

Design and Evaluation of a “Play Place Sound” service that Changes the Image of a City by Music and Sound

Saori Aisawa

Graduate School of Media and Governance
Keio University
Kanagawa, Japan
e-mail: saoiiai@sfc.keio.ac.jp

Katsuhiko Ogawa

Faculty of Environment and Information Studies
Keio University
Kanagawa, Japan
e-mail: ogw@sfc.keio.ac.jp

Abstract—According to *The Image of the City*, which is one of the most representative works of Kevin Lynch, paths, edges, districts, nodes, and landmarks are important elements that constitute the image of a city. Actually, these elements are very strong and seem to influence not only the image of the city but also our actions. Therefore, we propose to add sounds to a city experience as new elements could make a great impact that can change the existing strong image of the city. We call this “change” the city. We developed a Web service called Play Place Sound (PPS). By using this service, users can hear the sounds plotted for an arbitrary spot on the website automatically when they approach that spot in the real world. Then, we performed an experiment to define the differences in the cognitive map between walking in the city while using the PPS or without it. A cognitive map is the collection of beliefs, experiences, and information that a person uses to orient himself or herself within an environment such as a social setting. As a result, when people use the PPS, the cognitive map is more detailed. Furthermore, when the content increases significantly, edges tend to appear in the cognitive map.

Keywords—sound scape; cognitive map; urban design.

I. INTRODUCTION

In Japan, there are several places where we can see people who walk, jog, or run alone while listening to music on their portable music players or mobile phones. However, it is a fact that jogging in the same way while listening to the same music becomes boring as time passes, and there is no novelty. We feel it is regrettable that the act becomes usual and boring though we come in touch with the real city.

In *The Image of the City* [1], which is one of the most representative works of Kevin Lynch, he proposed that the role of the scenery of the city is to be seen, memorized, and please people. With that in mind, to consider the configuration of the image of the city, he performed an experiment with a cognitive map in three cities of the United States of America—Boston, Jersey City, and Los Angeles. Then, he stated that the following are important elements to configure the image of the city: paths, districts, nodes, edges, and landmarks, and these make for a study about whether he can change the appearance of the city and its importance.

After this, in Japan, there have been several studies to consider spatial awareness through the cognitive map, and

there are many studies about the association of sound and image, and their point of interest is also different [2]-[5]. In addition, studies about harmonization of the image and music have done [6][7]. However, there are few studies that consider changing the existing cognitive map by adding new elements to the city.

Therefore, using a new form of art that redesigns the city by sounds, we propose a Play Place Sound (PPS) service for individuals to enjoy the experience of the city. Instead of simply enjoying music, the PPS is a service for enjoying the sounds that can be heard only at a particular location. So, the user can listen to the sounds attached to a certain location only by going to the place. Information services that display a message according to the location have already been used in art museums, but there are few studies that add a sound to a particular place.

This way, by adding sounds as a new fascination of the city, we examine how this novel factor can affect the existing image of the city and what are the changes as represented by the cognitive map.

This paper describes the concept of PPS and service design. Then, we pick the peripheral port of Yokohama as the sample spot and consider the relationship of the pasted sound content and location through some samples. Section 2 describes the concept of the PPS, and in Sections 3 and 4, we describe our experiments. Finally, we present the conclusion and future work in Section 5.

II. THE CONCEPT OF “PLAY PLACE SOUND (PPS)”

Like *The Image of the City*, when we undertake city planning or investigate the existing city, especially in the architectural field, paths, buildings, and open spaces like parks are emphasized as elements of the city. The same may be said when we consider what kind of impression of the city people have. Actually, these elements are very strong, and our actions and impressions regarding the city are strongly influenced by them. As a result, our actions and images tend to be limited or patterned. Therefore, by adding sounds as a new element, we want to change the city and its rules that have been made by the existing physical environment such as paths and buildings.

A. Usage of the PPS

PPS is intended to be used with smartphone. When the user approaches a spot, he or she can hear the installed sound through the earphone connected to his or her smartphone.

Figure 1 shows an example of the use of PPS. In this sample, users who are jogging on the same route every day follow this routine with PPS. With regard to the relation between the area and sound, four sounds are assigned to each area, from area 1 to area 4, and the user can hear sounds in each area. This way, we expect that the user will feel like going on a different street from his or her usual routine or spend more time jogging.

