

## Connectedness Oriented Communication: Fostering a Sense of Connectedness to Augment Social Relationships

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This paper discusses a concept for network communication that we call *connectedness oriented communication*. The concept of *connectedness oriented communication* is intended to shed light on the aspect of communication that supports and augments the social relationships of people by fostering a *sense of connectedness* among them. While traditional network communication technologies focus on transmitting the contents of messages precisely, *connectedness oriented communication* focuses on the *sense of connectedness* that is fostered by exchanging the presence and status information of people as well as providing lightweight communication media. In this paper, the concept and design issues of *connectedness oriented communication* media are presented, and example systems we have constructed are described. Some results on initial experiments on the systems and issues towards the further development of *connectedness oriented communication* media are also addressed.

### 1. Introduction

With the rapid advancement of network technologies, ‘always-on’ Internet connections are becoming widely available at low cost. Wireless networks are also providing anytime and anywhere network access. Users now can exchange messages anytime as well as enjoy various network services. These advances are making it possible to develop new types of network services.

Current network communication technologies mainly focus on the contents of messages exchanged. For example, existing popular network communication media — such as e-mail, bulletin boards, and instant messaging services — are primarily designed to handle messages whose contents can explicitly be represented in written languages. The characteristics of these network communication media can be considered as follows: (1) communication depends mainly on written or spoken languages, and (2) communication is mainly intended for discussion and notification (in other words, communication is task-oriented).

In contrast, we naturally engage in various kinds of communication activities other than just discussions and notifications in our daily

lives. Examples include casual greetings, self-introductions with the exchange of name cards (when we meet new people), informal inquiries on the whereabouts of acquaintances, and chatting just for plain enjoyment. In addition, in the context of daily social relationships, we share implicit information or knowledge with others on our surroundings, such as the presence and mood of others and social contexts. This kind of awareness is used as ‘cue information’ to adapt to different ways of communicating with others.

As described above, many of our communication activities are concerned with maintaining and strengthening our social relationships. However, most network communication media are basically designed just to deliver the contents of messages to the receiver. Accordingly, there is a huge gap between daily communication and communication over a network.

In order to fill this gap and to provide a direction for designing new network communication media, we propose the concept of *connectedness oriented communication*, which we define as a mode of communication targeted at maintaining and enhancing human social relationships. For example, casual greetings between people and exchange of implicit information or knowledge on our surroundings are typical examples of connectedness oriented communication.

In order to clarify the proposed concept, we call the mode of communication often found in conventional network communication *contents oriented communication*, which is targeted at

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exchanging meaningful contents of messages. Note that communication activities over networks are not categorized as either of these two modes of communication. Rather, these two modes can be considered to represent the opposite ends of an axis with respect to the purpose of communication, and each different communication activity lies at a different point along this axis.

Actually, connectedness oriented communication is observed in existing popular network communication media. For example, messages exchanged over mobile phone short message services tend to be short and their contents less significant compared with those composed with conventional personal computers. In the case of mobile phones, the fact that a short message is transmitted and (possibly when the message is sent) may be more important to the receiver than its contents. Thus, it is more connectedness oriented than contents oriented.

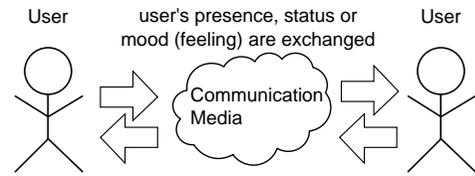
However, mobile phone short message services were not designed primarily to facilitate connectedness oriented communication. It is sometimes cumbersome to use this medium for connectedness oriented communication. For example, a user still have to go through the process of composing a text with 10 tiny keys to send a message. In order to facilitate connectedness oriented communication over the network, we need to clarify the characteristics of this mode of communication, and identify requirements of the communication media to support the connectedness oriented communication.

This paper is structured as follows: the next section describes a model of connectedness oriented communication and design issues of connectedness oriented communication media. Section 3 presents the example systems that we have developed along with some results on initial experiments. Subsequent sections discuss related work and future issues. Section 6 concludes the paper.

## 2. Connectedness Oriented Communication

### 2.1 Model

The purpose of the proposed connectedness oriented communication is to maintain and foster social relationships as a result of communication activities. Thus, in connectedness oriented communication, the contents of the message itself are not so important as communi-



**Fig. 1** Model of connectedness oriented communication.

cation activities. However, to start with, we need to identify what kind of messages should be exchanged in order to foster a sense of connectedness.

