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Design and Development of a Companion Toy for Children with Autism

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Abstract: Globally, there are more than 67 million people with autism, 40% of whom are children, and the number of children with autism in China has reached more than 2 million, with a rising trend year by year. The lack of social skills is the core deficit of autistic children, which seriously affects their social development. Early intervention treatment is especially important for autistic children. With the progress of the times and the development of technology, the research on the use of modern technology for autism intervention is increasing, and based on the characteristics of autistic children's "pro-objects", more and more intelligent products play an important role in helping autistic children's rehabilitation and education. In China, there is less research on products for autistic children, especially on intelligent products, and most of the intelligent products on the market are designed abroad. Against this background, this project explores the needs of autistic children in intervention therapy by studying the social interaction ability of autistic children, exploring the design strategies related to them and practicing the design from the perspective of smart companion products guiding the social intervention of autistic children.

Keywords: Autistic Children; Companion Robot; Emotional Characteristics; Product Design.

1. Background of the Study

Autistic children have long been a marginalized group in our country. It is only in recent years that the education of autistic children has been recognized by society and gradually attracted attention. Autistic children lag behind normal children of the same age in emotional cognition and other aspects, and the best treatment period for autism is 3-5 years old, so I will target the population of 3-5 years old autistic children to conduct research and design.

The team started from the literature research on autistic children, analyzed and summarized the current methods of treating autistic children in detail, and finally found a way to start through the music interactive therapy, during which it also carried out research on related products and field interviews, analyzed the direction of the product design, and launched an innovative product research and development combining with the current principles of intelligent interactive products to make a contribution to the autistic children in China.

2. Significance of the Study

Aiming at the special group of autistic children, the concept of play therapy is put forward, which focuses on analyzing the design of toys in play therapy. It can be found through the study that toys are mostly used as the medium of various forms of play therapy, and toys, as the effective objects in play therapy, have always been playing an extremely important role, so toy designers should take into account the psychological, behavioral, cognitive and other factors of the autistic children in designing toys. Therefore, when designing toys, toy designers should fully consider the psychological, behavioral, and cognitive factors of autistic children and follow the playfulness, safety, and functionality of toy design. These toys allow autistic children to get a better sense of pleasure and interaction with others when playing with toys, so that this pleasure can be used as a reinforcer, both verbal and non-verbal, which has a significant effect, which further verifies that toys are the material basis of play therapy. Finally, as the number of children with autism is increasing dramatically every year, the research in this country is lagging behind, and it still remains on the validation of foreign theories, so the research on this topic is also of some practical significance.

3. Current Status of Research at Home and Abroad

3.1. Current Status of Autism

Autism is a pervasive developmental disorder caused by lesions in the brain and nervous system, most often in early childhood.

Since its discovery in the 1940s, researchers in various fields have conducted different studies on autism from the directions of medicine, pedagogy and psychology, and have achieved corresponding research results in various aspects such as etiology, early diagnosis and intervention. However, with the improvement of diagnostic level, the improvement of diagnostic tools, the expansion of diagnostic scope, and the improvement of public awareness of autism, the prevalence of autism has shown a rising trend year by year. Currently, reports show that autism is one of the fastest-growing diseases, and the number of children with the disease has attracted great attention from all over the world. 2014, the U.S. Centers for Disease Control and Prevention released the latest prevalence rate of autism, which has risen from 1:50 in 1975 to 1:68, and now every 20 minutes a child in the world is diagnosed with autism. Since 2008, April 2 has been celebrated as World Autism Day, and by 2011, there were more than 67 million people with autism. China first included autistic children in its national survey of children with disabilities in 2001, and included autism rehabilitation training in its Eleventh Five-Year Development Program in 2006, specifying that autism rehabilitation training institutions should be established in all regions. Report on the Developmental Status of Children with Autism in China" pointed out that the incidence rate of autism in China is about 0.1%, referring to the international

prevalence rate, and it can be estimated that there may be more than 10 million people with autism in China, of which the number of people aged 0-14 years old with the disease may be more than 2 million, and the prevalence rate is increasing year by year. Due to the complexity of autistic children's behavior, ordinary schools are generally reluctant to accept autistic children into their schools. However, due to the serious shortage of public institutions for autism in China, and the expensive fees charged by most private institutions, most autistic children can only be intervened and educated at home, and the lack of professional knowledge and guidance, and some parents' lucky breaks have led to the lack of timely and effective treatment for many autistic children. In addition, no matter whether the rehabilitation education is conducted in specialized institutions or parents are trained to conduct intervention at home only, as autism is associated with lifelong, so the families of autistic children have to bear a huge economic burden and mental pressure, and also bring unprecedented challenges to autism-related industries and social security.

