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“Tell Tell” - Effects of Personality of Kansei Agents

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Abstract: The purpose of this study is to propose an emotion generation model that consists of pseudo-personality and pseudo-moods. Agents implementing this model have various personalities for each user. In order to verify its usefulness, we implemented the model on an agent called “Tell Tell” and performed an experimental performance evaluation using a web application. In addition, we tried to performed an experiment to identify the nurtured agents. From the experimental results of performance evaluations, it was found that the agent of the proposed method had a positive difference in impression between "enthusiasm-lose interest" and "human-like-mechanical". However, in the items of getting tired and fun, there was a significant decrease in subjects with many interactions. From the experimental results of the nurtured agents, it showed that the proposed agent had a higher discrimination rate than the agent with personality only. Therefore, we analyzed the interaction of each subject, the agent of the user who was able to discriminate had little change in personality, and the user who couldn't discriminate had changed personality many times. In the future, it is necessary to improve the impression of getting tired and increase the discrimination rate by implementing an algorithm that changes the facial expression depending on the intensity even for the same personality.
Keywords: *Kansei Agents, Pseudo-Personality, Pseudo-Moods, Emotion Generation Model, Boredom*

1. INTRODUCTION

Communication robots and agents have been actively developed more and more in the year. Most of communication robots and agents aim at communicating with people in daily life such as home. However, they have a problem that we get bored of them in three months called “a wall of three months”. We assume that there are problems in communication that the action generation algorithm is simple, and they don't grow and we cannot feel the intention as living things in them.

First, there is a way to complicate the action of agents to keep from getting tired. However, it is difficult for the purpose of interaction with user to build the model that complicate agents behavior. It was found that the more complicated the behavior, the less difficult it is to get bored [1]. Therefore, it is necessary not only to complicate the generation model of agents actions, but also to make the user feel the creatures and intentions as living things.

Ogasawara et al. [2] proposed the character giving model for Kansei robot. They aimed to develop more humanity and empathetic robots by using their model. The model used the relationship between parent and child [3]. From their experimental results, the model could give various characters to the robot but the impression that the robot that moves randomly was more complex than the robot implemented by the model was highly evaluated. The problem is that the response of the robot becomes monotonous by the model, and the user could easily predict the response.

When considering the relationship between parents and children, the reaction to the parents is not constant but changes depending on the mood of the day. According to Cowie [4], human emotions have temporal characteristics and the emotions affected by expressions, attitudes, mood, traits, etc. It is not clear how to use them to express emotions.

In this paper, we present an emotion generation model that consists of pseudo-personality and pseudo-moods. We verified that the agent implemented the proposed model could improve the impression on the agent while preventing the response from becoming monotonous. In addition, to test the hypothesis that it is possible to find the agent that the subjects raised, we examined whether it is able to prevent the user from getting tired and not to lower the discrimination rate of their own agents.

2. METHODOLOGY

2.1 Kansei Agent “Tell Tell”

We developed a kansei agent “Tell Tell” as shown in Figure 1. We performed an experimental performance evaluation using web application. Figure 2 shows the web application that we developed running on Firebase [5]. We deployed the application and user could play the

application anywhere if the device could connect the internet.

Figure 1: Kansei agent "Tell Tell"

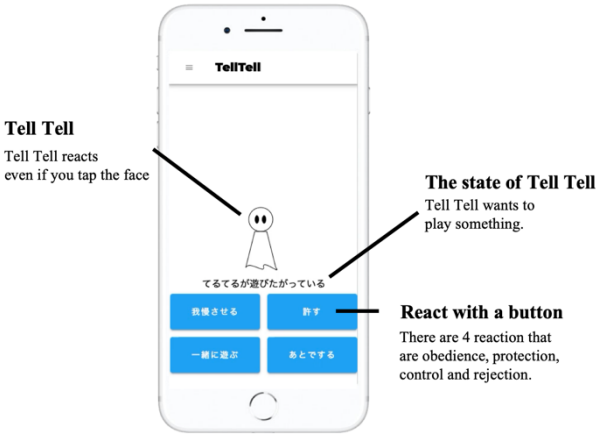

Figure 2: "Tell Tell" on web application

2.2 Emotion Generation Model

We developed the emotion generation model that consists of pseudo-personality and pseudo-moods. Pseudo-personality is implemented based on the parent-child relationship and pseudo-moods is mounted based on the Russell's circumplex model of affect [6]. Figure 3 shows the model that we propose in this paper.

