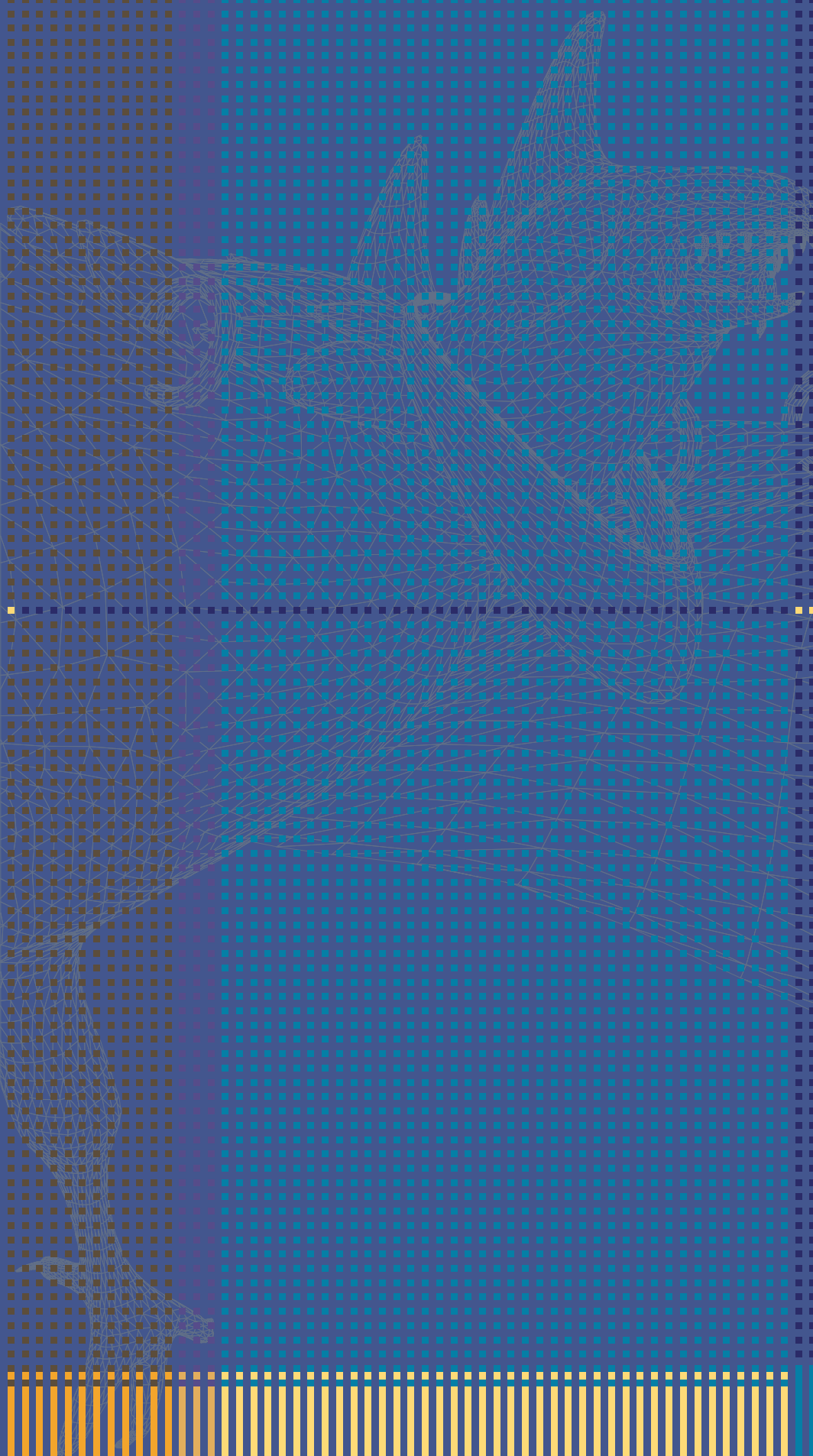
ISSN 1738-8074



International Journal of Asia Digital Art and Design

Vol.17 No.04 2014
Asia Digital Art and Design Association

Contents

Categories for paper

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A paper in this category has to be a logical and empirical report of the study, the review and the proposal by the author on the issue of digital art and design based on media technology. It also has to include the novelty and academic values which can be shared with ADADA members or the people who study digital art and design.
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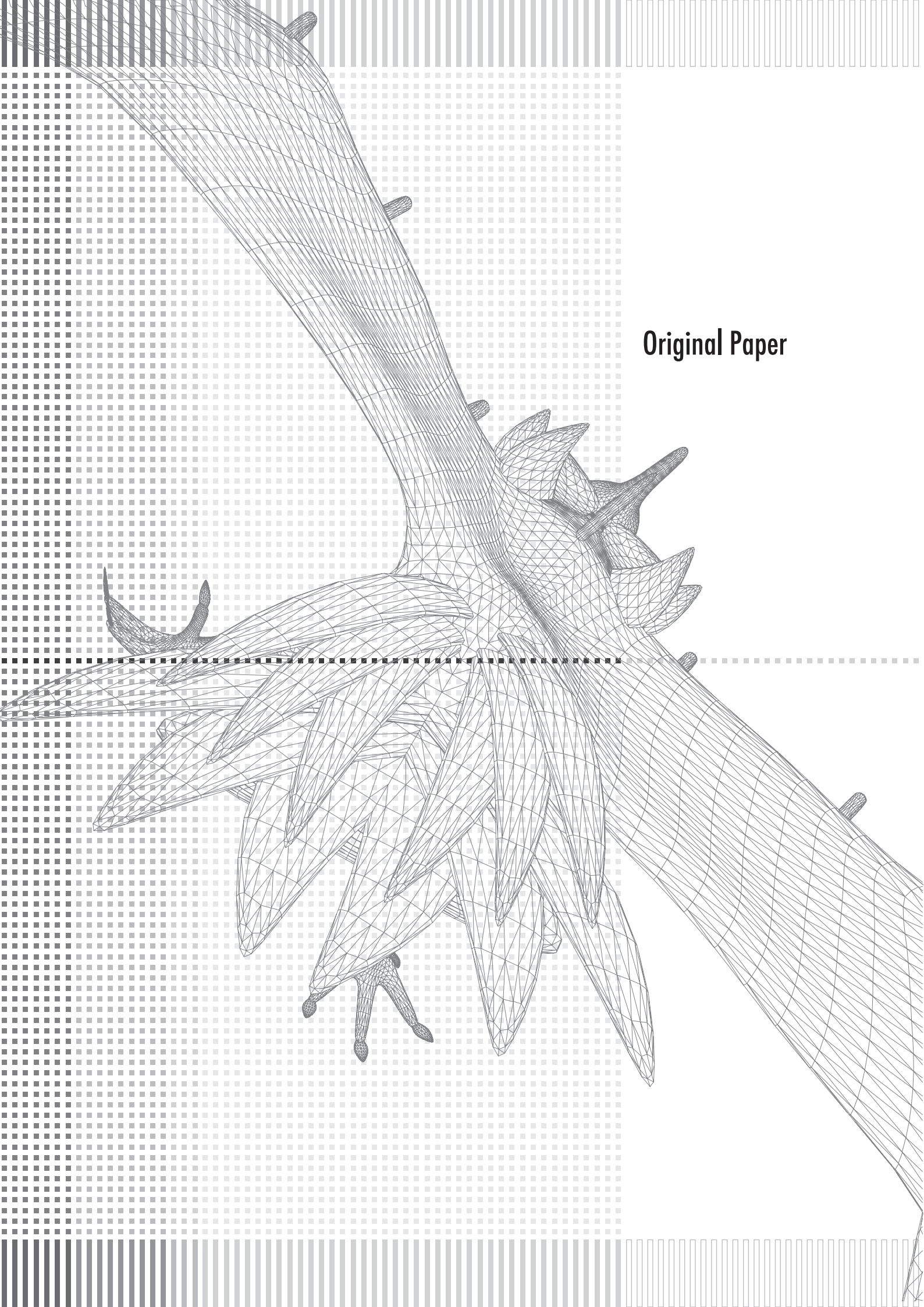

Original Paper

Received September 28, 2013; Accepted December 27, 2013

International Journal of Asia Digital Art&Design

Discussion on Using Mockumentary Staging Techniques in the Creation of Frightening Imagery

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Abstract
Recently in the horror genre of films, mockumentary staging techniques have often been utilized. A mockumentary is a staging technique by which the audience is led to believe that a created work of fiction is actually a documentary. In this paper, taking societal backgrounds into account, we used subjective evaluation experiments to determine why mockumentary staging techniques are so frequently utilized in today's film industry, particularly in the horror genre. Furthermore, in our subjective evaluation experiments, we clarified the significance of the POV (Point-of-View) aspect - a frequently used staging technique when presenting imagery in the mockumentary genre (hereafter mockumentary) - and also the significance of inserting the film's premise at the storyline's beginning. From this, we discussed a depiction of frightening imagery through mockumentary staging techniques.

Keywords: film , documentary , staging techniques

1. Introduction

In recent years, utilizing staging techniques to create a mockumentary, a pseudo-documentary, has been popular in the horror film genre. Mockumentary is a term coined from "mock" and "documentary" and holds the meaning of something which mimics or imitates (or, in some cases, parodies). Mockumentary staging techniques present a fictional work as a non-fictional documentary. One factor that led today's film industry to favor the mockumentary style is that filming itself has become readily accessible to ordinary people. Since Sony first introduced its Handycam in 1985, commercial camcorders have rapidly spread and have been constantly improved. Today's camcorders have evolved into high-quality units capturing high-definition imagery. As camcorders became smaller and gained more functionality, it became possible for anyone, at any time, to film/record high-quality images of any subject. Furthermore, because cell-phones and digital cameras are now capable of image recording, filming has grown to be part of everyday life for many people. Meanwhile, on the Internet, video-sharing websites such as YouTube and Nicovideo came to be widely used and made filming an essential part of people's lives. Because of the above-mentioned environmental factors enveloping the general public, it can be said that easy access to filming is one of the contributing factors that make today's mockumentary films successful. Based on these points, through our subjective evaluation experiments using original short films, we will review and discuss the conditions by which mockumentary staging techniques become effective for the films in which they are used.

