Fortune Air: Interactive Fortune-Telling for Entertainment Enhancement in a Praying Experience

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Abstract. In Japan, people visit shrines to pray for good fortune. For determining their fortune, they draw fortune-telling paper slips called Omikuji. The Omikuji contain predictions ranging from daikichi ("great blessings") to daikyo ("curses"). As a novel, interactive fortune-telling system, we propose the "Fortune Air." According to the person's interactions and a random value generated by the measured resistance of a leaf from a tree in the shrine, in real-time, a unique fortune is determined. Then the fortune-air system visualizes the fortune using one of the four patterns generated by double vortex rings: merging, rebound, disappearance and no-interference. After the visualization, the paper containing the fortune is printed by a thermal printer. In this study, we conducted an experiment for determining the parameters for controlling the four patterns of double vortex rings. From the results, we confirmed that the distance between the air cannons and a combination of the air pressure as well as the angle of the two air cannons, are the parameters to control the four patterns generated by the vortex rings. Using the results, we implemented a prototype system for the fortune-air and evaluated the entertainment value provided by the interactive system to enhance the praying experience.

Keywords: Interactive air media · Vortex ring · Air cannon

1 Introduction

In Japan, people visit shrines in order to pray for good fortune. For determining their fortune, they draw fortune-telling paper slips called Omikuji. The Omikuji contain predictions ranging from daikichi ("great blessings") to daikyo ("curses") As a novel interactive fortune-telling system, we propose the "Fortune Air". According to the person's interactions and a random value generated by the measured resistance of a leaf from a tree in the shrine, in real-time, a unique fortune is determined. Then, the fortune air system visualized the fortune using one of the four patterns generated by double vortex rings: merging, rebound, disappearance and no-interference. We adapted four fortune telling message to these four patterns of vortex rings. After the visualization, a paper containing the fortune-told is printed by a thermal printer. In this paper, we conducted an experiment to determine the parameters for controlling the four patterns

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of the double vortex rings. From the results, we confirmed that the distance between the air cannons and the combination of the air pressure as well as the angle of the two air cannons, are the parameters that control the four patterns generated by the vortex rings. Using the results, we implemented a prototype system for the fortune air and evaluated the entertainment value provided by the interactive system to enhance the praying experience.

2 Related Studies

2.1 Air Media

Generally, vortex ring is generated by a moderate-sized hole punched on one of the faces of a cardboard box and the side of the box is struck, creating a mass of air that travels linearly while holding its shape. Hence, a vortex air cannon requires a container that has a circular hole and can be easily built if there is a device to rapidly expel the air [1]. Vortex rings are extensively studied; its stability conditions and speed controls can be designed according to the well-known principles. In our previous study [2], we developed a small air pressured facial tactile display to generate a sensation for the theater environment. By applying our previous knowledge, we developed two small air cannons placed side by side, to control the patterns of the vortex ring, for this study. The interactive media system while being unobtrusive, uses air pressure for the haptic interface. Suzuki et al. used an air jet to provide a force feedback for improving the realistic sensation while interacting with a virtual object such as an unobtrusive haptic display [3]. Sodhi et al. also developed a compact air-pressured tactile display called aireal to provide a haptic sensation on a CG object for a game-playing user in the real world [4]. As an unobtrusive aroma transmitter, the vortex ring is used for an olfactory display that transmits aroma to a distant target-user without diffusing it locally [5]. In this study, we have endeavored to control and create the patterns of the vortex rings representing a physical message. This message is mainly visual, but in future, the pattern will be used for a multi-sensory display integrating olfactory and the haptic functions.

2.2 Ritual-Related Interactive Interface Design in HCI

In the HCI field, we have often encountered interfaces that technically enhance traditional rituals. ThanatoFenestra [6] is an interactive altar that technically changes and controls the photos of deceased by the movement of a candlelight and “burning aroma” (representing incense sticks) that are used for rituals in front of the altar while praying for the deceased. This proposed system enhances the interaction with the deceased. Our proposed system is not a replacement for the altar for the family’s deceased but it is for public use. A prayer companion [7] was proposed as a design study to aid for praying, for cloistered nuns by providing RSS news feeds as a resource of praying contents. This proposed system is an interface to provide updated news as a resource of the prayer activity for technically handicapped people like cloistered nuns or elderly people. Our proposed device is a substitute for a fortune-teller, using visualized vortex rings.

