

wIzQubesTM - A Novel Tangible Interface for Interactive Storytelling in Mixed Reality



ZhiYing Zhou, Adrian David Cheok, Jefry Tedjokusumo and Gilani Syed Omer

Department of Electrical and Computer Engineering, National University of Singapore, Singapore.

Abstract—In this paper, we present a novel tangible interface, wIzQubesTM, for interactive storytelling in Mixed Reality. A pair of cubes tracked by computer vision is used to control the storytelling process. The first cube is used to navigate through different scenes of the story, with the numbers printed on fiducial markers pasted on the six sides. The second cube is used to choose different items needed in the story, with the cartoon symbols on the six sides. Bringing two cubes close to each other with right items selected advances the story. wIzQubesTM embeds the concept of both Mixed Reality and Tangible Interaction. Multiple modalities including speech, 3D audio, 3D graphics and touch are used to provide the kids with multi-sensory experiences in interactive storytelling

Index Terms—Cubes, Mixed Reality, Storytelling, Tangible User Interface.

I. INTRODUCTION

Storytelling is an important part of human culture both in entertainment and education. Traditional storytelling by books enables multi-sensory experiences including speech (narration), vision (seeing the book) and touch (turning pages and pointing). The e-books for storytelling provide enriched multimedia supports but limits user interactions to the usage of a mouse and keyboard. The story content is generally rendered by pre-defined camera view points.

Mixed Reality storytelling interfaces [1] has more advantages over 2D GUI-based interfaces by providing the user with 3D augmented graphics on the physical book, allowing a more natural tangible interface. However, the planar configuration of the book and paddles (as shown in Fig 1) limits the 3D exploration of story contents.

As shown in Fig 2, our previous work Magic Story Cubes [2] enhances the tangible interaction of traditional books by using a foldable cube [3] to 'turn' the page, while still keeping the main advantages of the traditional physical books. However, apart from moving the foldable cube to view the story in 3D mixed reality and changing the story scene by unfolding the cube, users are not able to interact with the story or change the storyline. Although the unfolding of the cubes brings the excitement to the storytelling experience, it is generally difficult for young children to manipulate.

Our new development, wIzQubesTM interface, as shown

in Fig 3, uses a pair of cubes is used to control the storytelling process. The first cube is used to navigate through different scenes of the story, with the numbers printed on fiducial markers pasted on the six sides. The second cube is used to choose different items needed in the story, with the cartoon symbols on the six sides. The story continues if the user gives the correct item into the story scene. This way of interaction opens the possibility of non-linear story line.

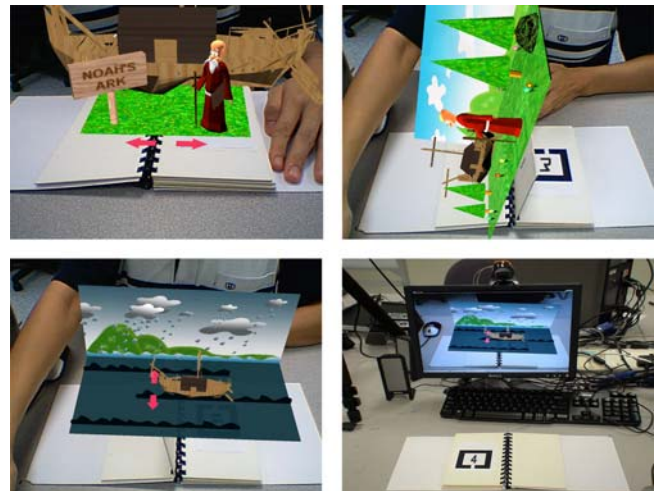
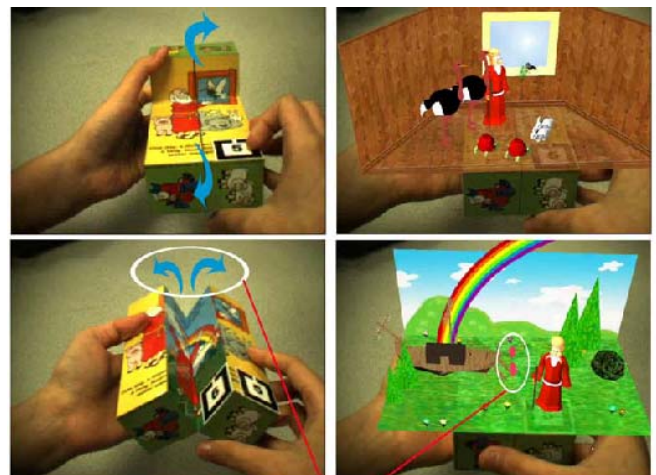


Fig. 1. Traditional "Magic Book" allows a planar physical manipulation of turning a book page. In this example, it is telling a Bible story - Noah's Ark. (See Color Plate 3)



Animated arrows for manipulation instruction

Fig. 2. Magic Story Cube [2, 3] is telling the same story. The user can use both hands to unfold the cube and explore the story contents. (See Color Plate 4)

This paper is organized as follows. Section II shows other story telling related works. Section III discusses the reason why cube is chosen as Tangible User Interface (TUI). Section IV describes the system setup. Section V gives detailed information on the implementation. Section VI we show the results of our user study. Section VII concludes our paper.



