong et al. 2004] by developing a tangible tool for sharing moving pictures across different communities.

4 Design objectives and overall strategy

The general aim in Moving Pictures[2] has been to design tools for collaborative discussion, local and remote, about the user's space. The specific design aim has been to design tangible interfaces for digital media creation, exploring means to increase usability.

4.1 Implementation: a participatory design approach

To create a tangible system for sharing personal productions of media, we have applied a participatory design approach [Douglas and Aki 1993; Druin et al. 1999] with Swedish and Irish children aged 10-12. Children have been involved in the project at all stages, as part of the design team and as test users.

A series of participatory design sessions focusing on young people's use of video-related hardware and software has lead us to observe the complexity of existing products and notice how it affects users' creativity and group interaction. Design sessions with young users informed us of their needs and preferences regarding group interaction as well as of attitudes and trends influencing their choice of products. Together with the researchers, users have explored different types of input tools and tested a series of design concepts. We introduced users to a number of cinematic concepts, e.g. space, time, continuity, point of view and action-reaction sequences, and developed solutions for a spatial, tangible interface that enables a flexible approach to these expressions.

During the design process, Swedish children from several local schools tested a number of iterations of the prototype. During the media creation process, Swedish, Irish and American children from different communities created a

[1] http://www.apple.com/ilife/imovie

[2] Web Site : http://web.media.mit.edu/~cati/movingpictures.html

number of movie-stories with their own footage. Our final evaluation was made through a cross-cultural workshop involving users from a local school in Umeå, Sweden, and visitors to a children art and cultural centre in Dublin, Ireland.

4.2 Detailed description of the embodiment: System and method for media editing using Tangible Media Tokens (TMT)

The Moving Pictures system (see Figure 1 and 2) consists of a table top with embedded RFID readers, a computer, a display, a set of two cameras, and a collection of RFID tokens (see Figure 3).

Figure 1 : The Moving Pictures device

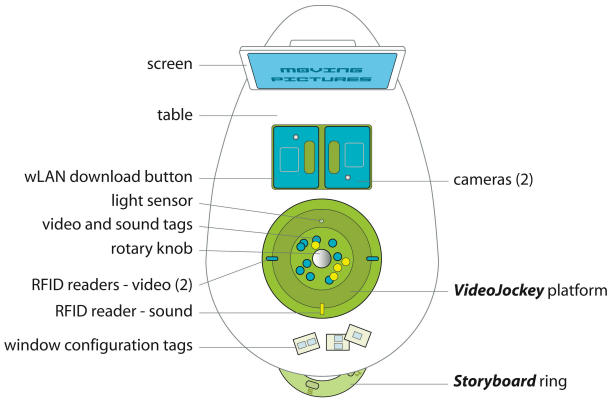

Figure 2 : Components in Moving Pictures

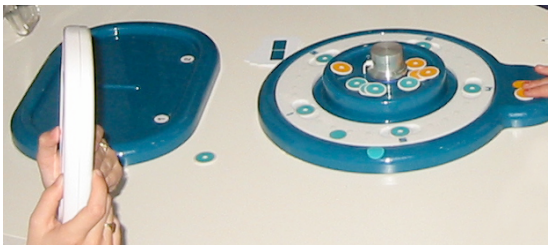

Figure 3 : The Tokens: blue (video), yellow (sound)

The design is intended to support group interaction and encourage collaborative creation (see Figure 4). RFID readers embedded in the table read token IDs and send these to the computer; the computer retrieves the appropriate video or sound segment and plays them back accordingly.

Figure 4 : Group collaboration

Moving Pictures relates to a system for associating media to physical tokens, as the media is recorded independently from a mobile unit computer. These tokens are then used to facilitate viewing and manipulation of the media (see Figure 5).

Figure 5 : Video capture with tokens

More particularly, the invention relates to a system in which a token with a digital ID is inserted into a PDA with a camera so that its ID is permanently associated with the temporal sequence of image and sound as it is recorded. Once removed from the camera, the physical token can be used to retrieve the sequence of images from memory, to display this sequence and to place this sequence within a longer media sequence. By offering a tangible representation of media elements, Moving Pictures transforms single-user screen-based media sequencing into multi-user physical interaction, adding a social and collaborative dimension.

