POSTER: Introduction of Animation Assignment in Graphic Science Education making Use of CG Application of Data Describing Type

Hirotaka SUZUKI
Osaka City University
3-3-138, Sugimoto, Sumiyoshi-ku
558-8585, Osaka-city, Japan
suzuki@arch.eng.osaka-cu.ac.jp

ABSTRACT

In Osaka City University, Graphic Science Education has been located not as an entrance of drawing and designing exercise but as design language education. Design language is constructed by knowledge and technique which facilitates intelligible communication making good use of figures and drawings. From academic year 2006, number of lecture units in half year increased 1 unit in Osaka City university. Making use of the unit, we secured 3 units for animation exercise and introduced geometry CG art for further understanding about parametric control method in POV-Ray. Due to these change, we decided to regard animation work as compulsory assignment. Comparing to GUI interface CG modeler, it is difficult to construct animation with parametric modeler. As users have to consider relationship of parameters and produced image manually with parametric CG modeler in return for vast possibility of animation idea. Students submitted a lot of type of animation works. And almost all students evaluated CG animation as "interesting" exercise comparing to other topics. In this paper, the content of the subject and submitted animation works is introduced. And the comparison analysis between result of class evaluation for animation and that for other topics is discussed.

Keywords

computer graphics, animation, graphic science education

1. INTRODUCTION

In Osaka City University, Graphic Science education has been located not as an entrance of drawing and designing exercise but as design language education. Design language is constructed by knowledge and technique which facilitates intelligible communication making good use of figures and drawings (See [Suz03]). Based on the concept, Graphic Science has been provided as a subject of liberal arts. Half of the graphic science education is allocated for hand writing education (learning of projection method) and the rest is allocated for computer graphics (CG).

CG application software POV-Ray (Persistence of Vision Ray Tracer) has been selected as CG education tool due to following reasons; 1)Freeware, 2)Free platform (hardware, software), 3)High quality, 4)Data description style(readable text format) (See [Suz03] as well). In this subject, students have to submit following 4 assignments; 1)Scarecrow (for mastering combination of primitive figures), 2)Stairs (for mastering repetition procedure), 3)Lighting Equipment (for mastering concept of Constructive Solid Geometry and knowledge about behavior of light, from academic year 2004, See [Suz06]), 4)Final assignment (applying all knowledge learnt in the subject).

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.
Copyright UNION Agency – Science Press, Plzen, Czech Republic.

As student's interest for CG animation is quite high, we had tried to introduce animation into the subject. However, as there were no computer terminal room for the CG exercise, we started teaching animation topic by only lecture. In the lecture, we selected good works from submitted student's works (still works, not animation) and generate CG animation with them. We introduce required tools for making animation and explain how to construct moving animation.

In academic year 2003, the room for CG graphic science education with 80 notebook PCs was established and we started 2 units (2 weeks) CG

exercise in the subject making use of format exchange tool for CG images and animation constructing tool. However 2 units was insufficient for students and we could not set animation works as compulsory assignment. Though some of students could submit the works and we could not reflect evaluation of the works to grade of students.

From academic year 2006, number of lecture units in half year increased 1 unit in Osaka City university. Making use of the unit, we secured 3 units for animation exercise and introduced geometry CG art for further understanding about parametric control method in POV-Ray. Due to these change, we decided to regard animation work as compulsory assignment. Comparing to GUI interface CG modeler, it is difficult to construct animation with parametric modeler like POV-Ray. As users can easily create animation by key frame setting with GUI interface CG modeler, users have to consider relationship of parameters and produced image manually with parametric CG modeler in return for vast possibility of animation idea. Students submitted a lot of type of animation works. And almost all students evaluated CG animation as "interesting" exercise comparing to other topics.

In this paper, the content of the subject and submitted animation works is introduced. And the comparison analysis between result of class evaluation for animation and that for other topics is discussed.

