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| Description | |

# An Intrablog-Based Informal Communication Encouraging System that Seamlessly Links On-Line Communications to Off-Line Ones

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**SUMMARY**    In this paper, we propose an intrablog-based informal communication encouraging system named "Attractiblog." It has been pointed out that daily informal communications at a shared public space play very important role in information sharing in an organization. However, in most cases, the communications are often mere chats. To make the communications more informative, it is necessary to feed some common and beneficial topics there. Attractiblog is a system that extracts some articles posted in an intrablog considering who are in the shared space, and show them on a large-sized display that is located in the space. Thus, Attractiblog attempts to seamlessly link on-line communications to off-line communications. We conducted user studies and confirmed that Attractiblog can achieve a natural correspondence between topics in face-to-face informal communications and issues related to the activities of an organization as given in its intrablog.
*key words:* informal communications, intrablog, knowledge sharing, knowledge creation

## 1. Introduction

It has been pointed out that daily adventitious informal communications at a shared public space play very important role in an organization [1]. Through such informal communications, various information and knowledge are shared and created not only within but also beyond sections in the organization. Accordingly, for instance, some companies set up recreation rooms, and let managers take the lead in using the rooms to encourage informal communications among managers and employees [2]. While such attempts have accomplished certain results, there are still many problems. One of the most significant problems is that the informal communications usually result in mere chats; informative information and/or knowledge sharing does not often occur. Therefore, some means to lead the informal communications to informative ones are required.

On the other hand, on-line non-face-to-face communication media have recently become common in offices. People exchange various information via e-mail, text chat, and so on. Thereby, the informal communications have come to be held on-line as well as off-line. At present, in particular, attention is focused on the "intrablog." The intrablog is a web log system used in closed and relatively small-sized organizations. The intrablog allows people to freely input a wide variety of contents, from job-related information to personal information and discussion of hobbies. It is often used as a new informal on-line communication medium, rather than a mere knowledge-base, in the organization. As a result, the intrablog is a major improvement over existing groupware in facilitating the accumulation and exchange of amorphous information and knowledge among members of the organization. Thus, in the intrablog, there are a lot of meaningful topics that directly relate to the sections/organization and interests of the members. By injecting such on-line topics to the off-line communications, we can enrich the face-to-face informal communications at the shared public spaces.

Hence, we propose a novel informal communication encouraging system named "Attractiblog." Attractiblog seamlessly links on-line communications to off-line ones so that it encourages face-to-face informal communications for allowing the members of a relatively small organization to share and create richer knowledge. Organization members can use Attractiblog as a conventional on-line intrablog: they can input various information as text-based articles. A public terminal of Attractiblog features a large-sized display that is installed in a shared public space, such as an employee lounge. Articles related to the people who are in the shared public space are displayed on the display of the public terminal. It is expected that these displayed articles will trigger off-line face-to-face communications.

Attractiblog inevitably induces duplications of topics and discussions in on-line and off-line. However, it would not be a mere waste of time; everybody does not always access on-line communication media, quick exchange of opinions is usually difficult in on-line communications, and it is usually difficult to verbally describe important knowledge, such as know-hows. Therefore, it should be beneficial to provide additional opportunities to discuss the same topics in the face-to-face communications that have already been discussed in the intrablog.

We installed Attractiblog in our laboratory, and investigated the behavior of the laboratory members to confirm whether people actually discuss on the topics provided by Attractiblog. As a result, organization's members were interested in the contents of the articles on the large-sized display in a shared public space and face-to-face informal communication is naturally generated. Thus, Attractiblog can actually link on-line informal communication to off-line

ones.

The rest part of this paper is organized as follows. Section 2 describes what the intrablog is and why the intrablog is widely accepted, and shows various related works that have attempted to encourage informal communications. Section 3 illustrates the system set-up of Attractiblog. Section 4 describes procedures of user studies. Section 5 shows results of the user studies and discuss effectiveness, advantages and remaining problems of Attractiblog. Section 6 concludes this paper.

## 2. Related Works

### 2.1 What and Why Intrablog

A "blog," abbreviated from "web log," is a web page owned by a person in which various articles, e.g., events, news and hobbies, are written like a personal (but open) diary. The owner frequently posts such articles. Furthermore, readers can also add trackbacks and comments to the articles. Recently, many tools for constructing blogs (e.g. Nucleus[†]) and commercial blog services have become available. Everybody can readily create his/her blog page at present.