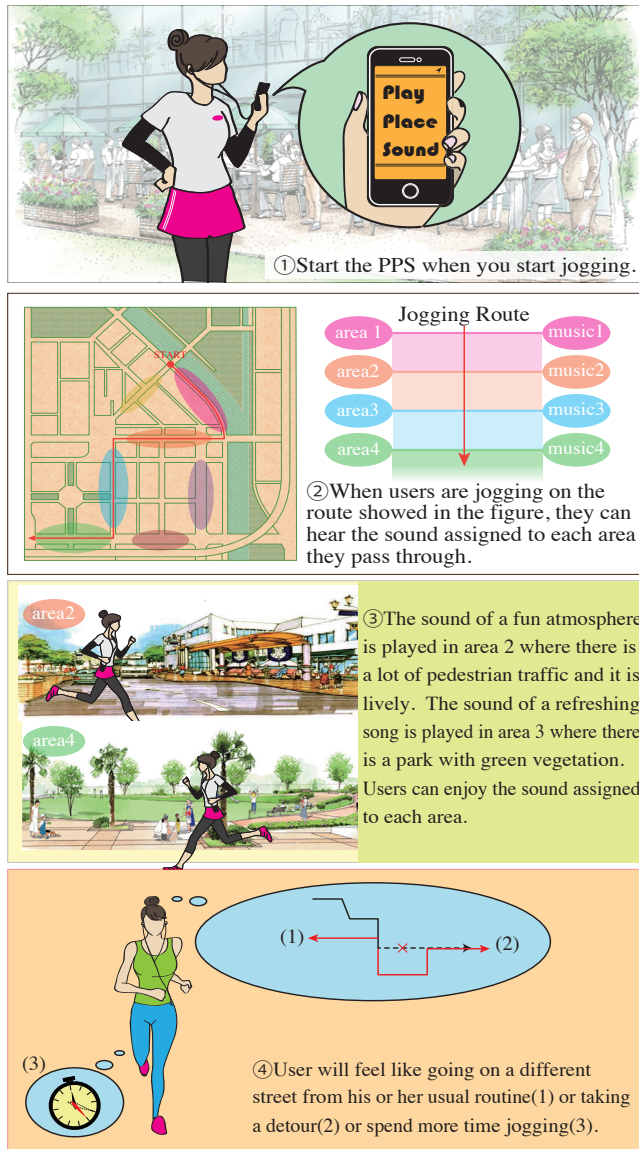


Figure 1. How to Use the PPS

B. System Configuration

The mechanism that should be prepared in advance is a system to plot sound files on the map. This system acquires the positional information of a place, plots sounds using

JavaScript, and plays these sounds in HTML5. The flow chart of this system is shown in Figure 2.

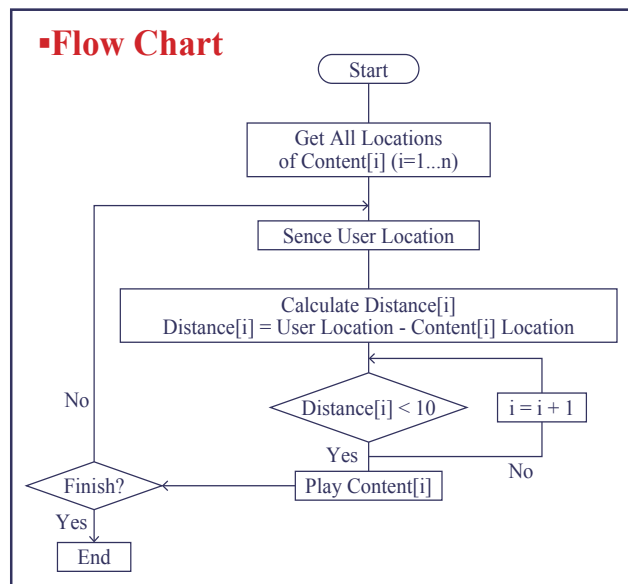


Figure 2. Flow Chart of PPS

This system sends the present location of a user, as detected by the Global Positioning System (GPS) function of the cellphone, to the Web server. When the user approaches the place where the sound has been plotted, it is played automatically.