Fig. 3. wIzQubes™ Interface for interactive storytelling in Mixed Reality. Photo courtesy of MXR Corporation.

II. RELATED WORK

Interactive story telling has a long history. Gorbet et al. in 1998 develop a system called The Triangles [4]. This system was able to generate a nonlinear interactive method of telling a story. Different web pages or audio files will be presented depending on how the children configure the triangles. The genieBottles [5] system presents a story that is told by three genies who live in glass bottles. When a bottle is opened, the genie contained inside is released and begins to talk to the user. If several genies are released at once, they converse with each other. This interface offers only auditory story-telling.

StoryMat [6], TellTale [7], and DollTalk [8] are collaborative story making systems. Children need to be trained to express their idea creatively. These story-making tools are based only on audio recording. They are not yet utilizing computer graphics.

Advancement in computer graphics makes it possible to produce real time 2D/3D animation. These animations when displayed in a large screen can immerse the children, giving impression as they are actually inside the story. Kids Room [9], work by Johnson et al. [10], "SAM" [11], and ActiveCube [12] use computer graphics to tell the story. However they are not yet utilizing "Mixed Reality" concept. They still have Physical Reality and Virtual Reality as separated entities.

III. CUBE AS TANGIBLE USER INTERFACE

After considering a few commonly used TUIs, we settled on using cubes/blocks as our interface as used by many before [13],

[14, 15]. We found the reasons for choosing cubes/blocks lies mainly in two aspects: (1) As compared to a ball or other artifact in complex shapes, a cube/block has stable physical equilibriums (resting on one of its surfaces) which make it relatively easier to track/sense. In wIzQubes™, we define the states of the cube by these physical equilibriums. (2) Cubes when piled together form a compact and stable structure. This could reduce scatter on the interactive workspace. In addition to the above mentioned the cube is an intuitive and simple object that we are familiar with since childhood. This graspable object allows us to take advantage our keen spatial reasoning and leverages off our prehensile behaviors for physical object manipulations [14].

For interacting with 3D virtual objects, 3D mouse [16] is also commonly used (see Fig 4). However, 3D mouse is not a TUI according to the definition of TUI given by Ishii and Ullmer [17, 18]. According to their vision which is the most wide spread, TUIs are systems relating to the use of physical artifacts as representations and controls for digital information. A central characteristic of TUI is the seamless integration of representation and control, with physical objects being both representations of information and as physical controls for directly manipulating their underlying associations. Input and Output devices fall together. In this sense, the 3D mouse can only be regarded as an input device but not a TUI if the representation of information is separated from the 3D mouse itself. In wIzQubes™, the 3D graphics is displayed on the cube itself. When the cube is moved or rotated, the graphics changes its viewpoint accordingly. Therefore, the cube is the physical control as well as the host of information representation. Compared to 3D mouse, wIzQubes™ has the following pros and cons:

1) It supports two-hand manipulation. The two cubes are acting like "noun and verb" metaphor [19]. However, 3D mouse allows only one hand manipulation

2) It is a space-multiplexed which is faster and intuitive than a time-multiplexed 3D mouse [20]

3) It uses vision-based tracking which only requires a cheap webcam however 3D mouse is using ultrasonic tracking which is much more costly

4) The vision based tracking is more accurate than the 3D mouse. Mixed reality application requires much more tracking accuracy than virtual reality application. According to the specifications of Logitech 3D mouse [21], the tracking accuracy is "2% of distance from transmitter". For a desktop application where the 3D mouse is 40 cm away from the transmitter, the displacement of the image position could be up to 8 mm which could be around 40 pixels (1/16 of screen width) on a 640x480 resolution mixed reality application. The jittering of the augmented image could make the application unusable. The vision-based tracking algorithm has the error of only a few pixels [22].

5) The vision based tracking is very sensitive to lighting environment. In addition, it requires the object to be always within the camera's viewing range otherwise the tracking is lost. However, 3D mouse doesn't have these problems by using ultrasonic tracking, although there could be interferences in some circumstances.

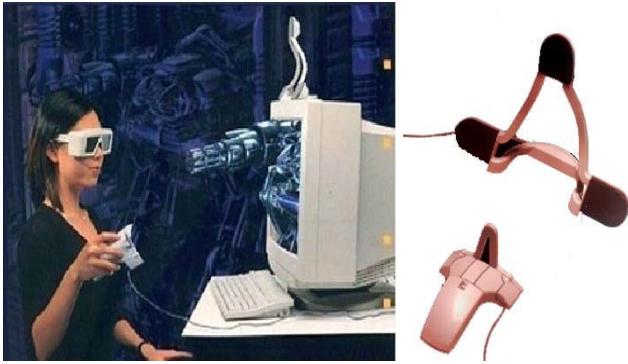


Fig. 4. 3D Mouse using ultrasonic tracker. This device is often used for navigation in 3D space. Photo courtesy of www.vrealities.com.



