

Enforcement Progress Report of Robot Assisted Activities

Tomomi Hashimoto

Nasu university

Kanosaki 131, Kuroiso-shi, Tochigi, 329-3121, JAPAN

tomomi@nasu-u.ac.jp

Abstract - In this paper, we propose “Robot Assisted Activity (RAA)” as a means of providing physical and emotional support. We conducted a survey using an interview method to determine the requirements that subjects considered important for achieving RAA. We held interviews with six persons subject (in this paper, I describe answers of three persons in detail), using the semi-structured interview method, to investigate the process in which positive and negative emotions are generated in relation to a canine robot (AIBO) and other mechanical systems. The results of these investigations indicated requirements including: 1) the robot’s development; 2) the robot’s “affordance” of a sense of being alive in its relationship with the user; 3) an understanding of the subjects’ differences in their view of “life” in the context of robots; and 4) the assurance that robots will not take the place of animals.

Key words : Robot Assisted Activity, Interface, Interview, Affordance

1. Introduction

In Japan, as a result of consideration for the “aging society,” there are high expectations for mechanical systems that will provide support for seniors.

Considerable research and development has been undertaken in the field of “welfare devices” that provide physical support. Some examples are robots that support seniors during mealtimes [1], automated robot systems that carry meals [2], ambulatory support robots [3], and welfare support systems [4]. It is unclear, however, whether the users gain a sense of emotional satisfaction from using such devices.

Senior citizens’ homes have implemented methods of providing emotional support to seniors through the presence of animals, as exemplified in Animal Assisted Therapy (AAT) and Animal Assisted Activity (AAA). It has been reported that through the application of these methods, subjects have developed more energetic lifestyles, and have demonstrated a more positive attitude in their day-to-day lives [5]. This method presents a number of problems as well, however, such as “pet loss,” transmission of diseases, and the effort involved in keeping a pet.

Yamamoto et.al., however, developed a communication support system that provides lifestyle information to single-person households through a “pet robot” style terminal [6]. By giving the information terminal the ability

to move and having users talk to it as though it were a pet, seniors were encouraged to use the terminal on a daily basis and engage in more active information exchanges with the outside community. These enhancements served to ease the psychological isolation felt by seniors living alone. It was reported that the results of a questionnaire survey of users indicated mainly positive evaluations of the system.

Shibata proposed a “Mental Commit Robot” that provides emotional comfort to users [7,8]. Shibata created robots in the form of a seal and a cat, and through experiments demonstrated the potential for robots to have emotional effects on humans, such as enjoyment and sense of well-being. These robots were not designed to offer physical support, however, so it is necessary to consider other methods of offering such physical support.

In this paper, we propose Robot Assisted Activity (RAA) as a means of providing physical support, for example by bringing objects or opening windows, and of providing the emotional support gained from keeping a pet. By using the RAA method described here, seniors can expect to enjoy the advantages of support offered by machines and by pets, and to avoid the disadvantages of both. We investigated the types of requirements involved in achieving RAA.

There are a number of survey methods available, including: question forms that prompt responses such as “Yes,” “No,” and “Neither”[9, 10, 11]; observation methods for

