

VISUAL FLEXIBILITY IN FUTURISTIC FURNITURE DESIGN

Gilar Sundara¹, Tian Arman Septian², Allegra Rizky Pratama³, Sandy Racmawan⁴

Program Studi Desain Furnitur, Politeknik Industri dan Pengolahan Kayu

Jalan Wanamarta Raya No. 20, Kawasan Industri Kendal, Kabupaten Kendal, Provinsi Jawa Tengah, 51372

gilar.sundara@polek-furnitur.ac.id

ABSTRACT

This research explores futuristic furniture design, focusing on a credenza named Ethereal. The primary objective is to demonstrate that the visual complexity of futuristic designs can be simplified while maintaining their distinctive aesthetic elements. Ethereal, serving as a case study, was developed in two versions: an intricate version incorporating modern forms and technology, and a simplified version retaining key aesthetic characteristics but utilizing more efficient materials and production processes. The study draws upon theories of futuristic furniture design, encompassing unusual geometric shapes, modern materials, and integrated technologies such as LED lighting and electronic features. The research methodology involves the creation and analysis of both design versions, aesthetic evaluation, and comparison between the intricate and simplified versions. Results indicate that the Ethereal product sample successfully demonstrates the visual flexibility of futuristic-themed products, implementing production efficiency while maintaining a utopian futuristic ambiance characterized by bright colors, clean materials, and technology integration.

Keywords: furniture, aesthetics, futuristic, credenza, visual flexibility

INTRODUCTION

Furniture is an essential facility in every room, serving to support users' activities, organize and store belongings, and create aesthetic value. As a form of applied art, furniture is designed as movable or permanent furnishings within residential interiors. Its functions include storage, working, dining, sitting, reclining, sleeping, and relaxation. Furniture may be used as a standalone piece or as part of a coordinated set. From a sustainability perspective, furniture needs to be considered throughout its entire life cycle, from material selection and production to use and end-of-life stages (Li, Xiong, & Qu, 2023).

A credenza is one type of furniture that traditionally takes the form of a low and elongated cabinet, originally used as a serving table in dining rooms. Today, the credenza has evolved into a versatile piece of furniture that can serve as storage, a display surface for decorative objects, or an additional table in various spaces, including living rooms, offices, and bedrooms.

Futuristic furniture is a design style inspired by visions of the future and technological advancement. This style is characterized by unusual geometric forms, the use of modern

materials such as metal and glass, and neutral color schemes often combined with bright or metallic accents. Futuristic furniture is not only visually appealing but also frequently integrates technological elements such as LED lighting and touch-sensitive features, creating an innovative and sophisticated atmosphere within an interior. This integration is consistent with the development of Internet of Things (IoT)-based furniture, such as smart street furniture in Sydney equipped with network sensors, lighting, Wi-Fi access, and USB charging ports (Steinmetz et al., 2021).

According to Niu (2013), contemporary furniture materials are increasingly diverse and include environmentally friendly, high-performance composite materials. Such materials are particularly suitable for producing modern furniture components that can be formed simultaneously within a single manufacturing process. This trend is consistent with the findings of Ichim et al. (2024), who indicate that natural-fiber-reinforced polymer composites are increasingly regarded as alternatives to wood in furniture structures because of their sustainability, dimensional stability, cost efficiency, and design flexibility. Dahy (2019) likewise demonstrates that lignocellulosic-fiber-reinforced polymer composites can be applied to furniture, in addition to acoustic panels and shell construction.

Furthermore, material diversity in the furniture industry has implications for production time and environmental impact. The use of various materials, including wood, metal, plastic, and composites, requires adjustments in processing and assembly techniques, potentially extending the overall production process. Each material possesses unique characteristics that require different manufacturing approaches, ranging from cutting and forming to finishing. In this context, additive manufacturing, or 3D printing, is regarded as one of the latest innovative developments in furniture production (Aydin, 2015). The production of 3D-printed furniture has also begun to shift from experimental one-off production toward small-batch manufacturing (Yang & Du, 2022). This technology has been used to replace wooden components or joints in furniture, such as connectors made from PLA (Nicolau, Pop, & Coşoreanu, 2022).

