

Preschooler recreational toy car form variable design

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Abstract: The core concept of the paper is to make the product more entertaining and applicable by changing the shape of the toy car. It also gives children a sense of novelty when using the product, making it more valuable and more usable for children. Based on the current market of children's toy cars, the concept of the multifunctional children's car is combined and transformed into a new solution, which will result in an innovative and highly utilised multifunctional children's car. The concept is based on the premise of safety, enhancing the design of the product while meeting the needs of children's curiosity and novelty, and designing a product that meets the expectations of pre-school children. The subsequent design not only shows the multifunctional aspect of the toy car for children, but also the innovative ways in which it can be transformed, allowing the buyer to see more possibilities, stimulating interest in children's products and inspiring a sense of childhood.

1. Introduction

In recent years, the rapid development of society is inseparable from the rapid development of the national economy, network information technology progress, whether it is living conditions or lifestyle have undergone radical changes. People for the material level and spiritual level of the overall requirements have also been greatly enhanced, especially the implementation of the national policy of three children. China has entered the era of three children, whose products accounted for a significant part of the family investment. This is why the design of children's products has posed a greater challenge and the requirements for their use have increased further. Children's toy cars are indispensable for children's growth and development, and play a major role in their development. As children grow older, their functional requirements for strollers are changing. At the same time, with the gradual increase in people's concept of environmental protection, the rational use of resources and the protection of the ecological environment have become the theme of the times. The children's products industry, as an important part of China's market economy, plays an important role in the healthy growth of children and the development of the economy.

The design concept of changing the form of children's recreational toy car products meets the requirements of the times and is of great significance in saving resources and promoting the sustainable development of the stroller industry, as well as being an effective way of designing for the diverse needs of children's groups. In order to design a child's toy car that meets contemporary requirements, has a high safety factor, and has a perfect change of function, it is necessary to understand the functional differentiation of each part, to meet the diversified needs of parents for children's car functions, and to meet the needs of the market.

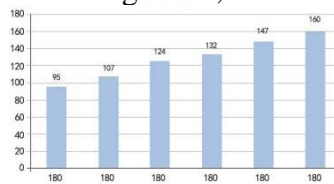
2. Significance of the study

First of all, the idea of combining and changing the design of the children's toy car is to meet the needs of the modern family in terms of changing the form of the children's toy car, changing the function and meeting the needs of the children. In the process of using this product, children can change the functions of the toy car whenever and wherever they like. By studying the physiological and psychological characteristics of children, fun can be better integrated into the design of the toy car, so that children can not only have more fun in the process of using the toy car, but also grow more knowledge and develop their intelligence [1]. Secondly, it saves money and space in the home, but more importantly, it improves children's hands-on skills and changes their thinking, extends the life cycle of the product, frees up more space in the home and avoids wasting resources. It is a rational use of resources, protecting the ecological environment while meeting the requirements of the times. Making changes for the better while bringing a better experience to the user. Finally, the current market is full of children's recreational vehicles, but they are also very multi-functional, short-lived, with a high rate of disuse and a serious waste of resources [2]. Combining the design of children's car products with the concept of morphological transformation design provides a new design concept and research idea for the design of children's recreational toy car products.

3. Market Analysis

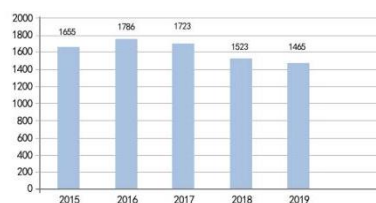
3.1 Analysis of existing products

In recent years, strollers are no longer a "luxury item" for baby families, but have long been transformed into an indispensable necessity for children on their way to growth. According to the data survey, by cumulative calculation of the current number of births of infants and toddlers found that the global population of more than 800 million people number of infants and toddlers under the age of 6 years old. The huge consumer market for strollers will exceed RMB 100 billion globally each year. However, the children's stroller market was hit by the New Crown epidemic. As the epidemic was quickly brought under control, the stroller market rebounded and developed steadily and continuously for the better, as shown in Figures 1, 2.



Unit: 10,000 people

Figure 1: China Baby Carriage Market Size Statistics, 2015-2020



Unit: 10,000 people

Figure 2: Statistics on births in China, 2015-2019

Through Figure 1 and 2 to understand the rapid growth of China's pregnancy, infant and children's market in the context of consumer upgrading. After the development in recent years, China's stroller

market is booming, multi-functional children's toy car market still has a large market, there is still a great demand for consumption.