3 Fortune Air System

3.1 System Outline

Figure 1 shows system outline of the fortune air system. Two parallel air cannons generate two vortex rings by controlling four electromagnetic valves; two electromagnetic valves are implemented in an air cannon. One of the electromagnetic valves opens the compressed air into the air container unit of the air cannon while the another valve expels the compressed air from the air container when the vortex ring is to be generated. The switching of these valves is controlled by a PC and an arduino. From our previous research [8, 9], we know that the combination of the pressure value of each air cannon and the distance between the two air cannons affects the patterns generated by the vortex rings. However we could not fully control the patterns using these two parameters. In this study we found that angle between the two air cannons is the third parameter for determining the generated pattern. Therefore in order to control the angle of the air cannon interactively, we implemented two stepping motors. After a visualized fortune-telling by any four patterns of vortex rings, a slip of paper containing the fortune-told is printed by a thermal printer and the person can bring it home with him. The four patterns of fortune are determined by a stick that can be selected from several sticks in a stick container and a random value generated using the measured resistance value of a leaf from a tree in the shrine, in real-time. The detailed system description is provided in Sect. 5.

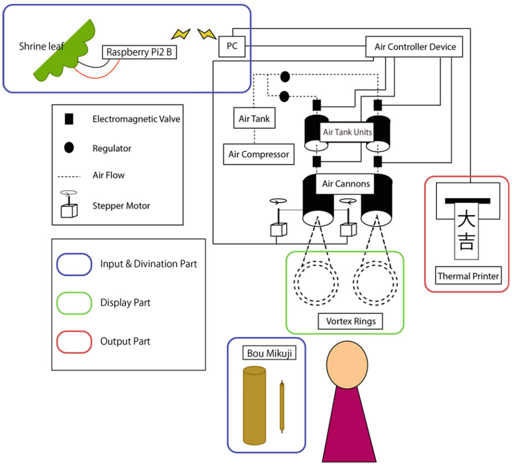

Fig. 1. Outline of fortune air system

3.2 Patterns of the Vortex Rings and Their Messages

The translational movement of two vortex rings causes a pressure decrease in between them and the vortex rings approach each other. Preliminary experiments to observe the patterns of translational vortex rings by changing air pressure values, were performed.

We found that four patterns of the vortex rings are likely to be generated in an ordinary space.

Figure 2 depicts a "merging." This is a merging of two vortex rings generating a large vortex ring. It proceeds slowly, straining in every direction. As this pattern combines two rings into one, we define it as a "Great blessing." Figure 3 shows a "rebound." This is a rebound of two vortex rings and each ring proceeds in opposite direction. As in this pattern, the two rings are repelled from each other, we define it as "Average blessing." Figure 4 portrays a "disappearance." Two vortex rings disappear as they approach each other closely and rebound strongly. We define it as a "Curse." Figure 5 shows a "no-interference." There is no interference between the two vortex rings and they travel forward in a straight path and fade out. We define it as "Small blessing."

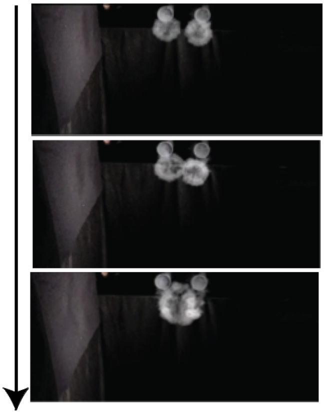

Fig. 2. Merging of the vortex rings (front view)

