# [Practical Paper] Jump-in-Ad: Embedding a Viewer's Face to an Advertisement for Increasing Attention

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***Abstract*** - This paper presents a video advertisement system named "Jump-In-Ad." As a large public display becomes common, its usage has been the issue of research in information technology. Advertisement is one of the major uses of such displays. It can be interactive by the software together with a computer. With some other background research contexts, the proposed system has been developed. It captures a face of a viewer who is in front of the system, and replaces the main character's face of the advertising videos with the viewer's face in real time. It has been developed to attract people and to get their attention to the advertisement. An experiment, which compared the proposed system with a normal video advertisement system, was conducted. The result demonstrated that more people looked at the "Jump-In-Ad" than the other.

***Keywords***: Digital signage, video advertisement, public display, interactive system.

## 1 INTRODUCTION

Public displays have become commonly used to replace conventional media such as posters and bulletin boards recently. They have been called digital signage systems and have often been used for advertisement. Advertisement by such display systems can be processed digitally unlike conventional paper advertisement. For example, it can be a slide show that changes multiple advertisements in regular intervals. However, many of these advertisements have not been fully explored the possibility of being the digital advertisements and/or digital processing yet. Typically they simply play some images or videos repeatedly, which are not different from the conventional advertisement very much.

An important aspect of advertisement is to draw people's attention. Drawing attention increases the value of the advertisement. In this paper, we propose an interactive advertisement system named "Jump-in-Ad" which embeds the viewer's face to the advertisement in real time, after some consideration of related research. By embedding the viewer's face to an advertisement, his/her attention to the advertisement is expected to increase. The experiment to evaluate it is also presented in the later part of this paper.

## 2 RELATED RESEARCH

### 2.1 Digital Signage

Digital signage represents a type of public display that uses typically a flat panel large display or a video projector and a personal computer that is connected to the display to control the displayed images. It sometimes includes a computer network to provide content update and the system management.

Digital signage systems have been in the market is increasing its presence. Fujitsu has introduced the digital signage system UBWALL including the interactive information kiosk called UBWALL Station that is a touch sensitive large display. It can also equip with an RFID reader/writer. The user can get personalized information by placing his/her device over the reader/writer and can save it [1][2]. Other companies have introduced digital signage systems, too [3][4].

Some systems also use the user's mobile device for interacting with the display. Ubiquitous Information Delivery System (UIDS) provides detailed information to the mobile personal device via short-range wireless communication when it receives the request from the user who watches the broadcasted information on the public display [5]. SuiPo is not strictly a digital signage system but is a digitally enhanced signage service. It uses Suica which is a very popular IC card primarily used as a prepaid train ticket. SuiPo is an information-enhanced poster. First as a setup, the user registers his/her Suica IC card to the service through the Internet by his/her mobile phone. Then if the user is interested in a poster, he/she holds his/her Suica IC card over the card reader placed next to the poster. This way the user receives additional information related to the poster [6].

Our research system falls into a type of digital signage. Certainly digital signage systems in the market have often been used for advertisement. However as have been introduced in this section, these systems typically need user's operation. Because user's explicit operation put extra load to the user, we do not think this way becomes most popular.

### 2.2 Interactive Display

As the cost of display devices decreases, public displays have become more common than before. Most of them are used in combination with computers and are interactive.

**(1) Community display**

Semi-Public Display is a public display system for supporting community. It is placed at a common area of a community, and provides shared information among the community such as reminders, collaboration space for asynchronous group work, attendance panel which registers attendance to events. It indicates the community members' whereabouts by changing the color saturation of the members of a group photo in ambient fashion [7].

MessyBoard is a public bulletin board projected on a wall of a common room, which activated discussion among the group members [8].

Dynamo is a large multi-user interactive display system that enables sharing and exchange of a variety of digital media such as photos, video clips, and websites [9].

HuNeAS is a system for promoting face-to-face information sharing. The user registers what he/she want to announce in public to the system in advance, and keep the RFID tag. The RFID tag reader is placed next to the large public display. When the user with the tag pass through the display, the tag reader detects the user's tag and the public display displays the registered announcement, which is intended other community members notice the announcement and start conversation [10].

