Proposal of discommunication robot

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Abstract: This study investigates a new element to facilitate active interaction from human by using desktop robot communication. In this paper, we proposes a discommunication robot that produces active behavior from human by facilitating intentional "dis-communication".

1 Introducrion

Ahead of the rest of the world, Japan is rapidly becoming a super-aged society, since approximately 25% of the total population consists of elderly people over the age of 65, and this number is expected to exceed 40% by 2055 [1]. An unfortunate consequence is the increase of "lonely death" or starvation in elderly households [2].

Development of a variety of communication robots can solve this problem, because these robots can converse in everyday life [3]. However, we are still in the middle of development of a communication robot to introduce into daily living [4].

As a first step in creating a communication robot to become a part of people's lives, it was decided to design a communication robot that people do not get tired of talking to. For this purpose, factors other than communication are needed. Therefore, a new element of excitement for communication is necessary between the human and robots. [5] shows, the resets that the people should be tempted to teach to robots which takes much time to learn tasks better than the robots which takes short time to lean them.

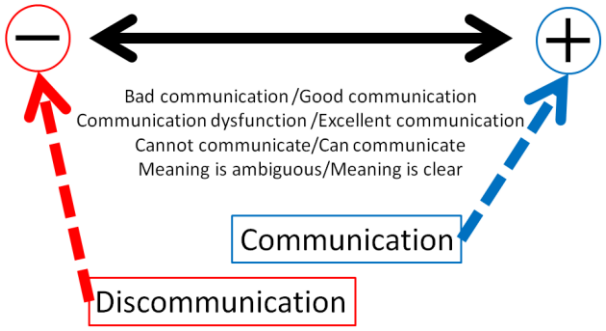

Fig. 1. Dis-communication versus communication

This study proposes to themethot draw out active interaction from dis-communication with human based on the results of intentional dis-communication. We call this dis-communication robot.

2 Dis-communication

2.1 Definition of dis-communication

In 1952, Tsurumi et al. began using the term of dis-communication in Japan [6]. Fig.1. shows the difference between communication and dis-communication. When communication is assumed to be insufficient or incomplete, we say this is dis-communication, i.e., communication failure [7]. Dis-communication occurs during conversation.

2.1 Dis-communication of humanoid robot

Dis-communication can happen not only between humans, but also between humans and robots. It is easier for a human to communicate with a humanoid robot. Therefore, the expressed dis-communication is the "declaration of intention in the response to a human's speech." For example, it was found that humans hate to be interrupted during conversation [8]. We believe dis-communication includes interruptions during normal conversation. The description of such behavior is described in Section 4.4.

3 Concept of dis-communication robot

We will show the concept of dis-communication robot a follows.

- Appearance can coexist with humans
- Development of new communication by we do not expect motion.

With the above points, a robot finds new possibilities

for human-robot coexistence in life. That is, the purpose of the communication robot is not solely communication. The robot is designed to perform a "disconnect communication" by ignoring the human's question in order to facilitate an action interaction.

4 Mechanical design of the dis-communication robot

4.1 Overview of the dis-communication robot

The external appearance of the dis-communication robot is shown in Fig. 2.

The robot is approximately 30 cm tall and weighs approximately 1 kg. The purpose of this study is to design the look of an average desktop communication robot. The control and the power supply of the robot are external.

4.2 Active part

This robot has three servo motors arranged on the neck. Consequently, the robot can be operated in three degrees of freedom: direction of head, and bending up and down and right and left. By these three servo motors, the robot can nod like a real human being.

4.3 Conditions of communication

The followings are the communication motions of the robot.

· Nod Motions:

[Description] When talking to the human, the robot can nod to liven up the talk [9].

[Motion] 20 degree down, one round trip in 0.6 seconds [9].

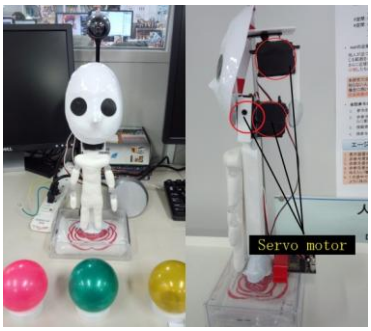

Fig. 2. Placement of the servo motor

· Dis agreement Motions:

[Description] When talking to the human, in the case of a negative response, the robot can shake his head in denial.