In the connectedness oriented communication, it is important to be able to be aware of the status or mood of people at the other end. For example, if the fact that a person is present at a remote location can be conveyed to a person at the other end, it may help maintain the relationship between these two people. Alternatively, if feeling towards a person at the other end can easily be conveyed to the other, it may also help maintain the relationship. For example, a casual greeting sent over the network could be beneficial to keep a social relationship.

Furthermore, we assume that these kinds of information need not be accompanied by written or spoken words. They do not need high-fidelity audio and visual, either. Rather, we assume that the symbolic representation is more suitable. Symbolic representation would prompt a receiver to imagine the status and mood of others rather than digest and interpret the received information.

Thus, connectedness oriented communication can be modeled as a series of exchanges of information on people's presence, status or mood that are represented symbolically. These exchanges will help people to be aware of each other, and contribute to maintain a social relationship among them (**Fig. 1**).

### 2.2 Design of Media

Let us consider the requirements for the media specifically targeted at connectedness oriented communication. In designing the media, the following issues need to be considered.

- How to capture the information such as presence, status or mood of a user. (sender side)
- How to present the received information to a user. (receiver side)

There are two approaches to obtain the presence and status information. One approach is

to monitor a user's presence and status by a sensor implicitly and automatically. For example, a sensor can detect the presence or movement of a user, and the detected information can be sent to the other end. In this case, the presence and status information can be captured without the user's intervention. In order to effectively cultivate a sense of connectedness, we need to carefully choose the type of information to use.

The other approach is to provide 'lightweight' communication media so that a user can express one's information (such as feeling, mood, and so on) explicitly and easily. Here, 'lightweight' means that there is a lower barrier to using the media (in this case expressing one's feeling). The issue here is to design an effective user interface to facilitate the interaction. That is, the user interface should allow a user to naturally and easily expressing one's feeling or mood. The user interface may also need to provide some kind of feedback to a user that the information expressed by a user has been conveyed to others.

At the receiver side, we can think of various ways to present the information to a user. What we need to consider is to appeal to the peripheral perception of the intended receiver so that the receiver's attention is not interrupted when a message is received.

### 2.3 Implementation

When we develop a specific communication medium, it is important to consider things from the user's perspective. This is especially important for connectedness oriented communication because its goal is to form and maintain the sense of connectedness among users, not just exchange messages with meaningful contents. Thus, we need to consider what kind of 'user experience' can be induced in the user instead of considering how to transmit message contents precisely. For example, we may write a scenario that describes the use of the media<sup>1)</sup> and design the user interaction (and/or interface) according to the scenario.

When we write a concrete scenario, there are various things to consider. For example, shall we consider only the current presence and status information, or shall we also consider the history of interactions (presence and status information exchanges)? Presenting the history will help a user to reflect on his/her communication activities, and be made more aware of his/her own connectedness with others, if it is

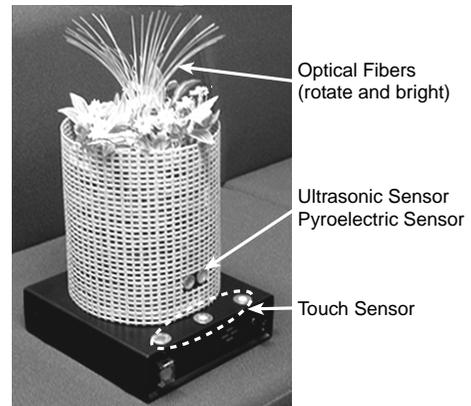


Fig. 2 FamilyPlanter (appearance).

presented to the user intuitively.

In addition, how many people are to be linked has an impact on the design. If the intended use is one-to-one communication, the scenario might involve private and intimate communication. If the intended use is with group members, the design will obviously be different.

In the next section, four example systems that we have developed are described. One system is called FamilyPlanter, and is designed to be used by remote family members. Another is Digital Chatty Window for use in remote offices. The main functionality of these systems is to monitor the presence and status of a user with sensors and represent the information to appeal to the peripheral perception of the intended receiver<sup>15)</sup>. That is, these system focus on the implicit and constant exchange of presence and status information.

