



The possibility of 3D-origami system as a tourism promotion tool for Japan

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Abstract

Aim: As part of this research, we created a mobile app that illustrates the steps involved in folding an origami paper, thereby introducing people to a facet of Japanese traditional culture. Numerous marketing resources are needed to spread the word about Japanese. The authors believe that traditional Japanese lifestyle culture is beautiful for many reasons.

Method: Origami was studied as a tool for tourism through a qualitative method.

Findings: Origami describes a set of meanings that are psychologically significant in representing forms and the functional study of line drawings, as demonstrated by the results. Some preliminary data suggest that the number of international visitors to Japan is rising due to ongoing promotion efforts.

Implications/Novel contribution: Since few studies have been done on 3-D Origami's potential for boosting tourism, the current study stands out as original.

Keywords: Origami, Japanese Culture, Mobile Device, 3D Expression, 3D Hologram, Sightseeing, Tourism Promotion

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INTRODUCTION

Many people have been working on projects related to the 2020 Tokyo Olympics, including campaigns to revitalise the Japanese tourism industry and promotions of Japan abroad. The "Tokyo Olympic" bid and other vigorous Japanese promotions, such as the "Cool Japan" policy, have attracted more attention to Japan abroad. However, when it comes to marketing Japan abroad, the country emphasises activities like visiting well-known landmarks and experiencing traditional Japanese sightseeing. International visitors, they need to catch up. Data show that non-Japanese want to learn about Japanese culture through direct contact with locals. For instance, rather than visiting Kyoto, one of the usual sightseeing spots, they focus on downtown Tokyo's "Aka-chochin" (literally means Japanese red lantern indicating a Japanese casual bar).

Popular culture in Japan, such as the art of "Origami," has managed to attract the attention of people all over the world. Origami is a paper-folding art that requires only one sheet of paper to create a wide range of fascinating creations. The world over admires the Japanese for their exquisite beauty and subtlety. Sterile and delicate "Origami" represents Japanese manual dexterity and beautiful design, and its creation and completion are increasingly popular.

In this research, we explore the art of "Origami" to introduce traditional Japanese culture to audiences outside of Japan. Several books are available with pictures of completed "Origami" projects or instructions for folding various "Origami" models. However, no options exist that provide a dynamic visual representation of the decision-making procedure. In this research, we created a mobile app to show how "Origami" is made from start to finish. This programme does more than just show a 3D image. Using a plastic reflector, it can cast "Origami" and its construction process onto the wall behind the screen. There needs to be a wide selection of marketing resources available to highlight Japan's best features. The authors speculate that one factor that attracts non-Japanese is the attractiveness of Japanese traditional lifestyle culture.

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LITERATURE REVIEW

Foreign People's Interest in Japanese

Recently, campaigns to revive the Japanese tourism industry and promotions of Japan to overseas people have been active. As a result, foreign tourists visiting Japan are on the rise.

According to statistics (the number of costumers by nationality and monthly) provided by [Japan National Tourism Organization \(2016\)](#), the number of the tourists from overseas has been increasing steadily since 2013 when the number exceeded 10 million, and it marked 13.41 million in 2014, 19.74 million in 2015 and 24.04 million in 2016 ([Ministry of Land, Infrastructure, Transport and Tourism, 2016a](#)).

The Government of Japan has set the goal to make the number of foreign visitors to Japan 40 million by 2020, in which the Tokyo Olympic Games will be held.

These statistics show that Japan has been attracting attention from overseas. Speaking of a-decade-ago old style Japanese sightseeing areas, these were Kyoto, Nara, Mt. Fuji, etc. However, in the present day, Japanese popular culture; for instance Japanese restaurants (Izakaya) and Japanese noodles (Soba), receives more attention from foreign people.

