TelMeA: An Asynchronous Community System with Avatar-like Agents

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Abstract: In this paper, we propose an asynchronous community system named TelMeA, which employs avatar-like agents, or scriptable animated agents, as the conversation interface. Few of current online community systems are close to real communities both in reality and in functions. We show with the proposed system that online community can be more like our real community in awareness of participants and of community itself. TelMeA realizes the following functions for asynchronous communication using avatar-like agents: individual embodied presence, physical communicative cues, interpersonal spaces, and cooperative reference. Participants can easily identify other participants with avatar-like agents. And people can understand meanings of other participants' messages well and become expressive in their messages with non-verbal behaviours of agents. We performed a preliminary psychological experiment to clarify functions of avatar-like agents, and implemented the result in TelMeA. We also evaluated TelMeA by a test use and showed that TelMeA is natural and useful for asynchronous communities.

Keywords: CSCW, CMC, Online Community, Anthropomorphized Interface, Avatar-like Agent, Awareness

1 Introduction

1.1 Online Communities as Social Information Systems

Recently, the explosion of communities on the Internet has drawn the public's attention. CMC (Computer Mediated Communication) systems, such as mailing lists, Usenet newsgroups, BBS (Bulletin Board System), IRC (Internet Relay Chat), and MUD (Multi-User Dungeon) (Damer, 1998), allow distant people to voluntarily build and gather into communities. These communities on the Internet are called online communities.

In many cases, participants of an online community hold shared interests or intentions. Furthermore, many of these participants have wide experience and knowledge in their shared topics or problems and various viewpoints toward subjects of conversation. Since participants of these communities have such extensive experience and knowledge, the communities themselves can be seen as an information source of experience and knowledge. In these communities, especially in asynchronous ones, participants' experience and knowledge are built with members' notions through a process of describing. The built messages are shared among the community, evaluated by each other, and archived as conversation logs.

We believe this voluntary activity of online communities is a new and interesting approach to information processing. From the viewpoint of information processing, an online community can be regarded as a social information system that has four functions:

1) Information Builders:
   Communications causes information. Participants' concepts are realized as storable representations through communication in the community.
2) Information Filter:
   Information related to the special themes or purposes is collected and distributed.
3) Information Editor:
   Information is analysed, evaluated, and redressed to compose new information on the special themes or purposes.
4) Information Archive:
   Information is stored and served as abundant information resources for specialized fields.

Although these functions are promising to build social information systems, the current online community systems are insufficient for such a purpose. The main reason is that the current systems are unnatural as community systems because they are simply designed with traditional communication technologies, i.e., most of them are text-based communication systems.

1.2 Anthropomorphized Interface for Asynchronous Community System

An asynchronous community, that is an online community based on asynchronous communication channels such as ML, BBS, and Usenet newsgroups, gives participants time to read others' contributions carefully, to retrieve information about the current topics, and to improve their writing as they compose messages. Hence, asynchronous communities have greater abilities to integrate information than synchronous communities such as text-based IRC, MUD, and videoconference systems, because information is more deliberated and more organized.

However, the contributions of current asynchronous community systems are usually represented by text-based documents. The text-based conversation is conventional and familiar, but lacks various implicit contexts such as awareness of participants that found in ordinary face-to-face conversations. Such a context is important especially in asynchronous many-to-many conversations because text-based conversations often cause unexpected situations like "flaming" discussions. Identity, subjectivity, narrative, and coherence of utterance are based on consistency in corporeality. We think that a lack of consistency in human corporeality causes this lack of awareness in text-based conversations.

In this paper, we propose a community system named TelMeA, which supports activities in asynchronous communities, especially the process of knowing each other. In order to support this process, TelMeA employs a conversational interface with corporeal anthropomorphized aspect. We call such anthropomorphised conversational interface as avatar-like agent. An avatar-like agent is defined in this paper as a scriptable anthropomorphized animated agent for a telecommunication-specific conversational interface. The avatar-like agent becomes a substitute for its user in online communities; users communicate with one another through their associated avatar-like agents.

Each avatar-like agent has its own body and individual aspects so that users can identify each other in TelMeA communities. A user of TelMeA can use conversational field such as interpersonal space among avatar-like agents, so that he or she can be aware of other participants and their activities as well as showing his or her own presence. Furthermore, a user can refer to web pages for background contexts of conversation topics and is capable of representing explicit and implicit contexts for community ambience. Therefore, users can send and receive information with rich semantics.

