Cross-cultural study of perception and acceptance of Japanese self-adaptors

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ABSTRACT
This paper reports our preliminary results of cultural differences in expressing and perceiving self-adaptors of virtual agents. There are culturally-defined preferences in self-adaptors and other bodily expressions, and allowance level of expressing such non-verbal behavior are culture-dependent. We conducted a web experiment to evaluate the impression and allowance of Japanese culture specific self-adaptors performed by a virtual agent by members of other cultures. The results indicated non-Japanese participants' insensitivity to the different types of self-adaptors and over sensitivity to Japanese participants' to stressful self-adaptors.

Author Keywords
HAI, human-agent interaction, intelligent virtual agents, gesture, self-adaptors, non-verbal behavior, evaluation, culture-specific behavior, cross-culture

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Intelligent virtual agents (IVAs) that interact face-to-face with humans are beginning to spread to general users, and HAI research is being actively pursued. IVAs require both verbal and nonverbal communication abilities. Among those non-verbal communications, Ekman classifies gestures into five categories: emblems, illustrators, affect displays, adapters, and regulators [1]. Self-adaptors are non-signaling gestures that are not intended to convey a particular meaning [2]. They are exhibited as hand movements where one part of the body is applied to another part of the body, such as picking one's nose, scratching one's head and face, moistening the lips, or tapping the foot. Many self-adaptors are considered taboo in public, and individuals with low emotional stability perform more self-adaptors, and the number of self-adaptors increases with psychologi-

cal discomfort or anxiety [2, 3, 4].

Because of its non-relevance to conversational content, there has not been much HAI research done on self-adaptors, compared with nonverbal communication with high message content, such as facial expressions and gazes. However, self-adaptors are not always the sign of emotional unstableness or stress. Blacking states self-adaptors also occur in casual conversations, where conversant are very relaxed [5]. We focus on these "relaxed" self-adaptors performed in a casual conversation in this study. If those relaxed self-adaptors occur with a conversant that one feels friendliness, one can be induced to feel friendliness toward a conversant that displays self-adaptors. We apply this to the case of agent conversant, and hypothesize that users can be induced to feel friendliness toward the agent by adding self-adaptors to the body motions of an agent, and conducted two experiments.

The first experiment evaluated continuous interactions between an agent that exhibits self-adaptors and without [6]. The results showed agents that exhibited relaxed self-adaptors were more likely to prevent any deterioration in the perceived friendliness of the agents than agents that have no self-adaptors. In addition, people with higher social skills harbor a higher perceived friendliness with agents that exhibited relaxed self-adaptors than people with lower social skills. Thus, we expect that it would be possible to improve humanness and friendliness of agents by implementing self-adaptors in them. The second experiment evaluated interactions with agents that exhibit either relaxed self-adaptors or stressful self-adaptors in a desert survival task. The result suggests the need to tailor non-verbal behavior of virtual agents according to conversational contents between an agent and a human [7].

This paper reports a preliminary result of our consecutive experiment that deals with cultural issues. Our two previous experiments used only Japanese participants and did not consider cultural differences. However, there are culturally defined preferences in types of gestures and expressive methods of gestures [8]. Therefore, we can assume that there are cultural differences of expressing and perceiving self-adaptors as well as gestures.

We focus on cultural differences of perception and evaluate the impression of the agents with Japanese self-adaptors in this experiment. We hypothesize that "when the agent per-

forms Japanese-specific self-adaptors, Japanese participants have better impression than foreign participants".

EXPERIMENTAL METHOD

We used a female 3D model using Poser 7 (http://poser.smithmicro.com/poser.html) for the agent's appearance and created animations with three sets of conditions: "agents that exhibit relaxed self-adaptors (RA hereafter)", "agents that exhibit stressful self-adaptors (SA hereafter)", and "agents that exhibit beat gestures (BE hearafter)". The self-adaptors implemented for RA are the three types that were implemented in [6]. Based on the results of video analysis of the conversations between friends in a Japanese university, we found the following three types of self-adaptors occurred most frequently in most pairs: "touching hair," "touching chin," and "touching nose." Each stroke occurred once as a one-off action with a narrow range of hand movements. The timing was either at the beginning or at the end of an utterance. The self-adaptors implemented for SA are three of the self-adaptors used in [7]: "head-scratching", "neck-scratching", and "chin-scratching". A stressful self-adaptor is a scratching action which occurs a number of times over a wider range of hand movements than a relaxed self-adaptor. We implemented beat gestures to the agent as a control condition. A beat gesture is a rhythmic gesture used in conjunction with speech to emphasize certain words or phrases [10]. RA is shown in Fig. 1, SA is shown in Fig. 2 and BE is shown in Fig. 3.

