New Generation Computing, 17(1999)417-427
Ohmsha, Ltd. and Springer-Verlag

NEW GENERATION COMPUTING

Public Opinion Channel for Communities in the Information Age

Toyoaki NISHIDA
Department of Information and Communication Engineering
School of Engineering
The University of Tokyo
7-3-1 Hongo, Bunkyo-ku
Tokyo 113-8656, Japan
nishida@kc.t.u-tokyo.ac.jp

Nobuhiko FUJIHARA, Shintaro AZECHI, Kaoru SUMI and Hiroyuki YANO
Kansai Advanced Research Center Communications
Research Laboratory
588-2 Iwaoka, Iwaoka-cho, Nishi-ku, Kobe-shi
Hyogo 651-2401, Japan
{fujihara, azechi, kaoru}@crl.go.jp

Takashi HIRATA
Graduate School of Information Science
Nara Institute of Science and Technology
8916-5, Takayama, Ikoma
Nara 630-0101, Japan
takash-h@is.aist-nara.ac.jp

Received 7 February 1999
Revised manuscript received 19 April 1999

Abstract In this paper, we propose as a new challenge a public opinion channel which can provide a novel communication medium for sharing and exchanging opinions in a community. Rather than simply developing a means of investigating public opinion, we aim at an active medium that can facilitate mutual understanding, discussion, and public opinion formation. First, we elaborate the idea of public opinion channels and identify key issues. Second, we describe our first step towards the goal using the talking virtualized egos metaphor. Finally, we discuss a research agenda towards the goal.

Keywords: Community Support System, Agent Mediated Communication, Talking Virtualized Egos.

§1 Introduction

New information and communication technologies have brought about a tremendous potential in the way people interact with each other. It is an engineers' role to establish a methodology of designing and assessing effective information tools for helping people understand each other.

In this paper, we propose as a new challenge a public opinion channel which can provide a novel communication medium for sharing and exchanging opinions in a community. A public opinion channel, as we consider in this paper, is a social information processing system which collects messages from people and feeds edited messages back to the people. The messages communicated through public opinion channels are not limited to pure opinions, but may well be questions people ask, stories people tell, findings people make, jokes people like, wits people have fostered, opinions people raise, and proposals people want to make. At the sentence level, they may be assertions, arguments, counter-arguments, questions, answers, agreements, and so on. We would like to incorporate a facility to summarize this information, and provide people with a handy means of understanding what other people are speaking about.

The role to be played by public opinion channels is to mediate and facilitate communications in communities. Rather than simply building a passive medium, we aim at an active medium that can provide a sound ground for public opinion formation based on mutual understanding through discussion.

Traditionally, those functions have been partly provided by mass media. People usually acquire information about other parts of the society and build an image of the society, by watching TV, listening to radio, reading news papers and magazines, and so on. It has often been pointed out, however, that conventional mass media have a severe limitation in its ability to cope with rapid technological development and accompanying change in the society, unless basic facilities of information gathering and surveying are significantly improved. People often receive very fragmentary information about state-of-the-art technology as well as life styles of contemporary people in other cultures. Still worse, messages from conventional mass media may be biased. Generally, it is hard to resist or even to recognize the bias if any, for ordinary people have only limited means to examine the correctness of messages they receive from mass media, except applying a few simple heuristics such as cross-checking messages from multiple sources.

The Internet and other recent advances of information and communication technology provide a partial solution to the above problems at a reasonable price. WWW allows people to post their messages on the Internet. Search engines help to locate information source. Bulletin boards provide people with an asynchronous channel for public discussion. Internet relay chats enable people in distant places to participate in conversation. Nevertheless, we consider they are not enough to regard as public opinion channels. People are exposed to overwhelming amount of raw incoherent information.

In order to overcome this difficulty, we aim at a direction similar to internet broadcasting. Messages into public opinion channels are summarized and

edited into a single coherent stream so that people can comprehend and enjoy them in a casual fashion just like listening to the radio.

