# Research on the Application of Computer Modelling Technology in Product Design Taking Intelligent Thermal Box Modelling Design as an Example

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**Abstract**—The rapid development of the smart era has made the future of the smart product industry extremely promising; the development trend of smart products is steadily improving. This paper takes the modelling design of the intelligent thermal box as an example, Sharp3D computer modelling technology is gradually maturing, the application field is wide, using Sharp3D efficient and convenient modelling technology advantages to model the intelligent thermal box to achieve, explain in its design process design points and computer modelling on the intelligent thermal box design parameters and modelling influence. It is concluded that the application of computer modelling technology can significantly improve the efficiency of product modelling.

**Keywords-** computer; modelling; intelligent products; design

## 1 INTRODUCTION

The rapid development of computer technology has made household electrical products intelligent. The intelligent insulated box is connected between the Internet and the computer phase, and the temperature inside the intelligent insulated box can be controlled remotely through APP commands, reducing the user's personal control of the intelligent insulated box and making it more convenient for the user to use. Depending on the settings, the products placed in the incubator can be kept at a constant temperature, refrigerated and heated. The intelligent safety lock device on the smart incubator can alert the user under different circumstances, for example, if the incubator is not closed properly or if the incubator is faulty, the intelligent safety lock will send an alarm command to the user's APP to alert the user. Different from the traditional thermal insulation box, intelligent thermal insulation box on the use of new materials, product structure improvements and production processes have been enhanced, which also improves the product's technological content. The development of the digital era of products so that product form and product function has changed a lot, product form focus on technology, the future, product function is more emphasis on humanistic care, humane development. With the rapid development of China's scientific and technological undertakings, material innovation, process innovation and technology level innovation makes intelligent insulation box in the iteration of the update has a greater improvement. In today's significant liberation of social productivity, people have solved most of the product batch production needs, and consumers have formed a multi-level, diversified and personalized product demand characteristics[1] . The development of productivity so that the end of the

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development trend of intelligent insulation box become diversified, the user in the focus on functional diversification at the same time is also concerned about the capacity of the product, the shape and the sustainability of the product. The appearance of the product is a very important part of the design of the intelligent insulated box. The current popular style on the market is modern minimalist, for example the Xiaomi brand of home appliances is the main focus of this style. At the same time, the sustainability of the product is an important goal for the future development of all intelligent products, and is also an inevitable trend in the development of intelligent insulation boxes .

# 2 TYPE STYLE AND FONTS

## 2.1 State of the Industry for Smart Products

Intelligent products are designed to bring in advanced computer technology and automation technology while retaining the traditional functions of the original product. Through the integrated management of technology, various application systems are organically combined to enhance the comfort, safety and efficiency of the product, bringing a more humane living space to the user. As a new product technology, intelligent products change the traditional way of life, transforming the original static product equipment into intelligent product equipment, helping users to maintain a smooth exchange of information with the product, optimising the user's lifestyle while being able to arrange time more rationally for the user, creating a convenient, energy-saving and comfortable living environment for the user. Smart products are specialised products of hybrid products with product categories and physical realisations of digital product descriptions. The area covered by smart products is very broad and the vision of smart products raises questions relevant to various fields of study, including marketing, product engineering, computer science, artificial intelligence, economics, communication science, media economics, cognitive science, consumer psychology, innovation management and many more. There is a huge potential for the development of smart products, and people's interpretation of smart products has changed from high-end products to everyday use. In recent years, as the technology of smart products has been constantly updated and improved, the market has been strengthening the promotion of smart products to make the public more aware of the advantages of smart products and to stimulate consumer desire. At present, China is vigorously promoting various competitions and projects that can actively promote the promotion of smart products, encourage more innovative and practical smart product development, and further promote the development of the smart product industry. The smart product industry is an extremely important industry in the development of the economy, and its industry-driven role cannot be underestimated.In the path of intelligent development, the industry continues to develop a variety of products to create a society and lifestyle that saves time and effort[2].