The experiment was conducted on the web to gather participants from all over the world. Participants were instructed to evaluate reliability of an e-learning agent in the web experiment. They watched three movie clips where the agent talks about three different topics (i.e., the origin of pasta or panda's diet) assigned to them randomly. The agent performs either RA, SA or BE in one movie clip. They answer a questionnaire on the impression of the agent after they finish watching the first movie clip. They repeat the same task three times until they experience all three conditions. A post-experiment questionnaire was conducted to evaluate social and individual acceptance of the self-adaptors.

Fig. 1. Agent Exhibiting Relaxed Self-adaptors

Fig. 2. Agent Exhibiting Stressful Self-adaptors

Fig. 3. Agent Exhibiting Beat Gestures

RESULTS & DISCUSSION

We gathered 29 participants from Japan and 15 from other countries (i.e., USA, France, Germany, and Korea). We performed two-way ANOVA with repeated measures on the results of the impression evaluation questionnaire in two factors, with self-adaptor (RA, SA and BE) and participants' nationality (Japanese (JP hereafter) or non-Japanese (NJ hereafter)). We verify whether there are differences in the impressions of the agents and impressions of the interactions according to the types of self-adaptors and the participant's nationality. Fig. 4, 5, 6 show comparison of perceived friendliness, perceived intelligence, and perceived emotional stability of the agent respectively between the JP and NJ. Each question was rated with 7 point Likert scale.

Firstly, for the results of the perceived friendliness of the agents, no main effect of self-adaptors was found. There is an interaction between self-adaptors and nationality (F=5.79, p<0.01). The results of multiple comparison showed significant differences of perceived friendliness rated by JP between SA and BE (F=7.43, p<0.01) and RA and SA (F=14.81, p<0.01). (Fig.4). In both comparisons, SA was rated as significantly less friendly than RA or BE by JP. However such difference was not found in the ratings by NJ, and NJ's ratings were constantly lower than the median score in any self-adaptor condition.

Secondly, the perceived intelligence ratings showed similar results (Fig. 5). There is an interaction between self-adaptors and nationality (F=8.06, p<0.01). Again, SA was rated as significantly less intelligent than RA or BE by JP. However, such difference in perceived intelligence was not found in any ratings by NJ, and NJ's ratings were stayed flat around the median score in any self-adaptor condition.

Thirdly, in terms of perceived emotional stability (Fig. 6), there is an interaction between self-adaptors and nationality (F=17.04, p<0.01). Again, SA was rated as significantly less emotionally stable than RA or BE by JP. However, such difference in emotional stability was not found in the ratings by NJ between RA and SA. However, BE was rated as significantly less emotionally stable by NJ than JP, and than RA and SA. The reason for the low rating of BE by NJ is that the way JP and NJ perform beat gestures are different. Japanese culture-specific beat gesture is performed as palm down movements, which was implemented in BE. However, we were informed by the foreign participants that they always perform beat gestures as palm faced up. Japanese beat gesture was interpreted as "Calm down, be quiet." Thus the palm down beat gesture was interpreted as aggressive by NJ.