Fig. 5. The system setup of wIzQubes™ system. Photo courtesy of MXR Corporation.

IV. SYSTEM SETUP

The system setup of wIzQubes™ is shown in Figure 5. It comprises of a pair of the physical cubes, a normal webcam and a computer. Though in figure we only show a desktop computer but the system can be deployed on a laptop and tablet PC as well.

The pair of cubes have printed surface (fiducial markers) on all six sides. However printed material is different on both cubes. One cube is printed with numeric digits (1 to 6) and other cube is printed with different visual patterns. The cubes are placed on a table top area, in front of the display device. This area is termed as an interaction space. A web camera is mounted on the display to capture the perspective table top view.

Users interact with the cubes in physical 3D reality. In response they observe the 3D virtual behavior of the system on display, in real-time.

While facing the display users physically manipulate the cube in 3D interaction space. They can either rotate or translate the cube to trigger the corresponding virtual behavior. This is achieved by tracking the fiducial markers on the cubes. Fiducial marker tracking provides the estimate of position and

orientation of the cube in the physical world. 3D graphics are then rendered on the physical cubes according to the users' interactions. Accordingly digitized audio and speech is also played to give user a multi-sensory perception of the system. Users view the mixed reality graphics shown on the display without wearing any head mounted displays (HMD).

V. IMPLEMENTATION

5.1 Tracking

wIzQubes™ uses a normal USB camera to capture the tabletop area where the two cubes are manipulated by the user. As shown in Figure 6, the image captured will be passed to the vision-based tracking [2] block to obtain the position and orientation of the cubes. Then the cube event manager will translate this information into cubes' events. For example, cube flipping event, cube twisting event, cube stacking, and cube closing event. The 3D graphics rendering engine (DirectX 9.0c) will then render the story in 3D according to the storyline and the cubes' events that triggers different segments of the 3D animation. The final system runs at 30 fps on Pentium 1.6 GHz, 512MB PC, and 32MB video accelerator video card.

2D Markers are relatively hard to grasp and the tracking will be difficult if our hands occlude the markers when manipulating cards. To surmount these problems, we designed an algorithm to track our 3D cube which has six different markers on each of its surfaces. The position of each marker relative to one another is known and fixed. Thus, to identify where the cube is, the minimum requirement is to track any of the six markers. This idea is similar to "multiple marker tracking" in ARToolkit. However, instead of putting multiple markers on the same card, we extend and apply this idea to 3D artifact, i.e., cube.

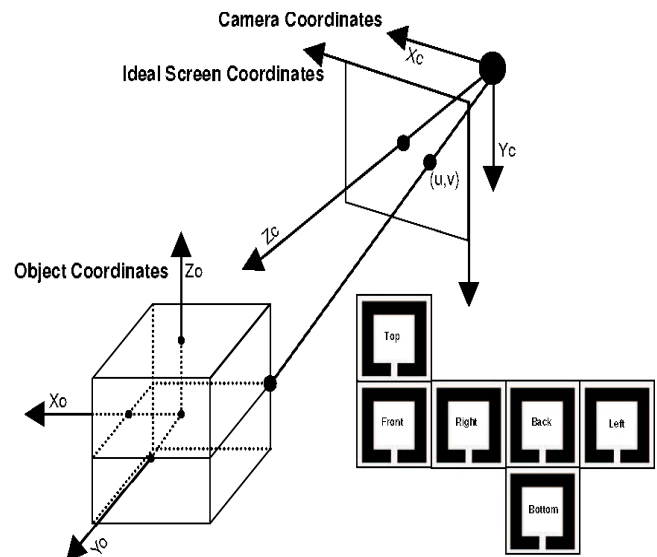


Fig. 6. Coordinate system of cube tracking system.

The algorithm used to track the cube is as follows: (1) Detecting all the surfaces markers and calculate the

corresponding transformation matrix (TCM) for each detected surfaces. (2) Choose a surface with the highest tracking confidence and identify its surface ID, that is top, bottom, left, right, front, and back, as shown in Fig 6. (3) Calculate the transformation matrix from the marker coordinate system to the object coordinate system (TMO) based on the physical relationship of the chosen marker and the cube. (4) The transformation matrix from the object coordinate system to the camera coordinate system (TCO) can be calculated by following equation:

$$T_{CO} = T_{CMi} \times T_{MiO}, i=1, 2, \dots, 6 \quad (1)$$

Our algorithm ensures continuous tracking when our hands happen to occlude different parts of cube during interaction. As shown in Fig 7, even the hand occludes some part of the cube, as long as at least one of the cube surfaces is being tracked, the algorithm can still track the whole cube. Moreover, since the cube size is pre-known, we are able to render the graphics showing the correct occlusion relationships among the cubes and the augmented graphics, as shown in Fig 7. The extension of the tracking from 2D to 3D successfully overcomes the drawbacks of 2D marker tracking systems: hard to grasp, easily lose tracking when covered by hands or fingers, incorrect occlusion effects (because when the marker is flipped over, it loses tracking). Therefore, our improvements offer an intuitive and direct handling of the cubes with very little constraints in two-hand manipulations.