[Japan National Tourism Organization \(2016\)](#) published the following results of a survey on what foreign tourists have wanted to do during the travel before coming to Japan (multiple answers allowed.) Many foreign tourists travel to Japan for the purpose of experiencing Japanese pop culture, for example, "eating Japanese food" (73.1%), "staying Japanese inn" (22.5%), "experience of Japanese history and traditional culture" (18.9%) and "experience of Japanese daily life" (18.3%) ([Ministry of Land, Infrastructure, Transport and Tourism, 2016b](#)).

Judging by the results, the actual needs from foreign tourists are becoming subtly different from the sight-seeing spots and Japanese culture activities that Japanese people have appealed.

Japan should be famous as a more attractive sightseeing destination by the activity that can respond to tourists' demands certainly instead of just the one-sided sightseeing promotion of Japan that has been done so far.

Rising Interest in "Origami" by Foreign People

Because of active Japanese promotions like "Cool Japan" policy and "Tokyo Olympic" bidding, Japan has been receiving more attention from overseas. Speaking of a-decade-ago old style interests in Japan, these were sightseeing to Kyoto, Nara, Mt. Fuji, and typical Japanese contents; for example, "Anime", games, "Kabuki" and "Ninja".

Amid growing interests in Origami, there are many books and websites that introduce the works of "Origami" and how to create "Origami". Some of them are provided in Japanese, and some are translated into English and other languages. We can find that Japan is becoming popular ([Tatsuya & Yasuo, 2012](#); [Uriko & Nobuko, 2017](#)).

METHODOLOGY

What is Origami

Origami (Figure 1) is one of the Japanese cultures and attracts attention not only in Japan but also overseas. Though there are various opinions on the origin of Origami, it is said that, Origami has been developed uniquely in Japan ([Tokyo Origami Museum, 2016](#))

Moreover, Origami has an artistic aspect and Origami is a traditional representative play of Japan, which is beginning to be familiar all over the world. Origami is not only a children's plaything or educational material but also the play that adults can enjoy because the delicate and highly artistic types of Origami have been designed recently.



Figure 1. Origami image

One of the attractions of Origami is the fact that people can create fine and complex works from a square sheet of paper. Even for Japanese people, it is difficult to imagine what kind of production process the creator went through by only looking at a completed work of Origami.

If the manufacturing process is stereoscopically expressed, we can convey the three-dimensional and delicate charms of origami works more effectively.

Tourism Promotion of Japan

Cool JAPAN means the Japanese attractions that foreign people think as cool, for example, the contents (animation, cartoon and games), food, traditional cultures, designs, robots, environmental technologies and so on. Cool JAPAN strategy is a branding strategy that transforms this attractiveness to economic growth in Japan by bringing in the world economy's growth; effectively developing each process of information, transmission, overseas expansion of the products and the services, and inbound tourism consumptions. It is one of the strategies to make tourism promotion of Japan more attractive by creating excellent designs, and promote collaborations across the barriers amongst public/private sectors and various industries for wider development (Cabinet Office, 2012)

Moreover, one of the points is to incorporate the perspective of foreign people. In Japanese tourism promotions, there are many cases that there is a gap between Japanese and foreign people's point of views.

However, they are supposed to become more effective promotions by carrying out the revisions with foreign people's perspective.

3D REPRESENTATION SYSTEM WITH MOBILE DEVICES

3D Image by Smartphone

There is an easy way to express a 3D image by using a combination of a smartphone and a tetrahedral reflecting mirror made of four clear trapezoidal plastic parts (Figure 2). It is easy to see 3D image. Moreover, we can make the reflector with familiar materials. In this study, we use this hologram technique. Figure 3 is the 3D image of Tsuru displayed in the tetrahedral reflector, which was actually created (Miyazaki, Yasuda, Yokoi, & Toriwaki, 1996; Risa & Takayuki, 2016).



Figure 2. 3D image by a tetrahedral reflector and a smartphone (ex: Origami box)

Structure of the Tetrahedral Reflector

The dimensions of the prototype reflectors to express 3D Origami by smartphone are shown in Figure 4 below. The reflector is designed so that the angle of the smart phone screen and the plastic plate is 45° , when the reflector is set up as indicated in Figure 3.