III. PRELIMINARY EXPERIMENT

In proposing the PPS, it is necessary to consider what kind of sound is suitable for what kind of place. We performed a pre-experiment as the first step. In this experiment, we prepared sounds used in a movie as content and posted these sounds along two plot patterns. Then, we investigated how the PPS affects our behavior and what kind of impression was provided when we walk in these areas. Three people were the subjects of the first pattern and five of the second pattern. Both areas were near the port of Yokohama. This area is called Minato Mirai and is being continuously developed since 1965. We show the famous view of Minato Mirai in Figure 3.



Figure 3. Image of Minato Mirai

There are not only offices of various companies, but also amusement facilities such as an amusement park, concert

hall, hotels, and a large shopping mall. Hence, this area is one of the most famous sights of Japan.

A. Sound Content

Before conducting this experiment, we considered the sound content. In this experiment, we took up three kinds of sound— music, sound effect, and dialog—used in the movie *Star Wars*. Michel Chion carefully considered what sound to be used in a movie, and we refer to his consideration [8][9]. Generally, a movie is being edited a lot, even if it is a live-action movie. Thereby, the producer can convey something that cannot be represented only through pictures, such as the atmosphere of scenes, feelings of characters, or clues. This research is intended for an experience in real space. We consider that the way of sound arranging in a movie is similar to the way of sound arranging in this study. A movie director removes unnecessary noise and adds various sounds.

First, the music we used as content included not only famous theme songs such as “Main Title” or “Imperial March” but also various music used in the movie as Background Music (BGM). Then, for sound effects, for example, the subjects could hear the sounds of warriors wielding their weapons, ray guns, robots waking up, and so on. Each of these sounds had a characteristic feature, and we could understand the sound source just by hearing the sound. Finally, dialog could be heard through the voices of characters. Humans and many other characters, including robots and aliens, appear in *Star Wars*. In many cases voices are edited, and they resemble a sound effect. However, the primary difference between dialog and sound effects is that there are meanings to the former. For example, in this experiment, we used a line of one of the main characters, C-3PO: “Help!!!”. In this case, it was not only an electronic sound but also meant that someone is asking for help.

B. Plot Pattern

As a sample of the change in Minato Mirai area by sounds, we proposed two plot patterns of content. We show the map plotted with sound along pattern 1 in Figure 4.

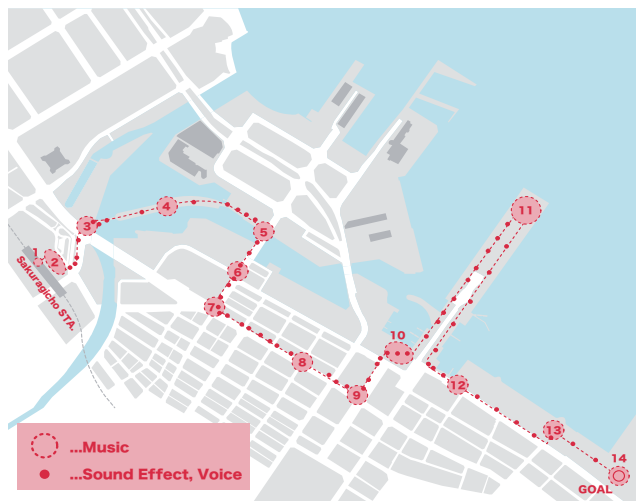


Figure 4. Plotting Map of Pattern 1

In pattern 1, we plotted sounds along the street in the order of their use in the movie and kept the story arbitrary for the user. In this sample, the user started from Sakuragicho Station and walked to the Yamashita Park via the Canal Park, Nippon Boulevard, and Osanbashi (international passenger terminal).

For the second pattern, we plotted sounds, in particular sound effects and dialog that were not limited by existing ways. In this design example, we designated two areas, a good area with a focus on the hero and a bad area with a focus on the old enemy. For example, sounds that are used in the hero's hometown scene were plotted near the center of the good area, the theme music of the evil side was plotted near the center of bad area, and the sounds used in the battle scene were plotted along the contact surface of each area. We expected that the user will feel, “What kind of sound will I hear if I go to that place?” We show the map plotted with sound content along pattern 2 in Figure 5.