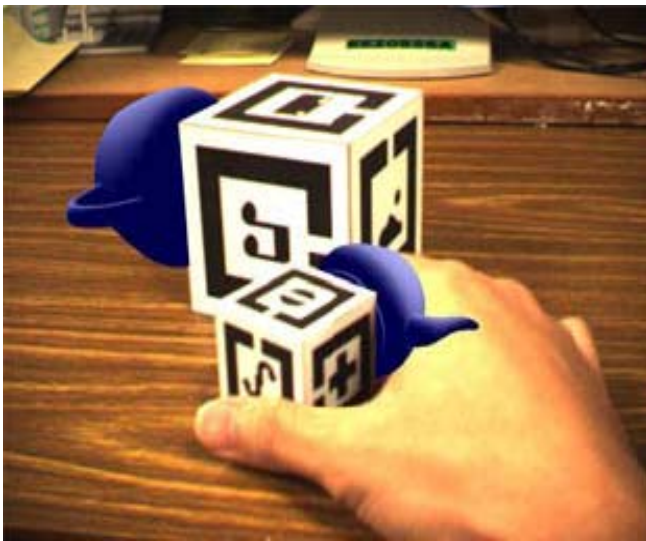


Fig. 7. The seamless registration by displaying correct occlusion relationships.

5.2 Story State Transition Model

wIzQubes™ applies simple state transition models for interactive storytelling. Figure 8 shows state transition models of wIzQubes™. The state transition is triggered only when the contents of current state have been fully played.

The orange cubes (with number 1 - 6 on its side) is used to display the story scene, the kids will have to rotate this cubes sequentially as the story advance. The blue cube with 6 different

icons on its side is used to display 6 different items. At some time in the story, the actors inside the story scene will asked for the item he/she needed. The kids have to give the correct item to advance the story.

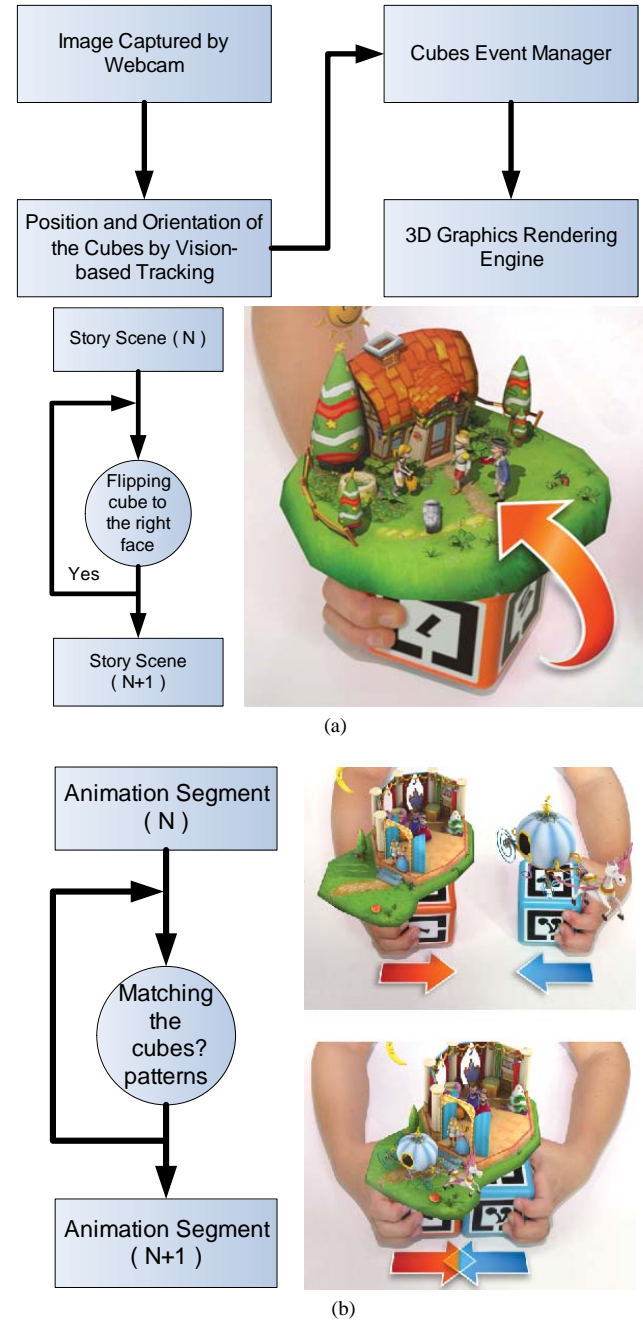


Fig. 8. State transition models of wIzQubes™ (a) User flips the cube to play the corresponding story scene (b) User matches the cubes patterns to advance the story.