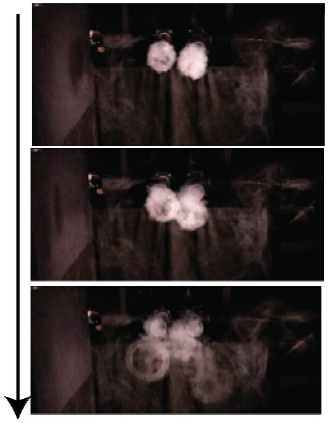

Fig. 3. Rebound of the vortex rings (front view)

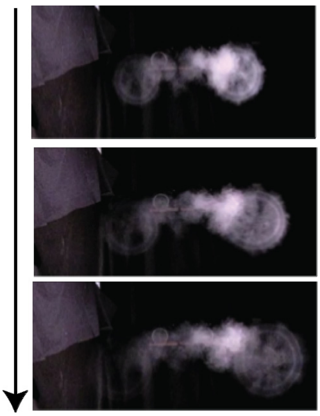

Fig. 4. Disappearance of the vortex rings (front view)

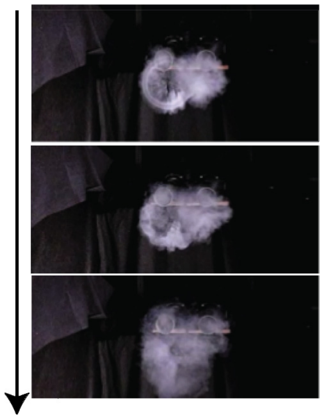

Fig. 5. No-interference of the vortex rings (front view)

4 Experiment to Determine the Parameters for Controlling the Four Patterns of the Vortex Rings

4.1 Observation of the Generated Patterns of the Vortex Rings

In our previous study, we found that the distance between the two air cannons and a combination of the air pressure were the parameters that determined the patterns generated by the vortex rings. However the determined combinations of these two parameters could not always generate these four patterns but they increased the probability of generation [9]. Thus, the system could no predict the pattern that would be generated. To output the fortune-told using a thermal paper, the system has to know the result. Hence, we sought an additional parameter to increase the probability of the four generated patterns.

In this study, we enlarged the aperture of air cannon (D) = 108 mm, compared to the previous study, where D = 77 mm, for stabilizing the vortex rings and for increasing the visibility of the generated patterns. Along with the change in the aperture, the length of the air cannon (L) become 445 mm and the volume of the air tank become 4275 cm^3, determined by the principle of air vortex rings [10].

Yanagida et al. crashed two vortex rings on purpose to spread a smell locally via free space to the targeted person [11]; a vortex ring that delivered the smell was crashed by striking it with another vortex ring, from an oblique. This inspired the idea that the angle can be another parameter to control the patterns generated by the vortex rings. As a first observation, we refereed to Yanagida's result; we evaluated if we could generate the disappearance pattern by tilting an air cannon in-and-out. Figure 6 shows two experimental conditions; one is to tilt the air cannon 3° inside (inside-tilt condition) and the another one is to tile it 3° outside (outside-tilt condition). Tilting the cannon caused a change in the distance between two air cannons accordingly, as depicted in Fig. 6. By changing the air pressure of each air cannon, we observed the disappearance pattern more often in an inside-tilt condition than in an outside-tilt condition. Moreover, with the inside-tilt condition, we observed an increase in the merging pattern by changing the angle to 1°. With these results, we hypothesized that controlling the angle by inside tilting inside is a promising method to control the generation of the four patterns.