1.3 Organization of this Paper

This paper is organized as follows. In Chapter 2, we show a psychological experiment to clarify functions of avatar-like agents. We show the overview of our prototype system for an asynchronous community, TelMeA, in Chapter 3, and describe its details in Chapter 4. Results of a test use of TelMeA are shown in Chapter 5. Finally, we conclude this paper in Chapter 6.

2 Functions of Avatar-like Agents

In this chapter, we discuss difference between textually mediated and avatar-like agent mediated conversation. We analysed the difference through a psychological experiment.

2.1 Problems in Text-based Conversations

In face-to-face conversations, people express themselves with physical non-verbal cues such as facial expressions, postures, gestures, gazes, finger pointing, and so on. People use these non-verbal

cues in a way that is complementary to vocal speech in order to convey messages quickly, clearly, effectively and safely. For example, suppose a person wants to give someone a message related to an object near her. She may smile and simply say pronouns like “this” or “that” while turning her gaze and pointing her finger to the object. This expression is not prolix but instead economical. If she represents the same message only by text, the description may be long-winded and tedious.

Text-based conversations can hardly express physical cues like smiling, gazing, or pointing. People are therefore often forced to use complicated phrasings to avoid misunderstanding emotional expressions or referred terms. Such complicated phrasing can cause much trouble for both writers and readers, and can make asynchronous conversation sequences awkward.

Moreover, identifying people is not easy in text-based communication. New visitors often feel difficulty to identify the participants of text-based online communities because the existence of a participant is represented only by her name and messages. Accordingly, a person’s presence is not embodied, and her identity is not recognized in a corporeal aspect.

Figure 1 is a model of the process for recognizing and naming a person (Young et al, 1985). The important point of the model is that the process is strictly sequential: a person cannot access information related to other people unless familiar aspects can be found, and she does not access additional information on them such as names, unless she can access their “semantic” information such as their biographies, interests, personalities, episodes, and so on.

By applying this model to text-based asynchronous conversations, users cannot provide enough information to identify people and their names because the participants’ names and texts are provided without their physical aspects. Therefore, if a visitor to the community cannot know other participants well, the visitor might be able to understand each message of the contributions but would probably encounter difficulty to identify a participant as the contributor of previous messages. This difficulty prevents participants from recognizing other people’s personalities and relationships in the group, the meta-structures in conversations, and as a result the participation of new visitors in ongoing conversations. If messages are provided with physical aspects in asynchronous communities, visitors might identify and recognize

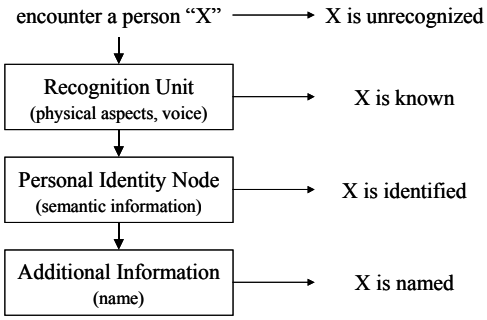


Figure 1: Model of the process for recognizing and naming a person.

other participants more naturally and feel more freely to join a conversation

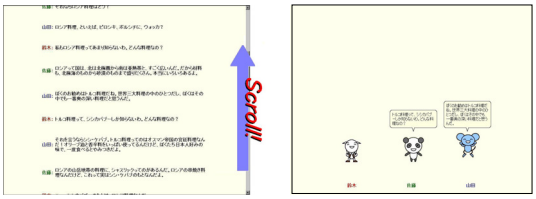
2.2 Anthropomorphized Agent as a Social Existence

Based on the Media Equation paradigm (Reeves et al, 1994), social behaviour of anthropomorphized agents can induce a user’s recognition in which the agent is regarded as an actual social existence, and the user unconsciously tends to behave socially as if she or he would toward a human (Takeuchi et al, 1999; Takahashi et al, 2000). As well as the case of anthropomorphized agents, we think avatar-like agents also make users recognize the agents as social entities, which have their own subjectivities or delegated ones.

2.3 Psychological Experiment

To verify the effects of avatar-like agents’ subjectivity, we made a psychological experiment by comparing the situation of textually mediated conversation and avatar-like agent mediated conversation.

