Communication Scheme based on the Concept of Media Biotope

Hidetsugu Suto

***Abstract*—**A communication scheme is described that is based on the concept of "media biotope." In this concept, communication medium structures are discussed using the analogy of an eco-biotope. In the proposed communication scheme, communities created using the local media are connected with and mutually affect each other. The local media revitalize local communities and help them keep their autonomy. The traditional scheme for communication media as described by Shannon and Weaver's is expanded in order to discuss the concept of media biotope. In the traditional scheme, an information sender and a receiver are required. In contrast, in the proposed scheme, the information sender is not defined, and receivers obtain information by observing and recognizing signs in the environment around them. Then, the properties of communication media, i.e., scale, connectivity, generality, and design, are discussed. In the concept of media biotope, the range of the medium must be comparatively small, and each community created through the medium should have connections. Many people should be able to freely participate in the mediums. Furthermore, these communities must be autonomous and stable like a bio-system created through an eco-biotope. Furthermore, examples of communication mediums designed for creating media biotope are shown.

***Keywords*—** Communication medium, Communicative action, Community design, Revitalizing local community.

I. Introduction

TRANSMITTING large volumes of information at high speed has become possible with the recent explosion of highly digitalized communication infrastructures, e.g., the Internet. While on the one hand these media connect people in distant places, they also weaken the connections between residents of local communities [1]. As a result, local residents often become indifferent to one another. Furthermore, the loss of enthusiasm for their region is seen as a reason for decreasing civil participation in suburban cities.

In Japan, major television stations based in Tokyo broadcast programs to every city and, as a result, the diversity of the sense of values has been diminished and people aim to become "like Tokyo." This trend is related to the lack of enthusiasm for their region. Many young people have moved to Tokyo, causing the population to be excessively concentrated there. As a result, the concept of "media biotope [2]" is attracting attention. In the media biotope concept, communication medium structures are discussed using the analogy of an eco-biotope.

In this paper, the concepts of communication media and community are defined, and the traditional scheme of communication is expanded in order to discuss the concept of media biotope. The effect of broad-based media, e.g., television and the Internet, on communities is also discussed. Then, the definition of media biotope is discussed based on the expanded scheme. Furthermore, examples of communication mediums are shown and discussed using the expanded scheme.

Manuscript received October 9, 2011: Revised version received March 4, 2011. This work was supported by Grants-in-Aid for Scientific Research from the Japanese Society for the Promotion of Science (No. 20500220 and No. 21360191).

H. Suto is with the Muroran Institute of Technology, 27-1 Mizumoto-cho, Muroran-sho, Hokkaido, 050-8585 Japan (corresponding author to provide phone: +81-143-43-5400; fax: +81-143-43-5499; e-mail: suto@csse.muroran-it.ac.jp).

II. Media and Community

A. Communication

The word "communication" has various meanings, and even the transmission of data can be considered communication in certain contexts. The aim of this paper is to clarify the framework of communication in terms of both syntax and semantics. Hence, communication is defined in accordance with the concept of communicative action as put forth by Habermas [3]: actions taken with the aim of understanding each other.

Generally, the term "communication medium" means a single-direction medium, e.g., television, newspapers, and radio, or an interactive medium, e.g., cellular phones and e-mail. However, we can also obtain a great deal of information from chatting and speaking in daily life and then make decisions in accordance with such information. Furthermore, we can see the actions of others even in such things as graffiti on a wall or a can left on a bench. Consequently, a medium can be thought of as something that can be perceived through one or more of the five senses and that affects our actions through the information received. Of course, the technologies or techniques used in the medium are irrelevant.