The last two systems (Gleams of People<sup>10),12)</sup>, FaintPop<sup>11)</sup>), on the other hand, assume that a user explicitly sends his/her status (or mood). In this sense, these systems can be considered lightweight communication media. These systems also consider the history of communication, and the last system also handles group communication.

## 3. Example Systems

### 3.1 FamilyPlanter

FamilyPlanter was developed to be used by family members living apart. Figure 2 shows the appearance of the terminal, and a block diagram is shown in Fig. 3.

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The first two systems were developed by the group led by the second author, and the last two systems were designed by the third author.

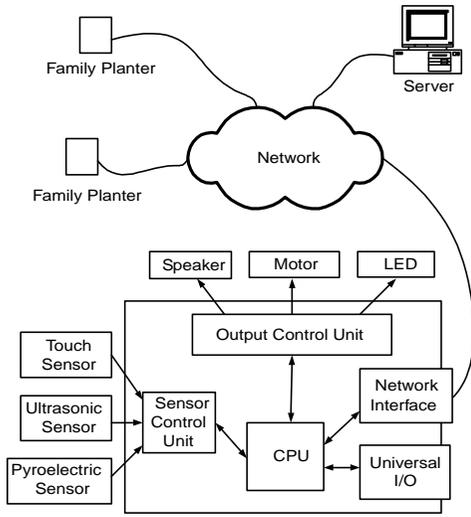


Fig. 3 FamilyPlanter (block diagram).

The terminal is connected to other terminal(s) via a server. The terminal has ultrasonic and pyroelectric sensors, which are used to detect human motion. The detected human motion is transmitted to a pre-designated terminal via the server. The terminal at the receiver side presents the received information by rotating and internally illuminating optical fibers. This is intended to exchange presence and status information implicitly and constantly without explicit intervention from the users. These exchanges are designed to blend into the everyday life of a user. The terminal also has a touch sensor. Touching the terminal causes the receiver's terminal to emit a sound. In this way, explicit messaging is also possible.

The FamilyPlanter terminal can be used simply by plugging it into a power outlet and connecting to the network. There is no complex configuration involved. The operation of the terminal is simple, and the user need not learn anything. These features are important in the design of any connectedness oriented communication media.

Let us describe an application scenario of FamilyPlanter. Suppose that a father is living far from his family. When the father comes back to his remote house, FamilyPlanter detects his motion and sends a message to the FamilyPlanter terminal installed in his main house. The message is translated into the motion and/or emission of light beams from the optical fibers. When other members of the family notice this change, they can feel the presence

of their father. They might choose to react by touching the terminal. The touch is conveyed to the terminal at the other end, which emits a sound. In this way, a sense of connectedness is expected to be fostered using the system.

In a preliminary experiment, the FamilyPlanter system was deployed to link geographically distant offices for three months. When the experiment period ended, test participants (seven in total) were asked to answer questionnaires. The results of the questionnaires indicate that people who are more active in communication tend to feel pleased when there is some action at the terminal (such as lit-up optical fibers, their movement, and emitted sound). At the same time, people have likes and dislikes about the particular light, movement and sound. This indicates the difficulties in presenting the presence and status information such that many users are satisfied.

### 3.2 Digital Chatty Window

We have developed another system called Digital Chatty Window, which is intended to be used in an office setting (Fig. 4). Its terminal is connected to the Internet, and can communicate with other Digital Chatty Window terminals either directly or via a server. The terminal exchanges the presence and status information of its user, which is captured by an infrared sensor.

There are two modes for displaying the presence and status information on the terminal's monitor: the 'all-members' and 'individual' modes. When a user selects the 'all-members' mode, the terminal lists the names of all members currently connected along with a still image of each member. The still image reflects the status of the corresponding member on the list. When a user selects the 'individual' mode, a movie (video clip) is chosen according to the status of the individual selected, and is displayed on the terminal screen. The current implementation shows a video clip of an empty fish tank when the user at the other end is not at the desk, and a video clip of a fish swimming in the fish tank when the user is present. In this way, the status information is implicitly and constantly conveyed. This will lead to a shared sense of connectedness among remote office workers.

