EgoChat Agent: A Talking Virtualized Member for Supporting Community Knowledge Creation

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Abstract

In this paper, we propose a method for supporting knowledge creation in a community by talking with virtualized-egos. We propose two ideas for the community knowledge creation. The first idea is talking with virtualized community member called "virtualized-ego"; a virtualized-ego is a software agent that mimics a community member. Virtualized-egos replay past speeches of community members and generate a conversation with voices. A community member can exchange knowledge by oral chat with virtualized-egos on behalf of other community members. The other idea is a story-telling; speeches of virtualized-egos are ordered as a story. A story is a series of speeches that reflect personalities of community members, and using story is casual method for exchanging knowledge because story-telling is human-style communication method. We have developed a system called EgoChat to investigate these ideas, and discussed effectivity of the proposed system for the community knowledge creation based on a experiment.

Introduction

In the human community, intelligent agents can facilitate community activities by interacting with humans. Such social agents for supporting humans has been studied in the research area called Socially Intelligent Agents(SIA) (Dautenhahn 1998a). Our approach to SIA is talking with virtualized community members for evolving community knowledge. We have ever developed a knowledge sharing system called CoMeMo-Community (Nishida 1999) where agents talk to each other on behalf of the real people in a community. In this paper, we call a group of persons who share common interests "community". For example, teachers and students in a school community discuss about the same interest to learn, workmen in a workshop community interact with each other to share their know-how, or people in a local community talk about their great interest in wisdom of a daily life. In CoMeMo-Community, the agents show relations between some interests of community members by text-based virtual conversation to facilitate community knowledge sharing.

This paper presents the advanced CoMeMo-Community agent that talks autobiographic stories on behalf of a community member and supports community knowledge creation. In human processes of knowledge creation, informal communication for exchanging their personal experience brings innovative knowledge (Nonaka & Takeuchi 1995). In the same way, interaction among humans and agents can be also enriched by the personal experiences. To improve a relationship between humans and agents, telling autobiographic stories about oneself and biographic reconstructions about other persons/agents help social understanding between humans and agents. (Dautenhahn 1998b). These autobiographic stories appear in our daily chat. According to Schank (Schank 1990), especially interesting prior experiences form a story in human memory, so our everyday chat are based on stories. Our great challenge to SIA in this paper is to generate autobiographic conversation from our daily e-mails.

Because recent progress in communication technologies on electronic media such as e-mail or WWW facilitates activities in a community, we apply SIA on these electronic communication media. Our method for supporting knowledge creation is using human-style talking agents called "virtualized-egos". A virtualized-ego is one's other self which works independently of one's self and can talk on one's behalf. Virtualized-egos store everyday e-mails as autobiographic memory that stores experiences of community members and generate a story from this memory.

The virtualized-egos work in our system called EgoChat, which is a virtual environment for a conversation among humans and virtualized-egos with voices. On EgoChat, community members can exchange their experience with each other even in some members' absence because virtualized-egos can talk on behalf of absent members.

Virtualized-ego : a talking agent on EgoChat

Because interaction among humans and virtualized-egos should be as casual as possible for humans, virtualized-egos have two modalities. The first is talking with voices; because the voice is a familiar mode for humans, a user of EgoChat can interact with virtualized-egos by oral chat and understand what they said easily. The other is using a body and gestures; a virtualized-ego is embodied by photographic 3D face CG[1] and can generate a simple gesture. A face CG

[1]"Facial Image Processing System for Human-like "Kansei" Agent" http://www.tokyo.image-lab.or.jp/aa/ipa/

Figure 1: Screen shot of EgoChat system

clears who is the original person of the virtualized-ego and its gesture shows a degree of interest in a topic in a conversation.

Figure 1 shows a screen shot of EgoChat. A user is talking with three virtualized-egos, each of which has the face CG of another community member.

Moreover, the virtualized-ego emphasizes her/his believability by not telling a robotic message but talking about personal stories of a real community member.

Story in human relationships

When virtualized-egos tell a story, they generate it from their personal memories that consist of past speeches of community members. Text-based messages of a community member exchanged on electronic media such as mailing-lists, electronic bulletin boards, and so on, are summarized and uttered, and then stored in memory of her/his virtualized-ego. Oral messages are also recorded in the memory of virtualized-ego when a member tell her/his thoughts to virtualized-egos on EgoChat.

