

# The influence of surface finishing methods on touch-sensitive reactions

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**Abstract.** This paper describes the modern technological development trends in jewelry design. In the jewelry industry, new trends, associated with the introduction of updated non-traditional materials and finishing techniques, are appearing. The existing information-oriented society enhances the visual aesthetics of new jewelry forms, decoration techniques (depth and surface), synthesis of different materials, which, all in all, reveal a bias towards positive effects of visual design. Today, the jewelry industry includes not only traditional techniques, but also such improved techniques as computer-assisted design, 3D-prototyping and other alternatives to produce an updated level of jewelry material processing. The authors present the specific features of ornamental pattern designing, decoration types (depth and surface) and comparative analysis of different approaches in surface finishing. Identifying the appearance or the effect of jewelry is based on proposed evaluation criteria, providing an advanced visual aesthetics basis is predicated on touch-sensitive responses.

## 1. Introduction

The relevancy of the paper is associated with the fact that the role of jewelry in our information-oriented society is changing from day to day. Possible updated surface finishing techniques and non-traditional materials determining the visual aesthetics of jewelry are considered. The characteristic aspects of jewelry forming in terms of new visual aesthetics requirements are being investigated. It is these aspects that do develop the information-oriented society itself, digital technology, Inter Web and the virtual content of a new culture.

Nowadays, the range of materials used in jewelry is expanding. The existing raw source is becoming a less important jewelry classification factor as newly-applicable materials can not be defined as 'precious' ones. Raw feature becomes less decisive in the classification of jewelry as already used materials and is far removed from the concept of 'precious' [1]. It is possible that in the near future, different ornaments and decorations would be considered as pieces of jewelry if they involved such jewelry work methods as engraving, filigree, artistic enameling.

## 2. Materials and methods

The research included engineering methods for handling processes of complex surface finishing via updated techniques, (computer configuration INTANT i7025, 3D printer WANHAO Duplicator 4, 3D printer Alaris 30 ), methods of analyzing perceptual quality (portable ECG, equipment for video shooting, SMI iView X HED — a device for video recording of eye movements in the infrared



radiation range, portable ECG) and comparative analysis methods to compare similar visual counterparts.

### **3. The influence of surface finishing techniques on forming processes**

Traditionally, the jewelry crafting technique was handmade. Nowadays, it is either mechanized or automated. One of the tasks of art-design is the distribution of unique items. This involves two widely-used processes involving robot-manipulators and 3D-printers. Due to the modern technology development level, many items that were only handmade 50 years ago can now be produced. In view of this fact, the jewelry life-cycle is focused more on the product design than on its own design. Consequently, the most relevant issue is to study all the factors influencing visual aesthetics of jewelry design. The main factor is the application of computer technology. [2, 3] In this case, as quickly as possible, it is necessary to build on the technological chain, which is close to computer-aided design and actual production levels. Improving the production process software is focused on creating decorative surfaces for jewelry.

Considering the fact that modern techniques have increased freedom for a designer in forming highly-aesthetic jewelry, the jewelers are paying more and more attention to the decoration itself. To define the above-mentioned tendencies, the concept “decoration” should be classified into 2 types: depth decoration and surface decoration. Depth decoration is achieved by changing the material structure. This typically embraces traditional techniques, involving the development of 3D-printing. Surface decoration is ornamenting the surface of jewelry items. This tendency is rapidly developing, as well as the so-called “plating techniques”, i.e. the finishing technique, the form of which is similar to thin sheets. Samples for surface decoration are extremely wide-ranging: from macro to micro-world forms. There is an atlas of decoration samples — illustrated photos of iron-carbon alloy structures. Designing the decorative pattern involves the selection of a corresponding sample from the atlas. This matching is so exact that it is possible to design such an item embracing this or that appreciable mood. For example, a rounded-shape sample creates a sense of peace. If a designer wants to create a sense of dynamics or expressiveness, then, in this case, the most suitable samples would be those generated by relevant material finishing techniques. In this case, one could use enlarged images of micro-splinters and micro-cracks on the surface of ceramics. Today, the range of decoration means is replenished by updated techniques which either reduplicate natural forms or imitate natural forming processes [4,5,6].

Modern information culture forwards new requirements applicable to the designing of jewelry forms. Intensive integration of computer technology and the Internet transformed the design activities in general. We can observe morphologically advanced processes which emerge at the interface between reality and virtuality and is connected with new techniques and updated materials. This made it possible to automatize the processes in producing complex forms, which previously could be only handmade. However, automated designing of complex-formed items requires sophisticated software. The technology based on 3D-printers excludes the application of sophisticated software. On the other hand, a limited range of applied materials restricts the application of these techniques.

Consequently, the development of new techniques and materials furthers the jewelry development trends, which, in its turn, expands the possibilities of fine surface finishing and involves the design of new forms.

Developing modern jewelry techniques embrace not only the production of new alloys, but also the implementation of sophisticated technological processes, including an alternative IT environment. Different software tools are used in designing and modeling jewelry form variations.