The reflection by the plastic plates to bounce the light from the images displayed on the device like a smartphone reaches the observer's eyes. This is an application of mirror physics: The light of the object reflected by the mirror reaches the observer's eyes. We can see the image as if the object existed within the mirror, as far as the distance between the object and the mirror surface.

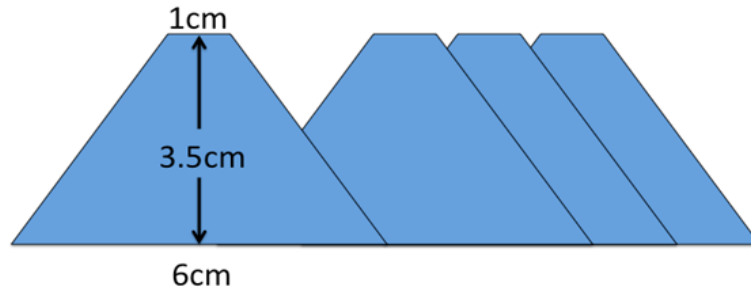


Figure 3. Dimensions of the plastic reflectors

The 3D hologram by the reflector uses the system of the mirror physics. The light (image) that is beamed from the device like smartphone intersects the face of the plastic plate normally. Then, the light is reflected at the same angle of incident by the plate. After that, the light reaches the eyes of the observer. At this time, the observer has error of sense that there is an image in the reflector, and they can see the image by 3D expression (Figure 4).

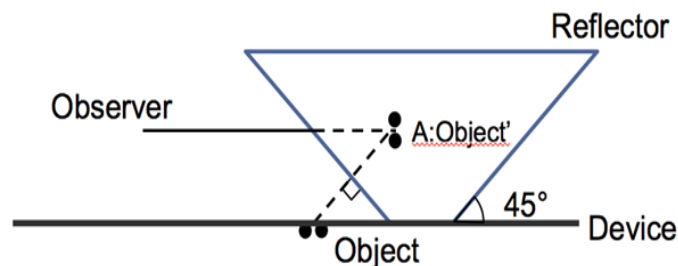


Figure 4. The system of the 3D hologram

OVERVIEW OF ORIGAMI APPLICATION

Contents of Application

We suggested the system by which the user can experience 3D expression easily with a smartphone. We developed the application for foreign people by which they can enjoy Japanese Origami culture easily and suggest the system that enables the experience of the 3D expression by using the plastic reflector (Ogawa & Fujimoto, 2017).

In this paragraph, we introduce the contents of the origami application. The application basically consists of the following four sections.

1. Tutorial of the way to make Origami
2. 3D view of the completed creation
3. Introduction of how to project 3D Origami
4. Introduction of how to make the tetrahedral plastic reflector

First part is the tutorial function to introduce how to fold Origami. The user is required to tap the tutorial button in the Origami catalog. He or she can take each step to fold Origami using a tetrahedral plastic reflector.

There are go and back buttons displayed on the screen. When the go button is tapped, the page changes to the next step following the procedure to fold Origami. Similarly, when the back button is tapped, the page goes back to the previous page.

The authors implemented the smartphone application as described above in our past paper, The development and evaluation for Japanese Origami application with 3D expression (Ogawa & Fujimoto, 2017).

Origami Catalog

The following are the Origami that are explained in this application. This application demonstrates three kinds; Japanese traditional ORIGAMI, furniture type ORIGAMI and unit type ORIGAMI. Japanese traditional ORIGAMI is a type of design from old times.

The works are created in the motif of the Japanese symbolic animals and tools. For example, Tsuru (crane) is a representative example of Origami. How to fold "Japanese traditional ORIGAMI" has been inherited from long time ago. There are various Origami designs that every Japanese has an experience of folding in his or her childhood (Risa & Takayuki, 2017; Yuya & Makoto, 2011).

The following are Japanese traditional ORIGAMI instructed in the application. (Figure 5 Tsuru, Figure 6 Ballon and Figure 7 Kabuto) Kabuto is one of the Japanese traditional Origami styles. This is a Japanese traditional protective weapon on head.