First, we divided subjects into two groups and shown one group a conversation log by text and other with avatar-like agent. We told the subjects “the conversation shown here is a log that took place via a network” before the experiment. In the conversation, three participants talked about dinner



2-a (left): Auto scrolling text style conversation
2-b (right): Conversation with physical cues by avatar-like agents

Figure 2: Screenshots of conversation under each experimental condition.

menu. One of them suggested Turkish food and the other suggested Russian food. Conditions of log style for two groups are as follows:

Text Condition:

A text style conversation by three people takes place. All messages are given with the speaker's names and furthermore showed with different colours. We showed the messages scrolled down automatically for about 130 seconds (Fig.2-a).

Agent Condition:

Three avatar-like agents appear with their owner's names. The avatar-like agents make conversations using synthesized voices and balloon text for about 150 seconds. The agents have gestures, facial expressions, and gaze in accordance with the context of the conversation (Fig.2-b).

We gave a questionnaire to all subjects after the conversation. In the questionnaire, the subjects were requested to answer questions from three choices and also to rate attitudes on a scale of 1 to 7, where 7 is the most positive attitude.

The questionnaire contained 1) four questions on recalling memories about the content of the conversation, 2) three questions on identifying the utterers, 3) three questions on ratings for impression of conversation, and 4) two questions on ratings for whether the subject wants to participate the conversation.

2.4 Result of Questionnaire

The subjects consist of 13 men and women in their twenties. Through their personal data, we know that all subjects have the experience of participating in some kind of mailing list, 11 of them participating on BBS, and 8 of them participating on chatting on the Internet. Each experiment took about ten minutes. We placed 6 people in the Text Condition and 7 people in the Agent Condition.

Table 1 shows the results of the questionnaire. The first row of Table 1 shows that no statistical difference appeared according to the rate of recalling memories about the content of the conversations between two groups. In contrast, the second row shows a significant difference between subjects in the Text Condition and those in the Agent Condition. The identification rate in the Agent Condition was higher than in the Text Condition ($p < .05$). This difference is consistent with Young's identification model (Fig. 1). That is, physical aspects of others are important for identification.

In actual online communities, participants seem to identify each other accurately. However, participants of text-based communities, especially newcomers, incur much effort for identification of each utterer. This effort seems to be an obstacle to community perspective and hinders spectators from uttering. In fact, though the third row of Table 1 shows that no statistical difference is observed according to the result of self-rating about the impression of the conversation, the last row shows a significant tendency of self-rating about the voluntariness of participation in the conversation between the Text and the Agent Condition. Subjects with avatar-like agents showed interest to join the conversation more than subjects with text.

	Text Condition	Agent Condition
Number of right answers (out of 4); conversation recalling	2.84 (0.76)	3.16 (0.68)
	No statistical difference	
Number of right answers (out of 3); utterer identification	1.32 (0.81)	2.43 (0.78)
	Significant difference ($p < .05$)	
Self rating; impression of conversation	5.4 (0.9)	5.5 (1.9)
	No statistical difference.	
Self rating; volunteer for conversation	3.3 (1.4)	5.1 (2.1)
	Tendency of statistical difference ($p < .10$)	

(SD values in parentheses)

Table 1: Result of the questionnaire

2.5 Conclusion of the psychological experiment

The result of the experiment shows that avatar-like agents have effects for identification of participants in online. In addition, it was found that avatar-like agents tend to give an incentive to participate in the online conversation more than in the case of text. Though part of this tendency arises from the novelty of the avatar-like agent mediated conversation, we think the biggest cause is the visibility of conversation.

3 Asynchronous Community System with Avatar-like Agent

As mentioned above, two issues in terms of awareness should be stressed for text-based asynchronous conversations. One is the issue of non-verbal cues and the other is the issue of identity. Installation of avatar-like agents into asynchronous community systems is expected to solve these two issues to some extent.

With avatar-like agents, we can easily represent non-verbal physical cues such as facial expressions,

Figure 3: Conceptual diagram of our community

gestures, and finger pointing and moving on the display relative to other agents' positions. By means of such physical cues with avatar-like agents, users can converse in a form close to natural face-to-face multi-modal communications even in an asynchronous way. In addition, avatar-like agents can show embodied aspects associated with participants in asynchronous communities. Not by participant's names but by their agents' aspects, new visitors to the community can identify participants easily and find familiarity with them through intuition. The visitors can easily attribute contexts of contributions as participant's semantic information via avatar-like agents' aspects. Additionally, social presence and behaviour of the avatar-like agents can generate a realistic ambience in conversations in the asynchronous community.