[Motion] 45 degree to the left and right, one round trip in 0.8 seconds [9].

· Joint Attention Motions:

[Description] Eyes follow what the human has shown, such as something indicated by the human's gestures.

[Motion] Maximum 15 degree upward, 180 degree to the left and right limit, 25 degree tilted in the direction of maximum [3].

4.4 Conditions of dis-communication

Dis-communication includes interruptions during normal conversation. The followings are the dis-communication motions of the robot.

· Stare Motions:

[Description] While interacting with the human, the robot indicates through its eyes when the human is behaving incorrectly.

[Motion] Robot and the human are face to face, within a range 15 degree to the left and right, with the robot staring 10 degree to 30 degree upward [10][11].

· Line-of-sight shift Motions:

[Description] While interacting with the human, the robot looks away to decrease the human's confidence.

[Motion] Moving face by looking to the upper limit and 45 degree to the left or right [10][11].

· Looking down Motions:

[Description] The look down when the question of the frequency to the robot surged humans.

[Motion] 20 degree to 60 degree to the horizontal, 30 degree adjustment moving the head up, 40 degree adjustment moving the head down [10][11].

Fig. 3. Stare motions

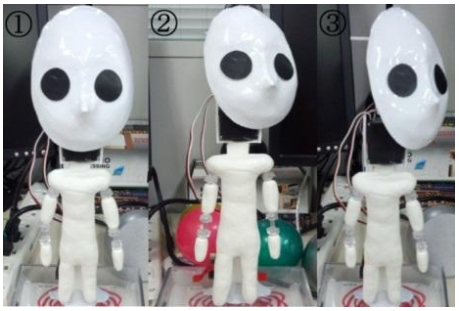

Fig 4. Line-of-sight shift motions

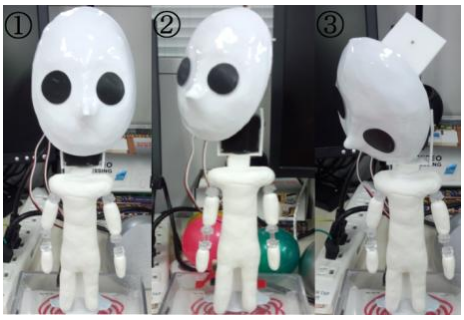

Fig 5. Looking down motions

5 Experiment

5.1 Experimental purposet

We investigate how characters of human have an influence on the impression by dis-communication from the robot to human. We evaluate the impression received by the human from the dis-communication robot.

5.2 Experimental configuration

The experimental environment is shown in Fig. 6. The image of video camera 1 is connected to PC1, which is connected to PC2 to operate the robot. Two video cameras behind and in front of the participant take photos of the robot-human interaction for later video analysis.

5.3 Experimental methodology

The experimental procedure is stated below. The steps correspond to the photos in Fig. 7.

(1) The participant answers questions about his/her personality in a questionnaire. After completion of the questionnaire, the participant sits in front of the robot, which has been placed on top of a desk. The participant plays a game with the robot.Signal of the start of the game comes out, you hear the reaction shown to the robot balls of three colors at hand.