These are the display systems for a group or a community of people, and in this sense they are semi-public displays. Here the displayed content is the information to be shared among the users and is often related to the target users from the beginning. Thus direct intention to draw the user's attention to the content itself has not been a focus of research very much.

**(2) Interaction with a large public display**

Interactive Public Ambient Display is a system to present information according to the distance of the user from the display. The system recognizes four interaction phases according to the distance and has different functions for each. Ambient Display phase is the most distant phase. The system displays big text characters and figures for distant people to glance at as the ambient display and does not offer operation from the users. Implicit Interaction phase is the next distant phase. The system recognizes the user's body position and orientation and uses this information to infer the user's openness to receiving information. The user is notified in a subtle manner if there is urgent information that requires attention. Subtle Interaction phase the closer phase. When the user approaches the display and provides an implicit cue such as pausing for a moment, the system enters this interaction phase. In this phase the system displays the personalized information typically of shared public information for the user. The system recognizes simple hand gestures and body movements, for which the user can select information to watch. Personal Interaction phase is the closest phase. The user can touch the display directly and operate personal information. The user has to put infrared reflective markers on his/her body and hands to be recognized by the system that employs the Vicon motion tracking system. This system demonstrates how displayed information and their interaction technique should change according to the distance of a user [11].

Frisbee is a technique for interacting with areas of a large display that are difficult or impossible to access directly. It consists of two display areas called the "telescope" that is in local areas and the "target" that is in remote areas. The remote data surrounded by the target is drawn in the telescope and interactions performed within it are applied on the remote data [12].

Many interaction techniques with a large public display can be found including the research introduced here. Some have been applied to the digital interactive advertisement as introduced later. However the first step of advertisement is to draw attention of people. Thus we thought drawing-attention step should have more research priority than the later steps.

**(3) Drawing attention**

"Mirai Tube" is an interactive very large display system or an installation that uses the ceiling area of a subway station. It detects a person on the concourse and displays various images according to the location, the walking speed, and the behavior such as coming close to the image, stopping of the person. This is realized by the sensors on the ceiling. For example, it moves along with the walking [13].

Historical interactive media art VideoPlace by Myron Krueger captures the user's figure and overlaid it to the video in 1970's [14]. This demonstrates the user interacting with the video, visual effects of the video, and the visual effects of the user's figure processed such as changing its sizes and extracting body contour.

Because interactive visual image can draw people's attention, many similar attempts have been conducted since then. EffecTV is a toolkit to add visual effects to a movie in real time [15]. It is thought to be capable of applying to an advertisement, but not done.

## 2.3 Portrait Application

Applications of visual image or video of a user have been investigated.

With the virtual fashion simulator, a user can add decorations of a cloth, hair, and makeup to the movie of him/herself. The system merges the video of the user and computer graphics objects [16]. However CG must be aligned with the video images at initial stage manually.

Responsive Mirror is a social fashion comparison system for a physical retail fitting room. It consists of the camera to capture the user's image and recognize classes of clothing, another camera to detect orientation toward the mirror, a conventional mirror, and two displays. One display shows the user with previously worn cloth and the other display shows other people's images for comparison [17].

Countertop Responsive Mirror is a mirror system that records and matches images across jewelry trials for physical retail shopping [18].

In a research named DIM (Dive Into the Movie) [19], a 3D viewer's face is captured and used as the actor's face of a 3D movie. The system is named FCS (Future Cast System). Although it is capable of capturing 3D face image, it uses 7 cameras to scan the facial image and takes a few minutes. It cannot embed the image into the movie in real time.

"Aura Shindan" is an entertainment application system of face recognition that consists of a video camera and a display. When the user stands in front of the display, the video overlaid by "aura" around the face is shown in real time. The aura color is chosen according to the feature quantity of the face image [20].

