Teaware Design

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Teaware designers and producers have invisibly created a considerable carbon footprint with regard to nonrenewable clay and energy waste due to excessive production. The size of the tea-drinking container and the thickness of the cup's rim will affect the perception of the tea's taste and smell.

visual perception | tactile perception | sustainability | sustainable behavior | design thinking | tea culture | fuzzy set qualitative comparative analysis | sustainable design

1. Introduction

Kreifeldt [1], in a study of the tactile aesthetics of aesthetic design, proposed that the object should be designed to give people a pleasant experience through its appearance or image. The appearance and image of the object can evoke the appropriate imaginary tactile feeling through vision. In other words, people's visual image of an object evokes psychological feelings and stimulates the corresponding tactile feelings. While most research focuses on the multisensory taste perception of chemical sensory stimulation and the physical content of the food itself [2], the proverb "you are eating with your eyes" [3] shows another meaning of visual influence on food taste. Visual images evoke appropriate imaginary tactile sensations and affect the taste of food. Studies have found that in addition to the tactile characteristics of foods that impact the judgment of several flavors [4], the external tactile information of packaging materials or containers also impacts the flavor and taste of food and beverages [5][6][7]. Van Rompay et al. [8] found that the visual and tactile stimulation of food or beverage containers in restaurants or supermarkets is closely related to the deliciousness and charm of food [9].

Human sensory receptors receiving external stimuli do not operate independently but are compounded and engaged simultaneously. While we are eating food, the smell and taste of the food itself, as well as our eyes, ears, and skin, also help to form a "flavor system" [9]. Many studies have found that consumers' perceptions of red wine, soda drinks, juice, coffee, and hot cocoa, consumer behavior, and the shape and color of the container are highly correlated [7][10][11][12][13]. Spence et al. [14] stated that, although there is a large population of tea drinkers globally, few studies explore tea's visual and tactile perception. In particular, there is a lack of in-depth investigation and research into Chinese teacups. From the environmental perspective of consumers' collective behavior, empirical investigation of the appropriate teacups for Chinese tea is necessary given the lack of published research on this issue, especially because China's tea consumption ranks first globally and the tea-drinking population is prevalent. Recent studies have found that some consumers, tea merchants, and tea art teachers focus on the material selection and the firing method of ceramic teacups. Although designers also focus on visual form innovation, the

lack of research on sensory perception and teacup visual image leaves the designers without a design reference [15]. Under the policy of “industry culturalization” and the development of tea culture, the ceramic industry has turned to the production of tea utensils, seeking changes and innovations in design to increase competitiveness, and constantly creating all kinds of tea utensils [16]. However, continuous innovative designs have raised production costs and caused energy waste issues that undermine ceramic tea utensils’ durable and environmentally sustainable properties. Social and environmental problems, such as stimulating consumption, energy, and resource waste, have attracted many scholars [17][18]. Especially in recent years, Taiwanese ceramic teaware creators have been keen on time-consuming and energy-consuming wood-firing teaware. The impact of environmental damage from an ordinary wood-burning kiln that requires at least 3 tons of firewood and smoke generated for at least 3 days of burning should not be underestimated.

Moreover, currently, there are 600 wood-firing kilns in Taiwan alone. The accumulated high energy consumption and endless environmental pollution problems must be reconsidered. In recent years, ceramic artists have introduced environmentally friendly wood-burning technology and built environmentally friendly wood-burning kilns to avoid air pollution caused by smoke and dust [19][20]. However, it still needs to consume a lot of wood energy to pursue beauty and artistic value. In addition, pottery clay materials are not renewable and reusable, and the environmental problems of high fuel and resource consumption make the ceramic industry an economic sector with a large carbon footprint.

In the current post-consumption era of excessive consumption, the artistic and practical evaluation of product design is crucial to add value to the design and solve the potential social crisis. From the viewpoints of design thinking regarding practical aesthetics and sustainable development, the researcher believes that understanding the relationship between the cup shape and the tea taste can assist in the design of practical tea utensils. In addition to embodying the concept of Kreifeldt [1] in his aesthetic design, that product appearance design provides people with a pleasant feeling, it can also contribute to the development of the tea industry and promote sustainable development.

2. Teaware Design and Human Sensations

“Feeling refers to the immediate and physiological response of the sensory system when it receives an external stimulus” [21], while the sensation is the “primitive experience” of the senses. The accumulation of these “primitive experiences” is the basis for the human construction of knowledge. The sensation can be divided into three stages: the physiological response of nearby stimuli, neural transduction, and the psychological response of consciousness (**Figure 1**) [22].

