An Education Method for VR Content Creation using Groupwork

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Our other VR applications

Abstract

VR content creation is a comprehensive development, and it requires a variety of skills, not only sensing technology and computer graphics techniques, but also aesthetic design and storytelling, for completing the project. A groupwork-based project is a suitable approach for creating a VR application, because the group members can exert their full powers in their special fields by collaborating with each other.

Students learn best when they are actively involved in the process, such as in group discussion and field work. These groupwork projects are also effective in improving their collaboration skills.

This paper introduces an education method for creating virtual reality content by means of groupwork, and shows the advantages of this method.

CR Categories: H.5.1 [Multimedia Information Systems]: Artificial, augmented, and virtual realities ; K.3.1 [Computer Uses in Education]: Collaborative learning

Keywords: Emerging Technology, Virtual Reality, Groupwork

1 Introduction

Human society is becoming increasingly complex. If science and technology remain fragmented into specialized disciplines, we cannot deal effectively with the multifaceted problems which we now face. Thus, we need new multidisciplinary approaches to solve complex problems.

In the early years of the twenty-first century, the so-called *knowledge age* has become a reality, after intense innovation in computer and communication technology. In the knowledge age, a new paradigm of industries, service industries, has been growing. From the point of view of the characteristics of service industries, it is necessary to adapt their product flexibly to a client's demand [Castro07].

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We have taught our graduate students a method of knowledge creation for solving complex problems through a groupwork-based project regarding a virtual reality application.

About IVRC

IVRC (International collegiate Virtual Reality Contest) which is organized with *Virtual Reality Society of Japan*, is a technical contest regarding virtual reality, robotics, and interactive technologies, established in Japan, in 1993. From 2004, IVRC has cooperated with a French virtual reality student competition called *Laval Virtual*[1]. The aim of this contest is deep understanding of virtual reality and interactive technologies through developing their own system. IVRC is not only a technical competition but also a novel education framework to encourage participants to think, study and create by themselves.

The competition usually starts in May and ends in November. There are four rounds as outlined in Figure 1; 2) screening of proposal (early in June), 3) oral presentation(late in June), 4) preliminary contest(mid-September), and 5) finals (early in November).

The average acceptance rate to the final stage is four from over forty applicants.

Many works which were selected for the IVRC final stage had been accepted at SIGGRAPH Emerging Technology, therefore IVRC has become a prestigious technical competition in Japan. We have participated in IVRC since 2003, and some of our works have been exhibited in abroad, such as at SIGGRAPH and Laval Virtual.

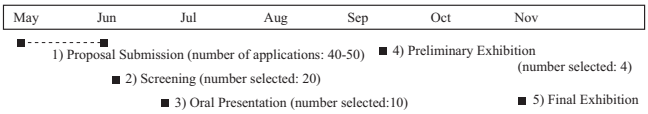


Figure 1: *IVRC Schedule*

2 What we made

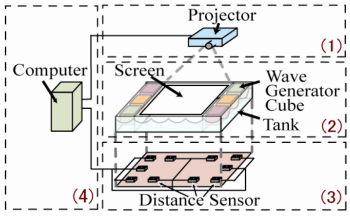
This section introduces our representative works prior to describing how to make a virtual reality (VR) application through groupwork. All related movies of our works are shared on our YouTube channel[2].

[1]http://www.laval-virtual.org/
[2]http://jp.youtube.com/mytlab

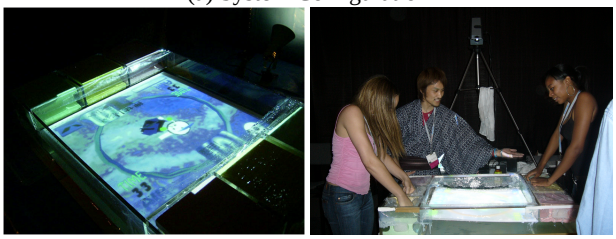
2.1 Ton^2

Ton^2 is a new body sensory style VR application that is implemented by using an intuitive and robust interaction model, as shown in Figure 2. This application captures the player's motion data as displacement values by means of distance sensors, and uses the data for its interaction model.

We have revived an old traditional game in Japan, *Paper-Sumo*. Normally, we play this game on a board using paper and cardboard, but we design it as a game that can be played underwater. We used water as the media, not just to enjoy the game, but the players could also feel the comfort of pressing down water. In the 3D imagery, which is projected on the floating screen, the powerful performance of Sumo will be fought by the movement of the Sumo-Wrestlers, influenced by both players pushing down water. This system was exhibited at SIGGRAPH 2005 [Ton205].