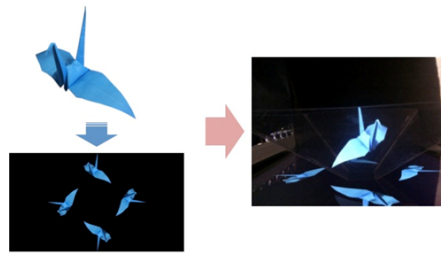


Figure 5. Origami image and 3D image (Tsuru)

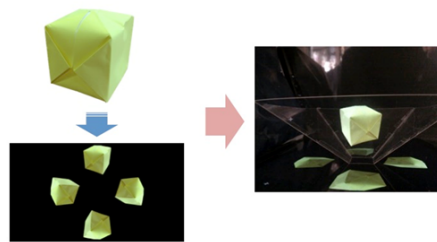


Figure 6. Origami image and 3D image (Ballon)

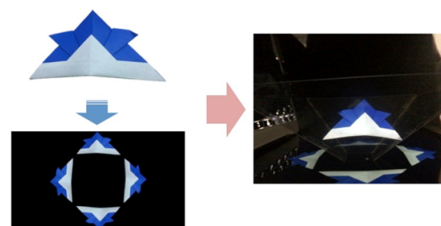


Figure 7. Origami image and 3D image (Kabuto)

Furniture type ORIGAMI is a type of Origami to model general items such as a fancy box and a vessel by one piece of paper. Furniture type ORIGAMI in this application are shown below (Figure 8 Vessel).

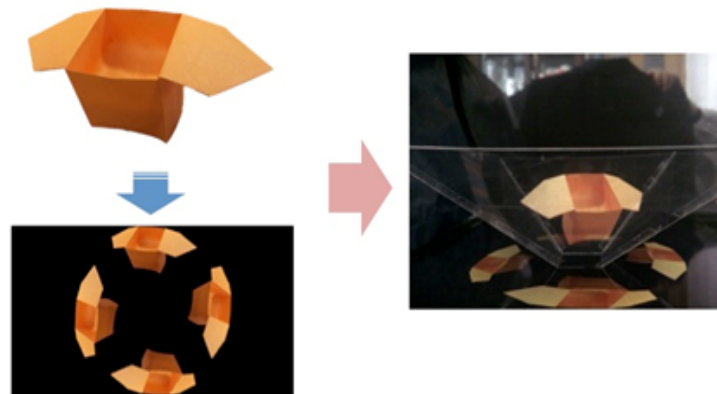


Figure 8. Origami image and 3D image (Vessel)

Unit type ORIGAMI is a paper folding technique to use two or more than two sheets of papers and it is the way to create one model by combining multiple units. (Figure 9 Ninja star) (Risa & Takayuki, 2016).

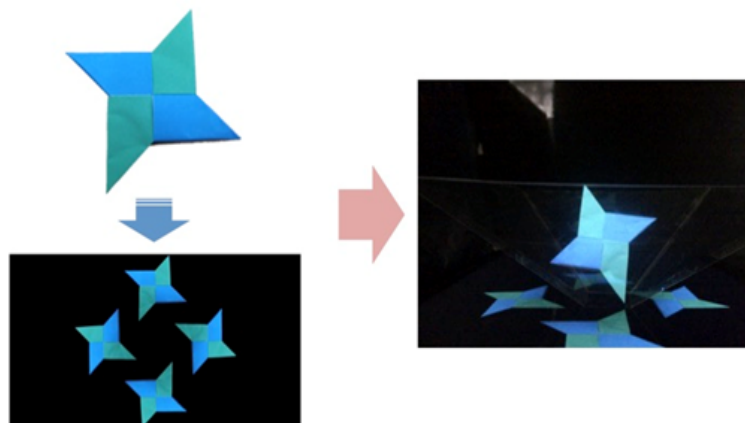


Figure 9. Origami image and 3D image (Ninja star)

Photographing Origami

For the images of Origami tutorial, the photographs of all the actual steps of how to fold each Origami were taken from four-directions. Figure 10 shows the images of how to make Tsuru created for this application.