People care about themselves more or less, which requires or prompts to look at the self images. This means that the

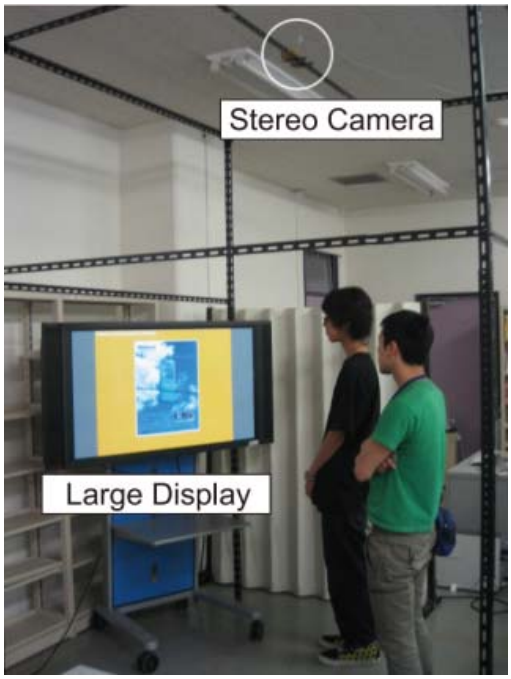


Figure 1: GAS

self portrait image draws good attention, which can be applied to advertisement.

### 2.4 Advertisement System

Some of above introduced research elements have been applied to advertisement.

Interactive Fliers is a prototype electric advertisement system for a community intended to facilitate communication between advertisers and advertisees. The system consists of a public display with a sensor to detect a person and a computer network. It notifies the advertiser who is waiting behind the advertisement across the network when a person watches the advertisement, and allows him/her to appeal directly to the person by displaying real time captions below the advertisement. It also provides the person watching the advertisement the real time chat function to the advertiser when he/she go to the detailed advertisement page by touching the advertisement screen [21]. This is an application of a digital signage system and draws the advertisee's attention by real time interaction. However text communication, not visual image, is the way of drawing attention. Most importantly the advertiser must keep waiting for the advertisee with this system, which is not realistic.

GAS (Group-adaptive Advertisement System) is a system that displays advertisements to a group of viewers in front of the system, not like common systems that displays advertisements to an individual (Fig. 1). It senses the interpersonal distances of a group of people in front of the display as important nonverbal cue, and estimates the attribute of the group from the cue. Then it selects appropriate advertisements according to the estimated group profile of the users and displays them [22]. This system is more advanced than the adaptive advertisement systems for the single user that the user must register his/her profile to the ID tag in advance. Although the advertisement is selected from the collection of advertisements for the users, the each content is fixed.

Interface agent has been applied in an advertisement system to draw attention of the passerby. The system also uses the interpersonal distance of the user from the interface agent shown in a display and changes behavior of the interface agent. It estimates the position of the user and the interface agent looks to the position. This is another way of drawing attention [23].

"tenoripop" is an interactive display system that recognizes a hand by its skin color and projects visual images to the hand. It also recognizes a few hand gestures and changes the images [24][25]. This suggests that interactivity is a way of drawing involvement from the participant.

Saika is an entertaining digital signage software developed by SIKUMI DESIGN [26]. It captures a viewer's face and decorates the image with illustrations in real time when it is displayed. It also detects motions of a viewer and changes the color of the related area when displayed. The company announced that the produced video drew 13.5 times more than the normal video [27]. Although it has been announced that the software can be used for advertisement, it does not handle advertisement as the main content. It can decorate the viewer's image but does not deal with advertisement itself. Advertisement seems to be shown beside this entertainment content. Different from this, our research focuses on the dynamic change of the advertisement itself.

East Japan Marketing and Communications conducted the interactive advertisement for Japan Racing Association in the year's end of 2009. It captured the viewer's face image and embedded the image to the advertisement poster. It was just like a self-portrait signboard for a souvenir photograph which is often placed at a tourist spot mainly in Japan.

Shiseido created the website for promoting a men's hairdressing product. The user could upload his face image to the website and could watch the promotion movie with his face image embedded. Although this advertisement embeds the viewer's face image, the user must use the system spontaneously to make the movie. Moreover, the face image must be a still picture, and it could be embedded only to the few special promotion movies on the website.