2. Background and Research Goal

Using the Internet is now an indispensable part of daily life and acquiring cinematic information is no exception; many people utilize internet services to obtain information about soon-to-be-released movies. In mockumentary films, the depth to which the audience believes what they are viewing is non-fiction is determined by the effectiveness of the staging techniques presented to them. In *The Blair Witch Project* (USA, 1999), a mockumentary film released in 1999, a mix of media tie-ins, including the use of the Internet as an advertising tool, produced successful results. Prior to its release, the filmmaker launched a website (http://www.blairwitch.com/) (Figure 1) that provided information about the movie and introduced the Blair Witch Legend, a folklore created to serve as the film's premise, to the website's visitors. *The Blair Witch Project* had a production budget of only $30,000 but because the information on the website evolved organically as people's curiosity grew, the movie became a blockbuster hit with the box office revenue of $200 million. Motivated by the success of this movie, mockumentary staging techniques came to be widely used in the 2000's horror movies. Elements common amongst these movies include the insertion of the film's premise and the use of a subjective point-of-view (hereafter POV shot). In this paper, the insertion of the film's premise is defined as being the presentation of story background and settings at the beginning of the movie; the POV shot is defined as unfolding the scene through a character's point-of-view, which leads the audience to feel that they too are participating in the scene as it is presented. Because the POV shot is presented with shaky or out-of-focus camera shots, which is very similar to the type

Figure 1 The Blair Witch Project Official Movie Site (A Timeline in the History of the Blair Witch)

of recordings people would make when they use their own portable devices (e.g. cameras), the POV technique increases the realism for the viewer. In this paper, by identifying the effect of mockumentary films based on the above mentioned aspects, we think it is possible to define what makes for a frightening depiction of events specific to mockumentary staging techniques. To achieve this, we conducted subjective evaluation experiments to determine how the insertion of the film's premise and the use of a POV shot contribute to the staging of a mockumentary film.

3. Commonality in Mockumentary Horror Movies

Based on the assumption that today's horror movies often make use of mockumentary techniques, i.e. documentary-like imagery, rather than following conventional, storyline-based filming techniques, this paper will discuss commonalities found in mockumentary horror movies before discussing the effectiveness of mockumentary techniques.

3.1. Insertion of the Film's Premise

One of the common elements found in a number of mockumentary films is that the insertion of the film's storyline premise at the film's beginning is presented as if it is part of a documentary. The meaning of "insertion of the film's premise" is that at the beginning of the film there are scenes (refer to Figure 2) which present the story background and settings. This technique was observed in numerous mockumentary horror movies recently released. In mockumentaries, this insertion of the film's premise not only serves to explain the situation under which the film's sequences were recorded/saved but also sets up the precondition under which the viewer will watch the story that has been composed of those sequences. By presenting the film's premise, the setting in which the filming was done becomes clear and the POV technique used to film the story is now understandable. One example from recent movies is a panic movie titled *Cloverfield* (Figure 2). This movie starts with a scene which reads "Multiple sightings of case designate 'Cloverfield.' Camera retrieved at incident site U.S. 447 area formerly known as 'central park.'" This movie is presented under the premise that it is recorded footage of an incident, implying that the sequences of the storyline were recorded through POV shots. Also, in the movie titled *The Fourth Kind* (Figure 3), an actress appears at the story's opening saying "I am actress Milla Jovovich and I will be portraying Dr. Abigail Tyler. This film is a dramatization of events that occurred October 2000 in Alaska. To better explain the events of this story, the actual archived footage was included. This footage was acquired from psychologist Dr. Abigail Tyler, who has personally documented over 65 hours of video and audio materials." This presents the film's premise that the composition of this film is a mix of dramatization and archived footage of a psychologist.

Figure 2 Opening of Cloverfield
Cloverfield. Dir.Matt Reeves. Perf. Michael Stahl-David. Paramount Pictures,2008.

Figure 3 Opening of The Fourth Kind
The Fourth Kind. Dir. Olatunde Osunsanmi. Perf. Milla Jovovich. Universal Pictures,2009.

3.2. POV Shots

Another common element in addition to the insertion of the film's premise is the use of a POV shot. Although the movies *[REC]* and *The Blair Witch Project* are often referred to as representative works of the POV technique, this type of shot is often utilized in action and suspense scenes. This allows the camera's angle to match with a character's point-of-view, leading the viewer to feel that they are part of the story. Most movies using the specialized filming technique of a subjective shot often require the insertion of an explanatory scene at the beginning or end of the movie to make the story natural. However, thanks to the insertion of the film's premise in those movies, their POV shots do not require this explanation.
Normally, filming is done with much consideration given to

technical aspects such as mounting the camera on a tripod for stabilized image quality or shooting in a studio with lights to minimize interference from weather and natural light conditions. However, films shot under those conditions often include artificial aspects and, based on director's intention, the imagery captured within the viewfinder is generally narrowed down to contain a minimal amount of information. On the other hand, these aspects of POV films - unstable image quality, shaky shots or the sound of the cameraperson breathing - often become advantages that are important in making the movie highly realistic to the viewer.

3.3. Discussion of the Insertion of Film's Premise and POV Shots

We have shown that a number of films use the techniques discussed in the previous section. Based on this finding, it can be said that these techniques are essential elements in determining what makes a frightening depiction within the mockumentary genre. In this paper, by identifying the characteristics and effects of the insertion of the film's premise, and the use of POV shots, on mockumentary films, we believe it is possible to analyze frightening descriptions specifically created through mockumentary staging techniques. To achieve this, we produced multiple sets of sequences that followed a specific pattern and conducted subjective evaluation experiments using that imagery to see how the insertion of the film's premise and the use of a POV shot contribute to the film's effect.

4. Subjective Evaluation Experiments

4.1. Experiment Description

In this study, we conducted subjective evaluation experiments with specific regard to the techniques of inserting the film's premise and the use of a POV shot, both of which are common in mockumentary horror movies. Then, we will use the result in an attempt to define which elements of a frightening depiction are specific to mockumentaries. For films to be used in the subjective evaluation experiments, we produced three kinds of shots with varying staging techniques. Conducting a comparative analysis on data acquired through the subjective evaluation experiments according to the three different shot patterns, we then investigated the effect and characteristics of each staging technique for those shots. Figure 4 shows a conceptual diagram of the comparative analysis.

1) Subjects

Experiment participants: Japanese Males (41) and Japanese females (19) between the age of 18 and 25

∗ Shot A: 20 individuals, Shot B: 20 individuals, Shot C: 20 individuals

2) Procedure

The experiments were conducted on one side of a studio located at Kyushu Sangyo University. In the experiment room, lights were off and the computer workstation used to view the video was partitioned (Figure 5) so that several subjects could view shots at the same time. The subjects viewed the sequences on a 20-inch computer monitor with headphones. Additionally, the subjects were divided into assigned groups by type of shot - A, B or C - and viewed only one type of shot. Prior to the experiments, the subjects were informed that the experiments were about frightening imagery. After the experiments, the subjects were to fill in questionnaires on a scale of one to five.

Figure 5 Experiment Device

3) Shots of Experiment

To assess subjective evaluations with specific regard to the insertion of the film's premise and the use of a POV shot through cross comparisons, we produced different shot patterns in accordance with the experiment's purpose. Since this is a comparative experiment on the effects of the insertion of the film's premise and the use of a POV shot, we created Shots of Experiment using a consistent storyline to clarify the individual characteristics of those components. The content of the experiment shots is as follows.

Shot pattern used in the experiments

- Shot A: Raw footage captured by handheld camera(1min)
- Shot B: Composed of staged shots with background music(2min and 4sec)
- Shot C: Shot A imagery with the film's premise inserted(2min and 5sec)

A composition of shot patterns is shown in Figure 6.