## 2.2 State of the Industry for Smart Products

The concept and scope of smart products are constantly evolving, covering a wide range of product forms such as software, hardware and cloud services enabled by artificial intelligence[3] . From another perspective, smart products have an inseparable relationship with AI. China's artificial intelligence industry started relatively late, and is currently in the stage of transition from the developing starting period to the mature period. Under the trend of the

general social environment and the strong support of national policies, the development speed of China's artificial intelligence industry has surged, with a growth rate of 38.94% in 2020, and the amount growing from 108.86 billion in 2019 to 151.25 billion yuan .In 2021, the development scale of China's artificial intelligence industry will grow by 28.35%, and the amount will increase from 151.25 billion in 2020 to 194.14 billion yuan. In 2022, China's artificial intelligence industry development scale growth rate of 22.34%, the amount increased from 194.14 billion in 2021 to 237.53 billion yuan(Chart 1). Driven by the artificial intelligence industry, the scale of related industries also showed a rapid growth trend. 2019 China's artificial intelligence driven industry scale is 385.25 billion yuan, 572.57 billion yuan in 2020, a year-on-year growth of up to 49.83%.In 2021, it was 770.54 billion yuan, year on year growth of up to 34.5% .In 2022, it was 965.51 billion yuan, year on year growth of up to 25.3%(Chart 2) .

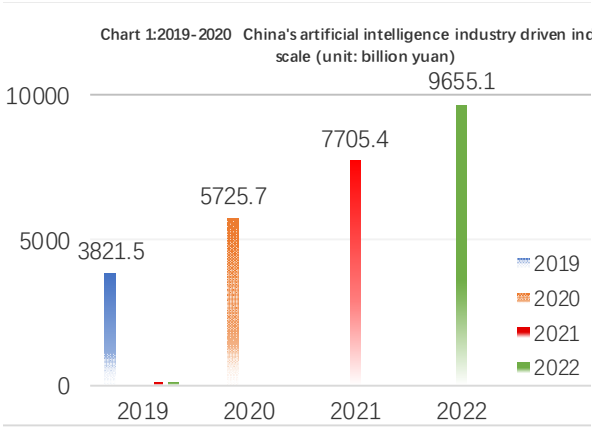


Chart 1:2019-2022 China's AI industry driven industry scale (unit: billion yuan)

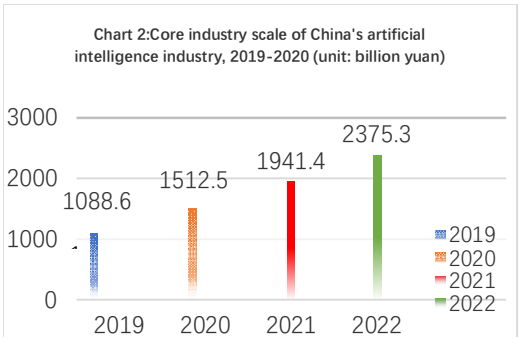


Chart 2:2019-2022 China's AI industry core industry scale (unit: billion yuan)

(Source: China Artificial Intelligence Market Status and Application Trends Analysis 2021[4] )

The above data clearly shows that the scale of the intelligence industry has been rising in the past two years, with considerable data and bright development prospects. 21st century, human beings are planning, science is researching, technology is cooperating, and with the development of Internet+, Internet of Things technology, cloud space and big data application, artificial intelligence will participate more and more widely in people's lives, changing or even subverting people's life and production methods[5].

# 3 CURRENT STATE OF APPLICATION OF SHARP3D MODELLING TECHNOLOGY

## 3.1 Sharp3D Technical fields of application

Shapr3D is an engineering drawing software developed by a team of three engineers, whose professionalism enables the developers to understand the needs of engineering users. [6]Shapr3D is a fast and accurate 3D model creation tool with a wide range of applications, initially mainly for engineering design, but gradually expanding in the direction of industrial design, product design and jewellery design in research and development. Shapr3D is currently favoured by product designers, architects and jewellery designers. Shapr3D The development of the software has a very important role to play in the industrial sector, and with the development of innovative and intelligent technology, the industry demand for 3D modelling will become stronger and stronger, which is proof that the era of 3D modelling and design has ushered in a new phase of development. With realistic visual effects and easy and convenient operation, 3D modelling technology has been widely used in various fields as soon as it was studied[7] . This means that Shapr3D will be transformed from a traditional 3D modelling software into a practical and comprehensive modelling software, which will attract more users to use the software by continuously improving its technical application areas, while at the same time providing feedback to users on its portability and efficiency.