The "intrablog" was proposed by Hitachi Ltd. in August 2004 as a solution for information sharing in an organization. The intrablog is basically the same as a conventional blog, but access to/from it is restricted to a designated intranet; users are not permitted to link to or trackback from any site external to the intranet nor access the intrablog from outside of the intranet. Namely, the intrablog is a closed blog that can only be used by the members of an organization. The intrablog is expected to become a substitute or complementary tool for groupware or the portal site of an organization. In Japan, the intrablog consortium[††] was recently established to spread the use of intrablogs.

Intrablogs have already been installed in many organizations. There are usually no restrictions on the usage of the intrablog; for example, any contents from personal hobbies to business matters are welcome and every member can post an article at any time. This is to encourage the members to post articles freely. Actually, not only hobby articles but also many important business-related articles have been posted, despite the lack of restrictions imposed on contents. Furthermore, the comments added by a boss or colleagues motivate the users to post more articles, and on-line discussions are eventually further vitalized.

Up to now, mailing lists, electric bulletin boards (BBS), and WikiWiki systems have been used as on-line communication media for information sharing in an organization. The significant difference between these ordinary media and the intrablog is that they provide only a public space shared by all members. Therefore, members feel a responsibility to only post useful articles, if they post anything at all. This becomes a psychological barrier to people expressing their opinions, and thus many users refrain from posting opinions. Therefore, it is usually difficult to maintain a vital exchange of opinions over these media. Groupware is a system to support sharing and storing information in an organization. However, it is more frequently applied to official business matters than are the above media. Accordingly, there is an even higher psychological barrier to people freely expressing opinions.

In contrast, the intrablog provides each user with his/her individual space. Only the owner of the individual space can post articles there, and readers can only read the articles and add comments to the articles. This feature of the intrablog alleviates the feeling of responsibility that they should always post useful articles that contribute to all members. Accordingly, more users feel comfortable with freely posting a greater variety of articles, including very personal ones, and eventually a vital exchange of opinions can be maintained on the intrablog. Therefore, it becomes possible to accumulate not only concrete factual information but also highly subjective amorphous information while also vitalizing communications among the members.

### 2.2 Informal Communication Support

There have been many attempts to enhance adventitious communications in an informal communication space.

Meeting Pot [14] and Cyber-Hearth [8] enhance face-to-face adventitious communications. Meeting Pot informs colleagues in an organization that someone is brewing coffee in an informal communication space by emitting the smell of coffee in offices in order to gather them. This system prompts people to meet there and improves the chances of informal communications. Cyber-Hearth is an implementation of a "justification object" that provides justification to go to an informal communication space and to stay there even if there is no objective reason to do so. This system alleviates proxemic pressure [6]. These systems induce adventitious face-to-face informal communications. However, the topics of conversation would be very general and not specialized to the organization.

OfficeWalker [13] and FreeWalk [10] enhance on-line adventitious communications. OfficeWalker provides a virtual passage using a video link between remotely separated offices. A user who works at one side of a building can adventitiously meet with someone at the other side in the virtual passage. FreeWalk provides a virtual community space. Users can enter the virtual community space using avatars and walk about there. When people adventitiously meet there, they can have informal communications. Similar to Meeting Pot and other efforts, the topics of conversation would be very general and not specialized to the organization.

Silhouettell [12], HuNeAS [9], InteractiveFliers [11] and the Plasma Poster Network [3], [4] provide specific topics for adventitious communications. Silhouettell supports informal face-to-face communication by people who meet for the first time at, for example, a party. This system shows

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[†]http://nucleuscms.org
[††]http://intrablog.jp

profile data of people (corresponding to "business card information") in a large-sized display. HuNeAS shows information that a user wants to know, e.g. "Need info: How to use winmm.dll," on a large-sized display that is installed in the public space. People near the display can easily read the information and, if someone knows about the desired topic, immediately exchange information. InteractiveFliers displays electronic advertisements on large-sized displays in public spaces. If an audience member views the advertisements, this is immediately alerted to the advertiser, who can contact the viewer with a detailed information page through a text chat system. Thus, the advertiser and the audience member can immediately talk about the advertisement over the text chat system. The Plasma Poster Network also uses electronic bulletin boards that display advertisements. The audience member can annotate existing ads by using a PDA, and advertisers are notified when their advertisements are annotated. As a result, this system aims to achieve "person-to-place-to-people-to-persons" communication. These systems require the users to register "topics for communication" beforehand. In contrast, our system extracts topics from the articles in the intrablog. Therefore, the users need not input topics for talk in adventitious encounters, and the information provided from the system is always fresh because the articles in the intrablog are always updated.

