Collecting, Visualizing, and Exchanging Personal Interests and Experiences in Communities

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Abstract. In this paper, we propose a notion of facilitating encounters and knowledge sharing among people having shared interests and experiences in museums, conferences, etc. In order to show our approach and current status, this paper presents our project to build a communityware system situated in real-world contexts. The aims of the project are to build a tour guidance system personalized according to its user's individual contexts, and to facilitate knowledge communications among communities by matchmaking users having shared interests and providing real and/or virtual places for their meetings. In this paper, we first show PalmGuide, hand-held tour guidance system. After that, we show two Web-based systems to increase the level of "community-awareness". One is Semantic Map, a visual interface for exploring community information, such as exhibits and people (exhibitors and visitors). Another is AgentSalon, a display showing conversations between personal agents according to their users' profiles and interests.

1 Introduction

In this paper, we propose a notion of facilitating encounters and knowledge sharing among people having shared interests and experiences in museums, conferences, etc. In order to show our approach and current status, this paper presents our project to build a communityware system [4] situated in real-world contexts.

In investigating how to create such communityware situated in real-world contexts, we have chosen exhibition-type applications such as museums and open houses at research laboratories. The reason is because these are places where knowledge is accumulated and/or conveyed to people by seeing, touching, and experiencing actual exhibits, and where exhibitors as specialists provide knowledge to visitors with diverse interests and viewpoints.

The aims of the project are to build a guidance system personalized according to its user's individual contexts, and to facilitate knowledge communications among communities by matchmaking users having shared interests and providing real and/or virtual places for their meetings [11].

The followings show our scenario of knowledge communications using our system [12].

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Tour navigation. Users carry their own PalmGuide, hand-held guidance system, during the tour. PalmGuide manages its owner's profile and visiting records so far and recommends exhibits according to his/her current situation (location and time) and interests. He/she can browse information of the recommended exhibits on PalmGuide.

Exhibit display. The user can obtain a personalized explanation of each exhibit by connecting PalmGuide with exhibit displays located at individual exhibit sites.

Information kiosk. Our information kiosks are connected with servers via a LAN and enable visitors to access accumulated community information. In order to increase the "community-awareness" among people involved in an exhibition, the kiosks provide users with services such as visually showing the relationships between visitors and exhibitors according to their interests and touring histories. The community services on the kiosks are almost identical with off-site services provided via the Internet. However, in the case of the kiosks, we can offer more sophisticated services situated in location and time, e.g., highlighting information related with the front exhibit. Moreover, the kiosks located at the exhibition site have the potential to facilitate real face-to-face meetings between visitors with shared interests.

Off-site services. By using Web-based system, potential visitors can preview exhibit-related information at their home/office beforehand. As will be described later, we provide users with Semantic Map, a tool for visually exploring exhibit-related information. Each user's behavior when using Semantic Map, such as keyword selection, is used to quantify the user's preference, which will then be exploited for the personalization of the guide agent while actual touring at the exhibition site.

Community network. We believe that providing people involved in an exhibition with visualized community networks, by structuring all users' contextual information accumulated in the actual exhibition site, will help new encounters among users sharing interests and community formation. The community network's structure is a graph whose nodes represent visitors, exhibitors, and exhibits and will have connections between people and exhibits according to the degree of attachment to exhibits. Here, by attachment to exhibits, we mean exhibitors being involved in the exhibits and visitors being interested in them, i.e., highly rating them on PalmGuide. Accordingly, the Semantic Map users can discover partners who might be interested in collaborating in the future.

In this paper, we first show PalmGuide. After that, we show two Web-based systems to increase the level of "community-awareness". One is Semantic Map, a visual interface for exploring community information, such as exhibits and people (exhibitors and visitors). Another is AgentSalon, a kiosk located at the exhibition site displaying conversations between personal agents according to their users' profiles and interests.