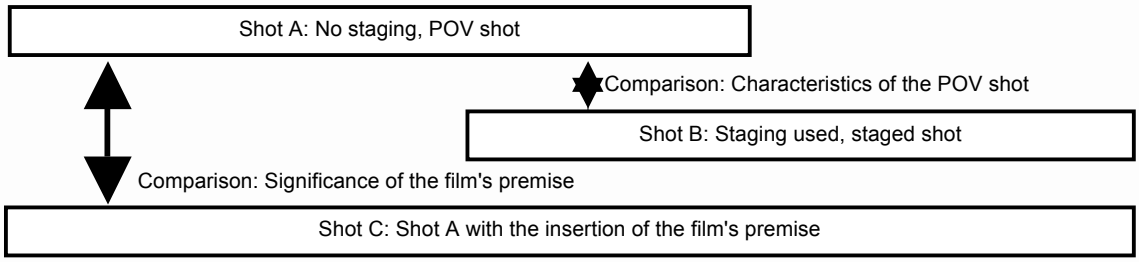

Figure 4 Conceptual Diagram of the Comparative Analysis

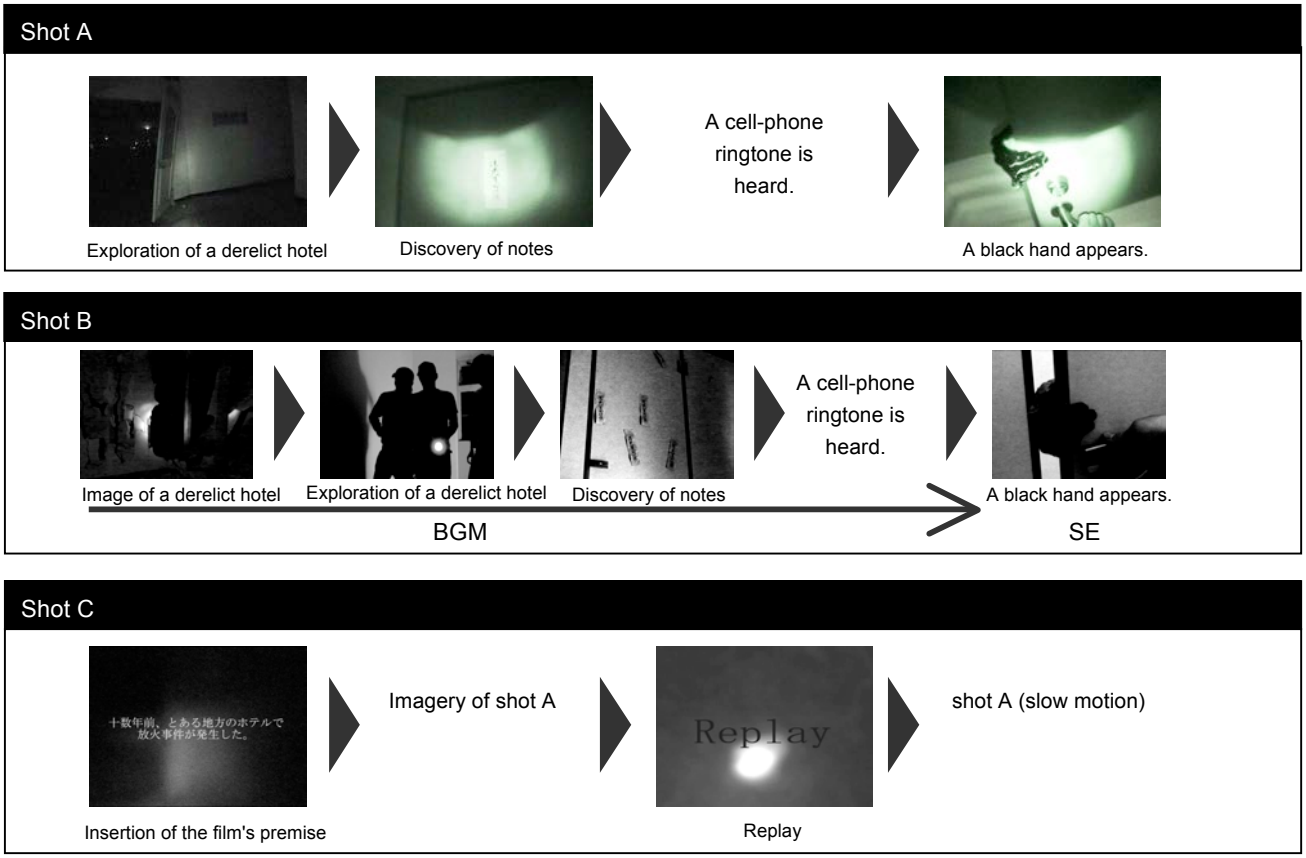

Figure 6 Composition of Shots of Experiment

4) Story

Shot A, B and C were produced using a consistent storyline. The storyline: Three male university students enter a derelict hotel on a dare. Inside, they find a door that has some notes affixed to it and, at that location, have a frightening experience.

5) Selection of Evaluation Terms

For evaluative terms, 29 students chose 118 adjectives that are considered as being associated with the depiction of horror movie scenes and then narrowed it down to 25 suitable evaluative terms. Evaluation terms used in the questionnaire are as follows:

暗い(Gloomy), 驚きを感じる(Surprising), 気持ち悪い(Gross), ぞっとする(Creepy), 不気味である(Spooky), 奇怪である(Bizarre), 醜い(Ugly), 不快である(Uncomfortable), 臨場感(Dramatic), ありえるような(Plausible), 写実的である(Realistic), すぐ近くの(Within striking distance), 自然な(Natural), 引き込まれる(Engaging), 謎である(Mysterious), 緊張感が高まる(Growing tension), 未知的な(Unknown), ストーリー性のある(Story-telling), 難解である(Difficult), 単純な(Simple), 不思議な(Enigmatic), シュールである(Surreal), ザラザラした(Coarse), 荒い(Harsh), 見やすい(Conspicuous).

5. Results and Discussion

5.1. Analysis 1 (Shots A and B - Principal Component Analysis)

To determine characteristic features of Shot A and B, we conducted a principal component analysis.

Under Component 1 (Table 1) of Shot A, loadings were higher for the following adjectives:

暗い(gloomy), 驚きを感じる(surprising), 気持ち悪い(gross), ぞっとする(creepy), 不気味である(spooky), 奇怪である(bizarre), 醜い(ugly), 不快である(uncomfortable), 写実的である(realistic), すぐ近くの(within striking distance), 引き込まれる(engaging), 緊張感が高まる(growing tension), 未知的な(予見できない)(unknown (unpredictable)), ザラザラした(Coarse), 荒い(Harsh).

This component was designated as the "**horror component**."

Under Component 2, higher loadings were seen for the following adjectives:

謎である(Mysterious), 不思議な(Enigmatic), シュールである(Surreal).

This component was designated as the "**mystical component**."

Next, with Shot B, the adjectives that showed higher loadings for Component 1 (Table 2) are as follows:

臨場感(Dramatic), 引き込まれる(Engaging), 謎である(Mysterious), 未知的な(予見できない)(unknown (unpredictable)), ストーリー性のある(Story-telling).

Table 1 Component List of Shot A

	Component	
	1	2
Gloomy	**.663**	.074
Surprising	**.880**	-.205
Gross	**.887**	.220
Creepy	**.864**	.159
Spooky	**.891**	-.097
Bizarre	**.746**	.262
Ugly	**.549**	.514
Uncomfortable	**.532**	.414
Dramatic	.132	-.302
Plausible	.086	-.727
Realistic	**.448**	-.039
Within striking distance	**.492**	-.223
Natural	.133	-.260
Engaging	**.751**	-.112
Mysterious	.272	**.556**
Growing tension	**.637**	.128
Unknown (unpredictable)	**.629**	.064
Story-telling	.410	-.444
Difficult	-.153	.472
Simple	-.279	-.587
Enigmatic	.006	**.751**
Surreal	-.493	**.584**
Coarse	**.581**	-.288
Harsh	**.509**	-.250
Conspicuous	.499	-.189

Table 2 Component List of Shot B

	Component	
	1	2
Gloomy	-.464	.779
Surprising	.375	.157
Gross	-.461	**.544**
Creepy	.181	.451
Spooky	.249	.434
Bizarre	.125	**.570**
Ugly	-.677	.430
Uncomfortable	-.582	.317
Dramatic	**.500**	.051
Plausible	.338	-.064
Realistic	.240	.245
Within striking distance	.490	.432
Natural	.245	-.040
Engaging	**.537**	.006
Mysterious	**.500**	.485
Growing tension	.374	.222
Unknown (unpredictable)	**.632**	.483
Story-telling	**.683**	-.150
Difficult	-.507	.258
Simple	.483	-.346
Enigmatic	.054	**.816**
Surreal	**.523**	**.525**
Coarse	.331	.174
Harsh	.103	.486
Conspicuous	.449	-.253

This component was designated as the "**entertainment component**."

Under Component 2, loadings were higher for the following adjectives:

暗い (Gloomy), 気持ち悪い (Gross), 奇怪である (Bizarre), 不思議な (Enigmatic), シュールである (Surreal).

This component was designated as the "**eerie component**."

1) Discussion of Shot A and B

Based on the subjects' impressions, we found the following components in each of experiment shots.

- Shot A

  Horror component, mystical component

- Shot B

  Entertainment component, eerie component

Although the Shot A mockumentary was only a short sequence, it still delivered horror elements as well as some mystical aspects. On the other hand, Shot B held entertainment aspects but, as a horror film, did not have as many horror elements as Shot A; instead, it only contained an eerie component.

5.2. Analysis 2 (Shot A and C - Factor Analysis) (Table 3)

Table 3 Loadings of Each Factor

	Factor				
	1 Horror level	2 Roughness level	3 Entertainment level	4 Realism level	5 Clarity level
Gross	**.963**	.131	−.226	.021	−.013
Creepy	**.961**	−.244	−.041	.165	.214
Ugly	**.856**	−.163	−.059	−.128	−.039
Bizarre	**.760**	−.001	.037	−.165	.063
Spooky	**.591**	.262	.112	.129	.013
Surprising	**.411**	.334	.312	−.014	.058
Harsh	−.121	**.920**	.122	−.116	−.074
Coarse	−.040	**.815**	.044	−.042	.049
Gloomy	.272	**.560**	−.188	−.051	−.340
Within striking distance	−.139	**.418**	−.056	.241	−.071
Enigmatic	−.092	−.016	**.781**	−.333	−.140
Natural	−.299	.023	**.699**	.226	.064
Unknown (unpredictable)	.112	.080	**.605**	−.065	.128
Growing tension	.043	.226	**.523**	.008	.121
Engaging	.171	.093	**.401**	.312	.292
Plausible	−.131	−.062	−.127	**.903**	−.094
Realistic	.180	.022	.075	**.646**	−.419
Conspicuous	.141	−.006	−.133	−.241	**.754**
Dramatic	.013	−.165	.166	−.091	**.514**
Simple	−.324	.305	−.596	.092	**.353**

Correlation among Factors

Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
1.000	.445	.568	.196	.084
	1.000	.430	.275	.204
		1.000	.211	.267
			1.000	.410
				1.000

Software: SPSS

Rotation: Promax rotation

Extraction method: Principal factor analysis

The aim of this analysis is to determine whether the viewer's impression can be altered through the insertion of the mockumentary film's premise. Because Shot A and C are both mockumentaries, it was thought that an analysis at deeper psychological levels than the previous analysis was necessary for this comparison. To do this, a factor analysis was first conducted on data from Shot A and C; mockumentary film factors were extracted; and then the score for each factor, calculated by simple addition, was used to compare data between Shot A and C.

1) Factor Analysis Results (Table 4)

Using scree plots, the number of factors was determined to be five. Then, a principal factor analysis was used to extract the factors, upon which a promax rotation was applied. For Factor 1, the adjectives gross, creepy, ugly, bizarre, spooky and surprising received higher factor loadings, so this was designated as the "horror level" factor. For Factor 2, the adjectives harsh, gloomy and coarse received higher factor loadings and, as a result, was designated as the "roughness level" factor. For Factor 3, the adjectives enigmatic, natural, unknown (unpredictable), growing tension and engaging received higher factor loadings, so this was named the "entertainment level" factor. With higher factor loadings in the adjectives plausible and realistic, Factor 4 was designated as the "realism level" factor. Lastly, Factor 5 was designated as the "clarity level" factor for its higher loadings in the adjectives conspicuous, dramatic and simple. Now, after calculating the score (-2 to +2) for each factor through simple addition and then averaging it, the results were compared.

