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Medallion: 3D-printed Wall Plaques based on Procedural Modeling

Abstract

“Medallion” is a series of 3D-printed wall plaques featuring ornate shapes generated procedurally. The main purpose of this project is to sublimate a traditional beauty found in decorative ornaments into a modern algorithmic art by using a combination of procedural approach in Computer Generated Imagery (CGI) and 3D-printing technology which has been growing rapidly. Each medallion was generated by using metaballs which are a kind of modeling method in CGI. A drawing algorithm for metaballs was modified and optimized for generating ornate relief-like objects in this project. Also, regular-polygonal shapes were used for the process of density calculation in drawing metaballs. Generated patterns were converted into 3D models, and the models were 3D-printed finally. The resultant artworks have been displayed at several art exhibitions; some of them was intended to display traditional art forms such as paintings and sculptures.

Keywords: 3D Printer, Metaball, Ornament

1. Artist Statement

Producing decorative ornaments is time- and energy-intensive because it usually involves complicated motifs. Therefore, ornaments have tended to be removed from contemporary designs along with the modernization of manufacturing after the industrial revolution[1]. However, it is pointed out that the world of traditional manufacturing may change drastically because 3D-printing technology has been growing rapidly in the past several years[2]. By using the technology, it makes possible exquisite designs which have been difficult and costly in traditional manufacturing. This characteristic seems also beneficial in the field of formative arts, especially decorative ornaments.

Also, a procedural approach, which is a technique to represent CGI based on algorithm, may be useful for generating ornate shapes efficiently. Procedural techniques have been used mainly to represent natural objects and natural phenomena that are too complicated to be drawn or animated by artists. However, applications of the approach to artificial entities including decorative ornaments increased gradually in recent years[3,4,5]. Consequently, an algorithmic approach for generating complicated ornaments has been attempted in this project.

Based on these viewpoints, a combination of 3D-printing and procedural approach was attempted in this work. This project does not intend to generate an existing style of ornaments, but attempts to generate “ornament-like” shapes efficiently.
2. Algorithm
In this project, metaballs were used as elements of the medallions. Metaballs, also known as blobs, are used as a modeling method for smooth-curved organic shapes by calculating an iso-surface of density distributions defined in a space. Although metaballs have been mainly used in 3D space, the same method can also be used in 2D space. As an artist, the author has produced some procedural computer animations using 2D metaballs. Specifically, a modified algorithm, which can generate complicated and unexpected forms in which the curves of each metaball emerge partially, has been used (Fig. 1).

Incidentally, conventional metaballs are usually spherical or circular shapes. However, this project used metaballs with a regular polygonal density distribution as elements of a medallion. Then, by arranging metaballs symmetrically, medallion-like objects were generated. Figure 2 shows automatically generated patterns by using the techniques.

3. Fabrication
The generated 2D patterns described above were converted into 3D models by using displacement mapping. Then, the models were printed out by using a 3D printer; Projet3500 by 3D Systems was used in this project. Since it was found out that casting and molding were difficult because the printed medallions were ultraprecise, printed objects were finished with lacquer directly. Finally, the finished medallions were mounted on the frame carefully. Figure 3 shows another artwork using the similar method.

4. Exhibitions
The finished artworks have been displayed at several art exhibitions this year. Among the exhibitions, some were focusing on not only digital arts, but also traditional art forms such as paintings and sculptures. Besides, all exhibitions were intended for a sales purpose of artworks. Although this work used 3D-“printing”, the edition, which is popular in printmaking, was not numbered in each piece. Namely, each piece in this series was produced as original; reproduction will never be printed.

5. Conclusion
In this project, it was attempted that a combination of procedural modeling and 3D-printing was used for representing decorative ornaments. Also, the resultant artworks were displayed at several art exhibitions which focus on traditional art forms. In conclusion, it was able to confirm that using a combination of 3D-printing and procedural modeling has a great potential in the field of decorative arts.

Acknowledgement
This work was supported by JSPS KAKENHI Grant Number 26350030.

References