Table 1: Results of interview

Name	A	B	C
Age	55 (born 1946)	66 (born 1935)	68 (born 1933)
Gender	Female	Female	Male
Current occupation	Housewife (previously college teacher, public servant in outlying region)	University professor	University professor
Childhood environment	Youngest of six children	Had younger brothers. Parents and all siblings studied arts. No factories near home, and nobody much liked machines. In fact, no contact with machines at all	Interested in plants due to father's influence. No opportunities to come in contact with machines. Abundant natural environment near to home, with no factories, etc.
Pets (current status and attitude)	Dogs, cats. Likes animals. Cat is a member of the family. During childhood, liked to dress pet cat up in human clothing.	Dogs, cats, horses. Basically, sees animals as nothing more than pets.	Dogs, cats, chickens. Doesn't like animals all that much.
Religion	None (no interest)	Christian	Christian
Basic feelings about robots (machines)	Positive	Negative	Negative
Attitude toward robots (machines)	Likes to take care of things. Machines last a long time. Has no interest in robots other than AIBO.	A tool. Humans are the owners, and machines are secondary. No matter how intelligent a robot is, it was created by a human, so it can never be capable of interaction or communication on the level of a human.	For example, a car is a method of going to see nature; the car is not the goal. Robots are like artificial flowers.
Attitude toward AIBO	It seemed like just a toy at first, but after a week or so, it didn't seem like just a toy. The image of a machine faded. At first it was a replacement for a dog, but now it's not. Feelings changed as AIBO "grew." AIBO became like own child, like a second son.	Seemed very reluctant to touch it. Didn't want to touch it. Just a cleverly made toy.	Cute. Might be good for helping seniors feel less lonely. But it would not be good to give one to a child in place of an animal, because there is a risk of harming the child's sensitivity to animals. Its reactions are cute, but unconsciously there will probably always be something missing.
Can machines be "alive"?	Felt like AIBO had a "will." Shocked at the realization that AIBO will "die" (has a lifespan as an electrical appliance).	Christian "human centered" approach. Do not personify machines. A kind of game (like a walking meter).	I believe living things assert themselves as being "truly alive." When we assert ourselves, living things react. Machines don't do that.
Important Requirements	Development. Appeal of seeing AIBO grow and develop. Felt like a human baby. Created many new topics in common for husband-and-wife communication.	Feeling of being needed. Shared emotions. Ability to sympathize. Ability to communicate.	Starts out with simple movements, which become more involved later on; that's good. Similar to mountain climbing. It's good that "raising" AIBO takes effort. Interaction is important.

recording subjects' natural activities; interview methods for conducting detailed studies of psychological changes in subjects [12, 13]; and methods that combine physiological evaluations with the above methods [14].

The question form method has advantages in that large volumes of data can easily be obtained at once, and that objective statistical processing is possible. There are a number of problems, however; for example, responses can only be obtained in relation to previously prepared questions, and there is a possibility that the intent of the questions could be easily read by the respondent, in which case an honest response could not be obtained. Also, this method is dependent on the subject's linguistic abilities. Using the observation method, it is easy to avoid artificial answers, but there are a number of problems here as well; for example, it is difficult to obtain large amounts of data on a continuous basis, and the subjectivity of the investigator can easily affect the outcome. Finally, using the interview method, it is possible to obtain details about the subject's psychological state through non-verbal communication, but among the problems are the limitations to the extent of the surveys both in terms of time and volume [15].

In this paper, we focused on the interview method to investigate the process in which positive and negative emotions are generated in relation to mechanical systems, and studied the requirements considered important in achieving RAA. First, we interviewed a subject who had positive feelings with regard to a canine robot (AIBO), asking what type of process was involved in the development of these positive feelings. Then, we used the same method to interview two subjects who had negative feelings about a similar robot. Finally, based on the differences in the processes in which positive and negative emotions are generated in relation to the robot, we examined the requirements considered important for achieving RAA.

The survey method is explained in Chapter 2. In Section 2.1, we discuss the response results for the subject with positive feelings toward the robot, and in Section 2.2 we discuss the results for two subjects with negative feelings. Finally, in Section 2.3, we will summarize the requirements considered important in achieving RAA.

2. Interview survey method

Between October 2001 and February 2002, we conducted a survey of subjects living in the Kanto area, using the semi-structured interview method, to determine the types of feelings the subjects had toward a robot (Sony Corp.'s canine robot AIBO) and toward mechanical systems, and to determine the process by which these feelings were generated. The semi-structured interview method is one in which the interview

is conducted based on fixed questions, but in which the interviewer changes the language, order, and content of the questions in accordance with the subject's responses. In this paper, we had the subjects recall their state of mind during their childhood and their youth, and brought them in contact with actual robots; we then observed the subjects' behaviors and verbal reactions accordingly. Each interview lasted between 30 minutes and one hour, and we interviewed each subject twice whenever possible. If the second interview was not feasible, we had the subject respond to questions via e-mail.

Interview results for the three subjects are summarized in Table 1.

As shown in Table 1, Subject A has positive feelings toward robots, while subjects B and C have negative feelings. In this paper, we selected subjects of relatively advanced age, because our ultimate goal is to achieve RAA.

