Social Creativity Supported by Sensing of Re-Creation Processes

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Abstract. We analyzed the user behavior of *Modulobe*, a creation and sharing platform for articulated 3D models with complex motion for supporting social creativity. Modulobe has two components: a 3D modeling application and a model sharing web site. The former is intended to achieve complex motion simulation of a 3D model and provide a user-friendly interface. The latter has a feature to show relationships between re-used models by embedding a global model-ID to all modules of a model. By analyzing the model sharing web site, we found some social creative activities: (1) Some models were found to be handled as one componets; (2) some competitive and collaborative creations were observed; (3) communities of different characteristics have formed in a workshop. A few heavy users in such communities collaborate with users in other communities.

1 Introduction

Humans have been doing creative activities for eons: drawing pictures on walls in caves and creating pots displaying various patterns. Various tools for creation have been developed: paintbrushs, chisels, canvas, and so on. These creations have been distributed worldwide and techniques of creation and tools for creation have evolved. Various new creations have arisen from such interaction worldwide. Recently, digital creation tools or creations supported by computers and the internet are spreading. Not only the possibilities of creation tools but also the speed and scope of distribution of their creations have become extremely high.

With such evolution of technologies, *User Generated Contents (UGCs)* have received worldwide attention. Simply, UGC denotes those contents which are created by ordinary people, not by professional artists and journalists. At *Wikipedia*, QA sites, and Social Bookmarking sites, huge and useful contents are created collectively by many people. Such a process is often called *collective intelligence* or the *Wisdom of a Crowd*. Numerous creations have been uploaded to *YouTube* or *Flickr*; new creations have been stimulated by other creations. Fischer has designated such creativity as caused by interactions among many people [3].

Modulobe [3] is one of interesting creation and sharing platform. The system

[3] http://modulobe.com

supports articulated 3D models with complex motion. Modulobe has two components: a 3D modeling application and a model sharing web site. The former is intended to achieve complex motion simulation of a 3D model and provide a user-friendly interface. The latter has a feature to show relationships between re-used models by embedding a global model-ID to all modules of a model.

We exhibited Modulobe at *ICC* [4] from 2005 and held workshops related to Modulobe in museums and schools since 2006. We also developed a model sharing web site and analyzed the user behavior. By analyzing the model sharing web site, some models were found to be handled as one components. That phenomenon resembles that of *emergence semantics* of social bookmarking [2]. Furthermore, some competitive and collaborative creations were observed. For example, some users mutually compete to create the fastest model; other users modified one another's incomplete bicycle models so that they eventually run stably. Additionally, we found that communities of different characteristics have formed in a workshop. A few heavy users in such communities collaborate with users in other communities.

So far, many researchers analyze and develop online community. They discuss that what we behave in an artificial social environment and how we should design such an environment. Nonnecke explain the importance of Luker [8], Millen investigate the drivers of social engagement [6]. These analyses get through how to sustain collaborative relationship, which is the basic problem of CSCW [4]. They analyze mainly access logs and messages on community systems. On the other hand, recently new types of services spread: social networking services; social bookmarking services; and online games. Consequently, we can obtain a new type of data from such services and it stimulates this research area. To investigate the design of personal profile on the system, Lampe analyze *facebook* [5] and Riegelsberger analyze online game [9]. Ames analyzes tags of Flickr to investigate motivation of tagging [7] and Sen experiments on social tagging and proposes a model of vocabulary evolution [10].

We developed a new environment to create and share 3D models and analyze it. Users communicate and collaborate through creative works. Many researchers analyze metadata such as tags and comments of creative works. In this paper, we set the target of analysis on creative works.

The next section explains the Modulobe design. Section 3 shows our implementation of the modeling application, Section 4 shows the model sharing Modulobe web site. We present and discuss experimental results of a test installation in section 5, and conclude this paper in Section 6.