Speeches of virtualized-egos are ordered as a story. In this research, we define a story as a series of speeches that represent personalities of community members. When we observe conversations in a mailing-list, we find that a speaker of the mailing-list inclined to talk with a special member who had the same interests as the speaker had. We therefore assumed that members in a general community have this kind of inclination about conversation, and that the inclination represents personalities of community members. On EgoChat, each of virtualized-egos selects a message from her/his personal memories and tell it to each other orderly. Topical messages follow the theme, and the order of messages is characterized by the above-mentioned inclination in order that virtualized-egos may reflect social relationships in a community.

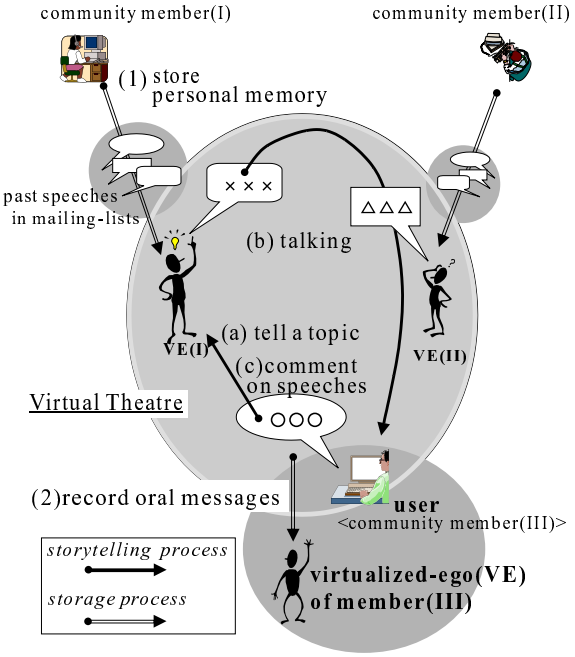

Figure 2: Overview of EgoChat system

Overview of EgoChat

The EgoChat system consists of three storytelling processes and two storage processes (2). In the storytelling processes, community members can share their knowledge by creating a knowledge stream with their virtualized-egos. When a user would like to gain community knowledge, s/he inputs her/his interest into EgoChat by using voice messages(storytelling process(a)). Voice messages of the user are recognized by a commercial speech recognition system, then virtualized-ego(VE)s start talking about related topic(storytelling process(b)). Virtualized-egos will continue talking with each other if the user doesn't interrupt the conversation to comment on speeches of virtualized-egos or change a present topic to another topic(storytelling process(c)).

While talking with virtualized-egos, personal memory of a community member is enriched in the storage processes. Before using EgoChat system, the personal memories are stored in virtualized-egos by using automated summarizing technology or summarizing humanly from past speeches exchanged on electronic media such as mailing-lists(storage process(1)). These personal memories are described by structured lists in HTML, and this enables people to edit and browse their personal memories by using ordinary editors and browsers. Besides text-based speeches, virtualized-egos store newly commented oral messages of a user on EgoChat(storage process(2)), thus virtualized-egos tell community knowledge in past speeches of community members and users add new ideas into their virtualized-egos in a loop of community knowledge creation.

