

# Design of civil aviation tableware based on user experience

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**Abstract.** In-flight meals are an important touchpoint between passengers and airline services, tableware design is the carrier of air service and brand culture. This paper analyzes the in-flight meal experience of passengers in a special high-altitude environment, It is proposed that there is a "pressure space" in the in-flight meal experience, and takes tableware design as the entry point, from the tableware shape, color, material, and other elements, the plan of the cabin tableware design is proposed. Make aviation tableware artistic, aesthetic and economical, relieve the fatigue of passengers due to high-altitude flights, and improve the service level of airlines.

**Keywords:** Modular design; Aviation tableware design; User experience.

## 1. Introduction

With the development of economic globalization and the growth of national travel, China's air transport industry has ushered in a golden period of rapid growth. According to the "2022-2027 China Aviation Passenger Transport Industry Investment Value Analysis and Development Trend Forecast Report" released by the China Research Institute of Industry Research, in 2021, China's civil aviation complete a total transportation turnover of 85.7 billion ton-kilometers, a year-on-year increase of 7.3%; passenger traffic volume 440 million, a year-on-year increase of 5.5%. China Civil Aviation's route network, fleet transportation capacity, airport and other infrastructure are constantly improving. At the same time, how to improve customer experience has become the focus of competition among various civil aviation companies. User experience is proposed by Donald Norman, an American cognitive psychologist, computer engineer, and industrial designer. The ISO9241-210 standard defines user experience as "people's perceptions and responses to products, systems or services that are used or expected to be used." Taking tableware design as an example, designers use modern design methods to design environment, dishes, tableware and other peripheral products to enrich people's dining experience and enhance the added value of products. With the opening of more routes, passengers have more diverse travel needs. Therefore, meeting user needs and improving cabin experience and comfort have become more and more important. In-flight meals are an important point of contact between passengers and aviation services. The sophisticated design of aviation tableware can improve the service quality and corporate image of airlines. Well-designed aviation tableware can add brand value to civil aviation. But most airlines don't realize the significance and importance of aviation tableware design. Therefore, this article takes the cabin as the carrier, considers the particularity of the dining environment such as in-flight meals, small cabin interior space, high personnel density, and large mutual interference, re-examines the tableware design, and pursues both "beautiful in colors, rich connotation, and unique appearance" tableware design. To tap the potential demand of civil aviation passengers for tableware, and use the modular design concept to design civil aviation tableware.

## 2. Current status of domestic and foreign research

At present, China's civil aviation design focuses on the design of aircraft cabin facilities, which mainly cover seats and their parts, luggage racks, kitchens, toilets, cloakrooms, dining cars, video players, aviation headphones, life jackets, lifeboats, Curtains, porthole panels, etc. It has the characteristics of many types, small batches, customization, and high complexity. Therefore, the safety and comfort of cabin facilities, the choice of colors and materials, and the layout and selection of cabin design are the key points of the study. Domestic and foreign aircraft manufacturers and cabin equipment manufacturers have improved the safety of the cabin through technological innovations

and promoted the rapid development of the global aviation industry. For example, the new cabin seats designed by Aviointeriors, the British Priestman Goode Design's "Pure Sky" new cabins. However, there are few related studies about the civil aviation tableware design and in-flight meals experience. Civil aviation tableware needs to be small, light, low cost, beautiful, easy to recycle, and fit the size of a dining cart. How to save space, reduce weight, facilitate recycling and cleaning, how highlight local cultural characteristics, and how to make tableware resonate with people's emotions are the focus of this article. Luo Yong refined the elements of aviation tableware design in the aviation tableware design trend, including the size, volume, weight, material, color, shape and inner emotion of the tableware. The material of aviation tableware affects the comfort of the passenger's in-flight meal experience. The more interesting and creative aviation tableware can improve passenger satisfaction, bring novelty, surprise, and humanized experience, and arouse emotional resonance when using tableware. Reduce the cold and dry feeling during the use of tableware. In 2020, Qiu Chuhang designed in-flight meals' tableware for children - "Gengzi Golden Rat", as shown in Figure 1. The design of this aviation tableware combines china's zodiac and tableware. It adopts a combined design and has a strong interest turns tableware into toys, enhancing children's hands-on ability, and highlights the convenience and fun of aviation tableware design, which not only saves space but also reduces costs.

This paper uses the method of literature review to collect relevant theories such as aviation tableware design, modular design, user experience, etc., summarizes the principles and elements that should be followed in aviation tableware design, summarizes the problems existing in airline tableware, and optimizes tableware to improve passengers 'in-flight meal experience.



