

BAUHAUS UNIVERSITY WEIMAR

MASTER THESIS

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# Comparison of Interactive and Non-Interactive advertisement in public display

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*A thesis submitted in fulfillment of the requirements  
for the degree of M.Sc*

*in the*

HCI group  
Human Computer Interaction, M.Sc

June 11, 2016

## Declaration of Authorship

I, Hasibullah SAHIBZADA, declare that this thesis titled, "Comparison of Interactive and Non-Interactive advertisement in public display" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
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Signed:

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Date:

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*“Thanks to my solid academic training, today I can write hundreds of words on virtually any topic without possessing a shred of information, which is how I got a good job in journalism.”*

Hasibullah Sahibzada

BAUHAUS UNIVERSITY WEIMAR

*Abstract*

Faculty of HCI  
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M.Sc

**Comparison of Interactive and Non-Interactive advertisement in public display**

by Hasibullah SAHIBZADA

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

## *Acknowledgements*

The acknowledgments and the people to thank go here, don't forget to include your project advisor...

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## List of Abbreviations

**LAH** List Abbreviations Here

**WSF** What (it) Stands For

## Physical Constants

Speed of Light  $c_0 = 2.997\,924\,58 \times 10^8 \text{ m s}^{-1}$  (exact)

## List of Symbols

$a$	distance	m
$P$	power	$\text{W} (\text{J s}^{-1})$
$\omega$	angular frequency	rad

*For/Dedicated to/To my...*

1

**Advertisement application**

## 1.1 Introduction

The use of technology in advertisement plays a major role in advertisement industries, it would have been much difficult to reach to their customers without technologies, and technology enhances the two-way communication with client and customers. The companies can now easily express their thoughts and vision to their customers with the use new technologies. Advertisement are everywhere like in websites, in your smartphone, in television and radio and especially from past decade it is more common on the streets, supermarkets, airports and areas where is crowded, so for every context or setting there are set of technologies that are being used to make the advertisement more appropriate, and when it comes to interactive advertisement the use of right technology plays another major role in terms of usability and understandability, interactive advertisement in websites are usually interactive using keyboard and mouse, in smartphone they are using the capability of the touch or other sensors to make the interaction easy, and interactive advertisement in public space has again another bunch of technologies that could make the interaction usable like using face recognition, body and position recognition, hand gesture recognition and also touch sensors, proximity sensors and much more.

This chapter explains all the technical aspects of advertisement system that were developed during the thesis work for attracting attention application and main advertisement application, it discusses what technologies and hardware had been used and what algorithm and methods were implemented to accomplish the goals. Beside the technical details it describes the interaction design of interactive advertisement display.

## 1.2 Applications

### 1.2.1 Silhouette representation

The reason behind silhouette representation of passers-by was to attract their attention toward the display. There are a lot of body sensing technologies, and the most easy way was to use Microsoft Kinect camera<sup>1</sup>, that has built-in algorithm to track people, the camera has a resolution of 640x480 pixels. I created the colored silhouette representation from the *UserMap* array sent by camera, which is a 1xD integer array that corresponds to the pixels of the image, the array looks like bellow

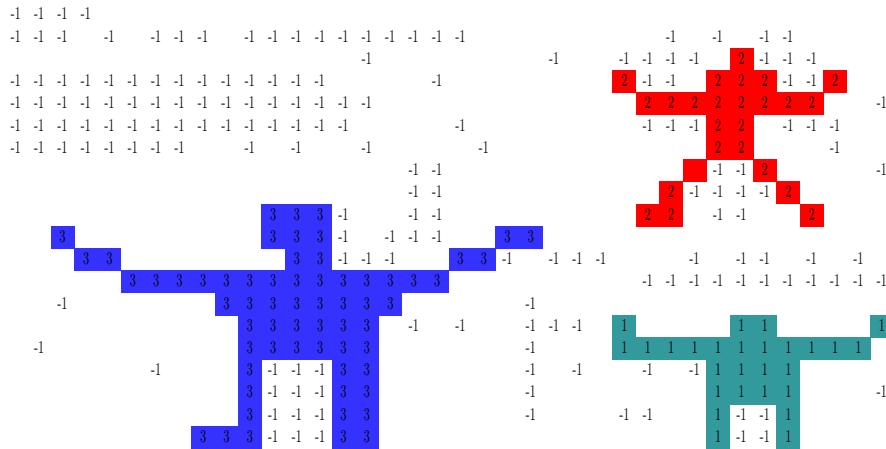
```
Int upix = context.userMap();
upix = [1,1,1,1,1,1,2,2,2,2,2,2,-1,-1,-1,-1,-1,2,2,2,2,...]
```

The above example shows the structure of the array, the index of the elements of array correspond to the pixel number of image and the element values correspond to the user id standing in front of the camera, the user id is always above zero, any value which is not above zero in fact could be background or non-user pixel, the example shows that there are at least two people standing in front of the camera, which has user id (1 and 2) the -1 value is a non-user pixels. So the application iterates to this array and assigns specific color to each of the pixels of the user image and does not give color to the non-user pixels, and after assigning the color value to each index of the user in the picture and leave out the background as null, the bellow picture will be created.

---

<sup>1</sup>Microsoft Kinect: <https://developer.microsoft.com/de-de/windows/kinect>, last accessed 5 jun 2016

TABLE 1.1: UserMap and application color mapping



The above picture has very limited pixels; it is not an original picture but is made to clear the idea of how the coloring of silhouette works. As you can see from above picture, the white areas or the -1 values are background and non-user and the remaining positive number represent the pixelse related to the user. Check the Silhouette video<sup>2</sup> and For more information about the source codes, please refer to the DVD.

### 1.2.2 Main advertisement application

In this section the main advertisement applications are being discussed. According to the plane there was a need to develop three-advertisement application (non-interactive, body interactive and mobile interactive), which had the same functionality but were different in terms of interactivity and control.

The advertisement application was designed to show important places of Bauhaus that were included in Bauhaus-Walk tour, the pictures of these places are attached on top of the Weimar map with a name on top and a small description at bellow this technique helps participants to build a relationship of location and the map, only five locations are randomly chosen by the software to be shown on the map, each come one after another and when all the locations are explored then the advertisement video will be played and after that the application will repeat it self.

#### Non-Interactive application

As can be understood from the name, the application is not influenced by the passers-by but triggers automatically, it automates through whole three hierarchical levels of interfaces, (1)Initial interface, (2) Map interface, and (3) the advertisement video interface, all the interfaces have a fixed time in which it will switch from one to another, see the bellow figure.

<sup>2</sup>Attraction attention method: <https://www.youtube.com/watch?v=1EtHVqS412M>, last accessed 5 jun 2016

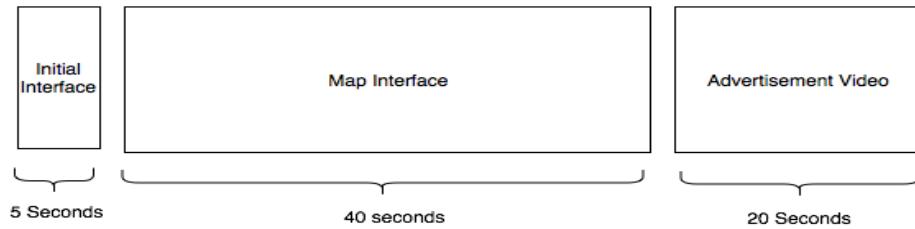


FIGURE 1.1: Interface flow

### 1. Initial Interface:

Initial interface of advertisement shows is the *Gropius walter* room, and the Bauhaus-Walk name on the upper left side, and the Bauhaus University logo at the bottom right.



FIGURE 1.2: Initial Interface

### 2. Map Interface:

This is the city map of Weimar that has some interest regions shown on the top of the map. Those regions are blinking to signal the users.



FIGURE 1.3: Map Interface

The location pictures are animated randomly and they are first enlarged, and then resized back to fit on the map region.



FIGURE 1.4: Enlarged picture

The resized pictures on the map looks like bellow.



FIGURE 1.5: Pictures on the map

### 3. Advertisement video:

In this interface the video is being played, this picture is a screenshot of one of the frames of the video.



FIGURE 1.6: Advertisement video

This is the last frame of the video that shows information about how and where to join the Bauhaus Walk.



FIGURE 1.7: Advertisement video last frame

The advertisement video was created in PowToon<sup>3</sup> with a free version account, visit this video<sup>4</sup> that shows the advertisement video or browse the animation from the DVD.

To see the full non-interactive advertisement flow of interfaces and its animations visit this video<sup>5</sup> or browse the video from DVD.

### Body Interactive application

As discussed earlier there are three interfaces or phases (initial interface, map interface and advertisement video) of the application, and in body interaction the same interfaces are used, but with a difference of interactivity, the first two interfaces are interactive and allows participants to interact with using their body with the advertisement, in this case exploring the interest points on the map by moving physically (forward, backward, right and left) in front of the screen. Kinect camera is used to track user's body position.

#### 1. Initial Interface (Call-to-Action) :

This interface is basically the same interface as non-interactive but with a difference, that it projects passers-by silhouette on interface, this interface is also called *call-to-action* interface because it calls passers-by to interact with the screen, as you can see below there is someone standing in front of the screen and the interface calls him to come near. This interface also has alert messages on the top right that alerts the participant if they move away from the camera range, in this example a second person had got untracked from the camera and the system pops that message to raise his hand to be tracked again.

<sup>3</sup>PowToon: <https://www.powtoon.com/index/?gclid=CJqSqr5180CFesV0wod1u8IEQ&edgetrackerid=10083804111572>, last accessed 5 jun 2016

<sup>4</sup>Advertisement Video: <https://www.youtube.com/watch?v=-y1Dbz6E6bU&feature=youtu.be>, last accessed 5 jun 2016

<sup>5</sup>Non-interactive Ad: <https://www.youtube.com/watch?v=ZLszzfbZJgI>, last accessed: 5 Jun 2016

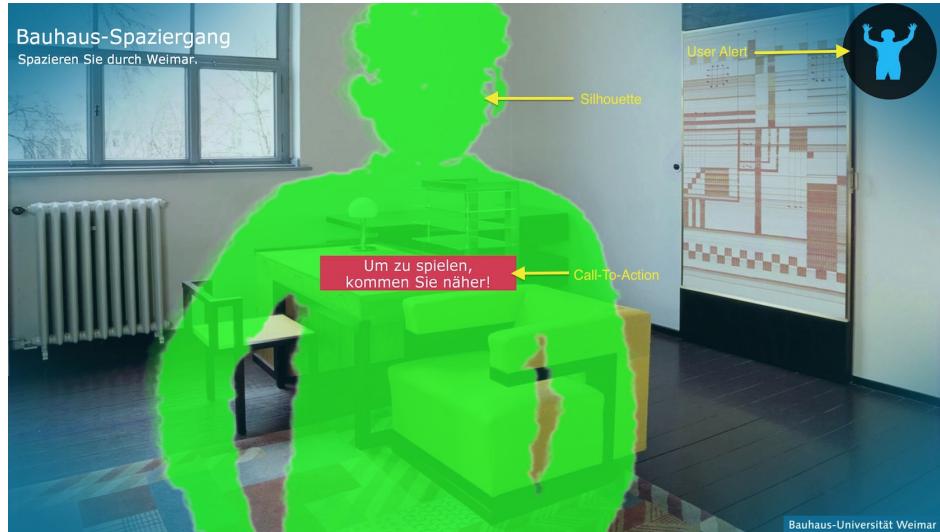


FIGURE 1.8: Initial interface

## 2. Transition to Map Interfaces:

The transition happens when the person stands close to the screen for more than 3 seconds and the bellow process happen.

### (a) Loading animation:

The loading animation is implemented to show reaction to the action of the participants, and at the same time participants waits for something to be loaded.

### (b) Scaling down the silhouette:

To walk freely on the map environment and to give the participant the feeling of real walking, the participant's silhouette is scaled down, the scaling happens smoothly frame-by-frame.

### (c) Show task instruction:

Every interaction has instructions, the instruction is fairly very easy and it is simplified in one sentence to explore locations on the map.

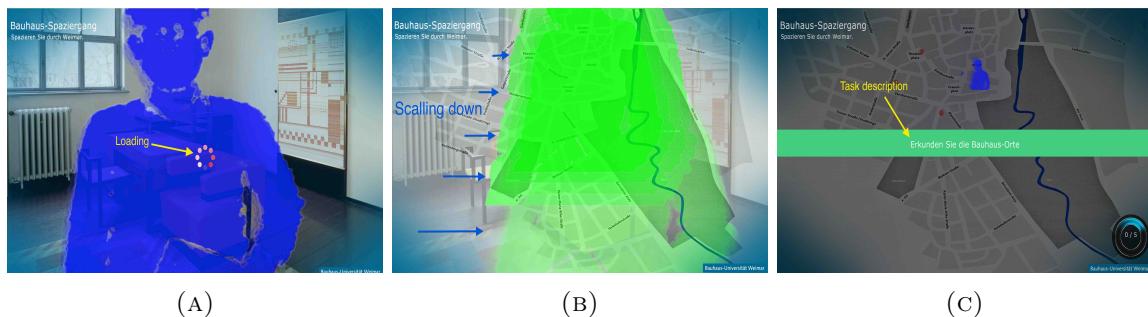


FIGURE 1.9

As can be seen in picture A, the person is close to the screen and the loading animation is started, in picture B the person silhouette is being scaled down (in this example the silhouette color is green) and in picture C the instruction is shown.

## 3. Map Interface (Interaction):

In this interface participant can interact with the elements on the map. In bellow

picture, the silhouette has visited two locations therefore has 2/5 score, to finish the interaction he needs to visit all the location or the timer(40 seconds) on the corner right will be over.



FIGURE 1.10: Map Interface

#### 4. Advertisement video:

The same advertisement video, which was for non-interactive, is shown after the interaction is overed.

## Mobile Interactive application

In this application, the display interface is absolutely the same as the other two applications; the only different is that a user carries out the interaction with a smartphone. The mobile interaction technique and platform was adapted from the Bauhaus University *MMM Ball*[12] project under Mobile Media Group<sup>6</sup> department.

#### 1. Initial Interface (Call-to-Action) :

This interface is designed in such a way to attract passers-by and also guide the participant on how to use their smartphone to access the advertisement application. The attraction is again the same method that was used for body, the passers-by silhouette is projected at the back of Access information. The interface has QR code that could be easy to be scanned instead of typing the whole IP address, and there is an alert area, that gets activated when a logged in person has not turned their phone in landscape orientation.