(a) System Configuration



(b) User Experience

(1) Projector that projects the image on the screen, which floats on water. (2) Wave Generator Cube (WGC) is to generate waves from the pressing action of the player. There are three WGCs on each side of the tank. (3) Distance Sensors are to obtain the displacement data. They are placed at the four corners of the screen, and six for each WGC, which are all set under the tank. (4) The computer, which controls the whole system, calculates the input data from the A/D conversion board.

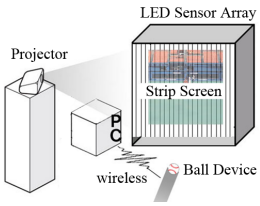
Figure 2: *Ton^2*

2.2 Kyukon

Kyukon realizes a virtual pitching experience by means of a non-wearable interface. Our system allows control of the ball like a real pitcher. Wireless sensing technology and the strip screen enable the non-wearable interface. There are no physical restrictions, so a user can pitch the ball freely.

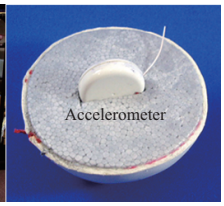
The strip screen smoothly connects a player to the virtual stadium projected on the screen. The mission is to strike out the batter. As the player throws the ball to the screen, the ball will smoothly go through the screen. At the same time, the virtual ball will be projected at the exact place the player threw the ball, which also reflects the speed and the rotation of the thrown ball. The player can also pitch a miracle ball at particular rotation and speed of thrown ball.

A player will try to control their arm and wrist to pitch a miracle ball. Figure 3 illustrates the system configuration and the screen shot. This system was exhibited at Laval Virtual 2006, and was awarded a prize in the category of *Jeux Vidéo et Attractions*.



(a) System Configuration

(b) Screen Shot



(c) Installed Devices (d) User Experience

The wireless accelerometer is inside the ball. It detects the time when the ball is released from the hand, and the rotation of the ball. The optical sensors are installed behind the strip screen. They detect the time and the position where the ball reaches the screen.

Figure 3: *Kyukon*

2.3 Interactive Fountain

This project presents an interactive system which controls fountains. The system consists of seven fountain units as shown in Figure 4; each unit has a PC-controlled water pump and nine full-color LED lights.

The lighting color and jets of water are controlled by the motion of a player's fan. The system links human intuitive motion and water jets of a fountain. A player operates fountains with a fan-type controller. The fountains react to user's motion instantly, and change water jet and the illumination color of water. This system was exhibited as an invited work at Laval Virtual 2007.

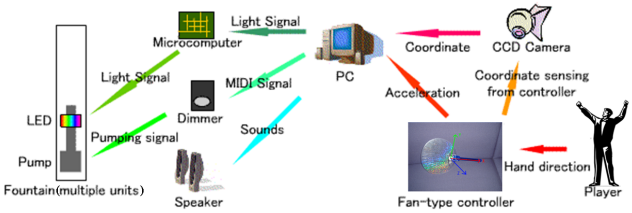
2.4 Landscape Bartender

This project presents a system that generates landscapes using a cocktail analogy. With this system, users generate landscapes by combining "ingredients."

Users select a bottle containing the intended landscape element, such as sand, rock, cloud, water, and sun, and pour an appropriate amount of water into a shaker. The amount of water used from each bottle determines the ratio of landscape elements. The relief of the surface and the position of each element are changed by shaking the shaker. This system provides the enjoyment of creating one's own favorite scenery. Figure 5 illustrates the system configuration, user experience, and sample scenes. This interactive system was exhibited at SIGGRAPH 2008 [Landscape08].

3 How we collaborate

This section describes how to make a VR application through groupwork.



(a) System Configuration

(b) User Experience

This system consists of PC, fan-type controller, CCD camera, seven speakers, two MIDI-controlled 4ch dimmer switches, and seven fountain units. The top of the nozzle is enclosed in a metallic nozzle head surrounded by nine full-color LEDs. The MIDI-controlled dimmer switches change the height of the water jet. The self-illuminated fan is used as the body of the controller. The wireless three-axis accelerometer is set on a part of the handle of the controller. The system detects the position of the controller by means of a background image subtraction method.