**Fig.1** Gengzi Golden Mouse

This article is divided into six parts. The first part is the research background, expounding on the research significance and content of this paper, and the second part is the literature review. By discussing the current situation of civil aviation catering design, it puts forward the existing problems in civil aviation tableware design, which provides a reference for the innovation of this paper. The third part is the basic theory, which discusses the application of modular design and user experience in design. The fourth part analyzes the dining experience of civil aviation passengers from the perspective of in-flight meal environment and tableware. The fifth part is the design practice of modular design in the aircraft cabin tableware, and the sixth part is the summary and prospect.

### **3. Related Theory**

#### **3.1 Modular Design**

Modular design is to discuss the individual needs of user's layer by layer, and realize the combined production of different general modules, to create products with a unique personality. That is to say, modular design is to combine certain elements to form a subsystem that can meet the functional requirements of users, and the subsystems can be freely selected and combined to form a new system that can meet the different needs of users. Each module is relatively independent, but has interchangeability and versatility, which can simplify product design and production and shorten

product development cycle. As shown in Figure 2, the tapas set was designed and produced by Carlos Tiscar. It is composed of some different circular-arc shaped dinner plates and trays, and consumers can choose the number and size of the plates to combine and splice.



**Fig.2** Tapas set

### **3.2 User experience**

User experience is the user's feelings and impressions when using a product or service. A designer's increased focus on emotion and experience can improve product value. Tableware is one of the key factors affecting the "dining experience". Experience design is based on people's visual senses, usage methods, tableware functions, and emotional transmission in the use of tableware. Aviation tableware's appearance, material, feel and function directly affect passengers' dining mood, quality and evaluation of airlines. Passengers can get the beauty from the shape and color of the tableware, the tactile experience from the texture, and the functional experience from the shape.

## **4. Analysis of Meal Experience of Civil Aviation Passengers**

In this section, the problems existing in the dining experience of passengers and the design of tableware are analyzed from the perspective of environment, tableware and meals.

### **4.1 Analysis of dining environment**

Different from other public spaces, the aircraft cabin is a special indoor environment, including physical space and human interaction space. Physical space is the objective image and carrier of the cabin, such as space layout, product placement, etc. The characteristics of the physical space of the aircraft cabin are 1. There are many items placed in the limited area; 2. The spatial distribution density is high, the personnel density is high, the passenger density in the circulation area is high, and there is only a narrow main channel, Passengers' personal space is cramped, and the area for passengers to move freely is limited. Because of the high-density distribution of physical space, the behavior of passengers is restricted. This enables human interaction spaces to socially interact with the surrounding environment and people. When passengers dine in the cabin, there are links such as catering distribution, delivery, dining, and recycling of tableware. These social interactions can make passengers feel crowded in the cabin, lack personal privacy and complicated processes. Therefore, the comfort and convenience of dining are the dining needs of passengers.

### **4.2 Cabin Dining Experience**

#### **4.2.1 In-flight meals**

This paper collects the in-flight meals of China Southern Airlines, Japan Airlines, Emirates Airlines, and Singapore Airlines, as shown in Table 1. It is found that there are many types of in-flight meals, but the in-flight meals of different classes are quite different. Fast food is available in economy class, while business meals are more extensive

**Table 1.**Some in-flight meals

Airline cabin seat	China Southern Airlines	Japan Airlines(JAL)	Emirates Airlines	Singapore Airlines
economy class				
business class				
first class				

First-class meals are the most abundant, including appetizers, main dishes, desserts, and more. In addition, the meals provided by different airlines are personalized and ethnic.

#### 4.2.2 Tableware

As shown in Table 2, this paper uses the method of comparison to analyze the appearance, material, and function of the tableware in economy class, business class and first class. The tableware in economy class uses disposable products, such as lunch boxes made of aluminum foil. This material heats up quickly but has the poor setting ability, which is difficult to meet the needs of beautiful design. Some airlines use new food-grade Polystyrene or Polypropylene, but the recycling rate is low. The appearance design of tableware usually uses a square shape, which meets the needs of high-density space and a high utilization rate. In terms of color, the tableware is mainly white, but Japan Airlines combines the culture and the color of the tableware in the cabin and uses the color of the izakaya to highlight the regional food characteristics. The design of economy class tableware is conventional and monotonous, and only provides the basic functions of tableware, which cannot make passengers feel refreshed and arouse emotional resonance of passengers. First class tableware is made of high-end materials, such as Polyphenylene sulfone resins, bone china, etc., to match high-end meals. The tableware has a unique appearance design, but the material cost is high, and the design cost is also relatively high, so it is difficult to promote it in the economy class. The tableware design of business class is between economy class and first class, and there are no obvious advantages and disadvantages. To sum up, the cabin tableware design of cabin tableware satisfies the basic functions of reheating, high utilization, and lightness, but ignores the visual experience of passengers, the aesthetics of tableware, and the promotion of tableware to airline brands and regional cultures.