## 3.2 Sharp3D modelling technology advantages

Sharp3D has certain functional features, Sharp3D is a professional 3D modelling app dedicated to IOS. the design interface is simple and easy to understand. Thanks to the introduction of the smart stylus IPAD Pencil, together with the use of fingers, it is possible to classify drawing and movement in the 3D modelling process, thus increasing efficiency[8] . For those with a basic knowledge of the software, Sharp3D takes around fifteen minutes to get started and create simple models. Shapr3D is highly compatible and is a cross-platform design application that is compatible with many major software such as Auto CAD, Fusion360, Rhino3D etc. Shapr3D has the ability to import projects directly into Sharp3D and export work to other rendering and drawing software (Figure 1) (Figure 2). Shapr3D is an industrial-grade CAD tool for Windows that can transform your 3D modelling workflow. Go from idea to 3D modelling design in minutes, create anywhere, and export a manufacturable model. Transform your workflow in the way that works best for you. Start designing on your tablet and import to PC for detailed adjustments.

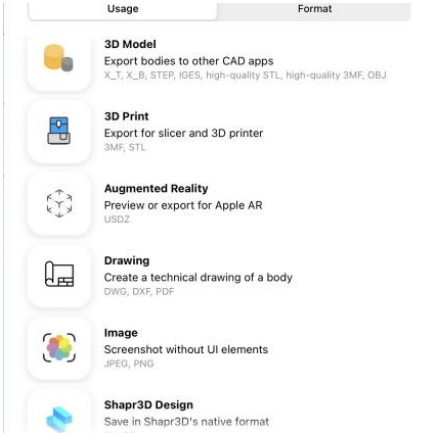


Figure 1. Exporting the scene map

Supported Formats

| Format | Import | Export |
|---|---|---|
| X_T (Parasolid) | ✓ | ✓ |
| STEP | ✓ | ✓ |
| IGES | ✓ | ✓ |
| SLDPRT | ✓ | ✗ |
| SLDASM | ✓ | ✗ |
| STL | ✓ Reference only | ✓ |
| 3MF | ✗ | ✓ |
| SHAPR | ✓ | ✓ |
| OBJ | ✗ | ✓ |
| DWG | ✓ | ✓ |
| DXF | ✓ | ✓ |
| SVG | ✗ | ✓ |
| PNG | ✓ | ✓ |
| JPG | ✓ | ✗ |
| PDF Single or 1st page only | ✓ | ✓ |
| TIFF | ✓ | ✗ |
| BMP | ✓ | ✗ |
| ICO | ✓ | ✗ |
| RAW | ✓ | ✗ |
| GIF Not animated | ✓ | ✗ |
| USDZ | ✗ | ✓ |

Figure 2. Supported formats

# 4 SMART INSULATED BOX MODELLING PRACTICE WITH SHARP3D MODELLING TECHNOLOGY

## 4.1 key point in the design of the intelligent holding tank shape

The use of computers has greatly improved the quality of products and accelerated their production. Computers are also using the two advantages of high intensity computing power and the ability to derive graphics to assist designers in product design, helping them to broaden their field of thinking and enrich their design concepts so that they can design products that are as individual and fashionable as possible[9].The design should take into account the place of use and environmental factors as well as emotional design, design products with safety, versatility and comfort, combine intelligent design, ergonomics and universal design theories in the Internet mode, use reasonable product dimensions, focus on the combination of practicality and aesthetics of product shape design, and integrate intelligence[10].Combine visible products with invisible services and networks, and connect a user-centered design approach[11].

### 4.2 smart holding tank modelling design parameters and modelling influences

When the overall chamfering parameter is 0mm, the product will look very sharp around the product, then the chamfering parameter should be adjusted appropriately, after adjusting the parameter the overall product becomes smooth, visually give users a soft, comfortable and safe feeling, in line with the modern product design trend. What can be learned through modelling experiments is that there is a certain link between the value of the chamfer and the inner wall of the product, when the larger the chamfer the thinner the inner wall size, the insulation box conventional inner wall size of 34mm, the best insulation effect at this time. By adjusting the parameters of the chamfer around the product (Table 1), it is clear and intuitive that when R=10mm/30mm, the distance between the inner wall is 34mm, and the modelling diagram shows that the most comfortable state of product appearance is when R=30mm (Figure 3) (Figure 4) (Figure 5) (Figure 6).