Figure 4: *Interactive Fountain*

3.1 Why groupwork

In general, teams are stronger when ideas are intermixed and integrated through collaboration, especially interdisciplinary teamwork.

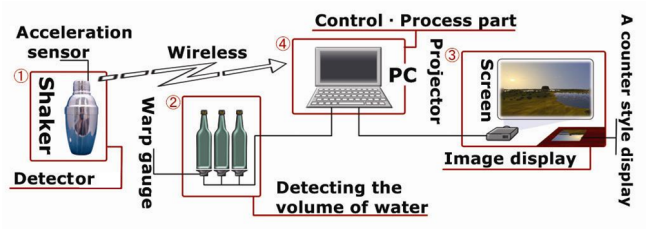
Csikszentmihalyi says that people enter a *flow* state, in which, when they are involved in an activity, nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it. He also describes the effectiveness of *flow* experience as follows; *The self becomes complex as a result of experiencing flow. When we choose a goal and invest ourselves in it to the limits of our concentration, whatever we do will be enjoyable. And once we have tasted this joy, we will redouble our efforts to taste it again. This is the way the self grows* [Csikszentmihalyi90].

We have observed that students learn best when they are actively involved in the process, such as in group discussion and field work. Groupwork is also effective to improve their collaboration skill. In addition to this, a variety of skills, including technical skills and design expertise, are required for creating a VR application.

Therefore, we have applied a groupwork method [Douglas78] both for making better VR applications, and for developing a students as people.

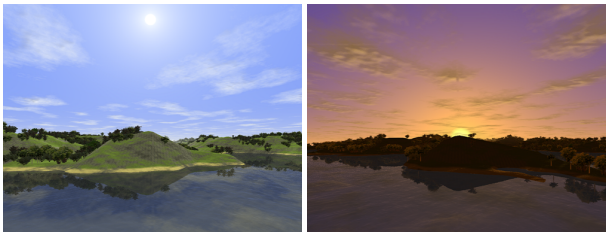
3.2 The process of groupwork

The design process is the most important element in content creation. In a design process, physical objects and user interfaces are often the most tangible, attractive and visible outcomes, however a user's experience plays a more important role than any of them. That is, an experience design is an essential practice of designing content, applications, and systems.



(a) System Configuration

(b) User Experience



(c) Sample Scenecs

The system consists of four modules; 1) shaker-type controller with wireless accelerometer. The accelerometer is hidden inside the cap of the shaker. The acceleration data is used for changing the relief of ground and the position of each element, 2) measuring module for sensing the volume of water, 3) counter-type image display unit, and 4) PC.

Figure 5: *Landscape Bartender*

James Webb Young says that there are the following five steps to produce an idea [Young88].

1. Gather raw material
2. Digest the material
3. Put the issue out of your mind completely
4. Constantly think about it
5. Expose the idea to reality

He states that 'an idea is nothing more nor less than a new combination of old elements.' He also suggests that the second most important principle is the ability to see relationships between disparate things. We have followed his method to produce ideas in a groupwork project regarding a VR application.

The following subsection describes the process of groupwork, divided up into the following three steps;

1. Divergent Thinking: put forward many ideas intensely
2. Convergent Thinking: unify and combine ideas
3. Idea Crystallization: feasibility study and embodiment of idea

3.3 Divergent Thinking

The first step for VR content creation is putting forward an idea intensely, as the impulses take them. In this step, it is important to think up ideas freely without being shackled by stereotypical thinking and conventional methods.

We support divergent thinking by utilizing a BBS based on the concept of *Idea-Marathon System (IMS)* [IdeaMarathon]. *IMS* is a way of life that involves recording your own ideas at least once a day into a notebook. You can record any type of ideas as long as they are your own original ideas, regardless of the field or topic. The essential of *IMS* is continuous practice of putting forward ideas everyday, whatever they may be.