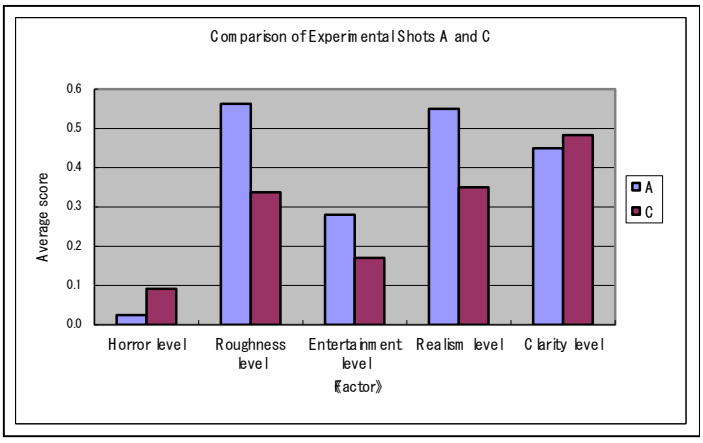

Table 4 Graph Illustrating Comparison for Each Factor

2) Comparison of Shot A and C

Although significant difference was not seen among any of the factors, Shot A showed slightly higher significance in the roughness, entertainment and realism level factors. However, no statistical significance in the horror level - the most important factor in horror films - was observed between these two Shots of Experiment.

6. Subjective Evaluation Experiment

Conclusion

In Analysis 1, after performing a principal component analysis for both shots, it was found that the characteristic features of Shot A, which used POV shots, were different from those of Shot B, which did not use POV shots, even when both shots used the same storyline in its short sequence. Of horror movie characteristics, Experiment Shot A contained various elements as a horror film whereas only the eerie component was noticed in Shot B. Based on these findings, it was determined that while a POV shot in a mockumentary provides little, easy-to-see information, it is more effective when it comes to depicting frightening imagery.

For Analysis 2, mockumentary film factors were determined and two Shots of Experiment were used to compare each of these factors. As a result, the following factors were extracted: horror level, roughness level, entertainment level, realism level and clarity level. In Shot A, in which the film's premise was not inserted, significance was observed for the roughness and realism level factors. However, between the two Shots of Experiment, there was no significant difference in the clarity level or in the horror level, the factor most important in a horror movie. One explanation for this result is that inserting the premise in a reality-based POV shot may give the viewer an impression of artificiality. However, the reality is that most of today's mockumentary films include the insertion of the film's premise. With regard to this point, it can be said that for mockumentaries with longer running times, unlike our short sequence Shots of Experiment, it remains essential that the audience understands the story setting even if doing so decreases the film's realism.

7. Discussion

In this study, we identified the insertion of the film's premise and the use of a POV shot as characteristics of mockumentary staging techniques that create a frightening depiction. In subjective evaluation experiments, different shot patterns and five-point scale questionnaires regarding those shots were used to analyze the characteristics and effects of these techniques on imagery. An analysis of the results found that Shots of Experiment using mockumentary staging techniques contained various elements of horror movies and were therefore effective in depicting horror imagery to the viewer. At the same time, however, a problem point identified was that inserting the film's premise could lead to a deterioration of realism and that it could have an adverse effect if it was not presented with caution.

It can be noted that there has been a recent trend to using mockumentary staging techniques in amateur movies. Originally, mockumentary was a filming style that was frequently seen in independent films. Because it does not require a large production budget nor specialized equipment, it is considered as an easy-to-use technique for amateur filmmakers. However, because the POV shot technique provides a minimal amount of information through its imagery, we believe a carefully crafted approach to story plotting and settings is important in making high-quality POV shots.

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Received September 20, 2013; Accepted December 27, 2013

International Journal of Asia Digital Art&Design

A Method for Composing Ad-hoc Following Networks on Twitter for Sharing Information among Event Participants

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Abstract
Twitter is one of the most popular micro blog services in the world. It has a large number of users and posts. One of the reasons why so many people uses Twitter is that they can use it easily and can obtain many kinds of information in real time. On Twitter, information is delivered via following networks. The following networks on Twitter are static and have to be specified manually by each user, so a user cannot share information that he/she wants if that was out of his/her following networks. On the other hand, it often happens that users want information about an event such as festival or sport game when they are attending it. In this paper, we propose a method for composing ad-hoc following networks automatically among users who are attending the same event for sharing information about it.

Keywords: Twitter, Ad-hoc following network, information sharing

1 Introduction

Micro blog systems, which are one of SNS (Social Networking Service), are becoming popular in these days. In Twitter, users can send messages which are called "tweets" within 140 characters and the messages are sent to their followers. For example, if a user ("A") follows another user ("B"), tweets of "B" are sent to "A" in real time. Moreover, each user can select the followees (twitter users the user is following) without approval of them. Therefore a user can obtain information about topics that the user is interested in by following other users who are also interested in the same topics.

The following network of a user is generally composed of family, friends, and/or acquaintances and it is static. Therefore it does not change dynamically depending on purposes of the user. In other words, Twitter can only support to share information within a closed community. Of course, it is very useful as a daily communication tool, but it would be sometimes inconvenience when following situations:

- when user want information about an event such as concert or festival which he/she is attending,
- when user want information about a sport game which he/she is watching, and
- when user want information about an accident or disaster which he/she is involved.

In these situations (we call it "event" in this paper), a user can't obtain information about the event that the user is attending because the followees of the user would not attend the same event. When user tries to obtain information about the event in real time, popular solutions are to use BBS or to use other SNS that provide community functions. However, Twitter has a larger number of posts than other BBSs and SNSs. For example, about 2,500 messages (tweets) were posted on Twitter related to "JOIN ALIVE 2012", which is a summer music festival in Japan. On the other hand, only about 200 messages were posted on 2ch, which is the most popular BBS in Japan. Therefore, we think that it is effective to use Twitter for obtaining information about an event from its participants.

In order to obtain information about a topic, Twitter provides a search function. Using the search function, users can find tweets that contain the words that they send as a query. However, it is very difficult and ineffective for users to check all of the search results because they would contain a lot of tweets, so effective solutions for selecting important tweets are required.

In order to gather tweets that concern a specific topic, the hash tag system is widely used on Twitter. Hash tags are words or phrases prefixed with the symbol #. They could be included in tweets and works as tags on the tweets. However, all of tweets do not contain the hash tags because they have to be attached to tweets explicitly by users. Also, the tweets that concern to the same topic do not always have the same hash tag. For example, different hash tags "#JOIN_ALIVE" and "#JOIN_ALIVE_2012" were used for sharing information about the JOIN ALIVE 2012.

For those reasons, we propose a system that can construct following networks (we call it ad-hoc twitter following network) with users who are attending the same event (we call it a *reporter*). Using our system, you can obtain information about an event on twitter easily and efficiently by following the reporters. Figure 1 shows an example of a conventional follow network on Twitter. On the other hand, Figure 2 shows an example of an ad-hoc following network that is provided by our system.

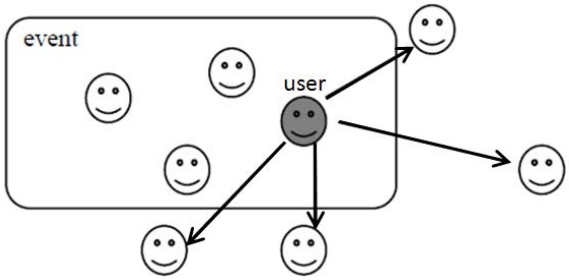

Figure 1: Conventional following network on Twitter

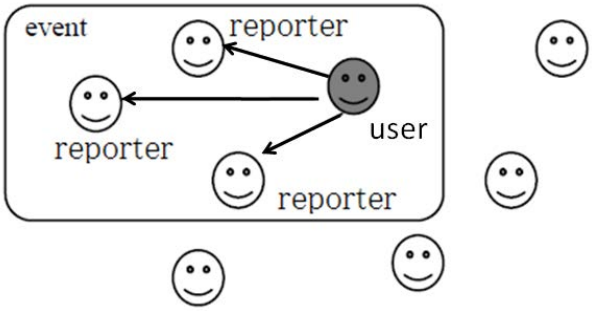

Figure 2: Ad-hoc follow network on Twitter

Figure 3 shows an overview of our system. The system works as follows.

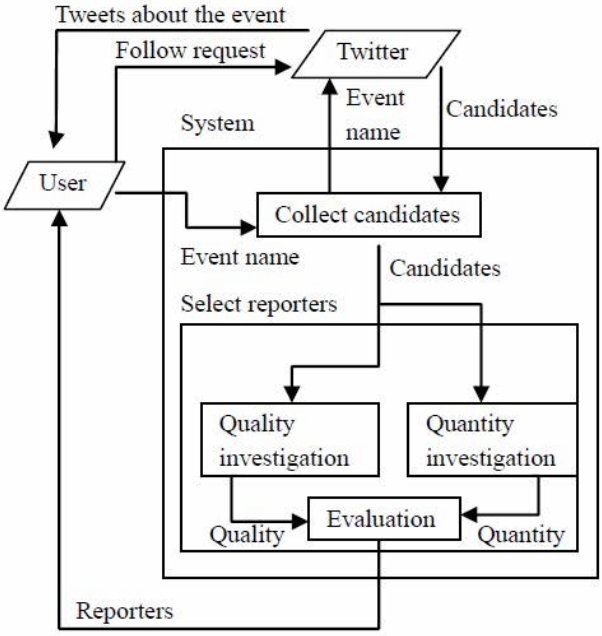

Figure 3: Overview of our system

(1) A user inputs the name of an event (e.g. the name of a festival, a sport game, or a TV program) as a query.