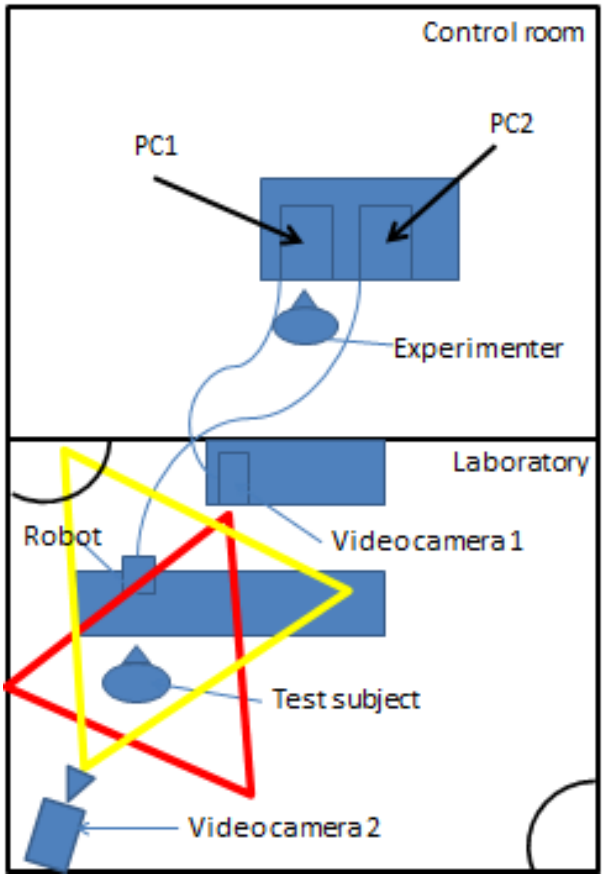

Fig. 6. The experimental environment

(2) Signal of the start of the game comes out, you hear the reaction shown to the robot balls of three colors at hand.

(3) We hear the reaction carefully either the robot running on communication conditions, dis-communication condition will appear at random.

(4) The participant continues to play the game with the robot.

(5) The participant raises his/her hand to finish the game at the end of the experiment, and the experimenter answers some questions regarding the robot.

(6) After the experiment, subjects answer a questionnaire for the operation of the robot.

The following are conditions for the robot in the experiment.

· There are balls of different colors, red, blue, and yellow, arranged in an order.

· The robot knows the order, and the participant visually sees the reaction of the robot.

Table 1 Personality diagnosis by Ego gram

	CP: Critical Parent	NP: Nurturing Parent	A: Adult	FC: Free Child	AC: Adapted Child
(a) High	CP(a): Strong sense of responsibility	NP(a): Exhibits protective kindness	A(a): Rational thinking	FC(a): Bohemian	AC(a): compromising
(b) Middle	CP(b): normal	NP(b): normal	A(b): normal	FC(b): normal	AC(b): normal
(c) Low	CP(c): Loose personality	NP(c): Frosty personality	A(c): Irrational thinking	FC(c): Closed	AC(c:) Self-paced

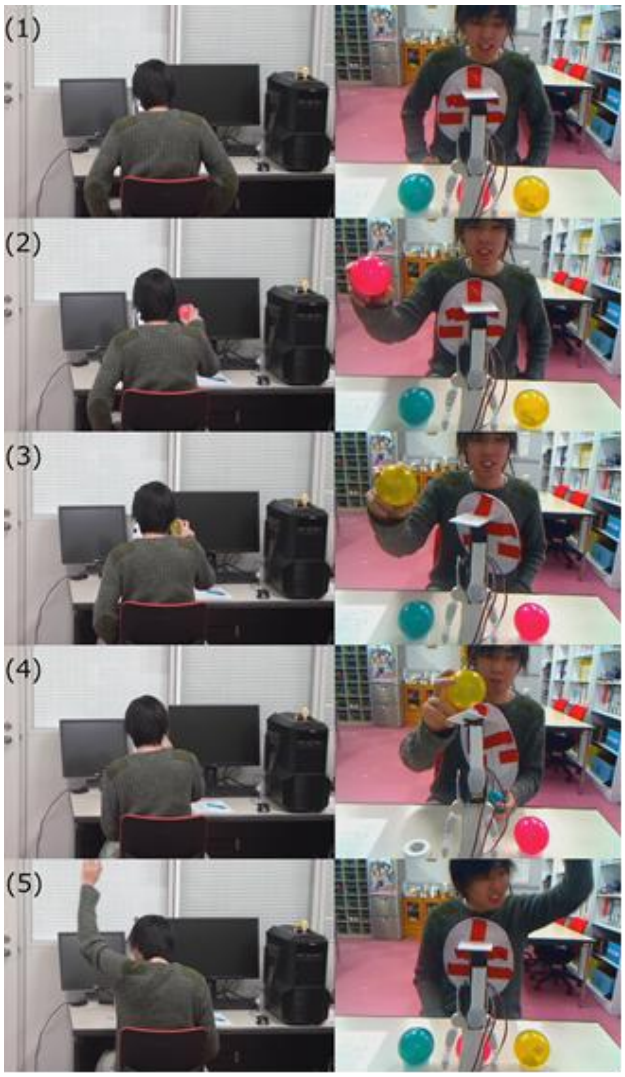

Fig. 7. Landscape experiment

· The participant raises his/her hand if the experiment is assumed to have finished.