<sup>6</sup>Mobile Media Group: <https://www.uni-weimar.de/de/medien/professuren/mobile-media/>, last accessed 5 jun 2016

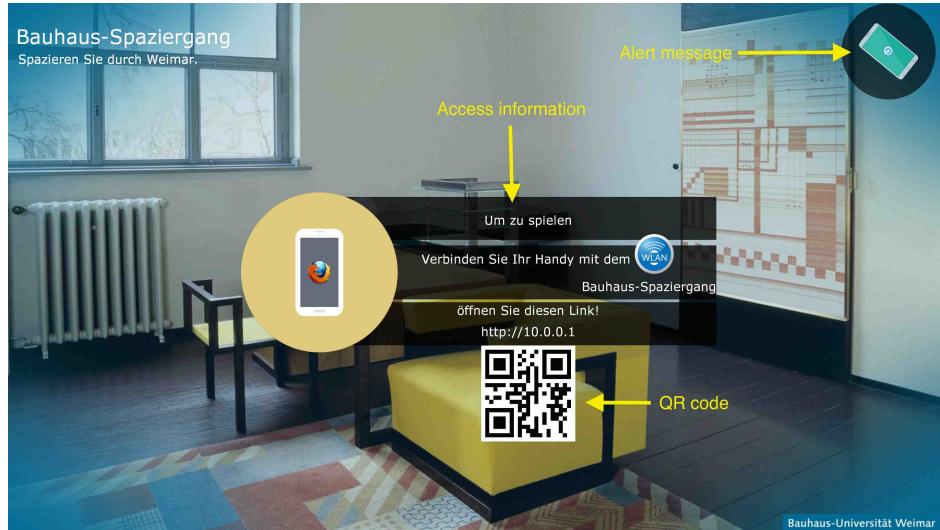


FIGURE 1.11: Initial Interface

## 2. Transition to Map Interface:

The user should login to the advertisement system and open the interaction controller and hold the mobile in landscape mode and then the bellow process will be triggered.

### (a) Loading animation:

The loading animation is a reaction to the action of the participants, and at the same time participants waits for something to be loaded.

### (b) Creating Colored cursor:

A colored circle will be created for the participant in the center of the screen; each participant would have different colors matching to their controller interface in their phone.

### (c) Show task instruction:

The instruction is fairly very easy and it is simplified in one sentence to explore locations on the map by using their phone.

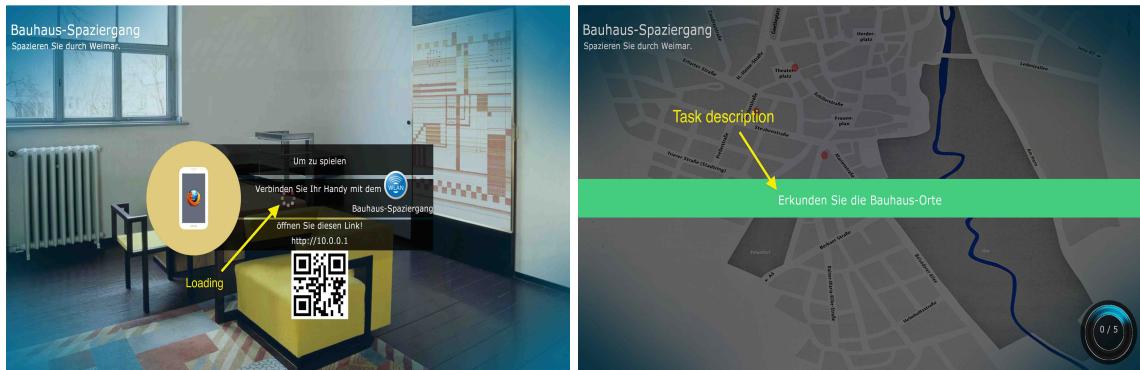


FIGURE 1.12: Transition of interface

In picture (A) a user has logged in and the screen is loading, in picture (B) the task description is shown.

### 3. Map Interface (Interaction):

Map interface is interactive for the participants; participants can navigate the cursor using their phone controller page. As can be seen in bellow picture, the user is controlling the cursor and has explored one location, the user's defined name is also shown on the cursor, to provide a hint that they have reached an interest point a small circle is shown to determine the area of that interest point. The interaction finishes when all the locations are explored or the interaction time (40 seconds) gets over.

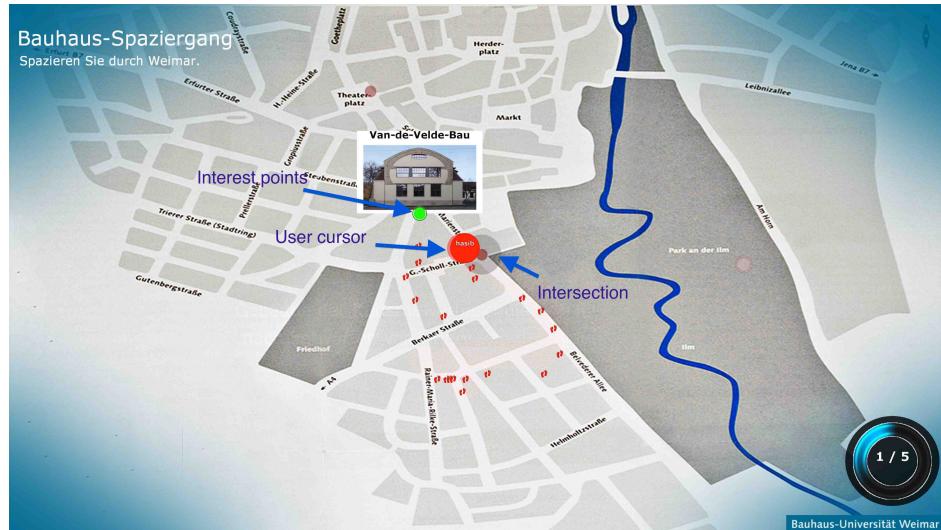


FIGURE 1.13: Map interface

### 4. Advertisement video:

The same advertisement video, which was for non-interactive, is shown after the interaction is overed.

### 5. Mobile interface:

The interaction controller in smartphone is shown in bellow picture, the interface is very simply designed and has two elements, the cursor and the select button, with cursor the user can navigate inside the map for interest points and when reached on an interest point the participant presses the select button to explore that location, see the picture bellow.



FIGURE 1.14: Mobile controller

## 1.3 Interaction Design

The body interaction model is designed based on *Audience funnel*, because it suites well for public setup like Tourist information center and advertising, with the design of this interaction model different levels of interactions and phases can be observed. Based on this model the three phases of the applications were designed (Call-to-Action, Interaction interface and ad video), this model attracts passers-by and gradually motivates them toward display for interaction to be engaged and at the same time it is convenient for passers-by to avoid the display.

### 1.3.1 Body Interaction Design

As can be seen in bellow diagram, that shows the display on top, the body-tracking area illustrated by a triangle, which is divided in two sections that is separated by dashed lines, (1) gray region defines the least interest regions, because in this area it is assumed that people maybe busy with other things around display, and people in this region can easily avoid the display and display will not motivate them for interaction, and (2) the highest interest region that it is assumed that people are aware of display and display would motivate them for interactions only if they are facing toward display.

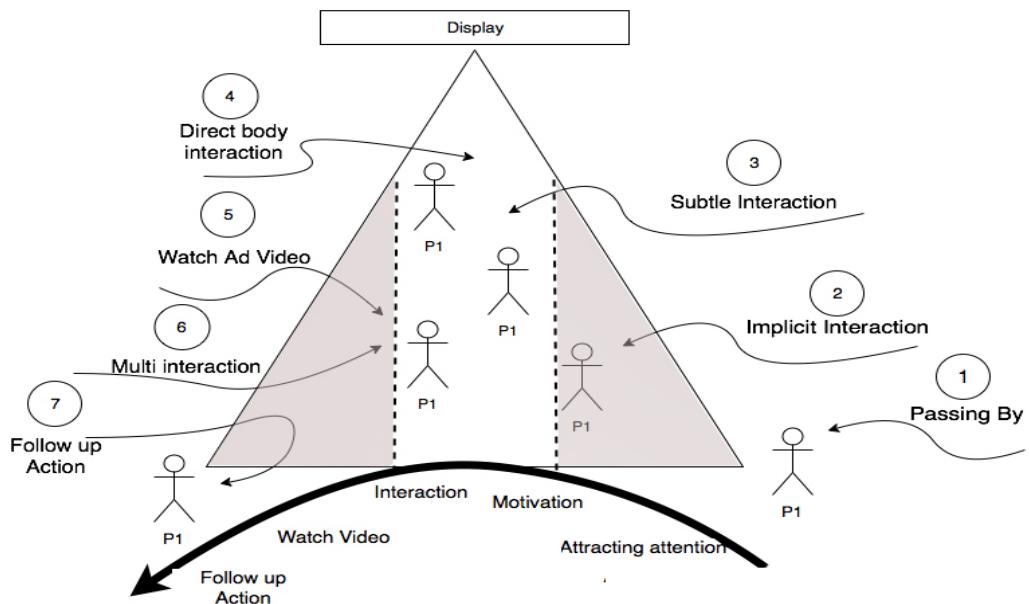


FIGURE 1.15: Body interaction design.

The model consists of seven phases, (1) Passing by phase, which demonstrates passers-by who are not in display tracking range, (2) Implicit Interaction phase, when passers-by are in the gray region of display tracking range but are far or at the side of the display, (3) Subtle interaction phase, where the user is in near and center area of tracking range and facing toward display, the system motivates the user for direction interaction with the call-to-action feature “*To play, Come near*”, (4) Direct body interaction phase, is when the user has actively started the game interaction and is playing, at this phase the whole tracking range (gray and white) could be used for direct interaction until the end of interaction phase. (5) Watch ad video phase, happens when the interaction is over and a short advertisement video is shown,(6)multi interaction phase, demonstrates that the user can perform interaction multiple times, and (7) Follow up Action phase, which demonstrates that the user takes a follow-up action after the interaction is completed.

Follow up action phase, is when the user leaves the display's tracking range and performs other actions.

The Black curve bellow the diagram shows the transition of user between each phase and shows the flow of the attention, motivation, interaction and other phases. The attention is captured mainly in implicit interaction phase, the motivation occurs when the user is in subtle interaction phase and the interaction is when the user is directly playing with his/her body in the entire tracking coverage area, after the interaction and watching ad video the curve changes direction to down which illustrates that the user would likely leave the interaction area and follow other actions unrelated to the screen.

- Attention:

A bottom-up approach was used to achieve the passers-by attention because the approach can help get attention by showing a sudden object, or by contrasting various colors. To do so, the silhouette representation of passers-by were projected on the screen, this representation can bring higher level of attraction because it is responsive on user movements, and has different contrast colors in relation to background. In chapter 3, this method was compared with other forms of representation and attracting attention and the silhouette was the top candidate.

- Motivation:

The motivation is done by bring joy, fun, curiosity and challenge[42] to the users who are attracted toward display. In body interaction design the use of passers-by's silhouette presentation would be a good motivational force to bring passers-by near the display, because this technique can become a source of fun and entertainment and can give a sense of connectedness with the display, and at the same time it also motivates passers-by by showing a *call-to-action* message like "to play! Come near", which is responsive to user movement and gives confident to them to play.

- Interaction and follow up actions:

When the user starts the interaction, the interaction carried out should be meaningful, understandable and easy else the user will leave immediately after some tries. Therefor many focus groups and evaluations of many prototypes were conducted to assure the usability of the body interaction. The interaction is explained in detail in the previous sections. After the end of interaction the advertisement video is shown and then the user can start again interaction or leave the screen.

### 1.3.2 Mobile Interaction Design

The bellow diagram shows the mobile interaction design; the diagram shows the display on top, and the triangle, which is body-tracking range for passers-by. The design has 8 phases. (1) Passing by phase, which demonstrates passers-by who are not in display tracking range, (2) Implicit Interaction phase, the mobile version also has the implicit body interaction for attracting attention only and it is not limited to a certain region, but the whole the tracking area could be used for this purpose, and no further direct interaction is possible, (3) Read Access info, after the user is attracted toward the screen, the user reads how to use his/her mobile phone to connect to the display, (4) connect to system, in this phase the user connects to Wi-Fi and opens the controller, (5) direct interaction phase, is when the user actively interacts using smartphone with the display, (6) Watch ad video, this phase is triggered when the interaction is over, (7) multi interaction phase, demonstrates that the user can perform interaction multiple times, (8) Follow up action phase, is when the user leaves the display's tracking range and performs other actions.

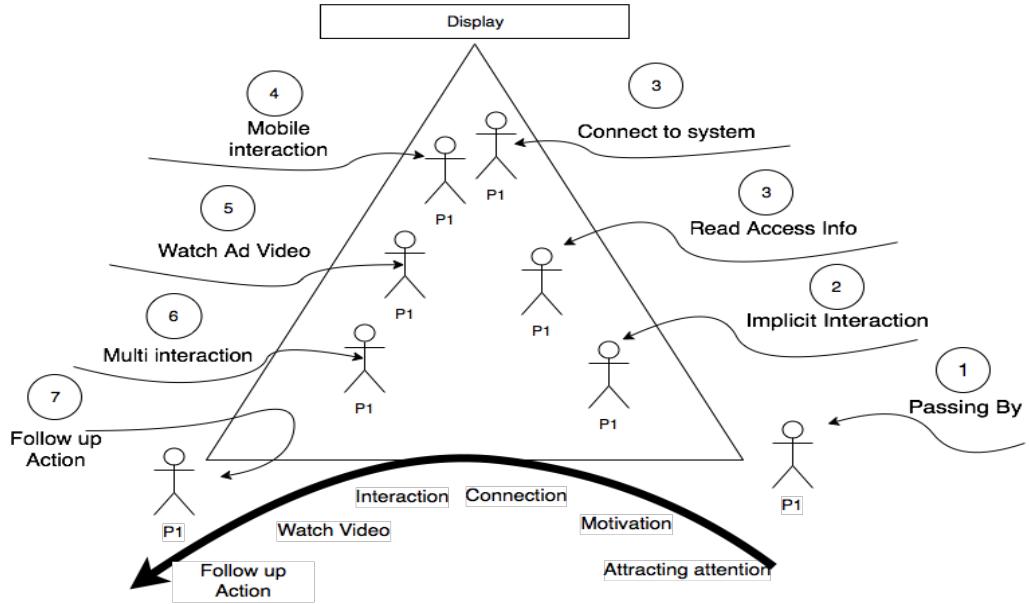


FIGURE 1.16: Body interaction design.

### 1. Attention:

Technologies like Bluetooth, infrared and NFC<sup>7</sup> of mobile devices in fact could be used for attracting attention of passers-by, but these technologies have their limitations and limited usage and not all mobile phones support all of the technologies and at the same time it is possible that the passers-by have not switched on these technologies because of battery consumption or other purpose. Therefor to attract all the passers-by without any limitation, the silhouette representation was used as it was used for body interaction design.

### 2. Motivation:

The motivation is also similar to the body interaction, because of the silhouette that bring curiosity and joy, and beside that an Info text is shown on the screen to give sufficient information on how to access the advertisement system and play the game.

### 3. Interaction and follow up actions:

The interaction with the game element is only possible with the use of a smart phone, the interaction usability is important in order to keep the passers-by engaged with the display. Therefor two prototype versions of mobile interactions were evaluated to remove any possible usability issue. After the interaction is over the advertisement video and other follow up action is taken by user.

<sup>7</sup>NFC: Near Field Communication

# 2

## **Interactive and non-Interactive Advertisement field study**

## 2.1 Introduction

Norman [81] describes that there are three different level of interactive computer system, (1) *visceral*, *behavioral* and *reflective*, visceral level is about the first impact or impression of a product it is about its appearance and look, (2) *behavioral level* is about the use and experience with something, and finally the (3) *reflective level*, which is the highest level of feeling, emotions and thoughts on something. Taking these levels in consideration, non-interactive advertisement can reach only the first visceral level that can only show content on the screen and cannot go further than that, but Interactive advertisement can reach the behavioral and reflective levels too, and can build strong experience and impressive effects, as a result more audience would likely pay significant attention to the content, which would consequently equate to higher advertisement recalls [87], and would increase involvement of both users and product that is believed to have an effective advertising to convey the advertiser message [86]. To observe the above effects in advertisements, there is a need to do field study.