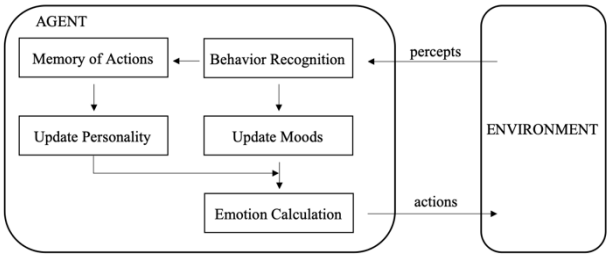

Figure 3: The emotion generation model for agents

First, the model recognize the behavior from user. The behavior fall into four categories: obedience (+), protection (+), control (−), and rejection(−). Figure 4 shows the polar coordinates of pseudo-personality, we developed the system based on the parent-child relationship [2,3]. The pseudo-personality($\boldsymbol{P_n}$) is updated with the input($\boldsymbol{I}$) from the user using Eq. (1). Point P (is pseudo-personality) is updated using Eq. (2). In this equation, α is weight that determined how much the current user's behavior is reflected in agents pseudo-personality.

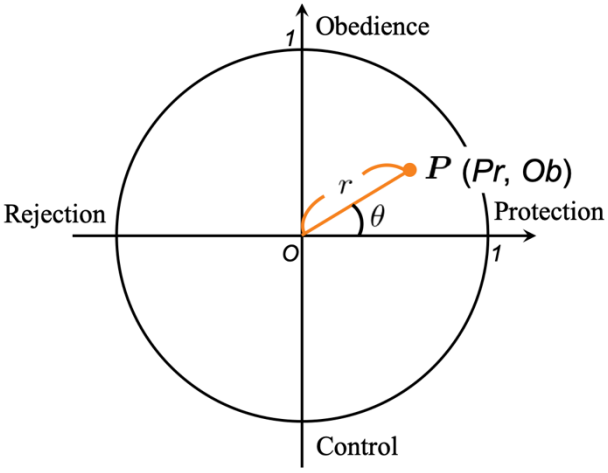

Figure 4: Personality generation model: Polar coordinates of pseudo-personality

$$\boldsymbol{I} = [rcos\theta, rsin\theta] \quad (1)$$

$$\boldsymbol{P_n} = \begin{cases} [0,0] & (n = 0) \\ \alpha\boldsymbol{I} + (1-\alpha)\boldsymbol{P_{n-1}} & (n \geq 1) \end{cases} \quad (2)$$

We also designed the moods generation model. Figure 5 shows the polar coordinates of pseudo-moods, we developed the system based on the circumplex model of affect [6]. The pseudo-moods is changed every time to get a new value($\boldsymbol{M_{new}}$) that the user performs an action using Eq. (3,4). In this equation, β is weight that determined how much the new value is reflected in agents pseudo-moods. If the value is high, the new value take precedence and agents become an emotionally unstable.