Gossip Wall [15], The Notification Collage [5] and Semi-Public Display [7] facilitate communications among members of an organization. Gossip Wall is an information sharing system for people who live/work in the same building. This system provides an ambient display consisting of 124 LEDs that show members various community-related information items in an ambiguous manner. Members can obtain concrete information by using their PDAs in front of the LED display. The Notification Collage and Semi-Public Display are used in relatively small-sized groups. These systems include a semi-public display that provides information about each member's activity to all other members. Although these systems provide organization-related information, they are not aimed at prompting communications by displaying the information.

## 3. System Setup

### 3.1 Intrablog

Initially, we simply installed Nucleus as it is in our laboratory and operated it for about six months from mid-July 2005 to mid-January 2006. The number of users (i.e. subjects) was fourteen ($1^{st}$ year master's course: 5, $2^{nd}$ and $3^{rd}$ year master's course: 5, doctoral course: 3, teacher: 1). M1 students started using the intrablog from August, and one of them has posted neither articles nor comments. Doctoral and M2/M3 students were required to report research progress on the intrablog twice a week, and this requirement was once a week for M1 students. Except for the progress reports, we did not impose any restrictions about the type of topics on the subjects throughout the entire period including
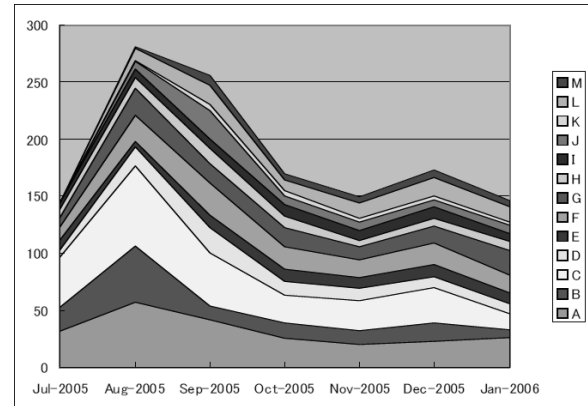


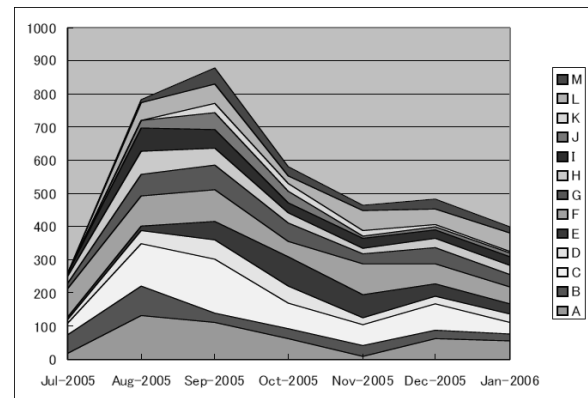**Fig. 1**   The number of articles for each subject.



**Fig. 2**   The number of comments that each user received.
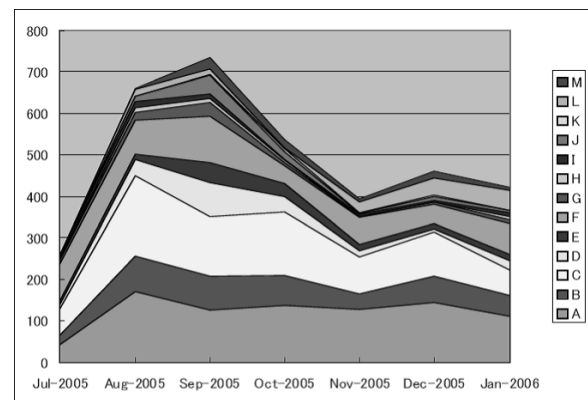


**Fig. 3**   The number of comments that each user appended to the articles of others.

control period and experiment period shown in Sect. 4. Not only research related articles but also hobby related ones, jokes and so on were welcome. Finally, 1,317 articles and 3,846 comments were posted, where 383 of the 3,846 comments were anonymous.