For these effects, we developed a community system named TelMeA, which employs avatar-like agents as an asynchronous conversational interface. In a TelMeA community, all contributions are in the form of scripts for avatar-like agents and the scripts appear as behaviour of avatar-like agents, i.e., avatar-like agents perform face-to-face multi-modal conversations instead of text messages.

Figure 3 shows a conceptual diagram of our online community. In this community, users are able to become aware of the presence of other participants by the displays of their avatar-like agents. However, such presence does not mean the synchronous access of associating participants. Rather the presence of an avatar-like agent stands for track of the activity of a participant and this presence provides an ambience of reality and dynamics to the asynchronous conversation.

By means of TelMeA, users can script their agents with the following types of representations:

A) Voice by text-to-speech synthesizer
B) Text writings in balloons
C) Facial expressions by animations
D) Gestures by animation
E) Face rounding by animation
F) Finger pointing by animation
G) Moving on the display in connection with animation

In addition to the above, users can do the following without the agents:

H) Specify URLs of any web pages and open the pages
I) Upload any image files to share and open them

By combining these types of representation, users can perform a variety of expressions:

- Utter with a laugh
- Respond with head-nodding
- Gesticulate with/without voice
- Move to an agent and address it
- Open and compare two web pages
- Point a finger at an image on a page
- Show and comment on a picture

4 Implementation of TelMeA

WWW is a sociable place (Donath et al, 1994). TelMeA makes the WWW more sociable. TelMeA was developed as a web application system, and users can access information via web browsers. The server is implemented with JSP (JavaServer Pages) technology[i)], and avatar-like agents are in the entirely client-side program implemented by MS Agent technology[ii)]. MS Agent is a set of software agents functioning as interactive personalities, and it can be programmed with JavaScript code in web pages (Bell et al, 1997; Microsoft, 1998). Since MS Agent is used, each client is needed for installing components of MS Agent as well as its character files as the avatar-like agent. Internet Explorer is required for the client browser on TelMeA because MS Agent uses ActiveX technology[iii)].

Figure 4 shows the architecture of the TelMeA system. One TelMeA system manages multiple communities and multiple users who can belong to multiple communities at the same time. The database in the server stores the attributes of communities and users. All of the contributions in the communities are also registered in the database in the form of conversation sequences. The contributions are described in an original script language named ALAScript. A description of ALAScript consists of texts with tags associated with agent behaviours. The

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[i)] JavaServer Pages Technology [http://java.sun.com/products/jsp/]
[ii)] Web Workshop – Microsoft Agent Home – [http://www.microsoft.com/msagent/]
[iii)] ActiveX Controls [http://www.microsoft.com/com/tech/ActiveX.asp]

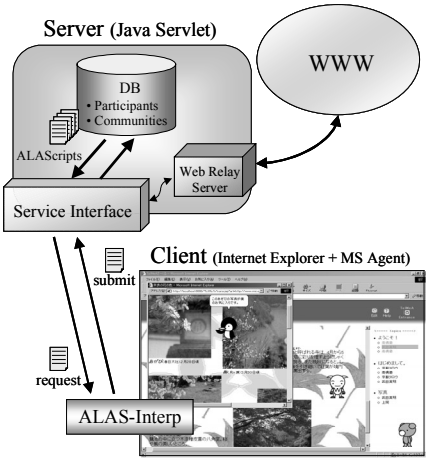

Figure 4: Architecture of TelMeA

set of tags used in the current ALAScript are as follows.

- Identification
  <#actor> *agent_name*
  Designation of the active avatar-like agent
- Verbal Representation
  <#speak> *comment_sentence*
  Utterance with synthesized voice and text in balloons
  <#think> *comment_sentence*
  Balloon utterance without voice
- Physical Representation
  <#play> *animation_name*
  Physical behavior by animation
  <#move> *point_on_the_screen*
  Movement to a designated point on the screen
- Interpersonal Space
  <#approach> *agent_name*
  Approach toward a designated avatar-like agent
- Cooperative Reference
  <#open> *url*
  Denotation of a designated web page
  <#refer> *image_id@ url*
  Denotation and Reference of a designated image file uploaded by a participant or located on a designated web page

Figure 5 shows the authoring page. The contributions written in ALAScript are composed on this authoring page. A user can compose descriptions by checking her agent's actual behaviours. The user is also able to perform a preview through all acts of her agent to determine whether the agent is behaving as she wants. Because TelMeA is not an avatar-based virtual society system but an asynchronous community system, the user is able to modify her message with the preview of the message until she is fully satisfied.