Material diversity also has implications for environmental sustainability. Some materials may originate from limited resources or involve complex recycling processes, while others may be more environmentally friendly but require greater energy inputs during production. A life-cycle assessment of 25 furniture products indicates that furniture groups with greater material mass tend to have higher environmental impacts, with the pre-production stage generally contributing the greatest impact, followed by the production stage (Yang, Vezzoli, & Su, 2025). Yang, Zhou, Liang, and Ma (2025) emphasize that eco-design should not focus solely on the renewable and recyclable properties of materials, but should also prioritize extending product lifespans and reducing material and energy consumption. Accordingly, Yang and Vezzoli (2024) developed furniture-specific life-cycle design guidelines and a toolkit to improve the environmental performance of furniture products, while Pei, Italia, and Melazzini (2024) emphasize the importance of designing products that are easy to assemble and disassemble so that their components can be reused. Therefore, material selection in the furniture industry needs to consider not only aesthetic and functional aspects but also production efficiency and long-term ecological impacts.

According to Xiao et al. (2017), smart materials for furniture include innovative engineered wood materials, intelligent glass, and intelligent metal materials. Examples of engineered wood materials include honeycomb-shaped composite boards made from cardboard or recycled paper. These boards are lightweight and resistant to deformation.

Intelligent glass can be used in modern furniture characterized by smooth and simple forms. This glass is coated with an extremely thin diamond-like carbon layer, producing a smooth surface that does not retain fingerprints and is resistant to mild acids, alkalis, and oxidation. Intelligent metal materials address the limitations of conventional metals, which tend to be heavy, prone to corrosion, and rigid. These new metal materials are produced by combining metal with air cavities, resulting in lighter and stronger structures with good electrical and thermal conductivity as well as strong mechanical properties.

Multifunctional futuristic furniture that incorporates the latest technologies can attract users' interest. However, environmental considerations also need to be taken into account during the manufacturing process. Designs that can be produced within a short period while utilizing advanced materials and tools can provide more positive impacts. Thus, futuristic furniture can be not only functionally innovative and aesthetically distinctive but also environmentally friendly. The balance between cutting-edge design and efficient, sustainable production processes, while considering the entire product life cycle (Li et al., 2023), is essential for creating ideal furniture for the future.

Fitriana and Purwaningrum (2024) conducted an interior design study of a museum based on a futuristic concept. Their study found that futuristic design emphasizes the use of forms, colors, and technologies perceived as modern and innovative, with the aspiration of representing the future. Its characteristics include unusual and elongated dynamic forms and lines, the dominance of chromatic colors such as white and blue, and the integration of advanced technologies such as LED lighting and monitor screens to create a futuristic atmosphere. In addition, the principles of "Less is More" and nihilism are emphasized through design simplicity and minimal furniture and decoration, while extensive use of glass and advanced LED lighting further enhances the modern and innovative impression of the overall interior.

Kavut and Karagözler (2020) analyzed science-fiction films featuring futuristic themes and interpreted them from a design perspective. These films present both utopian and dystopian atmospheres. From a utopian approach, several recurring ideas can be identified across different futuristic designs. Common characteristics of utopian culture in futuristic design include bright, clear, striking, and generally visually appealing color palettes, ranging from nearly monochromatic or single-color shades to highly saturated and intense colors. Such colors are often used to evoke feelings of happiness, warmth, and relaxation.

Material choices in utopian design typically include materials that appear clear, clean, bright, or striking, such as aluminum, platinum, glass, and plexiglass. Softer materials, or materials that are visually unobtrusive, pleasant to touch, non-threatening, and perceived as high quality, are also commonly used.

In terms of objects and forms, utopian design often features symmetrical compositions or self-contained patterns and sequences, with forms characterized by soft edges and generally rounded or oval shapes that are considered difficult to produce using current technologies.