2 PalmGuide: Personal Tour Assistant

The user of our system carries PalmGuide, a hand-held guidance system, while touring an exhibition. A personal guide agent runs on PalmGuide and provides tour navigation information, such as exhibit recommendation, according to the user's contexts, i.e., personal interests and temporal and spatial situations (Figure 1). The guide agent running on PalmGuide can migrate to and provide personalized guidance on individual exhibit displays or information kiosks that are ubiquitously located in the exhibition site. It keeps its user's personal profile and touring records, which are used for personalizing the presentation of individual exhibits and matchmaking with other users having shared interests and touring records.

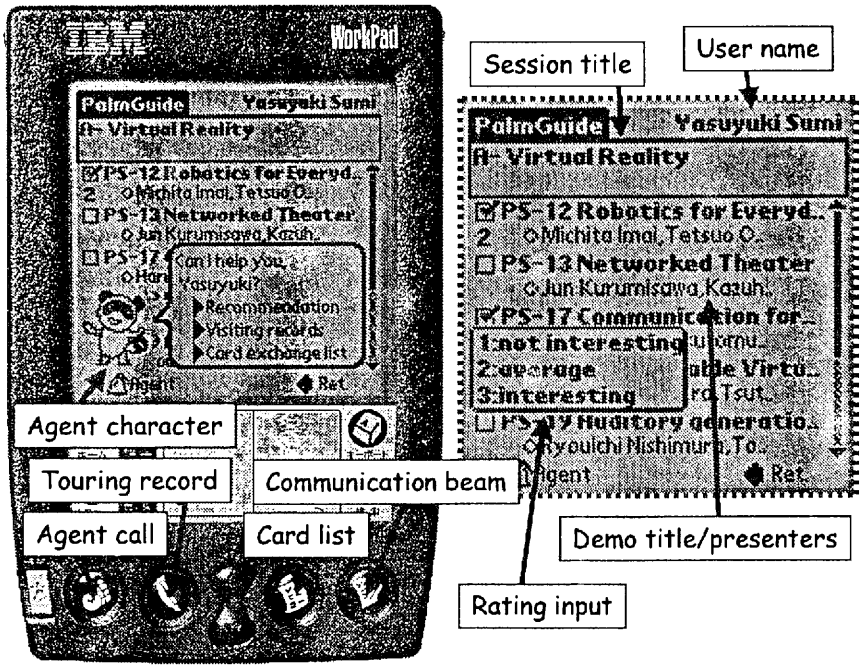

Fig. 1. PalmGuide display.

Connecting PalmGuide with exhibit displays by infrared updates the user's visiting history. This architecture allows us to capture the visiting histories of users without special methods such as employing location detection devices. The updated history of a user renews the personal guidance information, e.g., exhibit recommendations, on PalmGuide.

On PalmGuide, the user can rate individual exhibits that he/she visited so far (Figure 1). The ratings improve the precision of the exhibit recommendations by the guide agents. That is, exhibits sharing keywords with exhibits rated highly by the user are highly recommended, and exhibits sharing keywords with exhibits rated lowly are lowly recommended. The ratings are also used for building community networks. That is, a high rating for a certain exhibit by the user

is represented as a link between the user and the exhibit on community networks; this is described next.

3 Semantic Map: Visual Explorer of Community Information

We built Semantic Map (Java applet) as a visual interface for exploring community information accessible via the Internet and on information kiosks located in exhibition sites.

We believe that providing people involved in an exhibition with visualized community networks, by structuring all users' contextual information accumulated in the actual exhibition site, will help new encounters among users sharing interests and community formation. The community network's structure is a graph whose nodes represent visitors, exhibitors, and exhibits and will have connections between people and exhibits according to the degree of attachment to exhibits.[1] Accordingly, the Semantic Map users can discover partners who might be interested in collaborating in the future.

The Semantic Map shown in Figure 2 displays the graphical relationships between exhibits presented in the last open house of the authors' laboratories. The rectangular icons in the graph signify exhibit titles and the oval icons signify keywords or participants (including exhibitors, i.e., researchers, and visitors). The keywords are technical terms characterizing the contents of the exhibits, which were previously extracted from outline texts prepared by exhibitors. This Semantic Map provided the users with graphs, with links between exhibit icons and keyword/participant icons; this helped the users browse the information space of the exhibition.