(2) The system finds candidates of reporters from Twitter by using the query.

(3) The system selects conclusive reporters, who post valuable tweets about the event frequently. In order to select the reporters from the candidates, the system evaluates quality and quantity of each candidate's posts. We will explain it in more detail in section 3.

(4) The system recommends the reporters to the user. By following one or more of the recommended reporters during the event, they can compose a follow network for the event temporally and obtain information about the event in real time.

2 Related Works

In the last few years, many researchers analyzed Twitter and tried to discover some unknown features in human society such as trend or public opinion, etc. The reason why they use Twitter is that it deals with overwhelming information. Twitter is the most appropriate social media to statistically analyze trend or opinion of the public. Bernardo et al. [6] researched about the correlation between the number of follow/follower on Twitter and the number of real friends. Also, Danah et al. [7] classify the usage of retweets by its purpose. These researches are types of studying about the characteristic of Twitter itself.

On the other hand, there are also many researches that detecting a phenomenon or tendency of society by analyzing Twitter. Wakamiya et al. [1] proposed a Twitter-based estimation of behavior of TV audience for better TV ratings. They analyzed tweets for specifying the users who were watching a certain TV program. Then they estimated the TV ratings from the tweets of the users. They said that the advantages of using Twitter are followings:

(1) people can use Twitter with almost no cost, and

(2) people can obtain not only the TV ratings but also opinions or sentiments of TV audience simultaneously.

Similarly, Jansen et al. [2] proposed an approach to gather consumer opinions concerning a brand, and Akcora et al. [9] utilized Twitter to identify breakpoints and capture trends in public opinion.

Moreover, Twitter is also used to detect events promptly. For example, Sakaki et al. [3] introduced a system that can detect earthquakes by monitoring tweets, and Aramaki et al. [4] proposed an approach to detect Influenza Epidemics using natural language processing techniques. Most of these researches utilized SVM [8] in order to classify the tweets.

Sugitani et al. [5] presented a technique for detecting local events by analyzing tweets regionally. They implemented a system that can detect not only big events but also small local events by observing tweets in real time. The advantages of using Twitter, they said, there is time lag between the event occurring time and the time when some articles or blogs about it are uploaded in most cases. It means that some articles and blogs are uploaded after the event. On the other hand, most of tweets about the event are posted in real time. They focused on the fact that most of tweets about an event are posted intensively at the time and place, so they executed clustering for the tweets about time and place. If some peculiar words would be detected in the cluster, they supposed it as a related word about the event and judged that there is an event at the place.

3 Method

In this paper, we focus on recommending twitter users (reporters) rather than tweets. The reasons are followings.

- If the system detects important tweets about an event, the system has to search tweets that include characteristic features of the event and select some important tweets from them. In such case, if a tweet does not have any related words, it could not be recommended even if it has important information about the event. In fact, there are a lot of such cases in actual events and twitter timelines. Thus, the above approach would tend to miss important tweets.
- It requires much time to estimate the importance of each tweet every time when user requests. On the other hand, if the user follows the recommended reporters once, they can obtain tweets that have information about an event without consulting the system.

3.1 Collecting reporter candidates from Twitter

First step is collecting Twitter users who are supposed to be participating in the event and post tweets about the event. The most typical criterion for evaluation is whether the user posts tweet that includes the name of the event. Hence, the system searches tweets that include the name of event with Twitter API. For example, when user posts query "oman" during the soccer game "Japan vs Oman" which was played on November, 4th 2012, the search results would be like "Oman is leading by one point!" or "Japan vs Oman, so exciting!" However, there may be many tweets that are related to the same soccer game even though they don't include the word "oman" itself. For example, the tweet "I'm watching the world cup elimination round, Japan is leading by one point!" doesn't contain the word "oman", but it can be considered to be related to the same game. Like this, there is a possibility that some users will be candidates even though they don't post tweets that contain the query word itself. In order to solve this problem, the system uses related words. For example, in this case, if the system specifies related words such as "World Cup" or "elimination round", the users who posted tweets that contain the related words can be added to the candidates.

3.2 Specifying related words

At first, the system collects co-occurring words with the query word in each searched tweet. Fig 4 shows the co-occurring words with the word "oman" and their ranking by the number of occurrences. However, it is not appropriate to use these words as related words. This is because that for example the word "man" and the word "elimination round" shows the same number in the fig 4 but the word "man" is considered to be used in many topics besides the soccer game. On the other hand, the word "elimination round" is considered to be used only in the soccer game topic. In this case, the word "man" has to be considered as less important related word, and the word "elimination round" has to be considered as more important related word. To compute such importances, our system emploies cosine distance. The cosine distance is defined as follows.

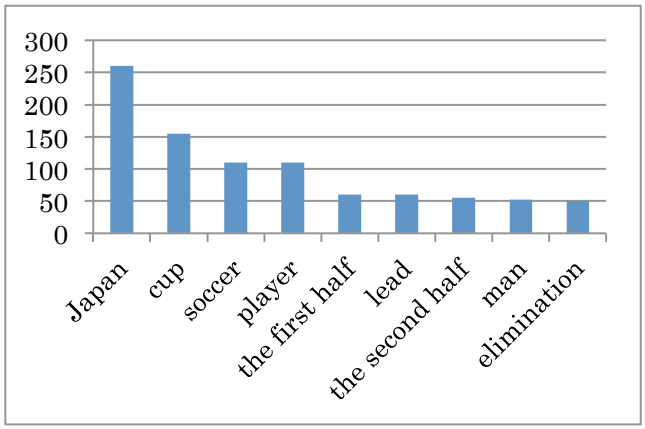

Figure 4: Ranking of co-occurrence words and its number of occurrences

In the formula (1), X refers a set of tweets which contain the query word and Y refers a set of tweets which contain a co-occurrence word (fig 5 shows "the second half" as a example of co-occurrence word).

$$\cos(X,Y)=\frac{|X\cap Y|}{\sqrt{|X||Y|}} \qquad \ldots(1)$$

However, it's almost impossible to count the accurate number of each set of tweets in Figure 5, because twitter has enormous number of tweets. Therefore, we compute the ratio of each number of tweets as the following two steps.

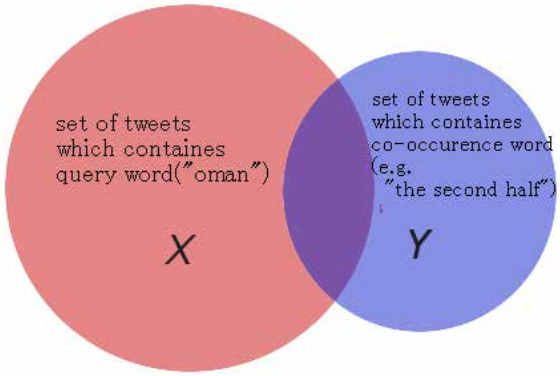

Figure 5: Conceptual diagram of cosine distance

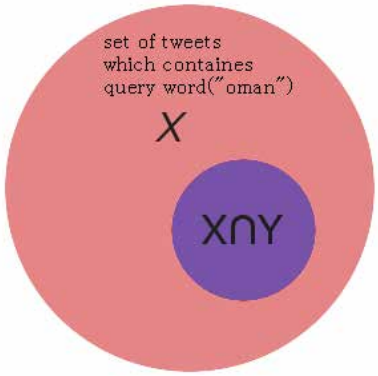

Figure 6: Computation of the ratio (1)

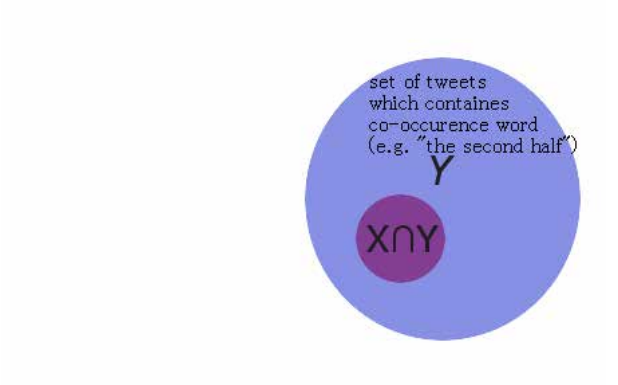

Figure 7: Computation of the ratio (2)

1. In the set of tweets that contain the query word, compute the ratio of the number of tweets that also contains the co-occurrence word at the same time.
2. In the set of tweets that contains the co-occurrence word, compute the ratio of the number of tweets that also contains the query word at the same time.

For instance, when the results of steps 1 and 2 are 1/10 and 1/8 respectively, the formula of the ratio is shown as follows.

$$X : X \cap Y = 10 : 1$$
$$Y : X \cap Y = 8 : 1$$
$$\therefore X : Y = 10 : 8$$

As a result, the formula of cosine distance is shown as follows.

$$\cos(X,Y) = \frac{1}{\sqrt{10 \cdot 8}} = \frac{1}{4\sqrt{5}}$$

Figure 8 shows the ranking of the words with the cosine distance in this case. A vertical axis shows the value of cosine distance between the word and the query word. As this figure shows, the value of general words like "man" became low, and the value of niche words like "elimination round" became high. In this paper, we use the cosine distance as the value of relevancy between the related word and the query word.

As we described in section 3.1, the system adds the users who posted a tweet that contain the related word to the candidates of reporter.

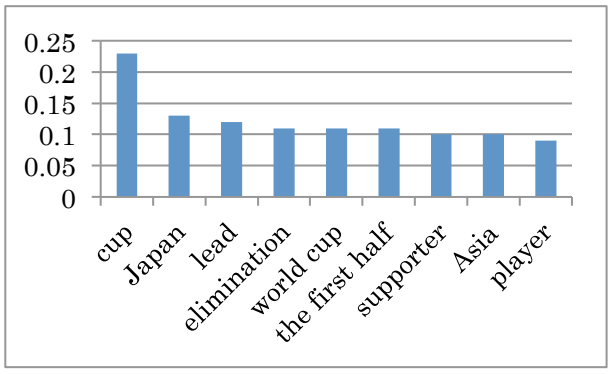

Figure 8: Ranking of cosine distance

3.3 Selecting reporters

Next, the proposed system selects conclusive reporters from the candidates. The requirements of reporters are shown as follows:

1. the users who will post tweets that are related to the event constantly, and
2. the contents of tweets are informative.