3.2 Consumer analysis

3.2.1 Analysis of the user population

In order to further certify the market demand and user needs of multifunctional children's toy cars and the preferences of the users, the authors initiated a series of data questionnaires (as shown in Figures 3 to 6 below), in this questionnaire a total of 112 points were collected, with 98 valid questionnaires and a male to female ratio of 6:4, and in this data it was pointed out that the most frequent use of children's toy cars were preschool children aged 3-6 years old, occupying In this data we find that the frequency of use decreases with the age of the child. In another interesting set of data, it was found that no matter what the age of the child, their interest in and time spent with toys decreases significantly as the time spent with them increases and as they get older, with 40% of the children saying that they spend most of their time with toys within 30 minutes and only 5% of them being able to play with them for up to 120 minutes. In the questionnaire we therefore concluded that the age at which children use children's cars is mostly concentrated in the 0-6 age group, a period when children are very active and have a strong curiosity about the outside world. And boys have a greater need for children's toy cars than girls, with 40% of users maintaining a time frame of 0-30 minutes for stroller use, perhaps because children have limited physical strength and patience and find it difficult to keep using toy cars for long periods of time.

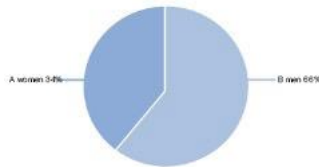


Figure 3: Gender distribution of users

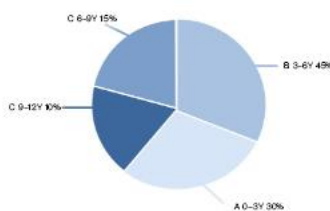


Figure 4: Age distribution of users

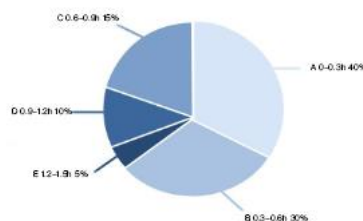


Figure 5: Distribution of users' time spent with strollers

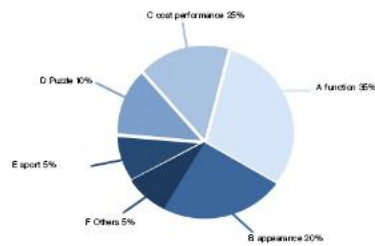


Figure 6: Distribution of buyers' focus in choosing a stroller

In the stroller products children are the object of service, but because they are still young, their own ability to judge the products is also still immature, it is difficult to make rational choices and judgments. Therefore, the design of stroller products should be based on humanization, designing stroller products that are beneficial to children's growth and development, and designing products that are safe, comfortable, harmoniously colour coordinated and aesthetically pleasing under the premise of meeting the physiological and psychological characteristics of babies. Modelling, comfort and safety are crucial factors in the design of stroller products, which can drive children's emotions and meet their preferences and aesthetics, among other elements. Therefore, we give primary consideration to children's needs when making stroller designs, and co-ordinate the needs and desires of users in the later design to reduce deviations for the later design positioning and design children's toy car products that satisfy the users.

3.2.2 Analysis of the purchaser's decision making

In the process of people's consumption, the link of the consumer's decision making process is very important. As children are young and do not yet have the maturity to choose their purchases, the final decision maker is mostly the child's guardian, who is also the direct purchaser of the stroller. In fact for most stroller products, parents are also the operators of the stroller aids. Most of the products on the market nowadays focus only on the needs of the infant and toddler group, while ignoring the implicit needs of the parent group.

Therefore, when designing stroller products, only by fully understanding the purchase motives and decision entry points of consumer groups can we better design products that cater to market demand.

When parents buy children's products, they mostly consider the following: safety, colour, cost effectiveness, practicality and size. Safety is perhaps the most important of these considerations: are the materials used harmful? Are the materials used harmful? Is the quality and safety of the product satisfactory? Will it cause physical harm to children? These are all issues that will be on the mind of the purchaser when making a decision, therefore the CMF design of our products should be based on safety first and non-toxic as the primary condition.

4. Design thinking

4.1 Programme conception

Due to the physiological characteristics of children, they belong to a vulnerable group and are more prone to injury, so the primary consideration when designing children's products is safety. According to national safety monitoring regulations, safety is the most basic prerequisite for the design of children's products, and only after it is met can other functions of children's products be considered. A stroller is like a child's partner, with whom the child has an intimate relationship, and if there are hidden safety issues, it will cause great harm to the child's health [3-5]. The following

points should be noted when considering the design of toy vehicles based on safety elements.

(1) Appearance safety

For strollers, in addition to the beauty of the appearance, more safety factors should be considered, such as whether the shape is rounded and whether the edges are sharp.

