

Research on Application of Man-Machine Engineering to Ceramic Toilet Design

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Abstract

An analysis on design of ceramic toilet is presented to indicate the essentiality of man-machine engineering in design of bathroom products. Man-machine engineering, ceramic toilet design and application of man-machine engineering to design of ceramic bathroom products are researched, and it is indicated that product design should fully adapt to and meet human demands. The principle of man-machine engineering is utilized for effective design, and man-machine interaction and perfect and harmonious fusion of people and products are bodied forth.

Keywords

Ceramic toilet man-machine engineering.

1. Introduction

Man-machine engineering serves as the major factor in human-machine interaction in design of bathroom products. With consumers' increasingly higher requirements on quality of bathroom products, bathroom products production enterprises strive to make breakthrough from model, function and practicability of products, desiring to scheme out bathroom products approbated by consumers to touch their heart. Take popular toilets in the market for example, they do not simply make breakthrough from model and color, etc., but also widely apply human-machine interaction based on man-machine engineering to design, i.e. applying human-machine interaction in the aspect of health, energy conservation, leisure, etc. to raise product level, and scheme out convenient product with aesthetic appeal. Then, how to scheme out ceramic toilet in line with man-machine engineering in design?

2. Man-machine engineering

Man-machine engineering is mainly focused on coordinating accordance among people, machine and environment in different work, with research technique and appraisal instrument involving a lot of environments such as psychology, physiology, medicine, anthropometry, esthetics and engineering domain. The purpose of learning is to apply knowledge to varied disciplines to direct design and rebuilding of instrument, methods and work environment of the work, so as to ameliorate work efficiency, security, health and comfortability, etc.

So-called man-machine engineering is to apply the research techniques of such disciplines as anthropometry, body mechanics, work physiology and labor psychology, etc. to research body constitution and function characteristics, and to provide body constitution characteristic parameters such as size, weight, surface area, specific gravity, barycenter of each part of body, and correlation of parts in motion and accessible scope, etc. It also provides sensory functional characters such as contribution scope of each body part and habits in motion, analyzes physiological effect, energy consumption, fatigue mechanism in various labors and adaptive faculty of people to different workloads, and delves

into factors influencing people's psychological condition in work and influence of psychological factors on work efficiency, among others. Ceramic toilet is just a requisite tool in modern life environment. Applying man-machine engineering to its design can scheme out bathroom products with aesthetic appeal and strong practicability, effectively combine people, toilet and environment, thus making bathroom products serve people in a better way.

3. Design principle of toilet

(1) Reasonable modeling design refers to that the designer analyzes the investigation data of bathroom product market to redesign or modify the products based on positioning and speculation over toilet's model, to enable mass production of the products and meet consumers' aesthetic appeal, use custom and life style. It is mainly divided into reasonableness in four aspects: ① reasonable structure: means combining toilet's appearance with reasonable internal structure in real production, while product's appearance tends to be confined by product's internal structure. Thus reasonable product structure is usually thought about in the beginning of design. ② Reasonable selection of materials: reasonable selection of production cost and appearance materials is directly influenced by materials. The selection of appearance materials is the key to design, thereinto the most pivotal factor is selection of material texture of toilet in design. The reasonable material selection will add gloss of designed product; ③ reasonable function: so-called functionality of toilet refers to accepting or rejecting of corresponding function key; ④ reasonable operability embodies reasonableness of the course of visual and touch perception and use course of toilet in the course of human-machine interaction. This aims to adopt reasonable and comfortable operation mode, grasp comfortability of practical operation to eliminate discomfort or use difficulty in using.

(2) Artistic model design is where the spirit of toilet model lies. The product only boasting economy and practicality while ignoring aesthetic appearance is imperfect. The model beauty of toilet requires to be comprehensive and monolithic, including form beauty, structure beauty, craft beauty, material beauty, and strong reflection of era awareness as well as intense national flavor. Its model beauty is a comprehensive and relative concept, so esthetic model of bathroom products is devoid of a uniform and absolute standard, but is provided with following characters: ① the form beauty of toilet model is an important constituent of beautiful form and the external attribute of visual product, also appearance beauty of product. ② Material beauty of ceramic toilet: materials with different textures will lead to different psychological feelings. For example, ceramic material feels delicate and slick, clean and bright, easy for washing and erosion-proof; ③ era awareness: the aesthetic appreciation gusto changes with time development, and the designers of bathroom products model are required to reflect people's expectation in the sentiment forming an era, use model, color and material property; ④ different genders, professions, cultures and geographies divide people's aesthetic perception. Thus toilet models show necessary differentiation and preference to cater for people's demands; ⑤ unique geography and climatic environment produce different politics, economy, cultures and religions, also divide people's thinking way in differing regions. Therefore the model design of toilet made with artistic form is certainly influenced by national style. For example European bathroom products have luxurious and rational model, while Asian model is compact and smart, which are all reflected in their product model design.