It is a big challenge for information and communication technology to develop a technology for public opinion channels. It will leverage information and communication technology as a social medium. In a long run, it is expected to bring about tight collaboration among technology, social science and human science.

In the following sections, we first elaborate the idea of public opinion channel and identify key issues. Then, we describe CoMeMo-Community, our first step towards the goal. Finally, we discuss a research agenda towards the goal.

§2 Issues Involved in Public Opinion Channel

A public opinion channel may consist of human experts including one or more caster with advanced computational assistance, at least in its first appearance. A public opinion channel, as a whole, skims, surveys, highlights, elaborates, refines, and arranges messages from people.

A public opinion channel continually broadcasts skimmed messages gathered from people, as illustrated in Fig. 1. It attempts to create meaningful stories reflecting questions, beliefs, and opinions arising in communities. We believe that these messages allow people to foster their mutual understanding and collective opinion formation. We also believe that messages from everyday life and real experiences make a lot of sense.

Public opinion channel is a big challenge in many respects. From engineering points of view, the concept itself is so novel that it is quite hard to char-

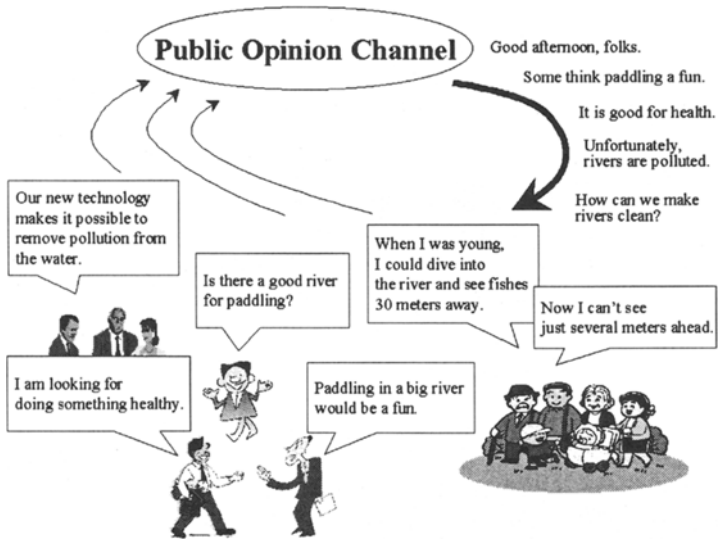


Fig. 1 A Typical Scenario with a Public Opinion Channel

acterize it. We do not know much about the nature of mutual understanding or quality of discussion to the degree that can be clearly expressed in computational terms. We do not know well-defined measures for evaluating systems. Producing effective monitoring of opinions or supporting large scale discussions might be a pure technical challenge. Quality of survey depends on the goal. When the goal is just to see how a majority of people are thinking, existing methods of information retrieval and document clustering might work to a certain degree. However, if the goal is to extract minor but insightful messages, commonsense should be referred to by some means. Producing continuous stories is another technical challenge. Besides fundamental story generation problems, we need to incorporate planning and re-planning of stories so that they can reflect dynamic changes in the world and entertain the channel's audience.

From psychological viewpoints, it is a big challenge, too. Firstly, most of conventional researches are concerned with controlled laboratory experiments. Few have shed light on people's real cognitive process in everyday life. Secondly, conventional approaches have been focusing on cases in which people play a passive role, e.g., how much they understand objective knowledge.[2] In contrast, public opinion channels are more about people's active attitudes, such as presenting their ideas and opinions as well as questions.