2 Usage Analysis of the System

In this section, we report use of Modulobe and the model sharing site. We opened a homepage for users to download the modeling application and a sharing web site from March 29, 2006 to the present day. To March 15, 2008, the modeling

[4] http://www.ntticc.or.jp

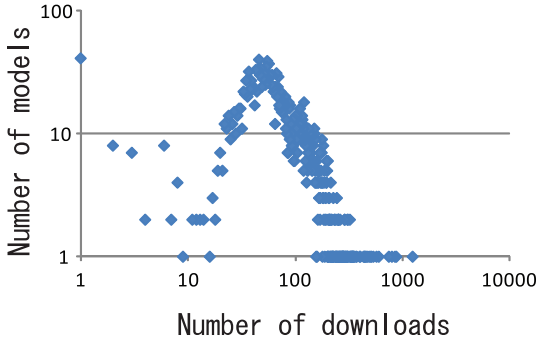

Fig. 1. Number of model downloads

Table 1. Popular tags except for a user's affiliation.

Tag	Models
RealModel	70
Creature	67
Car	65
human	64
Insect	42
MultiLegged	38
geometry	38
Interesting	35
gym	29
jump	27

application had 171,267 downloads and the web site had 686 million hits. In all, 3,356 models have been uploaded to the site; they have been downloaded 460,000 times. The number of unique users who create a model of Modulobe is 1103.

In fact, 2,467 models (73.5%) have been downloaded at least once. Figure 11 shows the distribution of the number of downloads. Using such data, the reported tendencies indicate that the number of downloads of almost all models is very low and few models have a huge number of downloads [1]. The tendency is almost the same as that shown in Fig. 1 too. However, the first peak of the number of downloads appears at download number one. The second peak is on about 50 and decreases exponentially.

Table 1 presents a list of the top 10 tags which are tagged to many models. The number of unique tags on the site is around 400.

Here, tags added to models are classified into five categories. Table 2 is a list of the top 100 popular tags. The 'author' tags denote author information or kinds of models. The 'character' tags present functions and forms of models, e.g. "jump",

Table 2. Type of tags in Modulobe.

Type	Tags	Examples
Author	33	Yoshiki Elementary School, tanimoto, etc.
Category	36	Car, vehicle, creature, bird, etc.
Quality and Character	27	Great, simple, Interesting, jump, MultiLegged, spin, etc.
For the system	5	notags, uploadtest, etc.

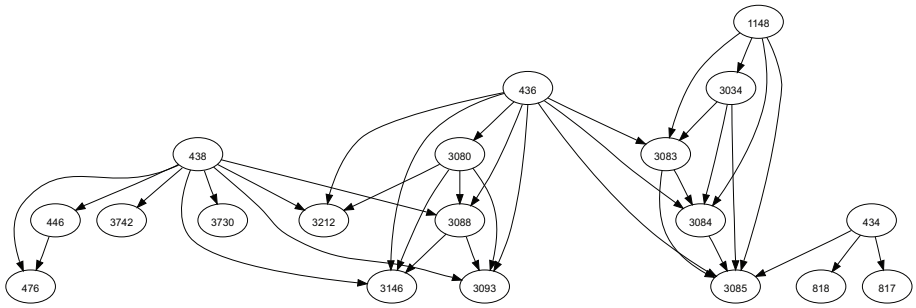

Fig. 2. A part of parent-child network.

"spin", "MultiLegged". These tags are useful for seeking reference models when a user creates a new model. It is difficult to add such tags automatically because the system must analyze the structure and motion of models.

3 Social Creativity on the Web Site

3.1 Reuse of Models

A parent-child relation is detected between when a user reuses a model to create a new model. There are 531 relations detected on the sharing web site. Of them, 349 models (10.4%) are parent models and 449 models (13.4%) are child models. The parent-child relation can be several generations, but almost all relations are two generations; the maximum is four generations. Figure 2 shows the largest parent-child network. A node implies a model and an edge shows a parent-child relation.

