

WEB-BASED ASYNCHRONOUS DESIGN DISCUSSION TOOL WITH UTILITIES FOR ATTACHING COMMENTS TO IMAGE DATA

A Study on a Decision Support Groupware for Collaborative Design

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Abstract. In today's global, multi-faceted society, architectural design has become a collaborative effort. Often, however, team members are separated by distance and difference in work hours. In order to keep team members connected, research groups have been developing groupware for communication and data sharing using information and communication technology. The results of recent research indicate that the systems developed are useful especially in the early phases of the architectural design process. While these systems cannot support the most important process in design collaboration—the decision making itself—they will enable team members to communicate effectively. The goal of this research is to develop a decision support groupware for the design team. As the first step, in order to enhance interaction among team members, we developed a web-based asynchronous design discussion tool named DesIBo: Design Interaction Board, such as Bulletin Board System. This paper deals with the development of DesIBo employing new concepts about entering and browsing comments and evaluating that system. In the future, we will add a decision-support function to DesIBo.

1. Background and objective

Collaboration is an effective means of solving problems. This is also true in architectural design or urban design (Caudill, 1971). Collaborative design, a modern design method, is the process of making decisions through communication among various entities.

Often, however, team members are separated by distance and difference in work hours. In order to keep team members connected, research groups

have been developing groupware for communication and data sharing using information and communication technology since the early 90s (Mitchell, 1994; Wojtowicz, 1995; Chiu, 1998; Maher, 1999; Morozumi, 2001; Matsumoto, 2001). The results of recent research indicate that the systems developed are useful especially in the early phases of the architectural design process. Generation of supporting systems, such as systems with functions of structuring and visualizing the design information (Lan, 2005; Kawasumi, 2006) or of inducing the design process for design education (Hirschberg, 1999; Matsumoto, 2006) are being developed. These researches indicate that the target of system development is shifting from simple removal of communication failure to supporting collaborative processes.

The goal of this research is to develop decision support groupware for the design team, i.e. to develop the mechanism of an intellectual support system to promote decision making through the visualization of interaction among team members. In this paper, in order to enhance interaction among team members, we developed a web-based asynchronous design discussion tool named DesIBo: Design Interaction Board, such as a bulletin board system, based on the functional framework of conventional asynchronous communication tools, and evaluated its basic functions.

2. Typical problems of web-based asynchronous discussion tools

A bulletin board system such as Digital Pinup Board^{Note 1)} used in architectural design provides an environment that helps design communication (explanations of an idea or a proposal and opinions or questions to it) no matter when or where team members are as long as the Internet is available. Those systems have two problems as shown in Table 1. Improving the ease of writing comments in or reading from a bulleting board would promote communication among team members and hence enhance their interaction.

TABLE 1. Typical problems of bulletin board systems

Problem	Detail
Difficulty in identifying which portion of the image is connected with the comment entered on the image data	It is sometimes unclear which portion of the image the comment is written for. Disconnection of the image and the comment will not only make it complicated for inputting explanation, opinions, and questions, but also prevent smooth understanding of registered information.
Complicated operation of entering and browsing the comments	The hierarchical nature of the menu system and execution process of tools make the system operation complicated. Hierarchical management of entered information makes it difficult to understand the whole picture.

3. Development of DesIBo

3.1. FUNCTIONAL FEATURES AND DEVELOPMENT ENVIRONMENT

Taking account of the problems in conventional web-based asynchronous discussion tools, we set new tool specifications (Table 2) and developed DesIBo based on the specifications.

DesIBo is a special webpage described by VB Script, Java Script, and HTML, and works in an ASP environment, using a database of Microsoft Access. It is an asynchronous design collaboration tool with web technology that allows us to attach comments directly on an image uploaded through the Internet. Below, its screen layout and summary of functions are presented.

