# An Experimental Study on Information Presentation Method using Four-frame Comic on Digital Signage

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Abstract:      Recently, international tourist has been increasing and mobility of human activity is increasing, so people have had more chance to contact with various cultures different from their own. In Japan, in anticipation of the 2020 Tokyo Olympic game, digital signage is expected to be an effective information presentation tool to improve cross-cultural understanding. In this study, four-frame comic was proposed to be an effective information presentation method, and an evaluation experiment was conducted to investigate how to make contents interesting or memorable by comparing four information presentation methods, four-frame comic, video, photograph and illustration. As a result of questionnaire conducted in the experiment, four-frame comic's humorous story and readability could be effective to attract viewers' interest and the amount of information included in four-frame comic and its humor expression could be effective to make viewers memorize information explained in presented contents. However, the effectiveness of four-frame comic was not significant. It was thought that the effect of information presentation methods is differ from topic type, and more detail experiment is expected to investigate the effective used of four-frame comics in future study.

## 1 INTRODUCTION

Recently, foreign tourists are increasing more and more all over the world. The UNWTO World Tourism Barometer (World Tourism Organization, 2016) showed that number of international tourists reached more than 1.1 billion in 2015, which is 4.4 percentage increase compared with 2014, and moreover, it was a record highest ever. They are expected to continue increasing and people have had more chance to contact with various cultures different from their own because of increasing mobility of human activity in the world. In this situation, therefore, cross-cultural understanding is important to realize the world where people of different cultural background can keep their cultural identities and respect each other(Brislin, 1993).

Also in Japan, the number of oversea tourists has been increasing in recent several years. Moreover, in anticipation of the 2020 Tokyo Olympic game, Japanese government decided "Action Plan to Accelerate ICT (Imformation and Communication Technology) Use in Entire Society toward 2020". In the plan, digital signage of 4K or 8K images is promoted as an information presentation instrument for foreign tou-

rists. Digital signage can provide information to large amount of people at a time when it is set in places where many people come and go by its big display. Digital signage, which has been realized by recent ICT, can give information in various ways such as video, picture, illustration or even interactive information according to Want and Schilit(Want and Schilit, 2012).

Digital signage is thought to be essential for a modern society, then many research studies have been done about the use of it. Müller et al(Müller et al., 2009) investigated that a viewer's expectation of a digital signage determined whether or not it attracted his/her attention, and it is showed thtat a digital signage in a shopping mall had a positive impact on consumers by Dennis et al. (Dennis et al., 2010). Many other studies also examined the influence of advertisement on consumers (Burke, 2009)(Dennis et al., 2014). New systems and applications have been also developed to improve usability of digital signage in various ways. Instead of a keyboard or a touch screen, Chen et al. (Chen et al., 2009) described an interaction system for controlling a digital signage display by using hand gesture, and Clinch et al. (Clinch

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et al., 2011) developed and deployed their networked public display systems for coutinuous long time use. Although many studies have been investigating the possibility of digital signages, because of its too wide variance of information presentation style, there is no specific guideline of how to use digital signage to get more efficiency when providing information. At present, users create its contents by their know-how or trial and error.

Considering today's circumstances of Japan, the purpose of this study is to investigate the effective method of information presentation to foreign tourists by using digital signages. Japanese unique food culture is dealt with as the presented information in this study. Especially this study focused on four-frame comic as an effective information presentation medium, which is showed to be effective for learning in some studies (Park et al., 2011) (McVicker, 2007) by their colorful illustration and representation of text.

## 2 PROPOSED METHOD

The effective method of information presentation is investigated for providing information using digital signages in this study. In case of providing information of Japanese unique culture for foreign tourists, it is important to satisfy two requirements, (a) a displayed content can attract their interests and (b) it can be easily memorized. Thus a method using comic has been proposed as an effective information presentation method on digital signages in our conventional study (Tsuji et al., 2017). There are relevant studies about using comic (Sumi et al., 2002) (Kurlander et al., 1996) though, this study particularly focused on a four-frame comic.

A four-frame comic is defined as a comic consists of only four frames, that is popular and traditionally established in Japan. It has 5 features as shown in bellow;

**(1)** It is a part of popular culture in Japan.

**(2)** It can emphasize what they want to give by using illustrations.

**(3)** It can describe a story.

**(4)** It has a sense of humor.

**(5)** It can be displayed as one figure on a digital signage.

Based on these features, four-frame comics are expected to be an effective method of information presentation.