In Fig. 2, four models are shown (model number is 434, 436, 438, and 1148) that have no parent model. Model #436 "Changing Circle" and #1148 "Eight Changes" are simple models, which consist of around 10 modules. Most models that reused these models reused other models together, meaning that users use

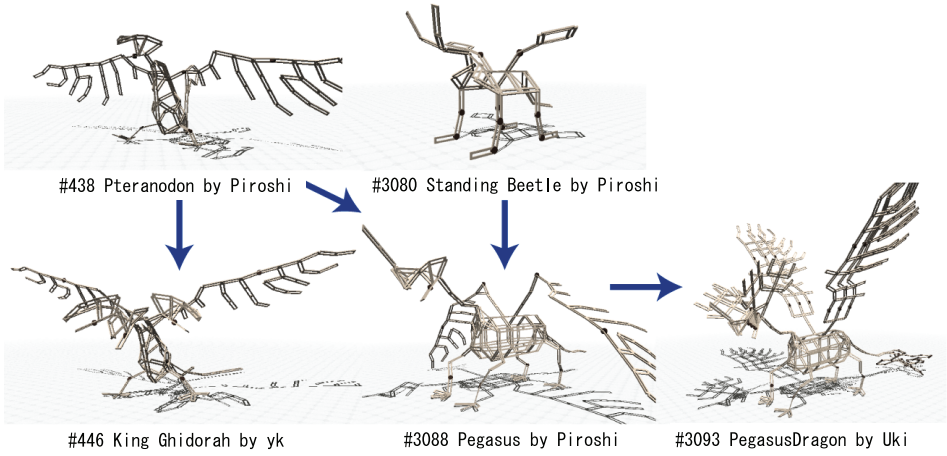

Fig. 3. Examples of models which have parents and children.

these models as components for their own creations: as useful sets of modules. On the other hand, #434 "Super Merry-Go-Round" and #438 "Pteranodon" are complex models, perhaps with more than 100 modules. Many models reused these models, but most have only one parent, meaning that they use #434 or #438 as a base of a new model. A user who is one of heavy users become to create models as componets like wheel, human body, and humanoid.

Figure 3 shows models in the network of Fig. 2. We can discover the re-creation of complex models by three creators. However, such detected parent-child relationships must be only part of the various types of re-creation processes. Users can imitate structure and the motion without copying the original model. In the future, we can address the possibility of estimating the parent-child relation by analyzing the comments.

3.2 Various Presentations and Interactions

One kind of popular model is a model that moves horizontally. However, we examined user activities in some workshops and found that users tend to produce a model which moves up and down irregularly at the first stage. Then they gradually learn to develop a model which moves smoothly horizontally by controlling the motion of links or structure. Some users held a competition for the speed to move horizontally and they created the fastest model on the site.

Various patterns to realize horizontal motion have appeared. Some typical models are shown as follows.

In the model of Fig. 4, a right front leg is connected with a left hind leg and a left front leg is connected with a right hind leg. This model brings up its own

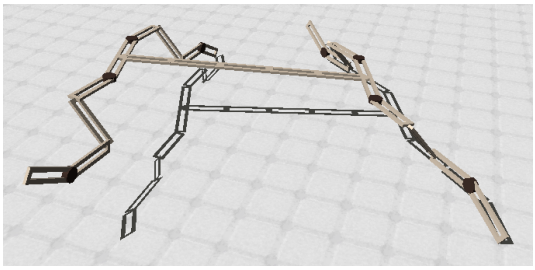

Fig. 4. A model which walks on its feet.

legs to the front and bears down its own legs to the back. This model walks by repeating this motion. In addition, a model was found whose framework closely resembles this model but for which the motion is entirely different. The model moves right and left legs concurrently and front and hind legs separately. The model jumps by repeating this motion.

