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Investigating How Children Interpret Robot Positive and Negative Gestures: Comparison with Different Age Groups

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***Abstract*— This study investigates effective human-robot communication by introducing rewarding and punitive behaviors. The aim is to enhance natural interaction for diverse age groups. This paper focuses on how children interpret the behaviors by designing gestures, eye colors, and voice tones to express these behaviors on the Pepper robot.**

Keywords—social robot, interpretation of social behavior, child-robot interaction

I. INTRODUCTION

As social robots play an increasingly active role in daily living environments, opportunities for robots to communicate with people of a diverse age range are expected to increase. Robots, in particular, need to interact with people logically and emotionally to achieve natural communication in daily situations. This study aims to clarify a method of generating robot behaviors that can gain people's attention and make them look back on their action choices by incorporating behaviors that make people feel comfortable and daringly unpleasant behaviors at effective times[1, 2]. To deal with this, we defined two types of robot behaviors: positive and rewarding behaviors that give comfort and negative and punishing behaviors that provide discomfort [3]. We experimented with older and young adults to clarify their impressions of the two kinds of behaviors in communication between the robot and each subject and the proper behaviors to gain attention. In this paper, we investigate how children interpret the robot's positive and negative gestures and compare our results with those of adults.

II. REWARDING AND PUNITIVE BEHAVIOR OF ROBOTS

In this study, we utilize Pepper as a robot since it can show gestures using its head, arms, and trunk, gaze, and adjust its voice. As discussed in the introduction, two types of gestures were defined as rewarding and punitive behaviors: gestures that give people positive impressions and gestures that provide people with negative impressions. Among the various gesture classifications, there are four types of gestures common to many studies: iconic gestures, metaphoric gestures, deictic gestures, and beat gestures [4]. Based on metaphoric and beat gestures, we created eight gestures, four each for rewarding and punishing behaviors. When the robot performed each gesture, the color of the LEDs around its eyes was changed to express its emotion. For the selection of eye colors, we created eye colors based on Pulcic's circular model according to the feelings and movements. Examples of gestures and eye colors are shown in Table I. The fact that the eight gesture types alone gave positive and negative impressions has already been confirmed in an experiment with adult subjects. The robot's voice is also helpful in expressing the robot's feelings. There are two voice conditions: a bright tone as a rewarding behavior and a dark tone as a punishing behavior.

TABLE I. GESTURES AND EYE COLOR TYPES

Gesture type	Gesture detail	Eye color
Rewarding gestures		
Kiss	Spread hands out	Light green
Happy	Sway from side to side	Yellow
Cheering	Bend both elbows in front of the body	Orange
Punitive gestures		
Thinking	Scratching head	Dark Blue
Depressed	Slouching	Purple
Perplexity	Waves arms up and down over head	Dark Blue

III. CONCLUSION

We experimented with 18 child subjects. The poster will show how children interpret robot positive and negative gestures and make comparisons with different age groups.

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