A Study of Communication Scheme for Media Biotope

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Abstract: The concept of "media biotope" is discussed from the viewpoint of system informatics. Media biotope is a concept of communication mediums in which the structures are discussed as an analogy of a biotope of the nature world. In this scheme, communities created with local media that are connected with and mutually influence each other. First of all, Shannon and Weaver's model for communication media is expanded in order to discuss the creating process of media biotopes. In this scheme, information sender is not necessarily required, and receivers obtains information by recognizing signs around them. Furthermore, the recognizing process of receivers is illustrated by using the channel theory, which is a mathematical tool for describing information flows.

Keywords: Communication media, community, channel theory.

1. INTRODUCTION

Media biotope is a concept of communication mediums in which the structures are discussed as an analogy of an eco biotope [1]. In this concept, the communities influenced by big media are considered to corresponding to un-diversified mountains which were planted huge cedars, and creating small communities with local communication media are aimed in order to get back diverse communities [2]. The authors have discussed the definition of media biotope, and have proposed some novel mediums which create media biotopes [3, 4]. However, we don't have any logical frameworks to analyze the mechanism of creating communities with such mediums.

Generally, communication scheme is discussed based on the Shannon's model for communication media. This scheme discards meaning of information and focuses on the amount of information. However, when discussing the media biotope, the meaning of information should not be ignored.

Therefore, the shannon's model will be expanded in order to discussing structure of media biotope. The first, survey the concept of the media biotope. Then, the proposed model is described. Channel theory is introduced in order to discuss logically the meaning of information transmitted by mediums.

2. MEDIA BIOTOPE

2.1 Problems with broad-based media

The authors have investigated the relationship between communication medium and communities from the viewpoint of "Further Benefit of a Kind of Inconvenience (FUBEN- EKI) [5]," which is the concept of "spending time and effort to create a new value."

From the viewpoint of saving time and labor, mass media and high speed digital communication media are very convenience. However, several problems have been reported. For example, the messages distributed by mass media reduce diversity of community [6], and the Internet weaken the connections between residents of local communities [7]. Furthermore, there is the Internet paradox where people with poor communication skills continuously use the Internet for communication, and gain negative effects instead of positive social involvement and psychological wellbeing. Consequently, we focus on concept of the media biotope.

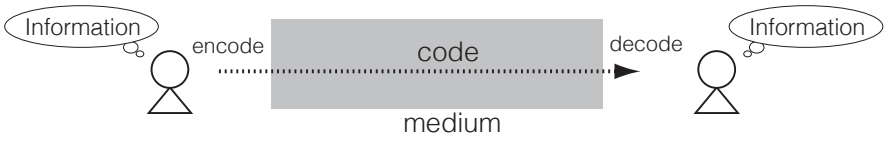
2.2 Definition of media biotope

The term "media biotope" conceptualizes the idea that media communication structures are an analogous to an eco biotope, and a word 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 eco system, e.g., a pond, square, ruined 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 is constructed between the regions, the regions and the system are also called a "biotope." Furthermore, the activities that maintain such regions are also called "biotopes" in Japan.

Media biotope can be thought of as a biology 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. If local communities are formed with 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."

(A) Shannon and Weaver's model for communication media.



(B) Author's model for communication media.

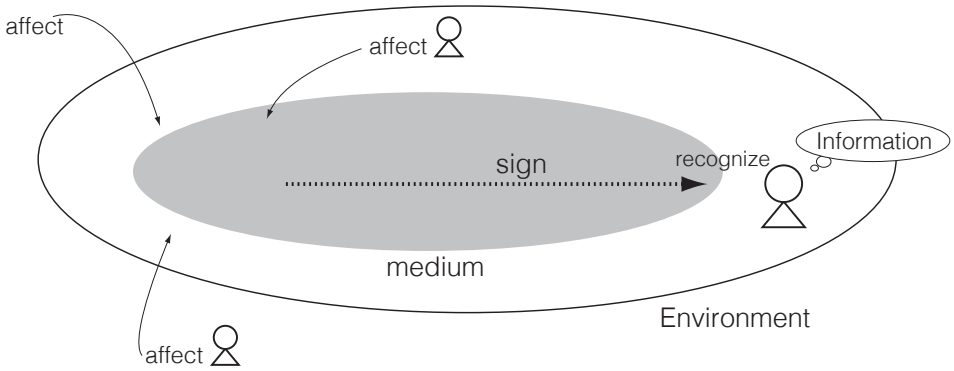


Fig. 1 Caption should be placed below the figure.