When flying, the appetite and behavior of passengers are affected by the physical space of the confined cabin at high altitudes, resulting in a decreased sense of smell, taste, obstructed vision, low relative humidity, and a sense of space crowding. Charles Spencer pointed out in the article "Tasting in the air: A review" that when eating at high altitudes, the mucous membrane of the nose is dulled, and the ability to smell decreases, which reduces the function of taste buds to 30% of the standard value. Therefore, there is a difference between meals on the plane and meals on the ground. It will make people feel that the taste is no longer so strong, the aroma is no longer so delicate, and the need for spicy, sour foods is greater. The pressure space generated by high pressure and high density will

have an impact on the physiology and psychology of passengers. For example, the space design of economy class allows passengers to have physical collisions during meals, resulting in a feeling of crowding, and they need to endure engine noise and noisy sounds. Some people have dizziness, vomiting and other phenomena will occur, and physical discomfort will produce unique psychological activities and emotions, which will affect the dining experience of passengers. On March 14, 2019, the Shanghai Consumer Protection Commission released the "Report on Airline Passenger Satisfaction Survey". The report pointed out that the satisfaction with airline meals is the lowest. Passengers' satisfaction with the variety and quality of catering is only 64.6 points. Therefore, airlines provide a variety of catering services and creative tableware can reduce the psychological pressure on consumers and improve passenger satisfaction.

**Table 2.** Comparison of airline tableware

cabin seat	Tableware Material/Use	Functional service	advantage	weak point
economy class	Aluminum foil, plastic:lunch box, Paper Boxes, Plastic Bags: Snacks, Paper Cups, Plastic Cups: Drinks	Fast food	Save time, Convenience, Low cost	monotonous design, Rough material, Not environmentally friendly
business class	Tray-type imitation bone china tableware, Glass metal cutlery	Dine-in package		
first class	Bone china tableware Special-shaped tableware Glass Metal Tableware	A la carte meal	Provide exquisite dining service	Higher cost, Less convenient

## 5. Design practice of "modular design" in aircraft cabin tableware experience

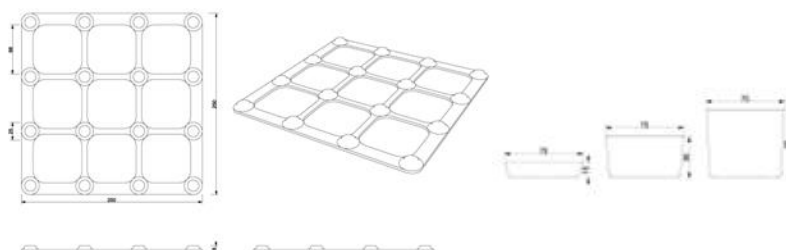
### 5.1 Principles and Elements of the Design of the Airplane Cabin Cutlery Experience

The design of tableware in the cabin is limited by the environment and has its characteristics. When designing tableware, it is necessary to consider the psychological and physiological needs of passengers. Therefore, the design of cabin tableware needs to follow the principle of customer experience. Secondly, since the passengers are eating when the plane is flying high, the safety of the tableware needs to be considered. In addition, since most passengers fly in economy class, meals in economy class are mainly provided for free, so the cost of tableware also needs to be considered. Therefore, this paper believes that the cabin tableware design needs to follow experience, safety, and economy. In this paper, the elements of "environment", "people" and "product" contained in experience design are corresponding to "cabin", "passenger" and "tableware". The cramped cabin environment requires designers to consider how to save space. Passengers are emotional elements. The design of tableware needs to be based on function and the core of emotion so that passengers have different experiences. Then when designing tableware, it is necessary to consider the color matching, and appearance design of tableware, whether it has a cultural connotation, creativity and

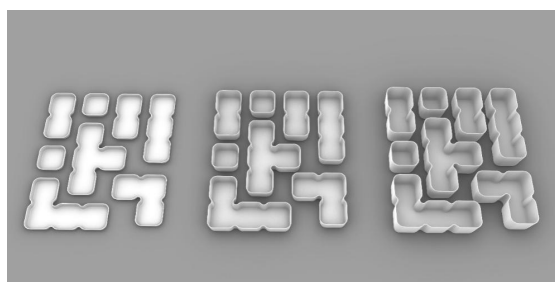
fun. In addition, due to the principle of economy, tableware materials need to choose low-cost and environmentally friendly materials.

