The potential of artificial intelligence toys — a technology-based design approach

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Abstract

Artificial intelligence is moving to a next step of development and application areas. From electronic games to human-like robots, AI toy is a good choice for next step during this process.

Technology-based design is fit to the development of AI toy. It can exert the advantages and explore more value for existing resources. It combines AI programs and common sensors to realize the function of intelligence input and output.

Designers can use technology-based criteria to design and need to consider the possible issues in this new field. All of these aspects can be referenced from electronic game development.

Keywords

Artificial intelligence, Toy, technology-based design

1. Introduction

Artificial intelligence has been developing for decades. It makes computer do more works than before. More and more AI technology is involved in physical products. It is changing the way of interaction between people and products. In this paper, I will give some points of view from my own about the application of AI in products, and the design approaches for these products.

This paper provides a forecast and argument for future products and design approaches.

We have a dream of computers that can think, learn, create, and have emotions the same as human. [1] During the development of AI technology, scientist needs achieve this aim step by step. Combining research and development with a practical and valid market together is a best way for development. If the market is common market, it will be a perfect combination, because common market can provide economic support and test the product in a larger range. In the past, the most large application area for AI was electronic games. Recent years, its application area extends to real product, production procedures, software, and R&D areas. In my opinion, one of the most potential AI development and application areas for next generation is AI toys.

This paper includes following four parts. At first it will analyzes why AI toy will be the next most potential application areas for AI development. And then I will give a definition about AI toy from my vision. Following that, this paper will talk about technology-based design which is fit to AI toy development, and what kind of technology can be used in AI toy. At last, I will give some suggestions about design methods and processes for this kind of product, and talk about possible issues and application areas.

2. APPLICATION DIRECTION OF AI TECHNOLOGY

It seems that artificial intelligence is technology is one of the most important directions of computer science. And it could take a dynamic change to our life in some future days. At present, AI has been widespread used in electronic games, but that is just a start. It isn't really used in extensive productive field or embedded in our daily live, because AI technology is still under development. But the time of AI product is coming.

One of the most potential markets for future is AI toy, since it has the same advantages as electronic game and is more practical than electronic game. It is a suitable choice for step by step progress to the time of human-like AI robot. John Laird said in his AAAI invited talk *"artificial intelligence research and computer games have quite a bit to offer to each other."*[2] That shows that electronic game combined very well with AI technology in common market.

The both advantage of game and toy is that they can provide a virtual, comprehensive, and marketable platform for AI research. The virtual means that before AI technology does a real job we can test it in a safe environment. And the comprehensive means this environment can simulate as real as possible for a test. The feature of marketable means it can combine development and application together. So, between technology and products, they have a mutual promotion for each other. It is an optimal combination between research and application.

3. WHAT IS AI TOY?

For more clear discussion, I need give a definition about what is AI toy from my view.

At first, it should be a toy in general meaning. *"For the young, toy is an important part of the process of learning about the world and growing up. For the Adults, toy is used to form and strengthen social bonds, teach the young, remember and reinforce lessons, exercise*

minds and bodies, practice skills, and decorate their living spaces. Toy is more than simple amusement, and the way they are used profoundly influence most aspects of life." [4]

And secondly, AI toy should exert the advantage of AI technology. Rodney Brooks is the director of the MIT Artificial Intelligence Lab. He said *"We propose developing the perceptual and intellectual abilities of robots so that people can interact naturally with them."* It shows that the abilities which AI should take to products always include two facts: *"perceptual and intellectual "*. [3] They provide mean for interaction and thinking.

- About the interaction way, the special interaction skill is the fundamental feature to an AI toy. Toy use these skills to input and output information with people. There are several skills which researchers have identified are suitable for AI product. "These include the ability to recognize others, to interpret gestures and verbal expressions, and to recognize and to express emotions" (Rodney.B 1999). These skills make product communicate with people more naturally [3]

- Secondly, AI technology gives ability of learning, creation and emotion to the toy. This feature simulates the thinking way of human and makes toy can finish some work which only can be done by people in the past.

Many developers prefer to call robot toy instead of AI toy. Indeed, we have dream about robots, and are striving for the aim of robot. However, in my opinion, we'd better separate different steps of the progress to make it clear. The progress starts from electronic game to toy, from toy to product, from product to robot. This plan is from a total virtual environment change to the real world and to the practical human society. For distinguish future mankind-like robot, I use the term of AI toy.

4. TECHNOLOGY-BASED DESIGN

4.1 What is technology-based design
How to face the challenge of these new generation product? I propose using technology–based design method to realize the meaning of AI into our daily life. In this way, developer and designer have a stable and meaningful starting point for work. That doesn't means the product is not for fulfilling people's need, but the project focuses on exerting the advantage and exploring more values of technology.

Technology–based design is a kind of resource-based design. Depending on different project, we can choose different starting points for a design process. Resource-based design always is compared with need-based design. [10] For resource-based design, designers focus on what we have got already and make full use of existing resource. For need-based design, it is more like a design for dream. That means designers get an aim first, and then try to find resource to fulfill.