5.4 Personality diagnosis by Ego gram

Ego gram is made based on the psychology of transactional analysis theory. It is a personality diagnosis very famous in Clinical psychologist and psychosomatic medicine. Personality is diagnosed by Ego gram derided in to five categories of mental state CP(Critical Parent) , NP(Nurturing Parent) , A(Adult) , FC(Free Child) and AC(Adapted Child)_(Table 1). In the Ego gram, the heights of the energy of the five mental ego states are plotted. This personality diagnostic questionnaire was divided into heights a, b, and c for step 3. CP would be (a)High if CP(a):Strong sense of responsibility. CP would be (b)Middle if CP(b):normal. CP would be (c)Low if CP(c):Loose personality. NP would be (a)High if NP(a): Exhibits protective kindness. NP would be (b)Middle if NP(b):normal. NP would be (c)Low if NP(c): Frosty personality. A would be (a)High if A(a): Rational thinking. A would be (b)Middle if A(b):normal. A would be (c)Low if A(c): Irrational thinking. FC would be (a)High if FC(a): Bohemian. FC would be (b)Middle if FC(b):normal. FC would be (c)Low if FC(c): Closed. AC would be (a)High if AC(a): compromising. AC would be (b)Middle if AC(b):normal. AC would be (c)Low if AC(c): Self-paced.

5.5 Experimental results

The data were evaluated using student t-test. A significant difference was observed in the overall average items [Fig. 8]. It is four items of "biological basis", "have the intentions", "dignified" "ponderous".

A higher evaluation is a better communication condition. So, we focused on the item of the higher dis-communication condition, as viewed by the results of the survey work in the Ego gram personality diagnosis.

CP is strict heart. The values include acting responsibly, which is critical to others. If this value is low, the result is a negligent character.

In the results of CP(a), a strong sense of responsibility was observed in the 20 items indicating a strong sense of responsibility (Fig. 9).

Rational is a field of the mind. We focus on reality and act properly accordingly. If this field is low, the character becomes irrational.

In the results of A(a), rational thinking is a significant difference observed in the 10-item amenability field (Fig. 10). In the results of A(c), a significant difference was

observed in the 18-item irrational thinking field (Fig. 11). I found that the "A (a)" "A (c)" and in spite of the character other end of the spectrum, both of which put a high reputation.

5.6 Discussions

As seen from the results of the experiment, Superiority of dis-communication is small in the average rating of all participants. However, there are more items towards the dis-communication condition is given a rating that a number of advantages looking at the different personality. CP(a), A(a), and A(c).