Digital Chatty Window is also equipped with a camera. After a user confirms the presence of the user at the other end, a video phone can be activated with a click of a button. The cam-

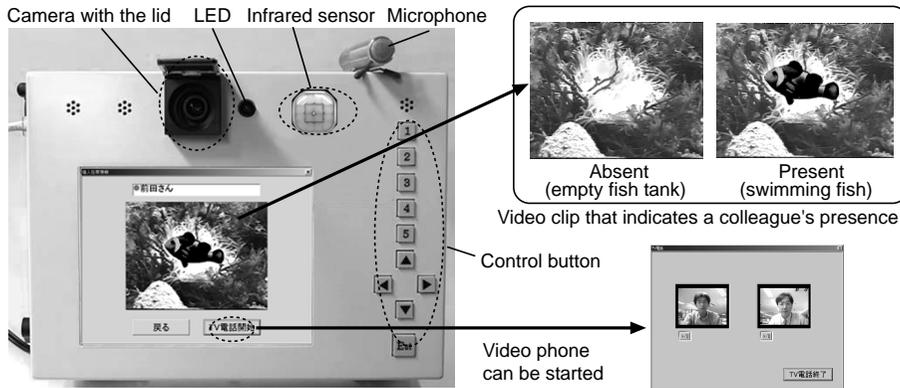


Fig. 4 Digital Chatty Window.

era has an obscuring lid which must be removed before using the camera. In addition, a small LED lights up after the video connection is established. These mechanisms are designed to remove the anxiety of the user by giving the user the power to prevent unintended monitoring.

One of the application areas of Digital Chatty Window is a tele-work setting involving teleworkers and a manager(s). Generally speaking, a tele-worker works alone in a geographically separated place. This kind of environment, which is often plagued by insufficient information, may cause anxiety about the completion of a task. Moreover, there are no colleagues with whom a tele-worker can chat and talk with easily. Digital Chatty Window can facilitate an informal and spontaneous conversation between tele-workers by exchanging presence information all the time, and somewhat lessen the anxiety described above. At the same time, Digital Chatty Window incorporates mechanisms to respect a user's privacy (for example, a lid on the video camera) as mentioned above.

We conducted a preliminary evaluation study of this system. In this study, the system was installed at a base office (with 4 users) and a satellite office (with 2 users) located about 600 km from the base office. There was no particular organizational hierarchy between the base and satellite offices.

The system was used for three months. Questionnaires and interviews were conducted before, during and after the experiment. According to the results of questionnaires, all the users reported that they did not mind their status information being exchanged all the time. There was a comment that if there is some hierarchy, some users might not be pleased, though. They

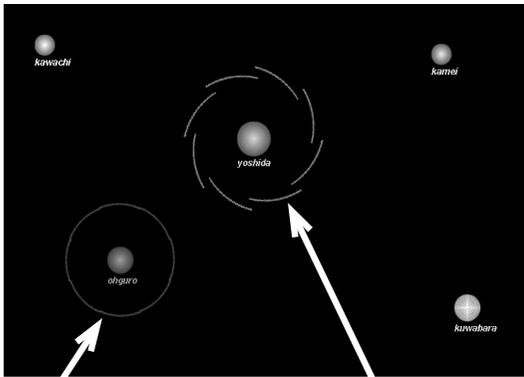
also reported that they thought of others more frequently. That is, when they looked at the display and recognized the presence of another person, they thought of the people working at the other end. In addition, it was reported that the Digital Chatty Window helps users to make contact with others since each user can know the status of people at the other end.

### 3.3 Gleams of People

Gleams of People was designed as a medium to maintain a sense of connectedness by exchanging a person's presence and status information over the network<sup>10),12)</sup>. This system is intended to be used in the situation where one has a feeling that he/she wants to communicate, but does not do so because it is somewhat troublesome for both sender and receiver. In short, this is intended as a medium for conveying *things that are not so important to talk about, but that are worth expressing*.

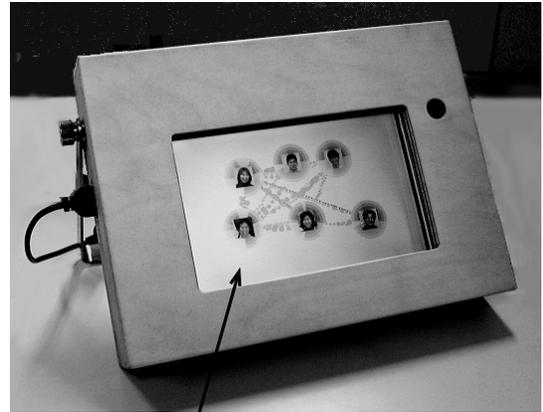
In the physical world, we conduct this kind of communication all the time without paying special attention to it. However, as discussed in the introduction section, current network communication media seem too heavy to convey a simple greeting (such as "how are you?") or a message just intended for keeping in touch. Gleams of People is designed as a very lightweight communication medium that suits these kinds of simple message exchanges. It is not designed for serious message exchanges, where conventional text-oriented media are more suitable.