2. CURRICULUM CONTENTS

2.1 Enrolled students

The number of students enrolled in this subject is 174 in total. Because the enrolled students are from a wide variety of departments (Architecture, Civil Eng., Environmental Urban Eng., Applied Physics, Information Eng. and Environmental Design), there was a concern over a difference in the level of information literacy that each student had acquired by then, which might be an obstacle for the smooth implementation of a class exercise. As it turned out, however, a disparity in information literacy has not emerged as a major problem. As a matter of fact, the quality of assignments submitted by students does not always have a direct link with the departments they belong to.

2.2 Class Contents

The lecture given prior to exercise is designed to enlighten students of the basic points concerning animation: 1) an animation is made by combining numerous still images with motion, 2) specific application software programs are used (In this class, Animation GIF Maker and Irfanview are used) in the process of converting format of still images and that of combining still images into unified animation file, 3) while it is possible to produce still images with motion by gradually changing parameters of scene files, POV-Ray uses the parameter called "clock," which sequentially changes from 0 to 1 at the time of rendering, and 4) by using "clock," it will become possible to add such motions as "moving objects little by little (combining with the parallel movement parameter)," "changing brightness little by little (combining with the light-source strength parameter)," and "conducting a walk-through by changing viewpoints (combining with the coordinate axis of the viewpoint)."

Table 1. Weekly subjects of Graphical Science

	Content	Assignment
1st	Introduction	Impression for the submitted works by past students, and Comments and Suggestions for the Lecture
2nd	The Basis of POV-Ray	
3rd	The Description Method of Primitive Figures	Giving Small Assignment 1 (Scarecrow)
4th	Rotation, Enlargement & Reduction, Translation and Repeat	Assignment 1 Due, Giving Small Assignment 2 (Stairs)
5th	Conditional Branch, Use of Defined Colors, Block Pattern	Assignment 2 (Hand writing plan) Due
6th	CSG Model	Assignment 2 (Scene File) Due, Giving Small Assignment 3 (Lighting Equipment)
7th	Midterm Examination	Assignment 3 (Hand Writing Plan) Due
8th	Behavior of Light Flow(Light Source, Reflection, Transmission)	
9th	Giving Final Assignment and Use of Texture, Group, Prism, Solid of Revolution	Giving Final Assignment
10th	Other Useful Knowledge	Assignment 3 (Scene File)
11st	CG Animation 1	
12nd	CG Animation 2	
13rd	Geometry Art and CG Animation 3	Assignment CG Animation
14th	GUI-type Modeler Exercise	

After that, before going into the instruction using scene files, students are taught how to put together images of the staplers photographed with a digital camera to make an animation in which the staplers move from one place to another or their jaws open and close. This session is designed to make students realize that these tools (the animation producing tool and the image-file format-conversion tool) are not only applicable to still images produced by POV-Ray but also has many other potential uses. The session also aims to give students tips on making animations with a limited number of still images by, for example, reusing or reversing them.

After taking this step, some of the still images submitted by students were selected to demonstrate how to make animations that express rotation, movement and the change of brightness. Then simple scene files (with the "clock" already combined with

their rotation angles to rotate the objects) were distributed to the students for hands-on exercise.

These scene files are used for rendering. After rendering several still images all at once, Irfanview is used to convert the images from BMP format files to GIF format files. After that, Animation GIF Maker is used to combine the files into Animation GIF format. When doing so, several parameters are set to shift the "clock" from 0 to 1 to indicate how resultant animations are affected by how parameters are set (quick and rough ↔ slow and smooth) and what will happen if parameters are set inappropriately (if a range from 0 to 1 is divided into four, the rectangular parallelepiped in the center will not rotate.)

2.3 Lecture on "Geometric Art"

The first 30 minutes of the 13th class is spent for a lecture titled "Geometric Art" designed to raise students' awareness about the possibilities of using POV-Ray in a more parametric way. Specifically, instructions are given about how use POV-Ray to express mathematically defined figures such as a 2D curve, a 3D curve and a 3D curved surface, using, as a sample for each figure, a hypotrochoid, a double helix and a hyperbolic paraboloid, respectively (See Fig. 1). Due to time constraints, we only distributed scene files to prepare each figure and showed students how changes of various parameters result in different figures. Students were allowed to spend the rest of the exercise time for finishing their animation assignments. And the students who had finished their animation assignments can spend the rest time for Geometric Art exercise.

