Human-Robot Interaction and Social Relation

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This paper presents the factor of designing an anthropomorphic agent such as a communication robot and an embodied communicative agent. Communication is a cooperative phenomenon between participants. People involved in a communication speak and hear actively during the conversation. However, it is difficult to engage them in the communication with a robot because they seldom actively consider the communicative intention of the robot. The paper explains the importance of social relationship between a human and a robot for engaging people in the communication. In particular, we consider how the relation makes them consider the intention of the robot. Also, I show what factors of the robot design elicit the social relation.

1 Intoroduction

Researches related to HRI (Human-Robot Interaction) investigate how to design a robot which has a anthropomorphic character, behaves autonomously, communicates with people. And they consider what application the robot achieves. In spite of progress of many researches, few systems use the merit of HRI. An agent which makes people anthropomorphize itself is used at ATM or MS Office. However, it gives their functions just something extra. However, there are a lot of researchers in the field of HRI. This means that they consider intuitively that there are valuable things in the interaction between people and a robot. The paper explains what are the key factors for applying HRI technology to an interactive system.

2 Key Factors at HRI research

Key factors at HRI research depend on a type of a used robot. There are two types of robots; one has a anthropomorphic figure and the other does not. This paper focuses on the robot which has an anthropomorphic figure because HRI researches are related to the aspect of communications. In particular, researches about non-verbal expressions such as gestures and gaze movements are important for HRI field.

I write four main factors which are important in designing a robot as a interactive system.

i. Characteristic of being athropomorphized

A human-like figure enhances the tendency of anthropomorphizing a robot. The robots which have a human-like figure are intended to utilize the characteristic. The human-like figure makes the robot communicate with people easily using verbal and non-verbal expressions.

ii. Capability of sharing environments with people

The words "sharing environments" do not indicate simply that the robot exists in the same place with a person. Those mean "cognitive sharing" (it is called Joint attention in developmental psychology [3]) that the robot pays its attention to the same thing/event as people and that it makes people consider that both of them look at it together. The design of the robot's behaviors is crucial to establish joint attention [1] [5]. The robot intentionally turns its gaze toward a target, makes eye contact with a person, and points at it with its hand at an appropriate timing. A research reported that the ability of establishing joint attention in a real world is higher than CG character on a PC screen [6]. The robot is more advantageous than the other devices in terms of sharing environmental information. For example, it can explain items at an exhibition or a route to a place by using verbal and non-verbal expressions. Moreover, since the body of the robot exists physically in our environment, the robot's expressions can be seen by people around the robot. The embodied expressions give information to them even though they are not a primary person in the communication.

iii. Establishing relation with people

The relation between people and a robot is significant for natural communication between them. People understand what the other said by inferring his/her communicative intention. However, they do not make the inference for an anonymous person. Since the inference is an active mental function, people make the inference for someone related to them. They seldom infer the communicative intention of the others who do not have relation with them. Although the relation exists between friends, family, colleague, and so on, it is not necessarily a formal one. People do not understand actively what the other says when they do not even have a casual relation. The study [4] found that the existence of the relation between a experimental participant and a robot have effect on whether he/she can understand the robot's utterance. The physical existence of the robot gives it the advantage when it establishes the relation with people.

iv. Constraints coming from existence

Since a robot has a physical body, it occupies our living environment. However, the physical body improves the abilities of sharing environments and establishing relations. CG character can also make the relations by preparing a context which engages a person in the interaction. However, it is difficult for CG character to communicate with people passing by. The CG character's abilities of attracting people is weaker than the robot's. The HRI research should employ the effect of the physical existence positively. For example, station staffs can manage the flow of crowded people in rush hour by just standing. Although nowadays robots do not have such a existence like a station staff, the HRI researches like a android science[2] will reveal what is an important factor to manage people.

3 Reconsider HRI research

The question related to HRI researches is that we need a robot as the interface of an interactive system. This section discusses the issue.

Is a robot needed to just achieve a communication with people? ?

Dose a robot need an anthropomorphic figure?

Is the anthropomorphic figure important to refer to information in a real world?

We do not need a robot if a system just gives us information. On the other hand, we must discuss the role of communications in human-society to conclude the question.

Humans do a lot of activities by communicating with the others: establishing a relation with others, empathizing with them, behaving considering them, and sharing an experience with them. The important matter among them is to behave considering the others. If a human and a robot behave considering the other's mind each other, not only the robot takes account of the human, but also he/she considers the robot when doing something. The bidirectional consideration makes them share their experience. The sharing the experience differentiates the robot from a simple computer which just gives anyone the same cold information. There is possibility that the robot can give each individual different information reflecting a shared experience between them.

We should reconsider the robot as the interface of an interactive system after succeeding in developing a robot which can interact with people based on shared experiences.

References

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