VI. USER STUDY

We conducted a user study at Singapore Science Center where our wIzQubes™ system is permanently exhibited. Fig 9 shows our system setup at Singapore Science Center. The subjects were randomly chosen from the children visiting

Singapore Science Center. Most of them were accompanied by their parents. We briefed the children before they tried the wIzQubes™ and interviewed them using a questionnaire. We have gathered data from 20 participants, 11 boys and 9 girls, in the age group of 5 to 15 years with an average of 9.5 years. All of them are right handed and familiar with computers. 12 of them used Chinese, 3 of them used English, another 3 used Malay, and only 2 used an Indian language as their mother tongue. The children could choose two stories: Little Red Riding Hood and Three Little Pigs. These stories are available in two different languages (English and Chinese). The user studies took 5 -10 minutes for each kid; once they completed it we give them a souvenir. We have attached the questionnaire in appendix A.



Fig. 9. wIzQubes™ user study with kids at Singapore Science Center where we use 42 inch plasma TV for the display.

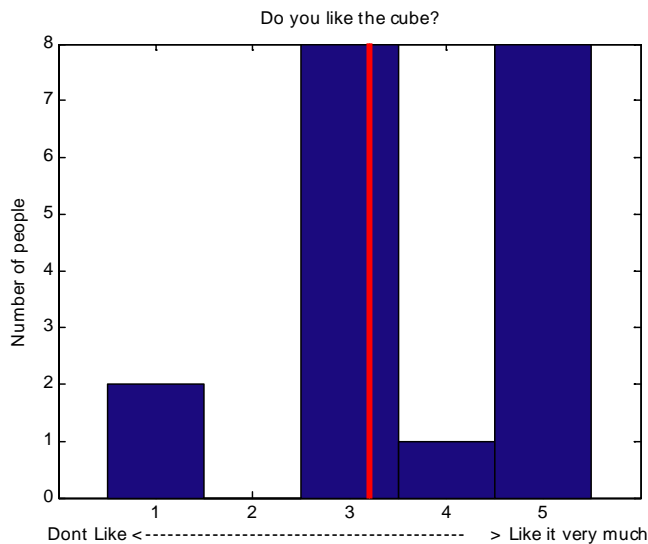


Fig. 10. The answer distribution of the last question, “Do you like the cube interface?”.

For the Eighth question in the questionnaire “Does your parent ask you to read story books on your own or do they take time for you to tell story and how often they do?”, six kids answered “(a) My parents never”, six kids answered “(b) My parents take time for me but asks me to read the book on my own” while four kids answered “(c) My parents take time for me and also help me while reading stories book (2-4 times in a

week)” and finally one kid answered “(d) My parents take time and also tell me stories(almost every day)”

From some other data we collected, seventeen of them liked reading stories while three did not. Fourteen of them liked to listen to stories while five did not. Twelve of them agreed that stories on TV/Computer are more interesting than on story books, while six of them prefer traditional story books.

Our general observations on the user of the wIzQubes™ exhibit at Singapore Science Center are: (1) Most of the visitors won’t read the instruction beside the exhibition. They will try to find out how the wIzQubes™ works by themselves. They read the instruction only when they encounter problems. (2) Users tend to cover the top of the cube with their hand, even after we give them instruction not to do so. (3) Joining the cubes together to trigger decisions is not ‘natural’ enough, as most of the users need to read the instruction to understand this functionality.

We observe that most of the kids rest the orange cube (story scene cube) on the table rather than holding it and viewing it from different angles constantly. They concentrate more on the story i.e. enjoying the animation of the 3D graphics. Sometimes they move the orange cube to get a better view of the story.

Lost tracking is not an important issue here, since most of the kids placed the cubes on the table while watching the animation. They played with the cube when (1) the story character asks for an item or (2) when the story advances to the next scene. They can orient the cube to get their desired view of the story scene without difficulties.

Our observations found that most kids have difficulty in finding the correct item on the blue cube, the reasons being: (1) The icons on the blue cube are misleading (i.e. not related to the augmented item displayed on screen). For instance, one kid tried to find the correct item by searching the icons of the blue cube instead of looking at the monitor screen for the virtually augmented item on top of blue cube. (2) Most of the kids have to rotate the cube several times before they can find the correct item. (3) Most of the time the blue cube is placed very close to the orange cube; hence the view of the blue cube is blocked by the virtual story scene augmented on top of orange cube. (4) Some of the items asked by the story character are ambiguous, for example in the Little Red Riding Hood story, the little girl asks “which way should I take”, and the correct item to be given is a “road sign”. One of the kids tried to answer this question by moving the orange cube in some direction that the character in the story wanted.