However, since the number of keyword/participant icons is huge, a graph including all of these keyword/participant icons is unable to provide useful visualization. Therefore, we have adopted a method with only the keyword/participant icons selected by the user being displayed based on his/her interests. As a result, the graph of Semantic Map can be structured based on an individual user's interests. For example, if a user selects the keyword "agent", he/she can view a partial graph formed with only "agent"-related papers. If the user selects other keywords, Semantic Map restructures the graph based on the corresponding viewpoint.

The guide agent keeps the selected keywords/participants as a part of its user's mental context, and uses the data for the personalization of Semantic Map whenever the user accesses information kiosks.

The exhibit icons and participant icons have links with related Web pages, e.g., project pages, personal home pages, and automatically generated touring diaries. Therefore, Semantic Map can be used for a visual interface for exploring information spaces of exhibitions, conferences, etc.

[1] Here, by attachment to exhibits, we mean exhibitors being involved in the exhibits and visitors being interested in them, i.e., highly rating them on PalmGuide.

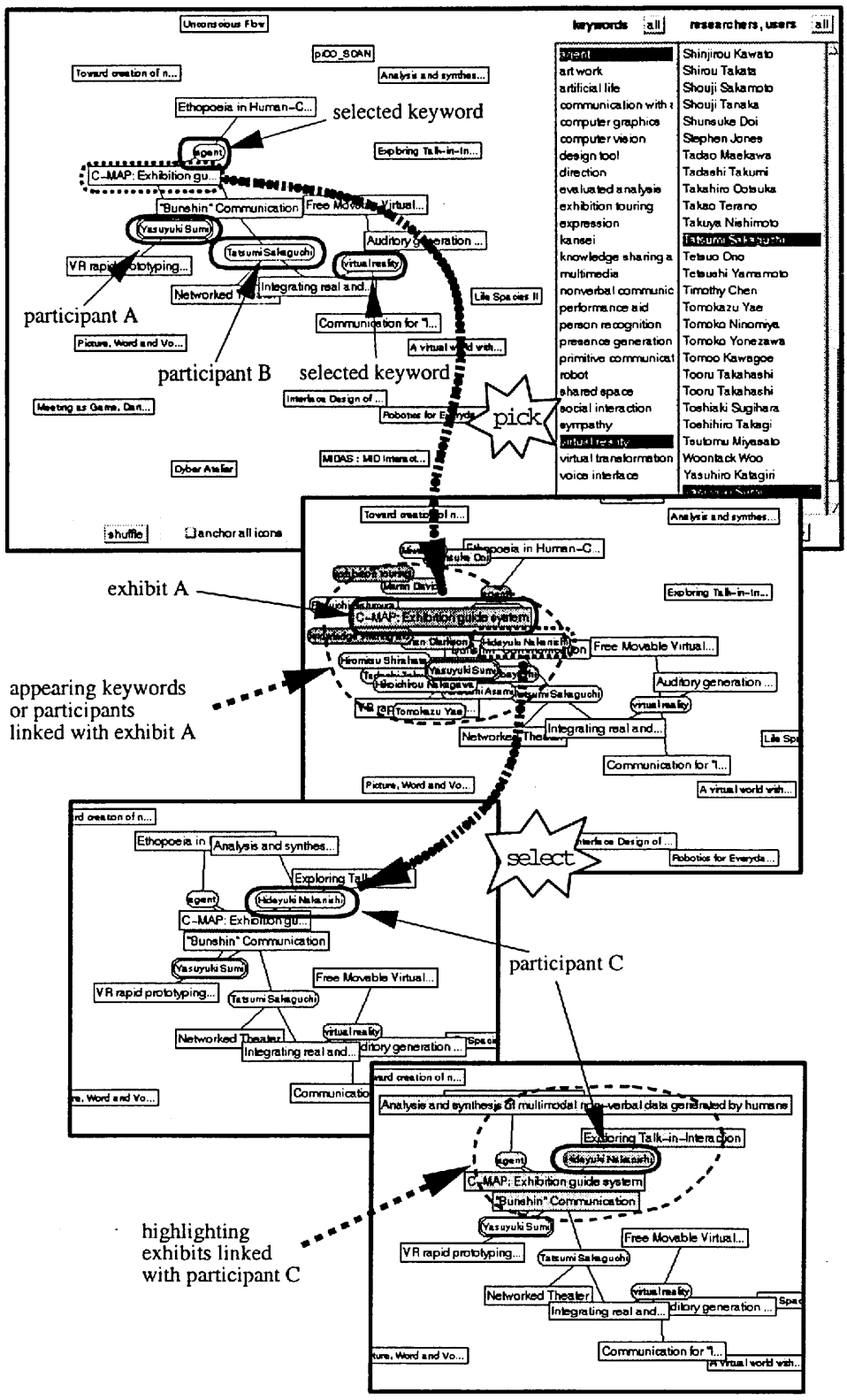

Fig. 2. Visual exploration of community information with Semantic Map.

There is a "Web Search" button on the bottom of the applet. Pushing the button opens a window showing a list of related Web pages searched , by a search engine (currently, Google), for keywords that currently selected on Semantic Map. It means that Semantic Map enhances users' exploring not only within community information collected by our servers but also in open resources on the Web.

Semantic Map facilitates its user's associative exploring of huge information spaces. In the example of Figure 2, when a user clicks the "exhibit A" icon with the right button of a mouse, Semantic Map provisionally shows all of the keyword/participant icons having links with exhibit A, including hidden icons. Therefore, the user can check for the existence of unknown keywords and participants related with exhibits that