Parametric Approaches to Innovative Jewelry Design


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Abstract: *This study aims to investigate the general usage of parametric modeling feature of computerized design which is used in innovative jewelry design, to examine the use of parametric design in the jewelry design field and to produce new ideas by comparative analysis.*

Keywords: *Design, jewelry design, 3D modelling, parametric design, parametric jewelry design*

Yenilikçi Takı Tasarımına Parametrik Yaklaşımlar

Öz: *Bu çalışma inovatif takı tasarımında son derece etkin bir biçimde kullanılan bilgisayarlı tasarımın parametrik modelleme özelliğinin genel kullanımını araştırmak, parametrik tasarımın takı tasarım alanında kullanımlarını incelemek ve karşılaştırmalı analizlerle yeni fikirler üretmeyi amaçlamaktadır.*

Anahtar kelimeler: *3 boyutlu modelleme, parametrik tasarım, takı tasarımı, parametrik takı tasarımı*

1. INTRODUCTION

The computerized design has started to be used in all the fields of design in today's world. Due to its ease of use and the reducing effect on the margin of error, it is preferred by many designers and has started to make its own promise in many areas of handmade design. For computerized design, it can be said that the old type handmade craft has turned into a new generation of crafts by adapting to the conditions. Tools such as hammer, anvil, saw were replaced by mouse, keyboard, drawing tablets and computerized design programs. In addition to this, in modern design methods, parametric design started to have a special place in architecture and product design. With parametric modeling, it is very easy to make changes by controlling variables on the final product.

2. COMPUTER AIDED DESIGN

Computers have been in use for more than 40 years in architectural design. However, it has not been a long time since the development of the concept and creative design phases [1]. A wide variety of computer-aided design programs have currently been in use, and these programs differ in terms of both the interface and the followed process steps [2].

Computer-aided designs can be modeled with one of the three-dimensional design programs. Also, they can be scanned by three-dimensional models that are made with any kind of material [3].

Computer-aided design is the first step of copying and duplicating the product by using a computer. With the design that is made in the computer environment, the designer can prevent all the negativities which may occur in the physical environment, thus the designs are completed perfectly in the virtual environment prior to transferring the models to real materials [4].

2.1. History of Computer Aided Design

Until 25 years ago, almost all of the drawing operations were made on paper. Minor changes on the models were mean redrawing. Basically, it was necessary to make a design from scratch for the big changes. Computer-aided drawing tools have completely changed this tradition [5].

With computer-aided design, two-dimensional drawings, plans, sections and views, three-dimensional modeling and models, animations and photorealistic images have become easily prepared expression techniques. Computer-aided design has gone through a difficult process to reach the conditions it has today [6].

The history of computer-aided design is thought to have been based on Vannevar Bush's imagination of a device that can provide information to people in 1945. He named this device as Memex.

In 1956, after computers entered commercial life, Fortune magazine defined the machines which have graphical input and which can display three-dimensional objects with multiple window indicators as Computer Aided Design i.e. CAD. These machines are the basis of today's machinery [7].

2.2. Development of Computer Aided Design

Although CAD applications were described in the 1950s, interactive computer graphics were first discussed in 1963. This system has been called “The Sketchpad System” with illuminated pens that are developed to be used along with the system [8].

In the late 1960s, computers were begun to be used in architecture offices, however, the second generation CAD systems emerged in the 1970s. A graphical user interface was developed with a mouse and window system by Macintosh. In the 1980s, before AutoCAD’s release, applications such as VarseCAD and CADkey were used for meeting market requirements [9].

The impact of the fourth generation of computer-aided design software has been on personal computers. During this period, the computers were still very low-power and simple-equipped but providing a basis for the fifth generation of software. In 1990, the construction sector was hit by computer and electronic communications. Digital design information has started to be sent over the internet in this period.

2.3. Computer Aided Design at the Present Time

Nowadays, the software that is used in the design process varies according to preferences as well as project requirements. Different software can be used during the sketch and the presentation stages. Vector-based, object-based, NURBS (curvilinear forms) and three-dimensional solid modeling software are used during the sketch and presentation stages of the design process.