The trends in the numbers of articles and comments are shown in Figs. 1, 2 and 3. Figure 1 shows the number of articles for each subject, Figure 2 shows the number of comments that each user received, and Figure 3 shows the

number of comments that each user appended to the articles of others. The numbers of progress report articles were 39 for each doctoral/M2/M3 student (subjects B-I in Figs.) and 18 for each M1 student (subjects J-M in Figs.). The number of articles decreased from August to October. However, in the following period, the numbers of articles and comments became constant. Therefore, the intrablog was accepted as an everyday on-line communication tool in our laboratory.

## 3.2 Attractiblog

We installed a PC and a large-sized plasma display panel (PDP) in a shared "refresh space"(RS) in our laboratory (Fig. 4). The RS is equipped with a coffee maker, many magazines, and so on. Therefore, members of the laboratory frequently visit this space everyday. We installed the Attractiblog system in the PC in the RS.

The basic system setup of Attractiblog is shown in Fig. 5. We employed an RFID system (Active RFID: RF Code Spider III A) to identify the subjects who visited the RS; we thus asked all subjects to always wear the RFID tag.
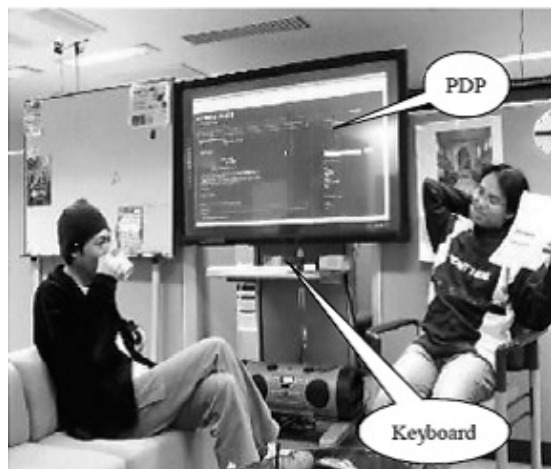


**Fig. 4**    A shared "refresh space" (RS) in our laboratory that is equipped with a PC and a large-sized plasma display panel (PDP).

Using the RFID system, we implemented the following two types of experimental systems:

Narrow-deep type:
　The narrow-deep type system provides an article that is as hot as possible and particularly related to the subjects in the RS. The selected article is displayed all the while the members in the RS remains unchanged. Therefore, it is expected that this type encourages deep discussions on the specific article.

- If there is only one subject in the RS: One of the latest articles posted by someone is randomly selected and displayed on the PDP.
- If there are one or more subjects (subject $X_1, X_2, \cdots, X_n$) in the RS and another subject $Y$ comes into the RS: The article posted by subject $X_i(1 \le i \le n)$ to which subject $Y$ added a comment most recently is displayed on the PDP.
- If there are three or more subjects in the RS and one of them leaves the RS: One of the remaining subjects (randomly selected) is regarded as subject $Y$, and the others are regarded as subject $X$s. The displayed article is selected in the same way as for the above case.

Shallow-wide type:
　The shallow-wide type system also provides articles particularly related to the subjects in the RS. However, not only the hottest article, but also old ones are selected and, in addition, the articles changes in a relatively short period of time. Therefore, it is expected that this type encourages wider discussions on the various articles.

- If there is only one subject in the RS: One of the articles is randomly selected from all articles and displayed on the PDP.
- If there are two or more subjects in the RS: One of the articles posted by a subject in the RS is randomly selected and displayed on the PDP.
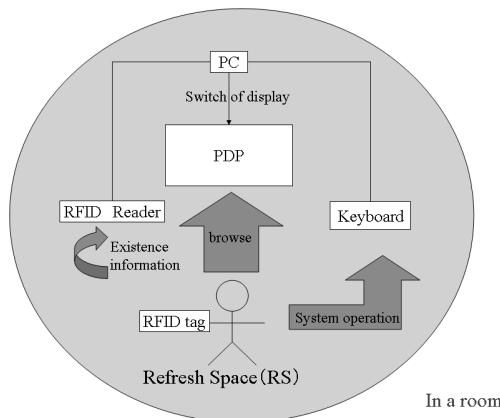


**Fig. 5**    System setup of Attractiblog.

- In both cases, the displayed article is automatically switched to another one every 30 seconds.

We could not conclude in advance which type would be more effective. Therefore, we implemented both systems and compared them based on the obtained results.