3.2. The Need for Social Thousand Pre for Children with Autism

Autism is usually diagnosed before the age of 3, and 2-6 years old is the optimal time for autism intervention, the earlier the intervention, the better the treatment outcome. During the optimal treatment period, 20-30% of children who undergo systematic, scientific intervention and treatment are able to complete basic self-care, and some high-ability children with autism can develop their dominant intelligences, such as music and math, into life skills that will enable them to successfully return to social life.

Social interaction disorder is one of the most central features of children with autism, and the disorder is lifelong, with far-reaching consequences for the development of children with autism. It includes inappropriate social behaviors in social situations, difficulties in initiating and responding to social interactions, and inability to share personal experiences and respond appropriately to the feelings of others, which deeply affect the social, emotional, and cognitive development of children with autism, and consequently affect their quality of life. Therefore, in recent years some researchers believe that improving the social competence and enhancing the social skills of children with autism is the key to intervention treatment, because even if an environment full of interesting interactions is provided, for children with autism who do not have social comprehension and social interaction skills, they are still not able to participate in it and enjoy the interactive interaction. and enjoy the fun of interacting with each other.

3.3. Current Status of Products for Children with Autism at Home and Abroad

At present, there is no uniform definition of domestic and foreign products for children with autism, but the function of foreign products for autism is introduced as: alleviate the impact of autism disorder, enhance or abate certain problem behaviors, alleviate emotions and cognitive correction and so on. Foreign product design for children with autism focuses on the characteristics of autistic children themselves, although such products are also applicable to ordinary children, but more targeted to children with autism. For example, Figure 1.3 shows a special "tent" (Social Sensory Architectures, hereinafter referred to as SSA) is designed with the principle of sensory training. In this three-dimensional space, children with autism can freely and safely maneuver, roll and climb. At the same time, SSA is very intelligent. Through the use of elastic textile materials, sensing technology and customized software, SSA becomes able to interact physically, visually and auditorily with autistic children, and the feedback of the contact area and pressure is conveyed to autistic children through pictures and music, which in turn enables them to understand and perceive their own bodily functions and enhance fine motor (hands, wrists, fingers, feet, toes, lips and tongue and other small movements of body parts) and gross motor (including head control, sitting, rolling over, crawling, standing, walking, squatting, running, jumping and other movements) abilities, while the customized scenes can lead them to be curious about the outside world and passionate about interacting with the outside world, and no longer enclose their selves in a corner.

Figure 1. Product design for autistic children (a)

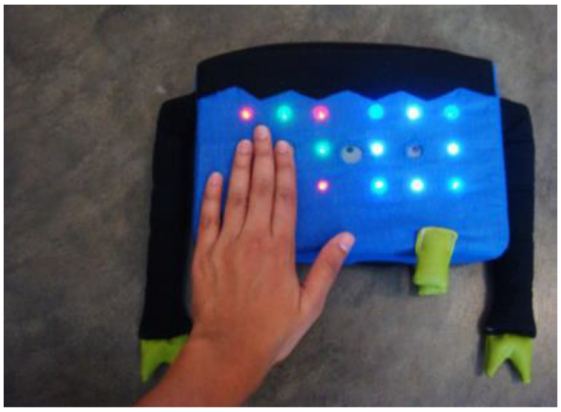

Figure 2. Product design for autistic children (b)

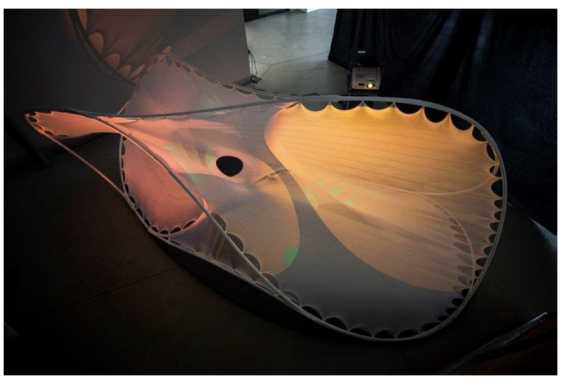

Figure 3. A special "tent" (Social Sensory Architectures)

The wearable smart bracelet Reveal can monitor the physiological conditions of autistic children in real time by measuring and tracking changes in the three main

physiological indicators of heart rate, galvanic response and body temperature, thus measuring the autistic children's response to anxiety, which can detect the precursors of their behavioral breakdowns and allow the chaperone to help the children to soothe their emotions before their emotional outbursts. In addition, the application of robotics in autistic children's companion products has gradually become a research hotspot, such as intelligent children's companion machine robot can assist adults in caring for children's development and growth, as well as providing children with learning counseling, games and entertainment and safety supervision, which to a certain extent reduces the burden of young parents' life and Mental pressure, in the family and early childhood education play a good auxiliary and complementary role. The family robot "Papero" released by NEC Corporation of Japan.