After finding the correct item, the kids need to bring the cubes close to each other. Sometimes the kids completely cover the whole cube with their hands, and hence the triggering of the decisions was not activated immediately unless the kids move their hands away.

Sixteen of the kids completed the whole study, while three of them didn’t because their parents have to leave. For those kids who completed the whole study, at the end of the questionnaire we ask the kids if they liked the system. Eight of them said that they like it very much. Eight of them claimed

neutral, while another two kids said that they don't like the story. We also asked them to rank how much do they like the cube interface based on 5-point Likert Scale (3 means neutral and 5 means 'Like it very much'). The results are shown in Figure 10. The mean answer is 3.68 with standard deviation of 1.34, which indicates that on an average they like the system.

VII. CONCLUSION AND FUTURE WORK

We have successfully improved our story-telling interface from Magic Book, Magic Cube, to wIzQubes™. Our wIzQubes™ interface is now more robust by tracking multiple markers in the scene. As long as one of the markers can be seen by the camera, the system will still run.

We have added interactivity to the story; our wIzQubes™ allows the users to see the scenes in the story from different viewing-angles and the user can interact with the story by giving the story character the item he/she needs.

We have setup our system for public exhibition at Singapore Science Center and we observed how people use the wIzQubes™. We noticed that that text/picture-based instruction is not an effective way of conveying the information. An explanation of how our system works in an audio-visual format seems to be more effective and widely accepted.

Our user study shows that parents nowadays may not have time to do the storytelling to their kids. Kids prefer an interactive story telling system than a traditional storybook. Our wIzQubes™ interface is loved by the kids, and on a scale of acceptance ranging from 1 to 5, 5 being most preferred, we found the average rating to be 3.68 that further confirms the user-acceptance of our system.

Loss in marker tracking happens quite often due to various user interaction issues and mishandling of the cubes, and currently we alert the user using the icon or dimming the computer screen but not many users understand the reason. A warning using audible speech like "Don't cover the top marker with your fingers" will be more useful.

wIzQubes™ interface allow the users to view the story from different viewing-angles. From our observation, this feature is not fully utilized by the users. In the future we are planning to develop applications that emphasize this feature. A non linear story line is also a possible future direction for the wIzQubes™ system.

APPENDIX WIZQUBE QUESTIONNAIRE -FOR KIDS

(To be filled by the interviewer, not by child, but if child wants to see it, let him do so)

Section A - Before the kid try the cube

- 1) Name:
- 2) Age:
- 3) Sex: Male/Female
- 4) Right/Left Handed: Left/Right
- 5) Do you use computer? If so how often?
- 6) Mother tongue: English/Chinese/Indian/Malay/

- 7) The Story chosen and the language:
- 8) Does your parent ask you to read story book on your own or they take time for you to tell story and how often they do?
 - a) My parents never
 - b) My parents take time for me but asks me to read the book on my own
 - c) My parents take time for me and also help me while reading stories book(2-4 in a week)
 - d) My parents take time and also tell me stories(almost every day)
- 9) Do you like reading stories? (a)Yes (b) No
- 10) Do you like listen to stories? (a)Yes (b) No
- 11) Which one do you find more interesting, story book or stories shown on TV/computer screen
 - a) I find the story book more interesting
 - b) I find the stories shown on TV/computer screen more interesting Why do you like (Don't insist the child to give answer to this question, just simply ask, if he/she is ready to answer then listen carefully, otherwise move to the other question)

Section B - After the kid try the cube

- 11) Did the kid try to turn the wIzQube™ and see the story scenes from different angles? (a)Yes (b) No
- 12) Did the kid have problem with the cube lost tracking?
- 13) Did the kid have problem finding the solution to advance the story?
- 14) Did the kid have problem finding the correct cube's top after the story advance?
- 15) Did the kid finish the story, if not WHY? and in WHICH scene he/she stop?
- 16) Do you like the story? Why? (1) Don't like (2) Neutral (3) Like it very much
- 17) Do you like the cube? Why? (1) Don't like (2) (3) Neutral (4) (5) Like it very much
- 18) Any special comment which child mention on his own, how was child feeling while answering the question?

Interviewed By:

Name:

Date:

Time:

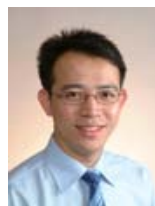
ACKNOWLEDGEMENT

The patented technology was developed by the Mixed Reality Lab at the National University of Singapore. A lab spin-off company, MXR Corporation has been carrying out the commercialization of the lab technology with exclusive license from the National University of Singapore.

This project was partially supported by the Digital Content Development Scheme (DCDS), Media Development Authority of Singapore (MDA).