Field studies are conducted outside the lab environment like workplaces, street, shop or even home, and the studies are involved in people observations in their everyday life and their behavior to a specific product or service [78], these field studies focus on social behavior of people, individual behaviors, product effectiveness and more. There were a lot of field studies on public displays, as Beyer, G [52] in which the user behavior and user experience was compared between flat and cylindrical displays, and Müller, J [11] did a study on how passers-by notice interactivity of public displays, another study conducted by Anthony Tang [20] that focused on consequences of the design choices with respect to encouraging *bystanders* to interact with the public displays, and classified *bystanders* who may never engage with the displays but contribute to interaction at some level. Junko Ichino [16] researched on how different display angles could impact social behaviors of people around displays and also in one of his another paper [17] investigated on User's cognition and subjective responses in relation to different display angles.

Audience behavior is an important research question in most of the public display evaluations; audience behavior is how a person or user(s) react around a situated display, these behaviors can result in higher attentions, for example the (1) *honeypot* [14] that is the effect that people who are already involved in interaction with display, attract other people around, it is also called “*sociable buzz*” by the author, in public displays this effect can even create multiple rows of people interacting [11]. Another audience behavior is (2) *landing effect* [11], where the passers-by realize the interactivity of the display after they passed the display and they tend to walk back for confirmation or for interaction. Another audience behavior is (3) *sweet spot* [52] where is a location that most people stand in relation to the display.

Effectiveness is another important area for public display and advertisement evaluation, which is defined by many factors (also discussed on chapter 3) like (1) Number of passers-by [28, 49], (2) among passers-by how many glanced [28, 29, 40] to display, (3) how many started interacting [11, 28] and (4) how long passers-by were engaged with display.

This chapter describes all the processes of the field study, in which the interactive and non-interactive advertisements were compared. The comparisons were on the attraction, effectiveness, passers-by different behaviors and their feedbacks on these advertisements. This research want to find out how much the interactive ads would change the attention level of passers-by, how much passers-by would be engaged and how their behaviors would be different compared to non-interactive, and if it does change how significant are these changes and what could be done to enhance these interactive displays to increase effectiveness of advertisement in public displays. In this study, two different interactive advertisements (body and mobile) and one non-Interactive advertisement displays were installed one after another each for one

week, and direct and indirect observations along interviews were carried for data gathering.

## 2.2 Advertisement

An advertisement for Bauhaus-walk<sup>1</sup> was developed after several small to medium user studies, to be the most meaningful and attractive advertisements for passers-by, and at the same time be same in all three conditions except the difference be in interaction and non-interaction.

### 2.2.1 Interactive and Non-interactive Ads

- **Non-interactive Advertisement**

This technique is composed of three phases, each of them is triggered automatically without the influence of passers-by, i also call it auto active advertisement. The first phase shows only the screen with the Bauhaus-Walk title and after few seconds switches to the second phase, in second phase the locations are automatically explored in random sequence and has expiration time of 40 seconds, after that the ad video is shown for about 20 seconds and switches back to the first mode. The entire cycle of the phases is around 60 seconds. Check phases sequence Demo Video<sup>2</sup>

- **Interactive advertisements**

Two interactive advertisement was developed, first Body interactive and second the mobile interactive. Both of them are designed to have three phases as non-interactive, (1) First phase, which is also called call-to-action<sup>3</sup> phase, (2)interaction phase and (3) the advertisement video.

Please read chapter 7 for complete interface and interaction space design.

1. Body Interactive:

The body interactive advertisement has the ability to detect up to seven people at a time and project their silhouette in the screen each with different colors, the Call-to-Action feature asks viewers to come near to the screen to start the interaction, when the interaction starts participants are given a short instruction on how to play the system, participants should walk physically in front of the screen in order to move the silhouette on the map to explore the regions. The interaction finishes if all the regions are explored or the 40 second time gets over and the Ad video is shown.

2. Mobile Interactive:

As you already got the idea that this technique works with smart phone, the system also shows partially passers-by silhouette for attracting attention, but the Call-to-Action is done through using a mobile phone, the screen gives instruction on how to access the system. Passerby should connect to the wireless local area network and browse the controller website from their phone, and the control opens in their phone to use navigate to different regions on the map to explore interest locations. The interaction is also constraint to 40 second time and after that the Ad video is shown.

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<sup>1</sup>Bauhaus Walk: , last accessed 30 May 2016

<sup>2</sup>Non-interactive sequence video: <https://www.youtube.com/watch?v=ZLszzfbZJgI>, last accessed 31 may 2016

<sup>3</sup>Call-to-action: A function of the system that invites participant for interaction

### 2.2.2 Advertisement Effectiveness

All the public advertisements like poster, banners and displays want passers-by attention and want them to stay longer and be involved because these factors enhance advertisement effectiveness.

#### 1. Attention

If an advertisement has higher attention then it can be an effective advertisement[87] and in public displays the attention is considered in

- Number of glances.
- Number of Honeypot effects.
- Number of Landing effects.

#### 2. Involvement / Engagement

Involvement describes the relationship of audience to a product or service and how strong or weak the relationship could be[85], and the strength of relationship can moderate the effectiveness of advertisement message [86], Engagement is one of the form of involvement for public displays. In this study the engagement was quantified as how long audience are involved with the advertisement screen.

## 2.3 Research questions

1. For which of the three conditions (body, mobile and non-interactive) advertisements passers-by
  - (a) Are more attracted?
  - (b) Perform Honeypot and Landing effects?
  - (c) Are engaged with the screen?
  - (d) Watch the advertisement video after interaction?
2. What are passers-by feedback about theses advertisement techniques?
3. What are other passers-by behaviors around this display?

## 2.4 Study design

### 2.4.1 Location

The screen was installed in Weimar Tourist Information center. This center is one of the famous tourist information in Weimar where a lot of tourists visit. Most importantly this location was chosen because the target audience (tourists) visit here.



FIGURE 2.1: Weimar Tourist Information Center Top-view picture, The locations are marked with yellow arrows.

### 2.4.2 Duration

Each of advertisement condition was installed for five days in the following three weeks.

TABLE 2.1: Week sequence

Advertisement	1st Week	2nd Week	3rd Week
Non-Interactive	X		
Body Interactive		X	
Mobile Interactive			X

### 2.4.3 Internal Validity

To be confident that the change in the weeks would not effect the findings, extra effort was done to make all the week environmental conditions the same as much as possible. The screen was installed in the same location, had the same screen brightness, height and also the surroundings of the screen were not altered, we asked the responsible person in tourist information center not to change anything in the surrounding. The luck was also with us that almost the weather conditions were the same too, but the only thing we could not control was the number of passerby; The flow of passers-by were also be nearly the same.

#### 2.4.4 Participants

The participants were the ones who pass by the screen, none of the participants were informed about this study nor any notes were put at the entrance. Roughly %60 of the participants were elder aged between 30-60, %25 were young and the rest %15 were children.

#### 2.4.5 Data gathering

Several types of data from different aspects were gathered for each individual week to be able for analyzing and also be able to answer new arising questions after the onsite evaluation, the bellow types of data were gathered.

##### 1. On-Site Observation

Observation periods were arranged in two different time slots per day, the first time slot was from 10:00 – 12:00 and the second was from 14:00 – 16:00, except for Saturday and Sunday where the tourist information center was open only until 14:00, then the observation period was from 10:00-12:00 and 13:00-14:00. During these two time slots the bellow observations were made and to remove the effects of specific time order, the orders were counterbalanced.

###### (a) Attention Level measurement

Attention level is how much a person gives attention to the display, which consist of number of glances and number of ignores and how long a person is standing in front of the display. At the beginning gaze-tracking method was considered for accurate measurement of attention level, a very impressive work have been done from Intraface [27] that can not only detect glances but also human emotions at the time, but because of high flow rate that method was not used and instead the glance counting which was proposed by [28] that has formalized a ranking system from which glance is considered if a person reacts to the display by turning his/her head toward it that last less than 3 seconds.

One hour attention level counting for each time slot was conducted, in which the observer was writing the number of people passing by and how many of them glanced and ignored the screen. see the glance counting sheet in Appendix: ??.

###### (b) Passers-by behavior and Interviews

During one hour per time slot per day the passerby behavior were observed like how they approach to the screen, how do they react, and what are they looking for and even how they ignore the display and after they are done with the display engagement a very short interview was taken from them.

Interviews were taken from the passerby that had some sort of engagement with the display like for non-interactive advertisement the people were interviewed that they stood for a while and saw the advertisement and for the interactive advertisement the people were interviewed that interacted or tried to interact with the system. A leaflet, that describes the thesis goal and interview consent form was handed to the participants and after signature the interview was conducted. All the interviews were audio recorded and later transcribed for analysis, all interviews took in average 4 minutes, the reason we took short interviews was that most of the people were tourists and had little time to stay and even some of them rejected interview because of shortage of time. Each week there were some variation in the questions dependent to the type of advertisement. fix the appendix

## 2. System Logs

The Advertisement application can generate the bellow logs.

### (a) Non-Interaction application

Only duration(seconds) spent in front of the display is logged for each individual person.

### (b) Interaction application

For this type the system can detect

- Time user joins.
- Interaction completion time.
- Number of tasks (locations) explored.
- Whole duration spent(sec).
- If the user has seen advertisement or not.

## 3. Colored-image recording

Colored-image recording from Kinect camera was done during entire three weeks for non-interactive and interactive advertisement for many reasons.

### • Passers-by engagement measurement

As discussed earlier, engagement was defined as involvement of audience with the display. The passers-by were considered as engaged if they had stayed longer than 3 seconds, in this sense two types of data were gathered for engagement.

- Number of engagements.  
Meaning how many people were engaged.
  - Engagement duration.  
How long audiences were engaged with the system.
- Count the number of Honeypot effects and landing effects.
  - Match the log data with the video data for accuracy.
  - Observe passerby behavior in detail.

Because of limited space and processing power, the actual depth information (x,y,z) for individual points was not stored but a 2D colored image was taken per second and after the image recording was done, in lab another post processing script was applied to integrate a static background using Adobe Photoshop application. To match the data logs and the image frames each image name consisted the date and time as (10.12.43.21.png).

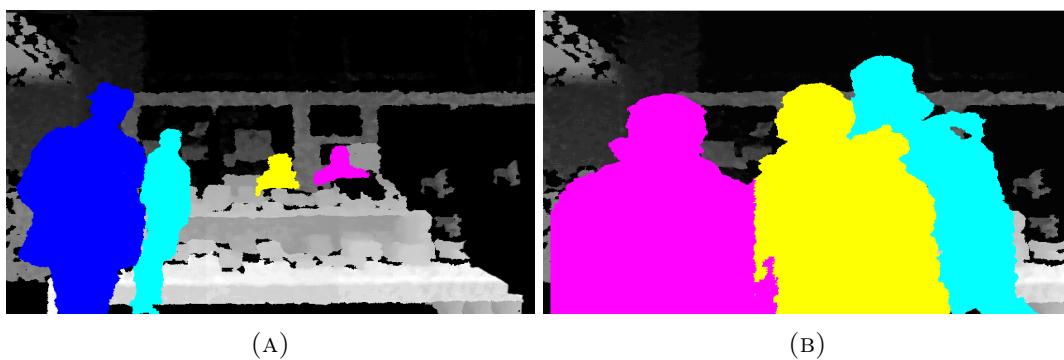


FIGURE 2.2: Depth recording examples

Other pictures were also taken using mobile phone from the scene, verbal permission were taken before the photographing them.

## 2.5 Data Analysing

### 2.5.1 Glance counts

The glance counts were transformed from paper to spreadsheet in which number of glances and ignores were recorded individually and then combined from which mean value and percentages are extracted. [fix appendix](#)

### 2.5.2 Interviews

All the interviews were transcribed and color coded from which interesting categories had emerged, each code is separately discussed in the finding section, To see color coded diagram see Appendix [fix appendix](#)

### 2.5.3 Display Engagement phases and time

Log files along depth images were seen and compared to have accurate values for each engagement phases and the whole interaction phases. depth frames were manually frame-by-frame analysed and the logs were cleared from any possible mistakes.

### 2.5.4 Honeypot and landing effects

These two effects were observed mainly from the depth frames and also partially from onsite observation.

### 2.5.5 Other observations

The observations were done onsite, the observer wrote down any important event happened at that moment, These notes also include observer own point of view of understanding the scenario during the entire day and week. Most of the notes have time stamp. See Appendix [fix appendices](#) The depth recordings were also observed frame-by-frame to see anything that was missed when the observer was not present at the center. Different behaviors are extracted from the observation, which you will find in findings.

## 2.6 Findings

To be more precise and structured, I have divided the finding sections in two separate sub sections, the first section describes the findings from each condition (Non-interactive, Body interactive and mobile interactive) separately and the second section compares the findings of these conditions among each other.

### 2.6.1 Non-Interactive findings

#### 1. Attention Level measurements

The number of glances and ignores were measured for the five consecutive days as shown bellow, each day (bar) has less than half number of glances compared to number of ignores and in total the average glance is %28, which slightly corresponds above (1/4) portion of passers-by.

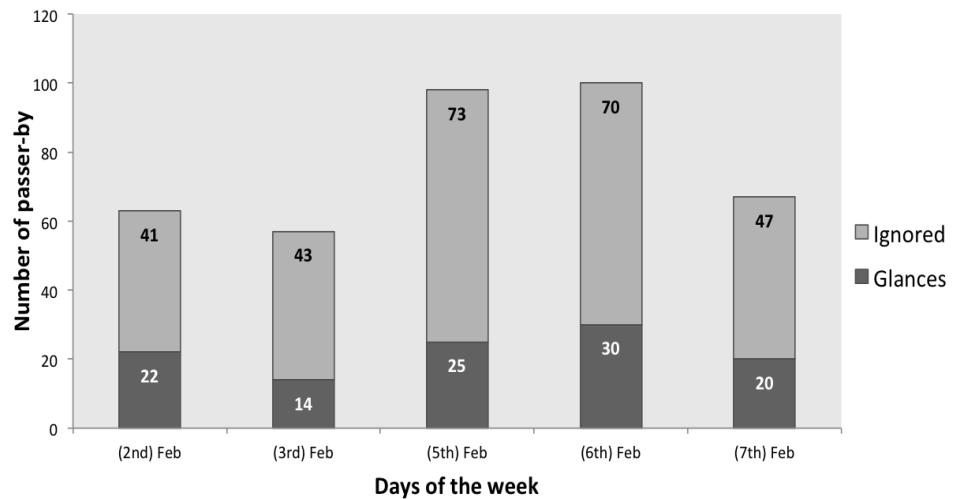


FIGURE 2.3: Non-interactive attention level chart

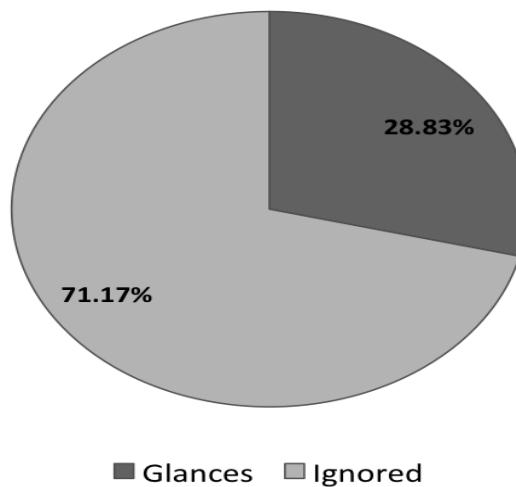


FIGURE 2.4: Non-interactive Attention level percentage

#### 2. Engagement Time

Not all people would take time to see the advertisement, some participants took very

little time like 4-5 seconds and some also saw the ad for about 100 seconds, which is almost twice of the advertisement time, so dependent to the interest, people were engaged in different durations and in average it took about 34 seconds to be engaged.