he/she is interested in. By moving the mouse while continuing to push the right button and releasing on one of the provisionally appearing keyword/participant icons, the user can select a new keyword/participant icon. In the example, the icon of participant C, who expressed his interest in exhibit A, is selected. Semantic Map then shows not only the icon of participant C but also other exhibit icons that participant C expressed his interest in. Accordingly, the user can notice the existence of not only participant C having a shared interest in exhibit A but also other exhibits that had not been noticed by the user yet.

Although Semantic Map has lists of keywords and participants as shown in the figure and its user can select interesting keywords/participants from the lists, these lists become useless when the information space consists of huge numbers of exhibits and participants. In such cases, the associative method presented here encourages human interest-driven information exploring.

4 AgentSalon: Facilitating Face-to-Face Conversations

AgentSalon [13] is a system that facilitates face-to-face knowledge exchange and discussion between users by tempting them to a chat via prompting by their personal agents, which maintain their personal interests and experiences. We prototyped AgentSalon as a kind of information kiosk assumed to be located in a meeting place of an exhibition site, with a large touch panel screen. AgentSalon has a big display for use by two to five users simultaneously.

The following is a scenario of using AgentSalon.

1. Personal guide agents on the PalmGuide of individual users migrate to AgentSalon with their users' personal information and are displayed as animated characters.
2. The migrating agents share their users' visiting records and interests and detect common as well as different parts in this information.
3. Based on the above results, the agents plan and begin conversations in front of the users. By observing the conversations, the users can efficiently and pleasantly exchange information related to an exhibit.
4. Because AgentSalon can access community information such as information on each exhibit and other users' personal information via the network,