TABLE 2. Specification of development tool

Problem	Specification	Functional classification
Difficulty in identifying which portion of the image is connected with the comment entered on the image data	Function to attach comments in relation to an arbitrary portion of the uploaded image.	Entering comment
	Function to browse comments in relation to an arbitrary portion of the uploaded image.	Browsing comment
Complicated operation of entering and browsing of comments	Function to quickly find an image from all the uploaded images to attach comments.	Entering comment
	Function to easily attach comments in the selected image.	
	Function to quickly find an image that contains comments from all the uploaded images to browse the comments.	Browsing comment
	Function to easily browse comments in the selected image that contains the comments.	
Function to quickly grasp the entire concept of the comments attached in the image.		

3.2. SCREEN LAYOUT

To log in DesIBo, team members have to enter their member IDs and passwords on the login screen (Fig. 1-a) and pass the user certification procedure. The main screen of DesIBo (Fig. 1-b) consists of, from up to down, a main menu, list of uploaded images, and display area for the image and comment.

3.3. ENTRY OF A NEW IMAGE

To upload a new image, users click the new image upload button on the main menu. The image upload screen appears and users select the image to upload and write its title and memorandum. The memorandum is used as a comment for an entire image, and is distinguished from a comment for specifying the location on an image. Small and main thumbnails of the selected image are added to the main screen of DesIBo. The title and memorandum are displayed on the uploaded image information area (Fig. 1-b).

3.4. ENTERING COMMENTS

Users can designate where to attach a comment with a simple double-click at an arbitrary point on the main thumbnail, and the comment entry screen appears (Fig. 1-c). When users finish writing a comment, a comment icon and the title of the written comment are displayed at the designated location (Fig. 1-d). The comment is added to the list of attached comments (Fig. 1-b).

There are two kinds of comment icons: a round icon when the comment writer and the image registrant are the same, and a square icon when they are different (left in Fig. 2). This makes it clear whether the attached comment is an explanation or an opinion. A reference image can be attached to comments (right in Fig. 2). A reference image is useful for understanding the meaning of the comments.