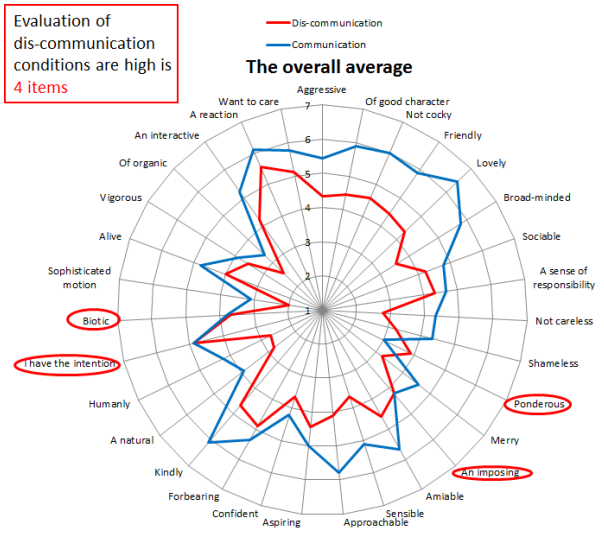

Fig. 8. The overall average

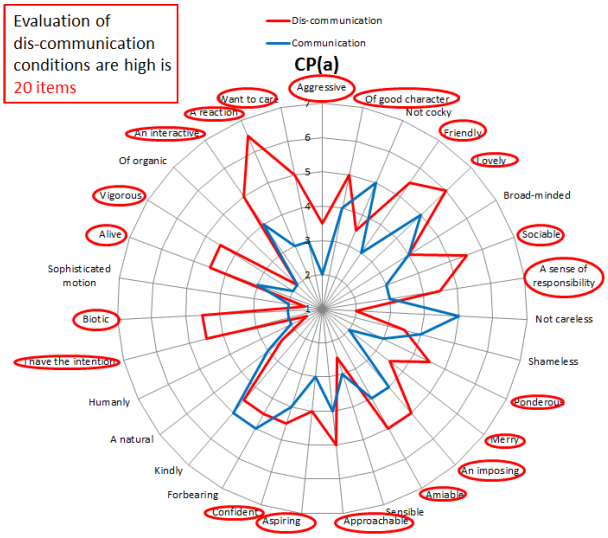

Fig. 9. CP (a) Result

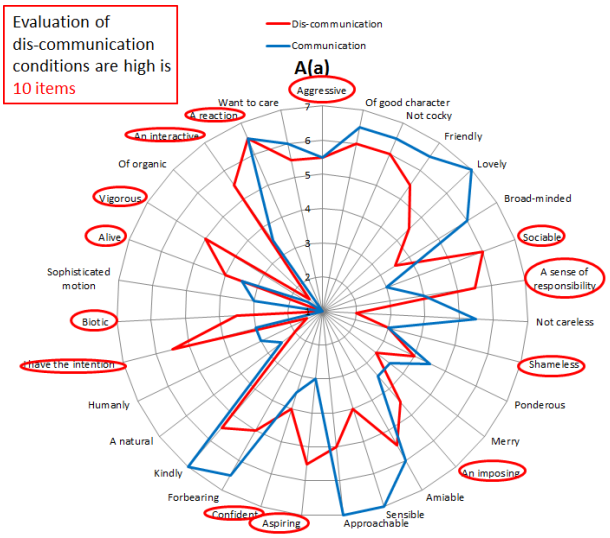

Fig. 10. A (a) Result

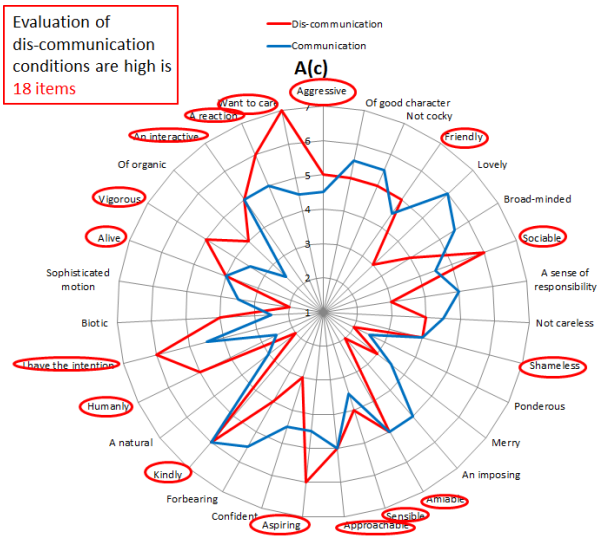

Fig. 11. A(c) Result

We found that there is a personality category the dis-communication conditions draw the interaction effectively than the communication conditions. They are strong sense of responsibility, rational thinking, and irrational thinking.

6 Conclusions

We conducted an evaluation of the impression which the subject receives from dis-communication robot. From the results of personality and diagnostic impression evaluation, we investigated the personality categories that are effect of dis-communication robots. This experiment yields that dis-communication conditions are effective strong sense of responsibility, rational thinking, and irrational thinking.

We want to make use to the development of further research the results of this study.

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