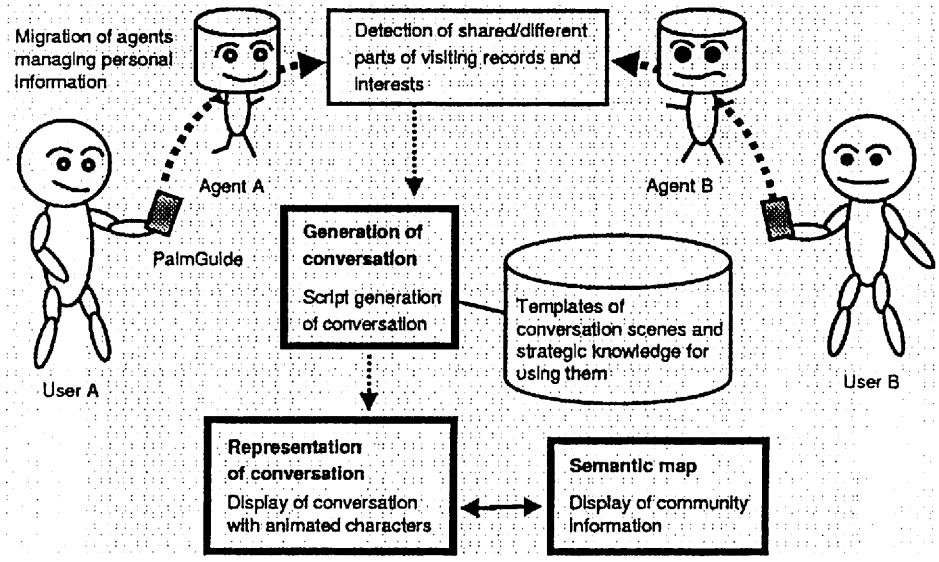

Fig. 3. System architecture of AgentSalon.

users can browse detailed information about exhibits or users referred by the agents.

As Figure 3 illustrates, AgentSalon consists of the following three components.

Generation of conversation. Generates scripts of *interesting* conversation using personal information managed by agents. It is a knowledge-based system having utterance templates and strategic rules to tailor scripts depending on context.

Representation of conversation. According to the generated scripts, this controls and represents utterances and behavior of animated agents by using Microsoft Agent. Stream of conversations, entrance and exit of agents, and simple interaction with users are controlled by using JavaScript.

Semantic map. A visual interface for browsing community information accumulated in the Web server. It shows semantic relationships between exhibits and people involved with them and helps a user to associatively explore large information spaces according to his/her interests.

AgentSalon runs on Microsoft Internet Explorer. Animated agents are displayed on the top of Semantic map using Microsoft Agent. The display is a touch panel, so users can manipulate Semantic map with their fingers and interact with their agents. Figure 4 shows AgentSalon used by two users.

In current implementation, when a certain agent enters the salon, its user's icon appears in Semantic map. At the same time, icons of exhibits that he/she has visited and evaluated as *interesting* appear and are linked with his/her icon. Therefore, it visualizes relationships (overlaps and differences) between touring experiences and the individual interests of users.

The following are example of conversation scenes performed by agents.

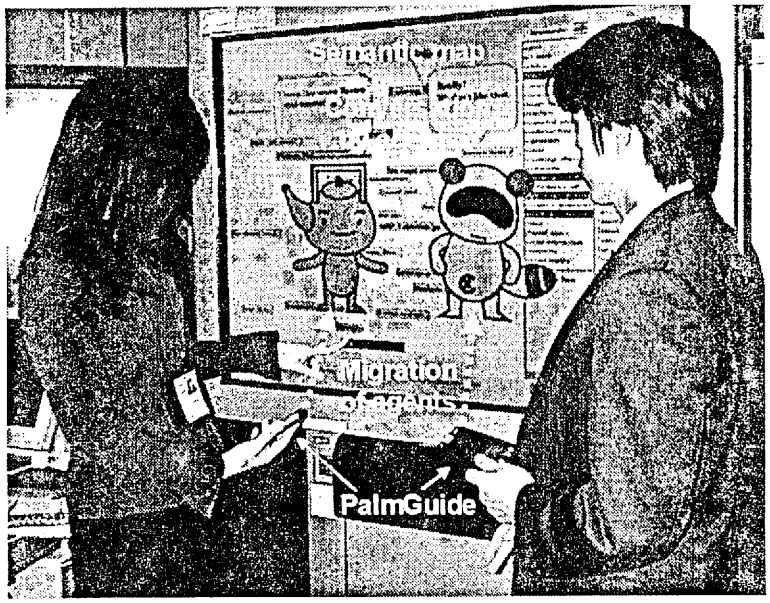

Fig. 4. AgentSalon in use.