In sociology and social-psychology, attempts to understand people's behavior in the networked communities are relatively new. They have been mostly working on conventional communication media such as E-mail and electronic bulletin boards.[3] An approach called action research aims at learning from taking actions.[6] Regarding software development, we still lack detailed guidelines for novice researchers and practitioners to follow.[1]

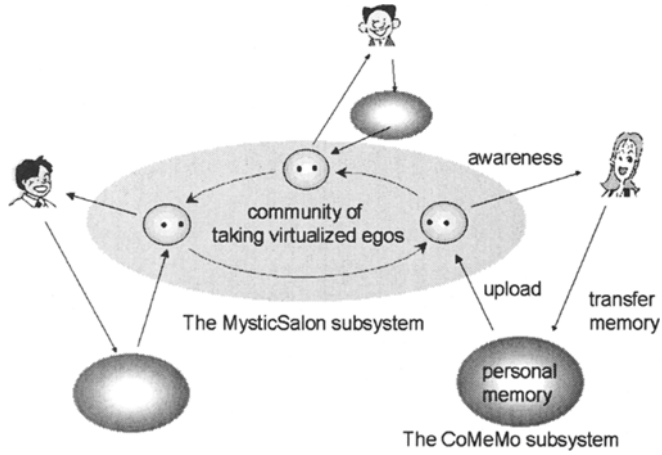
It is a big social challenge, just as digital democracy.[4] There are lots of hard questions. Does a public opinion channel facilitate community communication at all? Are they trustable? Are they independent of a hidden intention of bias? How do we interpret messages from a public opinion channel? What kind of effects does a public opinion channel cause? We need to develop a methodology of answering these questions in a reasonable way. At least, tight integration between technology and social science is necessary.

§3 Asynchronous Communication Channel by Talking Virtualized Egos

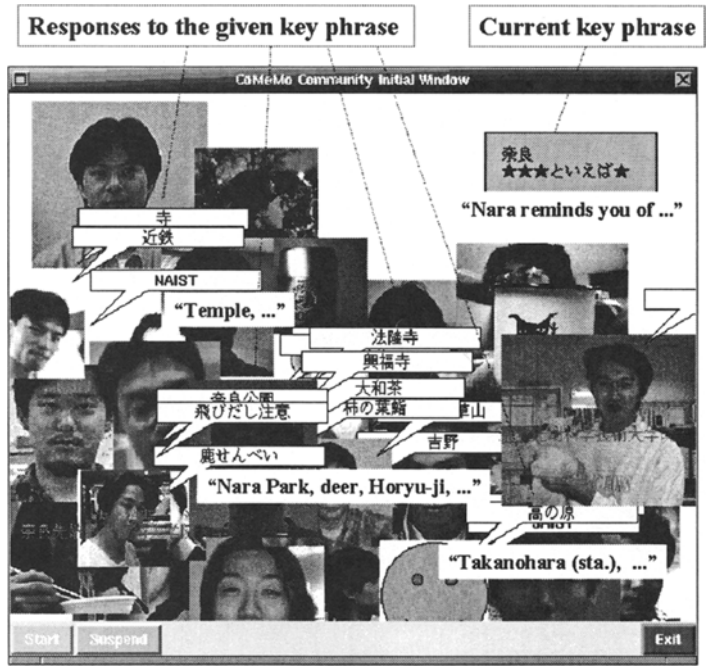
An asynchronous communication channel brought about by CoMeMo-Community[9] can be regarded as a step toward a public opinion channel. CoMeMo-Community is based on the 'talking virtualized egos' (TVE) metaphor in which icons representing real persons, called virtualized egos, are used to present information on behalf of users.

The architecture of CoMeMo-Community is illustrated in Fig. 2. Each real person has her/his virtualized ego that talks on behalf of her/him. S/he can enter her/his messages to her/his virtualized ego. S/he can call virtualized egos of others to have them talk with each other.

Memory of each virtualized ego is represented as a collection of *associative representations* of the form $\{k_1, \cdots, k_m\} \rightarrow \{v_1, \cdots, v_n\}$, which means that a



(a) the architecture



(b) example of screen image

CoMeMo-Community brings about a new asynchronous communication channel that has a casual and conversational flavor. Each person has her/his virtualized ego that talks on behalf of her/him. S/he can transfer her/his message to her/his virtualized ego at any time. S/he can call virtualized egos of other people to have them talk with each other.