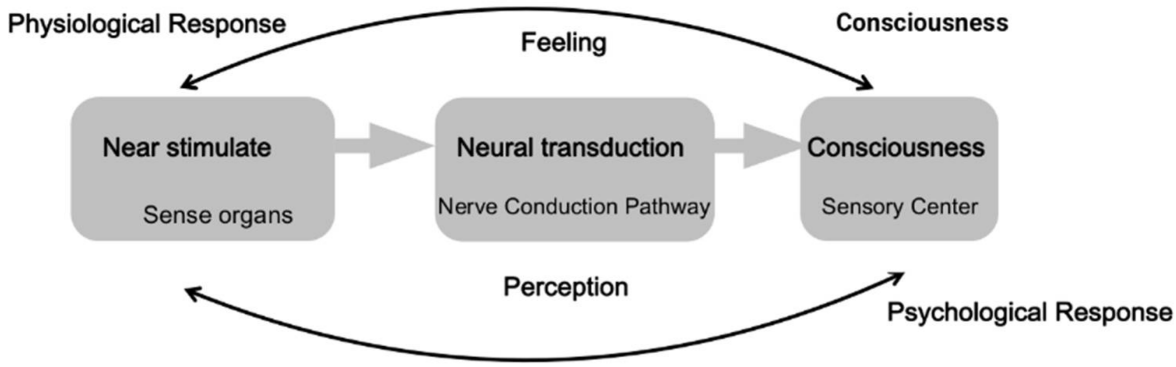

Figure 1. Three stages of the sensory process.

Spence et al. [23] found that people's response to taste usually comes from the complex information processing of product experiences, such as smell, vision, taste, and touch, forming a sense of taste. In the complex integration of multisensory visual senses, the first senses reaching food produce pleasant expectations, transform and awaken other sensory perceptions, and enhance and obtain satisfying and pleasant memories and hedonic experiences. Extrinsic cues, such as the packaging and container, have exerted an influence on our perception of flavor. More empirical research is showing that the shape of product containers, also applied to drinking receptacles, demonstrates a strong association with consumer behavior and taste experience [11][13][24]. Studies have found that the shape of the glass had little effect on the perception of the aroma of wine when the subject could not see or touch the glass.

On the other hand, if the subject saw and held the glass, the shape of the glass had a considerable influence on the perception of the aroma and taste of the wine [25][26][27]. Delwiche and Pelchat [25] evaluated the aroma of four different glasses of wine in a blind test and found that the wine glass's shape had a subtle effect on the aroma. In addition, studies have found that even professional wine or tea tasters will still be affected by the shape of the glass, including their perception of taste and aroma [28][29]. Hummel et al. [30] found that two-thirds of the subjects believed they had consumed more than one type of wine, which means that one-third believed they had consumed one type of wine. Research has also found that the grade of wine is affected by the shape of the glass. In other words, the shape of the wine glass affects consumers' perception of wine aroma and taste. Compared to other drinking receptacles, the shape of the beverage (or wine) container has received more attention [8][31][32]. Cavazana et al. [7] studied the influence of the smell and taste of cola in different containers, and the results showed a multisensory interaction between the smell and taste of the beverage and the container type. Compared to cola in incompatible containers (such as water cups or plastic bottles), participants felt that cola in a typical cola cup was sweeter, stronger, and more pleasant.

Li et al. [33] showed that Chinese and British tea sets create different visual perceptions of tea due to the complex cognitive process. Through personal tea-drinking experience, emotions, and social and cultural interaction, these results further support the view that human perception is influenced by visual senses regarding the shape and material of the container, which significantly affects the consumer's drinking experience.

Another factor affecting taste is the sense of tactility between the human body and utensils, as human tactile receptors have the highest distribution density in the nose, lips, and fingertips [34]. The sensations that arise when these tactile sensations are in contact with the utensils, through the associative effect of the experience memory in the brain, produce psychological responses that affect the taste sense [34].

The correspondence between the texture of the container surface and flavor has been proved. Van Rompay et al. [35] used a 3D printed surface pattern on the surface of the cup, which was an angular surface and a round surface. One hundred and sixty interviewees tested the bitterness and sweetness of sweet chocolate in the coffee cups with different surfaces. The cup with an angular surface produced a perception of the drink being more bitter and less sweet and seeming to have a more intense taste. In contrast, a cup with a round surface pattern elicited a sweeter taste evaluation and a less intense taste experience.