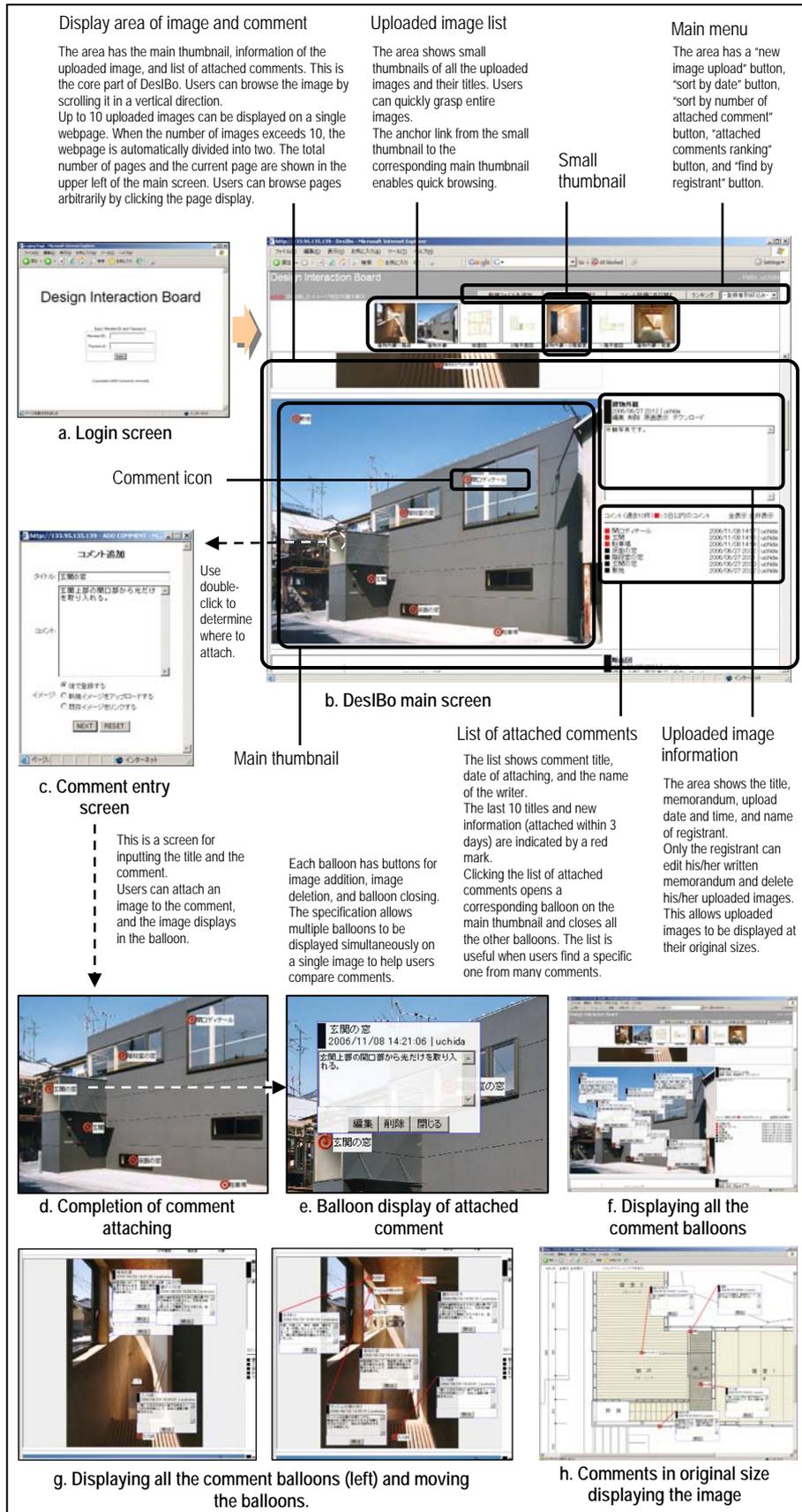


Figure 1. DesIBo (Design Interaction Board)

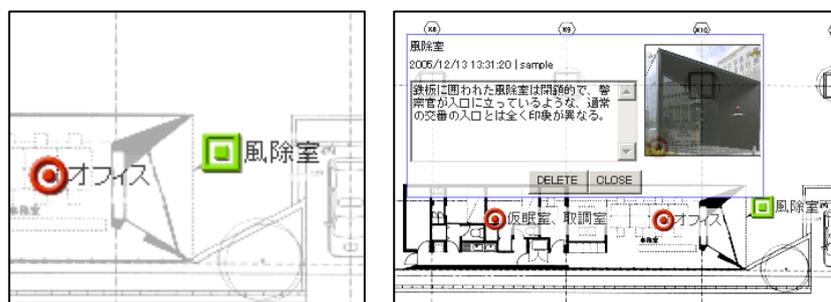


Figure 2. Two kinds of comment icons (left) and image attachment to comments (right)

3.5. BROWSING IMAGES AND COMMENTS

Uploaded images can be browsed in accordance with the intended use by combining “sort by date”, “sort by number of attached comments”, and “find by registrant”. The small thumbnails and the main thumbnails are switched when the sorting or finding button is selected.

Attached comments are displayed in a balloon when users click the corresponding comment icon or click a title in the list of attached comments (Fig. 1-e). The balloon is semi-transparent and does not hide the entire image when it opens. The buttons for displaying all and closing all, located on the top of the attached comment list, allow simultaneous opening and closing of all the comments attached to an image (Fig. 1-f). Users can move comment balloons on the uploaded image by dragging with the mouse (Fig. 1-g). There is always a red line displayed, connecting the comment balloon and the corresponding comment icon, to show the location where the comment is attached. This function was introduced to circumvent the problem that users have difficulty in browsing comments when many balloons overlap and in viewing the image around the comment icon when a balloon hides it.