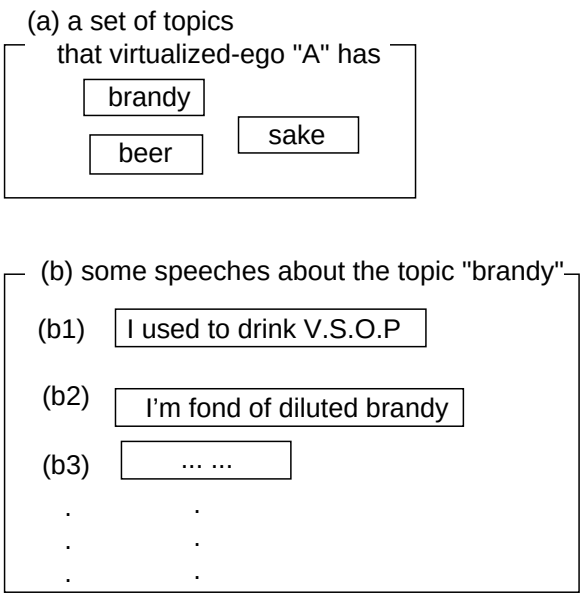

Figure 3: Example of a topics-and-summaries set

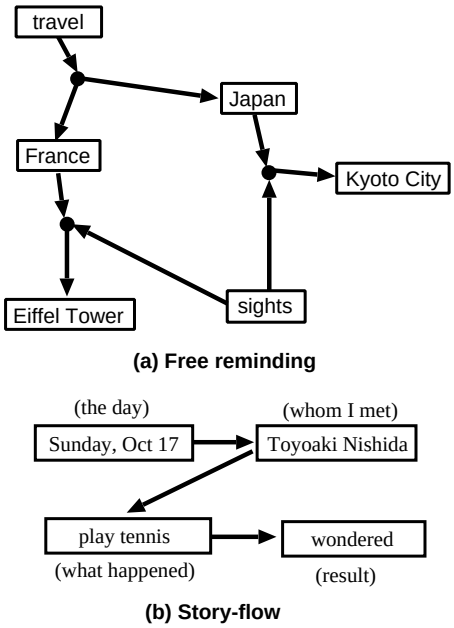

Figure 4: Example of associative representations

Storytelling by virtualized-egos

Virtualized-egos generate messages in turn, and these messages are ordered as a story by following processes.

I) (Beginning of a turn)

II) Each virtualized-ego selects a message associated with a topic from the personal memory.

III) Only a virtualized-ego whose message is presented in a most orderly and most reasonable way in a context speaks the message.

IV) The turn ends, and the next turn begins.

By repeating the process of generating and selecting messages stated above, virtualized-egos can tell a story.

In following three section, we propose two sets of representations of the personal memory that characterize a personality of a virtualized-ego as an agent of a community member; and lay out how to decide an appropriate virtualized-ego in process III).

Topics-and-summaries representation

Each virtualized-ego has a set of topics. Past speeches of a community member related to each topic are filed away into personal memory of a virtualized-ego. For example, when a virtualized-ego in a community of liquor fans has topics such as "brandy", "beer" and "sake"(Fig. 3(a)), some speeches about "brandy" such as "I used to drink V.S.O.P." " I'm fond of diluted brandy."(Fig. 3(b)) are stored in a memory of the virtualized-ego and speeches about other topics are stored in the same way.

Flow-of-topics representation

Virtualized-egos change topics at some intervals by referring to an associative representation set (Hirata, Maeda, & Nishida 1998) of a flow of topics.

The associative representation proposed on the work of CoMeMo-Community consists of many-to-many hyperlinks that associate one or more key unit with one or more value unit. The semantics of the associative representation is not defined strictly. Instead, we leave the interpretation of the semantics to human association based on our tacit background knowledge. As a result, the associative representation permits raw information materials to be accumulated with minimal overhead. In return, interpretation of such information heavily relies on tacit community knowledge (Maeda & Nishida 1998). An example of associative representations is illustrated in Figure4.

(a) Free reminding: Figure 4(a) denotes that from given concepts of "travel" as a key, one reminds of "Japan" and "France" as values, and from concepts of "sights" and "Japan" as keys, one reminds of "Kyoto City"as a value. Ten persons have ten different free reminding, and such free reminding is suitable for representing tacit knowledge in narrative mode (Bruner 1986).

(b) Story-flow: The associative representation is also able to show story-flow, as shown in Figure 4(b) that denotes an example of diary using the associative representation. A coherence of a story relies on human association since keys and values in the associative representation are connected by an association of whom generated the associative representation, and there is little lack of the coherence in a community (Hirata, Maeda, & Nishida 1998). For example, in Figure 4(b) a community member who belongs to the same community as an author of the diary can understand why the author wondered.