Therefore, the requirement 1 means the quantity factor of the user's tweets, and the requirement 2 means the quality factor of the user's tweets. We describe how to evaluate the quantity and quality factor in the next section.

3.3.1 Importance of quantity factor

The proposed system counts the number of user's tweets that is related to the event in order to evaluate the quantity factor of the user's tweets. In this paper, the system counts only tweets that are posted within the latest 5 hours. Also, if a tweet has at least one related word, the system regards it as related tweet to the event.

Formula 2 shows the definition of the value of user's quantity evaluation, where *av* refers "amount value", *u* refers "user", *t* refers "tweet", and *T(u)* refers the set of tweets that a user *u* has posted within the latest 5 hours.

$$av(u) = \sum_{t \in T(u)} \phi(t) \quad \ldots(2)$$

$$\phi(t) = \begin{cases} 1 & (\text{if the tweet has at least one related word}) \\ 0 & (\text{if the tweet doesn't has any related word}) \end{cases} \quad \ldots(3)$$

3.3.2 Importance of quality factor

Here, we would explain how to evaluate the value quality factor of the user's tweets. In this paper, the proposed system counts the related words that are included in the user's tweets in order to evaluate the quality factor of the user's tweets. For instance, Figure 9 shows example tweets of a candidate. In this case, the first tweet has four kinds related words and the total number of cosine value is 0.35. Therefore, the quality value of this tweet is 0.35. On the other hand, the second tweet has only one related word and its cosine value is 0.04, so the quality value of this tweet is 0.04. Like this, the system evaluates the quality factor of each tweet and as a result, it can evaluate the value of quality factor of each candidate by computing the average value per tweet.

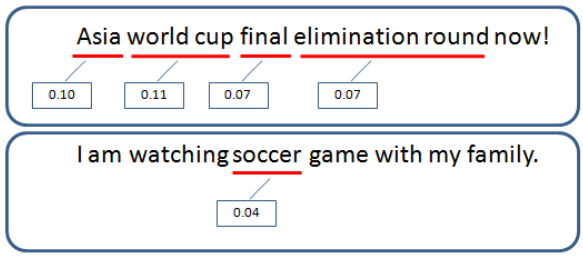

Figure 9: Example tweets

Because of this evaluation, a candidate who posts so many tweets that are not related to the event is rated too low, even though he/she may be rated high in the evaluation of quantity factor.

Formula (4) shows the definition of the value of user's quality evaluation, where *qv* refers "quality value," *u* refers "user," *t* refers "tweet," *T(u)* refers the number of tweets that the user(u) has posted within the latest 5 hours, and *w* refers the set of related words.

$$qv(u) = \frac{\sum_{t \in T} \sum_{w \in W} \varphi(t,w)\gamma(w)}{|T|} \quad \ldots(4)$$

$$\varphi(t,w) = \begin{cases} 1 & \text{(if the tweet has the related word w)} \\ 0 & \text{(if the tweet doesn't have the related word w)} \end{cases}$$

$\gamma(w)$: value of cosine distance of the word w $\quad \ldots(5)$

3.3.3 Conclusive importance of the candidate

The proposed system computes the value of conclusive importance by calculating the product of quantity value by quality value. We define the *tv*, which refers "total value." Because of the criteria of the quantity and quality value, as we described in 3.3.1 and 3.3.2, the candidates who often posts informative tweets that are related to the event are selected as conclusive reporters. The formula of the conclusive evaluation is shown as follows.

$$tv(u) = av(u) \cdot qv(u) \quad \ldots(6)$$

4. Evaluation

4.1 Procedure

In order to evaluate the reporters who are recommended by this system, we did an experiment. The subject of the event is "えべっさん", which was held in Osaka, Japan on January, 11th 2013.

We did this experiment relatively by comparing the tweets that were posted by the reporters and the tweets that were posted with the hash tag "#えべっさん." Moreover, we also evaluated the effectiveness of the related words by comparing the results of tweets that were acquired using the related words and not using it. The concrete procedure is shown as follows.

1. We send a query "えべっさん" to the system at 8 o'clock on the event day, and follow five reporters. Also, we followed more five reporters that were recommended by not using related words(using only query word).
2. One hour later after following, we collected the latest 20 tweets that were posted by the reporters.
3. At the same time, we collected the latest 20 tweets that were acquired by researching with hash tag "#えべっさん".
4. We sent out questionnaires about the sets of tweets that were collected in the above procedure. The contents of questionnaires are, "If you are attending the event and you want information about the event, do you think the tweet is informative or not? Please evaluate each tweet from one to five." The criteria of the evaluation are that one is "Not informative, it's not needed to get information", and three is "Neither", and five is "So informative." The subjects are not informed whether each tweet is posted by reporters or got by the hash tag.

The table 1 shows the results of this experiment. Each column shows the average value of the evaluation to the tweets by the subject. As this table shows, the average value of the tweets posted by reporters is higher than the average value of the tweets that were got by researching hash tag. Also, the value of t-test is $p=0.02<0.05$, which verify a significant difference of this results.

On the other hand, there is almost no difference of the results between the reporters that were selected using related words and the reporters that were selected not using related words. The reason of this is that the values of cosine distance of the related words are too low compared with 1, which is the value of cosine distance of the query word. As a result, when the system computes the quality evaluation of each tweet, the values of related words are almost meaningless. To solve this problem, we should compute the value of related words and the query word by respective measures.

Table 1: Results of the experiment

	Reportes	Reporters(without related words)	Hashtag
Subject A	2.85	2.79	1.95
Subject B	2.65	2.58	2.55
Subject C	2.75	2.89	1.95
Average	2.75	2.75	2.15

4.2. Discussion

We conducted an experiment for an event which is called "えべっさん", and got the good result. However, it doesn't mean that our proposed method can be applied effectively to all events. For instance, if the event is too small and the participants are very few, the results would be not so good. Because if the number of participants is small, there would be also few twitter users who posts about an event. In future, we are planning to do experiment for a small event and consider new approaches for it. Also, though the system currently uses related words that are included in tweets of each candidate in order to compute the quality factor of the candidate, it is not perfect. For example, the recommended reporters would post tweets that include similar words. To solve this problem, we have a plan to use the count of retweets or replies to the tweet to evaluate the quality factor of the tweet.

5. Conclusion

In this paper, we proposed a system that can construct ad-hoc follow networks on twitter for sharing information about an event automatically. In conventional systems, we have to search tweets by one or more hash tags in order to get information about an event. However, there are some problems of such systems. For example, there are many futile tweets that include a hash tag, conversely, there are also many informative tweets that doesn't contain the hash tag. These problems occur because appending hash tag to the tweet is optional function. Therefore, we propose a new approach that recommending "reporters" who will post informative tweets about an event constantly. The important point of this study is that how the system selects the conclusive reporters from the candidates. In this paper, we evaluated each candidate by looking at importance of both quality factor and quantity factor of the candidate's tweets.

To evaluate the reporters who were recommended by our system, we conducted an experiment for an event which is called "えべっさん." We asked three subjects to evaluate each tweet from one to five. The result shows that the average points that are evaluated to the reporter's tweets exceed the average points of hash tag tweets, and the value of t-test verifies a significant difference of this result.

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Received September15, 2013; Accepted December 27, 2013

International Journal of Asia Digital Art&Design

Verification about a button solidity in a touch-panel terminal

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Abstract
Many contrivances to give a button image solidity have been used in an interface design in order to enhance convenience for users by evoking operation to associate the real one.
The previous study shows that it is possible to perceive the three dimensional space from the two dimensional image with the luminance change via linear gradation.
As with the spread of touch-panel terminals in recent years, many studies about the interface design for touch-panel terminals have been conducted, however less studies about the brightness value of the linear gradation have been conducted.
We conducted an experiment about the luminance value of the linear gradation in gray scale, focusing on a button solidity in a touch-panel terminal in this study. As a result, strong correlation was observed between the highlight and the shadow of the gradation, the average brightness difference between the two was 63.22% and the true value was between 62.20% and 64.23%.

Keywords: button design, solidity, interface of touch-panel terminal

1 Introduction

(1) Research background

A touch-panel interface has been used mainly for ATM's at financial institutions, car navigation system, exhibition guides at museums, and as it is currently used for cell phones, portable game machines, mobile information terminals it has rapidly spread to our daily life.

Portable devices with a touch-panel interface has not only attracted people who use electronic devices on a daily basis but also people who have not used them before.

Operation of a touch-panel interface does not require an external input device in particular unlike old computers and cell phones. Users operate the touch-panel interface with their fingers while looking at the monitor.

On the other hand, interface design was performed on the assumption that there was an external input device before. As one of the expressions being used often on web sites, it is that images and text decoration change when a cursor comes in contact with images and texts. It is intended for users to distinguish selectable informations from the others. Apart from that, it makes it easier for users to operate a device, it enhances affordance as contrivance, and makes it easier for texts and images with operation to associate intuitively, it is intended to look like a bottom by giving an image solidity. The information previously stated can be considered as intentional. Each is an important factor in designing interface, especially for a touch-panel terminal that users only get an indication from the monitor that suggests it needs to be further consideration. In this research of an interface design in a touch-panel terminal, button solidity is also especially considered.

(2) Previous research

1. Perception of depth by the luminance change

Three dimensional space is perceived from two dimensional images based on various assisting factors about depth on a daily basis. One of the assisting factors about depth is shading thar we perceive as depth by the presuming location of the light source based on luminance change. Kleffner and Ramachandran (1992) conducted the experiment of adding a luminance change to inside of a circle by linear gradation and confirmed these two conditions "constraints of the light source above *2" and "Constraints of single light source *3".[1][2] Human perceive shaded linear gradations as convex or concave, specially with a top bright as convex and vice versa. (Figure 1)

Granrud , Yonas and Opland (1985) have done a research through the use of characteristics of infants reaching curved objects in their development. That research suggests that 7-month-old infants can perceive three-dimensional space from shading.