Two schemes of communication through a medium are illustrated in Figure 1. The traditional scheme for communication media, as described by Shannon and Weaver, is shown in Fig. 1 (A). The gray square between persons means a communication medium, and the arrow with dashed line means a information flow. In this scheme, an information

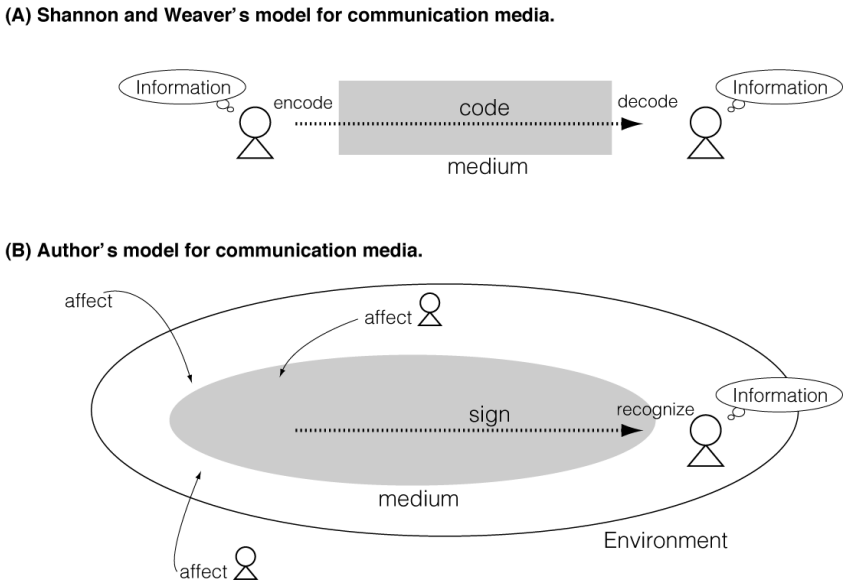

Fig. 1 Schemes of communication through a medium.

sender and a receiver are required. Information known to the sender is encoded and transmitted through a medium to the receiver. It is then decoded, enabling the receiver to understand it. Here, accurate reproduction of the original information is the main concern. The proposed scheme is shown in Fig. 1 (B). The gray oval means a communication medium, white oval means the environment around a receiver, and the arrow with dashed line means an information flow. In this scheme, a sign from the environment is transmitted through a medium to a receiver, who then obtains the related information by recognizing the sign on the basis of his/her context. That is, the receiver understands the environment around him/her through the medium. Hence, an information sender is not necessarily required. Consequently, above described situation in which the observer watches a graffiti on a wall can be illustrated.

Of course, the proposed scheme includes the traditional scheme, and the situation illustrated for the traditional scheme also holds for the proposed scheme. For example, assume a situation in which two people are talking. The speaker's voices and gestures affect the environment. The receiver hears and observes sounds and images as signs through the face-to-face communication medium. The receiver recognizes the signs and can understand the information.

B. Community

The word "community" also has various meanings. It could be a neighborhood association or a homeowner's association. Communities are also formed through intangible connections like those among people who went to school together or who use the common areas of an apartment building.

They can arise among people who share the same hobby or the same sense of values. In these cases, there is no physical aspect such as a school or apartment building, and the individual connections are conceptual. That is, communities can be formed by people who share an identity, e.g., values, ideology, or history.

Hence, there are two kinds of communities: those based on something physical and those based on relationships. Here, we discuss the second kind because it can also include the first kind.

C. Problems created by broad-based media

"Benefit of inconvenience" is the concept of "spending time and effort to create a new value." Kawakami et al. proposed using this concept for several system designs methods [4]. From the viewpoint of saving time and labor, mass media and high-speed digital communication media are very convenient. However, several problems with using these high-technology media have been reported. For example, distribution of messages by mass media reduces the diversity of communities [5]. Furthermore, there is the "Internet paradox": people with poor communication skills continuously use the Internet for communication, which creates negative social effects instead of positive social involvement and psychological well-being. Problems with hardware, e.g., the coverage area of cellular phones and the transmission rate of data have mostly been solved in the telecommunication field. Next, we should consider the things lost due to using convenient media. The concept of "benefit of inconvenience" should lead to effective solutions.

Therefore, media performance (efficiency, capacity, etc.) is not discussed here. Instead, the effect of media on people is considered.

