

2 Effective and Affective Design Paradigms in Robotics

2.1 *The Growth of Robotics and Personal Freedom*

The growth of the personal robotics market is showing signs of mirroring the early growth of personal computers. While this market is nowhere near as large as that of the personal computer, it is as large as that of traditional industrial robotics, and it is growing quickly. According to studies by the Japan Robotics Association, the United Nations Economic Commission, and the International Federation of Robotics, the personal and service robotics market is already equal to that of industrial robotics at about 5,400,000,000 U.S. dollars. By 2025 it is projected to be four times the size of the industrial robotics market, or about 51,700,000,000 U.S. dollars, and this is excluding military robotics and entertainment robotics which would greatly increase this dollar amount.¹

This explosive growth is garnering the same kind of investor excitement as the dotcom boom of the 1990s and a few large trade shows have been organized to help hype the technology and funnel investment dollars into this industry.² Behind the hype and over exuberance occasioned by the introduction of personal robotics technology, there is an interesting and significant reality. Slowly but surely, more or less autonomous machines are making their way into our lives, from expensive robotic toys like the Sony *Aibo* robotic dog, to robotic vacuum cleaners and lawnmowers, all the way to the new crop of robotic weapons platforms currently deployed in the Middle East (Aproberts, 2004).

One of the most socially interesting developments in robotics technology has been the creation of robotic companions built to suit the emotional needs of children, the elderly, and even love sick young adults. These robots are primarily designed by Korean and Japanese companies and research centers that are keenly interested in building machines that are more than simply appliances: they are interested in making our future friends.

2.2 *Design Paradigms in Personal Robotics*

We can see two distinct design paradigms forming in the burgeoning personal robotics industry. For the sake of discussion I will call them the ‘effective’ and the ‘affective’ design paradigms. For example, American and European robotics companies have largely focused on very utilitarian, or effective, implementations of robotics technologies by building robotic vacuum cleaners, lawnmowers, and

¹Data acquired here: (<http://www.robonex.com/roboticsmarket.htm>).

²Robonex is a consumer trade show (<http://www.robonex.com/index.html>) and Robobusiness is for industry members (<http://www.roboevent.com/>).

weapons platforms. Japanese and Korean companies have pursued the more playful or affective aspect of robotics, building ingenious robotic pets, dolls, and humanoid companions. Sony, Honda, and Hitachi have all built extremely expensive humanoid robotic mascots that dance and wow the crowds at tradeshow and in advertising.

Effective design here refers to the interpretation of robots as tools or appliances meant to automate some formerly human activity. Effective design in robotics is the design strategy that seeks to remove some task from the human lifeworld and delegate it to robotics technology that can deal with the problem with little or no human direction. The robot effectively takes over some task that is too mundane, dirty, dangerous, or otherwise distasteful to leave to humans. An example of an effective robotic design that is already in place might be a vacuum cleaning robot that is programmed to come out of its charging station at night so it can vacuum a room and have it ready before its owners awake.

Affective design seeks to imbed the robot deeply into the lifeworld of the humans with which it interacts. These machines are built to elicit, and even ‘experience’ emotion, in order to bond more fully with their human users. This is an intriguing notion, and it is by far the more radical of the two design paradigms found in robotics today. It is this design strategy that we will focus on in this chapter. In sections four and five we will look at a few examples of this technology and explore some of the motivations of the engineers working on these machines.

It would be too simplistic to suggest that the differences between effective and affective robotics design are entirely accounted for by diversity in culture since we will see that there are important researchers in the West that are making many breakthroughs in the affective design paradigm and the Japanese have lead the world in building factory robots that are firmly in the effective robotics design paradigm. However, it is true that one finds a more ready acceptance amongst consumers of friendly and good-humored robotic designs in the East, especially in Japan.

Before we look at some of the interesting affective robots that have already been built, we need to review some of the insights that have influenced the robotics movement towards affective robotics design.

3 Important Factors in Affective Robotics Design

3.1 Robots and Social Psychology

The roboticist Takayuki Kanda and other researchers from the Advanced Telecommunications Research Institute Intelligent Robotics and Communications Labs in Kyoto (ATR), in conjunction with a number of Japanese Universities, have studied the psychological and sociological factors that can be observed during human robot interactions. They state that, “[f]or realizing a robot working in human society, interaction with humans is the key issue” (Kanda et al., 2001). They add that to achieve a robot that can elicit positive emotional responses from its human users, the robot needs to have some understanding of human psychology and group dynamics so that it can more fully interact with those around it.