4.3 Use scenario

The system allows movie composition by enabling users to actively organize the video and sound tokens. Using different tangible affordances, users can move between the three modes

of operation: *Shooting or documentary mode* (see Figure 6), *VideoJockey* and *Storyboard* (see Figure 7).

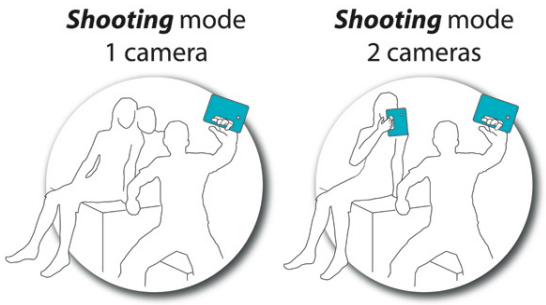

Figure 6 : General Scenario, Shooting

Figure 7 : General Scenario, VideoJockeing/Storyboarding

In Shooting mode (see Figure 8), users insert a token in the camera and then record a shot. They place the camera on the table and the video is transferred wirelessly to the computer. Once removed from the camera, the tokens can be used as a composition element on the table and the resulting video clips can later be combined by the group to achieve a common outcome.

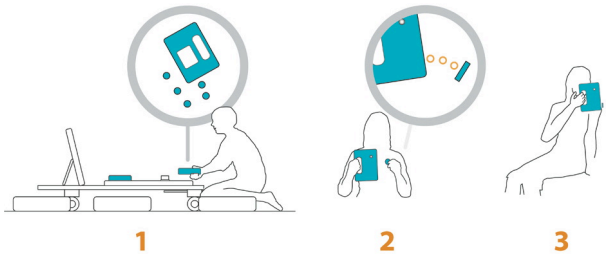

Figure 8 : Shooting Mode scenario

In VideoJockey mode, users can improvise video compositions using the tokens to play the video clips instantaneously on the screen. As they pass a token over a RFID reader on the table, the computer receives the ID, retrieves the segment associated with it and plays it back on the screen. In Storyboard mode users can create a structured composition by placing a number of tokens on a Storyboard tool (Storyboard ring) and playing them sequentially, as well as adding sound effects. A graphical user interface guides the users through the steps of composing a final movie (see Figure 9).

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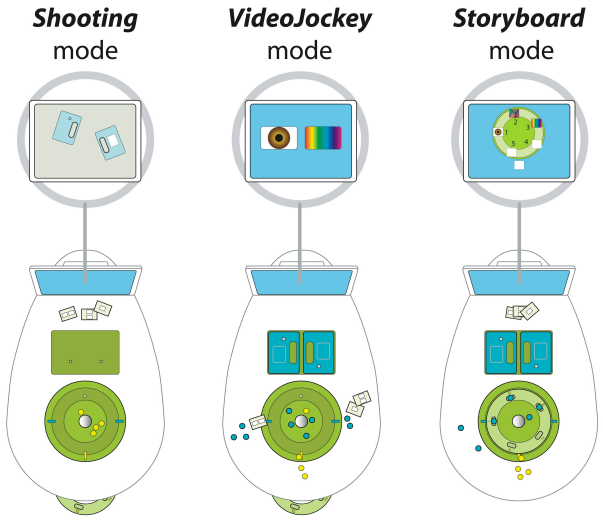

Figure 9 : Scenario, Graphical and Tangible User Interfaces

4.4 Evaluation: local tests and cross-cultural workshops

We carried out the first workshop in Dublin, with a group of children aged 10-12. During the first session of the workshop, members of the design team introduced the children to the Moving Pictures system and to basic cinematic concepts. During the second session, the children were asked to write a short script for a movie that they would shoot and then send to a group of children in Sweden. The theme for the movie was "*What we like about our city*". During the third session, the children used the two camera prototypes to shoot a number of scenes, and the interactive table to preview the video segments. Finally, they combined their video segments and a number of pre-defined sound effects in order to create a movie about their city. Having completed the task, the children decided to improvise a second movie, this time an "action" film.

The second workshop was carried out in Umeå, with a group of children aged 11-12. In this case, after introducing the children to the Moving Pictures system, the design team used the interactive table to present the two final movies that they Irish children had created. The team asked the children to comment on what they had seen and then asked them to change the ending of their favorite movie. The children chose

the "action" film and shot a number of scenes to modify the story. They then re-combined the segments and added sound effects, producing a new final movie.