In the case of virtualized-ego(a)(Fig.5), 'liquor' is a key

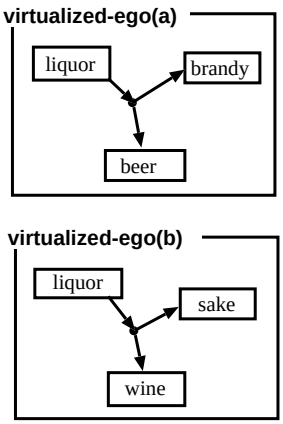

Figure 5: Example of a flow-of-topics set

unit and 'brandy' and 'beer' are value units. This associative representation of virtualized-ego(a) shows a flow of topics from liquor to brandy or beer, and other associative representation such as virtualized-ego(b) has shows other flow of topics.

Associative representations that shows associations of a community member are stored with "topics and summaries" in a memory of a virtualized-ego. One mediator selected by a user among virtualized-egos selects the next topic that is associated with the current topic, for instance, the message for changing topics is as follows; "I associate liquor with brandy. Next, let's talk about brandy." We suppose that association-based flows of topics make storytelling of virtualized-egos human-like and helps users to believe virtualized-egos as community members' other selves which work independently.

Storytelling by ordered messages

In a turn, though all the virtualized-egos select messages associated with a topic at the same time, only one virtualized-ego is selected to speak at a time by comparing priorities of selected messages. Each virtualized-ego generates a priority when it selects a message, and a criteria to decide priorities of virtualized-egos is as follows;

Story structure: a frequency of exchange between virtualized-egos follows that between community members in order that a stream of messages may reflect social relationships between community members. The frequency of exchange between a community member and the another member on mailing-lists and between a user and a virtualized-ego on EgoChat is recorded in each virtualized-ego. For example, when community member(a) inclined to talk with member(b) more than community member(c) and the virtualized-ego of member(b) has talked in the previous turn, not the virtualized-ego of member(c) but that of member(a) is prior in the present turn.

Coherence: a virtualized-ego that selects the following message after a message mentioned just before is prior in order to exchange messages coherently. The summaries in a personal memory are labeled with key words that represent contents of the summaries in a word. A message is regarded as the one that follows the previous message when its keyword matches the previous one.

Fairness: a virtualized-ego that speaks little is prior to that speaks a lot, in order to exchange messages fairly.

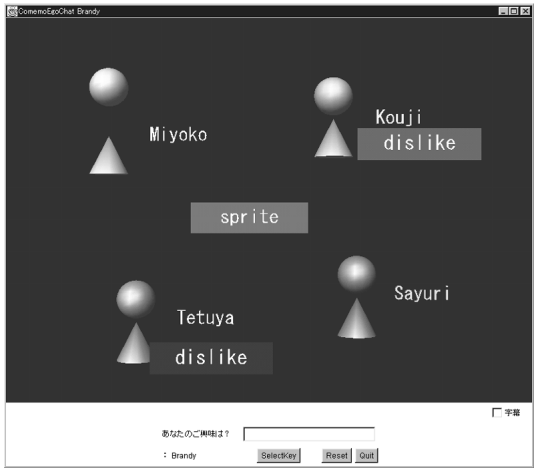

Figure 6: Screen shot of the experimental EgoChat system

Experiment

We have made a basic experiment on usability of the EgoChat system to investigate effects of a voice interaction between humans and agents. The experimental system is implemented by using Java and Java3D API on MS-Windows OS. The voices of virtualized-egos are not generated by text-to-speech software but recorded human voices. A body of a virtualized-ego consists of a sphere head and a cone body, and the sphere head was shaken up and down while talking.

Figure 6 shows a screen shot of the experimental EgoChat system. The virtualized-egos have no face and the difference between them is only their voices and names. While upper-left virtualized-ego named "Miyoko" is talking, centered characters shows the key word "sprite"(a brand of juice) of the message that she says. Upper-right virtualized-ego named "Kouji" and lower-left virtualized-ego named "Tetuya" have mentioned about the key word "dislike" in the past.

Method

We created four virtualized-egos and generated their personal memories from a humanly summarized log of a mailing list about liquor where participants exchanged ideas about how to sell brandy. Each virtualized-ego represents a participant of the mailing list. The subjects were three postgraduate students in our laboratory who have ordinary knowledge about liquor and they are not participants of the mailing list. Each subject is shown the conversation of virtualized-egos about brandy during three minutes and can

comment on a speech of a virtualized-ego when s/he feels an interest in the speech.