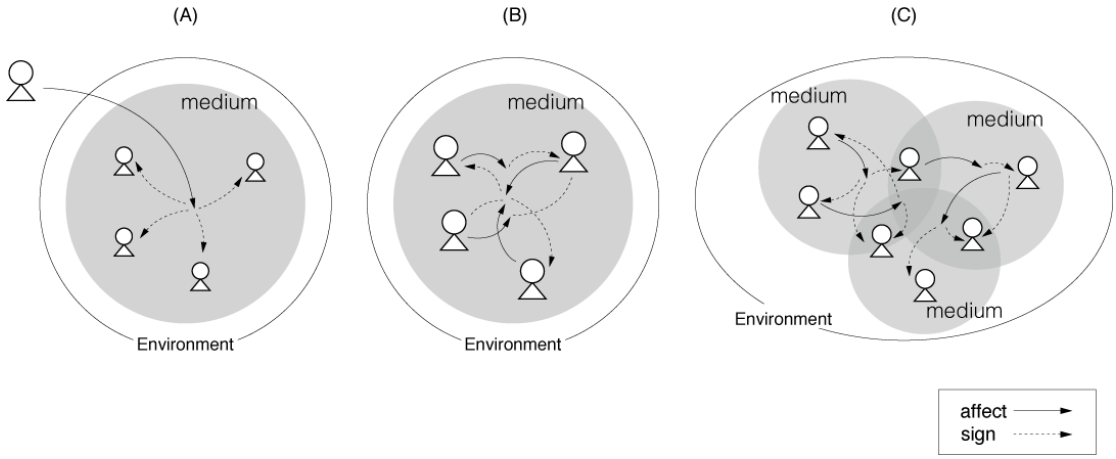

Fig. 2 Examples of communities created with mediums.

III. MEDIA BIOTOPE

A. Definition

The term "media biotope" conceptualizes the idea that media communication structures are analogous to an eco-biotope, a term coined from "bio" and "topos." It means a small area that is suitable for living things. In many cases, it indicates a small region with a uniform ecosystem, e.g., a pond, square, abandoned house, and field. However, if the region is isolated from other regions, its biotope characteristics are weakened.

When small living things, e.g., insects and birds, travel between such small regions and a network system forms between the regions, the regions and the system are together also called a "biotope."

A media biotope can be thought of as a biological system of information media. And this concept suggests that we can focus on small local media, e.g., cable television, free papers, and community FM radio, because we can easily use these media to send information. If local communities form through these small local media, and the communities construct a network system by interacting with each other, the communities and the system are a "media biotope." Furthermore, the medium that generates a media biotope is a "media biotope oriented medium." For example, the local media mentioned above could be media biotope oriented media.

B. Properties

"Small," "connectivity," "generality," and "design" have been mentioned as properties of eco-biotope [2]. "Connectivity" means a situation in which each ecosystem is connected and affects the others mutually. "Generality" means that the regions are not sealed off and behave as part of a life space. "Design" means that the regions are designed so that they continue to perform as a biotope. The properties of a media biotope are defined in accordance with these definitions.

1) Scale

The range of the medium must be comparatively small in the media biotope concept as well as the range of the eco-biotope. National newspapers and nationwide television stations can be called "big media" while notices for circulation in a region and bulletin boards at a train station can be called "small media." But what about a CATV channel that reports local news? The categorization is case dependent. The important factor is not the size of the area reached by the medium but the number of residents who can take part in the medium.

An example of model of big medium is shown in Figure 2 (A) using expanded communication scheme. In this model, signs that created by a few specific person are transmitted to the members of community through the medium. In contrast, an example of model of small medium is shown in Fig. 2 (B). In this model, the signs that created several persons are transmitted through the medium.

The motivation of residents to act as a community decreases as the possibility of each member affecting the community through the medium decreases. This means that each person should have same level of influence for a media biotope to form. However, if a specific person has disproportionate influence, there is risk that the biotope will reflect only the values and interests of that person. As a result, each person's influence must be more than negligible, and as many people as possible must be able to act through the medium.

2) Connectivity

Each community should have connections with other communities. Fig. 2 (C) shows an example of media biotopes created through the mediums. In this case, each member is belongs to one or more communities. As a result, each community has connections with other communities.