3.6. FUNCTION OF ATTACHING AND BROWSING COMMENTS IN THE ORIGINAL SIZE DISPLAY OF IMAGE

It is sometimes difficult, depending on the uploaded images, to attach or browse comments due to the small size of the main thumbnail. To prevent this problem, the tool has a function for attaching and browsing comments on an image of original size just as on the main thumbnail (Fig. 1-h). Users can move, display all, and close all comment balloons in an original size display of the image. Also, to reduce the complication of scrolling a large image, the tool has a panning function using mouse dragging.

4. Evaluation of DesIBo

4.1. EVALUATION TEST AND QUESTIONNAIRE SURVEY

We tested DesIBo and used a questionnaire (with a total of 16 questions) to evaluate its basic functions of entering and browsing comments (Table 3).

TABLE 3. Summary of evaluation test for DesIBo

Date	December 2, 2005 (Group A), December 3, 2005 (Group B)
Location	Collaborative Design room (Computer room of the Department of Architecture) at Kumamoto University
Participants	A total of 17 graduate students of the Department of Architecture, Kumamoto University
Test procedure	<p>a. Setting up examinee groups Examinees were divided into two groups, A and B. The groups used different architectural works and followed different test procedures in b. No difference was found in their test results.</p> <p>b. Entering architectural works to the tool Examinees entered to DesIBo an architectural work in an architecture magazine with photographs, drawings, and an introductory article. They were asked to take full account of the intent of the work when entering it. For the comparison of tools, they entered the same work to a web-based asynchronous discussion tool ^{Note 2)} (DPB, hereafter) that has the same functions of image upload and comment entry. Group B followed the steps in reverse.</p> <p>c. Browsing architectural works from the tool Each group browses the architectural work that was entered to DesIBo by the other group. Then, to make comparison between the tools, each group browsed the work entered to DPB by the other group.</p>
Entered architectural works	<p>Group A Sapporo Station Police Booth of Central Police Station (Design: Hiroshi Kawahito, Nihon Sekki, Inc.), GA Japan, 76, A.D.A Editor Tokyo, pp. 158-159, 2005.</p> <p>Group B Company housing of SUS Fukushima Factory (Design: Toyo Ito Architectural Design Office), GA Japan, 77, A.D.A Editor Tokyo, pp. 122-127, 2005.</p>

4.2. RESULT OF THE QUESTIONNAIRE AND DISCUSSION

Figure 3 summarizes results of the questionnaire ^{Note 3)}. We received positive answers to most questions. High evaluation was given to the entering function “quick attaching by double clicking” (Q1-3) and the browsing function “connecting between the attached comment and comment location” (Q2-4), which indicated that the most basic characteristics of DesIBo were highly valued.

When compared with DPB, DesIBo’s comprehensive evaluation (Q1-1, Q2-1) revealed a higher mark for the browsing function than for the entering function. According to the free answers, the examinees seemed to find entering comments in a specified portion of the uploaded image and making a title to each comment when they used DesIBo to be bothersome, in comparison to DPB. This suggests that another function is required to make efficient entering.

Many free answers highly evaluated the titles of attached comments. Answers such as “The title helps us to understand the summary of the comment before browsing the entire comment” and “We can see comments in our preferred order” show that the titles gave the examinees an additional degree of freedom for browsing. The viewing style of extracting information as we wish will enhance other interactions.

To the question about the viewability of comment balloons (Q2-6), more than 70 percent chose “Convenient” or “Quite convenient”. Most free answers were positive about the viewability, such as “I could move the balloons from the area I wanted to see” or “I could open multiple balloons at the same time. It was useful to compare the comments”. This shows that the movable balloons helped users to browse comments. Also, there was the opinion that “grouping the function of comments was a great help in understanding the design intent”.

The question about attaching and browsing on the original size image (Q1-6, Q2-7) received a very high evaluation. Namely, 100% of the examinees answered “Convenient” or “Quite convenient” to this question.