Figure 5: Authoring page of TelMeA

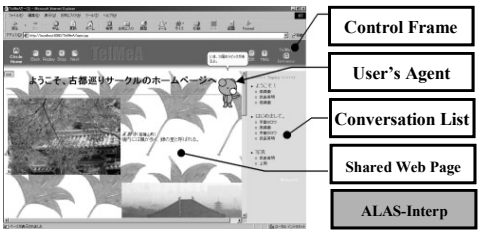

Figure 6: Configuration of a community web page

Figure 6 is a screenshot of a community's web page. When a user enters a community, a web page in this figure appears and then the agent associated with the user appears. The TelMeA community's web page consists of three frames. The control frame appears at the head of the page, which shows several icons to control the system. The main frame shows the web page, which is shared as a background context of the conversation. Initially, this frame shows the welcome page that is registered when the community is created. The right-hand side frame shows a list of conversations already done in the community. If the user clicks any conversation title, all avatar-like agents participating in this conversation appear and start to talk (Fig. 7).

Figure 7: Conversation scene among agents (A "penguin" agent is explaining a figure while pointing at it)

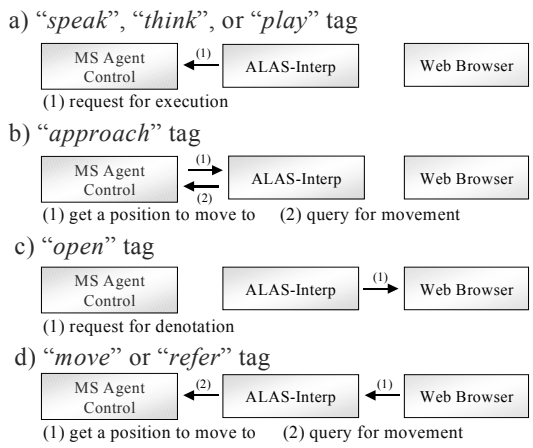

Figure 8: Scheme of the ALAS-Interp

Each web page of a TelMeA community involves an invisible module written in JavaScript. This module is the interpreter of ALAScript, which is called ALAS-Interp. By means of this module, the communications between the server and a client is mainly comprised of ALAScript data (Fig. 4). All composed and submitted contributions by ALAScript are stored in the database, and the appropriate ALAScripts are retrieved and interpreted in agents' behaviours when the user clicks a title in the conversation list. Figure 8 shows the scheme of ALAS-Interp.

5 Evaluation of TelMeA System

5.1 Test Use of TelMeA

As a test use, we made TelMeA public in the institute, and asked people to use it. Seven people logged in TelMeA, formed seven communities in it, and submitted eighteen contributions during the experiment period (nine days).

Table 2 and 3 show analysis of these contributions to show how various types of representation were used. Here we cut each contribution by phrase and classified these cut phrases by type of representation. Table 3 shows that contributions involved 17.0% of non-verbal representations, i.e., those with tags except "speak" and "think" tag was used in this case. We believe this figure indicates that non-verbal representation in TelMeA was accepted well by users.

Table 3 also shows the detail of non-verbal representation, i.e., a ratio among physical representation, use of interpersonal space and cooperative reference. The highest score in the three is physical representation and the lowest is cooperative reference. We expected that functions to manage web pages like functions to open and refer web pages would be used more, since these functions can make channels of information in communities wider. We believe longer use may result the different ratio because we observed many errors when the users used these functions.

Phrases* in <#speak>	352
<#play>	53
<#move>	4
<#approach>	10
<#open>	2
<#refer>	3
Sum	424

*accurately, Japanese *bunsetsu*

Table 2: Numbers of tagged representations

Verbal Representation	**83.0%**
Physical Representation	13.4%
Interpersonal Space	2.4%
Cooperative Reference	1.2%
Sum of **Non-verbal Representation**	**17.0%**

Table 3: Ratio of verbal and nonverbal representations

5.2 Result of Questionnaire

After we terminated the test use period, we asked these users to answer a questionnaire. In this questionnaire, they were asked to answer their subjective evaluation of the system with five ranks, where 1 is the most negative and 5 is the most positive.