Fig. 2 An Implementation of the Talking Virtualized Ego Metaphor

set of phrases $\{k_1, \cdots, k_m\}$ reminds one of another set of phrases $\{v_1, \cdots, v_n\}$. Associative representation is an informal representation in the sense that the meaning of "s_1 reminds s_2" is left open to the author. This convention allows miscellaneous information from everyday life to be incorporated on the fly. On the other hand, the interpretation of associative representation relies on shared background knowledge. It should be noted, however, that the use of associative representation greatly benefits from the TVE metaphor to compensate for its weakness, for the TVE metaphor is effective in communicating pragmatically important information such as trustability or context. It does happen that the user fails to understand the meaning of associative representation. At that time, the user can talk to the owner of the virtualized ego by other means. It will in turn facilitate communication in the real world.

Associative representation possesses indexical and ontological feature. It helps the user locate an adequate information source. It communicates a rough conceptualization of a given subject.

The current version of CoMeMo-Community provides a graphical editor with a powerful search and browse mechanism for manipulating associative representation. We have specified a set of HTML formats to be used as an external form of associative representation. This convention allows the user to use ordinary authoring tools to create and extend her/his own virtualized ego, if s/he likes.

In order to create a virtual conversation from a given set of keywords, CoMeMo-Community takes memory representations from a given set of virtualized egos and organizes them into a thread of chained keywords. Even with this simple mechanism, the user can gain an idea of who knows what and who is interested in what.

The TVE metaphor brings about a new asynchronous communication channel that has a casual and conversational flavor. Conversations proceed in a mixed initiative mode. The user initiates a virtual conversation by giving an initial set of keywords. The user then observes conversations among virtualized egos. The user may interrupt the virtual conversation to recourse the conversation. The user may also suspend the conversation to look at the details of memory representation underlying an interesting virtualized ego, if s/he finds an interesting piece of conversation. Or, the user may enter a message to her/his virtualized ego if inspired. Thus, the TVE metaphor motivates people to add their opinion on the fly. We believe that this will significantly contribute to the amount and richness of information explicitly shared in the community, and lead to knowledge evolution in a community in a long run. CoMeMo-Community has some additional facilities such as support for a social matchmaking and memory reviews for a given set of virtualized egos.

The first prototype of CoMeMo-Community was implemented using Common Lisp. A commercial version is being implemented using Java. A number of experimentation with the prototype has been made for several test cases with around ten to hundred participants. These experiments are mainly for feasibility study of the idea and not for comprehensive evaluation. We have gained several

findings, as follows:

- People can almost correctly recover the meaning of associative representation. Both precision and recall rates have marked around 80% in a couple of independent experiments, one at a high school and another at research laboratory.[9] In addition, we have found that the more people share their everyday life, the more precisely they can guess what is intended by associative representations. In ICMAS '96 Mobile Assistant Project,[8] which attracted about a hundred participants at an international conference, the information retrieval service based on a similar idea was relatively well accepted; 81% felt the search results were fine, 51% were satisfied with the service, and 55% answered that the service was useful for information retrieval.[7]
- People are not so good at composing associative representation as they understand them. Beginners tend to compose only simple associative representations, i.e., those with only one key. According to the feedback we obtained, they have sometimes got lost given a too much freedom in representation. To cope with the difficulty, they tend to copy and adapt other people's data. The popular subjects are about those closely related to everyday life, such as local community, hobby, and friends.

We have not evaluated the effect of the TVE metaphor itself on the formation of community knowledge and opinion. It is left for future research.

The basic idea underlying the TVE metaphor is to use the agent technology as a means of augmenting communication among people. The idea itself is not new (e.g., ReferralWeb[5]). However, there are many ways of elaborating the idea. In CoMeMo-Community, we have explored the idea of using agents as surrogates (or proxies) of people in communicating with other people.

This is sharply contrasted with other conventional approaches to agents in which agents represent computer services (such as an integrated database service) or talk with conventional computer programs on behalf of the user. Our approach is to use agents as a means of pushing (or presenting) information, rather than pulling (or receiving) information on behalf of the user.