If a community created through a medium with a scale as described above becomes isolated from other communities, it might become ruled by a specific sense of values. This means that communities must be able to influence each other so that

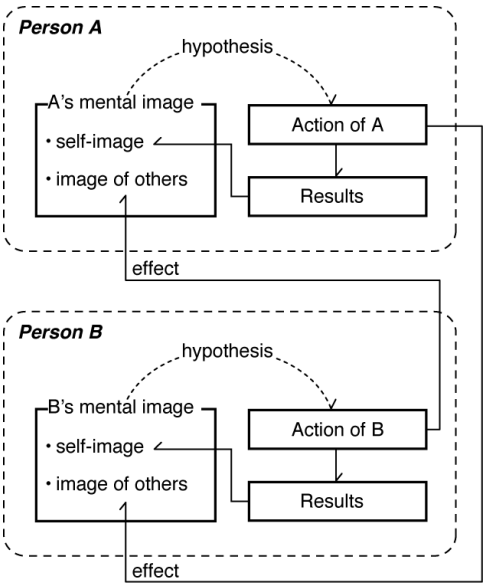

Fig. 3 Example of interaction system.

various senses of value are maintained.

3) Generality

The ability of many people to freely participate is also an important factor. If the members are selected by specific criteria, the community lost their diversity. As a result, it becomes difficult to have connection with other communities.

Therefore, communities created through network games or social network services, which have limited membership cannot be called media biotopes because not everyone can participate freely. For instance, a "gated city community" [6] cannot be called a media biotope because it is closed even though it satisfies the conditions of "scale" and "design."

4) Design

The meaning of information transmitted through a medium is understood not only from the contents but also from the structures of the medium [7]. It is difficult to form a community with the properties of a biotope if the medium is designed to simply transmit semantic information speedily and easily. When a new medium is being designed, the characteristics of the community and of its members must be analyzed, and the medium must be designed accordingly.

C. Autonomy of communities

Communities created through a media biotope must be autonomous and stable like a bio-system created through an eco-biotope. The autonomy and stability of a system should be maintained not by effects from outside the system but by the results of the system's behaviors. That is, the media information should be recycled instead of being simply broadcast and consumed. This flow mechanism should be incorporated when designing communication media.

Furthermore, a community that is completely stable could become isolated. Communities should be able to adjust in accordance with changes outside the community while maintaining their autonomy.

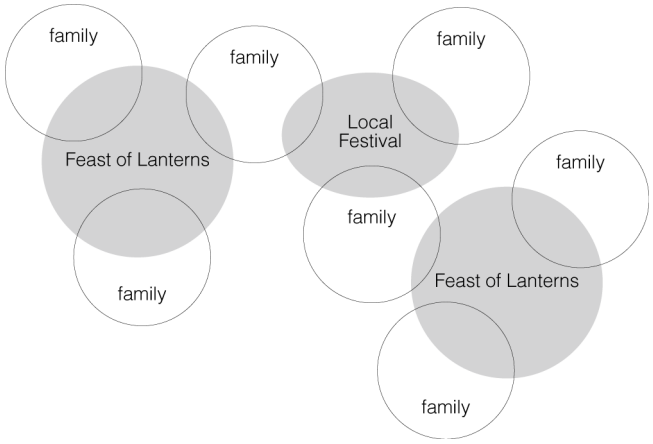

Fig. 4 Media biotope created through traditional events.

D. Communication medium as an interaction system

In a community, people behave in accordance with their self-image. For instance, a person might not try something that seems too difficult but will try something that seems doable. And the results of the action affect the person's self-image. This feedback system maintains a person's mental image, and it is called the "interaction system." Of course, the system includes other people. Consequently, the reactions of these other people influence the person's mental image. Figure 3 illustrates an example interaction system. In this case, person A acts in accordance with his or her mental image, and the results affects his or her self-image. Furthermore, the action affects person B's image of person A.

This process, i.e., controlling one's self-image from the perspective of others, is an important social skill. However, in a society with highly complicated media, the feeling of the presence of the others is weaker, so the ability to control one's-self image from the perspective of others is weaker [8]. As a result, one's self-image is formed mainly from one's own viewpoint, and one becomes increasingly narcissistic. For example, it has been reported that personal audio-video media, e.g. iPod players and 1-segment television (handy television), and self-promotion media, e.g., MySpace and YouTube, increase a user's concern for him/herself, so the user becomes increasingly narcissistic [9].