Therefore in this study, two hypothesis about four-frame comics comparing with typical media types of digital signage, photograph, illustration and video, were proposed as follows;

**H1.** When presenting Japanese culture information on a digital signage, four-frame comic can attract more foreigners' interests than photograph, illustration and video.

**H2.** When presenting Japanese culture information on a digital signage, the contents presented by four-frame comic can be memorized easier that those of photograph, illustration and video.

## 3 INVESTIGATION EXPERIMENT

To verify two hypothesis noted in chapter 2, an experiment was conducted including two investigations, "Interest Investigation" to verify H1 and "Memory Investigation" to verify H2.

Experiment was scheduled from Jan 20th 2018 to Jan 28th 2018 and 49 foreigners staying in Japan participated. When recruiting the participants, it was explained that this experiment would be conducted all in English. The detail of participants is shown in Table 1. No.22's answer was incompleted and there was no detail information about him so that his experimental data would be omitted from the results. Figure 1 shows the experimental room and Figure 2 shows iPad used to provide contents assumed to be on a digital signage. In this experiment, to avoid effects from other participants, iPad was used to privately present different method for each participant.



Figure 1: The conditions of the experiment.

### 3.1 Displayed Contents

In this experiment, all contents had been prepared in four presentation methods, four-frame comic, photograph, illustration and video. Examples are shown in

Table 1: List of participants' detail.

| No. | Gender | Age | Country | Length of stay in Japan |
|-----|--------|-----|---------|-------------------------|
| 1 | F | 29 | Philippines | 1 year |
| 2 | M | 22 | Malaysia | 6 months |
| 3 | F | 30 | Germany | 1 year |
| 4 | F | 23 | China | 4 months |
| 5 | F | 33 | Columbia | 1 year 3 months |
| 6 | M | 19 | Korea | 10 months |
| 7 | M | 44 | Iran | 4 months |
| 8 | F | 35 | Iran | 4 months |
| 9 | M | 22 | Malaysia | 5 months |
| 10 | M | 21 | Mongolia | 3 years |
| 11 | M | 23 | Malaysia | 6 months |
| 12 | M | 21 | Malaysia | 4 months |
| 13 | F | 29 | Costa Rica | 4 months |
| 14 | M | 26 | Belgium | 2 years 8 months |
| 15 | M | 24 | Uzbekistan | 2 years |
| 16 | F | 27 | Russia | 2 years 10 months |
| 17 | M | 16 | Iran | 4 months |
| 18 | M | 27 | Bangladesh | 1 year 3 months |
| 19 | F | 39 | Italy | 2 months |
| 20 | F | 29 | France | 5 months |
| 21 | M | 22 | Argentina | 1 year and 9 months |
| 22 | M | | | |
| 23 | M | 22 | France | 1 year |
| 24 | F | 24 | France | 1 year |
| 25 | M | 36 | Palestine | 2 years 10 months |
| 26 | F | 23 | Germany | 1 year |
| 27 | F | 33 | Mexico | 11 months |
| 28 | M | 32 | Canada | 3 years 11 months |
| 29 | F | 20 | Philippines | 3 months |
| 30 | F | 26 | Philippines | 1 year 6 months |
| 31 | F | 32 | Croatia | 1 year 6 months |
| 32 | F | 29 | El Salvador | 1 year 6 months |
| 33 | M | 27 | Cambodia | 4 months |
| 34 | M | 22 | Cambodia | 2 years |
| 35 | F | 24 | Cambodia | 2 years |
| 36 | M | 30 | Cambodia | 1 year 10 months |
| 37 | M | 28 | Cambodia | 3 years 2 months |
| 38 | M | 21 | Egypt | 4 years 6 months |
| 39 | M | 24 | Mexico | 1 year 3 months |
| 40 | M | 28 | Canada | 1 year 6 months |
| 41 | M | 27 | India | 1 year |
| 42 | M | 31 | Malaysia | 3 years 3 months |
| 43 | M | 24 | India | 11 months |
| 44 | M | 30 | Spain | 3 months |
| 45 | F | 25 | Palestine | 3 years 9 months |
| 46 | M | 31 | America | 9 years 5 months |
| 47 | M | 28 | Indonesia | 4 months |
| 48 | F | 28 | Russia | 2 years 10 months |
| 49 | F | 18 | Iran | 4 months |