(2) Structural safety

Whether the structure of the stroller is solid, reasonable, stable and tough enough to pass the test. Safety issues such as whether the appearance of small parts is sharp and whether the parts will be swallowed by mistake when they fall off should be fully considered in the stroller design process.

(3) Material safety

With the emergence of a wide range of new materials, the most worrying aspect of stroller materials is undoubtedly safety. As a stroller that comes into close contact with children, the child's hands, mouth and legs will be in close contact with body parts. Therefore, when choosing a stroller material, it must be a safe and green material that is free from harm and pollution. For example, food contact grade pp material, safe from contact, as shown in Figure 7.



Figure 7: PP material diagram

4.1.1 Functional design elements

It is a basic requirement for products to have a reasonable function. In the design of diverse children's toy car products, both in line with the requirements of the concept of green and sustainable development, but also to meet the illusory repeated use of the basis of high recycling and reuse, but also to meet the dual needs of parents and children [6]. As children change in age, the function of the stroller is constantly changing, and this stroller product is functionally based on the design and application of children's toy car form changes. Through the innovative combination of children's toy car functions, and through the children's psychological needs and combined with the children's growing process of changing the use of children's car design, in the case of the main body of the basic unchanged through the lifting and splitting and other structures to achieve the children's scooter to push the scooter to the single board scooter between the functions of mutual transformation. The realization of different functions of the baby stroller products will play a value of maximum use.

The growing nature of children dictates that the design of the stroller should consider the diversity of functional changes and refine the stroller functions to meet the needs of children in different periods of growth.

4.1.2 Design elements

Styling plays an important role in the design of strollers. Popular stroller designs are often innovative and unique in appearance, as shown in Figures 8, 9 and 10. Innovation is therefore the first step in attracting the attention of children. Strollers play a key role in the healthy development of children as a way of connecting them with social transport.



Figure 8: Cute shaped stroller



Figure 9: Overriding shape stroller

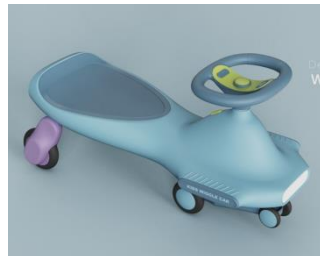


Figure 10: Rounded shape stroller

4.1.3 Material design elements

At present, the common materials used in toys are cloth, plastic, plastic natural materials (such as wood, bamboo and rattan) and metal. The textural expression of different materials can give different tactile sensations. Cloth and velvet are soft and warm, glass is transparent and smooth, metal gives a cold and hard feeling. Tactile sensation is one of the most important sensory experiences for children and it is through touch that children initially recognise differences and perceive the outside world. Through touch they can identify objects that are hard, soft, smooth, rough, warm or cold. If the visual sense is the external manifestation of matter, then the tactile sense is the material connotation of feeling. Therefore, the design of the safety performance of the stroller has a profound impact on the health of children.

4.1.4 Elements of colour design

The eye is the window through which a child knows and feels the world. All the objects we see have a combination of colours. The purer and brighter the colour, the greater the impact and the easier it is to attract children's attention. Psychological research has shown that most young children like bright, vibrant colours with a high degree of brightness and purity and significant contrast. As children get older their choice of colours changes, gradually shifting towards softer shades.

This shows how important colour is in children's visual space and their tendency to draw attention to themselves.

5. Design options

5.1 Design target positioning

The design takes the physiological and psychological characteristics of children as the starting point and their interests as the basis for design, and takes the design and application of children's toy car form as the characteristics for product production practice. Through the innovative combination between the functions of children's toy cars, and through the psychological needs of children and combined with children's growing process to change the use of children's car design, the overall body through the lifting and splitting and other structures to achieve the children's scooter to push the scooter to the single board scooter between the conversion. By changing functions manually, it is easy to give children a sense of achievement. The knowledge is hidden in it, which is both entertaining and educational [7].

With safety as the basis for the purpose of rounded shapes, as well as catering to children's preferences picking bright colours as the theme colour to create children's toy vehicles that wind up meeting children's preferences[8]. This not only adds to the innovative and fun nature of the product but also allows for a multi-functional blend of uses that can meet the different needs of children. Creative toys will make childhood more exciting and good design can make toys more valuable. The goal is to enhance children's minds and nourish their hearts, to meet their inner developmental needs, and to make toys that last and last.