As an additional characteristic, the atmosphere of utopian design tends to convey a sense of grandeur approaching euphoria while remaining relaxed, with everything appearing almost perfect and generating consistently positive impressions. Based on these characteristics, utopian culture in futuristic design may be understood as representing an idealized state of euphoria that is unattainable as a permanent human condition, with design choices consistently reinforcing this ideal.

In film, furniture design can convey important aesthetic messages (Ardatürk, 2023). For thousands of years, humans have used furniture as part of everyday life, while over the past century, film has become an integral part of our culture. Furniture shown in film scenes can reveal the personality of characters and contribute to the atmosphere that the film seeks to establish.



Figure 1. Furniture in Palpatine's Office in *Star Wars: Revenge of the Sith*
Source: Ardatürk (2023)

Figure 1 presents a scene from *Star Wars: Revenge of the Sith* cited and analyzed by Ardatürk (2023). According to Ardatürk, furniture in films helps create an immersive visual experience and enriches the narrative presented.



Figure 2. Aerial View of the Exterior of Al-Jabbar Grand Mosque and an Icon Representing Its Architectural Form

Source: aljabbar.jabarprov.go.id

Another example of a futuristic object is Al-Jabbar Grand Mosque, which features a contemporary modern architectural appearance with Turkish mosque influences combined with local artistic elements from various regions of West Java. According to its architect, Ridwan Kamil, as cited by Dewi (2023), Al-Jabbar Grand Mosque can be interpreted as a futuristic object. Its exterior makes extensive use of glass arranged in a kite-like configuration, although the form is softened by oval elements, resulting in a futuristic design consistent with the characteristics described by Kavut and Karagözler (2020:13).

Figure 2 demonstrates how a three-dimensional object can be represented visually through a two-dimensional image. The icon representing the architectural form of Al-Jabbar Grand Mosque is used in the mosque's logo. This illustrates the visual flexibility of a unique aesthetic form, whereby the form can be simplified to represent the original object in another medium while retaining a similar overall impression. The icon does not function solely as a logo but is also repeatedly applied as an ornamental element on the fence surrounding Al-

Jabbar Grand Mosque.

Research on the visual flexibility of static logos transformed into dynamic logos was conducted by Palit (2022). The visual flexibility explored in that study adopted a retro crystal-blue theme to enhance the aesthetic quality of a proposed visual promotion for a tourism area in Bandung.

This study aims to demonstrate the potential for visual flexibility in futuristic art objects, particularly furniture. Such flexibility can be identified through the simplification of visually complex objects while retaining their distinctive aesthetic characteristics. When applied to furniture design, this visual flexibilization may provide advantages in terms of manufacturing, particularly with regard to material use and the technical processes involved in furniture forming and assembly.

METHOD

This study required a furniture product sample to examine the flexibility of its visual representation. The process was designed to demonstrate how the distinctive aesthetic characteristics of a complex furniture design could be preserved while translating the design into a simpler version. Accordingly, the study was conducted through the following stages:

1. Development of the most complex version of the furniture product sample. In this study, a credenza named *Ethereal* was developed as the sample product.
2. Analysis of the most complex version of the *Ethereal* design.
3. Analysis of a simplified version of the *Ethereal* design, while maintaining its distinctive aesthetic elements and considering limitations in terms of raw materials, as well as the time required for fabrication and assembly.
4. Aesthetic evaluation of the complex and simplified versions of the *Ethereal* design.

RESULTS AND DISCUSSION

The furniture product sample designed in this study was named *Ethereal*, a credenza designed around a futuristic theme. More specifically, the futuristic theme was derived from a modern aesthetic. The visual appearance of the most complex version of *Ethereal* is presented in Figure 3..