Figure 3. Contents were prepared in the same format as shown in below;

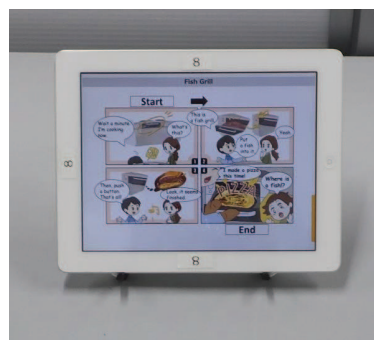**Four-frame Comic** The features were already described in chapter 2.



Figure 2: A device used to present information in the experiment.

**Photograph.** Photograph is one of the popular format of contents on digital signages. Photograph was presented together with explanation text in this experiment. It is based on the recent situation that everyone can create information with photograph without any special skills, using recent high-performance digital camera and software.

**Illustration.** Illustration is also a popular format of contents on digital signages. Illustration's quality is differ from the skill of illustrator however, illustration can emphasize the topic to be focused on. It was also presented together with explanation text in this experiment.

**Video.** Presenting video contents is impossible for traditional signboards but digital signages made it possible these days. Then it is popular to use dynamic information on digital signage, and actually, there are many large displays showing videos downtown, because video is thought to have strong impression and to be comprehensive. However, video needs some time to complete showing its contents and so viewers have to spent some time to see all the video, and moreover, they can't understand its meaning when they missed the beginning or the end. Video was presented with some explanation texts in this experiment.

According to the pre-experimental study (Tsuji et al., 2017), effective information presentation methods can vary by the type of information. For example, photo can easily show variety of food at a glance and video can show a procedure clearly. Therefore, to determine the difference between contents' types, two specific content types "variety" and "procedure" were chosen and experimental contents were prepared based on two types. Variety type includes the introduction of various examples about the topic such as Bowl meals and Vending machines, and procedure type includes how to make or use the topic such as Rolled sushi and Fish grill.
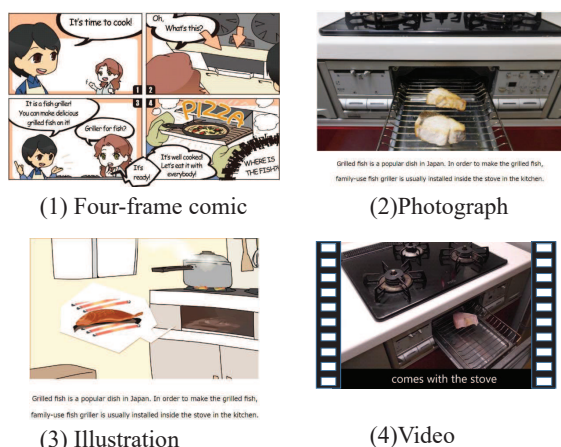
(1) Four-frame comic


(2)Photograph


(3) Illustration


(4)Video

Figure 3: Examples of four types of images.

## 3.2 Methods

Investigation experiment was conducted in the following the flow;

- Explanation about experiment (10min)
- Questionnaires about participants themselves (5min)
- Interest investigation (15min)
- Memory investigation (10min)
- Payment procedure (5min)

The questionnaires included two questions about comics: "Do you like comic books?" and "How often do you read comic books?", and other 18 dummy questions. Topics of the contents used in the interest and memory investigation were different from each other as shown in Table 2 and Table 3, and half of each were procedure topics and others were variety topics.

### 3.2.1 Interest Investigation

An experimental protocol of interest investigation is shown in Figure 4. Participants saw each 4 type variations of 8 Japanese unique food topics shown in Table 2 for each 1.5 seconds, because people walking around stop their eye-sight on a degital signage for 1.5 seconds in average (MdN DesignInteractive, 2010). Between each contents, a blank page was set to appear for 1 second to make contents' switching recognized. At the end of every topic, participants choose which was most attractive among four contents' types and why did they think it attractive. Presenting sequence of 4 variation was different between every participants to counterbalance ordering effect on contents' attractiveness.