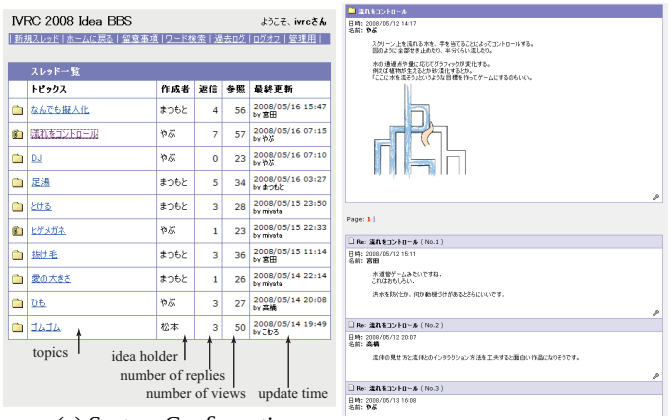
For collaboration in groupwork, it is required to provide an environment to share ideas among group members. We found that BBS is a suitable platform to share their ideas, because it allows a user to browse and comment on ideas easily at any time. Figure 6 shows the screen shot of our BBS. We have managed the BBS considering the following;

1) Indicate the number of replies and views This reflects attention and liveliness of a topic.

2) The latest updated topic is placed at the top This clarifies the current hottest topic. On the other hand, a topic which has few replies is left out of the main stream, and it may die out.

3) Negative comment is prohibited It is essential to put forward ideas continuously, whatever they may be. The negative comment may discourage the idea holder, and it inflicts harm on the community.

With this BBS, the group members can describe their ideas, refer to others, reflect, and think about the ideas at any time. This concept development phase of application design plays an important role in successful projects.



(a) System Configuration (b) Screen Shot

Figure 6: *BBS based on IMS*

3.4 Convergent Thinking

Using divergent thinking, we obtain many ideas. In the next step, we unify and combine ideas into an idea.

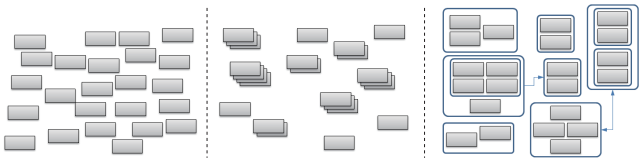
There are many methods for converging ideas, including PERT method, cross method, and KJ method. We have applied cooperative KJ method for converging the ideas produced. The KJ method consists of the following four steps, also illustrated in Figure 7;

(1) Card Making All ideas are written on individual cards.

(2) Grouping and labeling Cards that look as though they belong together should be grouped together, avoiding preconception. For each group, write a proper title and place it on top of its group. Repeat the group making, using new titles to create higher-level groups.

(3) Chart making Arrange the grouped cards on a large sheet in a spatial pattern considering their relations.

(4) Description Describe what the chart means, observing all the cards.



(a) Card Making (b) Grouping and Labeling (c) Chart Making

Figure 7: *KJ Method*

It is important look at the whole picture in the convergent thinking process. Digital tools are not suitable for this process, therefore we use *Post-its* and a large sheet as shown in Figure 8. During this converging process, the participants think over how the players will enjoy their target system, then the converged idea will be sophisticated and gain more depth.

Figure 8: *Convergent Thinking*

3.5 Idea Crystallization

In this process, the converged ideas are screened through a feasibility study, and the selected idea is embodied.

It is important to design a system from the point of view of the players, focusing on the quality of the user experience. That is, we design what the player experiences with a target application, how the player feels using a system, what kind of enjoyment and amazement a system gives, and so on. Here, we have to pay attention to design a system not to be a technology-oriented one. Especially, the idea of VR application tends to emphasize its technical fascination. However, the more important thing for a player is what he/she can experience.

For example, in the *Landscape Bartender* project, we started to design an application by scripting a short story and illustrating a concept image, as shown in Figure 9.

The small bar in a nook of a city. The bartender creates a small world in a cocktail glass. The landscape of the world makes a guest happy. The bartender is yourself. So, what kind of landscape will you make tonight?

Figure 9: *Concept Design*

Then, we sketched the user experience as shown in Figure 10, to share the story of the VR application among group members.

After finishing the experience design process, all we have to do is just implement the system. We think our groupwork method helps students to develop their critical and creative thinking capability [Baker01; Paul05].

4 Conclusion

We have outlined how groupwork helps in designing and creating a VR application efficiently. Some outcomes of our groupwork have been highly evaluated.

VR content creation is a comprehensive development, and it requires a variety of skills, not only sensing technology and computer graphics techniques, but also aesthetic design and storytelling, for completing the project. Therefore, a groupwork-based solution is a suitable approach, because the group members can exert their full powers in their special fields by collaborating with each other.

In future, we would like to adopt a method for conceptual synthesis in design process [Taura05; Nagai06; Chiu07] for obtaining highly creative ideas.

In summary, a groupwork scheme works well not only for creating a good VR application, but also as a training framework for graduate students.

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Figure 10: *Experience Design*

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