5 Contribution

We play, learn and exchange ideas about our environment using stories. In the past, the letter has been a dominant form, from family letters to pen pals. Today communication technology expands the resources we have at our disposal for exploring and sharing the environment we live in. However, existing tools for video production have, for the most part, emphasized the convention of a finished form with a beginning, middle and end.

Research has shown that students at various performance levels working together toward a common goal can enhance each other's analysis, synthesis, and evaluation of the concepts they are exploring [Gokhale 1995]. However, Ackermann [2004] explains that changing perspectives and switching roles requires the difficult balance to being simultaneously immersed and disengaged. We are therefore studying how people might engage in relationships where they exchange their perspectives and transfer a sense of space through play, collaboration, and storytelling using spatial tangible media interfaces.

Technology is at the heart of everyday life. We consider that its strength lies in the way people make use of it. Technology can bring people together, even if they have never met before. In a world in which media is everywhere, individual and collaborative media creation can provide a means of exploring our environment. Our focus is to look at which functions of an interface empower people to express about their environment, by actively "constructing" their own content.

Constructionists suggested that users could benefit from systems that support self-expression rather than create content for the user [Papert 1991]. Papert also proposes systems for children to relate to their 'real-world' experiences while learning specific skills such as mathematics. Movie editing systems could support personal creation and be structured as 'real world' experiences offering to assemble a movie by manipulating elements in a story. *Children build, make or manipulate objects or artifacts and in doing so are confronted with the results of their actions, learning as they go*, Papert. In Moving Pictures, the children not only create the content, i.e. media segments, for their later expression, (real time Video Jockey, or Storyboarding) but they also learn the process of making a movie "as they go"; indeed the design is self explanatory and each token represent a short-length video clip.

6 Discussion

Work in digital media is setting the tone for aesthetic expression into the next century, Sefton-Green [1999]

Observations from user tests showed us that the children enjoyed and were engaged in their use of the Moving Pictures system. The children understood the interaction with the system and were able to improvise movie-stories. Most children participated actively in the use of the tokens, and enjoyed being able to easily retrieve data on the interactive table. The system allowed children to work at different levels of complexity, from simply retrieving data created by others to creating complex final movies with their own footage and added sound effects. This encouraged different kinds of play and varying task distribution.

Observing the creativity process of the children working on digital media with Moving Pictures, we have reflected on the four aspects of student *Understanding of the Arts* proposed by Ross [1993] and reintroduced by Somers [2000]. *Conventionalisation* – an awareness and ability to use the conventions of the art form. *Appropriation* – embracing, for personal use, the available expressive forms. *Transformation* – in which the student searches for knowledge and meaning through the expression of 'feeling impulses'. *Publication* – the placing of the result in the public domain. Using Moving Pictures, our students have understood the process of making a movie using a series of traditional shots symbolized by the physical tokens. They have made a movie respecting the collaborative storyboard they had created. They have contributed to a multinational visual database by expressing their visual narratives for children living in another country.

Further on, we observed that the interface allowed children to collaborate as well as to work individually, as they wished. Small groups worked better together than large groups, especially when children knew each other from before. In general, the children showed interest in watching films created by other children, but were most engaged when asked to create material themselves. During all tests, the children were very engaged in creative discussions about the content of the scenes they were shooting and the procedures they would use to create a final movie. Even children that seemed to be more withdrawn took part of group discussions and eventually found a role within the team. This indicates to us that the system's tangible interface facilitated group work and encouraged participation. We believe the involvement from the children to participate in the workshops relates to our choice of interacting with them as design partners throughout the participatory design process instead of just as passive observation subjects.

We have encountered several conceptual limitations related mainly to the interaction with the table. The most common issues were related to the Storyboard ring and the relation between the tangible and graphical interfaces. In general, insufficient or delayed system feedback was also a common problem. The number of tokens was too limited to allow an improvisation of a movie in real time. Final movies tended to be the product of a pre-defined storyboard rather than of an improvised association of tokens. We believed that with more tokens, and more effects on the video clips the children would beneficiate from the real time approach of the system. Another limitation was related to the synchronization of sound clips to movies in real time. Not only children had difficulties in associating a piece of sound to a specific frame in the movie, but they also wanted to record their own sounds, or environmental sounds while capturing video.