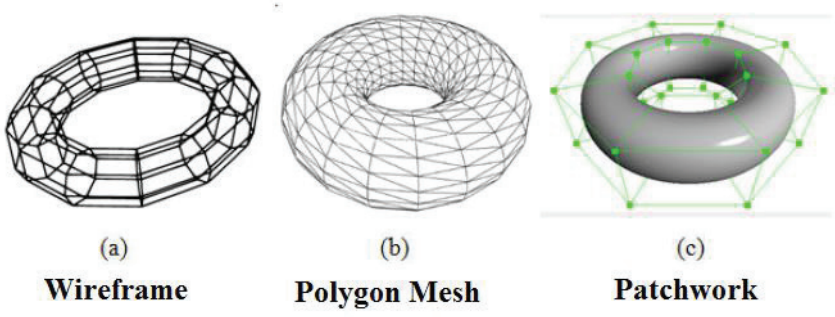

Figure 1. Three-dimensional design impressions

3. PARAMETRIC DESIGN

As a method, parametric design means a situation where the design process can be led depending on some variables. The desired product can be entered in the computer and the form is determined, then it is possible to make endless changes over the specified form. Thus, multiple variations can be produced from a single product.

3.1. History of Parametric Design

In 1978, Hillyard and Braid proposed a system where the geometric shapes between the coordinate components could provide a limited variation between certain tolerances. This proposal did not bring a major change to the current perspective. As Gossard Light refers to this situation as a basis of its own, it gives a reference to a more mature definition of parametric design.

In the late 1980s, there was a growing demand that geometric modeling, free-form surfaces, and solid modeling should be improved with respect to the ability of modeling techniques and the ability to change a model when the main techniques of solid modeling are assimilated.

In 1985, Professor Samuel Geisberg founded the Parametric Technology Foundation. In 1988, the development process of parametric design has been started with the development of the first commercially successful parametric design program Pro/ENGINEER.

3.2. Development of Parametric Design

In computer-aided design, the main problem is that some intuitive information about a machine can be interpreted and applied by the machine automatically [10]. This has created boundaries in parametric design. These limits began to emerge in 1963 in Sutherland's groundbreaking work. Many attempts were made to solve the problem of geometric limitation in an efficient and powerful way, but none have succeeded. Ge and colleagues (1999), Essert-Villard and colleagues (2000), Li and colleagues (2002), Aoudia and colleagues (2010) have tried different methods to improve this issue and tried to expand these limits [10].

During the development of parametric design, especially in the late 1980s, as geometric modeling, free-form surfaces and solid modeling techniques have become more common, it was thought that modeling techniques should be more interactive and changes should be made after a design.

Two topics have been drawn on this subject, one of these is increasingly less used and the other one draws the attention of the researchers. One of these is the programming of variables or the static generation of possible models, and the other is the systems that allow the change of size and constraints after the production of more complex models.

In the development of the parametric design process, new concepts were introduced, such as procedural modeling, history-based restriction modelers, variable geometry modelers, rule-based variable modelers and quality-based modeling, and parametric design continued to evolve [11].

4. APPLICATION AREAS OF PARAMETRIC DESIGN

Parametric design is applied in many areas in today's world. Especially, the use of parametric design in the architectural field is increasing. Apart from home decoration, furniture, accessories, jewelry, and clothing in many areas of the parametric design stand out.

4.1. Architecture

Although the idea of producing ideal cities with established principles and logical steps is based on the invention of the computer, their designs create networks between the sub-systems within the city and allow change. Parametric design techniques have also facilitated this approach [12].

The computerized modeling and design methods developed in the analysis of complex projects enable mathematical and parametric modeling. With the parametric models, the architecture allows architects to quickly and precisely change certain parameters instead of seeking alternative solutions for days.

For example, the correct form of the Swiss-Re building can be achieved in a scaled, complex and interrelated geometry in the context of regular restrictions.

Figure 2. Swiss-Re building

4.2. Urban Transformation

If we go through the Kartal-Pendik urban transformation project designed by Zaha Hadid Architects, it aims to reduce the burden of the old city by creating a city center in a 55-hectare area which is suitable for all kinds of buildings within the city. The importance of parametric design is very significant in the design of the texture and the design of the roads.

