pingpong: A platform for designing spaces with human behavioral data

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Abstract
This paper reports the development of a platform called the *pingpong platform* with the aim of collecting and visualizing the information on human behavior and also the outcome of a series of design workshops held for trying out this platform. With the proliferation of new technology, it has become easier for us to obtain the data of human behavior. Making good use of such collected data, new attempts have been emerged for designing spaces. In conjunction with trend, we have developed the pingpong platform by using Twitter and held design workshops at three different university campuses in Japan. The outcome shows that: 1. Human behavioral data can be easily obtained via the pingpong platform, 2. The visualization of the data greatly helps in putting the feedback to the best use for designing physical spaces.

Introduction
When designing a product or service, understanding human behavioral patterns, living environments and social contexts are recognized as essential insights for designing a successful product or service. Until recently, it has been thought to be difficult for us to obtain human actions in physical space, as they are usually not left on record. However, with the widespread deployment of the Internet today, large volumes of such needed data have been easily collected and analyzed via usage log analysis. Furthermore, with the developments in technology such as wireless network, mobile devices and remote sensing, the users' comments posted on their blogs and other social networking sites can also be easily gathered as samples to be observed and analyzed. It is now generally accepted to make good use of such abundant data for improving the design of Web services. Masten & Plowman (2003) call those data-gathering methods *digital ethnography* and propose it as one approach for design strategy.

With the above background, we developed a platform not only to extract and analyze human actions in physical space but also to link those data to location information. Collecting data by this platform, we started *pingpong project* with the aim of designing spaces and establishing a continuous process in which design and its use happen iteratively.

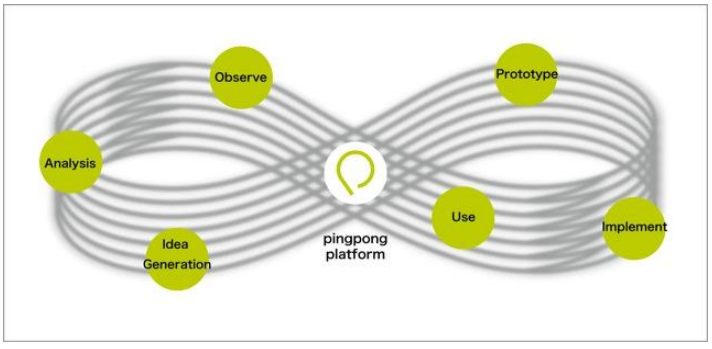

Figure 1: The concept of pingpong project

Figure 1 shows the concept of the pingpong project. The project was named in the hope that the iterative re-design process (cycle) would happen through the interaction between people and designs just like a pingpong match.

To conduct research on the effectiveness of the platform, we chose university campuses, and university libraries in particular, as the setting for this study. According to Casey & Savastinuk (2006) who proposed the concept of Library 2.0, it is essential to get feedback and evaluation from users of the libraries in order to continuously update the service. As the recent developments in ICT have made it possible to access information and materials easily from anywhere, university libraries are required to re-examine their role as *library as place.* Consequently, a good number of universities are establishing learning spaces called *Information Commons* or *Learning Commons* which are supposed to link cyberspace and physical space (Beagle, 2006). It is noteworthy how those new spaces are designed (Bennett, 2007). At the same time, for designing spaces, it is necessary to have evaluation for the established spaces and the concrete data on human behavioral patterns (Roberts, 2007).

However, since Information Commons or Learning Commons are newly established spaces, sufficient objective evaluation data have been yet to be gathered (MacWhinnie, 2003). Therefore, the pingpong platform which offers the mechanism of continuous extraction of users' actions and their feedback, will work well in addressing such challenges at these Information Commons. Moreover, for the pingpong project, a university or its library is an ideal environment with its network connectivity (wireless LAN…etc.) and a number of students ready for using the new tools. Based on this idea, we have held design workshops at three different university campuses in order to see how effective the pingpong platform would be to design spaces by extracting and utilizing human behavioral information. These workshops would not have been possible without the collaborative work of designers, computer scientists, library and information scientists and librarians.