### 3. Number of engaged passers-by

Counting the entire passers-by was a challenge and there was not accurate and automated method to do, therefor each day's recordings were watched and the numbers of passers-by were counted manually, this intense work was carried out with a couple of computer science students who voluntarily participated. The bellow chart shows all the count of passers-by and out of those the people who were stood in front of the screen for more than 3 seconds were flagged as an engaged passer-by.

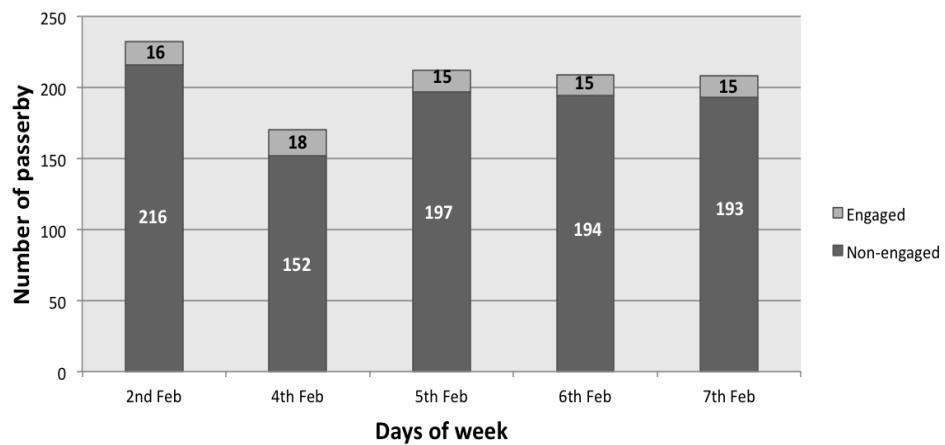


FIGURE 2.5: Non-interaction Number of engaged and Non-engaged passers-by

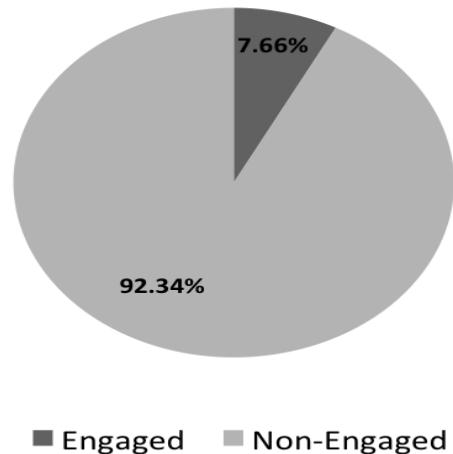


FIGURE 2.6: Percentage of engaged and Non-engaged passers-by

As can be seen in above chart it shows the number of passers who were engaged and number of passers-by who did were not engaged. The chart shows very few engaged people for each day and as an average %7.66 of the whole population was engaged within 5 days.

#### 4. Landing and Honeypot effects

Some might argue that Landing[14] effect do not exist in non-interactive displays because the displays do not react suddenly when a user pass by the screen, but at the same time users may react to the visual stimuli that generated by the non-interactive advertising by showing random contents, which is by its nature independent to the people around.

In non-interactive the silhouette is not projected and the passers-by do not see themselves in the screen, but still for some other reasons passers-by turned back from the end of the screen to the middle of the screen, there could be many reasons behind this, (1) maybe the screen was showing the advertisement video in which pages are changing after one another, (2) maybe the screen was showing city map in which interest locations are animated, (3) beside visual any other personal interest has dragged passers-by toward the screen.

As can be seen in the figure in the right, in frame (A) a person passes-by the display and is almost crossing the display, but suddenly in frame (B) he notices something and he stops, in frame (C) he explicitly shows his reaction by turning back toward display and in frame (D) he comes closer to the screen and starts to see or read advertisement content.



FIGURE 2.7: Landing effect

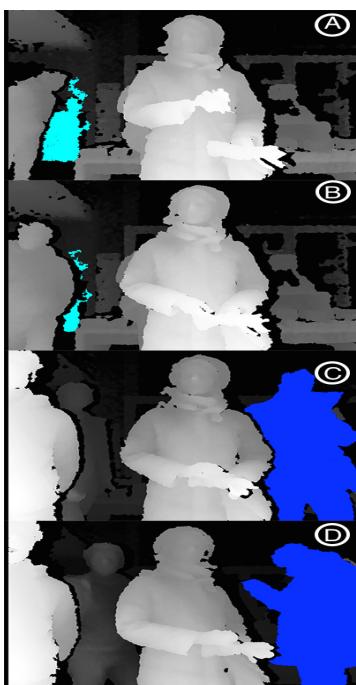


FIGURE 2.8: Honeypot effect

Honeypot[11] effects in non-interactive displays are rare because they do not make passers-by become curious about themselves, and passers-by do not perform any interaction or react differently, that could be noticed by other passers-by, therefore most of the observations on this effect seemed to be more passive and this effect could be due to that a friend was watching the screen and another friend of him / her got attracted or attracted person might just had another intension for-example to talk him. The scenarios seemed to be very personal.

As can be seen in the picture in the left, In frame (A) a lady is standing in front of the monitor and reading the content and after a while in picture (B) another person is approaching the monitor to see what was happening and immediately another person in picture (C, D) was also attracted to come close and see what was going on.

The below the number of effects that occurred for each day is recorded.

TABLE 2.2: Landing and honeypot effects

Days	Landing effect	Honeypot effect
2nd Feb	1	1
4th Feb	0	1
5th Feb	2	3
6th Feb	0	3
7th Feb	1	1

## 5. Interview

### (a) Likes

Many things from the advertisement were interesting, like the concept of map and the design. As one stated that, “*I find the idea good, it is nice to see the pictures of the places on the map*”, “*it is very nice idea because it will be remembered and when I go to the city I will remember*”

### (b) Dislikes

Most of the respondents complained on the speed of the advertisement that how fast the image changes as one said “*But the pictures were changing very fast*” other said, “*advertisement is a little fast*” They mentioned that why speed is an issue as stating, “*we wanted to see the map*”, “*Could not read the text*”. Many things were disliked by some of the respondents like the advertisement theme, one said, “*It did not have Bauhaus Theme, the color and that design*” One respondent also disliked the blinking points.

### (c) Participation

Respondents mentioned the same excuses that were given at body interactive advertisement, one said, “*I will join if I am free*”, other said, “*I have no time*”, or “*if the weather is good*”.

### (d) Advertisement recall

People could recall the ad, as one mentioned, “*It is for a tour of Bauhaus in Weimar*” other said, “*People can visit the city*” and some mentioned directly the name of the program “*Bauhaus-Spaziergang*”.

### (e) Recommendations

There were many recommendations proposed by the responders, which was on content, speed, design. Content related recommendations was that one said, “*If the prices are mentioned it would be good so that they can decide if they want to take it or not*” other said on timing, “*how long does this tour take so people arrange their*”. Another mentioned on speed like “*it must be little slow*”.

## 6. Audience behaviors

Note taking technique and video observations helped to analyze the environment and behavior of people around the display. See appendix fix this appendix

- Passive:

The behavior toward non-interactive during the 5 days observation seemed to be very calm and passive, passers-by selectively came to watch the screen there was no curiosity nor attractiveness that had driven their attention. It was thread as a source of information and whenever they approach the screen the participants would normally stand for a very short time and after looking for 1-2 pop-up pictures on the screen they would leave, except for participants that was looking for some events that stood for the complete duration of the advertisement. There was an interactive object in front of the display on the table, which many people tried to play.

- Display negligence

At most of the occasions the display was neglected and passers-by were busy with their own personal activities and discussions even though they were standing in front of the display facing toward it.

- Display blindness

Passers-by also ignored and passed by the display because they did not expect to be something special related to them.

- Display as information board

Some of the passers-by expected the display to be a source of information, for example some tourist stood in front of the display to see the map and find out locations by reading the street names on the map.

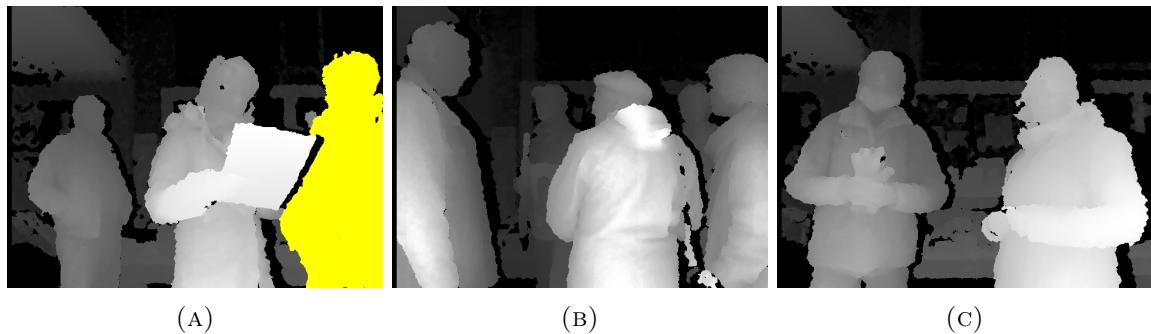


FIGURE 2.9: Passers-by Behaviors

As can be seen above, the first two pictures show that the display is completely ignored and people are busy with themselves. Picture C shows two couples are reading the screen.

### 2.6.2 Body Interactive findings

#### 1. Attention Level measurements

The bellow chart shows the observation number of glances and ignores of passers-by for two distinct hours of five days. As can be seen the in most days the number of glances and ignores are almost near but not still ignores percentage is higher, as can be seen in the pie-chart %41.41 are the number of glances and around %59 is the number of ignores.

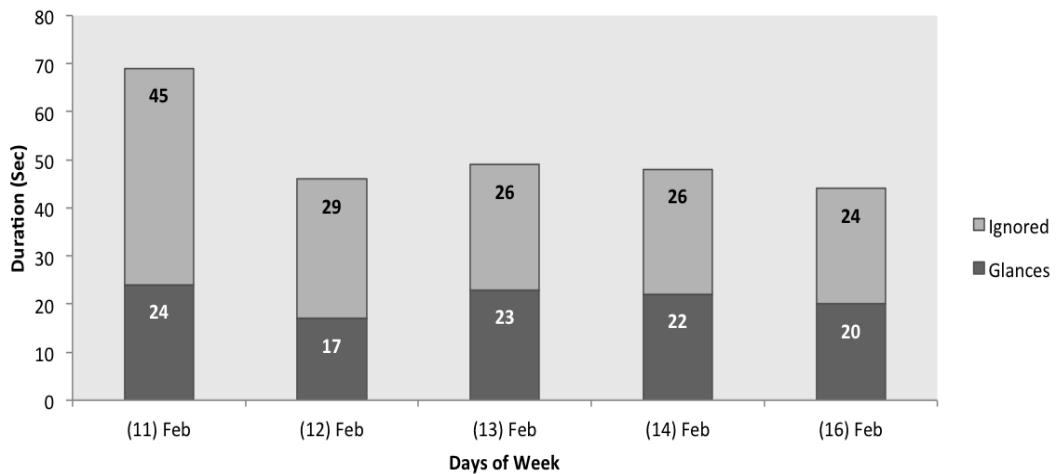


FIGURE 2.10: Attention level chart

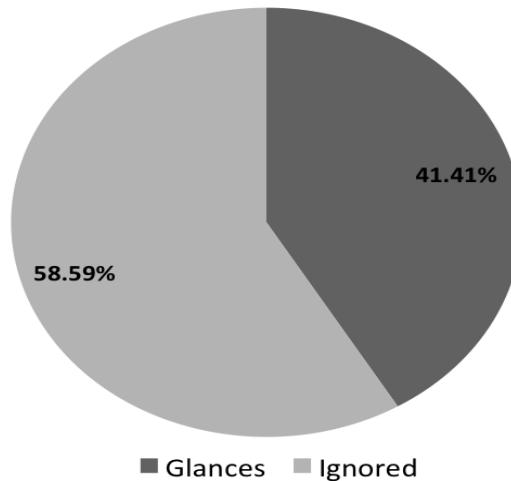


FIGURE 2.11: Body interactive Attention level percentage

## 2. Engagement phases and time

take average of single and group interaction time

There were passers-by who were very interested in the interaction that played the game even three times, some people triggered the game and left in the middle and some people were just staring at the screen and did not triggered the game, therefor people were engaged in different stages of the game and spent between (10, 200) seconds, and in average passers-by spent around 42 seconds.

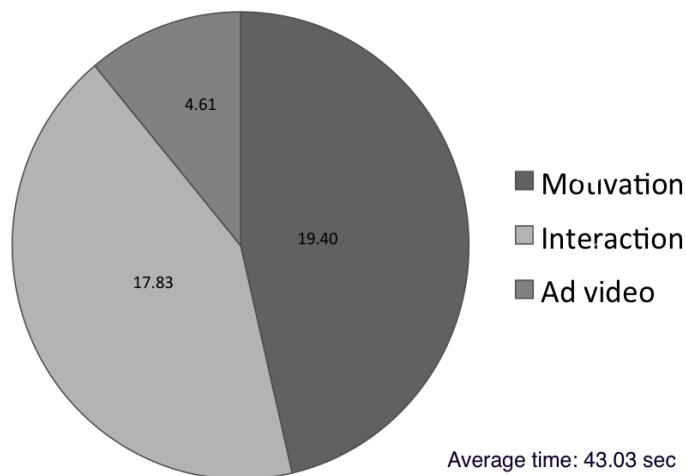


FIGURE 2.12: Average time for each phase

The advertisement was divided in three main section (1) Attention / Motivation, which is the pre-interaction phase that the participant has not started the game and just playing with body or looking to the screen or reading call-to-action text, in this stage some people by just looking to the screen approached and started the interaction less than 5 seconds and some people took longer time to think and then triggered the game, at some occasions participants just left without triggering the game so in average it took around 20 seconds for this stage. (2) The interaction part in which people again took different times, some people played more than two or three times and some played the first element and left so in average it took about 18 seconds for this stage. (3) The advertisement video which had the least time spent most of the participants left the

screen after they saw the advertisement video in 2 seconds and some were excited to play again so they waited for a while In front of display until the end of advertisement video this was very rare among participants, so in average it took around 4.5 seconds for advertisement video.

### 3. Number of engaged passers-by

As mentioned before, for non-interactive the entire day's recordings were manually analyzed frame by frame from which the number of passers-by were counted. The bellow chart shows all the count of passers-by and out of those the people who stood in front the screen for more than 3 seconds were flagged as an engaged passer-by.

