

Research on Environmentally-friendly Trash Bin Sorting Design Based on Human Factors Experiment

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Abstract: The current classified trash bins are generally divided into four categories, which are respectively used for recyclables, hazardous waste, other garbage and kitchen waste. However, they are not classified in this way in every place and the classified trash bins in public places such as roads, tourist attractions, and parks are divided into two categories, that is, trash bins for recyclables and non-recyclables. There are three types of classifications in schools and communities, which are recyclables, non-recyclables, and hazardous waste. Some new types of classified trash bins are set up in some places, with high-tech technologies and innovated materials applied to them.

1. Functional study on existing public classified trash bins

Classified trash bins can be divided into indoor trash bins and outdoor trash bins. The indoor classified trash bins are generally small in size, and most of them are one-piece cover-push and one-piece uncovered trash bins. The outdoor trash bins are generally large in size; because there is relatively more garbage generated outdoors, the structure of trash bins is simpler, and the shape is also uniform.

The outdoor classified trash bins are easy to use, and the garbage is classified according to the garbage classification signs, so that the garbage can be accurately put into the corresponding trash bins.

2. Research on the shape of existing public classified trash bins

Via investigation, it's found that most of the trash bins in the market are mainly cylindrical and square, and a few of them are of animal or strange shape. In terms of the shape, the cylindrical trash bins give people a feeling of stability and exquisiteness, while the square trash bins give people a sense of volume and tidiness.

Classified trash bins are generally divided into one-piece and open-cover types. The one-piece classified trash bins are mainly composed of the main body, the opening and the inner tank. The animal-shaped trash bins in some tourist attractions are one-piece, such as the panda-shaped trash bin, frog-shaped trash bin, and penguin-shaped trash bin, etc. Although the shapes are relatively special, it is difficult to handle the garbage, and the storage capacity is also small so that the garbage is very easy to overflow. Moreover, it is also less aesthetically pleasing to throw the garbage

through the mouth of the animal, which will have a negative impact on the children. The other type is the open-cover trash bin, which contains the cover, the opening and the inner tank. The inner tank facilitates cleaning of the waste, which thus extends the service life. In recent years, the classified trash bins have mainly been of round and square shapes. Although they are simple and elegant in the shape, and have been widely used, it will look monotonous and rigid to have always been of round and square shapes. There are also some trash bins that look good, but they lack of utility. For example, the covers of some bins are so heavy that the users are reluctant to open them for delivery, and the garbage will be directly placed next to the trash bin. Thus, it will not only destroy the environment, but also affect the appearance of the city.

In the survey, it was also found that the openings of a small number of classified trash bins are designed with special shapes, which are used to guide the users to conduct classification. In Japan, this kind of classified trash bins is very commonly seen. For example, the waste paper recycling bins will be designed with a rectangular opening and the recycling bins of plastic bottles and cans will be designed with a round opening to remind people that this kind of waste should be thrown in. Therefore, this is a design that can be used for reference, and it can clearly indicate the type of garbage that should be placed.

2.1. Color study of existing classified trash bins

The classified trash bins surveyed are usually of green, blue, red and gray colors, which are so bright that people will feel dull. The unreasonable colors of some classified trash bins can also have a negative impact on the appearance of the trash bins and the users' experience, which can also make them inconsistent with the surrounding environment. However, there are some new types of trash bins that have made great breakthroughs in color selection. For example, some light colors are adopted for matching, giving people a comfortable feeling, which will not cause burden or stress on the users. The types of classified trash bins are distinguished through the different colors. From the classified trash bins in the market, it can be found that there is no uniform regulation for the color design of classified trash bins. The author believes that different colors should be used to define each type of trash bins. For example, the green color represents recyclable waste, which includes waste paper, beverage bottles, milk cartons, scrap metal, waste glass and clothes, etc. The red color represents hazardous waste, including waste batteries, fluorescent tubes, paints, electronics, mercury thermometers, expired drugs, etc. The yellow color represents other garbage, such as leftovers, peels, dust, ceramics, animal droppings, etc. It is also possible for people to distinguish the garbage by color and then put it into the corresponding trash bin.