The rest of the paper is organized as follows: Section 2 outlines the pingpong platform we developed for this study. In Section 3, we report our pilot user studies conducted in the form of a workshop at a university using the platform. Finally, Section 4 depicts the lessons learned from the studies as well as the possibility of this method to be used for designing libraries, and ends with a discussion and some consideration for future work.

Pingpong platform system overview

Here we introduce a set of tools for collecting and extracting user actions using the micro-blogging service, Twitter. There are three main reasons why we have adopted Twitter as our platform; (1) Already a great many users use the service, creating its own ecosystem of social networks; (2) plenty of user guides are already available for free on the Web so that users can start using the service quickly; and (3) it offers a series of APIs that allow us to easily access the data.

Figure 2 depicts the overall flow starting from the data input by a user on a mobile device through to the visualized data shared through a web browser. The mobile device application is developed so as to gather data on what people are doing in a particular space, in this case a university campus with fine grained location information. This data is the primary data source for a design workshop described in the next section.

Figure 2: Overall flow

(1) A user specifies location information by specifying on the application interface, (2) a user then inputs text describing about his/her behavior related to the place, (3) the input data is then posted on Twitter with the location information, (4) our web server crawls the data and visualizes it on a map on a Web browser.

Figure 3: Snapshots of the data collector application. (a) list of building names, (b) a floor map, and (c) text input.

When a user launches the application, they are shown a list of building names on a university campus as depicted in Figure 3-(a). Then, after selecting one of the buildings, a screen with a floor map of the building appears in which each grid indicates 50 cm x 50 cm square meters of the actual space, depicted in Figure 3-(b). A user can post a short description about the particular

place by placing a finger on to the screen, which prompts the appearance of an input box as depicted in Figure 3-(c). The input description is then uploaded to the Web using Twitter.

The data posted by a user is accumulated with the users account name, posted text, a hash-tag, X-axis of the map, Y-axis of the map, the floor number, and the building number.

For example, if a user with an account name of miz_oka posts a text I am reading here, the location information of the map (X-axis, Y-axis, and the floor number, building number) along with the hash-tag specified for the workshop (in this case #ppklc) are automatically attached and will make the following post as a tweet using the Twitter service.

miz_oka, I am reading here, #ppklc, 283, 142, 5, 1 2010-06-15 10:35:33 JST.

It is important to note that the hash-tag makes it possible for us to gather all the data related to the study.

All the posted tweets with the has-tag (#ppklc) are crawled from the Web and posted texts (tweets) are visualized on a Web browser as depicted in Figure 4. The visualization is provided in the form of a map in which the verb is extracted from each post and mapped using its location information. The visualization was intended as a collaborative tool, provided so as to facilitate the sharing of information among the users. Figure 4 shows a snapshot of the tool developed for the design workshop described in the next section. Only the verbs are used on the map, but the original sentence is displayed on the left part of the window in the manner of a timeline. When a user clicks a verb on the map, the corresponding tweet is prompted and appears at the top of the timeline. Similarly, clicking a tweet on the timeline highlights the corresponding verb on the map.

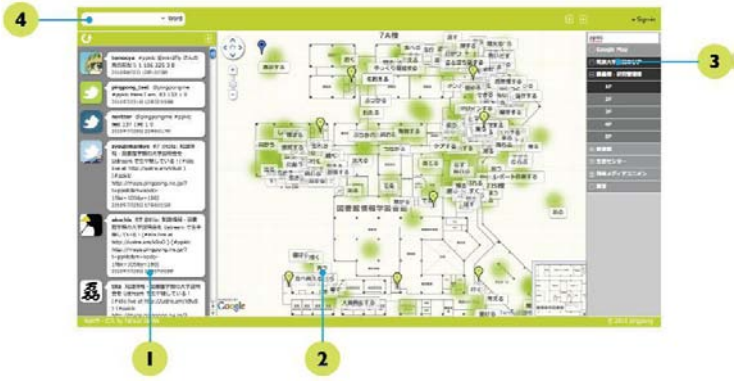

Figure 4: A snapshot of the visualization tool.