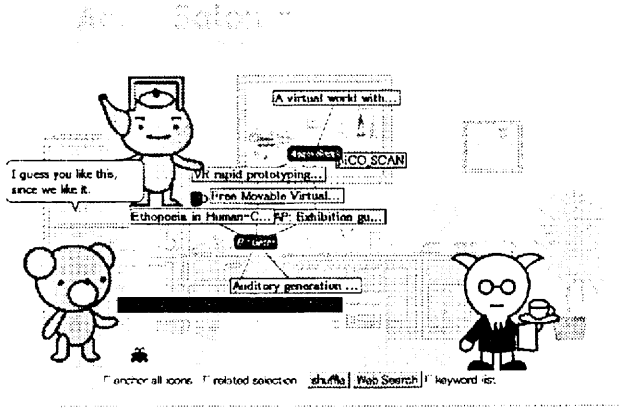

Fig. 5. Example scene of AgentSalon (1): Mutual recommendations.

- Suppose that *user A* has visited *exhibits 1, 2, 3* and *4*, and *user B* has visited *exhibits 2, 4, 5* and *6*. In this case, their agents will notice that the users have commonly visited *exhibits 2* and *4*, i.e., they share some interests in exhibits. Therefore, *user A*'s agent recommends *exhibits 1* and *3* to *user B*, and *user B*'s agent recommends *exhibits 5* and *6* to *user A* (See Figure 5).
- When two users' evaluations of a commonly visited exhibit are different (e.g., *user A* is interested in *exhibit 1*, but *user B* is not), their agents prompt a discussion about the exhibit. For example, the agent of *user A* says "*Exhibit 1* was interesting!", and then the agent of *user B* replies "Really? We didn't like it." By observing the dialog, *user A* and *user B* can know that they have

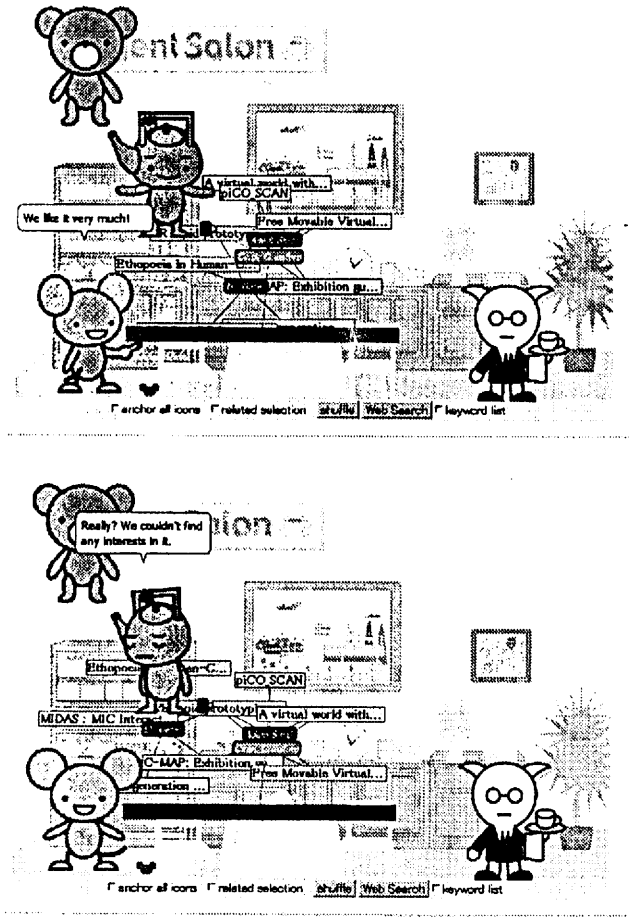

Fig. 6. Example scene of AgentSalon (2): Stimulating discussion.