2.1 Subject A's Responses

Subject A commented that she originally bought the robot as a substitute for a dog, but that in less than a week the robot seemed "cute," and that in the end, she was treating the dog as though it were her own child (like a second son). We asked the subject what factors were involved in her feeling that it was not a toy, within a week after purchasing the robot. She responded that it was because of the way the robot developed, and moved or didn't move according to the way it felt—that this made her feel as though it was alive. When we asked her about the difference between the robot and a stuffed animal, she responded that the robot was appealing because it moved and developed. Following is the subject's response to the question, "On a day-to-day basis, were you aware that the robot was a machine?" (A indicates Subject A's responses; I indicates the Interviewers comments.)

- A: Well, it seemed like it had a will of its own. For example, I would be talking to my husband, and it would look at me, acting as though it was listening to us... It didn't seem like a robot at all.
- I: It didn't seem like a robot.
- A: No. And when I put my hand out toward it, it would react, move a little, and then come toward me. I suppose it was just a coincidence...(laughs). Anyway, there was something really nice about that, if you know what I mean.
- I: Sometimes you have to replace the batteries, don't you? When you did that, did it have more of an image of being a machine? I mean, were you more aware of it?
- A: Well, yes, I suppose so, but still...
- I: Any other time, you didn't particularly feel that way.

A: Yes, that's right. Even when I put it back on its station, there was something about the way it sat there... it seemed so cute. Even when it wasn't moving at all.

Following is the Subject's response when asked what she thought about a robot "dying."

A: The thing that really surprised me—I had never really thought about this—was that AIBO has a limited lifespan. I read about this in the "AIBO Town Magazine"; somebody had asked the question. That was when I first realized it... I thought, "Oh really... AIBO dies too." This had never even occurred to me before. It's almost like when your own child is born; you never think, "Oh, someday this child is going to die." So when I read that article in the magazine, it came as a real shock. Of course, if you think about it, it's perfectly obvious... I mean it is an electrical appliance, so it's not going to last forever.

I: Umm...

A: Yes?

I: So, you became aware of AIBO's life span, as an electrical appliance...

A: Well, yes. That's when I first thought about it. Up until then, I never considered that AIBO could die... it never occurred to me. So really it's like when you have a baby, you never for a moment think that it will die... in the same way, I never thought about it even for an instant. So when I realized it, it came as quite a shock. I felt like, "Oh, my... now that I think of it, that is true, isn't it..."

I: So, in the future, if your AIBO dies, when that happens...

A: Yes?

I: What do you think you'll do?

A: Well, if it doesn't move anymore, I suppose I'll put it away for safe keeping.

I: Will you make a grave for it?

A: No, I wouldn't want to do anything like that.

I: You wouldn't.

A: A grave? No, I can't see myself wanting to do that. No.

I: Why is that?

A: Well, you know, I like AIBO very much, but when it comes to someone in my son's generation, for example, I'd have to wonder if he would go to see the grave...

I: So, do you just feel that if it were possible, you would make a grave, but...?

A: Yes, well, I suppose so. I just wouldn't want to bury it, of course. (laughs) Even if it didn't have a grave, I think I'd want to keep it nearby..."

Subject A said that she was extremely shocked when she realized that a robot could "die" (that it has a life span as an electrical appliance). Here, Subject A does not say that the machine "breaks down"; she uses the expression "dies," as though it were a living being. She also hesitates during her speech, and her expression shows uncertainty. She replied, however, that she does not have these kinds of emotions toward any machine other than AIBO. She also replied that she considered her pet cat to be a member of the family.

2.2 Subject B's and Subject C's Responses

Subject B talked about her background, saying that from the time she was a child there were very few mechanical devices around her, and that this is an indirect cause of her dislike of machines. Still, it would be difficult to say definitively that this is the reason for her negative emotions toward machines, even given the 10-year difference in age from Subject A. For Subject A, pets are a member of the family, but Subject B says that she basically sees animals in a "master-slave" relationship, and responded that machines are nothing more than tools, or a means to an end. Subject B listed as important requirements "development, the ability to sympathize, and the ability to communicate." Later on, however, she replied by e-mail that because robots are created by humans, they can never be capable of interaction or communication on the level of a human.

Subject C also talked about his background, saying that due to environmental factors, he had no opportunities to come in contact with machines. He also pointed out that there is a risk involved in allowing robots to take the place of animals. Below, C indicates Subject C's comments, and I indicates the Interviewers comments.