7 Future Work

Throughout the workshops with the children we have collected valuable data for future iterations. At times, we observed how children interacted with the system in unexpected ways, which has inspired us to explore new functionality and to improve existing features. Some of these ideas are mentioned here. First of all, we encountered a number of technical problems during the test sessions causing

delay in the scheduled activities and frustration for the children. In a future version, we will look for more stable alternatives for the technical implementation. Further on, the use of the camera units presented several problems. Due to time constrains, we decided to use the iPAQ original video software, knowing that it presented a number of usability issues for the children. In a future iteration, we aim at developing our own software, allowing us to better control the camera functions.

8 Conclusion

In this paper we have presented Moving Pictures, a robust and tangible system that allows users to improvise movie-stories in real time. In this project we aimed at designing a tool for collaboration that supports young user's social interactions. We expected young people to be critical thinkers by analyzing and evaluating their personal work and then the work of other students. We also aimed at designing a tangible interface for multimedia creation, appropriation and publication. We hypothesized that a tangible interface that provides possibilities for verbal storytelling as well as for physical manipulation of media could improve student understanding of the Arts and increase product usability. We also hypothesized that by improvising movie-stories and projecting them for others, young people can be challenged in their beliefs about other communities and their own.

During the participatory design sessions and test workshops, the children seemed to find exciting the idea of sharing movies with children in other countries and engaged in discussions about cultural differences and similarities. We thus believe that the Moving Pictures system fills an important role in being a tool for support of inter-personal production of digital media, as well as being a scaffolding technology for cultural exchange.

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References

ACKERMANN E. K. 2004. "Constructing Knowledge and Transforming the World" In Tokoro M. and Steels L. (Eds.) *A Learning Zone of One's Own. Sharing Representations and Flow in Collaborative Learning Environments.* The Netherlands: IOS Press. pp.16-35.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS), 1990. *Science for All Americans: Project 2061*, Oxford University Press, New York.

AFRICANO D., BERG S., LINDBERGH K., LUNDHOLM P., NILBRINK F., AND PERSSON A., 2004. Designing Tangible Interfaces for Children's Collaboration, In *Proceedings of the CHI 04 Conference on Human Factors in Computing Systems*.

BRANSFORD, J.D., R. D. SHERWOOD, T.S. HASSELBRING, C. K. KINZER, AND S.M. WILLIAMS, 1990. "Anchored Instruction: Why We Need It and How Technology Can Help". In D. Nix and R. Spiro (Eds) *Cognition, Education, and Multimedia: Exploring Ideas in High Technology*, Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 115-141.

BRONDMO, H. P., AND DAVENPORT, G. 1990. "Creating and viewing the elastic Charles - a hypermedia journal". In R. McAlesse and C. Greene (Eds) *Hypertext, State of the Art*, Intellect Ltd.

CASSELL, J. AND RYOKAI, K. 2001. Making Space for Voice: Technologies to Support Children's Fantasy and Storytelling, *Personal and Ubiquitous Computing*, 5 (3).

DAVENPORT, G., 2001. Flights of Fantasy. http://www.decordova.org/decordova/exhibit/flights.htm

DOUGLAS , S. AND AKI, N. 1993. *Participatory Design: Principles and Practices*, L.Erlbaum,U.S., Mahwah, NJ, USA.

DRUIN, A., BEDERSON, B., BOLTMAN, A., MIURA, A., KNOTTS-CALLAHAN, D., AND PLATT, M. 1999. "Children as our Technology Design Partners". In (Druin, Ed.). *The Design of Children's Technology*, San Francisco, CA: Morgan Kaufmann Publishers, pp. 51-72.

FREI, P., SU, V., MIKHAK, B., AND ISHII, H. 2000. Curlybot: designing a new class of computational toys. In *Proceedings of the CHI 00 Conference on Human Factors in Computing Systems*.

GOKHALE, A. A. 1995. Collaborative Learning Enhances Critical Thinking, *Journal of Technology Education*, 7 (1).

ISHII, H., AND ULLMER, B. 1997. Tangible bits: towards seamless interfaces between people, bits and atoms. In *Proceedings of the CHI 97 Conference on Human Factors in Computing Systems*.

JACOB, R., ISHII, H., PANGARO, G., PATTEN, J. 2002. Hands-On Interfaces: A tangible interface for organizing information using a grid, In *Proceedings of the CHI 02 Conference on Human Factors in Computing Systems*.