2.2. Study on the signs of existing classified trash bins

In the interview, some users are not very clear about the types of garbage and can't distinguish whether it is recyclable or non-recyclable. In addition, the sign of recyclables is similar to that of other garbage, which often causes confusion for users, and there is also some interference effect. Therefore, it almost brings a very small effect to paste only one recyclable or non-recyclable mark on the classified trash bin. It is learned through interviews that most users think that it can be recycled as long as it is paper, so many people put the non-recyclable goods such as paper towels in recyclable bins. In addition, many plastic products can also be recycled, but people only know that plastic products can't be recyclable. Therefore, in fact, signs only play a guiding role, and the garbage will also be wrongly placed due to the unreasonable design of the signs. In addition to the specific "recyclable", "non-recyclable" and "harmful" signs on the classified trash bins, the images, text and other signs of some goods should also be added, and these images should not be abstract,

which should be clear for users to recognize, and the design should be concise and clear.

3. Design ideas and development

3.1 Design goals

This topic is mainly aimed at outdoor classified trash bins in public places. The design of the classified trash bins should be considered to be able to correctly guide people to conduct classification, improve the classification awareness of the people, and make them fully understand the economic and social benefits brought by the garbage classification to the society. The design can be considered from the following aspects: (1). Appropriate materials are selected for the classified trash bins to make them difficult to deform, damage, and rust. (2). The openings of the trash bins should be larger. (3). Regardless of the placement of the trash bins, the users can conveniently put the garbage into them. (4). Appropriate colors should be chosen for the classified trash bins, which not only look beautiful, but also beautify the surroundings. (5) The inner tank of the trash bins should be easily taken out for cleaning.

3.2. Design positioning

In terms of the shape, the existing classified trash bins are mainly square and round. Although these trash bins are simple and elegant in the shape, it is inevitable to look rigid when they are used for a long time. Therefore, there is a great breakthrough in the shape design of public classified trash bins, which can be used for reference or they can be designed with meaningful shapes. Moreover, the capacity of the current classified trash bins is so small that the garbage will easily overflow, so the design of the shape must also be combined with the capacity issue.

In the selection of materials, they should be easy to clean, difficult to corrode, and cheap in costs, such as plastic, stainless steel, glass steel and galvanized sheet, etc.

3.3. Sketching

The technical development forces of China's environmental protection industry are mainly distributed in various major universities and research institutes, there is insufficient investment in technology development and it lacks of technological breakthrough. The environmental protection products are mainly conventional products with low technical content. In China, environmental protection infrastructure is mainly invested by the state, and the environmental protection equipment is still dependent on imports. From the perspective of the domestic trash bin market, the trash bins are mainly based on traditional mixed garbage bins, and the classified trash bins are mainly based on manual sub package. At present, it extremely lacks of practical and beautiful automatic classified trash bins with the function of deodorization in the market, as shown in Figure 1.

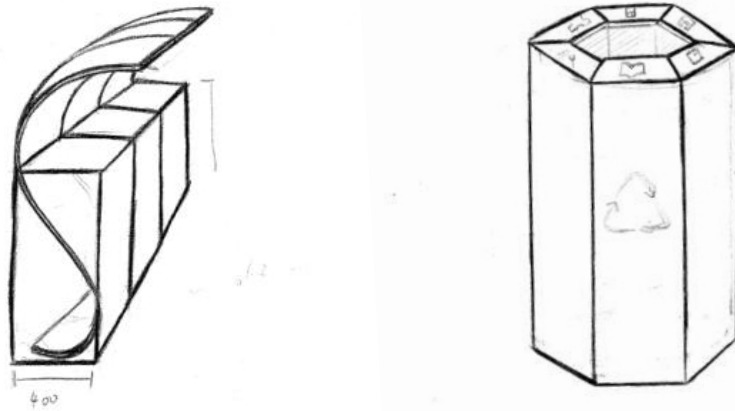


Figure 1 sketch design Figure 2 sketch design

From the perspective of the international market, the environmental protection industry is a growth industry. In China, the environmental protection industry is in the early stage of market-oriented development, where the total output value of the industry is just close to 1% of GDP, while the total output value of the environmental protection industry in developed countries has basically reached more than 250 million US dollars, as shown in Figure 2.