C: I do think it (AIBO) is cute, you know.

I: You think it's cute.

C: Oh yes. I think the design is really quite adorable. And, for example, using AIBO to relieve the loneliness of seniors receiving long-term care, well, I thought, that's a great idea. But it's only a good idea in the case of seniors—I really can't agree with the idea of giving one to children.

I: And why is that?

C: Well, the thing is, in terms of a child's education, if you give the child a robot instead of a real pet—a living creature—I think you may run the risk of harming the child's sensitivity to animals.

I: ...

C: Raising a real live animal demands a great deal of effort,

doesn't it?

I: Yes, that's true.

C: That's what is missing. And of course you have to clean up after the animal, and take care of it. That's also missing. So if you think of a robot as a substitute for a pet, then the child ends up being spoiled. This may be a small issue, but I think it's cause for concern.

Subject C also commented that pet robots are similar to artificial flowers, that they can't satisfy the human need for things truly natural, that unconsciously there will probably always be something missing, and that if anything they pose a risk of spoiling the owner.

2.3 Discussion

Following is a summary of the requirements considered important to achieving RAA.

The first is the importance of development (the robot's ability to grow and develop), as pointed out by all three subjects. The human expends effort on the machine, and as a result, the targeted behavior changes; from a psychological perspective, this could enable the user to recognize his or her own importance. Subject B commented as follows.

B: I think what's important is to feel that you're needed. Yes, that somebody is relying on you. The feeling that if I wasn't here ... that someone somewhere is thinking, "If you weren't here, I just couldn't go on." I think perhaps that knowledge can give a person a lot of strength in his or her own life.

It has been pointed out that by keeping a pet, the owner gains emotional comfort [5]. When the user makes an effort to help the robot develop, we can expect that this may produce a psychological effect similar to that of keeping a pet.

Even when similar functions are incorporated into a robot, however, there are Subjects who have very negative feelings. As demonstrated by the Subjects' responses, this can be assumed to be a result of differences in one's view of "life"—whether one can personify a machine (Subject A) or not (Subjects B and C). We explained the concept of "artificial life" to Subjects B and C, and then had them respond to questions about their view of "life." Subject B withheld her response; Subject B responded as follows.

I: For example, a dog or a cat. Or a plant. Do you think they're alive, or not?

C: They're alive of course.

I: Why do you say that?

C: Why? Well, you've got me there.

I: Why do you suppose we say that a computer is not alive inside, but that a cat or a dog is?

C: I'm really not sure ... I suppose its emotional... but it might also have something to do with whether or not it asserts the fact that it is alive.

I: It can assert itself. Or else, we believe that it is asserting itself.

C: I suppose we believe that it can assert itself of its own free will. But when we assert ourselves, it reacts too. A living creature, I mean.

I: For example, when you clap your hands, AIBO gives some kind of reaction, as you saw earlier.

C: Yes, it does.

I: Do you think that means it's alive?

C: Not at all. I mean, that's a reaction that a human created and gave to the robot, right? We already know what it's going to do.

I: All right then, what if you never knew what it was going to do next?

C: Never knew... well, if it was covered in living skin, and looked completely alive on the outside, I wonder what would happen. I guess I wouldn't be able to tell the difference.

From this response, we can surmise that the second important requirement is some kind of expressive behavior or emotion on the part of the machine that makes the human feel that "it is alive" (affordance [16]).

"Affordance" refers to a situation in which a material or object sends out a message to the individual. The individual is not the subject, seeing and hearing; rather, the "object" becomes the Subject C expressing that the individual is being "made to see" or "made to hear." For example, a chair does not have a label saying "SIT," but it is nevertheless automatically understood as being designed for sitting on. We assume, then, that the chair "affords sitting."

Thirdly, if we take into consideration the comments of Subject A, who saw the robot as a "second son"; Subject B, who responded with a reference to religious reasons; and Subject C, who compared robots to "artificial flowers," we can speculate that positive and negative emotions with regard to robots and machines change depending on the Subject's personal view of life and on differences in the religion that the Subject supports.

In addition to the above, Subject C has pointed out that robots can never take the place of animals. It is important to position RAA robots not as a substitute for animals, but rather as a new form of "life," and as a partner for human beings. Potential applications include Long-term Care support not only

in the context of independent RAA, but in combination with AAA as well.