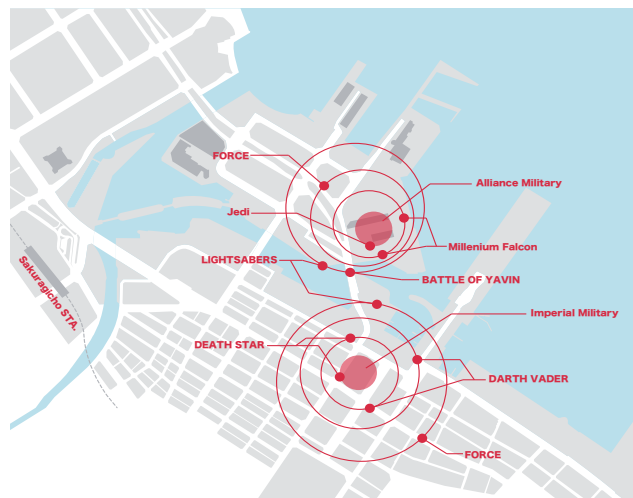


Figure 5. Plotting Map of Pattern 2

C. Result of the Preliminary Experiment

In pattern 1, although we supposed that users will walk down the street with plotted sounds, we wanted to give arbitrary instructions using only automatic sounds. Then, we started the experiment without notifying users which street has the plotted sounds. As a result, three users who completed this experiment could not find the street to go to and had lost their way. Obviously, since six users were scheduled to participate in this experiment, we were stopped unavoidably. This experiment underlined that it is too difficult to guide a person to the intended way only by sounds. Of course, to prevent users from getting lost, we plotted sounds at about 10m intervals in a straight line and at about 20m intervals at the corner of the street. Yet, there were many spots where we could not hear anything, and hence, the user became anxious each time. As a result of walking here and there, users got lost. In addition, in this case, PPS became a tool to find a specific way desperately rather than making town walking fun.

Similarly, in the second pattern, users walked around the area with plotted sounds. In this pattern, we informed where the sounds were plotted in advance, and it took about 15 minutes per person. The following is a list of opinions about this experiment.

Positive Opinions

- A sound of the breathing of Darth Vader is similar to that of snorkeling. I associated it with a snorkeling partly because the area was close to the sea.
- When I heard the voice say, “Run Luke, run,” I was on the lawn, and I wanted to run unintentionally.
- As for me, it was interesting because I didn’t know what kind of sound I would hear next.

Negative Opinions

- There is not much association with this place. It may be because the sphere of *Star Wars* is space.
- I felt uneasy when I heard nothing.
- I didn’t know what kind of rule the sounds were plotted along.
- These sounds were boring for me because I am not very knowledgeable about *Star Wars*.

With this result in mind, we considered a new plot pattern for the next experiment. Specifically, we thought that we would inform subjects of the way to walk in advance and use content of a longer duration.

IV. MAIN EXPERIMENT

In keeping with the result of the pre-experiment, we performed the main experiment. The aim of this experiment was to define the difference between walking the city as usual and while using the PPS. In this experiment, we used a cognitive map as a method, because it was used by Lynch, as well to investigate the spatial perception of the city.

The plot pattern of this experiment was designed to address the negative opinions of the pre-experiment. First, about the relation between sounds and the place, the user had obtained information from both eyes and ears. When the hearing information deviated from the sight information, this system might have become boring. Next, in order to remove uneasiness, we plotted sounds along a predetermined street, similar to the first pattern of the pre-experiment, and informed users of this street. About the content, when we used film music, the impressions of the system varied depending on whether the user knew the movie or not. Hence, we used music that everyone knows or can enjoy even though they do not know it.

A. Experimental Method

The area of this experiment was Minato Mirai (refer to Figure 3.), as in the case of the pre-experiment. We chose the route beforehand and plotted three pieces of content along it. The subjects of this experiment were eight people with ages between 20 and 50 years old, and we divided them into two groups, A and B. The subjects of group A only followed the guide and walked the route. The subjects of group B followed the guide while using the PPS and listening to the

music content. The subjects of both groups drew a cognitive map on A3 paper just after the walk. This experiment was conducted from the beginning to the middle of December, 2015. In Japan, sunset occurs at about 16:30 during this time, and when we performed the experiment, the area was already dark, and the illuminations of the city were turned on.