Following example is a conversation between virtualized-egos A,B,C and D and a subject [2].

1: A "Let's begin talking about brandy."

2: B "We have more prejudice against brandy than other liquor."

3: A "I often chat over drinking."

4: C "A public bar doesn't deal in brandy because brandy is too expensive."

5: B "Yes, certainly."

6: A "Sure."

7: Subject "Convenience stores don't deal in brandy too."

8: C "Shouchu [3] is more low-priced than brandy."

. . .

In the conversation, Line 4 follows Line 3 mainly because of a criteria for storytelling about coherence. Both messages have been humanly labeled with the same key word "shouchu" in advance since these two messages originally appeared in the context of advantages of shouchu. And short responses such as "Yes, certainly." and "Sure." are randomly inserted other than messages from the personal memories to make the conversation rhythmic.

After the conversation, the subjects answered following question: "By which method do you think easier to comment on speeches of other persons between text-based mailing lists and the EgoChat system?"

Results and Discussion

Two subjects answered that the EgoChat system is easier and more casual method to comment on messages of other members than mailing list because a chat-style conversation with voices facilitates their interaction with virtualized-egos. This result suggests that using storytelling agents with voices may facilitate interaction between humans and agents. On our previous system, CoMeMo-Community, we evaluate how much people shared their knowledge by virtual exchanging of the messages with text-based words and images. The result is satisfactory (Hirata & Nishida 1999)(Nishida 1999), hence, we expect that the EgoChat, using more human-like modalities such as voices and gestures, brings community members more knowledge than CoMeMo-Community.

The last one subject answered that interacting with virtualized-egos is too unnatural to communicate smoothly because virtualized-egos can't answer to his question. Truly, a storytelling method on EgoChat is not enough to tell concise responses to users, on the other hand, EgoChat can easily store and process a great number of messages because a representation of personal memories and methods of ordering messages are very simple. We are planning to apply the EgoChat to large community over a network practically and evaluate what amount of knowledge is created in the community, in this case, EgoChat has the merit of dealing large data.

[2] the conversation was originally in Japanese.

[3] Japanese distilled Liquor made from wheat or rice.

We foresee a lot of potential application areas, including application to campus communities that consist of professors and students, an integral part of knowledge management in a company (i.e., horizontal communities orthogonal to the job hierarchy), local commercial communities (i.e., shops and consumers), communities of volunteers, and so on. Currently, we apply the EgoChat system to a public opinion channel(POC)(Nishida *et al.* 1999) which is a novel communication medium for sharing and exchanging opinions in a community. POC is a kind of broadcasting system for a community that collects messages from members and feeds edited stories back to them. The EgoChat plays mainly a broadcasting part in POC.

Related Work

Technologies of conversational agents that support our thinking process are discussed in some works. SAGE (Umaschi 1996) agent helps to generate autobiography of a user to enable the user to explore her/his inner world. Rea (Cassell *et al.* 1999) and Imp Character [4] work with human-like interaction to explain commercial information to the customers. Each agent in these studies works alone and talks from one point of view, in contrast, EgoChat works with many agents and the agents talk from various view points of the community members. Therefore, the user can gain many views about a topic on EgoChat.

CommunityPlace [5], InterSpace [6], and BodyChat (Vilhjlmsson 1997) are graphical chat system that allow users to communicate synchronously via their avatars. EgoChat is a new asynchronous communication channel for a community that has a casual and conversational flavor. The virtual chat which the EgoChat system provides is applicable to a community formed over an asynchronous media, i.e., mailing lists or electronic bulletin boards.

Conclusion

In this paper, we proposed a new method for supporting community knowledge creation. We focused on a believable design of agents that help social activities of humans and have introduced two ideas of our method based on storytelling. We have developed a system called EgoChat which supports knowledge creation in a community by human-style conversation with voices between humans and virtualized community members called virtualized-egos. We discussed usability of EgoChat based on a experiment. As a future work, we are planning to apply the EgoChat to large community over a network practically and evaluate the usefulness of the system.

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