3. SUBMITTED ANIMATION WORKS

Fig. 2 shows examples of the animation works submitted by students. The top-left work is a mechanical animation based on a student's Final Assignment, which he had constructed in a parametric way with an eye to using it in his animation assignment as well. The top-right work, incorporating what is taught during the Geometric Art lecture, comprises several hypotrochoids turning around different axes. The bottom-left work is an animation showing the process of a Shogi game. The

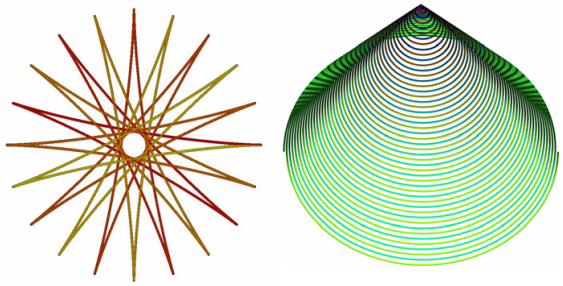

Figure 1. Example figures of geometric art works subjects (See [Suz07])

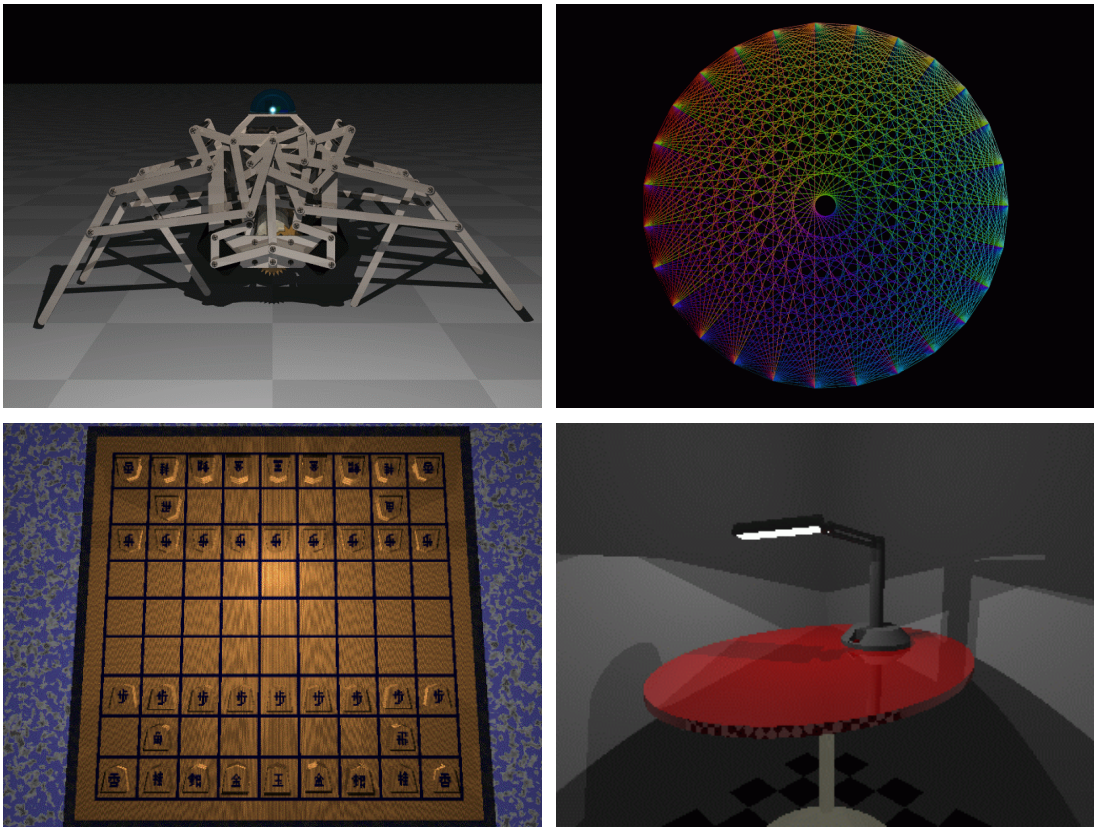

Figure 2. Examples of submitted works

Rotation		Movement		Generation and Deletion		Change of Property		Transfor -mation		Viewpoint Movement		Brightnes s Change		Change of Light Source		Rotation of Light Source	
S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C
67	37	20	19	1	12	7	4	2	5	1	2	16	1	2	1	3	1

- "S" means "simple" and "C" means "complicated".
- "Simple" animation works almost produced by single scene file combined with single clock parameter.