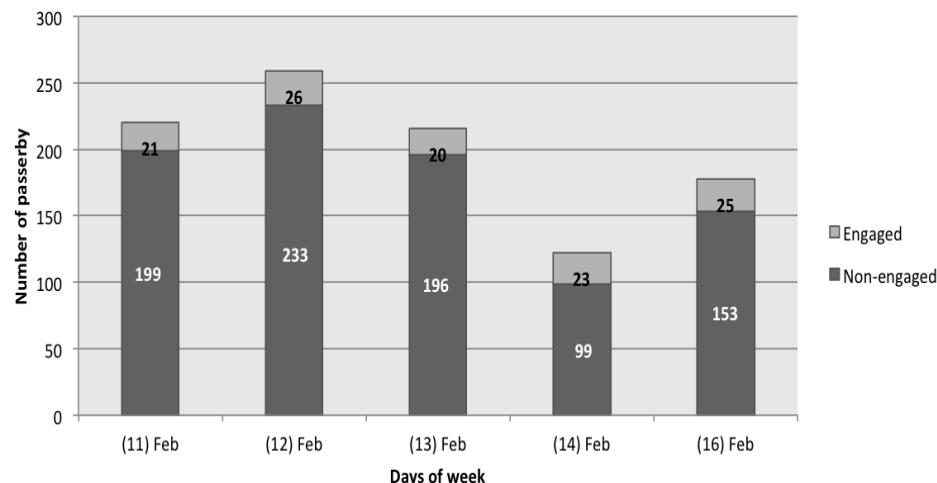


FIGURE 2.13: Body interactive Number of engaged passerby

As can be seen from the chart bellow the number of them are shown in bar chart for each of the day. And in average around %12 of the passers-by were engaged with the screen.

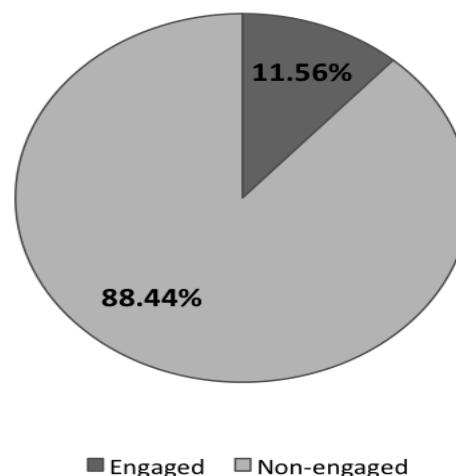


FIGURE 2.14: Percentage of engaged and non-engaged passers-by

#### 4. Landing and Honeypot effects

Interactive displays are known from the most well known user behaviors, (1) honeypot effect and (2) landing effect because they drag passers-by attention significantly so that the passers-by be involved. In body interaction both of these effects were observed while direct observation and while depth recording analyzing. This was the most time consuming task ever and took about a week to analyze and document them.

As before landing effect was discussed, that a person recognizes the interactivity after he /she has already passed by the screen and as a result walks back to confirm if the interactivity is there and check what the display is about, and how to interact. In body interaction all of the landing effects has happened by noticing their silhouette on the screen and has turned back, these effects were observed for individual and group passers-by.

As can be seen in the picture in the right, in the first frame two persons are passing by the screen and one of them has not seen his self in the display even his silhouettes was projected, but the second person who has yellow color (A) notices the interactivity while his friend is still continuing to pass (B, C), but this guy who has noticed stops (colored changed by Kinect camera) in frame (C, D), his stopping drags his friend attention and at this point his friend notices the display and walks back to see his self in the screen (E).



FIGURE 2.15: Landing effect

The honeypot effect is the effect, which other people are attracted by noticing the current people that are somehow involved (interacting) with the display. The people by whom the honeypot effect had occurred, were different, some people might have been in the initial interface by just playing with their silhouette, or they were actively interacting with the game or they were watching the advertisement video, that dragged the people's attention. The engagement duration was higher, as a result participants stood longer, which results in higher number of honeypot effects.

As can be seen in the picture on the left, a boy is interacting with the system in frame (A), the body moves a bit behind from the display in frame (B) at this time another random person who does not know him or has noticed before, tries to approach to the screen in frame (C) and then when the person sees his silhouette then he tries to actively to take control of the interaction by coming in the center of the screen in frame (D) and the other active person was left behind the scene.

The bellow chart lists all the frequencies of honeypot effect and landing effects that was recorded from the depth recordings

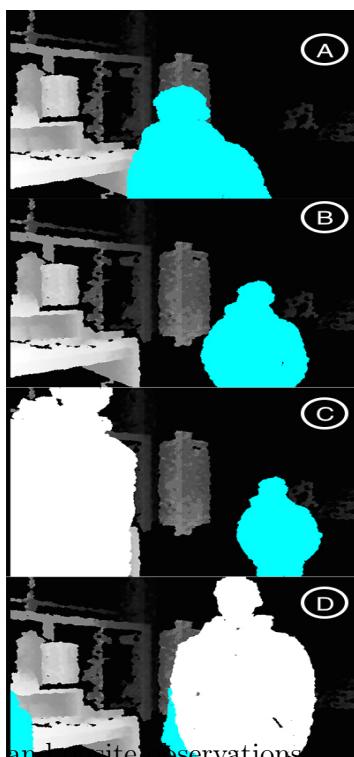


FIGURE 2.16: Honeypot Effect

TABLE 2.3: Landing and honeypot effects

Days	Landing effect	Honeypot effect
11 Feb	2	2
12 Feb	3	3
13 Feb	2	2
14 Feb	2	5
16 Feb	3	3

## 5. Interviews

The interviews were coded each individually and as a result the bellow categories are extracted, these categories are mainly taken from the questions and others are from the replies of the participants.

### (a) Noticing

Different people had their different experience and reaction when they noticed themselves in the display for the first time. Some of the people were standing and looking some books for long time when they saw themselves and for confirmation they waved toward the screen, as one said “*Yes at first I thought that it is not me. I waved my hand and came near.*” Other said, “*Yes I saw my blue color body*”. Other participants noticed at the time of passing from front of the screen, “*when I was passing I saw myself in the screen.*” Other people saw their friend first then noticed themselves like one said, “*I saw my friend in the screen and came near and I was also there with blue color.*” One participant who usually comes to the center every week said that because the screen was newly installed I came near to the screen to see what is new inside.

### (b) Ad recall

Respondents responded accurately the content and goal of the advertisement as one said, “*It was about a tour of Bauhaus, Bauhaus Spaziergang.*” “*It was about tour in the city.*” And other said, “*It was about Bauhaus-Walk. City tour.*” And other said, “*it is something to do with Bauhaus city walk*”.

### (c) Interest

People find this type of interaction very interesting, funny and motivative, one participant mentioned that, “*I liked to see myself in the screen, it was funny.*” Other says the use of media is very interesting and comfortable for people, “*I think that the people with the use of media is comfortable*”. The use of this type of interactive advertisement give people some sort of good feeling toward Bauhaus-Walk event like one said, “*Bauhaus is very interested to me and it sounds fun*”. People also liked the way content was inside the advertisement like one said, “*It is very interesting to see the pictures*” and even one participant exactly mentioned the goal of the advertisement interaction, “*it was a very interesting idea and it is like a small interactive tour for the people who want to take Bauhaus-Walk.*”

### (d) Event participation

Respondents showed sign of interest to join the program in future but are not able to join quickly because of many reasons like they are here for short visit as one said, “*We are here in Weimar for short visit*”, others said they are busy with many other programs like one said, “*Now we are going to Weimar Museum*”.

### (e) Confusions

There was some confusion during interaction, like the interaction seemed unclear, one said, “*I did not understand how it works*” other said, “*I left because I did not*

*understand*" and some people also experienced this by coming very close to the screen and nothing is shown to them at that time, "*when I was standing I saw that it says come near, and I came near to the screen and the map came but I left after standing for a short time because I did not understand it.*"

(f) Dislikes

When a person hovers on a location in the map, a related picture is shown on the screen and deems off after a while, some participants complained about time and said, "*Pictures goes very fast*", one person complained about the rendering speed and said, "*Pictures come very late*".

(g) Recommendations

Respondents recommended that the advertisement should be able to hint users on how to use it, as one said, "*It would be good to put some more information that how we can use it.*" Other said that "*Maybe explain how someone can walk with these body figures*". One person even said, "*It is good that here someone stand and describe it to the people who come near to the screen.*" Some of the participants also recommended to slow down the picture changing of the advertisement.  
fix the appendix

## 6. Other observations

During the body interactions despite honeypot and landing effect other different kinds of behaviors have been observed and how passers-by reacted when there was an interactive display, the behavior with the display was much different compared to non-interactive as listed bellow.

- Group and individual interactions:

Passers-by interacted both in groups and individual, the groups ranged from two to four people. %49 of engagement happened by individuals and %51 engaged were done in groups. The bellow pictures show different group interactions happening between friends as in picture (A, B) and another three persons interacting in picture (C, D).



FIGURE 2.17: Group interactions

- Calling others:

People were getting really excited and liked to call his / her friends to come and join and have fun with the interaction, most of this reaction was seen between children and parents and couples. As can be seen in frame (A) a person is watching the display and then moves out in frame (B) and in frame (C) calls a friend of him/her and in frame (D) both of them are in center of the screen and watching themselves in it.

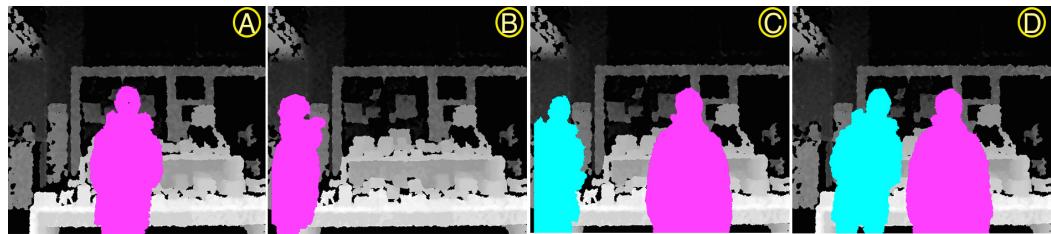


FIGURE 2.18: Calling others

- Playing with silhouette:

Passers-by liked the different colors specially when they were couples or children before they triggered the interaction. As can be seen in bellow picture there is a couple that likes to play with the different colors of their silhouette.



FIGURE 2.19: Playing with silhouette

- Interactivity confirmation:

People who saw their selves from far distance were not sure if the screen was interactive so they started waving their hands, body or their heads to see if their silhouette reacts to their movements. Some of the people did not apparently acted but progressively came near to screen like (spying) and then left. As can be seen in bellow frames, in (A) a person notices his/her silhouette and immediately raises hands in frame (B) and his fellow friend also notices and raises hand up in (C and D).

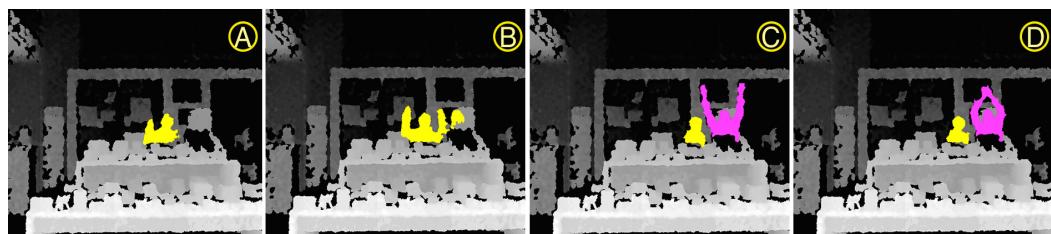


FIGURE 2.20: Noticing interactivity

- Raising hands up:

During the interactions some of participants raised their hands up mainly because of the alert message that was shown on top right corner of the screen if they were undetected by Kinect camera. As can be seen in the pictures that shows different frames people during interaction and prior to interaction are raising their hands up.



FIGURE 2.21: Raising hand

- Physical space domination

The people in front of the display were either interacting or either leaving the space by walking away or turning their face back from display, people felt some sort of influence of their presence in front of it.

- Call-to-action reaction

Most people came very close to the screen when approached by the application, this lead to confusion later in interaction because the camera could not longer track them.

- Interactions behaviors

The movement of silhouette during interaction is by moving forward / backward or left / right, some at early interaction leaned down or jumped higher to go forward or backward on the map.

- Incorrect expectations

Some passers-by who started the interaction using their body, expected that the screen should be working using touch, they tried many times to touch the elements, one of the main reason of this behavior seemed to relied on the fact that they were called to come near, and they felt became more personal with the display and the display which was small in dimension also provides the hint of being personal. Touch interaction is know to be more personal action than using body or other gestures.

- Interaction negligence (technology skeptical)

Some of the elder participants ignored the interaction even after understanding the call-to-action, and after interviewing them they responded that they did not know how that thing works, and after interviewing an employee of the tourist information, he said that the elders are a bit skeptical about the use of technology.

### 2.6.3 Mobile Interactive findings

#### 1. Attention Level measurements

Attention attraction technique was quite similar to body interaction technique, which was projection passers-by silhouette but with a difference of access information text rendered on top, people would partially see their silhouette but still it was an attention mechanism, the measurement was done for five days each day for only two hours of direct observation.

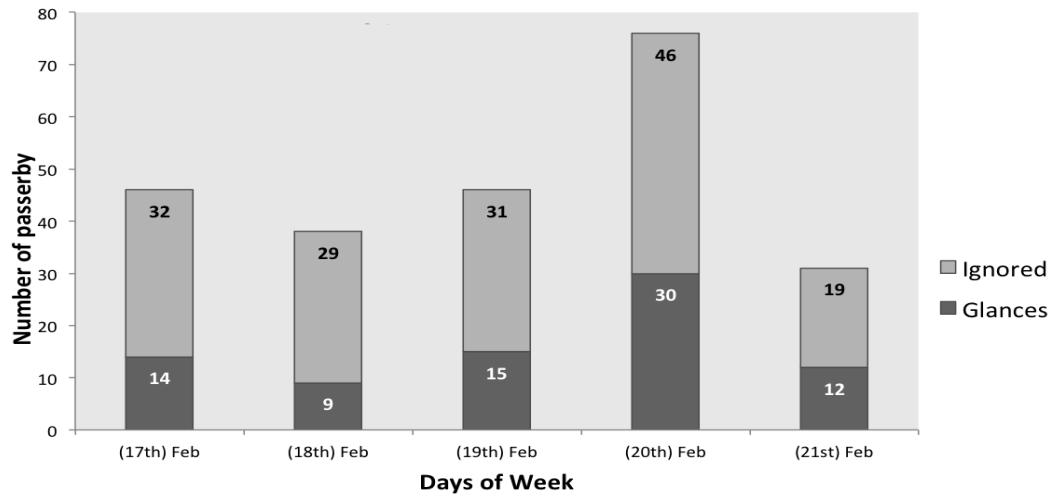


FIGURE 2.22: Mobile interactive attention level chart

As can be seen the number of glances have decreased compared to body interaction, since other things were not changed except for the access information so it could be the result of that, that people have not fully seen themselves or recognized.

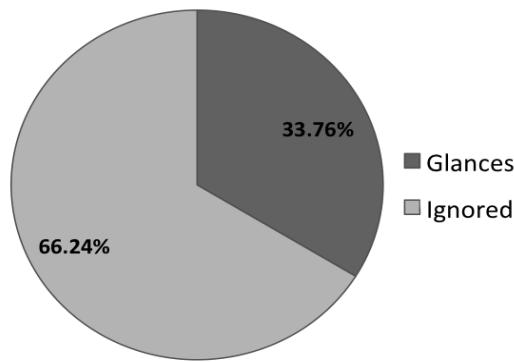


FIGURE 2.23: Attention level percentage

The percentage of the whole week of glances was around %34 and %66 of the cases the screen was ignored.