In both system types, when a subject enters the RS, a certain article related to all subjects in the RS is automatically displayed on the PDP, which is intended to trigger communications. In addition, for the sake of security, we implemented a function that automatically conceals the displayed article when all subjects leave the RS. Moreover, the system's PC in the RS is equipped with a keyboard. Therefore, it is possible for subjects to post comments to any article while staying in the RS.

## 4. Experiments

### 4.1 Control Period

The control period was for 44 days from November 1, 2005 to December 14, 2005. During this period, Attractiblog was not available, although everybody could manually operate the intrablog on the PDP in the RS.

We recorded scenes in the RS by using a web camera and a VCR during this period to observe whether the subjects manually displayed the intrablog on the PDP and how they used the articles in face-to-face communication there. We did not provide any instructions on usage of the PDP and so on beforehand: the subjects could use the RS and PDP as they wished.

We analyzed the recorded data and counted the number of communications that were based on the intrablog articles. We regarded a communication as article-related when a subject remarked on the article displayed on the PDP. We also regarded a conversational transition point as the beginning of a new communication thread when the content of the communication changed in correspondence with the change of the displayed article. Even when a silent period was observed, we considered the current communication thread to be preserved if the content was related to the same article that had been discussed before the silent period.

From the recorded data, when two or more people were in the RS, we found cases where a senior member had given some advice to a junior member based on the junior member's article and cases where they had talked about an article that was not related to research. However, in the control period, the subjects had to manually display the articles on the PDP. As a result, communications based on the articles were held only five times during this period (44 days).

### 4.2 Experiment Period

We investigated whether the displayed articles of the intrablog actually encouraged face-to-face informal communication.

### 4.2.1 Introductory Period

In order for the subjects to become accustomed to the Attractiblog system, we installed a simple introductory system that automatically displayed the latest article of a subject in the RS based on the RFID data. We operated this system for one month from December 15, 2005 to January 15, 2006. We informed the subjects that an intrablog article is displayed only when they enter the RS with the RFID tag.

### 4.2.2 Experiment 1 with Narrow-Deep Type System

Experiment 1 was conducted from January 16, 2006 to January 22, 2006 using the narrow-deep type Attractiblog system. We did not provide any special instructions and information on how the system selected the articles to the subjects. During this period, we held coffee breaks around 5:00 pm everyday in the RS to ensure meetings of two or more subjects in the RS.

We analyzed video data recorded from 12:00 pm to 2:00 am (next day) every weekday. The coffee breaks were held five times in total. The number of conversations triggered by the displayed articles on the intrablog was 24 in this period (4.8 times/day on average). The frequencies of the subjects' joining the conversations triggered by the displayed articles in this period were as follows: Subject A:6, B:5, C:11, D:3, E:6, F:13, G:15, H:7, I:7, J:0, K:0, L:8, and M:1. The average length of the conversations was 147.5 seconds and its stdv was 170.5. Here, 16 of the 24 communications related to the contents of the displayed articles, while the remaining 8 communications were about the system's algorithm and had no direct relation to the displayed articles. 10 of the 24 communications arose during the coffee breaks.

The narrow-deep type system always showed the same article if the subjects in the RS did not receive new comments even if they had posted new articles. In such cases, the subjects often complained about the system. In particular, subject G, who very frequently stayed in the RS, seldom received comments. Therefore, a very old article posted in September was always shown if he was in the RS. When there was only one subject in the RS, it was observed only twice that the subject viewed the displayed article or operated the system. The subject was the same in both cases.

### 4.2.3 Experiment 2 with Shallow-Wide Type System

Experiment 2 was conducted from January 23, 2006 to January 29, 2006 using the shallow-wide type Attractiblog system. We did not provide any special instructions and information on how the system selected the articles to the subjects. During this period, we held coffee breaks around 5:00 pm everyday in the RS same as in Experiment 1.

We again analyzed video data recorded from 12:00 pm to 2:00 am (next day) every weekday. The coffee breaks

were held four times in total. The number of communications where the subjects talked about the intrablog articles was 19 (3.8 times/day on average). The frequencies of the subjects' joining the conversations triggered by the displayed articles in this period were as follows: Subject A:7, B:4, C:8, D:8, E:2, F:9, G:10, H:5, I:5, J:0, K:1, L:9, and M:3. The average length of the conversations was 85.6 seconds and its stdv was 87.3. The content of all 19 communications related to the contents of the displayed articles. 7 of the 19 communications arose during the coffee breaks.