### 3.2.2 Memory Investigation

In memory investigation, the participants saw 8 contents for each 15 seconds. Each of the four types of the methods was used twice, and the sequence of presenting topics was different from all participants, to counterbalance ordering effect on topic's memorization. After finishing the contents' presentation, participants were required to write down what they could remember in 2 minutes.

To avoid primacy effect, 4 dummy contents were presented before the 8 measured objects for memorization. To avoid recency effect, 2 minutes video about Kyoto was presented and questionnaires about the video was conducted as a dummy task, between the presentation of measured contents and measured questionnaire for memorization.

Table 2: List of food cultural topics used in Interest Investigation.

|  | Topic | Content |
|---|---|---|
| (Topic 1) | Rice Ball sold in Convenience Stores | Procedure |
| (Topic 2) | Bowl Meal | Variety |
| (Topic 3) | Rice Cake Maker | Procedure |
| (Topic 4) | Sashimi (raw sliced fish) | Variety |
| (Topic 5) | Meal Coupon Vending Machines | Procedure |
| (Topic 6) | Japanese Confectionery | Variety |
| (Topic 7) | The Way to Hold Chopsticks | Procedure |
| (Topic 8) | Event Foods | Variety |

Table 3: List of food cultural topics used in Memory Investigation.

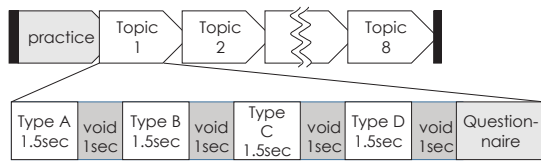|  | Topic | Content |
|---|---|---|
| (Topic 1) | Fish Grill | Procedure |
| (Topic 2) | Vending Machines | Variety |
| (Topic 3) | How to Hold Chopsticks | Procedure |
| (Topic 4) | Dashi (soup stock) | Variety |
| (Topic 5) | Rolled Sushi | Procedure |
| (Topic 6) | Tsukemono (pickled food) | Variety |
| (Topic 7) | Okonomiyaki (savory pancake with various ingredients) | Procedure |
| (Topic 8) | Ekiben (boxed station lunch) | Variety |

Figure 4: Experimental protocol of Interest Investigation.

# 4 RESULTS

In addition to participant No.22, No.14 and No.15 couldn't complete their questionnaires in interest investigation, and No.33 and No.36 misunderstood the questionnaires conducted in memory investigation. Thus, these five participants' results were excluded, so results includes 44 participnats' data.

## 4.1 Results of Interest Investigation

In the interest investigation experiment, video contents were chosen 118 times as the most attractive method of information presentation, which is the largest number of four methods as shown in Figure 5. Based on chi-square test, there were significant difference between video and other methods (p <0.01).

Table 4 shows the results separated by the contents' types. In the result of procedure type, video was the most often chosen method, on the other hand in the result of variety type, photograph was the most often chosen method as the attractive contents.
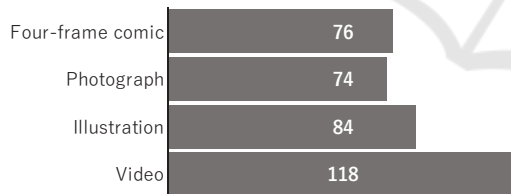


Figure 5: Number of how many times each method chosen as the most attractive information presentation method.

Table 4: Comparison between contents' types in Interest investigation.

|  | Four-frame comic | Photo-graph | Illust-ration | Video |
|---|---|---|---|---|
| Procedure | 43 | 9 | 49 | 75 |
| Variation | 33 | 65 | 35 | 43 |

## 4.2 Results of Memory Investigation

Figure 6 shows the result of memory investigation. The numbers mean how many times presented in-

formation memorized in each presentation methods. Four-frame comic and video contents were both remembered 44 times which was the most of four methods, however there was no significant differences based on chi-square test.

Table 4 shows the results separated by the contents' types. In the result of procedure, four-frame comic was remembered 28 times and it was the most memorized information presentation method. There was no significant difference between four methods of information presentation though, the difference between the total memorized numbers of procedure(N=92) and variation(N=63) was significant based on chi-square test(p <0.01).
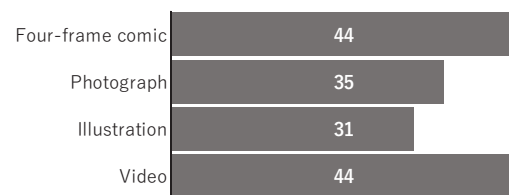


Figure 6: Number of how many times each method was memorized.