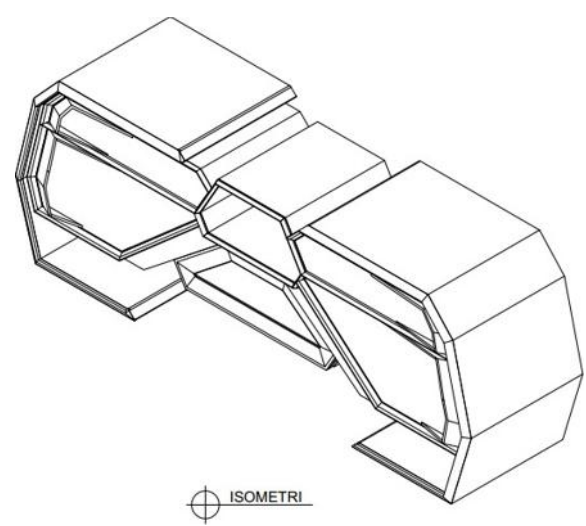
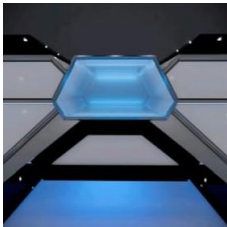
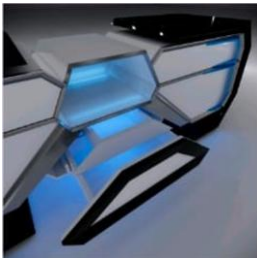
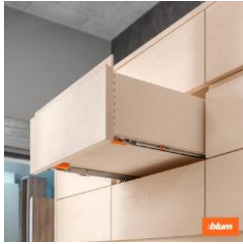


Figure 3. Isometric representation of the Ethereal credenza design.

In general, Ethereal features several *points of interest*, including its distinctive form, integrated lighting, glossy surface finishing, and multifunctionality. Details of these *points of interest* are presented in Table 1.

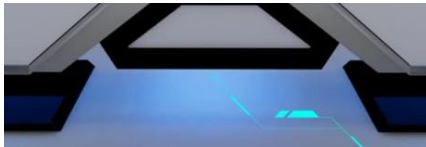
Table 1. Points of Interest in the Ethereal Credenza Design

Point-of-Interest		Description
		Form inspired by a car grille The lines of a car grille served as inspiration for the forms of the shelves
		Hidden compartment A hidden compartment is incorporated into the central drawer.



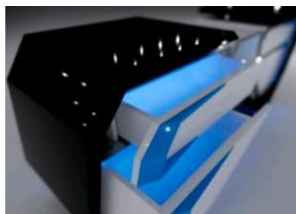
Furniture hardware

The furniture hardware consists of soft-close rails combined with a push-to-open mechanism.



Electronic features

The design incorporates wireless charging and LED strip lighting in crystal blue.



Surface finishing

The top coat has a glossy finish, with metallic gray, navy blue, and black as the base colors.

Using the aesthetic analysis proposed by Kavut and Karagozler (2020), the form inspired by automotive grille lines evokes the futuristic atmosphere depicted in *The Matrix*. The film portrays a world in which only one human city remains, while the rest of the world is controlled by machines powered by artificial intelligence. This representation suggests that one characteristic of a futuristic theme is the dominant presence of machines in everyday human life. Cars, for example, are products that incorporate mechanical systems. Automotive grilles are generally positioned at the front of vehicles, serving both an aesthetic function and a functional role in separating the exterior environment from the engine compartment. The lines of the shelves and drawers in *Ethereal* resemble the grille designs of the Toyota Raize (2024) and Mercedes-Benz GLS-Class (2024).

The use of automotive design as inspiration for the features of the complex version of *Ethereal* resulted in components such as a *hidden compartment* and *wireless phone charging*. The *hidden compartment* was inspired by the interior design of the Smart #1 Pro electric vehicle (2023). As an environmentally friendly vehicle characterized by low emissions and a sophisticated, well-organized interior, the Smart #1 Pro contributes to the utopian atmosphere incorporated into *Ethereal*. The *furniture fittings* used in *Ethereal*, including *soft-close* rails and the *push-to-open* mechanism, are likewise reminiscent of the mechanical fittings found in the interior of the Smart #1 Pro. A *wireless charging pad* for mobile phones is also incorporated into the vehicle's interior, positioned in the center console between the driver's and front passenger's seats.

The LED *all-round lighting* follows the curves and lines of the *Ethereal credenza*. When illuminated, the *crystal blue* light creates a striking visual effect and produces color gradients across the surface of the credenza. The glossy finish generates reflections and conveys a clean appearance, thereby reinforcing a luxurious and visually pleasing impression. The visual

representation of the most complex version of the futuristic furniture sample is presented in Figure 4a.