Table 2. Breakdown of submitted works

author of this work have prepared one scene file for each move, a production method different from other works using "clock". The bottom-right work realized complicated movement by using several scene files prepared by making different "clock" combinations and linking the last frame of one scene file with the first frame of following scene file. The work is simple but able to bring about a story-like impression.

Table 2 shows the breakdown of submitted animation works by content. In this table, an animation that falls into several different categories in terms of contents is counted as different works. That is why the total number of the works exceeds 151, the actual number of works submitted. Of the 151 submitted assignments, 31 works fell into more than 1 category and 9 works into more than 2 categories.

All submitted works are introduced in following web page as well.

http://graphics.arch.eng.osaka-cu.ac.jp/zukeikagaku/pov2006/animation/index.html

4. CLASS EVALUATION RESULTS

During the term-end exams, a class evaluation survey was conducted in which students are asked to answer such questions as "Was the class interesting?," "Was the class easy to understand?," "Was the class useful,?" "Was the class recommendable to other students?" Students were asked to answer each question in the scale of 5 from "Yes, very much" to "No, not at all."Fig. 3 contains the graph of the results of students' evaluation with respect to "Animation" which, from this academic year, requires students to submit assignments, and "Geometric Art," a newly introduced lecture, as well as "CSG," which has been taught before and beyond 2005 as the most essential contents of this class. Fig. 6 indicates the averages of the total scores determined on the basis of the class survey results (From "Yes, very much" = 5 points, to "No, not at all" = 1 point).

As the figure shows, many students feel that "Animation" is "interesting." As for other aspects, "Animation" earns about the same scores as "CSG." As for "Geometric Art," average scores are lower than the other contents of the class in all aspects but students' evaluation is particularly low with regards to the "easy to understand" aspect. Students in some

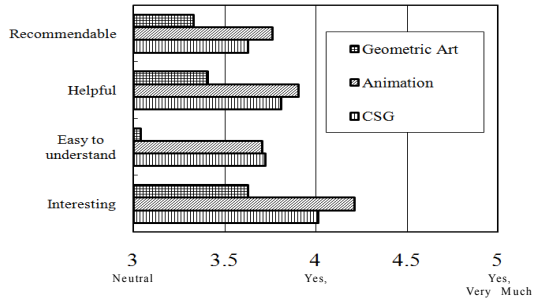

Figure 3. Class evaluation results

departments, however, give comments that they wish to hear more detailed explanation as to what Geometric Art is all about. The lack of thorough explanation, therefore, may be one of the reasons for the low evaluation of the Geometric Art session.

5. CONCLUSION

In this report, we have outlined the schedule, contents, submitted assignments, and class evaluation results with respect to an animation exercise incorporated into Graphic Science II, one of the basic subjects common to all departments of Osaka City University. Since we have not analyzed the results of the recent class survey by students' department, sex and the level of their submitted assignments, we should work out more accurate results by accumulating data based on various analyses and make use of such analysis results to improve the quality of our graphic science education in the years ahead.

6. REFERENCES

[Suz03]Hirotaka SUZUKI and Nobuhiro MIKI, A Graphic Science Education as a Training of Communication, Journal for Geometry and Graphics, Heldermann Verlag, Vol.7, No.2, pp.253-262, 2003.

[Suz06]Hirotaka SUZUKI, A Study on Impact of Introduction of Lighting Equipment Design Assignment into Graphic Science Education., Proc. of The 12th Intl. Conference on Geometry and Graphics, #E17, 2006.

[Suz07]Hirotaka SUZUKI, How to construct Geometric Art Works by CG (in Japanese), Distributed material in the lecture Graphic Science Education II, Osaka City Univ., 2007.