Figure 5 shows a screen image of Gleams of People. A message can be sent by double clicking on the sphere corresponding to the intended receiver. The content of the message is just a 'color', which represents the mood of the sender. When a message is received at the receiver's side, a sphere gleams with the color



When the message arrives, the sender's sphere gleams with the current color of the sender. A user sends a message by double-clicking on the receiver's sphere.

Fig. 5 Gleams of People (screen image).



Touch screen: icons taken from a group photo are on display for touch.

Fig. 6 FaintPop prototype.

sent. In this way, presence and status information can be exchanged without resorting to words.

Furthermore, the interval for which the sphere gleams reflects the number of messages received from the corresponding user. The size of the sphere also reflects the number of messages sent to the user. In this way, an encapsulated history of communication activities is provided.

The design policies of Gleams of People are simple, intuitional, and non-disturbing. These policies resulted in, for example, using a sphere to represent a user, simple but limited types of messages, and the representation of mood by color. The design policies and the resultant design match the objective of this medium, that is, sharing a sense of connectedness through simple and casual communication.

A preliminary experimental study was conducted for two weeks at the authors' laboratory with 17 users<sup>10)</sup>. The results indicate that the system is used casually especially when the status and/or presence are changed. This implies that the Gleams of People was used as a lightweight communication medium that is suitable for connectedness oriented communication. However, it was reported that selecting and interpreting 'color' as a representation of a user's 'mood' is difficult, since the interpretation of 'color' tends to vary with the user.

### 3.4 FaintPop

Whereas Gleams of People is designed for one-to-one communication, FaintPop is designed for group communication<sup>11)</sup>. In short, FaintPop is a medium that allows a group to maintain

a sense of connectedness among its members. Messages exchanged using this medium are expected to be *things that are not so important to talk about, but that are worth expressing* as in the case of Gleams of People. Such messages can possibly be well represented by more intuitive way such as touch, instead of by written or spoken words. Moreover, if the memories of the group's communication history are summarized and represented graphically in an intuitive way, the group members can perceive what is going on in the group. This is expected to be useful in maintaining the sense of connectedness among the members.

Figure 6 shows the prototype of FaintPop. It is a hardware device whose shape is modeled after a photo frame. Each member of the group has his/her own device with the same initial pictures. All of them have network connections to communicate with each other. Instead of using a real photograph, small pictures (or icons) of the faces of each member (possibly extracted from an original photo) are used.

Members can communicate with each other by touching pictures of their friends. Three types of touch are currently supported. A *tap* represents a 'neutral' feeling, a *pet* represents a more 'positive' feeling, and a *hit* represents a rather 'negative' feeling. Touching a picture of a friend means sending a message of one of the three types to that friend. The touch is encoded and broadcast to all members of the group, so that all members can know the communication activities in the group. When a message is sent, an animation effect is displayed in all member's 'photo frames': a small ball travels

from the sender to the recipient; its color and speed depend on the type of touch. Moreover, the picture of a member who has received a message shows animated reactions. For example, when a ‘positive’ message is received, the picture blinks bigger for a while. Furthermore, touching his/her own picture means sending a message to all group members.

Traces of the animation effects are left on the screen. Moreover, a pie chart that indicates which types of messages have been sent recently is shown behind the picture of each member. These ‘memories’ gradually fade over periods ranging from hours to a day. This feature is well suited to a typical usage scenario of this tool. That is, one might look at the ‘photo frame’ occasionally and notice that something has happened among his/her friends. In this sense, this tool also has the aspect of an asynchronous communication medium as well as a synchronous one.

We conducted a preliminary one-week experiment with six users at authors’ laboratory<sup>11)</sup>. Users were selected from the laboratory staff. They were of similar age and already knew each other, but belonged to different sections. Most users reported that they liked to communicate using touch. Though *FaintPop* was used as a lightweight communication medium and its simplicity was well appreciated, several users reported that they were not satisfied with the three types of feelings the system provided. They wanted to send more variety of message types, and short text messages. This can be interpreted that lightweight communication media such as *FaintPop* can lead to more active communication, and at the same time, seamless integration with other media is desirable.