## 2. Engagement time

Although no passers-by interacted with the system, all of the participants were in the first screen of the advertisement that showed the Bauhaus-walk name and their silhouette. It took in average around 22 seconds to be engaged passively with the screen, which is less than non-interactive and body interactive applications.

## 3. Passerby and engagements

The entire five days were observed using the depth recordings and manually the number of passers-by were counted and from which the passers-by who stood for more than 3 seconds were flagged as engaged, as can be seen below in pie chart that shows one day each. Most of the passers-by stood for a very short time.

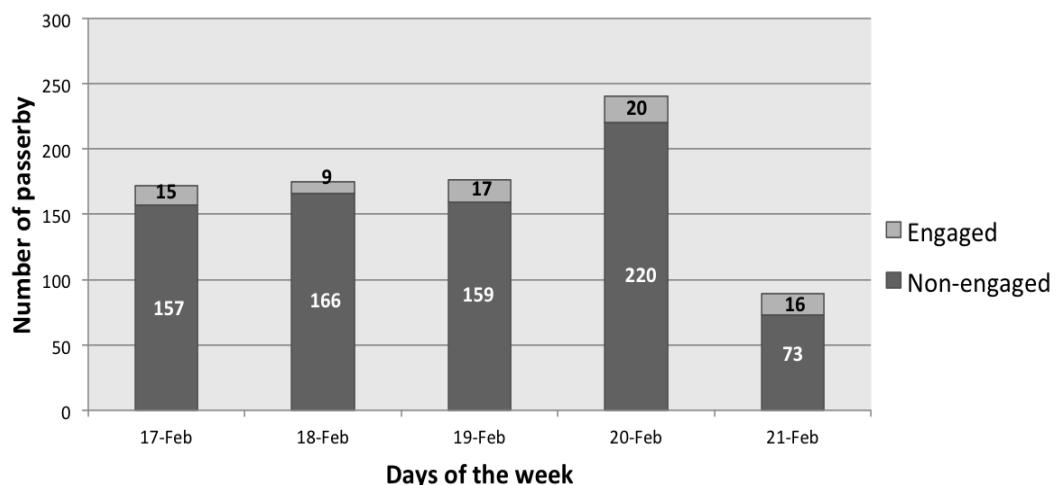


FIGURE 2.24: Mobile interactive Number of engaged passerby

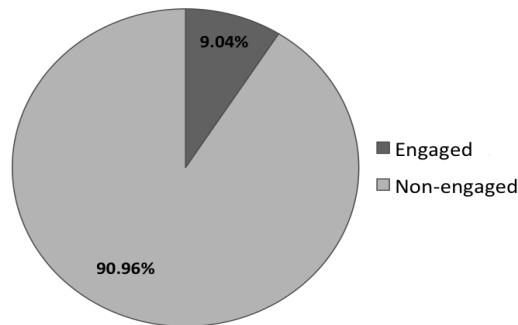


FIGURE 2.25: Percentage of engaged passerby

The pie chart above illustrates that only 9.04% of the passers-by were engaged with the system.

## 4. Landing and Honeypot effects

Landing and honeypot effects in this technique were very not strong enough mainly because no passers-by interacted with the system.

Honeypot effect was mainly because of the silhouette representation as said before this effect was very weak because of info-screen showed partial body representation, passers-by rarely noticed the text. Only two times honeypot effect occurred and people did not get

engaged with the system afterward. This effect could have been improved if passers-by had actively participated to play game. The picture bellow shows a green colored person at frame (A) at this point he was watching the screen for a while and when he moves out of the screen (B, C) another yellow colored person appears from the back side (C) and walks toward the screen (D, E) and gets close very close at frame (F).

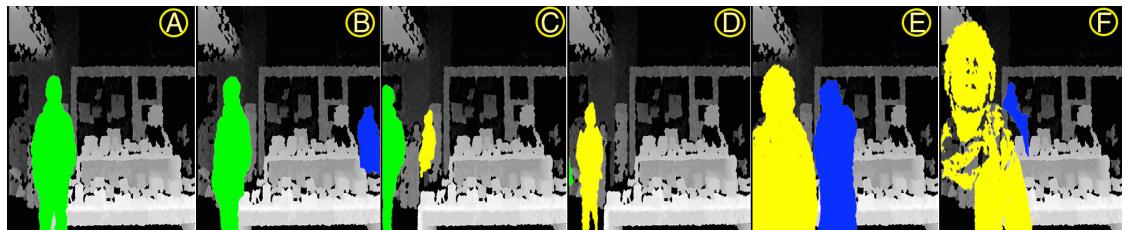


FIGURE 2.26: Honeypot effect

Landing effect was also recorded in some occasions and happened because they saw their silhouette, very less people noticed and most ignored. As shown in the picture from right to left a person is crossing the screen (A – E) but on frame (F) stops and move a little back to see what is on the screen. The person does not entirely come in the center of the screen. The passers-by left after standing in front of the screen without any interaction.



FIGURE 2.27: Landing effect

The bellow table shows the number of honeypot and landing effects that happened during the five days.

TABLE 2.4: Mobile Interactive Landing and honeypot effect

Days	Landing effect	Honeypot effect
17 Feb	0	1
18 Feb	1	0
19 Feb	2	0
20 Feb	0	0
21 Feb	1	1

## 5. Interviews

complete the interview report

## 6. Other observations

fix Appendix and put some picture frames

Passers-by were attracted to the system when they saw their silhouette, which was kind of similar to the body interaction technique. The below are behaviors people had with the system.

- Curiosity

Passers-by who noticed showed curiosity and tried to come near to the screen or started waving their hands toward the screen.

- Playful

Most of the kids that noticed, felt excited only to see their different colored silhouette and even at some point started to dance in group.

- Interaction ignoring

All the people who were attracted ignored to interact, that could have many different reasons, like the lack of enough knowledge of how to do, or not having mobile phones or not interested to play, as one of them were interviewed he said that he does not use phone in public he only uses it for calling.

- Scanning code

During five days only two persons tried to scan the QR-code and after scanning they just left.

### 2.6.4 Comparison of advertisements

This section compares different findings of each condition as listed below one by one.

#### Number of passers-by

Advertisements techniques were not conducted in the same days, this could ruin comparison of them in between because maybe different number of passers-by have passed in those weeks, therefore, there was a need to first compare the number of passers-by and prove that they were not statistically different in between.

##### Hypothesis:

- **H0:** There was no difference between numbers of passerby of each conditions.
- **H1:** There was a difference between numbers of passerby of each conditions.

The below is the table of passerby for three weeks.

TABLE 2.5: Number of passerby in three weeks

<b>Days</b>	<b>Non-interactive</b>	<b>Body</b>	<b>Mobile</b>
Day 1	232	178	172
Day 2	170	220	175
Day 3	212	259	176
Day 4	209	216	240
Day 5	208	122	89
<b>Total</b>	1031	995	852

ANOVA test revealed that there is no significant different of passers-by between each of the conditions. ( $F_{2,5}=0.8873$ ,  $p > .05$  ( $p=0.437$ ) So based on this the  $H_0$  hypothesis is being accepted and  $H_1$  hypothesis is being rejected. This gives us confidence to proceed our comparisons.

#### Attention Level Comparison

As can be seen Non-interactive had %28.83 number of glances, the Body-interaction had almost %10 high number of glances (%38.70) than non-interactive, The mobile Interaction had higher glances (%33.75) from non-interactive but still less than body interaction. With this I can not conclude that body interaction had higher until it statistically proven.

To compare which of the three methods drove more passers-by attention, the data of number of glances for each of the weeks were gathered as below and first Chi square test were applied to find if they were statistically different or not.

##### Hypothesis:

- **H0:** There was no difference between numbers of passerby of each condition.
- **H1:** There was a difference between numbers of passerby of each condition.

TABLE 2.6: Cross tabulation for each week attention level

Methods	Glanced (%)	Ignored	Total
Non-interactive	111(%28.83)	274	385
Body interactive	106 (%41.41)	150	256
Mobile interactive	80 (%33.75)	157	237
<b>Total</b>	297	581	878

The Chi-squared test reveals that  $\chi^2(2, N=878)=10.863, p < .05 (p=.004376)$ , meaning that there is a difference so  $H_0$  is rejected and  $H_1$  hypothesis would be accepted. To find that where actual difference was, each pairs were tested in between using again Chi-squared test.

#### 1. Non-Interactive Vs Body Interactive

The finding shows that body interactive advertisement had significant number of glances than non-interactive advertisement.

$$\chi^2(1, N=641)=10.8581, p < .005 (p=.000984)$$

#### 2. Non-Interactive Vs Mobile Interactive

The finding suggests that there was no significant difference between Non-interactive and mobile in this case.

$$\chi^2(1, N=622)=1.6716, p > .05 (p=.196039)$$

#### 3. Body interactive Vs Mobile Interactive

As can be expected the glances was not statistically significant among the body and mobile interactive advertisement too.

$$\chi^2(1, N=493)=3.0663, p > .05 (p=.07993)$$

### Engaged and Non-engaged passers-by

This test is to compare if there was a difference between number of Engaged passers-by or not between the conditions.

#### Hypothesis:

- **H0:** There was no difference between the numbers of Engaged passers-by between the conditions.
- **H1:** There was a difference between the numbers of Engaged passers-by between in each conditions.

The bellow table lists all number of engaged and non-engaged passers-by for three weeks.

TABLE 2.7: Number of engaged passers-by in three weeks

Days	Non-interactive	Body	Mobile
Day 1	16	25	15
Day 2	18	21	9
Day 3	15	26	17
Day 4	15	20	20
Day 5	15	23	16
<b>Total</b>	79	115	77

The ANOVA test strongly suggests that there was a significant difference of the number of Engaged passers-by between these three conditions.

$$(F_{2,5})=11.20, p < .05 (p=.002)$$

To find where were the main difference between them, the Post-Hoc Tukey's HSD test was conducted on each three pairs of the conditions to point out which of them exhibit statistically significant difference.

TABLE 2.8: Post-Hoc Tukey's HSD

Methods	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	5.6337	0.0047509	** p<0.01
A vs C	0.3130	0.8999947	insignificant
B vs C	5.9467	0.0032197	** p<0.01

Method A, B and C refers to (Non-interactive, body interactive and mobile interactive) advertisement accordingly. As can be seen from the above chart, there is no significant difference between group A and C, but group B shows a significant difference between A and C. it shows that the body interactive advertisement engaged significantly more passers-by than other two types of advertisement.

explain HSD Q statistic value

### Landing effect

The bellow table shows how many landing effects were recorded from the depth observation video for each of the weeks.

#### Hypothesis:

- **H0:** There was no difference between the number of landing effect of Passers-by for each condition.
- **H1:** There was a difference between the number of landing effect of Passers-by for each condition.

TABLE 2.9: Number of Landing effect in three weeks

Days	Non-interactive	Body	Mobile
Day 1	1	2	0
Day 2	0	3	1
Day 3	2	2	2
Day 4	0	2	0
Day 5	1	3	1

ANOVA test reveals that there was a significant difference between one or two above conditions, ( $(F_{2,5})=7.529, p < .05 (p=.008)$ ). So I reject the Null hypothesis and state that one of the above conditions were statistically significant from the others, to confirm this I again run Post-Hoc Tukey's HSD test on the above data to find out exactly which one was different.

TABLE 2.10: Post-Hoc Tukey's HSD results

Methods	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	4.7527	0.0144554	* p<0.05
A vs C	0.0000	0.8999947	insignificant
B vs C	5.9467	0.0144554	* p<0.05

Group A, B and C refers to (Non-interactive, body interactive and mobile interactive) advertisement accordingly As can be seen the test shows that the condition A and C were insignificant but condition B is significant from A and C, which means that body interactive advertisement has statistically higher landing effects than other two conditions.

### Honeypot effect

The bellow table shows how many honeypot effects were recorded from the depth observation video for three conditions.

#### Hypothesis:

- **H0:** There is no significant difference between the numbers of honeypot effect for the conditions.
- **H1:** There is significant difference between the numbers of honeypot effect for the conditions.

TABLE 2.11: Number of Honeypot effect in three weeks

Days	Non-interactive	Body	Mobile
Day 1	1	2	1
Day 2	1	3	0
Day 3	2	2	0
Day 4	2	5	0
Day 5	1	3	1

ANOVA test reveals that there is a significant different between the conditions, ( $F(2,5)=12.29$ ,  $p <.05$  ( $p=.001$ )), and after doing Post-hoc Tukey test it revealed that there was significant difference of Honeypot between Body Interactive and Mobile interactive advertisement, but less statistical different between Non-interactive and body interactive as the online tool gave one star for A and B and two stars for B and C.

TABLE 2.12: Post-Hoc Tukey's HSD results

Methods	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	4.2762	0.0264780	* p<0.05
A vs C	2.6726	0.1836687	insignificant
B vs C	6.9488	0.0010053	** p<0.01

## 2.7 Discussion

As in non-interactive, the phases were automatically triggered one after another in sequence of time, and passers-by might have encountered to different phases in different occasions and this could have influenced the attention level because not all the phases had the same interfaces, in the first phase the screen did not have enough movement and the other phases had more pictures, movements and colors, but there was a higher chance of encounters of passers-by with the second two interfaces because of the durations they were shown like, the first phase was only for 5 seconds and the others were for 20 to 40 seconds. While on other hand in interactive advertisements, passers-by had more encounters with the first phase because of the silhouette representation, this phase did not have any time limitation until the game interaction was not started.

Engagement of passers-by with the system were also different in three conditions, in non-interactive people might be engaged in watching the two phases (map and video phases) and in body-interactive in the first two phases (attraction, map phases) and in mobile interaction, the engagement was only in the first phase (attraction). Despite these difference in all the phases the Bauhaus-Walk logo and goal of the event was mentioned, people still could understand that what was the advertisement about.

Honeypot effect was more seen in interactive advertisement compared to non-interactive one of the reasons could be, *Interaction movement*, passers-by perform interactions that involve body movement and the movements can attract other nearby, while in non-interactive there were very limited movement. The landing effect was also significant in interactive compared to non-interactive. One of the main reasons could be that in non-interactive passers-by could have encountered in different phases of display and some of the phases might have been interested or more attractive and they performed landing, and in other phases they might have not performed landing effect at all, while in interactive advertisement, passers-by had performed landing effect in the first phase (silhouette representation) and in this case also not all had landed back to screen some people might have liked it and some might not.

In body interactive advertisement, People did not stay longer than 4.61 seconds to watch the video, which is very less compared to the interactive phases (game, silhouette). There could be many reasons for this, (1) *interaction disturbance*, The video phase is a disturbance to participants interaction and I believe that no one likes to be disturbed while they are busy with something, (2) *End of Fun*, by showing the ad video, the participant loses that interest and enjoyments while he/she had during the interaction, (3) *dis-connectivity*, the person feels disconnected to the screen and there is no more place for him/her in display, (4) *Force to watch*, the person feels the direct force to watch the advertisement video, (5) *Time consuming*, participant might think that it will take time to watch till the end of video (6) *Traditional ad effect*, it has the feeling of traditional TV or radio advertising like, in the middle of a movie an advertising video is shown, which people often do something else till the movie start again.