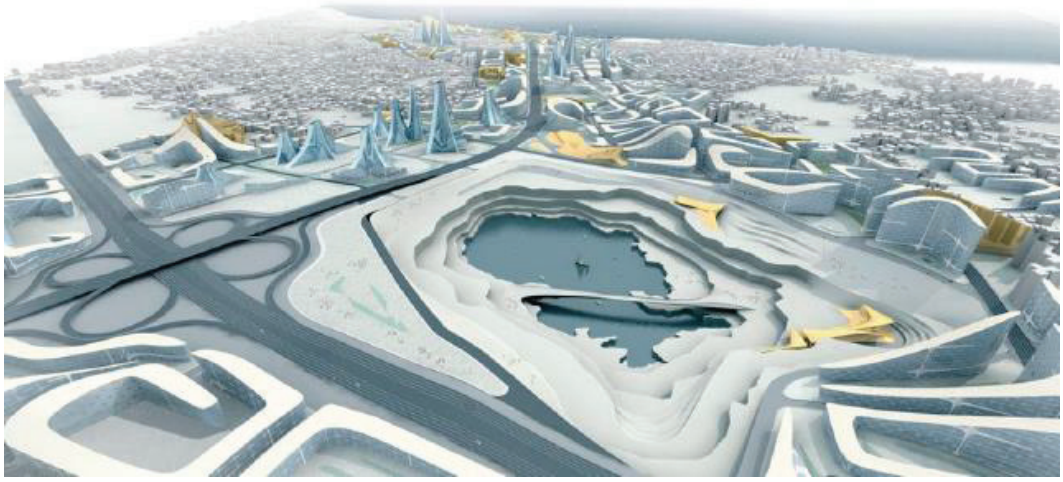

Figure 3. Kartal-Pendik Urban Transformation Project, Final Image, 2009

4.3. Home Decoration

In the home decoration industry, which goes to modernization in line with changing supply and demand, the place of parametric design continue to growing.

Figure 4. Parametric Seating Unit

Almost every part of the home decoration, especially the seating units, can be seen with the products prepared with parametric design. It is also possible that parametric design will be used more in the future with changing dynamics.

4.4. Accessories and Jewelry

With the increase in computer-aided design and developments in jewelry design and manufacturing sector, the use of parametric models and modeling is becoming increasingly widespread.

Designers can use new parametric design tools to achieve more modern and different looks, develop new ideas or bring new perspectives to traditional design ideas.

5. APPLICATION OF PARAMETRIC DESIGN IN JEWELRY DESIGN

Parametric design methods which have been used in many design applications can also be used effectively in jewelry design. This can be by introducing new design ideas or adapting existing designs into new and different designs by using parametric design tools.

5.1. Examples of Parametric Jewelry Design

The most used type of parametric design in jewelry is the texture studies in ring and necklace modeling.

Figure 5. Parametric design ring

By using parametric design, designers can prepare a specific model and then create changes and differences in parameters that can produce many different models effortlessly.

This also helps the designers to try all the new ideas in their mind and see them in the computer before they finish their model completely.

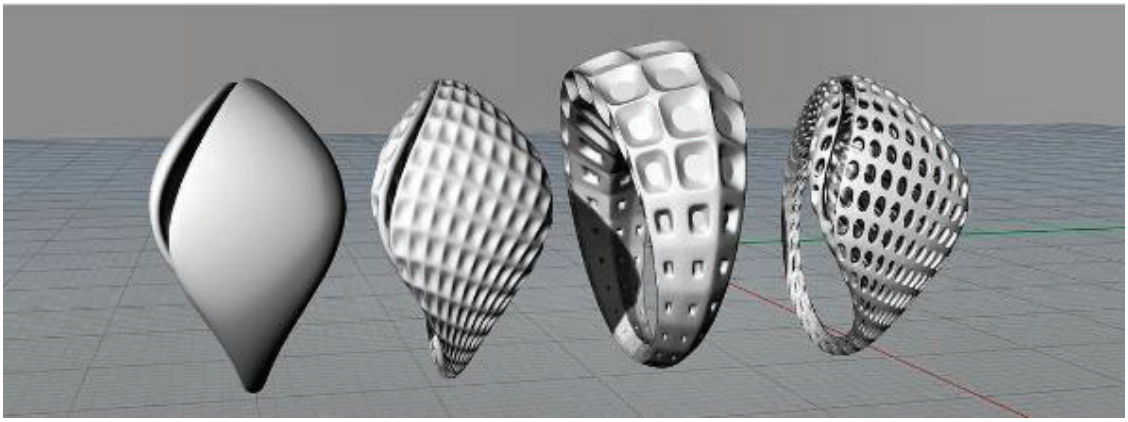

Figure 6. Differentiating the model by using different parameters

With parametric design methods, the designer can add different parameters while preparing a model. Then the designer can change the location and direction of these parameters and work on getting the desired result.