§4 A Roadmap towards Public Opinion Channel

Given that CoMeMo-Community is our current status towards public opinion channel, what are next goals? It seems obvious that the real progress will be made by employing an action research style methodology:[1] a tight coupling of research and practice, that is, a large scale experimentation through design and development of a prototype of a public opinion channel. We consider the following goals are both crucial and interesting technical milestones.

- Casual interface: The success of public opinion channels depends on the coverage of messages that go through it. The more vivid information is sent from a public opinion channel, the more intellectual stimuli are likely to be created. In order to sustain a spiral of collective knowledge creation, we need to develop a casual interface so that the user can enter and access messages at any time and any place. Development of casual interface involves lots

of interesting technical challenges in interaction design,[11] personalization, awareness support, and context-sensitive understanding and generation of messages in particular.

- From associations to stories: The current version of CoMeMo-Community organizes its memory based on associations, as described above. Good news is the ease of computational manipulation. However, associations are not enough for representing memory with complex structure. According to Schank, stories play a critical role in forming dynamic memory.[10] Technical challenges involve story-based memory organization: indexing, recalling, and creating stories from memory. To fill the gap between associations and stories, it seems promising to apply machine learning techniques to create meaningful clusters of associations.
- Privacy: The more messages are related to everyday life, the more privacy issues will be arising. Nobody wants private information to be distributed unlimitedly. However, it is cumbersome to control the range of information distribution, for privacy contains a complex structure depending on the structure of human relations. Technical challenges exist concerning automating information disclosure. For example, it might be quite convenient if the virtualized ego has a capability of intelligently pick out, transform and distribute information from a schedule book or a personal organizer.

§5 Conclusion

In this paper, we have proposed a public opinion channel as a new challenge. We have introduced the idea of public opinion channels and identified key issues. We have also presented CoMeMo-Community, our first step towards the goal using the talking virtualized egos metaphor and shown a roadmap for next steps.

References

1) Avison, D., Lau, F., Myers, M. and Nielsen, P. A., "Action Research", *Communications of the ACM, Vol. 42, No. 1*, pp. 94–97, 1999.

2) Eysenck, M. W. (Ed.), *The Blackwell Dictionary of Cognitive Psychology*, Basil Blackwell, 1990.

3) Gilbert, D.T., Fiske, S.T. and Lindzey, G. (Eds.), *The Handbook of Social Psychology (Fourth Edition)*, McGraw-Hill, 1998.

4) Huwitz, R. and Mallery, J., "Managing Large Scale On-Line Discussions: Secrets of the Open Meeting", In: Toru Ishida(ed.), *Community Computing and Support Systems*, Springer-Verlag, pp. 155–169, 1998.

5) Kautz, H. A., Selman, B. and Shah. M., The Hidden Web. *AI Magazine, 18(2):* pp. 27–36, 1997.

6) Lewin, K., "Frontiers in Group Dynamics. II: Channels of Group Life: Social Planning and Action Research", *Human Relations, Vol. 1*, pp. 143–153, 1947.

7) Maeda, H., Koujitani, K. and Nishida, T., "Constructing Information Bases

Using Associative Structures", *APPLIED INTELLIGENCE, Vol. 10, No. 1*, pp. 85–99, 1999.

8) Nishibe, Y., Waki, H., Morihara, I., Hattori, F., Ishida, T., Nishimura, T., Yamaki, H., Komura, T., Itoh, N., Gotoh, T., Nishida, T., Takeda, H., Sawada, A., Maeda, H., Kajihara, M. and Adachi, H., "Mobile Digital Assistants for Community Support", *AI Magazine*, pp. 31–49, 1998.