The proposed system "Jump-in-Ad" is different from any of these various advertisement systems. It does not select an advertisement from the collection. It does not use unrelated elements such as an interface agent or another entertaining content other than the advertisement. Rather it directly relates the viewer to the advertisement by embedding the viewer's face movie to the advertisement movie in real time.

## 3 PROPOSAL OF "JUMP-IN-AD," AN INTERACTIVE ADVERTISEMENT SYSTEM

Based on the survey in the previous section, we propose an interactive video advertisement system named "Jump-in-Ad." It captures a viewer's face and embeds it to the advertisement in real time (Fig. 2). Unlike any other related works, it aims to attract the viewer's interest to the advertisement by applying the real time video processing technology to the advertisement itself. It is also different from the previous

Figure 2: Appearance of the Jump-in-Ad system.

viewer-adaptive systems that select an advertisement from the list of advertisements.

### 3.1 Hardware

The system consists of a 52 inch display panel for showing advertisements in public, a camera to capture a viewer's face, and a PC for processing the captured video and the advertisement. It needs a viewer as close as 2.5 m to detect the face.

### 3.2 Software

Figure 3 represents the software process of the system. The software is written in C++ and OpenCV on Windows.

First, the system tries to detect a face in the frames from the camera. It is done by every frame. Haar-like algorithm was used for the face detection. The number of faces, their locations in x and y, and their sizes in width and height are recognized. When multiple faces are detected, the biggest face is selected as the closest one to the system and used as the viewer's face currently.

The same face detection process is also executed in the advertisement. The size of the area to embed the face is recognized.

Next, the face image is extracted from the frame according to the location and the size data. The mask image to trim the face shape as ellipse is prepared. It is a white ellipsoidal figure with black background (Fig. 4). The size of the mask is adjusted to the size of the area to embed the face.

Then the size of the viewer's face is adjusted to the size of the face area in the advertisement. The face image is trimmed by the mask image and is embedded to the area.

Figure 5 shows the original advertisement on the top and the processed advertisement that embeds the viewer's face at the bottom.

Example movies were prepared as the advertisement. They were 15 second short movies that show a face. This is because of the copyright issue. The system does not require specially prepared advertisement.

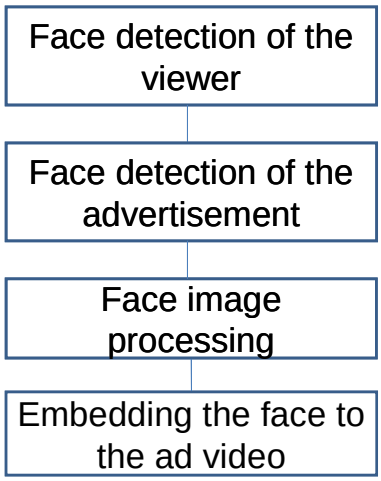


Figure 3: Software process of the system.

Figure 4: Mask image to trim the face shape.

## 4 EVALUATION

We have evaluated the system through a field experiment of comparing with a simple public display system.

### 4.1 Procedure

The proposed system and the simple public display system as the control system were used in the same condition. The control system displayed the same advertisement but was not interactive.

Two places were used in a university campus. One was an elevator hall and the other was a corridor (Fig. 6). Each system was set an hour at a time. The systems were switched after an hour. The order of the systems was counterbalanced. The systems were set 8 times in 2 days all together.

The advertisement area was videotaped.