Table 5: Comparison between contents' types in Memory investigation.

|  | Four-frame comic | Photo-graph | Illust-ration | Video |
|---|---|---|---|---|
| Procedure | 28 | 20 | 18 | 26 |
| Variation | 16 | 15 | 13 | 18 |

# 5 DISCUSSION

## 5.1 Interest Investigation

To determine the relationship between participants' preference and interest investigation result, they were divided into two groups based on the questionnaires conducted at the beginning of experiment. "Prefer comics" group includes those who positively answered both "How often do you read comic books?" and "Do you like comic books?", and "not prefer comics" group includes other participants.

Table 6 shows the relationship between personal preference and interest investigation. 20 participants were included in the prefer group, and they chose four-frame comic as the most attractive method 39 times, and other 24 participants were included in the not prefer group and they chose four-frame comic 37 times. There was no significant difference between

two groups by chi-square test. Therefore, the personal preference of comics was not thought to have any effect on comics can attract their interest.

Table 6: Relationship between personal preference and interest investigation.

|  | N | the number of times they select four-frame comic |
|---|---|---|
| Prefer comics | 20 | 39 |
| Not prefer comics | 24 | 37 |

Based on the results of interest investigation, four-frame comic was not the method which attracted participants interest the most, which means H1 was not verified. However, based on the reason why they chose the four-frame comic contents as the most attractive, some situation such as characters talking about the topics and humors used in story were thought to attract participants interest. For example, "The comic seemed humorous so that I wanted to read it to know jokes (about Bowl meal)", "It is easy to see 4 steps at a time (about Rice ball sold in convenience stores)", "It was most understandable with some chats and illustration (about The way to hold chopsticks)" and "This comic explained clearly what the event food is and I want to know more about it (about Event food)"

Based on these results, there is some possibility that four-frame comic can encourage viewers to know more about presented information by using characters' chat of explanation with moderate illustration. Humorous expression could make viewers expect that it may provide some information in pleasant way. In addition, because viewers can read four-frame comic freely in their own way such as reading speed or imaging contexts, such freedom of reading four-frame comic was thought to impress viewers favorably and interest.

## 5.2 Memory Investigation

To determine the relationship between personal preference and the result of memory investigation, the same analysis as the interest investigation was conducted and its results are shown in Table 7. There was neither significant differences between two groups by chi-square test. Therefore, the personal preference of comics was not thought to have any effect on whether comics can be memorized.

Based on the results of interest investigation, H2 was not verified. Although there was no significant difference between four information presentation methods in memory investigation, four-frame comic

Table 7: Relationship between personal preference and memory investigation.

|  | N | the number of times they remember four-frame comic |
|---|---|---|
| Prefer comics | 20 | 23 |
| Not prefer comics | 24 | 21 |

was ranked as one of the most memorized method as well as video. In four-frame comic contents, the story was presented where characters talk about the topics in four frames, while in video contents, 15 second movie was presented. Therefore the amount of information was larger in four-frame comic and video contents than in illustration and photograph contents, and this difference of information amount might bring the difference of memorization. Comparing video with four-frame comic, video is dynamic information so that video is thought to include more information than four-frame comic though, four-frame comic contents were memorized same times as video contents. It is thought that humorous story of four-frame comic including the slip end or punch line, promotes elaborative rehearsal in viewers' cognition to be easier for memorization.

## 6 CONCLUSION

As the result of investigation experiment, H1 and H2 was not verified. However based on the positive answers in the questionnaire of interest investigation, four-frame comic's humorous story and readability could be effective to attract viewers' interest. Also based on the results of memory investigation, the amount of information included in four-frame comic and its humor expression could be effective to make viewers memorize the information explained in presented contents.

There were some limitations in this study. The reason why participants chose the method as the most interesting was asked in interest investigation, however, it is also necessary to know why other methods don't attract participants interest at the same time to discuss from various viewpoints. In addition, this study focused on just two contents' types, procedure and variety types, however, there are many other topic types of information what foreign tourists want to know from digital signages. In future study, more detail experiment is expected to investigate the effective use of four-frame comic.

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