REFERENCES

- [1] M. Billinghurst, H. Kato and I. Poupyrev. The magicbook: Moving seamlessly between reality and virtuality, *IEEE Computer Graphics and Applications*, vol. 21, no. 3, pp. 2–4, May 2001.
- [2] Z. Zhou, A. D. Cheok, Y. Li and H. Kato. Magic cubes for social and physical family entertainment, in *CHI '05: CHI '05 extended abstracts on Human factors in computing systems*. New York, NY, USA: ACM, pp. 1156–1157, 2005.
- [3] I. AsieCo. Ltd, Story Cube. Patent NO.: China # ZL 92 2 18681.6. Available: http://www.intermedasie.com/products/cube_storycube.htm.
- [4] M. G. Gorbet, M. Orth and H. Ishii. Triangles: Tangible interface for manipulation and exploration of digital information topography, in *CHI, 1998*, pp. 49–56.
- [5] A. Mazalek, A. Wood and H. Ishii. Geniebottles: An interactive narrative in bottles, in *Proc. of SIGGRAPH 2001, Conference Abstracts and Applications*, Los Angeles, California USA, pp. 189, August 2001.
- [6] K. Ryokai and J. Cassell. Storymat: a play space for collaborative storytelling, in *CHI '99: CHI '99 extended abstracts on Human factors in computing systems*. New York, NY, USA: ACM Press, pp. 272–273, 1999.
- [7] M. Ananny and J. Cassell. Telling tales: A new toy for encouraging written literacy through oral storytelling, Presentation at Society for Research in Child Development, 2001.
- [8] C. Vaucelle and T. Jehan. Dolltalk: A computational toy to enhance childrens creativity, 2002.
- [9] A. Bobick, S. Intille, J. Davis, F. Baird, C. Pinhanez, L. Campbell, Y. Ivanov, A. Schutte and A. Wilson. The KidsRoom: A Perceptually-Based Interactive and Immersive Story Environment, E15, 20 Ames Street, Cambridge, MA 02139, Tech. Rep. 398, December 1996.
- [10] M. P. Johnson, A. Wilson, B. Blumberg, C. Kline and A. Bobick. Sympathetic interfaces: using a plush toy to direct synthetic characters, in *CHI '99: Proceedings of the SIGCHI conference on Human factors in computing systems*, New York, NY, USA: ACM Press, pp. 152–158, 1999.
- [11] K. Ryokai, C. Vaucelle and J. Cassell. Literacy learning by storytelling with a virtual peer, 2002.
- [12] H. Ichida, Y. Itoh, Y. Kitamura and F. Kishino. Activecube and its 3d applications, in *IEEE VR 2004 Workshop Beyond Wand and Glove Based Interaction*, Chicago, IL USA, 2004.
- [13] B. Ullmer and H. Ishii. The metadesk: Models and prototypes for tangible user interfaces, in *Proc. of UIST'97*, Banff Park Lodge, Banff, Alberta, Canada, pp. 223–232, October 1997.
- [14] G. Fitzmaurice, H. Ishii and W. Buxton. Bricks: Laying the foundations for graspable user interfaces, in *Proc. of CHI'95*, pp. 442–449, 1995. [Online]. Available: citeseer.ist.psu.edu/fitzmaurice95bricks.html
- [15] B. Ullmer, H. Ishii and D. Glas. mediaBlocks: Physical containers, transports, and controls for online media, *Computer Graphics*, vol. 32, no. Annual Conference Series, pp. 379–386, 1998. [Online]. Available: citeseer.ist.psu.edu/ullmer98mediablocks.html
- [16] 3D Mouse. <http://www.vrealities.com/3dmouse.html>, vrealities.com.
- [17] H. Ishii and B. Ullmer. Tangible bits: towards seamless interfaces between people, bits and atoms, in *Proc. of CHI'97*, pp. 234–241, ACM Press, 1997.
- [18] B. Ullmer and H. Ishii. The metadesk: Models and prototypes for tangible user interfaces, in *Proc. of UIST'97*, pp. 223–232, 1997.
- [19] K. P. Fishkin. A taxonomy for and analysis of tangible interfaces, *Personal Ubiquitous Comput.*, vol. 8, no. 5, pp. 347–358, 2004.
- [20] G. Fitzmaurice and W. Buxton. An empirical evaluation of graspable user interfaces: towards specialized, space-multiplexed input, in *Proc. of CHI'97*, Atlanta, Georgia, USA, pp. 43–50, March 1997.
- [21] Logitech Ultrasonic 3D Mouse and Headtrackers, [vrdepot.com](http://www.vrdepot.com). [Online]. Available: <http://www.vrdepot.com/vrteclg.htm>.
- [22] H. Kato and M. Billinghurst. Marker tracking and hmd calibration for a video-based augmented reality conferencing system, in *Proc. of the 2nd IEEE and ACM International Workshop on Augmented Reality '99*, San Francisco, CA, pp. 85–94, October 1999.



multimodal human-computer interaction.