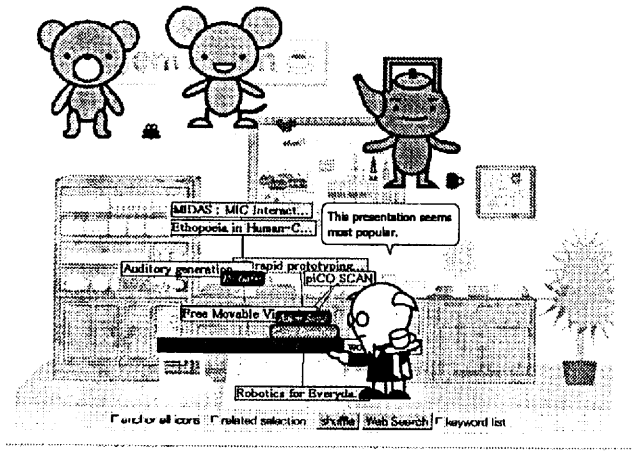

Fig. 7. Example scene of AgentSalon (3): Topic offering by salon agent.

differing opinions about a shared experience (i.e.; visiting *exhibit 1*), which efficiently leads them into a stimulating discussion (See Figure 6).

- The salon agent has more global view on Web resources than other agents belonging to individual users. When no events (e.g., entry of new agent) happen for a while, the salon agent offers a topic, such as pointing the most popular exhibit among PalmGuide users (See Figure 7).

5 Related Works

Our community network is similar to the social network proposed by [5], which is a network representation of relationships between people and knowledge. There have been other related studies such as a matchmaking agent that searches for people who share similar interests [1], a visualizing tool for helping community formation [2], recommender systems by collaborative filtering (e.g., [10]). These studies are related to ours since they aim at supporting collaborative knowledge communications by quantifying human interests and preferences. The above systems, however, only involve a desktop computing paradigm. Therefore, users have to explicitly input their preferences and queries. Our effort in prototyping a personal guidance system embeds such systems into real-world contexts so that the systems can semiautomatically work according to the contexts of users.

Related to AgentSalon, there have been some works to support knowledge sharing and creation such as systems to help collaborative Web browsing (e.g., Silhouettell [9] and Let's Browse [7]); asynchronous knowledge sharing using alter-ego agents [8,6]; and a helper agent who provides conversation topics to first-meeting users in a virtual meeting space [3]. However, their knowledge resources are commonly static information such as previously prepared knowledge bases. On the other hand, AgentSalon uses personal information constantly accumulated by personal agents on PalmGuides carried by users. Such information is embedded in the real world, therefore, information presented by AgentSalon has potential to instantly influence users' ongoing (touring) behavior and accelerate collaborative knowledge sharing and creation among communities.

The essential jobs of AgentSalon are to detect and represent shared/different parts of the personal information (e.g., interests and touring records) of several users. In terms of this, we have already proposed a method to visualize shared/different parts of several users' individual viewpoints during online discussion [14]. The Semantic map running on AgentSalon plays a similar role. However, efforts to read the shared/different parts from the visualized information spaces and to utilize it for further discussion are fully up to users. AgentSalon automatically reads the shared/different parts of users' knowledge/interests and represents them as *conversational stories*. Therefore, the cost of information conveyance between users decreases, and more casual usage and understanding are encouraged.

6 Conclusion and Future Work

We have shown our attempts to increase of awareness of shared interests and experiences among communities by presenting our ongoing project of a guidance

system for exhibition tours. We believe that building a context-aware personal guide agent will facilitate community formation based on shared interests and knowledge exchanges within communities.

Without the connectivity with real-world contexts, knowledge exchange in a digitized world, even one which has rich information, will not be effective. Therefore, accumulating real-world contexts and connecting these with the digitized world, i.e., our investigation's focus, are very important issues.

Finally, the following issues remain to be solved before achieving a communityware system.