#### 4. Related Work

In this section, we describe related work and further clarify the proposed concept of connectedness oriented communication.

There has been a lot of research, especially in the area of groupware, on the awareness of co-workers’ activities. This research stream includes the approach wherein the status of a co-worker is represented not on a computer display but with a “physical surrogate” which can be perceived by a user’s peripheral vision<sup>7)</sup>. The main goal in groupware research is to facilitate the collaboration between co-workers by letting them be aware of the status of others. The concept of connectedness oriented communication,

in a sense, focuses on this aspect of communication and extends it to more casual and informal settings.

There have been several research works on enhancing mutual awareness by exchanging symbolic representations of people’s presence and status information<sup>6),13),14)</sup>. In particular, the “Digital family portrait” system was proposed to let remotely located family members be aware of the activities of other family members<sup>8)</sup>. This research shares a similar goal with the proposed connectedness oriented communication in that they are designed to help people become aware of the presence and status of a person separated geographically. Its main concern, however, is to give the user some piece of mind by showing that the other members of the family are safe and sound. In contrast, connectedness oriented communication intends to revitalize communication among remotely located persons by providing them with not only presence and status information but also lightweight communication media.

The concept called “familyware” has also been proposed<sup>4)</sup>. This concept has a goal similar to that of connectedness oriented communication. Its focus is, however, more on one-to-one communication between intimate persons. *LumiTouch*<sup>2)</sup> is another example of such lightweight communication media targeted for intimate acquaintances.

#### 5. Further Issues

In this section, we discuss some of the issues in further developing connectedness oriented communication media.

##### 5.1 Inter-operability

We introduced four systems that implement some aspects of the proposed connectedness oriented communication. Currently, each system uses its own data representation and protocol to exchange messages. Accordingly, only terminals of the same type can talk to each other.

It would be desirable if we could interconnect different kinds of systems. Establishing connectivity between different types of systems would allow us to select the appropriate medium according to the user’s current situation.

If we can define a kind of ‘universal language’ for representing various information required for connectedness oriented communication including people’s presence and status, we could increase system flexibility since we would only need to define a translator between the ‘univer-

sal language' and the system dependent representation.

An abstract model for presence information was proposed for an instant messaging system<sup>3)</sup>. The presence information in this model is mainly concerned with the fact that a user can receive a message or not. The 'universal language' may be defined with reference to the model in the instant messaging service.

## 5.2 Privacy Issue

When a user sends his/her presence status and presence information to others, it is possible that some information that a user wants to keep private is leaked to others involuntarily. This violates the privacy of the user. This is a grave problem, especially when a sensor is used to obtain the user's presence and status information. The lid on the video camera in Digital Chatty Window is one of our early attempts to deal with this problem.

In addition, there is the problem of determining the level of detail that the presence and status information should convey. More abstract representations of presence and status information is better at protecting user privacy, but at the same time it might make it more difficult to infer other users' exact status<sup>7)</sup>.

The level of detail to be transmitted should depend on whom the information is to be sent to. For example, one might allow his/her detailed activities to be transmitted to family members, but not to co-workers, or vice versa. There also might be a need to force the contents of a message (that is, a kind of 'white lie'). In order to cope with this problem, mechanisms are necessary for modeling the receiver and modifying a message according to the model of the receiver.

## 6. Conclusion

This paper discussed the concept that we call connectedness oriented communication, the goal of which is to design communication media for fostering a sense of connectedness via network communication, and presented several systems that we have developed in this direction.

With broadband networks, we may now be able to achieve 'tele-presence' that is expected to enable us to feel as if persons in distant places are nearby. However, just exchanging high-fidelity audio and visual information does not necessarily lead to constructing social relationships among people. We believe that

exchanging symbolic representations of people and providing lightweight communication tools are more effective in cultivating a sense of connectedness among users.

We are carrying out research on future communication systems, more specifically, on *Socialware*<sup>5)</sup>, which aims to support the activities of network communities, and on *Home Communication*<sup>9)</sup>. The concept of connectedness oriented communication discussed in this paper is expected to play an important role in designing these systems. We plan to demonstrate the proposed concept in a real-world setting with a variety of connectedness oriented communication systems.

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