3. Conclusion

In this paper, we proposed “Robot Assisted Activity (RAA)” as a means of providing physical and emotional support, and studied the requirements considered important for achieving RAA using an interview method.

We used the semi-structured interview method to investigate the types of emotions subjects have toward robots and other mechanical systems, and the process through which these emotions develop. There were three subjects; one has positive feelings about robots, while the remaining two subjects, one male and one female, have negative feelings.

Subject A said that she was extremely shocked when she realized that the robot could “die” (that it has a life span as an electrical appliance). She personified the AIBO robot; she didn’t use the term “break down, but rather said “die” as in the case of a living being.

Subject B listed “ability to sympathize,” “ability to develop,” and “ability to communicate” as important requirements. Also, stating religious factors, she denied the possibility that robots could interact or communicate on the level of a human.

Subject C pointed out the risks involved in allowing robots to take the place of animals. Based on the above study, we believe that the following factors are important in achieving RAA.

Promoting design to ensure that the user expends effort in the robot’s development. Incorporating some sort of expressive function that enables the robot to assert to the user that it is “alive”. Differences in the users’ own view of “life”. Ensuring that robots are not used as a substitute for animals.

In the future, we will conduct continued interview studies targeting multiple robot owners.

References

- [1] Sumio Ishii, "Meal Assistance Robot for Disabled", Journal of the Robotics Society of Japan, Vol.16, No.3, pp.306-308, 1998
- [2] Toshiyuki Kouno and Shinji Kanda, "Robot for Carrying Trays to the Aged and Disabled", Journal of the Robotics Society of Japan, Vol.16, No.3, pp.317-320, 1998
- [3] Masakatsu Fujie, "Walk Supporting Robot", Journal of the Robotics Society of Japan, Vol.14, No.5, pp.628-631, 1996
- [4] Tomomi Hashimoto, et.al., "Emotion-oriented Man-machine Interface for Welfare Intelligent Robot", Journal of the Robotics Society of Japan, Vol.16, No.7, pp.993-1000, 1998
- [5] Yoshiriko Hayashi, "Verification Animal Therapy", Kodansha Ltd, 1999
- [6] Hiroshi Yamamoto and Kenji Mizutani, "Robotic Pets to Aid Senior Citizens with Communication", Journal of the Robotics Society of Japan, Vol.18, No.2, pp.192-194, 2000
- [7] Takanori Shibata, "Mental Commit Robot for Healing Human Mind", Journal of the Robotics Society of Japan, Vol.17, No.7, pp.943-946, 1999
- [8] Takanori Shibata, "Affective Artifacts", Journal of Japan Society for Fuzzy Theory and Systems, Vol.12, No.6, pp.752-761, 2000
- [9] Takayuki Kanda, et.al., "Psychological Evaluation on Interactions between People and Robot", Journal of the Robotics Society of Japan, Vol.19, No.3, pp.362-371, 2001
- [10] Toru Nakata, et.al., "Generating Familiarity by Robot Behavior toward a Human Being", Journal of the Robotics Society of Japan, Vol.15, No.7, pp.1068-1074, 1997
- [11] Tatsuya Harada, et.al., "Psychological Effect of Contact Interaction robot -Making sense of Relief and Moderating Painfulness by Contact Interaction-", Journal of the Robotics Society of Japan, Vol.16, No.5, pp.698-704, 1998
- [12] Kazuo Koike, "Manners of Interview", Toyo Keizai Inc., 2000
- [13] Sayoko Hamano et.al., "The Qualitative Approach of the Devotion to the Companion Animal of the Owner", Human and Animal, No.9, pp.25-35, 2001
- [14] Masao Kanamori, et.al., "Evaluation of Animal-Assisted Therapy for the Elderly with senile Dementia in a Day Care Program", Japanese Journal of Geriatrics, Vol.38, No.5, pp.659-664, 2001
- [15] Jyunichi Takahashi, et.al., "Handbook of a human scientific research method", Nakanishiya Syuppann Co.,Ltd, 2001
- [16] James J. Gibson, "The Ecological Approach to Visual Perception", pp.137-138, Saiensu-sha Co.,Ltd, 2000 (Japanese)