In most experiments how humans perceive three dimensional space from shaded two dimensional images was focused and researched. On the other hand, there is not much research about shading itself nor a specific description about brightness. However solidity should differ by brightness of shading.

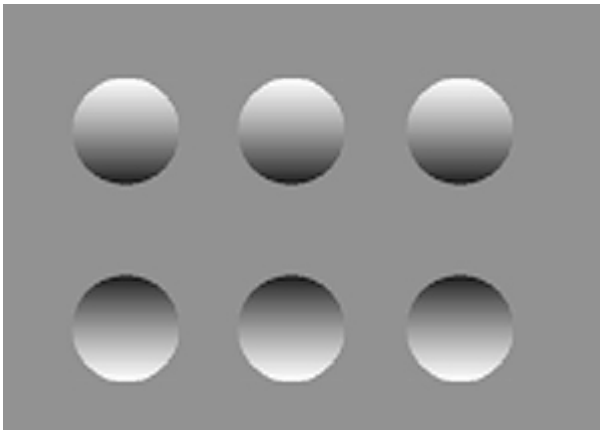

Figure 1:

A sample display adding a luminance change to the inside of a circle by linear gradation

(3) Research purpose

In interface design for touch-panel terminals, it is expected that a bottom solidity enhances affordance and makes it more user-friendly. For example, studies of the effects of button size and study of the effects of color on the screen have been made.[3][4] In addition, most of the researches about operability of touch-panel terminals use a convex bottom but there is not much research about how a bottom solidity is provided.

This purpose of this research is to examine if there is optimal value of luminance of linear gradations given to the bottom image. We first examined the correlation between the bottom image and luminance difference of linear gradation in the gray scale.

2 Experiments

Participants made images where they can perceive them as bottom mostly by changing the luminance value. We analyzed the results. We also conducted preliminary experiments so that participants can get used to this operation.

(1) Materials

An application was created for both this experiment and the preliminary experiment and then the experiment was conducted on a touch-panel terminal (iPad mini). The experiments were carried out in a bright room with a fluorescent lamp during the day. Brightness setting of the display that was used in the experiment is the same.

A bottom image is in the gray scale, 100px×100px, radius 10px rounded rectangle.

A slider is used to adjust the linear gradation luminance, luminance is adjusted by operating the slider horizontally.

24 people both male and female in 20's participated in the experiment.

The top of linear gradation is now called high light and the bottom shadow is called in order to create convenience. (Figure 2)

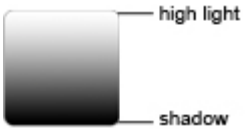

Figure 2: high light and shadow

(2) Procedure

1. Preliminary experiment

We explained to participants by speaking that we wanted them to adjust the luminance value with the slider where they feel the bottom image located in the center looks like a bottom and participants performed at their own pace.

Figure 3 shows the experiment screen. One bottom image that they adjust is located in the top center of the screen and the slider for adjusting luminance value is located in the bottom center of the screen. When participants finish adjusting luminance value they then touch the bottom image to determine the value.

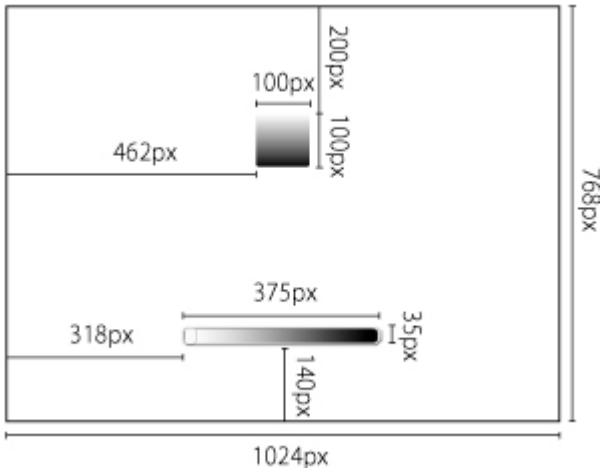

Figure 3: Preliminary experiment screen

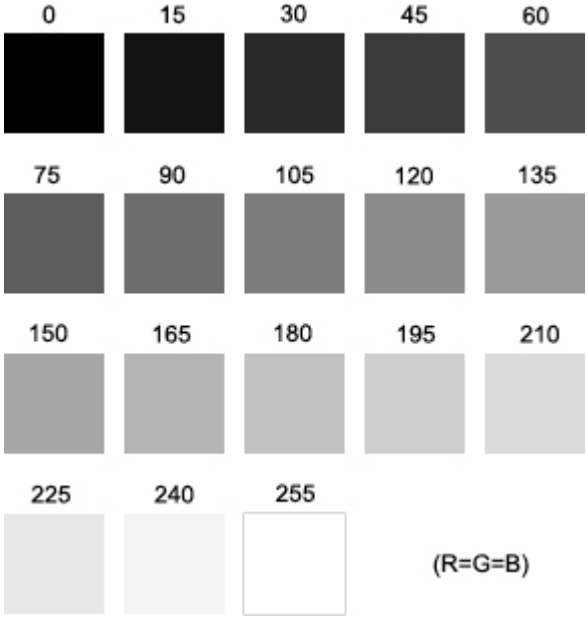

Figure 4: Preliminary experiment screen

This experiment is conducted in order for participants to get used to operation and seeing various gradation patterns as follows:

ⅰ. Shadow value is locked as (0,0,0), highlight luminance value is adjusted.

ⅱ. Shadow value is locked as (15,15,15), highlight luminance value is adjusted.

ⅲ. Process ⅰ～ⅱ is repeated till shadow value reaches (255,255,255).(Figure 4)

ⅳ. Highlight value is locked as (255,255,255), shadow luminance value is adjusted.

ⅴ. Highlight value is locked as (240,240,240), shadow luminance value is adjusted.

ⅵ. Process ⅳ～ⅴ is repeated till shadow value reaches (0,0,0).

Locked value changes at regular intervals.

2. The actual experiment

As with the preliminary experiment we explained to participants by speaking that we wanted them to adjust luminance value with the slider where they feel the bottom image located in the center looks like a bottom and participants performed at their own pace.

Figure 5 shows the experiment screen. One bottom image that they adjust is located in the top center of the screen, the slider for adjusting highlight luminance value in the bottom left of the screen and the slider for adjusting shadow luminance value in the bottom right of the screen. When participants finish adjusting luminance value they then touch the bottom image to determine the value as well as the preliminary experiment.

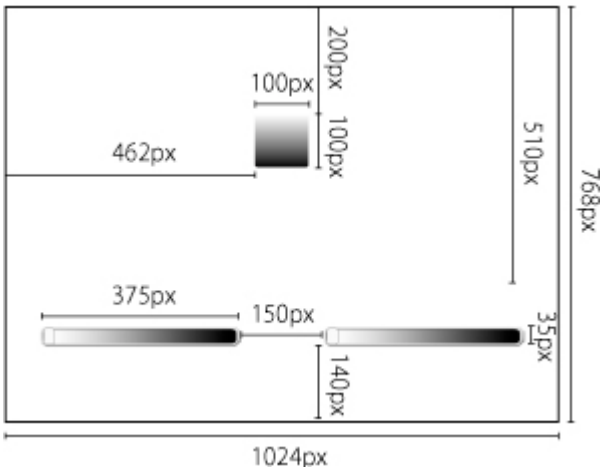

Figure 5: The experiment screen

In the experiment, from the top left of the screen, in range 1024px×510px background color is applied. The relation between highlight/shadow value in linear gradation and background color value was examined.

This experiment is conducted as follows:

Ⅰ. Background color is locked as (255,255,255), luminance value of highlight and shadow is adjusted.

Ⅱ. Background color is locked as (240,240,240), luminance value of highlight and shadow is adjusted.

Ⅲ. Process Ⅰ～Ⅱ is repeated till background color reaches (0,0,0).

Ⅳ. Process Ⅰ～Ⅱ is repeated till background color reaches (255,255,255) back again.

Locked value changes at regular intervals. The white screen is presented for 3 seconds at intervals between each of the trials.

3 Result and discussion

RGB data obtained in the experiment was HSV converted and the brightness was examined.

Brightness (%) was calculated by the following formula;

$$V=\{(\text{Maximum RGB})/255\}\times 100$$

In addition, numerical value that rounded off to the 3rd decimal point is described henceforth.

(1) Correlation between background color and value of highlight and shadow

In between background color and highlight, between background color and shadow, mean value was calculated and correlation coefficient was calculated.

A correlation between background color and highlight was -0.38. A correlation between background color and shadow was -0.56. As the result of the verification, there was no correlation seen in the previous information.

While both highlight and shadow tend to get darker as background color gets brighter on scatter diagram 6 and 7, there was no specific relevance between background color and the value of highlight and shadow.