5.2 Sources of inspiration

The inspiration for this change of form for the children's recreational toy car came from working as a part-time children's teacher in a drawing studio, where I learnt that children are more imitative in their consumption and have an obvious herd mentality due to their immature psychological development [9]. But at the same time, early childhood is also a period of parental dependence, as they are only users of the product, and it is often the parents who choose to buy the product. Thus, by observing children's toy car purchases, it is clear that in most families, as children's demand for children's toy cars increases, parents need more energy and money to purchase more functional, single, antiquated children's toy cars, which are not only inconvenient to carry but also easily cause space congestion. But nowadays the children's toy cars on the market are too single-functional, this children's entertainment toy car form change design through the transformation of functional form to bring the user to make a better change and a new sense of experience.

5.3 Product Design Sketches

Sketches are the beginning of product design development and are an important method of design research for designers. Pre-sketching schemes are mainly an expression of the pre-conceived ideas, as well as an attempt to refine and summarise some ideas, and to refine and summarise local shapes.

Pre-sketching is mainly to draw out various original ideas and to analyse and evaluate them, to push and analyse them according to each proposal, to select the best solution, and then to optimise the drawing process, to try to express the design ideas intuitively and graphically. Through sketching, the product's shape, details and structure are studied and analysed in a comprehensive manner, laying a good foundation for modelling and rendering at a later stage. The following sketches show the content of the preliminary scheme, as shown in Figures 11 and 12.

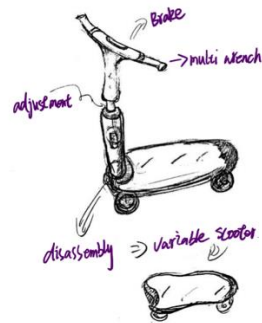


Figure 11: Sketch of a child's car

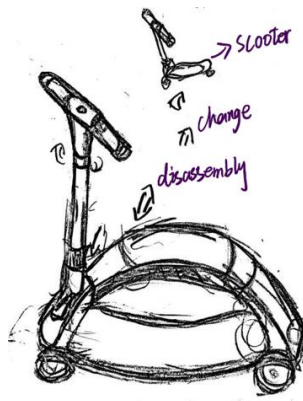


Figure 12: Sketch of a child's car

5.4 Scheme determination

Through the conception and drawing of the preliminary sketch scheme, several different sketch design schemes were initially formed, each with its own characteristics and shortcomings, from convenience, ease of use, stability, flexibility, adjustability, safety and comfort, appearance and modelling, etc. After analysis, selection and deliberation, one of the schemes was selected for in-depth and detailed design optimisation, in-depth and detailed analysis of the product modelling, as well as further design study of the The shape and local details of the product were further designed and studied, and some of the details were decomposed in order to achieve a detailed design and to pave the way for the next step of 3D modelling, as shown in Figure 13.

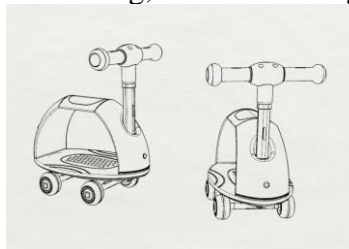


Figure 13: Diagram defining the programme

5.5 Product display

The main idea of this work is to focus on the change of the toy car form to achieve the change of the function of the product, from the child's handheld scooter and single board skateboard, and the

innovative combination of the two, and combined with the process of children growing up to change the children's car design, through the spiral structure to change the form. It is designed to meet different needs and to achieve multifunctional use. It increases the interaction between parents and children and gives children a good childhood. Let children's products have a higher quality of enhancement, so that people pay more attention to the development of children's changing needs, and no longer just develop the habit of blindly spoiling children [10]. Based on the original shape of children's toy cars in the market, the design technique of using morphological transformation is used to process the children's toy cars and design children's products that meet children's expectations. In addition to the use of drafts, relevant software is used to model and render them, showing the innovation of children's appliances and provoking people to pay attention to children's products. This is shown in Figures 14, 15.



Figure 14: Effect



Figure 15: Effect

6. Conclusion

The design of this work was conceived to meet the changing needs of today's average family in terms of the combination of children's toy cars, the change of function and the need to meet the changing needs of children. In today's rapidly developing world, the space available to everyone is becoming more and more compact. The design concept for the changing shape of children's toy cars was conceived to meet the needs of today's modern families for changing shapes, changing functions and meeting the changing needs of children. For the family, it is more economical and space saving, for society, it avoids the waste of resources and is more environmentally friendly. Through an in-depth investigation and understanding of the shape of children's toy cars, perhaps more should be done to address the shape, colour and function of many children's toy car designs and how to meet the needs and pain points of children's users, so that the product design can take its place in the market.

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