### **4. The effect of forms and surface characteristics on the quality of visual aesthetics**

Alternatives of sophisticated technology in material surface finishing determined the specific features of the culturally industrial jewelry design. The era of computerization resulted in the substitution of the perceptual jewelry concept as a jewelry masterpiece, traditionally being a cultural indicator of wealth and the holder's status and often empowering some magical power, but now, in present-day world, only serving some functions. The first and foremost function is its unique jewelry design

concept. If previously, the creation of new jewelry forms originated in a designer's workshop, now, in the information culture, this process is accomplished by continuous production variations [7–9]. The innovative methods in developing forms and surface characteristics via sophisticated techniques of jewelry surface finishing introduced a new concept of status based on the combination of design, material and techniques. The array of modern jewelry materials also include non-traditional materials—valuable wood and different plastic materials. We can consider a similar example—application of ebony wood in jewelry design, having density of  $1300\text{kg/m}^3$  at 15% humidity. Ebony exhibits the following properties: it does not float on water; requires specific drying conditions (its volume decreases after drying); it contains a significant amount of ether oil being resistant to the environmental effect and temperature and a humidity drop; it does not rot and is resistant to insect damage. Due to the ebony fibre structure and its hardness, a jeweler should be experienced in processing this wood. Another important factor is that ebony rapidly and easily blunts any wood-carving tools, so it is necessary to have special-purpose wear resistant tools. The cost of ebony is comparable to that of commonly used jewelry metals which are truly undergoing revolutionary changes. Being applied in jewelry design, fragrant and fibrous ebony is often encased with gems. A wide range of techniques in material surface finishing is applied in modern jewelry design [5, 6, 10]. The reticulated sample of 800 silver is illustrated in Figure 1. Many jewelers apply such technique as ruffles or ripples on metal plates as it exhibits an aesthetic effect.



**Figure 1.** The reticulated sample of 800 silver.

The wide selection of materials and techniques provides an opportunity to create a variety of jewelry forms which would satisfy even the most refined taste. The jewelry-ware of Christine Skobina (Irkutsk) was selected to study the perception effect on different materials. These included ammonites and rock crystal encased with silver (Figure 2).



**Figure 2.** Design of the rings: left – the ring encased with ammonites; right – the ring encased with rock crystal. Designer: C. Skobina (Irkutsk).

Perception of objects is quite different and governed by human mental state laws responding in a different way to materials of varied surface characteristics, forms and colors. The described analysis is based on the authors' proposed method which measures attention delay time, reveals specific perception effect on different natural materials (ammonites, rock crystal). This analysis proved the fact that jewelry-ware, matching unfinished natural materials with jewelry-forming finished metal or alloys, is in great demand. Abandoning the traditional jewelry forms furthered the possibility of focusing more attention on the techniques and materials, i.e. in the sense of 'feeling' (tactile/touch sensing level), the quality of such things as conchite or stones. Out-of-style-related, each jewelry transmits this or that visual legend and transforms into a source of new senses unique in itself involving a touch-sensitive contact for the holder (Table 1).

**Table 1.** Perception of jewelry designed from different materials

<b>Specific perception features</b>	<b>Jewelry from ammonites</b>	<b>Jewelry from rock crystal</b>
<b>Tactile (touch) sense of material surface</b>	smooth, warm surface	cold, intricate structure surface
<b>Visual perception of material surface</b>	non-transparent, matte surface, natural form harmony, distinct perfection	intricate transparent contour, surface with "traces of time"
<b>Perception of jewelry form</b>	simplicity, laconism, geometrical purity (spirals, circles of natural ammonite shells and rhythmic repeat of mounted silver)	jewelry form resembles archaeological artifacts, creating visual legends; jewelry attains the status of historical rarity
<b>Tactile sense</b>	wave fragrance	practically no
<b>Usability</b>	high level	low level

Ammonites and rock crystal are practically not exposed to finishing, and their natural forms are preserved in their primeval features by the designer, which makes it possible to feel the vigorous bond with the Earth energy. Touch, visual, tactile perception of ring forms transmits the richest pallet of senses which was confirmed by the results of the finished material tested on the quality of touch-sensitive responses and presented in Table 1.

## 5. Conclusion

Jewelry design in our modern society is connected with the search for new forms which are determined by emerging visual aesthetics based on existing alternatives of the information culture. This, in its turn, enables the human to penetrate beyond the boundaries of the visible world, to intrude into the microstructure, to observe the images created by Nature and to re-create them in ornamental patterns on the jewelry surface.

A wide spectrum of proposed techniques for surface finishing of jewelry is connected with two basic trends: introducing non-traditional materials in jewelry and finding new finishing techniques.

The priority trend is the combination of finished and natural materials. The designer selects the material finishing technique which determines the jewelry form. The diversity of proposed techniques is governed by the demand in creating different touch-sensitive responses, which would provide a varied level of emotional feelings.

Computer technology automatizes not only the process of producing visually defined jewelry forms, but also quality engineering of touch-sensitive responses.

## Acknowledgments

This work is done under the financial support of the Ministry of Education and Science of the Russian Federation by contract No 02.G25.31.0190

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