To summarize the impression of the agents, when the agent performed the relaxed-self-adaptors, impression evaluations made by the Japanese participants are higher than the ones made by non-Japanese participants. However, impression evaluations of the Japanese are lower than the one made by non-Japanese when the agent performed the stressful self-adaptors. Evaluations made by non-Japanese were constantly low across all conditions. These results partially support our hypothesis only to the case of relaxed self-adaptors and beat gestures.
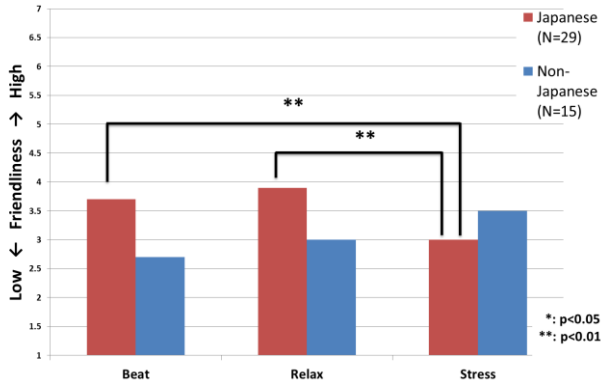

Fig. 4. Comparison of Friendliness Scores between Japanese and Non-Japanese
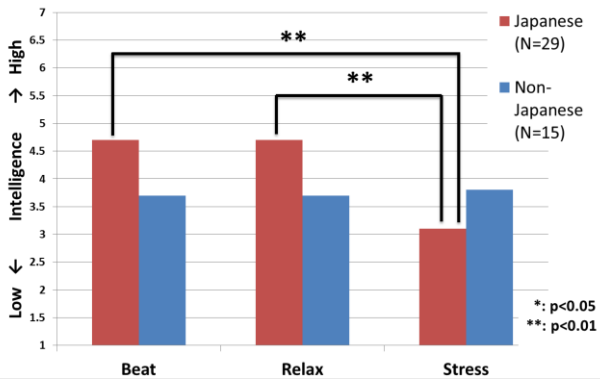

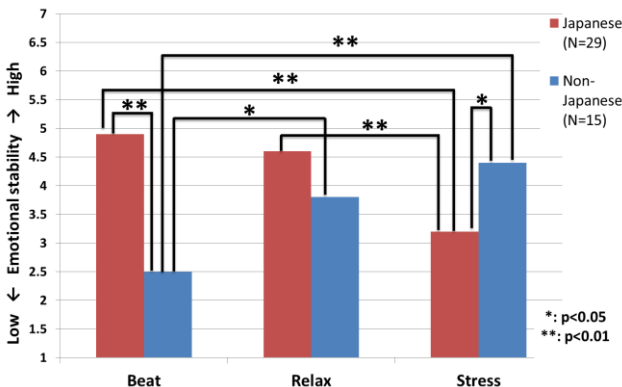Fig. 5. Comparison of Intelligence Scores between Japanese and Non-Japanese

Fig. 6. Comparison of Emotional Stability Scores between Japanese and Non-Japanese

Although the results suggested cultural differences in the impression of stressful self-adaptors, it is important to investigate whether the agent's behaviors and hand movements were perceived as natural. The result of perceived naturalness of behavior is shown in Fig. 7. There is an interaction between self-adaptors and nationality (F=8.43, p<0.01). Cultural differences were seen in RA and BE. JP felt significantly higher naturalness toward RA (F=15.35, p<0.05) and BE (F=25.89, p<0.05) than NJ. Similar to the impression analyses above, JP felt significantly less naturalness toward SA than RA (F=13.11, p<0.01) and BE (F=16.92, p<0.01), while NJ's perception of naturalness stayed low in across any self-adaptor conditions. Similar to Fig. 6, BE was perceive as significantly less natural by NJ.
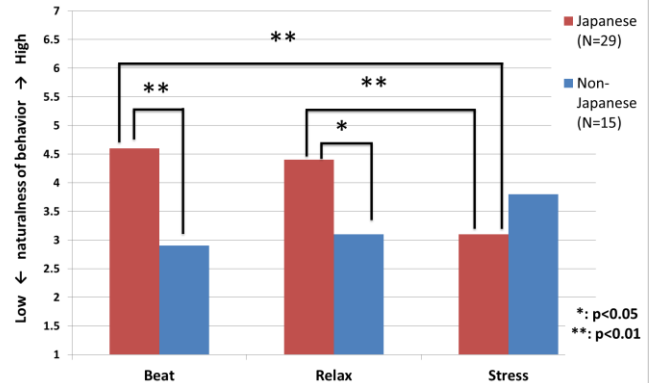