In Experiment 2, the article changed every 30 seconds. The subjects glanced at the articles nearly every time a new article was shown; consequently, the frequency of observing the PDP increased compared to that of Experiment 1. When there was only one subject in the RS, it was observed nine times that seven subjects viewed the displayed article or operated the system.

In Experiment 1, the subjects complained that the same articles were often displayed. However, in Experiment 2, different articles were almost always shown, and the frequency of article-change increased. Therefore, the subjects did not complain in Experiment 2.

## 5. Results and Discussion

This section shows experimental results and discusses efficiencies and remained problems of Attractiblog based on the results. All the results obtained from the recorded video data and questionnaires. Please note that we video-recorded the RS since when we first installed the large-sized display there till the end of all the experiments. Therefore, there should be no differences about negative effects on the subjects' minds that derive from being video-recorded among any experimental stages. Above all, all the articles and the discussions in the intrablog were originally public and naturally recorded. Namely, the topics and the discussions were ready to be recorded and shared. Accordingly, the subjects would not feel so much resistance about video-recording (and replaying) their face-to-face discussions on the articles in the RS.

### 5.1 From On-Line to Off-Line

#### 5.1.1 Directing Topics

Attractiblog aims to seamlessly link on-line informal communications to off-line informal ones by displaying intrablog articles on the PDP in the RS. In the control period, although people very frequently gathered in the RS and talked together, face-to-face communications based on the intrablog articles were held only five times in 44 days: only 0.11 times a day on average. However, in the experiment period through Experiments 1 and 2, face-to-face communications based on the intrablog articles were held 43 times in 10 days: 4.3 times a day on average [†], which is about 39.1 times the frequency in the control period. Moreover, even if the 17 cases that arose in the coffee breaks are excluded,

there were still 26 cases that naturally happened: 2.6 times a day on average, which is about 23.6 times the frequency in the control period. Thus, the frequency in Experiments 1 and 2 evidently increased comparing to the control period.

The subjects were of course strongly interested in the contents of the articles on the intrablog. In addition, the users of Attractiblog are the same as those of the intrablog. Therefore, even in the face-to-face situations in the RS, the articles could potentially become shared common topics of communication. Thus, Attractiblog could encourage face-to-face informal communications on topics related to the organization. This feature might provide more chances to collaboratively create new ideas.

Furthermore, we observed 3 and 6 cases in Experiments 1 and 2, respectively, where the subjects manually switched to other articles after conversations were initiated by the automatically displayed articles. This suggests that the subjects tend to maintain and develop communications that are initiated with the automatically displayed articles by intentionally selecting new articles. This result also supports that the intrablog articles could become good shared topics for face-to-face conversations.

On the other hand, we also observed 4 and 2 cases in Experiment 1 and 2, respectively, where the conversations were initiated by the articles manually displayed. In the control period, all displayed intrablog articles were also manually displayed. However, the number of the conversations initiated by them in this period was only 5 cases for 44 days (0.11 times/day). It is quite lower than those in the experiment periods.

This result shows that merely providing a large-sized public display is not enough to trigger the intrablog-related conversations. Indeed, manual operation to display the articles was annoying. However, it is not the only reason because manual operation should be also annoying in the experiment periods. More proactive function to provide triggers is necessary. The articles automatically shown on the display can work as the proactive triggers. In this case, the articles shown on the display work as "reminders" (not as "topics") that let people remind that they have read some interesting articles before. Non-intrablog articles that were usually displayed in the control period cannot work as such reminders.

The frequencies of the subjects' communication were different. Basically, a subject's frequency of communications in the RS was proportional to his/her visiting fre-

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[†]We normalized the frequencies of the intrablog-related conversations by calculating daily average frequencies of only the intrablog-related conversations, not by calculating ratios between the frequency of the intrablog-related conversations and that of all conversations. This is because we think that an absolute frequency of the intrablog-related conversations is more important. If we compare a case where one intrablog-related conversation is held in a day and that was all and a case where ten intrablog-related conversations were held within totally fifty conversations in a day, we think the latter case is much better from the "knowledge sharing" point of view. "Purification" of the conversations is a future work.

quency and stay time in the RS. Preferred communication styles were different, too. For example, while subject G rarely posted articles and comments in the intrablog, he frequently joined face-to-face communications in the RS: he prefers off-line communications rather than on-line ones. Conversely, subject J prefer on-line communications rather than off-line ones. Thus, everybody has different communication preference. Therefore, it is insufficient only to discretely provide off-line communication spaces and on-line communication media; subject G and J have rare chances to communicate each other. Hence, systematic and seamless integration of on-line and off-line communications is required to achieve dense and effective communications.