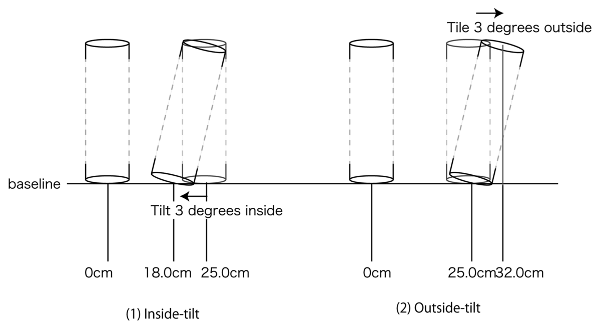

Fig. 6. Two positions of the tilting angle

4.2 Experiment

Based on the results of the preliminary experiment, we conducted an experiment to determine the parameter settings for generating the four patterns. Table 1 shows the combinations of the parameters for the experiment. We tilted the air cannon which expels a vortex ring with an air pressure 1 as shown in Table 1. A hundred trials were conducted for each pattern and we could generate the desired pattern of the vortex rings, a 100 %. “Rebound” and “no-interference” used the two parameter-combination of the air pressure and the distance; “merging” and “disappearance” additionally needed the angle parameter to generate the desired pattern.

Table 1.

Pattern	Air pressure 1(Mpa)	Air pressure 2(Mpa)	Distance(cm)	Angle(degrees)
Merging	0.045	0.045	22	1
Rebound	0.045	0.04	25	0
Disappearance	0.065	0.05	18	3
No interference	0.065	0.05	25	0

For the “merging” condition, by tilting the air cannon 1°, a more stable merging of two vortex rings was generated. On the other hand, by setting a larger difference in the angle (3°) than in the merging condition, each vortex ring crashed and disappeared before stabilizing. “Rebound” and “no-interference” were generated without the angle parameter. Rebound could be generated by creating a minor difference in the air pressure of each air cannon. However, no-interference could be generated by creating a significant difference in the air pressure of each air cannon.

5 Fortune Air Prototype System

We fabricated a prototype system for the fortune air. This interactive system conveys four types of fortunes based on the patterns of the vortex rings: great blessing, average blessing, small blessing and a curse. The prototype system is depicted in Fig. 7.

A person who is praying, pulls-out one fortune stick from five available sticks, each having a different value of a resistor, within. The person is asked to shake the container a number of times corresponding to the number of the month he was born, before pulling-out the stick. This step is adopted to create a similarity with a conventional fortune-telling. By placing the selected stick on a plate that has two conductive poles, as shown in Fig. 8, the person’s number is determined by the system, with values ranging from1–5. Additionally, we implemented a remote system with a compact computer (Raspberry Pi 2 Model B) that transmits the resistance value of a leaf attached to the electrodes as shown in Fig. 9. The remote system is placed in a university campus near a local shrine. The resistance value of the leaf from a shrine

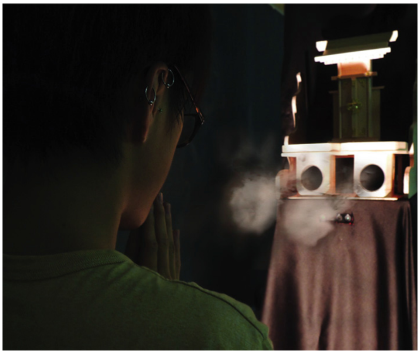

Fig. 7. Fortune air

Fig. 8. Stick fortunes and a plate

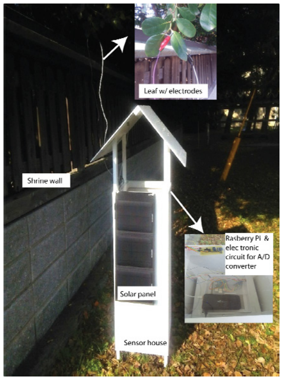

Fig. 9. Remote sensing system

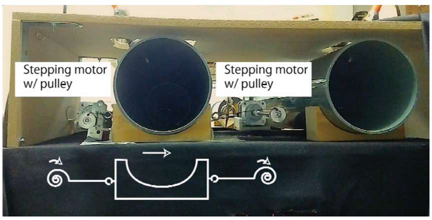

Fig. 10. Air cannon with a tilt function

Fig. 11. A thermal printer printed fortune-telling paper

symbolizes God, and has seasonal and a time variation. By adding this value to the number selected in accordance with the person's number, a unique number that determines the pattern of vortex rings, is selected. For the merging or the disappearance pattern, one of the air cannons is tilted-up to the predetermined value. The movement of the cannon is carried out by two stepping motors with a pulley function at each opposite end as depicted in Fig. 10. After the person has watched the visualized pattern, the fortune-told is printed by a thermal printer (Fig. 11), similar to a piece of fortune-telling paper, usually available in a shrine.