3. MEDIA AND COMMUNITY

3.1 Communication Media

The word "communication" has various meanings, and even the transmission of data might be considered communication in certain contexts. Here, communication is defined in accordance with the concept of communicative action as put forth by J. Habermas [8]: actions taken with the aim of understanding each other.

Generally, "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 a great deal of much information from chatting and rumors in daily life and 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 by the five senses and that affects our actions through the information received. In other words, we cannot obtain any information with out mediums. Thus, it can be said that media decide the information which should be recognized us. Of course, the technologies or techniques used in the medium are irrelevant.

Schemes of communications with a medium are illustrated in Figure 1. A traditional model for communication media proposed by Shannon and Weaver [9] is shown in Fig. 1 (A). In this framework, an information sender and the receiver are required. Information held by the sender is encoded into codes and transmitted to the receiver. The codes are then decoded and the receiver can understand the information. This scheme was developed in order to discuss the methodologies of reducing errors caused by noise sources. Here, amount of information is depend on only statistical characters of an event, and other factors are ignored.

In contrast, Fig. 1 (B) shows a novel model for communication media. In this framework, the receiver obtains the sign from the environment, and he/she gets information by recognizing the sign. The signs which can be received are depend on the medium. The receiver understands the environment around him/her through the medium. Hence, the information sender is not necessarily required. Of course, a situation in which a sender and the receiver are included can also be explained with this model. For example, assume a situation in which two people are talking. The speaker's voices and gestures affect the environment. The receiver gets sounds and images as signs through face-to-face communication field as a medium. The receiver then recognizes the sign and the information is known to him/her.

New technology media expand the environment around us. for example, we can see many event which happen in the distance through the internet instantaneously.

4. RECOGNIZING SIGNS

4.1 Chanel theory

The model shown in Fig. 1 (B) illustrates the situation of obtaining information by apperceiving the commitments of others from the sign, i.e. changing of the environment. Then, the relationship between the sign and the concept of the receiver should be described, and the channel theory [10] is introduced. A classification of channel theory is used for representing a concept of a person, and infomorphism is used for representing information flow.

(A)

	C	M	Y	cr/hi	cr/lo	s/hi	s/lo
P1	0	1	0	1	0	1	0
P2	1	0	0	0	1	1	0
P3	1	0	1	0	1	0	1

(C)

1	0	1	0	like
0	1	0	1	dislike
1	0	0	1	note_care
warm	cool	soft	hard	

(D) (B)

Fig. 2 Examples of classifications and an infomorphism.

4.1.1 Intra-Classification

A **classification:** $A = \langle tok(A), typ(A), \models_A \rangle$

consists of a set $tok(A)$ of objects to be classified, called "tokens of A," a set $typ(A)$ of objects used to classify the tokens, called "types of A," and a binary relation $\models_A$ between $tok(A)$ and $typ(A)$ indicating the types into which tokens are classified.

Given a classification A, a pair $\langle \Gamma, \Delta \rangle$ of subsets of $typ(A)$ is called a "sequent of A." A token $a \in tok(A)$ **satisfies** $\langle \Gamma, \Delta \rangle$ if a is of type α for $\forall \alpha \in \Gamma$; then a is of type β for $\exists \beta \in \Delta$. If every token $a \in A$ satisfies $\langle \Gamma, \Delta \rangle$; then $\langle \Gamma, \Delta \rangle$ is called a "constraint" supported by A, and denoted as $\Gamma \vdash_A \Delta$.

A **local logic:** $\mathcal{L} = A, \vdash_{\mathcal{L}}, N_{\mathcal{L}}$ consists of a classification A, a set $\vdash_{\mathcal{L}}$ of sequents of A called the constraints of $\mathcal{L}$, and a set $N_{\mathcal{L}} \subseteq tok(A)$ of tokens called the **normal tokens** of $\mathcal{L}$, which satisfy all the constraints of $\mathcal{L}$.

$\mathcal{L}$ is **sound** if $N_{\mathcal{L}} = tok(A)$, and $\mathcal{L}$ is **complete** if $\vdash_{\mathcal{L}}$ includes all the constraints supported by A. Given a classification A, a sound and complete local logic, called $Log(A)$, is generated from A.

4.1.2 Intra-Classification

An **infomorphism:**$< \mathbf{f}, \mathbf{g} >$ is a pair of functions. Given two classifications A and B, an infomorphism from A to B written as $A \rightarrow B$ satisfies

$$g(b) \models_A \alpha \text{ iff } b \models_B f(\alpha)$$

for $\forall \alpha \in typ(A), \forall b \in tok(B)$, where f and g are whole-part relationships.