We found positive free answers, such as “This function is effective for attaching and browsing detailed images such as architectural drawing” and “It is useful when the image is full of comments”. There were some negative answers to the question about the size of the main thumbnail (Q1-2, Q2-2), but it seemed that the original size display of the image covered the visual limit due to the size of the main thumbnail.

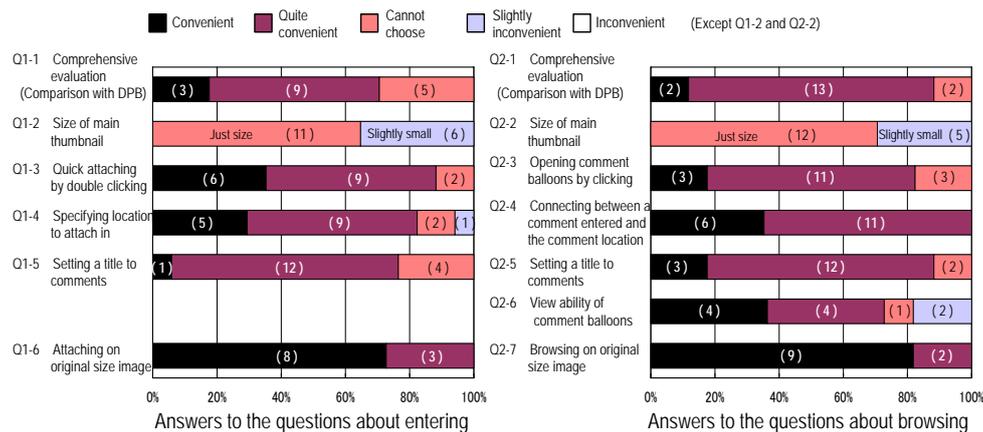


Figure 3. Results of the questionnaire for the evaluation test

5. Future work and perspectives

We developed a web-based asynchronous discussion tool in an environment for testing and evaluation. The tool has reached the level of practical use with functions of entering and browsing comments on images. In this paper, the evaluation of the tool was only based on a user interface—non-design task—. We aim to use the tool in actual collaborative design projects and evaluate it from the aspect of a collaborative design task. Furthermore, we aim to strengthen the decision-making support function by the visualization of interaction.

Before closing the section, we introduce our attempt at a decision-making support function. In the development of DesIBo, we not only improved the ease of entering and browsing but also added a function “Attached comments ranking” to visualize the interaction process among team members and help the decision making of the design team. The attached comments ranking (Fig. 4) is a list of uploaded images arranged in order of the number of attached comments (by other members) over a period of time. This enables the team members to take note of changes in ideas during the design process, which will aid in decision making.



Figure 4. Screen of attached comment ranking

The system functions we will extend in the next step of the system development are as follows: a) Visualizing which comments each member is interested in using the result of voting on comments attached to images by each member. b) Vast numbers of comments attached to all uploaded images are put together, and displayed as a comment list. c) Sorting or structuring

collected comments in the order of importance, by design topics or relation between locations of attached comments on the image.

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Note

Note 1) Electronic bulletin board for image data file sharing or visual browsing of images. The bulletin board program and board entry data are stored in a server, and users access the server from their client PCs. In the initial stage of the bulletin board system, developed in 1991, it was a local system that allowed access only through LAN. For details see (Wojtowicz, 1992).

Note 2) In the evaluation test, we used GW-Notebook (GWN) for comparison, which has been developed by our group since 1998. GWN is an integrated tool that comprehensively supports synchronous and asynchronous activities of students and staff in architectural collaboration. In the comparison test, we used its bulletin board functions of comment entering and browsing, although GWN has many supporting functions. The limited functions of GWN that we used were almost equivalent to those of conventional bulletin board systems. For details see (Morozumi, 2005).

Note 3) The results of Q1-6, Q2-6, and Q2-7 are those of another questionnaire conducted after the evaluation test of Table 3 with 11 examinees using the same questions.

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