Lack of sympathy is a symptom of a narcissistic-personality disorder caused because by excessive self-gratification. Consequently, the number of people who cannot sympathize with others has been increasing even though they are connected with many people through the Internet [10]. In the Media biotope concept, mechanisms are required that encourage people to respect and sympathize with others. In this concept, the interaction systems of residents overlap and form a large stacked interaction system. Communication among residents is

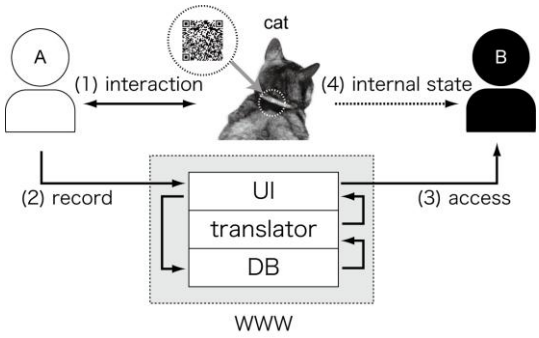

Fig. 5 Overview of Neko-Media.

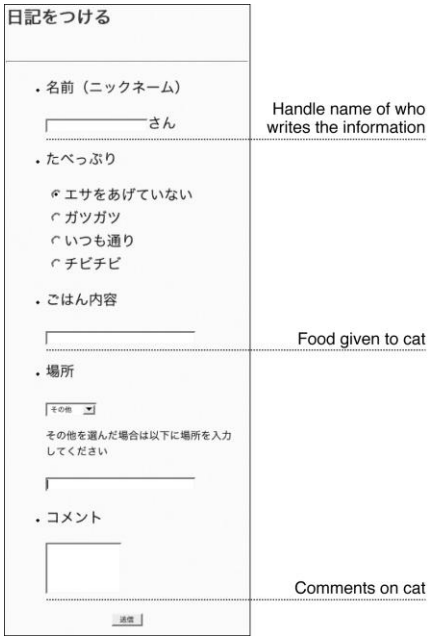

Fig. 6 Interface Example.

thereby activated, and a community forms naturally. The communication media of a media biotope should be designed to create such a stacked interaction system by making others more visible. However, relationships among residents would deteriorate gradually if the system worked negatively. On the other hand, the relationships would strengthen if it worked positively. The communication system also should have a mechanism that forms positive feedback by promoting empathy for each other.

IV. Examples of Media Biotope

A. Traditional events

These are many traditional events and festivals that function as a media biotope. A good example is the Feast of Lanterns in Japan. During this time, many people return to their home town to visit the graves of their ancestors. Ratio of nuclear families is

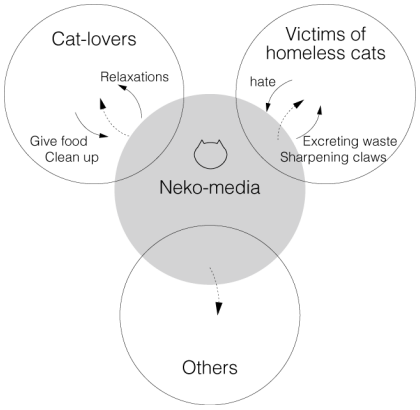

Fig. 7 Media biotope created through Neko-Media.

increasing in Japan. It is a good opportunity for them to see relatives and catch up on the news back home. Local festivals and the new year holidays function the same.

Figure 4 illustrates a structure of media biotope created through traditional events. The circles labeled family mean families who are living together. In this case, feast of lanterns function as mediums among relatives, and a local festival functions as a medium among residents in a region.

Traditional events have been creating media biotopes in the regions like this. However, interest in these events has waned, so new events as communication media that take their place could be designed using the media biotope concept.

B. Neko-media

The author's group has proposed a novel communication medium that uses homeless cats (Neko-media) [11], and we are investigating the characteristic of the medium [12]. The word "Neko" means cats in Japanese. Figure 5 outlines the information flow in the Neko-media system. Neko-media is a web application consisting of a web site that can be accessed by a cellular phone, a database system, and a translator engine.