6 Evaluation

We evaluated the entertainment and the novelty value provide by the interactive fortune air system for a praying experience. Six university students (4 male, 2 female, average age 24.0) participated in the evaluation. They underwent a fortune-telling experience individually, after they were instructed on how to use the system, including the types of patterns generated by the vortex rings and their significance. Figure 12 depicts the experience of a participant. After the experience, they answered four questions and were asked to comment about the entertainment and the usability of this interactive system. Figure 13, 14 and 15 shows the result of the questionnaires regarding the system. A positive feedback was obtained from all participants. Regarding the usability, as shown in Fig. 16, they did not find it difficult to operate.

Fig. 12. Scene of fortune air experience

In the comment section, they commented that,

1. The process of the generation of the vortex rings felt like they were waiting for the answers from God and it was fun.
2. The vortex rings with smoke looked celestial and matched with the contents.
3. The leaf from a shrine added as a factor for the fortune-telling was effective in making the user believe of the result of the fortune telling.

In this evaluation test, we could confirm that Fortune Air could be a novel interface to provide entertainment in a praying experience (Fig. 14).

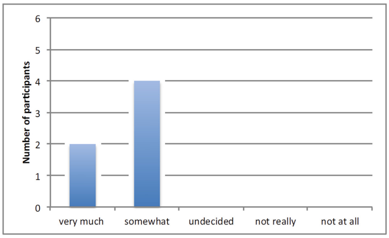

Fig. 13. Does this system give a fortune-telling experience?

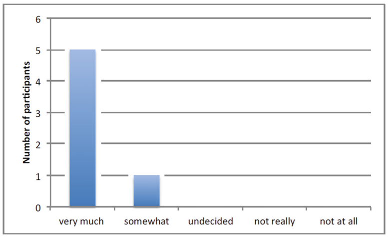

Fig. 14. Does this system provide new fortune-telling experience?

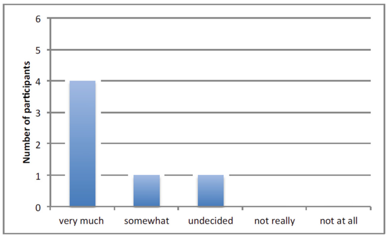

Fig. 15. Is this system entertaining compared to a conventional fortune-telling?

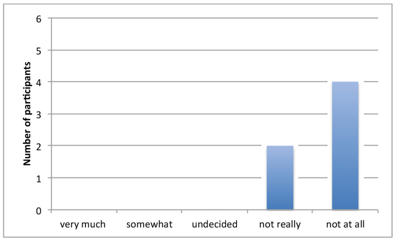

Fig. 16. Is this system difficult to use?

7 Conclusions

In order to propose a novel interactive system "Fortune Air," we implemented a prototype system. For generating the four patterns of the vortex air rings, we used two air cannons placed side by side and the vortex rings shot by each air cannon made four patterns such as merging, rebound, disappearance and no-interference by controlling three parameters: distance, air pressure and angle. The four patterns of the vortex rings were adapted to represent a special meaning in the fortune-telling. After the visualization of the vortex rings, a paper containing the fortune-told was printed by a thermal printer. In this study, we conducted an experiment to determine the parameters for controlling the four patterns generated by the double vortex rings. From the results, we confirmed that a combination of the distance and the air pressures as well as the angle of the two air cannons can be used to generate any one of the four patterns of the vortex rings. Using these results, we implemented a prototype system for the Fortune Air and evaluated the novel value provided a positive feedback regarding the entertainment value of the Fortune Air. By applying the principle of the physics of the vortex rings to a fortune-telling application, participants can grasp the meaning of physical phenomena as though it had a sacred meaning. This suggests that the interactive system can be used in cultural rituals for enhancing their meaning and for encouraging younger generations to appreciate their culture.

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