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# ***Amae* and Agency Appraisal as Japanese Emotional Behavior: Influences on Agent's Believability**

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## **Abstract**

Recently, autonomous agents with emotional behavior are developed to improve the human-agent interaction. Users' perceived "believability" of autonomous agents is considered to affect interactions with agents. While human-like emotional behavior is considered to increase believability, actual emotional behaviors differ across cultures. Therefore culture-specific emotional behaviors of agent might increase believability. In this paper, two kinds of emotional behaviors specific in Japanese culture, namely *amae* and Japanese way of agency appraisal, were implemented in agents. Influences of these behaviors on believability were investigated experimentally. Results showed that both Japanese behaviors increased believability. Especially *amae* increased personality factor, which is one of the factors of believability.

## **Author Keywords**

Autonomous agent; believability; emotional behavior; Japan; *amae*; agency appraisal; MikuMikuDanceAgent

## **ACM Classification Keywords**

I.2.11 [Artificial Intelligence]: Distributed Artificial Intelligence—Intelligent agents.; H.1.2 [Models and Principles]: User/Machine Systems—Software psychology

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## Introduction

### *Believability of Autonomous Agent*

In order for autonomous agents to spread more, higher believability is considered as an essential factor[5]. If the believability is perceived as low or not sufficient, users feel disbelief, anoetic or odd with the agent. While physical features of agent have already matured well, these days, emotional behaviors of agent are studied as increasing factor of believability[2]. As emotional behavior might contribute for agents to be perceived as more like human, people are likely to communicate more with agents with emotional behavior[1]. Therefore, implementation of realistic emotional behavior with agent is essential to promote interactions with autonomous agents.

### *Emotional Behavior and Culture for Autonomous Agent*

Some studies have implemented culture-specific behaviors into agents to increase realism or preference[4]. They showed that participants prefer the agents when the agents act participants' cultural behavior. However, previous studies have not focused on emotional behavior of agent in the context of culture. As emotional behavior may vary across cultures, agent's emotional behaviors specific in cultures should increase believability.

### *Purpose of This Study*

The purpose of this study is to investigate how emotional behaviors specific in a culture might influence on believability of agents. This study focused on Japanese culture for the feasibility of research. Firstly, two emotional behaviors specific in Japanese culture, namely *amae*, or indulgent dependency[9], and Japanese way of agency appraisal[6], are discussed. Then these behaviors were implemented with software agents. Finally, influences of these behaviors on believability were investigated through experiments using the agent.

## Japanese Emotional Behaviors

### *Amae*

Doi[3] defined *amae* as "to behave depending someone's generosity," and mentioned that *amae* is the key concept to understand Japanese specific interpersonal emotion. *Amae* always exists and remains through whole life of people in Japanese society[3].

Among various kinds of *amae* actions mentioned in previous researches, this study focused on the *amae* of wanting substitution that Kobayashi and Katou[8] suggested, because it is natural for agents to behave this kind of action, while other actions are not visible or not natural.

In implementation with the agents, *amae* action was expressed in situations where the agent had troubles in her task. They wanted the user to substitute her task. For example, when the agent was searching for some information and the browser did not work smoothly, the agent would say "It doesn't work. Please do this instead of me."

### *Japanese Agency Appraisal*

Agency is attributions for success or failure, and appraisal is to interpret to what extent individuals contributed or are responsible for the situation. Imada and Ellsworth[6] showed that in a successful situation, Americans reported stronger self-agency emotions than did Japanese, whereas Japanese reported a stronger situation-agency emotion, and vice versa (Table 1).

Situation	Japanese	Americans
Success	Situation-agency	Self-agency
Failure	Self-agency	Situation-agency

**Table 1:** Japanese and American agency appraisal[6]

In implementation, agency appraisal was expressed in situations where the agent succeeded or failed in doing her task. The agent attributes her success or failure in the ways shown in Table 1. For example, if the agent with Japanese agency appraisal fails in doing her task, the agent blames herself and attributed failure to her own.

## Implementation

Then both Japanese behaviors were implemented in agents with a computer software, MMDAgent[10]. It is a toolkit for building voice interaction systems.

Five tasks were prepared as scenarios in which users ask the agent to work. One is the example task. Others tasks are to ask the agent to help searching where to go out, to book a very popular concert ticket, and so on. Each task had variations in emotional behaviors, whether agency appraisal is Japanese or not, and whether do *amae* or not.

## Experiment

### *Experiment Design and Participants*

A 2 (do *amae* action or not)  $\times$  2 (Japanese agency appraisal or not) factorial design was employed for this study. Thirty-two Japanese university students (20 males and 12 females), aged between 18 and 23 years old ( $M = 21.0$ ,  $SD = 1.36$ ) participated in the experiment. Eight participants were randomly assigned to each of four between-participants conditions.

### *Procedure*

The experimenter showed the first task as a demonstration. Then participant was asked to act as if he/she was in such situations of the four tasks and started the tasks with instructions printed on paper and guide sentence on the screen. Finally, the participant answered the questionnaire.

### *Measures*

Two types of measurements were employed in this study: question about believability and the measure of Computer-Mediated Communication(CMC)[7] in order to measure general impression of agents.

### *Question for believability*

Gomes et al.[5] proposed the dimensions and metrics of believability. Dimensions are: awareness, behavior understandability, personality, visual impact, predictability, behavior coherence, change with experience, social, and emotional expressiveness. The templates Gomes et al.[5] proposed, were employed for the questionnaire, e.g. "The agent perceives the world around her(awareness)." Participants evaluated to what extent each of the sentences above matched with the agent, using seven-point Likert scales (1: "Not at all", 7: "Definitely").

## Results

A two (*amae* action or not)  $\times$  two (Japanese agency appraisal or not)  $\times$  two (participant's gender) analysis of variance was conducted for each of characteristic variables.

### *Believability*

There was a significant main effects of *amae* on personality score ( $F(1, 24) = 6.107$ ,  $p < .05$ ). This result suggested that *amae* increases perceived personality.

There was a moderately significant interactions between gender and agency appraisal on social score ( $F(1, 24) = 3.119$ ,  $p < .10$ ). Female participants rated agents with Japanese agency appraisal higher than non-Japanese agency appraisal ( $p < .10$ ). Finally, there was a significant interaction between gender and *amae* in social score ( $F(1, 24) = 4.874$ ,  $p < .05$ ). Male participants rated agents doing *amae* higher than those not doing *amae* ( $p < .05$ ).

### CMC

Agents with Japanese agency appraisal were perceived more earnest than those with non-Japanese agency appraisal ( $p < .05$ ). Agents doing *amae* were perceived more casual talk ( $p < .05$ ), short-tempered ( $p < .05$ ), less objective ( $p < .05$ ), and more volatile ( $p < .10$ ), than agents without *amae* action.

### Conclusion

This study proposed two emotional behaviors of autonomous agents that are specific in Japanese culture, which are *amae* action and Japanese agency appraisal. Influences of the proposed emotional behaviors on user's perceived believability were investigated through experiment. Results showed that agents with Japanese emotional behaviors obtained higher believability than those without Japanese emotional behaviors. To summarize, Japanese emotional behavior can be useful to increase agent's believability for Japanese users.

Endrass et al.[4] implicated Japanese behavior might have bigger influence on believability for Japanese people than foreign people. Comparative studies with participants from broader cultures should be conducted in future.

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