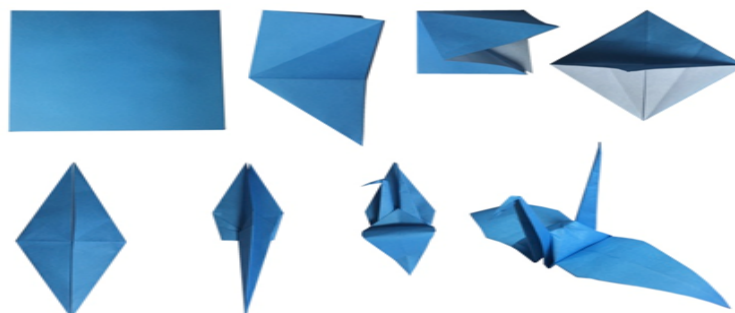


Figure 10. Images for origami crane Tsuru

APPLICATION TO TOURISM PROMOTION TOOL

Comparison of Existing Promotions

Introducing the actual products: This is the way to display samples of the products ready to the hand of the consumers. The merit is that consumers can purchase cosmetics or skin care products after they actually try one. Furthermore, this promotion can effectively convey texture and smells that cannot be transmitted only with the package (Figure 11).



Figure 11. Image of introducing the actual products

Digital Signage

It is one of the promotion tools that utilize video and sound in digital devices. For example, at the cosmetics sections in drugstores, products are introduced in small displays near shelves on which they are lined up. The previous main stream of the product introduction was to convey information to consumers with still images. With moving pictures on the digital signage, the vendors can introduce products effectively by gathering viewers' interests.

Recently, the digital signage embedded in the pillars of the stations' premises attracts people's attention by displaying the advertisements (Figure 12).



Figure 12. Digital signage

Food Sample

It is a method to display food models to simulate real food when providing information on food. This can quickly convey detailed information about the dishes to the consumers when explaining about food because they can see the completion figure same as the actual one (Figure 13).

Furthermore, food sample can be displayed for a long time and people can easily introduce information such as price and ingredients because it is reproduced with material that does not deteriorate but resembles the real one (Carta Osaka, 2017).



Figure 13. Food sample

Brochures or Pamphlets

Brochures are documents used for introducing sightseeing spots and maps. We can describe the objects and places in detail for introductions. There are not only Japanese versions but also translated versions in other languages. Many tourists use this type of documents. The brochure is made of text information and images on 2D on the assumption that the user actually goes to sightseeing spots (Figure 14)

Whereas we can use these types of documents in one hand, they are sometimes too much to carry and we need certain space for browsing them.

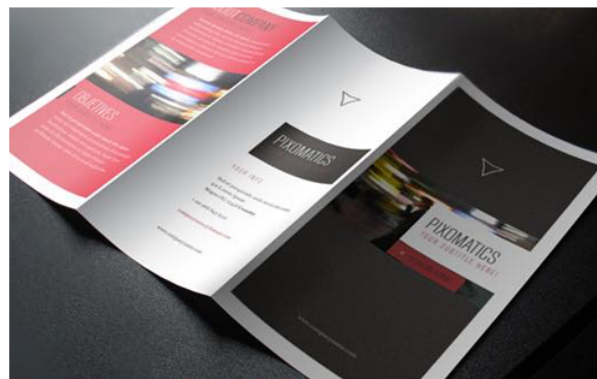


Figure 14. Brochures or pamphlets

Application Example to Sightseeing Promotion Tool

Thanks to current promotion activities abroad for Japan, there are some results that the number of foreign visitors to Japan is increasing. On the other hand, the activities foreigner people really need do not match the tourism and the cultural experiences positively featured by the Japanese. What many of the foreign people are interested in is the experiences of delicacy that Japanese culture has. Based on this, we supposed that Origami application devised by the authors could be applied to the field of tourism promotion. Because the system can easily express images in three dimensions by combining a tetrahedral reflector made of plastic plates and a mobile device.