B. Sound Content and Place

The first piece of content was “The Phantom of the Opera Theme Song” from *The Phantom of the Opera*. This content started at the half-way mark of Kishamichi Promenade where we can view Minato Mirai at night and ended at Navios Yokohama Hotel, which is a hotel in the shape of an arch. This content is in a minor key and is made magnificent by the powerful operatic singing voice. It shows an upsurge steadily towards the climax. We wanted to research how the strangeness of this content fitted the existing atmosphere and influenced the impression of the town.

The second piece of content was the BGM of *Pocket Monster*, which is a handheld video game developed and manufactured by Nintendo Co., Ltd. This content is heard when users walk through the area where there is nothing but lawn. This BGM is electronic music, which reminds us of an 8-bit game. We wanted to investigate the change of impression that resulted from plotting funny BGM at a dull place.

The third piece of content was a medley of Christmas songs that included “Santa Claus is Coming to Town” and “We Wish You a Merry Christmas”. Both these are basic Christmas songs in Japan and almost all Japanese people know them. The place we plotted was the open space between two warehouses. It was Christmas season when we carried out this experiment, and a Christmas market and a skating rink reproduced a European setting. We wanted to define the change of the impression of the place that already had a Christmas atmosphere by adding festive songs. The map plotted with the sound content in Figure 6.

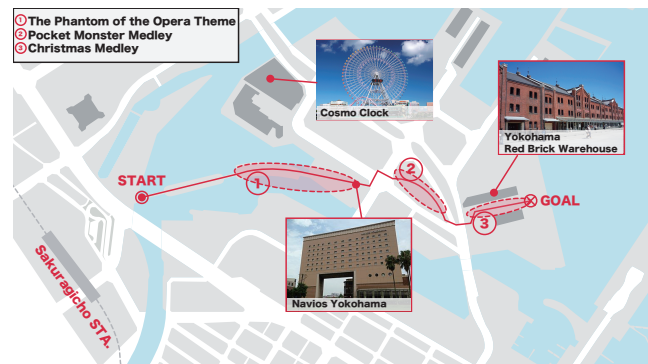


Figure 6. The Map of the Main Experiment

C. Result

It is true that there were individual differences in the ability of the subjects to grasp nuances about the space and

their drawing skills. However, there were many common points in the elements and the form drawn on the map, and we were able to clarify some tendencies by examining these points. First, we counted the elements that the subjects wrote on a blank paper one by one and arranged them to ascertain which subject wrote what. We assumed the elements that were written by more than four subjects were a major element and assumed anything other than that to be a minor element. We assigned serial numbers from 1 to 28 for each element and alphabetical letters A to H for each subject. In addition, subjects A, B, C and D did not use PPS, and subjects E, F, G, and H used PPS. We show this in Tables 1 and 2.

TABLE I. MAJOR ELEMENT

Major Element	Type of element	No PPS				Use PPS			
		A	B	C	D	E	F	G	H
1 Yokohama Red Brick Warehouse	Landmark	*	*	*	*	*	*	*	*
2 Navios Yokohama Hotel	Landmark	*	*	*	*	*	*	*	*
3 Cross Walk	Node	*	*	*	*	*	*	*	*
4 Cosmo Clock ;wheel	Landmark	*	*	*	*	*	*	*	*
5 Queen’s Square ;shopping mall	Landmark	*	*	*	*	*	*	*	*
6 World Porters ;shopping mall	Landmark	*	*	*	*	*	*	*	*
7 Railroad Bridge	Landmark	*	*	*	*	*	*	*	*
8 Landmark Tower ;office building	Landmark	*	*	*	*	*	*	*	*
9 The Other Side of Warehouse	Edge	*	*	*	*	*	*	*	*
10 Skating Link	District	*	*	*	*	*	*	*	*
11 Inter Continental Hotel	Landmark	*	*	*	*	*	*	*	*
12 Christmas Tree in Market	Landmark	*	*	*	*	*	*	*	*
13 Anniversaire ;wedding hall	Landmark	*	*	*	*	*	*	*	*