In Mobile interactive advertisement no one interacted with the game using their mobile phone, this could have many reasons, (1) *feel of Insecurity and trust*, smartphones are used by people for calling, messaging, note-taking, emailing, videoing, photographing and for other personal usages, therefore people feel insecure to use their smartphones in public spaces so that their personal belonging might not be theft by other people, in this case the owner of the advertising screen, (2) *Limited technical knowledge*, not all people have technical knowledge about the use of smartphone, specially the elder people, who can only use it for calling or texting, but not connecting to internet or playing games, (3) *Lack of smartphones*, elder people still use their old mobile phones, which does not have Wi-Fi or browser capabilities,

(4) *Physical setup*, the screen was placed in pathway, where people walk often, there is not a comfortable area to sit, connect to system and interact with the game, (5) *Time consuming*, the use of phone and specially a game is considered to be time consuming process, and people in Tourist information center do not have that much time to take their phone and play, (6) *Confusion*, the attraction method was with the use of body silhouette representation, and the interaction was with mobile phone, which might have confused passers-by.

## 2.8 Conclusion

This chapter concludes the findings and observations of three different advertisement techniques from which one was non-interactive and two of the others were interactive as described below.

Non-interactive advertisement in tourist information was very quiet, people reacted normally, the sense of joy and excitement was not felt with display, participants selectively stood and read the advertisement for a short period of time and most of others ignored the displays, around 1/4 passers by glanced in each two hours of observation, %7.6 passers-by were engaged among all the passers-by in the entire days of week and spent 34 seconds in average, people liked the design of the interface, but also complained about the speed and theme of content.

Body interactive advertisement started with joy and fun, the behavior toward the screen was different from the non-interactive, attention level was about %41.41 that passers-by glanced toward display, and people among all passers-by during the week %12 of them were engaged that took 42 seconds in average. Many landing effects and honeypot effects were observed and beside that, people reacted differently to notice the interactivity and approached toward the screen, the interactions happened individually and in groups, the attraction attention method was appreciated and participants understood how to trigger the interaction mode. In this technique a lot of passers-by seemed to be active at front of the monitor, the physical space around the screen directly had influenced the people behaviors, people called other friends to join the interaction and raised a sense of awareness around.

Mobile interaction technique was one of techniques that did not really find its value in the environment, except for the attraction attention area, no one interacted with the system and no one were motivated to try at-least for one time, but still people were interested to see their silhouette and spent a little time in front of the display. %33 of passers-by glanced and among all passers-by during the week only %9 of them were engaged within 22 second in average.

At the conclusion from the findings and observations and comparisons of all three different techniques body interaction technique was the most statistically attractive, which received higher number of glances, increased the number of whole passers-by to be engaged, increased the duration of engagement and raised number of honeypot and landing effects. This technique was one of the most acceptable and preferred techniques for interaction in the area by participants. The use of ad video after body interaction is not suitable for interaction design, else participants would leave the interaction quickly, The video could be embedded inside the interaction phase for a short period of time should not occlude the silhouette so that the person do not feel disconnected with the advertisement. The non-interactive and mobile interactive findings were not significant and I believe that mobile interactive advertisement would be significant if it is installed in a location that is comfortable for people to sit and take time to interact and the target audience should be more from young generation, who are more familiar with the technologies.

3

**Advertisement enhancement**

### 3.1 Introduction

The very first phase to get passers-by engaged with the display is the getting their attention first. In previous experiment during the course of five days, only %12 of the entire of passers-by were attracted and engaged, there could be many reasons, (1) the passers-by could not see their silhouette until got very close to the display and camera and by that time the passers-by might have turned his/her face from the display without looking to their silhouette, (2) Passing by the screen happens within 2 or 3 seconds and that is not enough for passers-by to understand interactivity quickly. [get the quotation](#), (3) from the observations made during three weeks, most passers-by turned their faces toward the table, which was located in front of the display, and walked around the table to look for books.

Because of the mentioned main issues and the attraction of less number of passers-by, this chapter discusses on the extended version of attracting attention design to enhance the attention level of passers-by who were far or at corner of display and still could be tracked by display. The chapter also discusses on the study design and evaluation of this technique and meanwhile compares this technique with the previous technique to see the effectiveness and advantages.

### 3.2 Enhanced attracting attention

The change in the new version was to extend the tracking area about 180 degree around display, this would over come the issues pointed before, because when passers-by walk from the sides the camera can track them and the application can project their silhouette, by doing this there will be enough time for passers-by to get attracted while coming toward display.

To achieve this, three Kinect cameras were integrated in the sides and in the center of the display and the tracked passers-by silhouette images were stacked together and shown on the display, a person passing from the side could see his self at the side of the screen and when moving to the middle of the screen the application could smoothly transition the person from side camera to the center camera by having the same silhouette color, physically the cameras were positioned side-by-side, therefor there was a small gap for each camera range, which was also not perceivable by passers-by. See the picture bellow to have a glance to the design.

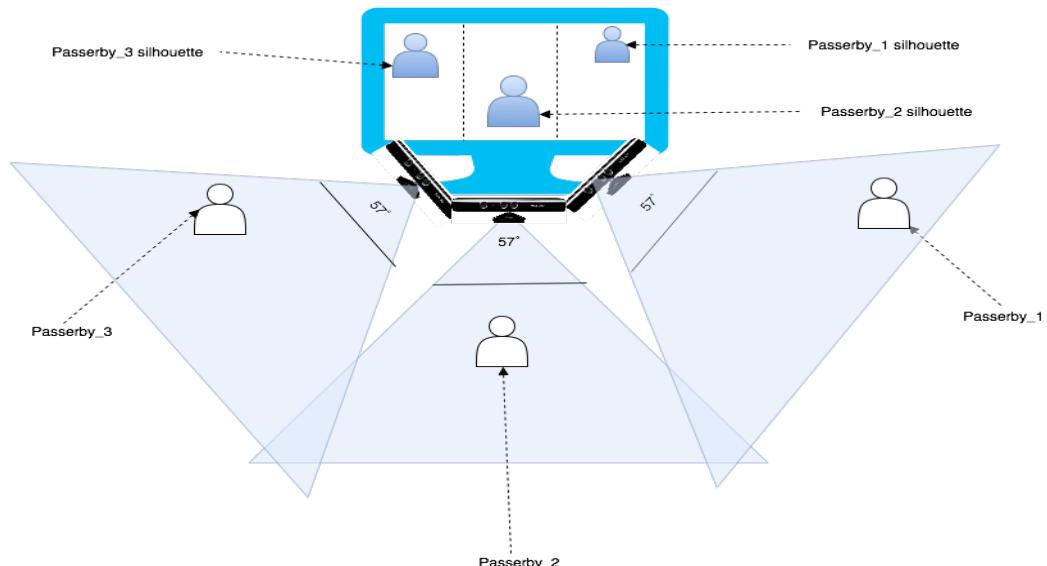


FIGURE 3.1: Attracting attention extended version.

### 3.3 Interaction design

The interaction design for the extended version is completely the same as the body interaction design that was introduced in chapter 7, it consists of seven phases, (1) Passing by phase, (2) Implicit interaction phase, (3) Subtle interaction phase, (4) Direct body interaction phase, (5) Watch ad video phase, (6) multi interaction phase, and (7) Follow up action phase. The range for implicit interaction phase is extended in both sides shown in gray color, which attracts passers-by from the sides of the display and also allows participants to do implicit interaction like playing with the body silhouette, and whenever users enter in subtle interaction zone shown in white color, then the display motivates users with call-to-action feature toward display for direction interaction and after interaction a short video is shown and then again participants can follow the interaction or be involved in other activities.

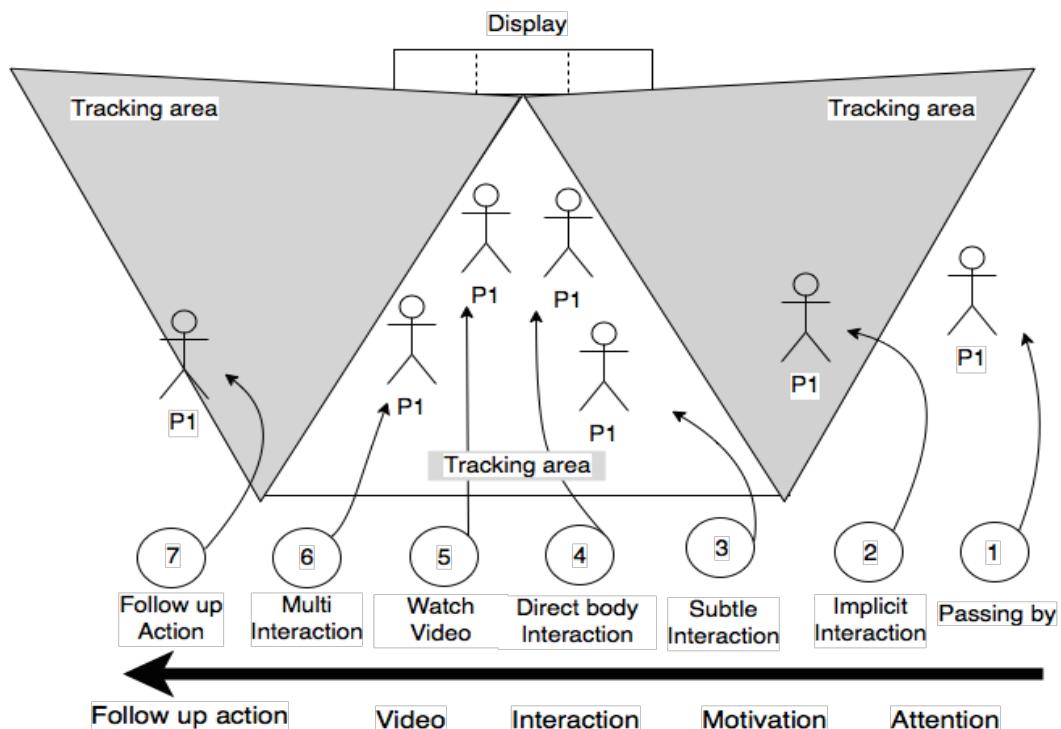


FIGURE 3.2: Extended Interaction design

### 3.4 Research question

This experiment was conducted to find out that what are the major effects when the coverage area is expanded in both right and left side of the screen, compared to the previous body interaction.

1. Would the attention level change?
2. Would the number of engaged passers-by increase?
3. Would the average engagement time rise?
4. Would there be any changes in number of Honeypot and landing effect?
5. What would be the passers-by behaviors to the display?

## 3.5 Study design

### 3.5.1 Location

This experiment was conducted in the same location that was chosen in previous location, it was positioned in the same pathway of passers-by with the same height and screen brightness. The surrounding of the display was also kept similar like the previous.

### 3.5.2 Duration

This experiment was conducted only for three continues days at end of the week, Friday, Saturday, Sunday.

### 3.5.3 Participants

The participants were from Tourist information center; they were not informed that there is an interactive screen. Most of the participants were of old age, and the rest were middle aged and young aged participants.

### 3.5.4 Data gathering

The bellow types of data were gathered during three days.

#### 1. On-Site Observation

Observation periods were selected the same as the previous study, from 10:00 – 12:00 and the second was from 14:00 – 16:00, During these two time slots the bellow observations were made.

##### (a) Attention Level measurement

Number of glances and number of ignores were counted by observing the passers-by from a fixed location, anyone who turned his/her face toward the display for less than 3 seconds were counted as glance, and those who had not turned their faces at all where selected as ignored. see the full report of glances in Appendix.  
**fix the appendix**

##### (b) Passerby behavior

The behaviors of the passers-by were observed by direct observation onsite and also from the Camera depth recorded frames. From the observation two important effects were taken in consideration (honeypot and landing effect).

#### 2. Colored-image recording

A 2D colored image was taken per second from each of three cameras, and meanwhile were joint together side-by-side and after the image recording was done, in lab another post processing script was applied to integrate a static background using Adobe Photoshop application. To match the data logs and the image frames, each image name consisted time as (12.43.21.png). Below three Kinect images stacked together, as can be seen that people's colored images was rendered on the images (1,2 and 3) these images are stacked together so that the transition of one person be smooth from one camera to the other.

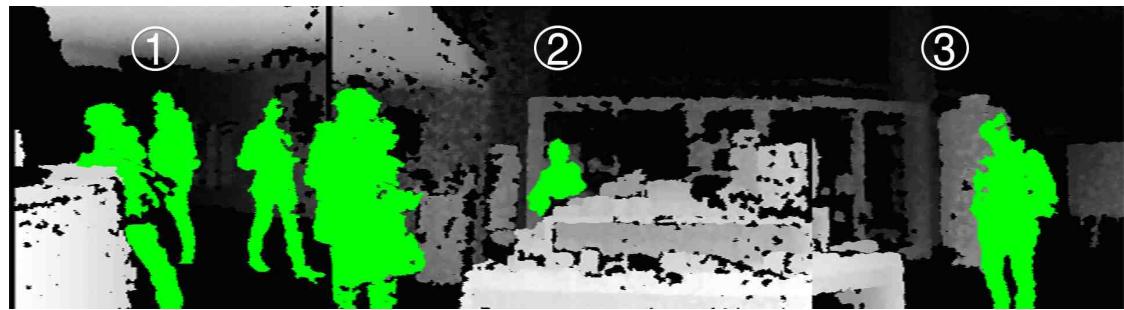


FIGURE 3.3: Three Kinect images

## 3.6 Findings and results

This section first lists all the findings for enhanced version of advertisement then it compares it with the previous interactive advertisement.

### 3.6.1 Attention Level measurements

The bellow chart shows the number of glances and ignore for the following three days.

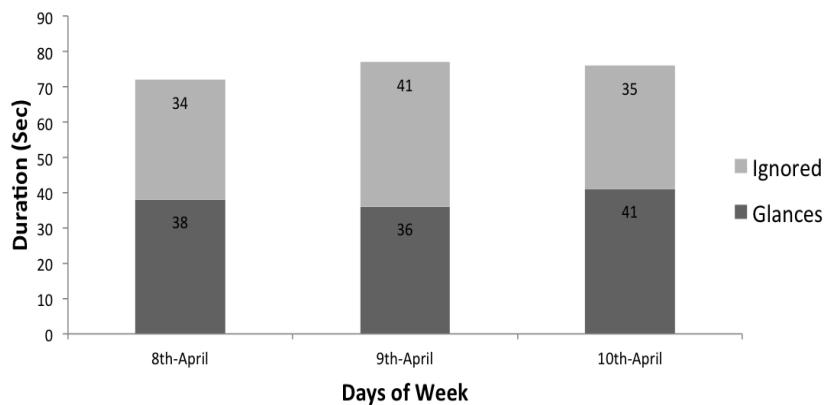


FIGURE 3.4: Attention level chart

As can be seen from the above chart every day has almost similar number of glances and ignores and in average it makes about %51 glances and %49 ignores.