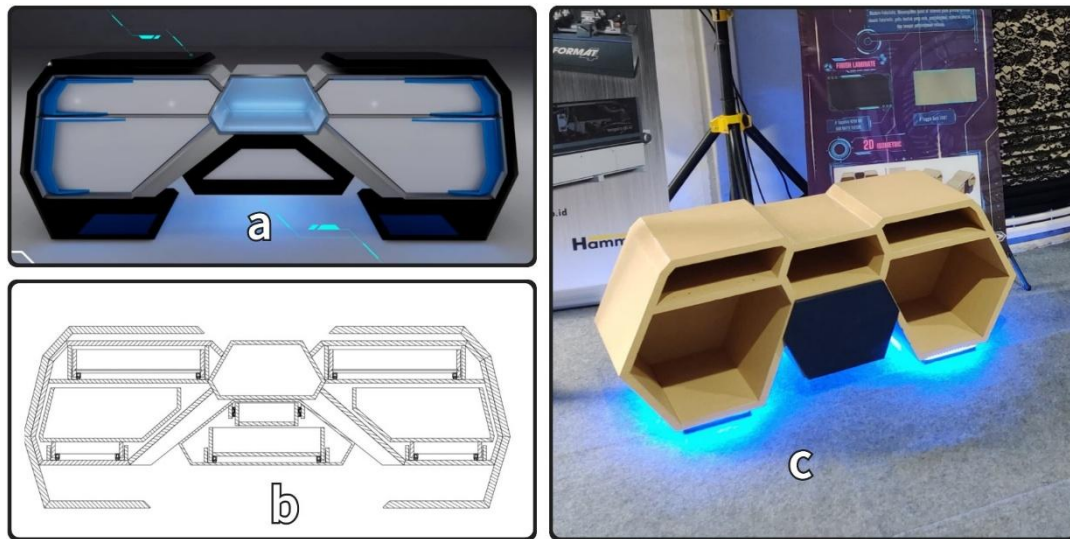


Figure 4. Visual flexibility of the design: (a) the most complex version of the Ethereal credenza, (b) a sectional working drawing exposing the interior of Ethereal, and (c) a photograph of the simplified version of Ethereal.

Subsequently, a simpler version of the Ethereal credenza was developed by retaining its distinctive aesthetic elements while imposing limitations on the materials used. The materials consisted of plywood and a high-pressure laminate (HPL) surface covering. The plywood was cut according to the simplified pattern developed for Ethereal. The individual components were then assembled to follow the form of the simplified version. At this stage, the simplified Ethereal had already acquired a form corresponding to the sectional representation shown in Figure 4b. The surface was subsequently covered with plain cream-colored HPL to create a more modern appearance.

To maintain the identity of the futuristic theme, a blue LED strip was installed underneath the simplified version of Ethereal. Other electronic features, such as wireless charging, were not incorporated because they would have required additional drilling, cutting, and installation of supplementary materials. The simplified version of Ethereal was completed within one day. Its fabrication was conducted alongside other products produced within the same timeframe as part of a *one-day project*, as shown in Figure 4c.

Figure 4 demonstrates that, despite the substantial reduction in complexity, both the most complex and simplified versions of Ethereal retain the same futuristic theme. The characteristics maintained in both versions correspond to the description of a futuristic design with a utopian aesthetic proposed by Kavut and Karagozler (2020, p. 5), in which colors tend to be bright and cheerful, while materials appear solid, clean, orderly, and well organized.

CONCLUSION

The case study of the Ethereal credenza illustrates how a complex futuristic design can be simplified without losing its key aesthetic elements. The analysis shows that both the

complex and simplified versions retain the defining characteristics of a futuristic theme, including bright colors, clean and modern materials, and the integration of advanced technology. These findings reinforce the idea that futuristic furniture can serve not only functional and aesthetic needs but also contribute to sustainability and efficiency in the furniture design industry.

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