An **information channel:** $\mathbf{C} = f_i : A_i \rightarrow C$, where $i \in I$, is an index family of infomorphisms with a common codomain C called the "core of the channel." I is an index set.

4.2 Describing medium

The environment around us is changing continuously, and we are judging which are important alternations and which can be ignored. Here, which alternations are transmitted to the receiver is depend on the medium used. That is to say, the events focused on us change when the medium used changes. For example, our attention points maybe different when the news source is different even if they reported the same affair. Thus, it can be consider that tokens of classification are decided in accordance with medium used.

For instance, a situation in which a receiver looks images of scenes (P_1, P_2, P_3) is assumed. The following classification I_c indicates the original scene.

$$tok(I_c) = \{P_1, P_2, P_3\}$$

$$typ(I_c) = \{C, M, Y, cr/hi, cr/lo, s/hi, s/lo\}$$

$$\begin{array}{lll} P_1 \models_{I_c} M, & P_1 \models_{I_c} cr/hi, & P_1 \models_{I_c} s/hi, \\ P_2 \models_{I_c} C, & P_2 \models_{I_c} cr/lo, & P_2 \models_{I_c} s/hi, \\ P_3 \models_{I_c} C, & P_3 \models_{I_c} Y, & P_3 \models_{I_c} cr/lo, \\ P_3 \models_{I_c} s/low & & \end{array}$$

Type C means cyan, M means magenta, Y means yellow, cr/hi means "contrast ratio is heigh," cr/lo means "contrast ratio is low," s/hi means "sharpness is heigh," and s/lo means "sharpness is low." The classification I_c can be described with a matrix as shown in figure 2 (A).

Here, assume that the receiver likes warm and soft picture, dislike cool and hard picture, and does not care warm and hard one. The following classification R indicate the receiver's taste in picture.

$$tok(R) = \{like, dislike, not\_care\}$$

$$typ(R) = \{warm, cool, soft, hard\}$$

$$\begin{array}{ll} like \models_R warm, & like \models_R soft, \\ dislike \models_R cool, & dislike \models_R hard, \\ not\_care \models_R warm, & not\_care \models_R hard, \end{array}$$

The classification R can be described with a matrix as shown in Fig. 2 (B).

In this case, an example of infomorphism:$I_c \rightarrow R$ is represented as following:

$$f(like) = P_1, f(dislike) = P_3,$$

$$f(not\_care) = P_2,$$

It means P_1 is the best for the receiver. Fig. 2 (C) illustrates the infomorphism $I_c \rightarrow R$.

On the other hand, if the image is B/W, the classification of the image I_{bw} is indicated as following:

$$tok(I_{bw}) = \{P_1', P_2', P_3'\}$$

$$typ(I_{bw}) = \{cr/hi, cr/lo, s/hi, s/lo\}$$

$$P_1 \models_{I_{bw}} cr/hi, \quad P_1 \models_{I_{bw}} s/hi,$$
$$P_2 \models_{I_{bw}} cr/lo, \quad P_2 \models_{I_{bw}} s/hi,$$
$$P_3 \models_{I_{bw}} cr/lo, \quad P_3 \models_{I_{bw}} s/low$$

The classification I_{bw} can be described with a matrix as shown in figure 2 (D). In this case, the size of classification shrank according to change the medium.

Accordingly, the infomorphism $I_{bw} \rightarrow R$ also changes as following:

$$f'(like) = P'_3, f'(dislike) = P'_1,$$
$$f'(not\_care) = P'_2$$

It means P'_3 is the best for the receiver.

By using this scheme, we can represent the situation that changing receiver's recognition with the changing of the type of medium.

5. CONCLUSION

In this paper, a representation model for communication medium was proposed. Shannon and Weaver's model for communication was extended in order to apply it for illustrating scheme of media biotope. In this model, information sender is not necessarily required, and receivers can gain several informations by recognizing signs from their environment. Furthermore, the channel theory was introduced for representing information flow through mediums. As a result, we can describe the semantic information flow which is corresponding to a kind of medium.

In this paper, communication media are considered as a determiner of classification of the channel theory, and the information flows through a medium are described by using an infomorphism. When two classifications are assumed, generally if the elements of the classification are decreased, diversity of infomorphisms generated between the classifications also decreased. This fact can be considered as decreasing diversity of interpretation of receiver for an event. Diversity is one of the most important factor when considering the concept of media biotope. The authors have been investigating the influences of telops in television programs on the diversity of audiences' interpretations [11, 12]. It is planed that analyzing the relationship between a type of medium and the diversity of receivers' interpretations based on the studies.

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