### 4.2 Result

The measure of the effect of public advertisement has not been standardized yet, which is thought to be different from the viewing rate of the television programs. The number of people in front of the advertisement or the gaze at the advertisement has been used to measure the effect in previous research [28][29]. "Audience Metrics Guidelines" that has been publicized by Out-of-home Video Advertising Bureau in the US in 2008. "Average Unit Gross Impression," which is the total quantity of looking at display and sojourn time in

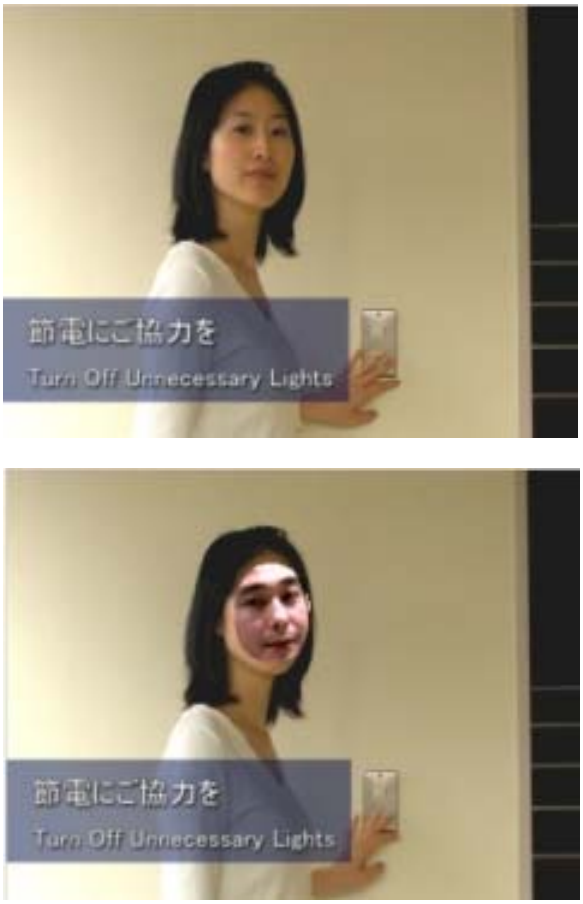


Figure 5: Top: original advertisement, Bottom: processed advertisement that embeds the viewer's face.

Figure 6: Places of the experiment.

a unit time, is proposed as the indicator of advertising effect [30].

Taking this into account, the system was evaluated in the behavior of the viewers and the sojourn time in front of the system.

The viewers were categorized in the following three types according to their behaviors. They are A) Pass by without looking, B) Pass by with looking (face detected), and C) Stop and look (face detected).

Figure 7 shows the rate of the viewer's behavior in terms of these types. 3.7% was type C in the proposed system while it was 2.3% in the control system. More percentage of people stopped and looked in the proposed system. Also, 4.5% was type B in the proposed system while it was 3.5% in the control system. More percentage of people passed by with looking the advertisement in the proposed system.

The sojourn time in front of the system in type C and type B were shown in Figs. 8 and 9 respectively. It was 13.6 second in the proposed system and 13.8 second in the control system in type C, and 5.6 second in the proposed system and 4.1 second in the control system in type B.

## 4.3 Discussion

**(1) Attention increase**

According to SIKUMI DESIGN, the video produced by their entertainment digital signage software Saika drew 13.5 times more than the normal video [27].

According to Wang, research shows that people are 5 to 10 times more likely to pay attention to dynamic rich-media content in contrast to the traditional static signs [31].

In our experiment, the proposed system attracted more attention than the control system. This can be calculated as the type B and C behaviors. Thus 3.7+4.5=8.2% paid attention to the proposed system and 2.3+3.5=5.8% paid attention to the control system. The proposed system attracted 1.4 times more attention than the control system. From this result, previous results of digital signage attention that both came from digital signage companies seem to be very high. Investigating the detailed conditions may help to understand the advertising effect.

Although the rate of type B and C was less than 10% of all the passers-by even in the proposed system, this rate cannot be discussed if it is small or not without the normal viewing ratio of this type of advertisement. Also the rate must be dependent on the content of advertisement.

**(2) Advertising effect measurement**

People do not just buy things. They experience a series of decision making processes including buying, which is called consumer behavior [32].