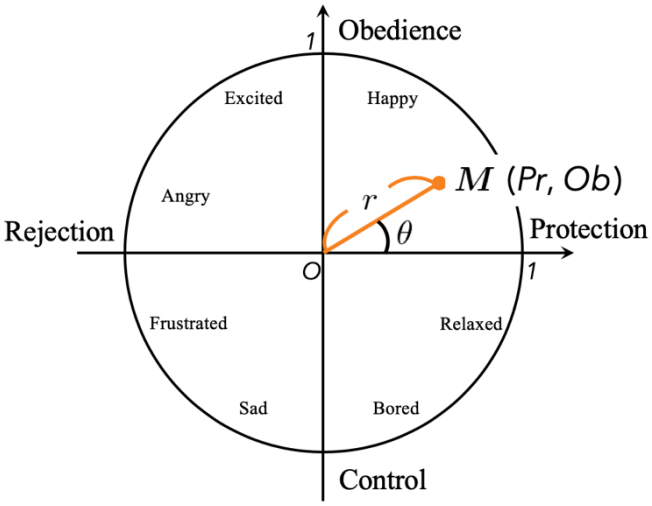

Figure 5: Moods generation model: Polar coordinates of pseudo-moods

$$\boldsymbol{M_n} = \begin{cases} [0,0] & (n = 0) \\ \beta\boldsymbol{M_{new}} + (1-\beta)\boldsymbol{M_{n-1}} & (n \geq 1) \end{cases} \quad (3)$$

$$\boldsymbol{M_{new}} = [rcos\theta, rsin\theta] \quad (4)$$

Finally, the emotion generation model calculates emotion using the pseudo-personality($\boldsymbol{P_n}$) and pseudo-moods($\boldsymbol{M_n}$). Table 1 shows the model of emotions that is called “negative priority”. In this situation, (1) if the pseudo-personality and pseudo-moods are positive, agents express positive behavior, (2) if the pseudo-personality is positive but pseudo-moods is negative, agents express negative behavior, (3) if the pseudo-personality is negative but pseudo-moods is positive, agents express negative behavior, (4) if the pseudo-personality and pseudo-moods are negative, agents express negative behavior. If the pseudo-personality and pseudo-moods have same vector that is (1) or (4), emotion ($\boldsymbol{E_n}$) is calculated the sum of them from Eq. (5).

Table 1: Negative priority [7]

Personality		Moods		Emotion
(+)	×	(+)	⇒	(+)
(+)	×	(−)	⇒	(−)
(−)	×	(+)	⇒	(−)
(−)	×	(−)	⇒	(−)

$$\boldsymbol{E_n} = \gamma \boldsymbol{P_n} + (1-\gamma)\boldsymbol{M_n} \quad (5)$$

There are 4 reaction of this model that are favor, predominance, disgust, and inferiority. Emotions depend on the value of θ of $\boldsymbol{E_n}$. Table 2 shows the relationship between θ and emotions. The agent “Tell Tell” could express four facial expressions, as shown in Figure 6.

Table 2: The relationship between theta and emotion

Theta	Emotion
0	Favor (+)
$\frac{1}{2}\pi$	Predominance (+)
π	Disgust (−)
$\frac{3}{2}\pi$	Inferiority (−)

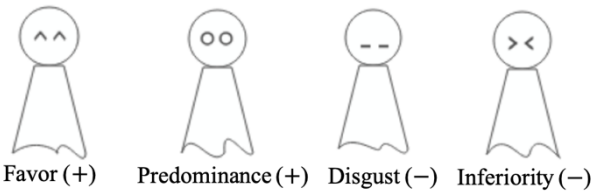

Figure 6: The four facial expressions

3. EVALUATION

The purpose of the evaluation experiment to measure the usefulness of the two agents. There are agent(P) with the pseudo-personality and the agent(PM) with the pseudo-personality and pseudo-moods. Two experiments were prepared for the evaluation experiment.

In the experiments, the subjects was divided into two considering the order effect. The subjects played the web application for 3 days and evaluated impression first day and last day and changed the agent that if the subject played with agent(PM or P) in the first three days, the subject played with agent(P or PM) in the last three days. In addition, the subjects tried to find the agent that is nurtured themselves on the third and sixth day.

3.1 Performance evaluation

We evaluated the impression of the proposed agent by the semantic differential (SD) method [8]. The subjects of this experiment were 13 men and 9 women. The average age of the 24 subjects is 22 (SD=1.57). The subjects rated their impressions of each agent using seven-point category scales for the 10 pairs of adjectives that we referenced previous research [2].

From the experimental results, it was found that the agent(PM) is more complicated but less friendly than the agent(P) in the third day, as shown in Figure 7. It was also found that the agent which is implemented our proposed method had a positive difference “enthusiasm-lose interest”, “human-like-mechanical” between first day and third day. From these results, it is considered that the agent was implemented the proposed model is not monotonous and has an interaction closer to a living thing.