TABLE II. MINOR ELEMENT

Minor Element	Type of element	No PPS				Use PPS			
		A	B	C	D	E	F	G	H
14 Illumination for Kishamichi	Path	*	*	*	*	*	*	*	*
15 Christmas Tree of World Porters	Landmark	*	*	*	*	*	*	*	*
16 Right side of Kishamichi	Edge	*	*	*	*	*	*	*	*
17 Shape of Kishamichi	Edge	*	*	*	*	*	*	*	*
18 Arch of Christmas Market	Landmark	*	*	*	*	*	*	*	*
19 Asuka ;luxuly liner	Landmark	*	*	*	*	*	*	*	*
20 People met on the way	Landmark	*	*	*	*	*	*	*	*
21 Nipponmaru ;exhibited ship	Landmark	*	*	*	*	*	*	*	*
22 Reflection on the surface of water	District	*	*	*	*	*	*	*	*
23 Lawn	District	*	*	*	*	*	*	*	*
24 Sound Source of the City BGM	Node	*	*	*	*	*	*	*	*
25 Christmas Market Stalls	Path	*	*	*	*	*	*	*	*
26 Santa Clause in Christmas Market	Landmark	*	*	*	*	*	*	*	*
27 Objrct near the World Porters	Landmark	*	*	*	*	*	*	*	*
28 Cosmo World ;amusement park	District	*	*	*	*	*	*	*	*

For example, Yokohama Red Brick Warehouse and Navios Yokohama Hotel are elements written by all subjects. The note about the far end of the Yokohama Red Brick Warehouse is characteristic in Table 1. All the subjects of Group B did a note about the square or sea or ship spread to the other side of warehouse as well as the warehouse. On the other hand, Group A did not have the person who made a note about scenery of the other side of the warehouse. There is the goal in the place where they have finished passing through the open space of the warehouse, and it is the scene which is completed while the Christmas medley that is the third contents becomes lively at the climax when they use

PPS. In Table 2, there are many numbers of elements that subjects of Group B write in at cognitive map, and they wrote in unique elements that were not cover by others. In Tables 1 and 2, we classify these elements into 5 types proposed by K. Lynch. Most elements recorded are classified as "landmark", and as it becomes the unique element, the ratios of other type increase. In particular, the element classified as "edge", is written in the cognitive map of only the subjects of Group B. We show the example of the cognitive map that a subject really made. Figure 7 is the cognitive map of a subject who did not use PPS, and Figure 8 is the cognitive map of a subject who used PPS.

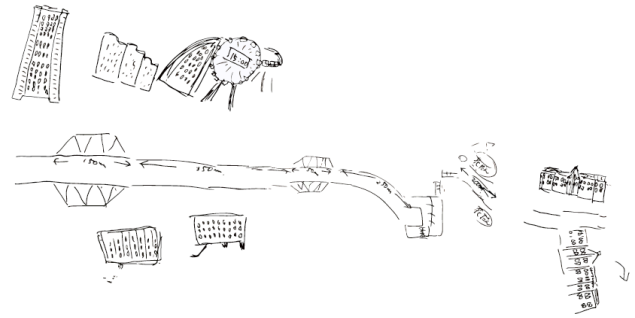


Figure 7. Cognitive Map of Subject C

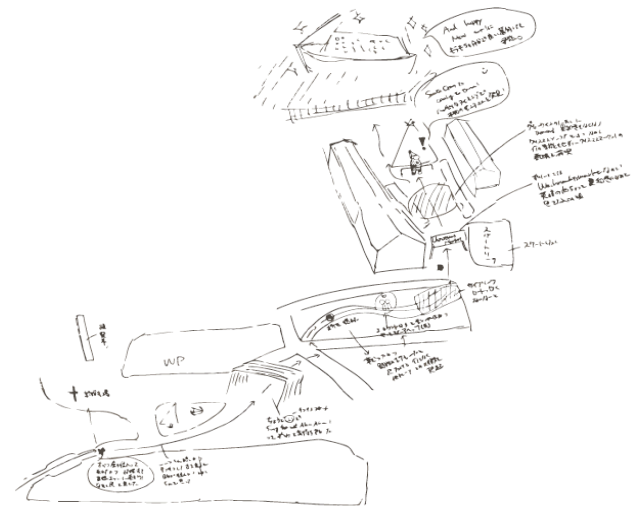


Figure 8. Cognitive Map of Subject G

As seen in Figure 7, all the subjects of Group A expressed elements by an illustration or a letter. On the other hand, as for the subject of Group B, three of four people left not only the illustration but also comments.