The questionnaire contained 1) four questions about how the users regard avatar-like agents, 2) ten questions about users' evaluation of acceptability and usefulness of avatar-like agents in a mediated online community, 3) eight questions about users' evaluation of individual representation functions, and 4) seven questions about users' evaluation of TelMeA compared to other community systems such as ML, BBS, and IRC (total twenty-one questions).

Most of mean values of rating for each evaluation are positive (more than 3), except for the question "I felt other agents behaviours and facial expressions were spontaneous," which is valued equal to 3 on average. As long as this evaluation, we think that TelMeA is a valuable online community system for a variety of users.

In addition, we found further interesting analytical results from the questionnaire:

- Recognition of avatar-like agents

Some users recognized avatar-like agents as avatars of their users, while others recognized avatar-like agents as delegates of their users. This recognition, however, is mostly consistent in individual users; if a user recognizes the user's own avatar-like agent as an avatar then the user recognizes other avatar-like agents as avatars; this tendency held for recognition as delegates. Only one user recognized avatar-like agents in an inconsistent way; he recognized his own avatar-like agent as a delegate and the other avatar-like agents as avatars. In addition, another user recognized her own avatar-like agent in two ways: only when she composed her message with her avatar-like agent did she recognize it as an avatar, but at the other times she recognized it as an delegate, while the other avatar-like agents were always delegates to others.

More interestingly, the users' evaluations of TelMeA seemed to be independent of the way of recognition.

- Evaluation of acceptability and usefulness

From detailed analysis for individual users, all users valued usefulness of avatar-like agents more highly than acceptability of them. Contrarily, most users valued acceptability of a co-presence place for avatar-like agents more highly than the usefulness of the place (six users out of seven). As the result shows, functions for non-verbal representation via avatar-like agent and the presence of avatar-like agents are high evaluated.

- Evaluation of usability

From the results of individual evaluations of community systems, TelMeA was evaluated highly as joyful tool rather than a convenient or functional tool. Users enjoyed their communication with TelMeA well although its interface is still unnatural to be improved.

6 Conclusion

In this paper, we proposed an asynchronous community system named TelMeA, which employs avatar-like agents. The avatar-like agents embody presence and enhance awareness in the identification and relationship of participants. These agents can also express non-verbal expression. Representation by physical cues, interpersonal space, cooperative reference, and so on leads to conversations in a form close to face-to-face communications and helps people to convey messages simply, clearly, and effectively even in asynchronous conversations.

In future work, we will consider a model involving avatar-like agents' conversations to express recognition of asynchronous conversations more effectively. At the same time, we will make the TelMeA system public on the Internet and improve the interface, especially that of the authoring page.

Acknowledgements

We sincerely thank Dr. Yasuyuki Katagiri and Dr. Yugo Takeuchi of ATR MIC, who have made grateful advices for psychological experiments. We also thank Ms. Keiko Nakao of ATR MIC, who has designed MS Agent characters we used in the figures. These characters are designed as a part of a project on personal agent at ATR MIC.

References

Bell, G. *et al*., (1997), Lifelike computer characters: The persona project at Microsoft, *in* Jeffrey M. Bradshaw (ed.), *Software Agent*, pp.191-222.

Damer, B. (1998), *AVATARS!*, Jeremy Judson (ed.), Peachpit Press, California.

Donath, J. & Robertson, N. (1994), The Sociable Web, *Proceedings of the Second International WWW conference.*

Microsoft Corporation (1998), *Microsoft Agent Documentation*, Oct. 1998. Available at http://msdn.microsoft.com/workshop/imedia/agent/alldocs.zip

Reeves, B. & Nass, C. (1994), *The Media Equation,* Cambridge University Press.

Takahashi, T., Takeuchi, Y., & Katagiri, Y. (2000), Change in Human Behaviors Based on Affiliation Needs – Toward the Design of Social Guide Agent System –, Proceedings of the Fourth International Conference on Knowledge-Based Intelligent Engineering Systems & Allied Technologies (KES2000), Vol. 1, pp. 64-67.

Takeuchi, Y. & Katagiri, Y. (1999), social character design for Animated agents, *In Proceedings of IEEE International Workshop on Robot and Human Interactive Communication (RO-MAN'99)*, pp. 53-58.

Young, A. W., Hay, D. C. & Ellis, A.W. (1985), The face that launched a thousand slips: Everyday difficulties and errors in recognizing people, *British Journal of Psychology*, Vol. 76, pp. 495-523.