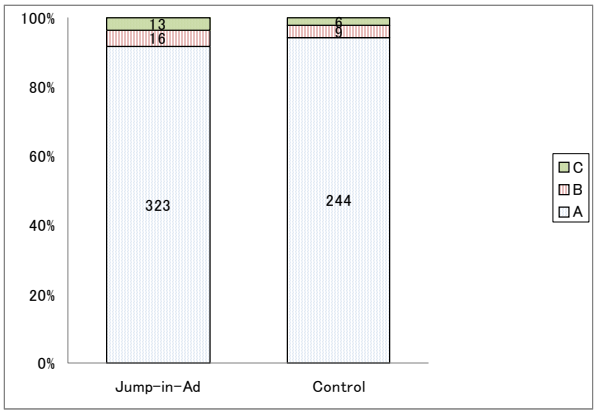


Figure 7: Viewers' behavior in the experiment.

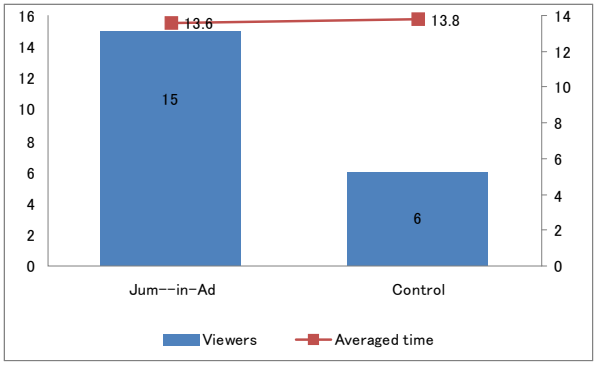


Figure 8: Sojourn time of type C people.

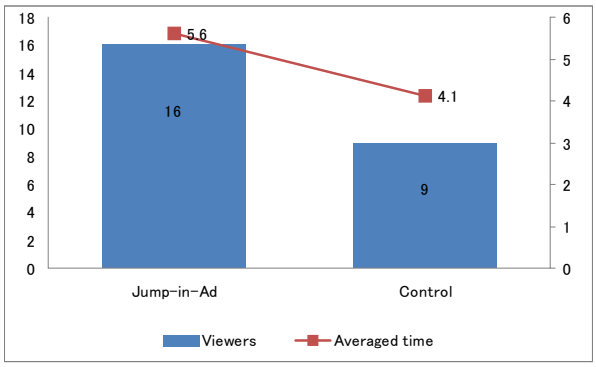


Figure 9: Sojourn time of type B people.

Models that explain consumer behavior have been proposed in marketing for understanding how to target a market effectively.

AIDA is an acronym introduced by Strong as proposed by Lewis that describes a common list of events that may be undergone when a person is selling a product or service [33]. "A" represents attention; the salesperson should attract the attention of the customer. "I" represents interest; the salesperson should raise customer interest by focusing on and demonstrating advantages and benefits. "D" represents desire; the salesperson should convince customers that they want and desire the product or service and that it will satisfy their needs. "A" represents action; the salesperson should lead customers towards taking action and purchasing.

AIDMA is another acronym shown in a book by Hall where "A" represents attention, "I" represents interest, "D" represents desire, "M" represents memory, and the last "A" represents action [34].

AISAS is yet another acronym proposed and trademarked by Dentsu where "A" represents attention, "I" represents interest, "S" represents search, the second "A" represents action, and the last "S" represents share [35].

In any of them, "attention" and "interest" appear as the initial steps of consumer behavior. These are contributed by the out-of-home advertising we have focused on.

**(3) Findings for improvement**

The proposed system did not work to type A people, who were not close enough to the system. The system works only when it detects the face of a viewer. A few people who came close to the system when they saw the system working to another viewer were found in the experiment. The system must be effective when it is placed where there are some people around. To use the system effectively even when there are not many people around, another method may be desired that makes the distant passers-by notice the system.

## 5 CONCLUTION

We have proposed a video advertisement system "Jump-in-Ad" that embeds the viewer's face into the advertisement in real time to attract more attention to the advertisement.

Interactive advertisement can be adaptive to the viewer. While most previous systems select an appropriate advertisement from the list of advertisements according to the viewer's profile, the proposed system is unique in changing the presentation of the advertisement video with the viewer's face in real time.

From the field experiment, the proposed system could attract more attention than the normal video system.

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