Also the difference between the value of highlight and shadow was calculated, and calculated correlation between the difference and background color was -0.11, therefore, there was no correlation seen in those. From this it is considerable

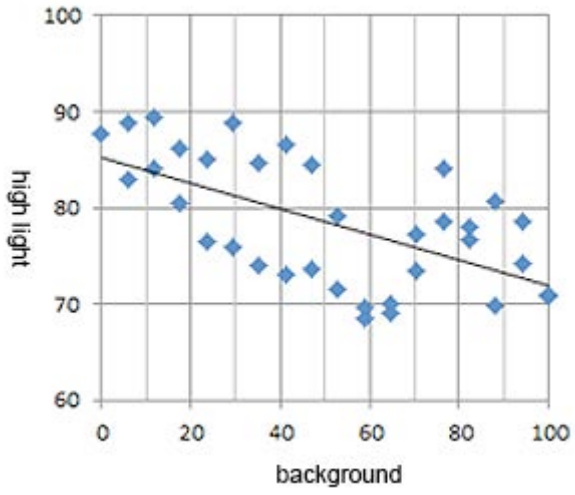

Figure 6: scatter diagram (background color - highlight)

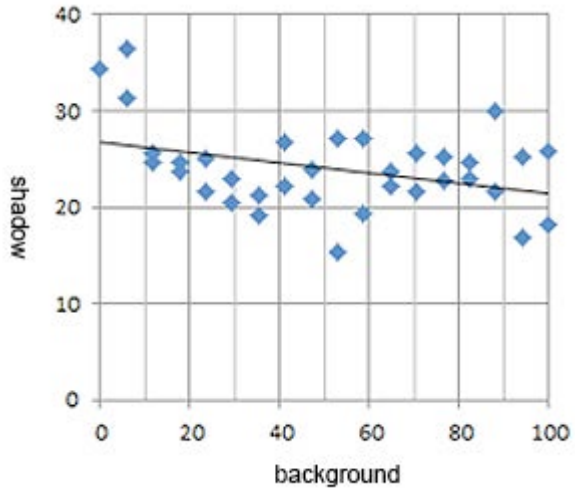

Figure 7: scatter diagram (background color - shadow)

that the difference between the values of highlight and shadow is almost the same regardless of the brightness of background color.

(2) A correlation between the values of highlight and shadow

A correlation between highlight and shadow was 0.57 and there was a weak correlation between those two as the result of verification.

Figure 8 is the created scatter diagram.

Looking at the data in detail, some data of concave in bottom images were seen. Concave bottom image has lower value of highlight than shadow and the previous study shows linear gradation like that which is perceived as concave. We excluded the concave bottom image data from the data and re-examined the correlation. Correlation coefficient between the two was 0.88 and it became a stronger correlation. Figure 9 shows the scatter diagram. From the result, there is probably correlation between highlight and shadow, however it is considerable that convex bottom is not always preferred.

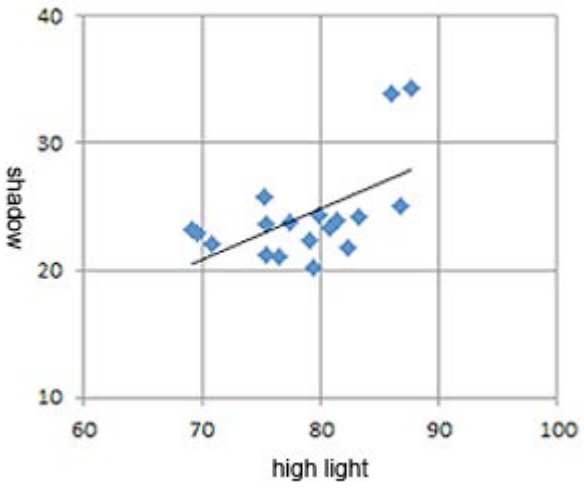

Figure 8: Scatter diagram

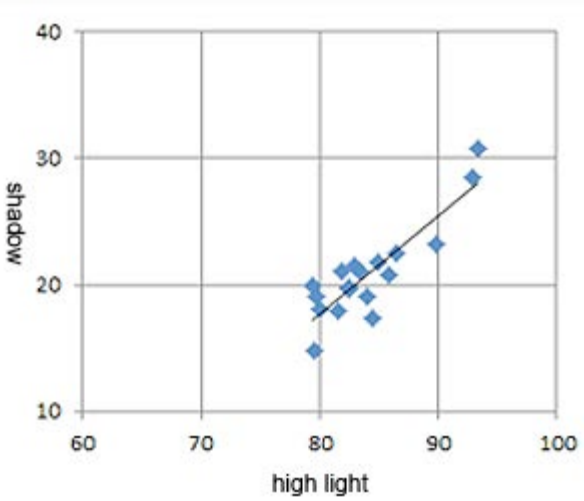

Figure 9: Scatter diagram
(in the case of excluding concave bottom)

(3) Discussion about concave bottom

There were 10 participants who created several concave bottoms out of 24 participants. The breakdown of that is as follows; 2 participants created 2 concave bottoms, 2 participants created 9 concave bottoms, 2 participants created 10concave bottoms, 1 participant created 1 concave bottom, 1 participant created 3 concave bottoms, 1 participant created 7concave bottoms, and 1 participant created 20 concave bottoms.(Figure 10)

concave bottom image data	0	1	2	3	7	9	10	20
participants	14	1	2	1	1	2	2	1

Figure 10: participants who created several concave bottoms

In the Kleffner and Ramachandran (1992) experiment, it is reported that detecting concave bottom out of convex bottom group (Figure 12) is more sufficient than detecting convex bottom out of concave bottom group (Figure 11). *4

In this research, it was observed that 11 participants created concave bottoms at different times. In the Kleffner and Ramachandran experiment, as grouping of convex bottoms is stronger than grouping of concave bottoms, it is possible that it made it easier to find concave bottoms in a convex bottom group. With only their experiment it remains unclear that concave bottoms have more visibility compared to convex bottoms and it still remains unclear which one has preference, the convex or concave bottom in this experiment. However more than half of the participants did not create concave bottoms and there were a few concave bottoms out of all the trials. From these reasons convex bottom has more preference in bottom design.

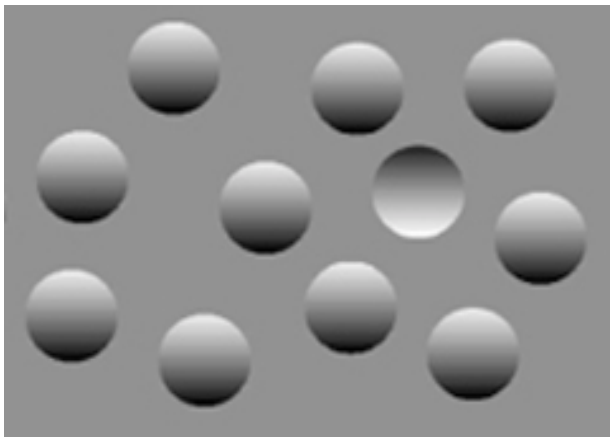

Figure 11 :
Detecting concave bottoms out of convex bottom group

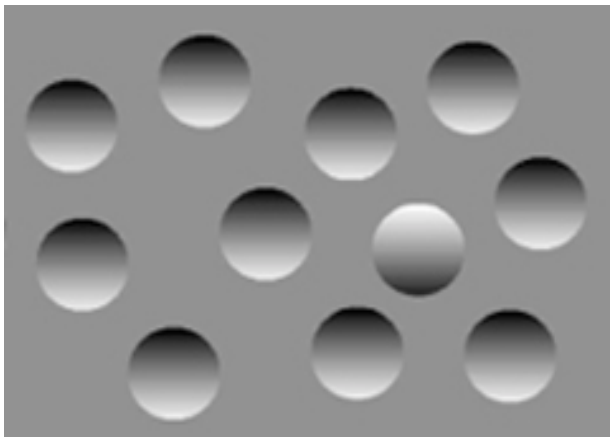

Figure 12:
Detecting convex bottoms out of concave bottom group

(4) Estimation of brightness difference

Based on data obtained we calculated the mean value of brightness difference between highlight and shadow and the result was 63.22%. μ is estimated for the 95% confidence interval and it was 62.20 <μ<64.23. (Figure 13)

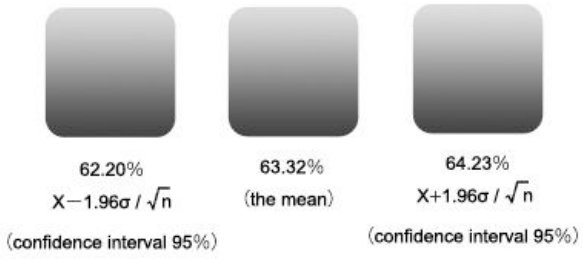

Figure 13: Results

4 Conclusion

In this research we conducted experiments with the purpose of examining if there was optimal value of brightness of linear gradations given to the bottom image. For the experiments we created an application where the brightness of linear gradation is adjusted respectively and we used the application.

The results of the experiments shows that while between the background color of gray scaled bottom and the value of highlight/shadow, highlight/shadow both tend to get darker as the background color gets brighter, there was no correlation between the two.

On the other hand, there was a strong correlation between the values of highlight and shadow and the brightness difference was 62.20 <μ<64.23. However as for the brightness difference in spite of no presentation to exclude concave bottoms in advance concave bottoms were excluded from the experiment result. That might have affected this experiment result and it is possible that the true value could be different from the the result of this experiment. To assess reference of convex/concave in bottom image still requires another experiment.

In the actual bottom design, even in gray scale there are bottoms that are whiter, or that are blacker, that are in between to be considered as various patterns. Optimal value of brightness difference in each case is a future problem and we will continue to conduct experiments about the influence of color being given.

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Annotation

*1 Affordance

Mainly the term affordance is used as Norman's theory states, in this paper "an action possibility which allows an individual to perform an action". Though in recent years Norman's affordance is called signifier in order to prevent misuse of the term affordance coined by Gibson, Gibson's theory states "relevancy between human and object" which is inclusive.

*2 Constraints of the light source above

Humans perceive three dimensional space from shading of two dimensional images by the assumption that the light

comes from above because humans always have the light source from above in the environment.

*3 Constraints of single light source
As for the linear gradation diagram with luminance change symmetrically in the vertical (Figure 1), when one is perceived as convex, then the other is perceived as concave. It's constant unless it's inverted. That shows that there is only one light source from above in addition to constraints of the light source above.

*4 Grouping
A major aspect of Gestalt psychology, "how objects in a visual field are grouped to form one", especially the law of similarity states that elements within an assortment of objects are perceptually grouped together if they are similar to each other. In this paper we use the word grouping as it is.

International Journal of Asia Digital Art and Design Vol.17 No.04

Date of issue 2014/01/10

Asia Digital Art and Design Association

Designed By Iwamoto, Yushi

Edited By ADADA Editorial

Published By

Asia Digital Art and Design Association

c/o Faculty of Design Kyushu University

4-9-1, Shiobaru, Minami-ku, Fukuoka, 815-8540, Japan

http://adada.info adada.post@gmail.com