When a person meets a homeless cat and gives it food (step (1) in Fig. 5), he/she then accesses the web site by using QR-code put on the cat's collar, and inputs information about the interaction with the cat (step (2) in Fig. 5). As shown in Figure 6, the user interfaces are mostly easy selection types, e.g. "Food was given or not given." The information input here is accumulated in the database (DB in Fig. 5). A person who comes across the cat (B in Fig. 5) accesses the web site, and he/she can see the records of other people and their interactions with the cat. The accumulated data is translated into "the cat's words" by the translator and displayed (step (3) in Fig. 5). Here, the cat's words are expressed in a human language such as English or Japanese. As a result, B will know the "cat's internal state" through the cat's words, and the person can relate to the cat accordingly (step (4) in Fig. 5).

It is possible to say that Neko-media reflects how the internal state of the cat has changed through interaction with people if

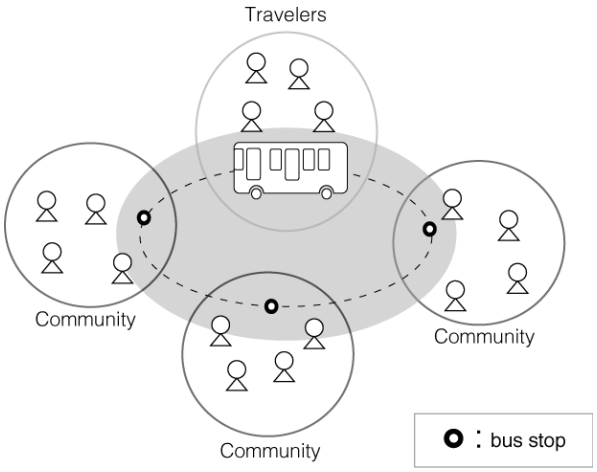

Fig. 8 Media biotope created through Bus-Media.

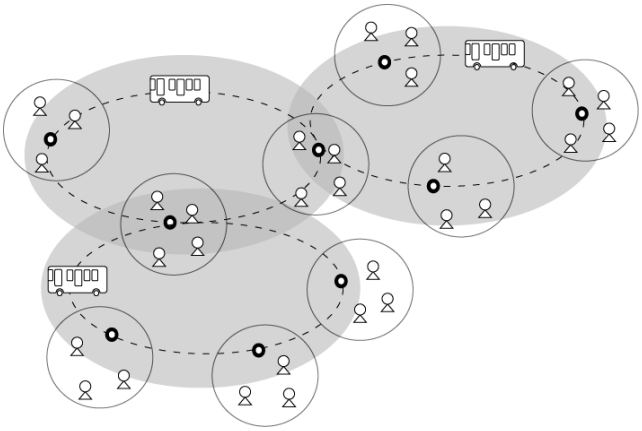

Fig. 9 Bus-Media with common transfer points.

we assume that the changes in our internal state (=feelings) are caused by relations with others.

If the purpose is only to share the information on the cats conveniently, the system should accumulate such information easily and display it directly. However, the Neko-media engine translates information that the person wrote on the web site into the cat's words and displays it. As a result, individual relations between cats and people will be kept. Therefore, it becomes easy for cat-lovers to join this community, even if they are passive and quiet.

Figure 7 illustrates a structure of media biotope created through the Neko-media. There are three communities, i.e. cat lovers, victims of homeless cats, and the others, and they are communicating through the medium. The members of "cat lovers" write about their interaction with a homeless cat on Neko-media. The information is transmitted to the members of "victims of homeless cats" and "others" via Neko-media, and consequently, they can understand how the cat lovers grapple with the cats' problems. As a result, their recognition of the cat lovers and homeless cats maybe be changed. The members of "victims of homeless cats" write their sufferings from homeless cats, and other residents can understand their feelings.

In this scheme, persons who aren't cat lovers are not likely to access the Neko-media system. However, even such people might become integrated into the community because of the change in other residents' recognition of homeless cats. The feelings of other residents are relative; therefore, the medium influences the entire community.

C. Bus-media

The author's group has also proposed a communication medium that uses community buses [13][14]. Figure 8 illustrates structure of media biotope created through buses designed as a communication medium. We call such a bus a "communicative bus." Two functions are incorporated: transportation for the residents and travellers and enhanced communication between residents and travellers.