At present, most of the trash bins used in China are classifiable trash bins and un-classifiable trash bins. The automatic garbage classification bins have not been widely used in China due to the high cost. The ordinary classified trash bins only depend on people's awareness of environmental protection, and can not achieve the final effect of garbage classification. The classified trash bins on the street perform practically no function, and many people still litter. Therefore, such new types of classified trash bins with moderate price, wide range and humanization are strongly demanded in the market, as shown in Figure 3.



Figure 3 sketch design

However, due to the constraints of China's economic development level, consumption level and other related factors, the current awareness of residents in China regarding the classification of

recyclable waste needs to be improved. A sampling survey conducted in multiple communities found that nearly 95% of the trash bins surveyed are mixed garbage bins, the reason for which is that the cost of automatically classified trash bins is too high, and most residents can't adapt to the extensive type of classified dumping, as shown in Figure 4.

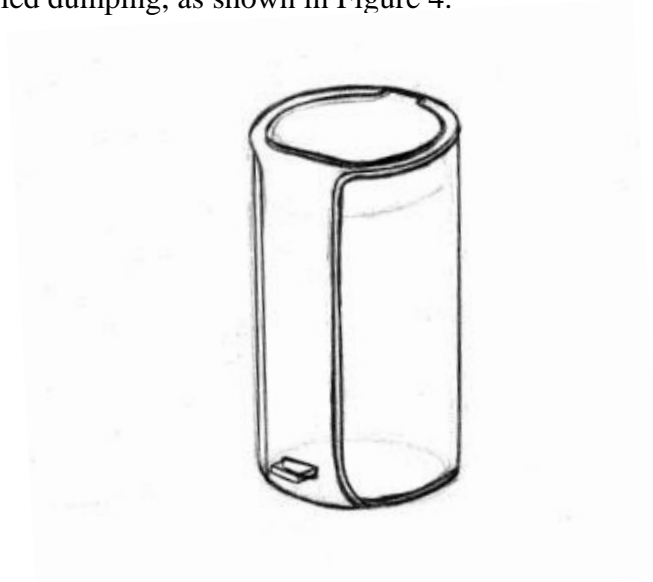


Figure 4 sketch design

According to the survey data, more than 1.8 million tons of domestic garbage will be produced in some province in China every year. Among the physical components of domestic garbage, it includes 11.97% of paper waste, 12.70% of plastic waste, 0.27% of metal waste, 2.46% of fabric, and 1.76% of glass. The above garbage belongs to recyclable garbage, as shown in Figure 5.



Figure 5 sketch design

Along with the growing demand for new type of environmental protection industry in the domestic market, more than 300 million Chinese families need to solve the problem of fashion home cleaning and environmental pollution, and public places such as hotels, medical institutions,

office places, and entertainment venues need to urgently solve the problem of garbage storage and classification. In the current technological era, as a new product in the market, the new-type classified trash bins lead the trend of upgrading of traditional trash bins, which have opened the market breakthrough and will become a new choice for the new generation, as shown in Figure 6.

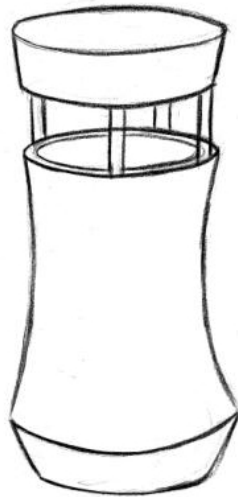


Figure 6 sketch design

In view of various factors, I will eventually decide to use sketch design (19) as the final scheme and conduct improvement.

4. Model making process

The model making is as shown in Figures 7-10.