**Tab. 1** Intrinsic link between chamfer values and the inner wall of the product

| Name | Symbols | Numerical values | Inner wall distance |
|---|---|---|---|
| All around corner | R | +10mm | =34mm |
| All around corner | R | +30mm | ≈34mm |
| All around corner | R | +50mm | ≈31mm |
| All around corner | R | +70mm | ≈24mm |

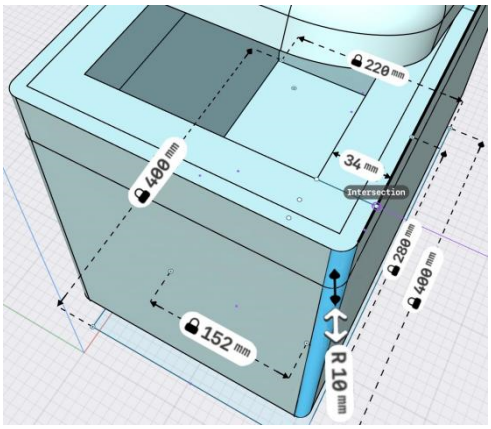


**Fig 3.** R=10mm

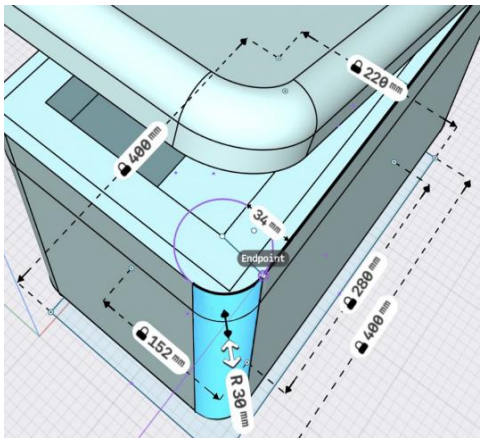


**Fig 4.** R=30mm

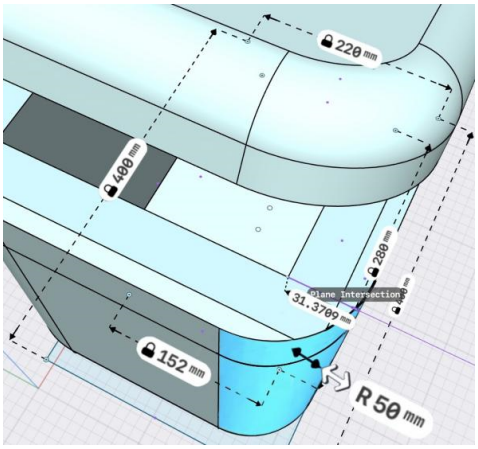


**Fig 5.** R=50mm

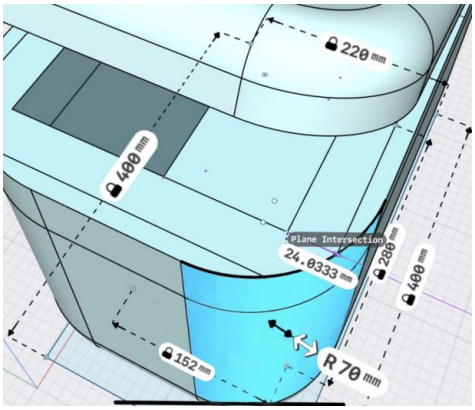


**Fig 6.** R=70mm

From the above table data and modelling data we can see the influence of the chamfer value on the shape of the smart box, the larger the chamfer value, the more rounded the product shape and vice versa the smaller the value the sharper the product shape.

## 5 CONCLUSION

This paper focuses on the application of computer modelling technology in the modelling design of intelligent thermal box products. Computer modelling technology can achieve the goals of shortening the development cycle, reducing the development cost and improving product quality,Computer graphic modeling has achieved 'visible and obtainable'[12] . Facing the problem of parametric modelling in modelling design, it points out the connection between modelling parameters and modelling forms in the modelling process, further describes the operation process of the parametric modelling system, focuses on the general method of parametric modelling, including determining the key steps of modelling extrapolation, parametric analysis, parametric modelling of modelling, etc. Finally, the modelling parameters of the smart insulated box are set as the research object, using the Sharp 3D modelling software visualisation advantages to design product modelling, according to the operation process detailed description of the relationship between the creation of parameter value changes and the model shape display effect, so as to arrive at the best operating parameters. The numerical results are satisfactory to both the designer and the user. Traditional design methods and the modification of 3D designs on demand are time consuming, the application of Sharp 3D modelling allows for shorter design times and more efficient designs, moving the overall design process forward more quickly.

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