In the setup 9 times coffee breaks during Experiments 1 and 2, as many as 17 times of communications based on the intrablog articles were held. This result suggests that the Attractiblog would be effective for setup opportunities of face-to-face informal communication, e.g., lunch meetings.

### 5.1.2 Comparison of Experiments 1 and 2

8 of the 24 communications in Experiment 1 related to the algorithm of Attractiblog, not to the contents of the articles. These 8 conversations discussed why the Attractiblog system so frequently displayed only the same articles. Therefore, by focusing on communications related strictly to the contents of the articles, the number in Experiment 1 was 16 (3.2 a day on average), that is, slightly less frequent than in Experiment 2 (3.8 a day on average).

In contrast, the average conversation time in Experiment 1 was longer than that in Experiment 2. There was a significant difference between them at 5 % by t-test. A prominent feature in Experiment 2 was that the subjects in the RS more frequently glanced at the PDP than they did in Experiment 1. This is because the shallow-wide type system automatically changes the articles every 30 seconds, a drastic increase in the frequency of article-change. Therefore, in Experiment 2, it was often observed that the article automatically changed into another ones though subjects had still been talking on a topic that had been initiated by a previous article. After the experiment, some subjects said "I wanted to arbitrarily turn on or off the function that automatically changes the displayed article." These results suggest that the shallow-wide type system might disturb a deep discussion on a certain intrablog article although it could initiate more conversations related to the wider intrablog articles. Accordingly, we should add a "pause" or "back to the previous article" function to the shallow-wide type system to deepen as well as widen the discussions.

Furthermore, it was particularly observed that the subjects frequently glanced at the PDP when there was a momentary pause in the conversation. We think that the new articles performed the function of maintaining the atmosphere of the RS. This phenomenon is a secondary effect different from the original purpose; however, it is very important. We can consider this situation analogous to the classic "smoke break." While the smoker is talking in the smoking room,

the atmosphere can be maintained by smoking when there is a momentary pause in the conversation. By smoking, participants can naturally wait for someone to begin a new topic without feeling awkward. Namely, in this case, the cigarette works as a "justification" for them to be there: they can say that they are there at that moment for smoking, not for communicating. Without such a justification, they might feel awkward being there because of proxemic pressure [6].

We think of the automatically displayed intrablog articles as "justification" for users to be in the RS in the same way as cigarettes, that is, they can justify their being there at that moment by the desire to read the intrablog, not to communicate with colleagues. Displaying articles obtained from a conventional web site might achieve the same effect. However, such information is not always effective for initiating new communication. As a result, pauses in the communication would become longer and eventually the environment of the communication would degrade. On the contrary, the intrablog articles are strongly related to the people in the communication space, which we think would give them the ability to effectively continue communication. Therefore, long pauses would seldom occur and a fruitful atmosphere for communication could be maintained. With the trend of public communication spaces becoming predominantly smoke-free, we believe that appropriate media can take the place of cigarettes in providing the function of "justification" in activating and maintaining informal communications.

### 5.2 From Off-Line to On-Line

We confirmed that face-to-face informal communications were initiated from the intrablog articles while using Attractiblog. However, the subjects added no comment to any item by using the keyboard attached to the PC in the RS. Of course, it was possible that subjects added comments to articles afterward from their own PCs based on the face-to-face communications in the RS. Thus, Attractiblog has achieved only a one-way link from on-line to off-line. At present, therefore, it is difficult for subject J, who prefers on-line communications rather than off-line ones, to benefit from Attractiblog. Nevertheless, to increase the information's value, it would be advantageous to encourage the users to immediately input comments at the time of the discussion. Some functions to promote initiation of on-line communications from off-line communications are required.

## 6. Conclusion

In this paper, we proposed Attractiblog as a system that seamlessly links the on-line informal communications to off-line ones. Several experiments confirmed that face-to-face informal communications related to intrablog articles were initiated by using Attractiblog. This improves communications and the chances of creating new knowledge in the organization.