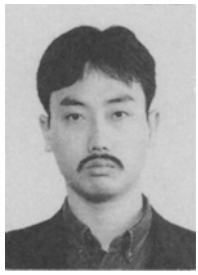
9) Nishida, T., Hirata, T. and Maeda, H., "CoMeMo-Community: A System for Supporting Community Knowledge Evolution", in: Toru Ishida (ed.), *Community Computing and Support Systems*, Springer-Verlag, pp. 183–200, 1998.

10) Schank, R. C., *Tell me a Story: a New Look at Real and Artificial Memory*, John Brockman Associates, 1990.

11) Winograd, T., "The Design of Interaction", in: Peter Denning and Robert Metcalfe (eds), *Beyond Calculation*, Copernicus, pp. 149–161, 1997.

Toyoaki Nishida, Dr.Eng.: He is a professor of Department of Information and Communication Engineering, School of Engineering, The University of Tokyo. He received the B.E., the M.E., and the Doctor of Engineering degrees from Kyoto University in 1977, 1979, and 1984 respectively. His research centers on artificial intelligence in general. His current research focuses on community computing and support systems, including knowledge sharing, knowledge media, and agent technology. He has been leading the Breakthrough 21 Nishida Project, sponsored by Ministry of Posts and Telecommunications, Japan, aiming at understanding and assisting networked communities. Since 1997, he is a trustee for JSAI (Japanese Society for Artificial Intelligence), and serves as the program chair of 1999 JSAI Annual Convention. He is an area editor (intelligent systems) of New Generation Computing and an editor of Autonomous Agents and Multiagent Systems.

Nobuhiko Fujihara, Ph.D.: He is a fellow of Breakthrough 21 Nishida project, Communications Research Laboratory sponsored by Ministry of Posts and Telecommunications, Japan. He received the B.E., the M.E., and the Ph.D. in Human Sciences degrees from Osaka University in 1992, 1994, and 1998 respectively. He has a cognitive psychological background. His current research focuses on: (1) cognitive psychological analysis of human behavior in a networked community, (2) investigation of information comprehension process, (3) assessment and proposition of communication tools in networking society.



Shintaro Azechi: He is a fellow of Breakthrough 21 Nishida project, Communications Research Laboratory sponsored by Ministry of Posts and Telecommunications, Japan. He received the B.E. and the M.E. of Human Sciences degrees from Osaka University in 1994 and 1996 respectively. He is a Doctoral Candidate of Graduate School of Human Sciences, Osaka University. His current researches focus on (1) human behavior in networking community (2) social infomation process in human mind (3) development of acessment technique for communication tools in networkingsociety. His approach is from social psychological view.

Kaoru Sumi, Dr.Eng.: She is a Researcher of Breakthrough 21 Nishida Project. She received her Bachelor of Science at School of Physics, Science University of Tokyo. She received her Master of Systems Management at Graduate School of Systems Management, The university of Tsukuba. She received her Doctor of engineering at Graduate School of Engineering, The University of Tokyo. Her research interests include knowledge-based systems, creativity supporting systems, and their applications for facilitating human collaboration. She is a member of the Information Processing Society of Japan(IPSJ), the Japanese Society for Artificial Intelligence(JSAI).

Hiroyuki Yano, Dr.Eng.: He is a senior research official of Kansai Advanced Research Center, Communications Research Laboratory, Ministry of Posts and Telecommunications. He received the B.E., the M.E., and the Doctor of Engineering degrees from Tohoku University in 1986, 1988, and 1993 respectively. His interests of research include cognitive mechanism of human communications. His current research focuses on discourse structure, human interface, and dialogue systems for human natural dialogues. He is a member of the Japanese Society for Artificial Intelligence, the Association for Natural Language Processing, and the Japanese Cognitive Science Society.

Takashi Hirata: He is a doctor course student in Graduate School of Information Scienc at Nara Institute of Science and Technology (NAIST). He received a master of engineering from NAIST in 1998. His research interest is knowledge media and knowledge sharing. He is a member of Information Processing Society of Japan (IPSJ), Japan Association for Artificial Intelligence (JSAI) and The Institute of Systems, Control and Information Engineers (ISCIE).