Zhiying Zhou received the B.Eng. and M.Eng. degrees from Southeast University, China, in 1998 and 2001 respectively. He received his Ph.D. degree from the National University of Singapore in 2005. He is currently an Assistant professor at the Department of Electrical and Computer Engineering, National University of Singapore. He is also the director of Interactive Multimedia Lab, www.impl.org.sg. His research interests include augmented and virtual reality, computer vision, and



human-computer interaction, wearable computers and smart spaces, fuzzy systems, embedded systems, power electronics, and multi-modal recognition. He has been a keynote and invited speaker at numerous international and local conferences and events. He was IEEE Singapore Section Chairman 2003, and is presently ACM SIGCHI Chapter President. He was awarded the Hitachi Fellowship 2003, the A-STAR Young Scientist of the Year Award 2003, and the SCS Singapore Young Professional of the Year Award 2004. Also in 2004, he was awarded an Associate of the Arts award by the Minister for Information, Communications and the Arts, Singapore.

Adrian David Cheok is Director of the IDM Network and the Director of the Mixed Reality Lab, National University of Singapore. He is Associate Professor in the Department of Electrical and Computer Engineering. He has previously worked in real-time systems, soft computing, and embedded computing in Mitsubishi Electric Research Labs (Osaka, Japan) and NUS. He has been working on research covering mixed reality,



Jeffrey Tedjokusumo received the B.Comp and M.Comp degrees from National University of Singapore in 2004 and 2006, respectively.

He is currently a Research Fellow at the Department of Electrical and Computer Engineering, National University of Singapore. His research interest include computer graphic, computer vision, augmented and virtual reality, and human-computer interaction



Gilani Syed Omer is currently a Research Engineer at the Department of Electrical and Computer Engineering, National University of Singapore. His research interest include computer vision, augmented and virtual reality, and human-computer interaction

2009 International Conference on CYBERWORLDS

7-11 September 2009 University of Bradford, UK.

Sponsored by IEEE Computer Society and organised in-cooperation with ACM.

Call for Papers

CW2009 will provide an opportunity for academics, scientists and engineers from around the world to share the latest research, ideas and developments in these fields. The conference will consist of full paper sessions, workshops and poster sessions which will demonstrate the state-of-the-art in the field.

Please download call for papers flyer in pdf format from here

Conference Topics

Visual cyberworlds	Computer vision and augmented reality for cyberworlds
Philosophy, evolution, and ethics of cyberworlds	Intelligent agents in cyberworlds
Cyberworlds and their impact on the real worlds	Communication in cyberworlds
Cyberethics and cyberlaws	Distributed virtual environments
Cybersecurity	Shared virtual worlds
Modelling and animation in cyberworlds	Data mining and warehousing in cyberworlds
Virtual reality in cyberworlds	Bioinformatics for cyberlife and medicine
Computer vision and augmented reality for cyberworlds	Healthcare in cyberworlds
Intelligent agents in cyberworlds	Cyberworlds for bioengineering
Communication in cyberworlds	Cyberinformation systems
Distributed virtual environments	E-business in cyberworlds
Shared virtual worlds	Cyberworlds for education
Data mining and warehousing in cyberworlds	Collaborative work using cyberworlds
Bioinformatics for cyberlife and medicine	Cyberworlds for design and manufacturing
Healthcare in cyberworlds	Cyber fairs and cyber museums
Cyberworlds for bioengineering	Multi-user web games
Cyberinformation systems	Cyberculture and cyberarts
Visual cyberworlds	Cyber social networks
Philosophy, evolution, and ethics of cyberworlds	Cyberethics and cyberlaws
Cyberworlds and their impact on the real worlds	Cybersecurity
Virtual reality in cyberworlds	Modelling and animation in cyberworlds

Journal Special Issues

Selected extended versions of papers from the conference will appear in the journals [Virtual Reality Journal](#) (Springer) and [The Visual Computer](#) (Springer). Around 6 papers for each of the journals will be selected by the organising committee.

Authors will be required to submit the extended versions. In order to maintain the high quality of these journals the extended versions of the papers will be subject to separate reviews in line with the journals' editorial policies.

Important Dates

- Paper submission **15th April 2009**
- Notice of acceptance **29th May 2009**
- Camera-ready paper **30th June 2009**
- Author registration **4th July 2009**
- Conference **7-11 September 2009**

Organising Committee

Honorary Co-chairs:

Professor Rae Earnshaw, School of Informatics, University of Bradford, UK

Professor Toshiyasu L. Kunii, University of Tokyo, Japan

Professor John Vince, National Centre for Computer Animation, University of Bournemouth, UK

Conference Co-chairs:

Dr Rami Qahwaji, School of Informatics, University of Bradford, UK

Dr Stan Ipson, School of Informatics, University of Bradford, UK

Programme Co-chairs:

Dr Hassan Ugail, School of Informatics, University of Bradford, UK

Professor Phil Willis, Department of Computer Science, University of Bath, UK

Conference Steering Committee:

Toshiyasu L. Kuni, University of Tokyo, Japan

Hock Soon Seah, Nanyang Technological University, Singapore

Alexei Sourin, Nanyang Technological University, Singapore

Conference secretary:

Rona Wilson, School of Informatics, University of Bradford, UK