As we pointed out in Sect. 1, duplications of topics and

discussions in on-line and off-line are not mere wastes of time but should be beneficial. In addition, we can receive another important benefit from the duplications: bi-modal communications on an identical topic. In on-line non-face-to-face informal communications, text data are principally used. Text data is effective for conveying and storing static and formal information. Moreover, the stored information as text data is highly reusable and processable. However, text data cannot convey non-verbal information such as gestures, facial expressions and voice intonation. Therefore, information/knowledge that can hardly be expressed in a formal manner, the so-called "tacit knowledge," cannot be exchanged and stored. In contrast, off-line face-to-face communication has the inverse feature: although it can convey even tacit knowledge because it readily conveys non-verbal information, the reusability and processability of stored data is very low, and the information is often quite ambiguous. Thus, on-line non-face-to-face communications and off-line face-to-face communications could be considered complementary. Accordingly, people should be able to profit from discussing a subject by using both modes of communication.

In the future, we would like to further investigate whether users can actually obtain more useful information by integrating on-line and off-line communication channels. Additionally, we also would like to facilitate feedback of information from the off-line to on-line communications in order to synergistically activate communications in both channels.

## References

[1] R. Kraut, R. Fish, R. Root, and B. Chalfonte, "Informal communication in organizations: Form, function, and technology," in People's Reactions to Technology in Factories, Offices and Aerospace, ed. S. Oskamp and S. Spacapan, pp.145–199, Sage Publications, 1990.

[2] K. Desouza, "Facilitating tacit knowledge exchange," Commun. ACM, vol.46, no.6, pp.85–88, 2003.

[3] S. Carterm, E. Churchill, L. Denoue, J. Helfman, and L. Nelson, "Digital graffiti: Public annotation of multimedia content," CHI '04 Extended Abstracts on Human Factors in Computing Systems, pp.1207–1210, Vienna, Austria, 2004.

[4] E. Churchill, L. Nelson, L. Denoue, and A. Girgensohn, "The plasma poster network: Posting multimedia content in public places," Proc. INTERACT '03, pp.729–732, Zülich, Switzerland, 2003.

[5] S. Greenberg and M. Rounding, "The notification collage: Posting information to public and personal displays," Proc. SIGCHI Conference on Human Factors in Computing System, pp.514–521, Seattle, United States, 2001.

[6] E. T. Hall, The Hidden Dimension, Doubleday, New York, 1966.

[7] E. Huang and E. Mynatt, "Semi-public displays for small co-located groups," Proc. SIGCHI Conference on Human Factors in Computing Systems, pp.49–56, Fort Lauderdale, United States, 2003.

[8] T. Matsubara, K. Sugiyama, and K. Nishimoto, "Raison D'etre object: A cyber-hearth that catalyzes face-to-face informal communication," Proc. Engineering and Deployment of Cooperative Information Systems: First International Conference EDCIS 2002, pp.537–546, Beijing, China, 2002.

[9] K. Matsuda and K. Nishimoto, "HuNeAS: Supporting information-sharing and activating human-network by exploiting spontaneous encounters in an organization," J. IPS Japan, vol.43, no.12, pp.3571–3581, 2002.

[10] H. Nakanishi, C. Yoshida, T. Nishimura, and T. Ishida, "FreeWalk: Shared virtual space for casual meetings," in Handbook of Internet Computing, ed. B. Furht, pp.227–247, CRC Press, 2000.

[11] K. Nishimoto and H. Nemoto, "Interactive fliers: An electric ad system for a community to facilitate communications between advertisers and audience," Proc. First International Conference on Knowledge, Information and Creativity Support Systems, pp.197–204, Ayutthaya, Thailand, 2006.

[12] M. Okamoto, H. Nakanishi, T. Nishimura, and T. Ishida, "Silhouettell: Awareness support for real-world encounter," Lecture Notes in Computer Science 1519, ed. T. Ishida, pp.317–330, Springer-Verlag, 1998.

[13] A. Obata adn K. Sasaki, "OfficeWalker: A virtual visiting system based on proxemics," Proc. 1998 ACM Conference on Computer Supported Cooperative Work, pp.1–10, 1998.

[14] I. Siio and N. Mima, "Meeting pot: Informal communication support by ambient display," IPSJ Symposium Series, vol.2001, no.5, pp.163–164, 2001.

[15] N. Streitz, C. Rocker, T. Prante, R. Stenz, and D. van Alphen, "Situated interaction with ambient information: Facilitating awareness and communications in ubiquitous work environments," in Human-Centered Computing: Cognitive, Social and Ergonomic Aspects, ed. D. Harris, V. Duffy, M. Smith, and C. Stephanidis, pp.133–137, Lawrence Erlbaum Publishers, 2003.

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