3.2 Identify the nurtured agents

In this experiment, the subjected identified their agent from the six agents, as shown in Figure 8. From the results, it showed that the agent(PM) had a higher discrimination rate than the agent(P). We considered that the reason was that the number of interactions was related, and taken the median number of interactions for all subjects, then the subjects were divided into groups with a large number of interactions and groups with a small number of interactions.

Therefore, we analyzed the interaction of each subject, the agent of the subject who was able to identify had little change in personality. On the other hand, the subject who couldn’t identify had changed personality many time. It was thought that various facial expressions were expressed as subjects raised the agents evenly. Therefore, it was considered that the pattern of the agent was not

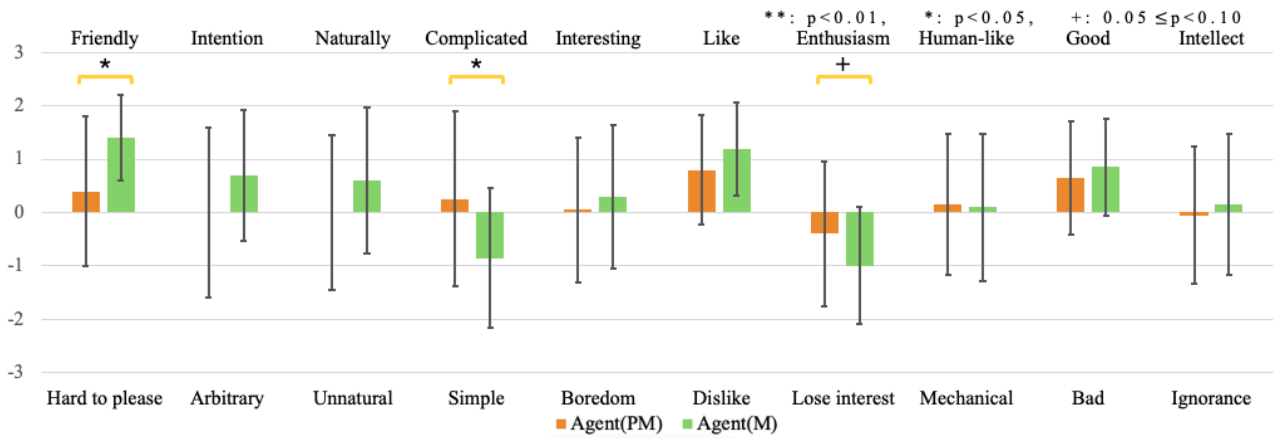

Figure 7: The result of performance evaluation

sufficiently recognized by the subject.

Finally, based on the two experiments, it was confirmed how much there was a difference in the impression of the SD method performed on the first and third days between the group with a large number of interactions and the group with a small number of interactions.

As a result, the subject could feel the intention as a creature for the agent(PM) rather than the agent(P). However, in the items of interesting and enthusiasm, there was a significant decrease in the subjects with many interactions. The reasons for this are, (1) there are not many types of agents demands (the states of behavior DB); (2) only four expressions are expressed. The more the subjects interact, the more likely they were to get used to the web application.

Based on the results, it was found that "the subjects with a large number of interactions improved their impressions" by the proposed model.

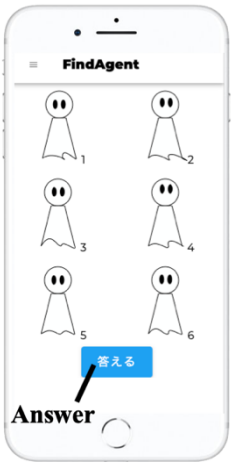

Figure 8: The subjects chose the agent which is nurtured themselves

4. CONCLUSION

This paper described an emotion generation model that consists of pseudo-personality and pseudo-moods. We developed the kansei agent "Tell Tell" and performed the experimental performance evaluation using web application. From the results of this experiments, the agent was implemented the proposed model is not monotonous and has an interaction closer to a living thing. In the future, it is necessary to improve the impression of getting tired and increase the discrimination rate by implementing an algorithm that changes the facial expression depending on the intensity even for the same personality.

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