D. Consideration

We compared the cognitive maps of Groups A and B and analyzed them. First, the primary feature was that the

subjects of Group B made their cognitive maps in more detail than those of Group A. When we walk the city, we depend on our sight for the most information, and though we always hear some sounds, we are not conscious of hearing them unless they are very loud. However, when we use PPS, the subject walks the city while being conscious of not only the sight information but also the hearing information because of the clear music. In this way, meanings and impressions are added to elements that had no meaning for the subjects when they just looked. Although music might not necessarily harmonize with scenery, there is a previous study that even if a feeling is incongruous BGM affects to remember the image [10]. Actually, almost all of the comments written in the cognitive map of Group B were descriptions that the subjects gave not only through sight but also through the image of the music. For example, a certain subject left a comment that she associated a kidnapped bride with the marriage ceremonial hall, because she had been listening to “The Phantom of the Opera Theme” when she looked at the hall. As a result of the questionnaire, we deduced that the reason why the cognitive map of group B has more comments with expressive sentences is because the best way to express the feeling in suit is to leave comments.

Next, we considered the notes about the other side of the warehouse that was featured only in the cognitive maps of Group B. Though the city does not have an area and a boundary line, we predicted that the cognitive maps of Group B have three areas divided by content. However, there was no cognitive map to show that.

However, when subjects heard the content reach a climax and end, they tended to draw an edge at that spot. There is a study that termination feeling of the music affects the termination of the video product [11]. In this experiment, the first and third pieces of content corresponded to that.

As mentioned earlier, the first piece of content played at the Navios Yokohama Hotel. This landmark has a very impressive external appearance and shape and all the subjects experienced this; not only subjects of Group B but also Group A did not forget to draw it.

Though this hotel is just a landmark for Group A, for Group B, it tended to perform a role as the end of the first area. This is because three subjects of Group B left notes on this hotel and perceived it as the end of the first piece of content.

About the point that subjects of Group B drew edges for the other side of warehouse, we considered that they grasped the range where they could hear the third piece of content as one area, and also, it was a spot where the music increased and concluded in a particularly impressive manner. Therefore, edges were expressed there.

V. CONCLUSION AND FUTURE WORK

We performed some experiments using the new form of art that changes the city through sounds. As a pre-experiment, we proposed two patterns of PPS. The first was a pattern that plotted sounds used in *Star Wars* in a sequence along the street. The second was a pattern that assumed a good-man area and a bad-man area and plotted sounds focused on the sound effect and character’s voice. Based on the outcome of

the pre-experiment, we performed the experiment with the cognitive map. In this experiment, we defined the difference between the cognitive maps while walking the city as usual and while using PPS. The contents used were “The Phantom of the Opera Theme”, *Pocket Monster* BGM, and a medley of Christmas songs. These contents were plotted for Kishamichi, a lawn, and the square of a red brick warehouse. As a result, we defined that the cognitive map drawn by the PPS user has more information, and when the PPS user hears the content reach its climax and end, he or she tends to draw an edge at that spot.

We inspected the movement of the PPS. We confirmed whether the sound played at the desired volume automatically when the user approached the assigned spot. Although sometimes it took several seconds for the sound file to be read, we confirmed that the service functioned normally. An aim of PPS is to create a fun experience and add fascination for a city where we do not feel novelty any more. We want to ensure that every user can plot sounds that will make a place more fun and create an original channel of PPS. Then, a user who is an audience can search for a favorite channel made by another user. In sharing the channels with each other, PPS will become a communication tool through the real space that uses sounds. For that, we want to first show a guideline for the user to plot sounds.

In the pre-experiment, we defined that user’s feelings are influenced by the content. However, the change of feelings was not tied to the image of the city. As a result, the image of the city did not change. In the next experiment, we found that the sound could not change the image of the city, but amplified that. However, this fact is dependent on this city. In the future, we need to perform a qualitative and quantitative evaluation such as a required time and junction on the cognitive map. In addition, the number of combinations of sound content and plotted places was not enough. It is necessary to examine more content and plotted spots and define more differences of the image of the city by adding sounds. Then, we want to define the guide of what kind of sound is suitable for what kind of place.

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