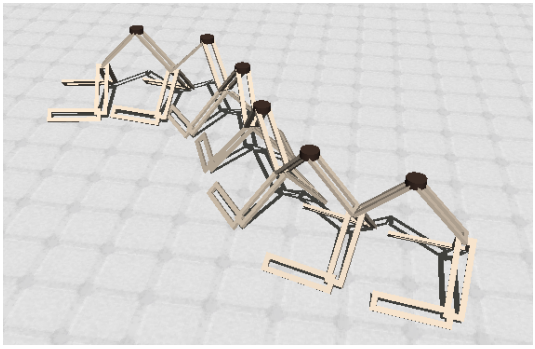

Fig. 5. A model which crawls on the ground.

Figure 5 is a model which moves forward by crawling like a snake. On the system, the direction of a frictional force between the model and ground depends on the angle between the model and the ground. Therefore, the model can move merely by changing the angle of grounding.

Figure 6 shows a model which moves by rolling a wheel. This model can not move stably while retaining its own balance. However, other creators modified this model and uploaded new models which can move stably using three wheels.

As described above, various modes for horizontal motion of a model can be conceived. They are realized using simple architecture; creators can use only

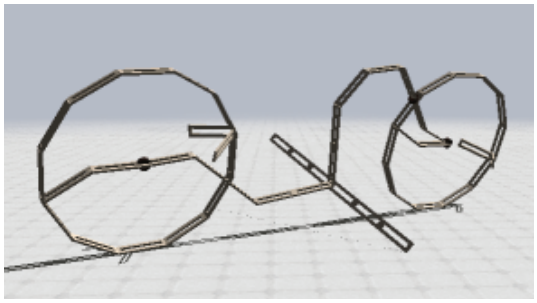

Fig. 6. A model which has wheels.

Table 3. Popular models' tags (top 3) in the community: 'EL' means elementary school; 'JHI' means junior high school; 'nit' is a name of a university.

Community	# of models	Popular models' tags (top 3)
modulobe WS	272	Insect, RealModel, cute
ICC	172	interesting
nit	127	dance, interesting, jumper
Toda East EL	108	animal, spring, gym
Toyoda West JHI	82	cool, Car, creature
Yoshiki EL	74	great, RealModel, cool
Ouchi South EL	74	geometry, interesting
Kawashita JHI	68	animal, string, text
Kagawa EL	59	creature, cute, MultiLegged
Hirakawa JHI	49	Car, creature, bird

modules of two types. This architecture encourages creators to create a variety of ways to move horizontally. Some collaborative or competitive creations also encourage to improvement of those technique to create a model.

3.3 Effect of Community

We held Modulobe workshops with some organizations and events at junior high schools, and elementary schools. Each workshop was attended by dozens of participants. In the workshops, facilitators teach participants how to use Modulobe. They learn how to create models not only through instruction from a facilitator but also through discussion with others. Thereby, a creative community is formed at the workshop. Table 3 shows tags of popular models of each community. It shows that each community has a different tendency.

Most community have a few heavy users. They account for several dozens of percentage of created models and downloads of community. They transcend

the boundary of communities and collaborate with others. Each creator of Fig. 3 belongs to difference community.

4 Conclusion

We analyzed Modulobe, which is a creation and sharing platform for articulated models with complex motion. Modulobe user can create a body structure by connecting modules of two types: shafts and links. Furthermore, the user can upload created models to the sharing web site.

The modeling application had 171,267 downloads and the web site had 686 million hits. In all, 3,356 models have been uploaded to the site; they have been downloaded 460,000 times. Results showed that users create various models in spite of that fact that they can use modules of only two types. By analyzing th model sharing site, some models were found to be handled as one components. Furthermore, users create various models and some collaborative creations occur. Some users compete mutually to create the fastest model. Some other users modified other users' incomplete bicycle model to run stably. Additionally, we found that new communities which have difference characteristics are formed at each workshop and a few heavy users in such communities and collaborate with other users.

In future studies, we would like to solve the mistakes in tracking of re-creation processes so that a user can emulate other' model without copying and pasting. Additionally, we want to tackle exploration of the re-creation process not only at the level of parts but also at the level of techniques and ideas.

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