(3) practical model design is requisite for toilet, and can fully exert materials' function of products. Generally speaking, toilets with different functions have dissimilar model designs, and the use function of toilet decides its model design. Therefore, model design of toilet must serve its utility function and embody scientificness of product and reasonableness of operation.

4. Application of man-machine engineering to ceramic toilet.

(1) Size relation in application of man-machine engineering to toilet. Ceramic toilet has developed rapidly in China. The turn of 21st century saw huge change of people's life and appearance of squatting pan changed bathroom space, which reflected improvement on people's life quality. In the 1990s, one piece toilet and two piece toilet, mainly dominated by middle and low grade, enjoyed something of a popularity boom. The birth of toilet greatly reformd bathroom design. By this time, the performance of toilet was significantly improved, and design was more humanistic with more esthetic shape;

In early 21st century, design of toilet began to develop toward energy-saving and intelligent bathroom products. When function and model requirements were met, people began to pursue comfort and health in design of bathroom products, hence, high-tech and water-saving bathroom products slipped into households. Characterized by stability and labor saving, toilet has become the mainstream article in household space. So in design and use, size relation of toilet became the focus of application of man-machine engineering. The toilet's size, proportion, area and so on are related to use comfort by people. So it is necessary to research man-machine engineering of toilet in design. The height of toilet influences greatly comfort of defecation. Different people in different countries vary in height, averagely 1.5-1.7m, so general height of toilet is 690-780mm, with water tank about 300mm high, which can facilitates calculation of capacity of water conservation. The closestool part is usually 400-450mm high, which is close to common chair's face sitting. In this way, people of all heights, high or low, can defecate comfortably; the length is basically 745-800mm, and width is basically 350-400mm, which economizes materials and suits use by the fat or lean, thus conforming to man-machine engineering; The size and shape of cover and seat ring of toilet are also very important. The size and curve of middle hole must conform to man-machine engineering. In all of this, basic size of toilet is 690-780 * 350-400 * 745-800mm, which comparatively conforms to data of man-machine engineering. However, as long as designed object conforms to man-machine engineering, change is allowed according to design demands. (As shown in figure 1, 2).

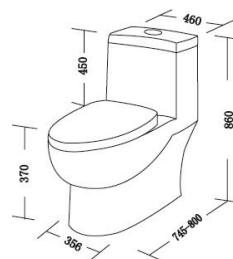


Figure 1

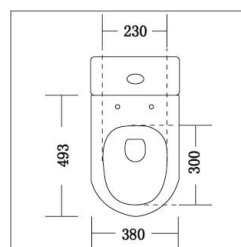


Figure 2

(2) Man-machine engineering in use of toilet. As a requisite article in life, toilet's use is more than just the product itself, and the matched bathroom accessories also contain man-machine engineering element. For example, the height of toilet and closing mode of cushion ring should be such designed as to facilitate user's stooping down to lift and close the cover when lifting cover, urinating, and close cover; the width, depth and water storage capacity of toilet should facilitate entering of the urine into pool to prevent spilling; in the behavior of sitting to defecating, the material and shape of cushion ring should be suitable for contacting body, and can comfort user who sits long; height and width of toilet should be

suitable for user to crouch and sit down, and the width should be suitable for two legs to contact cushion ring;

The position and illumination of lamplight should be suitable for reading, etc.; storage space and position of toilet paper should facilitate uses' taking, changing, moisture prevention, etc. The position of toilet paper box should be in front or at side of toilet, and should be reachable when user stretches out, with height generally at 500-700mm away from ground; the armrest height is usually 700mm from the ground. The vertical armrest for the oldsters and the disabled should be set at front 200mm away from front end of toilet; wastebasket should be placed at the side of toilet according to personal habit, and be inadvisable to be too near the back. The size and position of toilet and matched products should mainly aim to provide convenience and comfort and conform to man-machine engineering (as shown in figure 3).

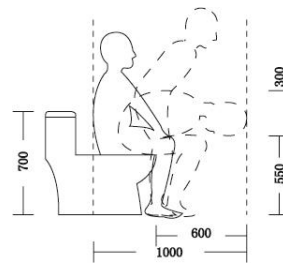


Figure 3

5. Conclusion

As people's requirements on living environment is escalating and science and technology is being effectively applied to design and production of ceramic bathroom products, the research on application of man-machine engineering to ceramic toilet cannot only stress product itself, but should fan out to cover size, usability and space utilization related to toilet, and should follow the relation between whole and part. As an important category in design of toilet, man-machine engineering expresses interrelation and contradiction among people, things, and environment. Meanwhile, the content between people and thing, people and environment, thing and environment should be grasped. Research on this is a direction of man-machine engineering and the substance of research on design of ceramic products, thus being of all-important significance.

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