### 5.2 Cabin tableware design practice

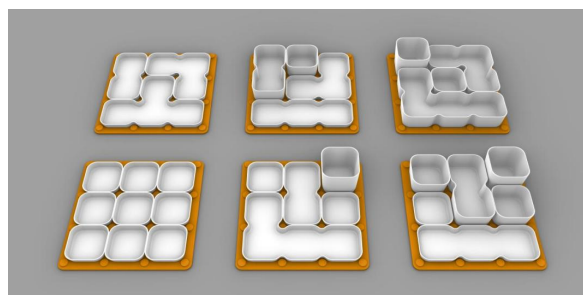
According to the survey, half-size dining cars are the most common in aircraft cabins, with a length, width and height of 430mm, 350mm, and 1030mm respectively. The length and width of the small table in the economy class are 420mm and 250mm. Desserts, drinks and a set of spoons and chopsticks. In this paper, considering the limitations of the cabin space, the size of the dining car and the table, and the types of meals, the length of the main food lunch box is 165mm, the width is 110mm, the height is 55mm, the height of the bowl is 4mm, and the height of the cup is 65mm. There are also shallow dishes (Figure 3, Figure 4). Place the cutlery in a nine-square grid tray (Figure 5). The tray design in the form of a nine-square grid is interesting, and the change of height and shape between tableware and tableware reflects a sense of order and layering. Taking into account the turbulent situation of high-altitude aircraft and the safety of dining, the overall shape of the tableware is a rounded rectangle, soft silicone is added to the material of the tray, and a recessed positioning is designed to prevent the tableware from falling off (Figure 6). Considering economy and environmental protection, the tableware designed in this paper uses rice husk fiber + plant starch, and the tableware after use can be degraded. In terms of color, choose a cheerful and bright color combination: white + orange, the two colors form a sharp contrast, which can not only relieve the visual fatigue of passengers, but also have a sense of luxury. The combination of different tableware allows passengers to make a variety of meal combinations when booking meals. To sum up, this tableware design can meet the needs of providing passengers with a variety of meals, and it is relatively convenient for delivery, delivery, and recycling of tableware. pleasure. Make passengers eat on the plane, just like eating at home, and produce a warm experience of "going home".



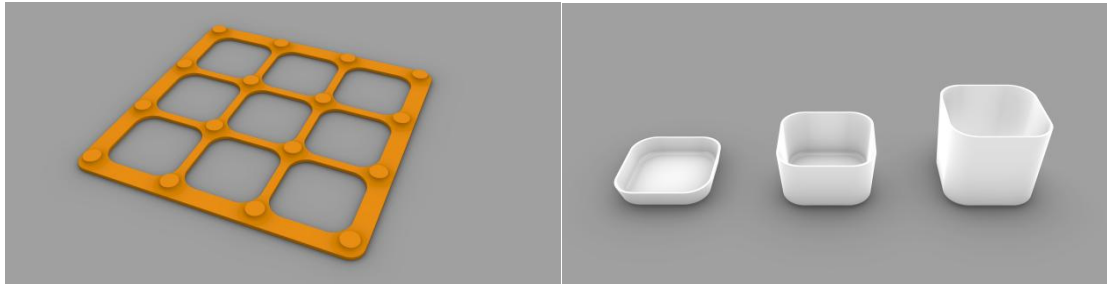
**Fig.3** Tray/Unit Cutlery Dimensions



**Fig.4** Aleware design renderings



**Fig.5** Design renderings of tableware combination



**Fig.6** Design renderings of trays and unit cutlery

## 6. Summarize

Modular design and experiential design is a design concept that meets individual needs, drives innovative models, and conforms to sustainable development. This paper applies the modular design concept to the design of tableware in aircraft cabins, and analyzes the passenger experience at high altitudes. Environmental dining experience, it is pointed out that when passengers dine in the aircraft cabin, psychological pressure and physiological pressure will be generated. Given the pressure faced by passengers, this paper proposes the problems existing in the design of tableware in the aircraft cabin, and alleviates the pressure of passengers by optimizing the design of tableware.

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