LEW, M. 2004. Live Cinema: Designing an Instrument for Cinema Editing as a Live Performance, In *Proceedings of NIME 04 the Conference on New Interfaces for Musical Expression.*

MAZALEK, A., DAVENPORT, G. 2003. Tangible viewpoints: A Tangible Platform for Documenting Experiences and Sharing Multimedia Stories. In *Proceedings of ACM SIGMM 2003 Workshop on Experiential Telepresence, ETP '03.*

MONTEMAYOR, J., DRUIN, A., CHIPMAN, G., FARBER, A., AND GUHA, M. 2004. Storyrooms and playsets: Tools for children to create physical interactive storyrooms, *Computers in Entertainment*, 2 (1).

PAPERT, S., AND HAREL, I. 1991. *Constructionism*, Ablex Publishing Corporation, NJ.

PATTEN, J., ISHII, H., HINES, J., AND PANGARO, G. 2001. Sensetable: A Wireless Object Tracking Platform for Tangible User Interfaces. In *Proceedings of the CHI 01 Conference on Human Factors in Computing Systems*.

RIZZO, A., MARTI, P., DECORTIS, F., RUTGERS, J., AND THURSFIELD, P. 2003. "Building narratives experiences for children through real time media manipulation : POGOworld." In M.A. Blythe, A.F. Monk, K. Overbeeke and P.C. Wright (Eds). *Funology : from*

usability to enjoyment (1-12). Amsterdam : Kluwer Academic Publisher.

ROSS, M., RADNOR, H., MITCHELL, S., AND BIERTON, C. 1993. *Assessing Achievement in the Arts*, Buckingham: Open University Press.

RYOKAI, K., VAUCELLE, C., AND CASSELL, J. 2003. Virtual Peers as Partners in Storytelling and Literacy Learning. *Journal of Computer Assisted Learning,* 19(2).

SALVADOR, T., BARILE, S., AND SHERRY, J. 2004. Ubiquitous computing design principles: supporting human-human and human-computer transactions, In *Proceedings of the CHI 04 Conference on Human Factors in Computing Systems*.

SEFTON-GREEN, J. 1999. "From hardware to software : The ressource problem ?" In (J. Sefton-Green, Ed.) *Young People, Creativity and New Technologies: the Challenge of Digital Arts*. London: Routledge. pp.138-145.

SHARLIN, E., WATSON, B., KITAMURA, Y., KISHINO, F., AND ITOH, Y. 2004. On tangible user interfaces, humans and spatiality, *Personal and Ubiquitous Computing*, 8 (5).

SMITH, B. K. AND BLANKINSHIP, E. 2000. Justifying imagery: Multimedia support for learning through explanation. *IBM Systems Journal*, 39 (3&4), pp. 749-767.

SOKOLER, T., AND EDEHOLT, H. 2002. Physically embodied video snippets supporting collaborative exploration of video material during design sessions, In *Proceedings of the second Nordic* conference *on Human-computer interaction*.

SOMERS, J. 2000. "Measuring the shadow or knowing the bird. Evaluation and assessment of drama in education" In (J. Sefton-Green, and Sinker, R. Eds.) *Evaluating creativity. Making and Learning by Young People*. London: Routledge. pp.107-128.

TRUONG, K., RICHTER, H., HAYES, G., AND ABOWD, G. 2004. Devices for sharing thoughts and affection at a distance, In *Proceedings of the CHI 04 Conference on Human Factors in Computing Systems*.

ULLMER, B., ISHII, H., AND GLAS, D. 1998. MediaBlocks: physical containers, transports, and controls for online media, In *Proceedings of the 25th annual conference on Computer graphics and interactive techniques*.

VAUCELLE, C., JEHAN, T., AND ISHII, H. 2002. Dolltalk: A computational toy to enhance children's creativity. In *Proceedings of the CHI 02 Conference on Human Factors in Computing Systems*.

VAUCELLE, C., DAVENPORT, G., AND JEHAN, T. 2003. Textable Movie: improvising with a personal movie database, In *Proceedings of SIGGRAPH 03, Conference Abstracts and Applications.*

VAUCELLE, C., AND DAVENPORT, G. 2004. An open-ended tool to compose movies for cross-cultural digital storytelling: Textable Movie, In *Proceedings of ICHIM 04, Digital Culture and Heritage.*