Fig. 7. Comparisons of Naturalness of Behavior Scores by Japanese and Non-Japanese

Finally, we examined whether the self-adaptors used in this experiment were considered as taboo or not (since most self-adaptors were considered as taboo if shown in public) individually and culturally. The results of participants' personal acceptance of agent's behaviors and social acceptance in their home countries are show in Fig. 8 and 9 respectively. JP evaluated the personal acceptance of SA lower than RA (F=54.04, p<0.01) and BE (F=54.04, p<0.01). JP's personal acceptance of SA is significantly lower than NP (F=8.60, p<0.01). These results indicate Japanese little acceptance to stressful self-adaptors. The results of previous research suggested that users unconsciously expect agents to behave in a manner that is appropriate to the topic of conversation as we do with humans [7]. Since the participants were instructed to evaluate reliability of an e-learning agent, JP evaluated the appropriateness of the behavior for an e-leaning instructor.

However, NJ didn't change their appropriateness evaluation according to the type of self-adaptors. The reason for constant evaluation across any self-adaptors by NJ is that NJ did not notice the differences of self-adaptors used in the experiment, since we used self-adaptors extracted from dyad conversation video recordings between Japanese university students. Only JP noticed the differences of the self-

adaptors and lowered their impression on the agent with stressful self-adaptors.
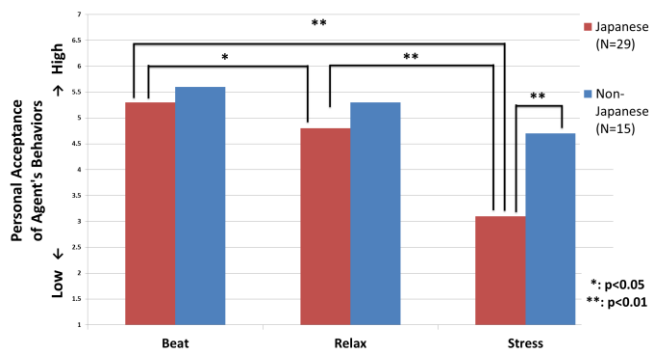

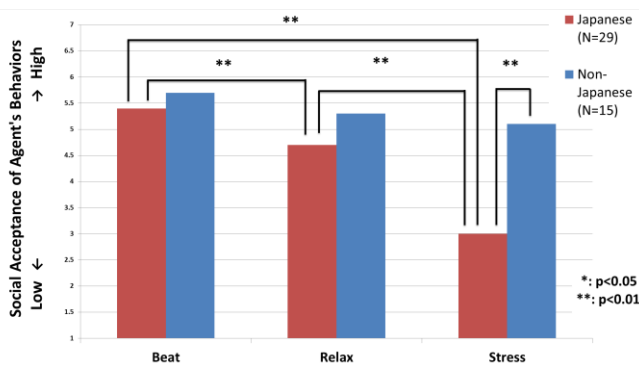Fig. 8. Participants Personal Acceptance of Agent's Behaviors

Fig. 9. Social Acceptance of Agent's Behaviors in Participants' Home Country

CONCLUSIONS

This experiment compared impressions of an e-learning instructor agent with Japanese specific self-adaptors rated by Japanese and non-Japanese participants. Our hypothesis "when the agent performs Japanese-specific self-adaptors, Japanese participants have better impression than foreign participants" was partially supported only to the case of relaxed self-adaptors. The results suggest Japanese significantly low impression and over sensitivity toward stressful self-adaptors compared to non-Japanese participants. This negative impression can be explained by lower social acceptance toward stressful self-adaptors among the Japanese participants. The Japanese participants evaluated the agent performing stress self-adaptors were not appropriate as an e-learning instructor.

On the contrary, the non-Japanese participants were insensitive to the differences in the types of Japanese culture specific self-adaptors. However, they reacted negatively to the Japanese culture specific beat gestures, which are closely coordinated with speech and add meaning to the content. In order to investigate different impression and sensitivity to culture specific self-adaptors and their influences to interacactions, future study should investigate self-adaptors shown in other countries, implement them with agents, and conduct a cross-cultural experiment with larger number of participants and countries.

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