Not only has the voice recognition ability to talk with children, but also by the face recognition system in the home to realize the monitoring trespassing. Moreover, Papeiro can move freely in the room without being affected by obstacles, and can realize its real-time monitoring by following children's activities. At present, the domestic research for special children's educational support products is still immature, most of the products designed for autistic children on the market are mainly teaching and learning toys, and most of them are imported from abroad or refer to the improved design of foreign toys, and there is a large gap in the market for products for autistic children. Compared with foreign countries, there is also a certain gap between domestic intelligent escort products in terms of innovation and technology. In recent years, although there are relevant toy companies and research institutions gradually intelligent, fun children's companion products as a research and development direction, but for autistic children's intelligent companion products are almost none.

3.4. Definition of Autism and its Main Characteristics

Autism, Spectrum Disorders (ASD), also known as autism, is a neurodevelopmental disorder that most often begins in early childhood development and is characterized by impaired social interaction as well as communication deficits and repetitive stereotyped behaviors with a narrow range of interests.

Social interaction disorder is one of the most central features of children with autism, and without intervention this disorder is lifelong, placing a heavy burden on the child, the family and society. It includes inappropriate social behaviors in social situations, difficulties in initiating and responding to social interactions, and an inability to share personal experiences and respond appropriately to the feelings of others, which profoundly affects the social, emotional, and cognitive development of the child with autism, and consequently his or her quality of life.

3.4.1. Status of Autism in the Country

In recent years, the incidence of autism in the world is increasing year by year. According to the latest statistics from the United States, the incidence of autistic children has risen directly from 1/88 in 2009 to 1/59 now. The incidence of autism in China has reached as high as 0.7%, and there are currently more than 10 million people with autism disorders, of which there are about 2 million children under the age of 12.

In our country, the group of autistic children has always been a marginalized neglect. Autistic children's education and guidance and be recognized by society and gradually attracted attention, but in recent years. A great deal of media publicity has brought autism into the public eye, but overall, it still lags behind the West.

4. Current Problems and Shortcomings

Although this is a useful exploration, the study may need further exploration at a later stage in terms of the depth of the study due to the lack of literature and limited personal ability and other circumstances. The design of this paper draws on some methods in autism rehabilitation therapy, which are researched by medical practitioners or special educators based on the developmental characteristics of children with autism, and long-term domestic and international education and teaching experience has also proved the effectiveness of these treatment methods. However, after applying them to products, it is necessary to evaluate the effect of the intervention of the product, and then verify the usability of the product. Due to the special characteristics of autistic children, this process requires a long period of time. So, this aspect can be continued to be explored and measured in the next step of the research. In choosing the research location, we only chose pediatric hospitals and hobby children's rehabilitation centers, although in the preliminary literature research to understand the geographical differences will have an impact on the results of the research, but for personal reasons and later research in-depth considerations, we can only be close to the representative of the research location, so the research of the population may be limitations, the results of the research can only serve the needs of this topic research, I hope that in the future We hope that in the future, we will have the opportunity to carry out volunteer service in other places to enrich the understanding of the subject in a more comprehensive way. Due to the special nature of the research object and with the daily order of the organization, we can only use the observation of the bystander type, for the parents of the interview in order to avoid touching their heartbreaks cannot be more in-depth exploration, although the interviews with teachers and doctors is more complete, but due to the research object in the description process of personal subjectivity, so cannot guarantee the objectivity and accuracy of the results of the research.

5. Design Principles

Intelligent companion products that incorporate social intervention methods no longer serve as a passive "play" tool, but rather as a close companion and intelligent teacher when interacting with autistic children. The interaction between children with autism and the product does not occur naturally, but is formed based on certain design principles. In order to form a harmonious interactive relationship between products and autistic children, it is necessary to take into account the psychological characteristics, behavioral characteristics and needs of autistic children in the design, which can be summarized as the principle of safety, the principle of generalization of intervention effects, the principle of experience and the principle of entertainment.

6. Summary

Based on the social intervention methods of autism and the characteristics of autistic children, we summarize the methods of designing intelligent companion products and apply them

to social practice.

Accumulate a large amount of primary research data on the study of autism rehabilitation education characteristics. We go deep into the classroom of autistic children's rehabilitation education to dig out the problems and needs in autistic children's social intervention from behavioral observation, and to understand their problems and needs by interviewing other important participating roles in autistic children's rehabilitation education: teachers, parents, and doctors.

Based on the research cases, a typical character scenario story of rehabilitation education for autistic children is established. Based on a large number of literature studies and field studies, the characteristics, needs and problems of important players in the rehabilitation education of autistic children are sorted out, and the typical character scenario story is established. The characteristics and needs of typical users are clarified.

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