Technology–based design can fit such a technology time. It always likes a bridge between technology and application to improve our live. At present, more and more new technologies need to realize their meanings. Technology–based design can provide some appropriate approaches for making technology embedded in daily life for common people. Scientists announce new achievements every day, but these technologies always look ahead in future and are far from real life.

AI technology is a good example for this phenomenon. Through the development process of electronic game, we can get a skim of technology-based design. Along with computer becoming faster and more powerful, the focus of PC game development moved from simple calculation to multimedia application, and moved from video and audio reappearance to human thinking simulation. All of these changes are based on the development of modern personal computer.

 4.2 Technology in AI toy
AI provides more possibility to explore interaction way between people and product. The application of AI technology could be divided into two categories: intelligence recognition and thinking simulation. They are the core technology for realizing the two basic functions of AI toy—recognize information from input and generate reaction for output. Combining with diverse sensors, AI toys can use different way to get input from user, and using screen, speaker and mechanical actions to give output. That means AI toy need to use many technologies at the same time. That is a challenge and opportunity for designers to develop interesting and marketable products.

To realize the interaction feature for input, AI toys could be based on several intelligence recognition technologies listed as below: voice recognition by microphone, gesture or face character recognition by camera, fingerprint recognition by optic-sensor, and handwriting recognition by touch board. AI programs combine popularly and successful with these input devices in many products. They grant AI toy more natural abilities of recognizing and understanding. That means toys can know who is talking and playing with them, and what the meaning of these actions or words.

For output, AI can do many kinds of thinking simulation. This program can directly move from electronic game. Such as an algorithm called Neural Networks, it is an AI software system which can do a learning process. *"Neural Networks can be used as a means of updating the AI system… The network can improve continuously"* [5] Using this technology, toy can generate a special character to one owner. Playing longer time with it, toy can fit better players. Users wouldn't feel the play is boring and easy, or understand the toy very well in a short time. For future, AI in toy will be more effective and creative. These features make AI toy more lively, natural, and attracting.

5. DESIGN FOR AI TOY
 5.1 Design method, process and issues.
I have some experience of working with some technology departments. We used technology-based design in project sometimes. I can apply the approaches and process for AI toy. The challenge to designer is that they must well understand these resources and predict possible issues.

The designer can try to answer following questions to be more familiar with the technologies in AI toy: what are their most features, what can they do, how does people use it now, what is its future, and so on. Through answer these questions, designers can find out the most possible choice. That means developers do not need to spend time and energy to develop a totally new part for the product, but explore more value from the mature technology by design.

The work can start with listing possible application ways with a brainstorming method. And then, designer gives assessment to each way and goes some deeper research with top 3 selections. The criteria of selection could be focus on better daily life, more popular market, or easier produce, but the most important is the design should exert the advantage of AI technology.

The possible issues could be whether the output reaction is natural. The same as problems which was met during electronic game development, an appropriate AI program need cost a lot of time to test and improve for feeling more real and natural. Another issue is that because AI toy is more real than game, the influence to people should be considered as well. Some people would be addicted to an electronic game, so it is possible that somebody rely on an AI toy too much also. We can imagine that if someone used to living with an emotional toy for a long time, and then the toy lost memory by some error, what will happen? Some psychological consideration should be involved.

5.2 Possible application area
Through the method mentioned above, we can do the brainstorming and get top 3 selections for AI toy by technology-based criteria. As a result, it could focus on entertainment, education, and family. Some products have been serviced in following area.

Entertainment purposes are very common to normal toys. People like any kinds of performances like dancing, singing, acting and so on. But they need interest, new and attracting ways. Machines can do some activities more precisely and faster than human. Developers can use this point to design amazing actions for a

performance. Sony Dog AIBO was entirely designed for amusement and commerce. Its action is a kind of performance. [6]

Concerning education, a toy can always be used as an edutainment product. Toys need make reaction to user's actions or words. It is an opportunity to influence users too. Using this opportunity to do education is a good way for receiving knowledge. Toy can take the scattered time to influence user in daily life. A toy called Robota is designed to solve the problem of children with autism. Children study how to communicate and interact with others by playing an action imitating game. [7]

Thus about company purpose, people don't like to stay lonely, so we always need accompany with others to communicate and chat. If simulate a real person is too hard, a pet could be better in the first stage. Living things always make people feel better and safer, even a plant could adjust the atmosphere in the room. Omron Corporation developed a cat as a companion toy for the elderly. It can live and react as a real animal without danger our trouble. [9]

6. CONCLUSION
The analysis above shows that now we are prepared for the coming of robots time, and AI toy is the first step for this journey. In such a technology time, scientists are developing more and more technologies to improve our life. It is a great opportunity for designers to apply these technologies into human real life.

Intelligence recognition systems and thinking simulation systems are the core technologies for AI product. Combining with different input and output

devices, they build up the basic structure of future products. This system has universal applicability. Like personal computers, based on the basic structure, it can use for different field by change input/output device and software. Different AI products can use the same principle to recognize and translate, learn and remember, think and analysis, decide and create.

To face this situation, we can use design to combine research and market in an appropriate way. Using right design method and process, designers can mediate resource and need, enhance the efficiency of work, avoid issues, and lower cost. They will combine rational and emotional way together to solve problem and use experience to predict possible situation.

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