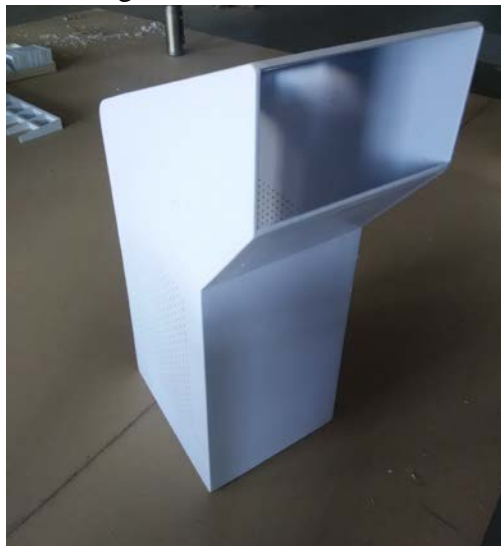


Figure 7: process picture

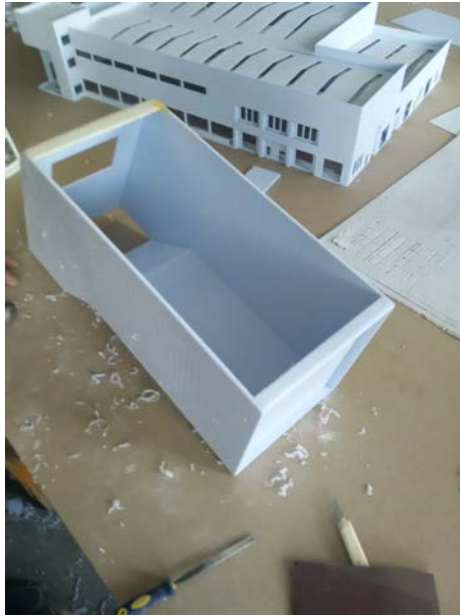


Figure 8: process picture



Figure 9: process picture

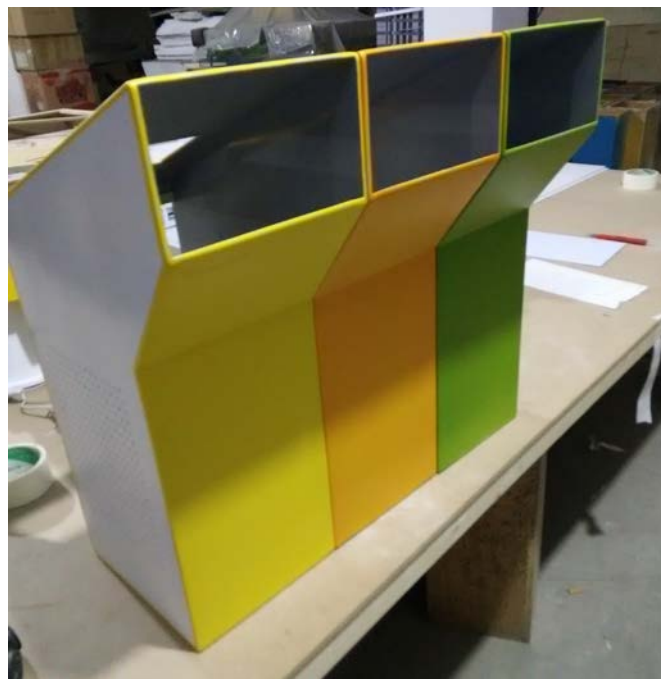


Figure 10: process picture

In fact, the environmental awareness and aesthetic level of Chinese people are gradually improving, and the types and quantity of trash bins are also constantly increasing. People pay more attention to the beauty and practicality of them, and the products are also developing in a convenient and intelligent direction. In some public places with a large human traffic, trash bins are basically equipped, but they are all old-fashioned and not novel, and thus there is still more garbage not thrown into them, which is just scattered about in a mess, with a stinking smell. Thus, it will seriously pollute the environment, damage the appearance of the city, and affect the health and life satisfaction of people. Therefore, a new type of classified trash bin with the classification function is urgently needed in the market, as shown in Figures 11-15.



Figure 11: physical model picture Figure 12: physical model picture



Figure 13: physical model picture Figure 14: physical model picture



Figure 15: effect picture

5. Conclusion

In terms of the colour, the classification of colours can also guide users to sort garbage, so each trash bin should have its own colour. For example, the red color represents hazardous waste, the green color represents recyclables, and the yellow color represents other waste. But it should also note that the trash bins cannot be designed with too many kinds of colors so as to avoid some problems like confusion, etc.

Regarding the signs, it's found from the survey that there are only "recyclable" and "non-recyclable" marked on the trash bins. However, people can not distinguish the type of garbage according to these signs. The author believes that it is not enough to only popularize the awareness of people regarding the garbage classification in order to have them accurately classify waste, so the marking patterns of garbage type can also be added in addition to the garbage classification marks so as to facilitate the users to deliver the garbage more accurately.

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