Local products, e.g., sweets and special lunch boxes, would be sold to the travellers at each bus stop. The name of the next stop and the special product sold there would be announced before each stop. The passengers could buy the local products they like as they use the bus for transportation. As a result, the travellers would naturally improve their understanding of the region while enjoying their trip.

Electronic message displays would be set up on the front of the bus, on the side near the back doorway and above the driver. Passengers could freely send brief messages like a "Twitter message" about their impressions, memories, etc. of the trip and on local products to these displays by using their cellular phones.

The messages would be displayed until another user sends a message or until a fixed time has passed. These message displays would allow passengers to share their thoughts and feelings and entertain people outside the bus.

Furthermore, because travellers are typically interested in local products and historical places, they would get a chance to communicate with the local community by buying their products.

As a result, the memories of their trip would become more impressive. Travellers who ride together could use these messages as a means to communicate. In addition, communities and industry in the region would be invigorated, and the attractiveness of the region would increase as a result.

Furthermore, the system can be expanded by creating communication pathways among different routes as illustrated in Figure 9. In the expanded system, buses have several common transfer points, and users can transfer to other route buses at these points. The creation of such pathways provides a chance to participate in the community of other region for passengers. Consequently, passengers experience more of the culture and the topics of other communities, and their affection for the other communities increases. In addition, these experiences enable detecting the advantages of one's own

community and enriching the culture of one's own community. The lives of residents will be enriched by such a positive spiral.

V. Related works

Many communication media studies have focused on the concept of quality of service. Two in particular [15][16] focused on the relationship between the media and its users. The emphasis has been on the quality of expression for users. In contrast, we focused on the relationship between a medium and the users' behaviors, and properties of communities which created through the medium.

Some studies have investigated the relationship between new technology media and its users. Plaesu and Dalu discussed the effects of the Internet on society [17]. They argued that the Internet revitalizes public discourse although it fosters audience and issue fragmentation. The problems of fragmentation should be reduced by the introduction of communication media designed on the basis of the media biotope concept. Chiribuca et al. discussed the relationship between communication media and communities from the aspect of education [18]. They pointed out that the backgrounds of the media users are important for socialization processes and formal education. The proposed scheme helps illustrate the framework of their arguments.

Community broadcast systems (community FM radio) have been studied as a communication medium for a small scale community. Community broadcast is wireless broadcasting over weak electromagnetic waves. Communities created through community broadcast systems can be regarded as media biotopes. Tkayama [19] also focused on a process in which a community is created through the activities of informing and leaning, thinking and understanding, sharing, acting, etc. through community broadcast. Green [20] discussed the differences between communities of broadcasts and communities of interactivity such as the Internet. These aspects are very important to design new communication media for media biotope.

VI. Conclusion

The proposed communication scheme is based on the concept of media biotope. Shannon and Weaver's model for communication was expanded in order to illustrate the media biotope concept. In the proposed communication scheme, an information sender is not necessarily required, and the receivers obtain information by recognizing signs in the environment.

Three types of communication mediums were shown. These mediums are used to revitalize the communication among families, revitalize communication among different groups in a region, and help travelers learn about sight seeing spots and communicate with residents. Main idea of them is to exploit familiar things in daily file as a communication medium. Therefore, it is expected that a lot of persons can use it daily and easily.

The effects of new technology media on society have been studied theoretically and empirically. However, there was no framework for discussing the effects from the viewpoint of system informatics. The proposed scheme can serve as the basis of a mathematical framework of communication. It can thus contribute to the analysis of the relationship between new technology mediums and our daily lives.