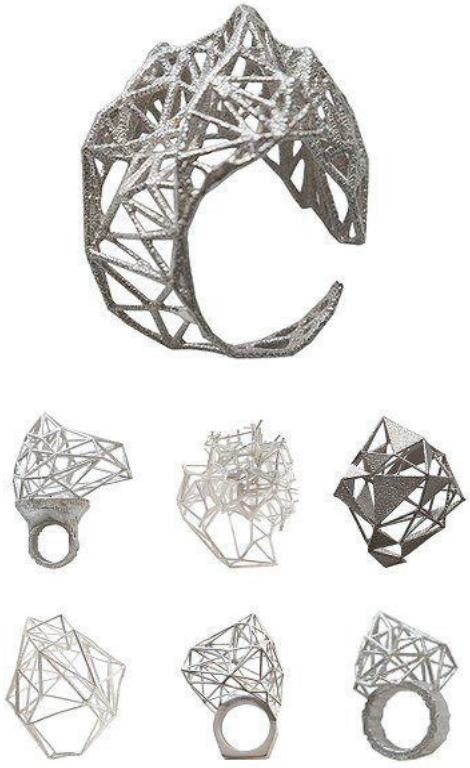

Figure 7. Types of parametric jewelry using different parameters

5.2. Parametric Jewelry Design Ideas for Future Application

It has not been ignored by many companies that the parametric design has become increasingly widespread and has a different impact on the jewelry sector with its modern appearance.

Many companies have been using the different variations of the old models from their catalog for the new season models and utilize different types of products that they sell.

With the parametric design, even the most sold and most popular classic models can be modified to be brand new. Even models such as Snowflake, Heart, Eternity, Angel Wings, Dragonfly can be reshaped with parametric design.

Figure 8. Best seller necklace models

Also, some companies use the hollow structure of the parametric design to produce larger parts and bigger products using less material. The most prominent example of this is the bracelets produced by Nusret Jewelry , which are specially preferred by Arabic countries.

Figure 9. Nusret Jewelry Fusion Bracelet

Other companies have also seen this change in the jewelry as well as jewelry sector, and they have begun evaluating the materials they have in order not to remain alien to their market and try not to fall behind these innovations by carrying out R&D studies.

6. CONCLUSION

After the development in the use of computerized design, the designers first started to move the models they designed in their heads to the computer environment. After that, they continued to develop themselves by using the variable parameters with the development of the parametric design concept.

Thanks to the parametric design, the changes that are made on a model enable different designs to be easily prepared by only entering the variables differently without the need to make the whole model from scratch. In this way, the amount of consumed time and energy is reduced whereas the productivity i.e. the number of products is increased.

The world of infinite possibilities and differences of parametric design can be the salvation of the jewelry and jewelry sector which happens to be in a difficult situation now. First of all, thanks to the parametric design, the designs using hollow structures provide less product weight and require less material, thus the designs can be sold at cheaper prices.

Another reason is that the products sold in the world of jewelry design are generally certain and people do not stop choosing these models. Using parametric design methods, it is possible to add another look to the products that sell well and always sell, such as the sign of infinity, angel wing, snowflake, four-leaf clover, dragonfly and heart. These products can be prepared with new textures that are prepared using parametric design and modeling. This can increase the chances of selling different and new forms of these models.

It can be predicted that the use of parametric design will increase in time in the jewelry design sector. One reason for this is the increasing modernization in jewelry design. Another reason is that people prefer personalized products. Personalized jewelry design with parametric jewelry design allows consumers to choose their own preferences.

In any case, it can be said that parametric jewelry design products will be seen more on shelves in the future and people will pay more attention to parametric design.

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