We will create a tool that empowers Japanese sightseeing activities by reproducing sightseeing spots and traditional cultures in tourists' hands with the system that has enabled the users to enjoy the delicate and steric charms of 3D-ORIGAMI. Using this tool, the user can transmit information more effectively.

The following is a picture that Japanese castle is projected as three-dimensional representation by 3D hologram technology (Figure 15).

On the websites, other than them, we just had to go to the actual spots. With this system, the users can enjoy seeing sightseeing objects stereoscopically in hand.



Figure 15. 3D image by a tetrahedral reflector and a smartphone (ex: Japanese castle)

Moreover, they can enjoy the visual expressions that they have never experienced before if we use some motives that we cannot take a look at closely or touch by hand. For example, they are world heritages and important cultural properties.

By changing the objects for reproductions, they can freely enjoy seeing something that they have previously recognized only in the texts or by 2D images. Additionally, foreign visitors' consumption behaviors are expected to become active because of the effective product introductions and information transmission by the new representation that is totally different from the other existing approaches.

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REFERENCES

- Cabinet Office. (2012). *Cool Japan*. Retrieved from <https://goo.gl/HSwehZ> (accessed on 13 September 2017)
- Carta Osaka. (2017). *The role and effects of food sample*. Retrieved from <https://goo.gl/ZFCyhf> (accessed on 13 August 2017)
- Japan National Tourism Organization. (2016). *Visitor trend statistics*. Retrieved from <https://goo.gl/TEvW2b> (accessed on 24 June 2017)
- Ministry of Land, Infrastructure, Transport and Tourism. (2016a). *Release of reports on the estimated airport income and expenditures for fy2015*. Retrieved from <https://goo.gl/6WzTEs> (accessed on 2 Junly 2017)
- Ministry of Land, Infrastructure, Transport and Tourism. (2016b). *Visit Japan tourism ambassadors made a courtesy visit to senior vice-minister Tanaka*. Retrieved from <https://goo.gl/ceDpkX> (accessed on 17 February 2017)
- Miyazaki, S.-Y., Yasuda, T., Yokoi, S., & Toriwaki, J.-I. (1996). An origami playing simulator in the virtual space. *The Journal of Visualization and Computer Animation*, 7(1), 25-42. doi:[https://doi.org/10.1002/\(sici\)1099-1778\(199601\)7:1<25::aid-vis134>3.3.co;2-m](https://doi.org/10.1002/(sici)1099-1778(199601)7:1<25::aid-vis134>3.3.co;2-m)
- Ogawa, R., & Fujimoto, T. (2017). The development and evaluation for Japanese origami" application with 3d expression. In *25th International Conference on Systems Engineering*, Las Vegas, NV.
- Risa, O., & Takayuki, F. (2016). Development of mobile device/application expressing 3d-origami. In *International Conference on Supercomputing*, Istanbul, Turkey.

- Risa, O., & Takayuki, F. (2017). The realization of 3D modeling system for Japanese origami. In *4th International Conference on Computational Science/ Intelligence & Applied Infomatics*, Hamamatsu, Japan.
- Tatsuya, M., & Yasuo, M. (2012). Origami simulation in virtual space. In *International Conference on Intelligent Robots and Systems*, Vilamoura-Algarve, Portugal.
- Tokyo Origami Museum. (2016). *Japan origami associate*. Retrieved from <https://goo.gl/8KaswC> (accessed on 14 July 2017)
- Uriko, F., & Nobuko, K. (2017). *Origami, folding paper over the web* (Unpublished master's thesis). Kodaira-shi, Tokyo: Department of Mathematics and Computer Science, Tsuda College Tsuda-machi.
- Yuya, K., & Makoto, O. (2011). Proposal of origami tutoring system with augmented reality. *Human Computer Interaction*, 142(16), 1-6.