References

[1] L. H. Dreyfus, *On The Internet*, Routledge, 2001.
[2] S. Mizukoshi, *Media Biotope*, Kinokuniya Publication Services, 2005. (Japanese)
[3] J. Habermas. *The Theory of Communicative Action I*, Heinemann, 1984.
[4] H. Kawakami, M. Nishimura, O. Katai, T. Shiose, "A System Design based on Benefit of Inconvenience and Emotion," *Proc. ICROS-SICE International Joint Conference (ICCAS-SICE 2009)*, CD-ROM 2A11-5, 2009.
[5] R. Silverstone, *Why Study the Media?*, SAGE Publications, 1999.
[6] E. J. Blakely, M. G. Snyder, *Fortress America: Gated Communities in the United States*, Brookings Inst. Pr., U.S.A., 1999.
[7] M. Macluhan, *Understanding media: the extensions of man*, McGraw-Hill Books, 1964.
[8] T. Imada, T. Tomoeda, *Basic Sociology*, Yuhikaku Publishing Co., Ltd., 1991. (Japanese)
[9] E. Gwinn, "Self-love is a risky business," *The Courier-Mail*, p. 53, March 27, 2007.
[10] H. Suto, O. Katai, M. Okita, H. Kawakami, "A Medium Design for Sharing Empathetic Memories," *Proc. of 8th Workshop on Social Intelligence Design*, pp. 199–205, 2009.
[11] H. Suto, M. Okita, "Proposal of a Novel Communication Medium to Promote Community Using Homeless Cats," *Proc. of 6th Workshop on Social Intelligence Design*, pp. 287–296, 2007.
[12] H. Handa, H. Suto, M. Okita, H. Kawakami, "Agent-Based Simulation of Regional Cat Activities," *Proc. of 11th Asia-Pacific Workshop on Intelligent and Evolutionary Systems*, CD-ROM, 2007.
[13] M. Sakamoto, H. Suto, M. Sawai, "Communication Media based on the Media Biotope," *Proc. of 2010 International Conference on Humanized Systems*, pp. 14–19, 2010.
[14] H. Suto, M. Sakamoto, "Local Communication Media Based on Concept of Media Biotope," *Proc. of SICE Annual Conference 2010*, pp. 2188–2191, 2010.
[15] N. Manouselis, P. Karampiperis, I.O. Vardiambasis, A. Maras, G. Liodakis, "Digital Audio and Internet Radio Broadcasting Systems under a QoS," *Proc. of 4th WSEAS International Conference on TELECOMMUNICATIONS AND INFORMATICS*, pp. 284-289, 2005.
[16] Z. Bojkovic, D. Milovanovic, Z. Perisic, "Quality of service (QoS) in multimedia communications: modeling, architecture, management," *COMMUNICATION WORLD*, WSEAS Press., pp. 52-58, 2001.
[17] A. Plaesu, A. Dalu, "The social and interactional dimensions of Internet utilization," *RECENT ADVANCES IN EDUCATION and EDUCATIONAL TECHNOLOGY*, WSEAS Press., pp. 198-202, 2008.
[18] D. Chiribuca, I. Pah, D. Hunyadi, "Social and Cultural Challenges of the New Communication Technology Used in Education Oriented Activities," *RECENT ADVANCES IN EDUCATION and EDUCATIONAL TECHNOLOGY*, WSEAS Press, pp. 129-134, 2008.
[19] T. Kanayama, T. Kaneko, M. Tanaka, M. Hirayama, *Community Media*, Keio Univ. press, 2007. (Japanese)
[20] L. Green, "Communities of broadcasting and communities of interactivity," *COMMUNICATION WORLD*, WSEAS Press., pp. 158-163, 2001.

Hidetsugu Suto was born in Osaka, Japan, in 1968. He studied in the Faculty of Integrated Arts and Sciences, Tokushima University, from 1987 to 1991, the Graduate School of Education, Osaka Kyoiku University, from 1997 to 1999, and the Graduate School of Informatics, Kyoto University, from 1999 to 2004. He received an Informatics Diploma from Kyoto University in 2006. His major fields of study are media informatics and communication systems.

He worked for Justsystem Corporation from 1991 to 1997 as a software engineer, and for the Akita Municipal Junior College of Arts and Crafts as a

lecturer from 2002 to 2006. He joined the Department of Information and Electronic Engineering, Muroran Institute of Technology (Japan), in 2006.

Associate Prof. Suto is a member of The Society of Instrument and Control Engineers (SICE), The Human Interface Society (HIS), The Japan Society of Kansei Engineering (JSKE), and The Japan Society for Artificial Intelligence (JSAI).