All the posted tweets are visualized on a map for the sharing of information. The original tweets are displayed on the left part of the window in the manner of a timeline (1), and its corresponding verb tag is displayed on the map (2). Switching among different floors and buildings in the campus can be done by the using buttons on the right (3) and users can search for tweets that contains a particular keyword by inserting a query into the search box (4).

Figure 5: Prototyping of the idea to project tweets live onto the columns in order to facilitate the communications between the users on the different floors

Implementation: three workshops on academic libraries and a university campus

As mentioned above, with the aim of evaluating the validity of designing spaces by utilizing the data collected via the pingpong platform, we held design workshops at three different university campuses in Japan; Tama Art University Library; Media Library, Future University Hakodate and Kasuga Area, University of Tsukuba. In these workshops, after collecting human behavioral data (tweets) for the space or the field via the pingpong platform, the student participants deepened their understanding of the field by analyzing gathered tweets, identified problems and their causes, generate new ideas to solve the problems, and prototyped the idea in the final phase. Each workshop was conducted over four days. During the study period, we enabled anyone to tweet by using the pingpong platform and, furthermore, encouraged the workshop participants to post their own everyday activities.

Case1: Tama Art University Library

Period: October 2009
Total number of participants: 7 (six undergraduate students and one librarian)
Total number of tweets: 612

Main findings and outcomes: In the case of Tama Art University Library, the participants themselves posted their behavioral information using Twitter and also created a map. They printed out each tweet on stick-on notes and put it on the map by hand. Later the map created in this manner became the prototype of the current pingpong map.

From the results of the analysis by the workshop participants, we found out an unconscious gap between the people's actual actions and what they truly desired to do in the library. In addition, it was revealed that some facilities made by a designer with the intention of bridging the library and the users were not used and even paid any attention at all.

Case2: Media Library, Future University Hakodate

Period: February 2010

Total number of participants: 15 (12 undergraduate and graduate students from Future University Hakodate and three students from other universities).

Total number of tweets: 661

Main findings and outcomes: A part of Media Library is built in an open interior space first to fifth floor with some pillars supporting the building. From the data analysis with the pingpong platform, it was discovered that this overlook and those pillars were not put to good use, even if the users intended to do so. Therefore, they proposed to implement the idea to project live tweet onto the pillars in order to facilitate the communications between people on the different floors (Figure 5). At present, it is being negotiated within the university, whether to make this a permanent implementation.

Case3: Kasuga area, University of Tsukuba

Period: May – July 2010

Total number of participants: 18 undergraduate and graduate students (from University of Tsukuba)

Total number of tweets: 3,373

Main findings and outcomes: Through the workshop, it became clear that the users of the pingpong map could follow along with the actions of various people in different clusters, which to greater or lesser extend affected by users' own perception about each place and range of their activities within that space. In the hope of publicizing and spreading the pingpong map across the campus in order to vitalize the space and the people, the workshop participants proposed an implementation plan using a speaker, a laser, and an architectural model of the campus combined with the pingpong map, in a hope that it would strengthen the effects of audio-visual stimuli on the users. To be concrete, they have come up with the mechanism in which a vocalized tweet would be heard from the speaker, and location information would be indicated by the laser and the architectural model. Presently, negotiations are taking place in the university to actually implement it.

Conclusion

In this study, we have developed the pingpong platform by using Twitter as a means to collect human behavioral data from physical space and a visualization software in order to establish the iterative cycle or feedback loop for designing spaces. We have reported a series of design work shops held at three university libraries by using our platform, which enabled us to easily obtain abundant data on users' behavior and their consciousness in the libraries. Through the workshops, some cases were found to have a gulf between the library designer's intention and the users' actual behavior, and some proposals for solution are given by the participants. In this regard, the pingpong platform is shown to be beneficial as a tool to collect human behavioral information and utilize the data to create an effective iterative process for designing spaces.

Contrary to our expectation, the number of tweets has been decreasing at every university since the workshop ended, which indicates the use of the platform is still transient. Thus, one of our future challenges is how to embed pingpong platform in everyday lives of humans so that the constant cycle of design and feedback will be realized between physical space and cyberspace.

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