Tu et al. [6] applied the “sensation transference” theory proposed by Paras-Fiszman and Spence to study the influence of tactility on taste using packaging materials for traditional Chinese cold tea beverages. Blindfolded subjects tasted the same tea in glass, paper, and plastic cups with similar functions and sizes. The study found that the subject’s touch of the container significantly affected their perception of the sweetness of the tea but did not affect the sourness or bitterness. At the same time, the test subjects felt that the tea in glass cups was colder than the tea in paper cups and plastic cups. Therefore, consumers’ sense of touch has been shown to play a very important role in the stage of taste judgment.

3. Conclusions

The essence of design is to solve the user’s problem, make the user feel happy, and create a sense of happiness for the user. The essence of teacup design should be to solve the problem of drinking tea. The tea maker hopes to perfectly present tea tasting for consumers through a good cup design. Consumers hope that a good cup can make up for imperfect tea-making skills. Tea merchants who sell tea hope to satisfy consumers with tea taste through a good cup design and achieve a good sales performance of tea. However, the Chinese tea manufacturing process is complicated and the tea brewing technology is cumbersome. Therefore, in addition to solving the function of the tea carrier, the teacup design can change the user’s sense of taste through the visual and tactile design of the teacup to produce pleasure and happiness, which is the value of the teacup design.

However, the current society faces a cultural crisis and a design crisis because many design practices are based on a small number of commercial interests and ignore potential system crises, similar to how the California government banned plastic toy ducks for causing cancer and congenital disability. Yet, the cultural and design background behind making such a product for children should be worth considering. Therefore, designers should rethink the environmental, social, and cultural responsibilities of product design. The concept of Actor-Network Theory (ANT; a social analysis method that believes that social science and social backgrounds interact with non-human actors to form a heterogeneous network, construct each other, and evolve), proposed by French sociologists Michel Callon and Bruno Latour in the mid-1980s, emphasizes the mutual construction and co-evolution of scientific practice and its social environment between people and non-human actors. The more highly

modern society is, the more highly interactive the entanglement [36]. Therefore, nature and human society are not opposites but, instead, should find a social stability point in the interaction between human and non-human actors through human interaction. Producers, designers, users, earth's clay, energy, and environmental protection are intertwined to form a heterogeneous network in the ceramic industry. The interaction entangles the complex relationship between consumption, production, and environmental protection, especially between consumers and the environment.

When most studies are concerned with sustainable design issues, they tend to focus on product design to change user behavior, increase product lifespan, and reduce energy waste [36], or use the user experience to influence the behavior of other users [37]. Although our knowledge of how design changes behavior is rapidly expanding, we rarely discuss how to design products that meet the real needs of users and reduce design waste and excessive consumption. For example, under the pressure of environmental protection and sustainable development, teaware designers and producers focus more on resource reuse, product sustainability, or zero environmental pollution. Although ceramic teacups are consistent with sustainability and a long product life cycle, less environmental pollution and the non-reusability and excessive production and consumption of clay, coupled with the unique beauty of traditional firewood potters and consumers, have created an enormous carbon footprint in recent years. Thus, sustainable design appears to be empty talk. Unless manufacturers have the advantage of market interest, it is difficult to persuade them to accept sustainable design and reduce production. Tromp and Hekkert [38] discussed that the designer's social responsibility for the influence of design should emphasize the realization of desired consequences rather than the prevention of undesired ones. As a designer and one of the actors in the network, one should understand the social problems and dilemmas resulting from conflicts between personal interests and public interests brought about by the design of tea utensils. This research found that a teacup shape's visual and tactile sense impacts tastes and smell, which can provide teaware designers or ceramicists with a basis for innovative, creative production, solve user problems, and meet user needs. Consumers would have a reduced opportunity to choose inappropriate teacups and waste resources. Manufacturers can reduce the hoarding of improperly designed products and causes of environmental resources and profit depletion. In other words, if producers and designers design products based on the feelings and needs of consumers, users can use products that meet their needs, reduce the waste of clay in the ground, and protect the environment. Through this research, practical teaware design thinking fulfills the designer's social responsibility. Echoing the Actor-Network Theory, in the interaction between humans and non-humans, nature and society, the rearrangement of "people, circumstances, and things" seeks the organic balance of nature, society, culture, people, etc.

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