- We need to create personal agents that can each capture the context and information of its user from every possible digitized data that daily involves the user, in order to use the current exhibition guidance system as an everyday personal assistant.
- We have to continuously work on finding solutions to social issues such as the authorization and privacy of exchanged information.
- We want a communityware system that allows asynchronous/distributed communications depending on agent mediation. Accordingly, we need a method for the externalization, communication, and presentation of agent knowledge with multi-goal scripts, so that agents can semi-automatically interact with each other on behalf of their users.

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References

1. Leonard N. Foner. Yenta: A multi-agent, referral-based matchmaking system. In *Proceedings of the First International Conference on Autonomous Agents (Agents'97)*, pages 301–307. ACM, 1997.
2. Fumio Hattori, Takeshi Ohguro, Makoto Yokoo, Shigeo Matsubara, and Sen Yoshida. Socialware: Multiagent systems for supporting networked communities. *Communications of the ACM*, 42(3):55–61, 1999.
3. Katherine Isbister, Hideyuki Nakanishi, Toru Ishida, and Cliff Nass. Helper agent: Designing an assistant for human-human interaction in a virtual meeting space. In *Proceedings of CHI 2000*, pages 57–64. ACM, 2000.
4. Toru Ishida. Towards communityware. In *Proceedings of the International Conference and Exhibition on the Practical Application of Intelligent Agents and Multi-Agent Technology (PAAM-97)*, pages 7–21, 1997.
5. Henry Kautz, Bart Selman, and Mehul Shah. The hidden web. *AI Magazine*, 18(2):27–36, 1997.
6. Hidekazu Kubota, Toyoaki Nishida, and Tomoko Koda. Exchanging tacit community knowledge by talking-virtualized-egos. In *Proceedings of Agents 2000*, pages 285–292. ACM, 2000.

7. Henry Lieberman, Neil W. Van Dyke, and Adrian S. Vivacqua. Let's browse: A collaborative browsing agent. *Knowledge-Based Systems*, 12(8):427–431, 1999.
8. Toyoaki Nishida, Takashi Hirata, and Harumi Maeda. CoMeMo-Community: A system for supporting community knowledge evolution. In Toru Ishida, editor, *Community Computing and Support Systems*, volume 1519 of *Lecture Notes in Computer Science*, pages 183–200. Springer, 1998.
9. Masayuki Okamoto, Hideyuki Nakanishi, Toshikazu Nishimura, and Toru Ishida. Silhouettell: Awareness support for real-world encounter. In Toru Ishida, editor, *Community Computing and Support Systems*, volume 1519 of *Lecture Notes in Computer Science*, pages 316–329. Springer, 1998.
10. Upendra Shardanand and Pattie Maes. Social information filtering: Algorithms for automating "word of mouth". In *Proceedings of CHI'95*, pages 210–217. ACM, 1995.
11. Yasuyuki Sumi, Tameyuki Etani, Sidney Fels, Nicolas Simonet, Kaoru Kobayashi, and Kenji Mase. C-MAP: Building a context-aware mobile assistant for exhibition tours. In Toru Ishida, editor, *Community Computing and Support Systems*, volume 1519 of *Lecture Notes in Computer Science*, pages 137–154. Springer, 1998.
12. Yasuyuki Sumi and Kenji Mase. Communityware situated in real-world contexts: Knowledge media augmented by context-aware personal agents. In *Proceedings of the Fifth International Conference and Exhibition on the Practical Application of Intelligent Agents and Multi-Agent Technology (PAAM 2000)*, pages 311–326, 2000.
13. Yasuyuki Sumi and Kenji Mase. AgentSalon: Facilitating face-to-face knowledge exchange through conversations among personal agents. In *Proceedings of Agents 2001*, pages 393–400. ACM, 2001.
14. Yasuyuki Sumi, Kazushi Nishimoto, and Kenji Mase. Personalizing shared information in creative conversations. In *IJCAI-97 Workshop on Social Interaction and Communityware*, pages 31–36, 1997.