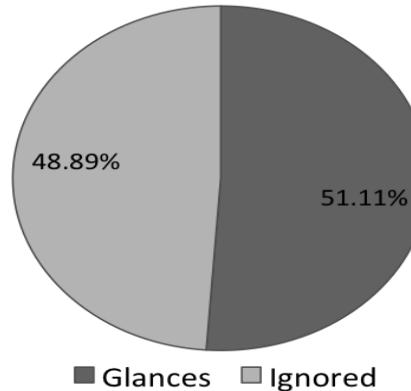


FIGURE 3.5: Attention level percentage

### 3.6.2 Engagement phases and time

The engagement time for phases were measured from system logs and depth recording manually and in which people spent 16.10 seconds in average for the Attraction/Motivation phase some people took longer and some shorter, and some of them may have left without switching to the rest phases. 16.20 seconds in average was spent for interaction phase, which was different from person to person, and only 3.63 seconds in average was spent for video advertisement.

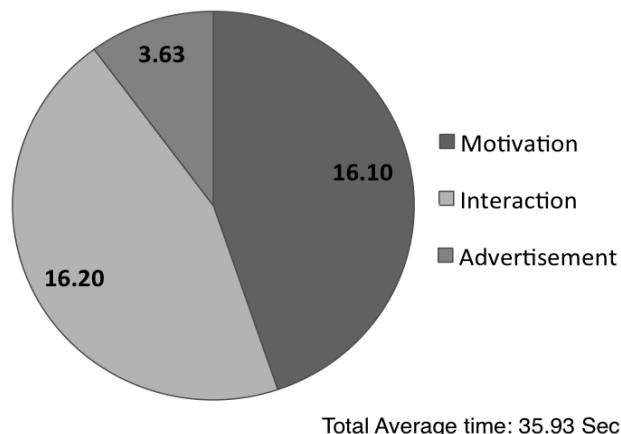


FIGURE 3.6: Average time for each phase

The entire average engagement duration for all these three phases together, was around 36 seconds.

### 3.6.3 Number of engaged passers-by

The entire three day's recordings were manually analyzed frame by frame from which the number of passers-by were counted. The bellow chart shows all the count of passers-by and out of those the people who stood in front the screen for more than 3 seconds were flagged as an engaged passer-by.

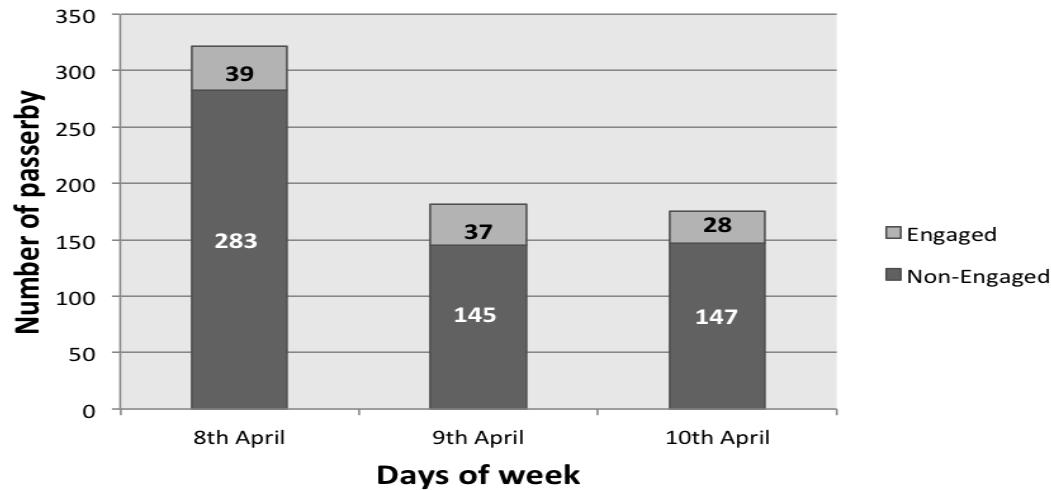


FIGURE 3.7: Number of engaged passers-by

From entire passers-by %15.32 of them were engaged with the display and the rest might have only glanced or simply ignored as shown in the chart bellow.

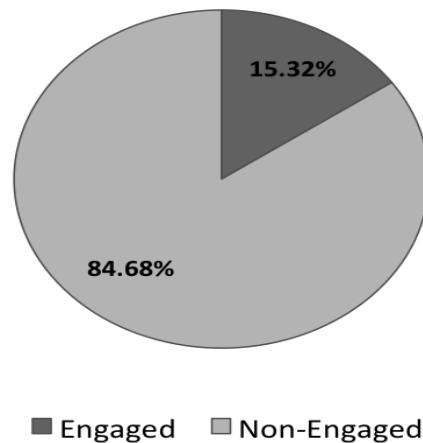


FIGURE 3.8: Percentage of engaged and non-engaged passers-by

### 3.6.4 Landing and Honeypot effects

Although the number of days were only for three days, but Landing effects [11] and Honeypot effects[14] were observed for this type of technique and they were not as strong as in previous interaction technique. See the example frames bellow.

- Honeypot Effect:

As can be seen from the picture in the right, which is composed of three kinect images that has covered right and left and the center of the display. In first frame (A) in the middle of the screen two persons are engaged and interacting for some time and a women at the left is busy with the help desk, but she is curious about the screen and has got attracted toward the screen, and she has looked many times in previous frames, in frame (B) the two guys leave the interaction and walk away from the screen and the application is left alone, and in frame (C) that women is left alone and is watching her self in the screen, and then approaches toward the screen in frame (D), she is near to the screen and I guess realizes that the screen is in fact interactive and in frame (E) she comes closer and starts actively interaction in frame (F).

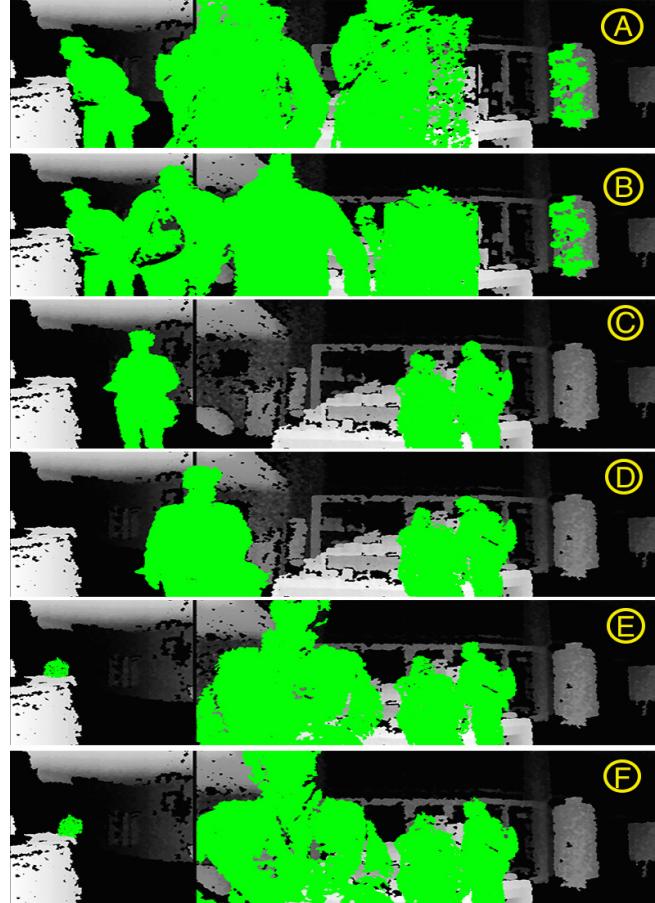


FIGURE 3.9: Honeypot effect

- Landing Effect:

Few landing effects had also happened, which were similar to the previous experiment with one camera. The landing effect has happened differently like, some noticed the interactivity in the middle and stopped by the display, and some noticed the interactivity at the very corner of the display and then moved back toward. As can be seen in the picture in the right, there is a lady (the camera could not capture the entire body of her, maybe because of the sun light), the lady is passing by the screen from frame (A – D) continuously and notices the screen interactivity in frame (E) and stops at her position and when she realizes then she moves gets closer to the screen in frame (F) and reaches the middle of the screen at frame (G) and starts to explore the interaction and game.

- Numbers of Honeypot and Landing Effects:

The chart bellow shows the frequencies of landing and honeypot effects for three days.

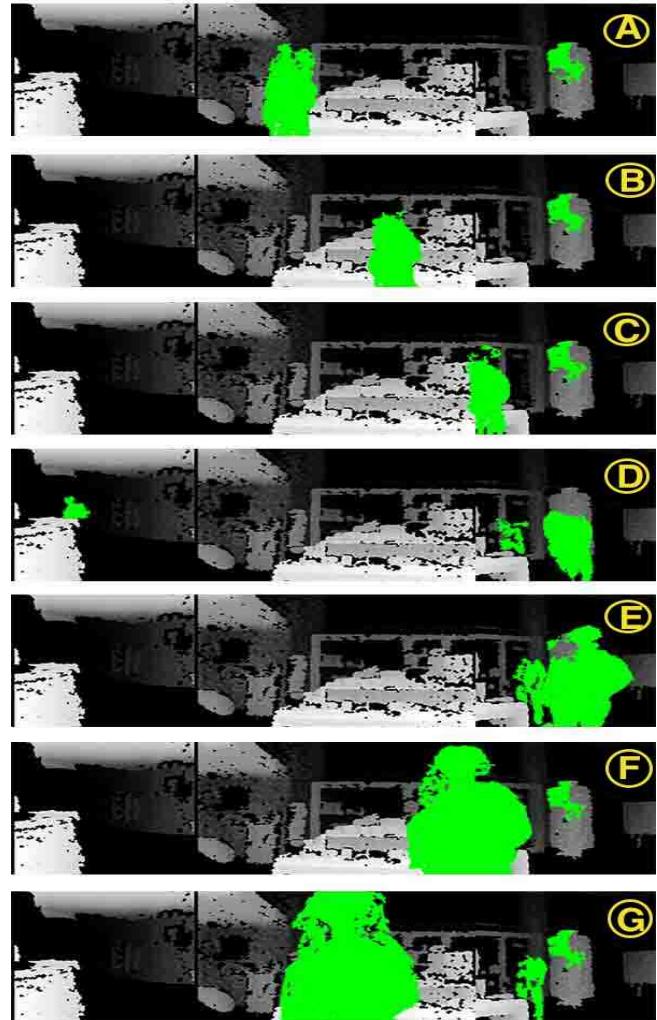


FIGURE 3.10: Landing effect

Days	Landing effect	Honeypot effect
8th April	3	3
9th April	2	5
10th April	1	2

### 3.6.5 Other observations

Beside the above behaviors there were other observations recorded too as they are listed bellow.

- Calling Others:

When a person is engaged with the display and is more excited about it, the person will most likely call his / her friend or family to see and give it a try.

Few of this calling effect have occurred in this enhanced version too, as you can see the picture in the right, in frame (A) a lady was engaged with the screen for a while and is standing in the middle of the screen, and then she calls his friend who is standing very far from the display and is busy with looking to some books, she turns her self toward her friend in frame (B) and seems to be talking to him in frame (C) and her friend leaves his work and starts to look at her in frame (C) and moves toward the screen in frame (D) while the lady is back busy with the screen, when her friend comes closer to the screen in frame (E) she gives a bit space for him to let him see by moving a bit back in frame (F), and finally her friend is also attracted and experiencing with the advertisement in frame (G).

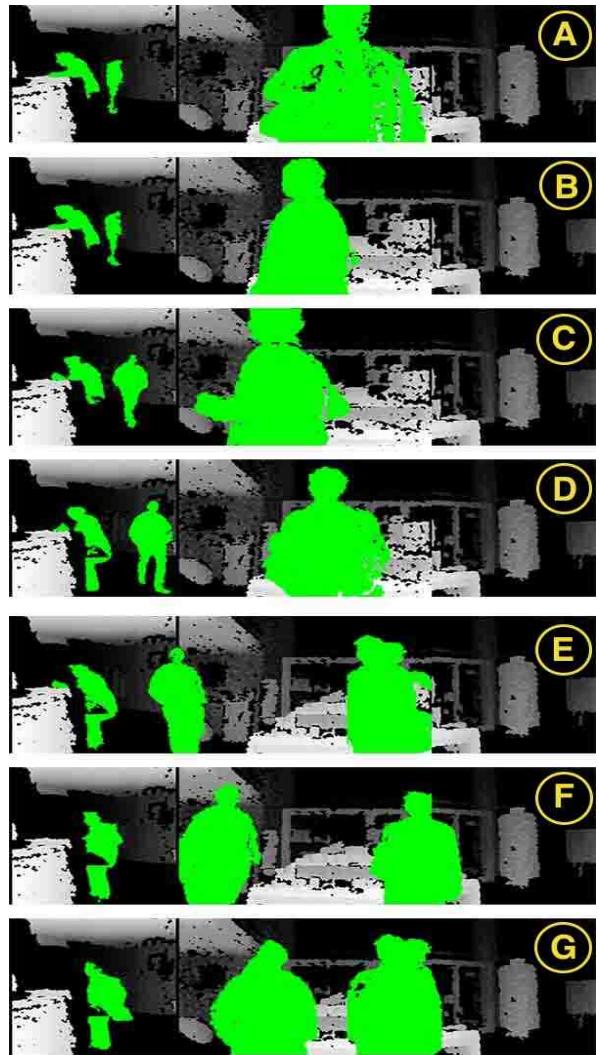


FIGURE 3.11: Calling others

- Noticing Interactivity earlier:

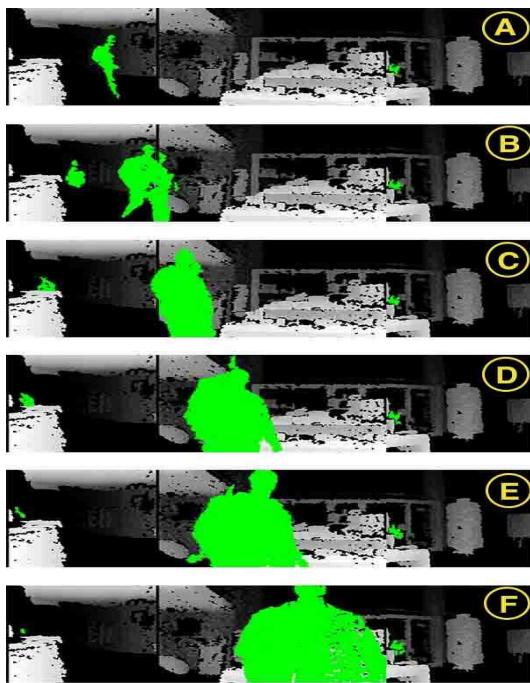


FIGURE 3.12: Noticing interactivity earlier.

Passers-by also directly came from the corners of display without showing any landing effect toward the screen and started interacting, this effect might be because of when they were passing by the screen had noticed themselves on the screen from the first camera, which was faced toward the side of the display, so it is assumed that they understood the interactivity and then came in the center of the display and started interacting. As can be seen from the image at the left side, a person is walking by from the left side in frame (A) and continues his walking toward the screen and gets closer and closer toward the middle of the screen, he is not passing by the screen by he intentionally

stops in the middle and starts interacting.

- Side interaction:

The integration of Kinect cameras at the side provided passers-by or people who were standing at the side of the display and did not or could not come close to the screen, were still able to have some sort of bound or connection with the system, this feature provided a sense of safety comfort zone for them to stay back and still be able to interact passively.

As can be seen in the picture in the right, there is a girl standing at the left side of the picture, she was standing with her parents in the information desk, and she recognizes herself in the screen and waves her hand first to see if it is actually her, and then starts to play with her silhouette on the screen and have fun.

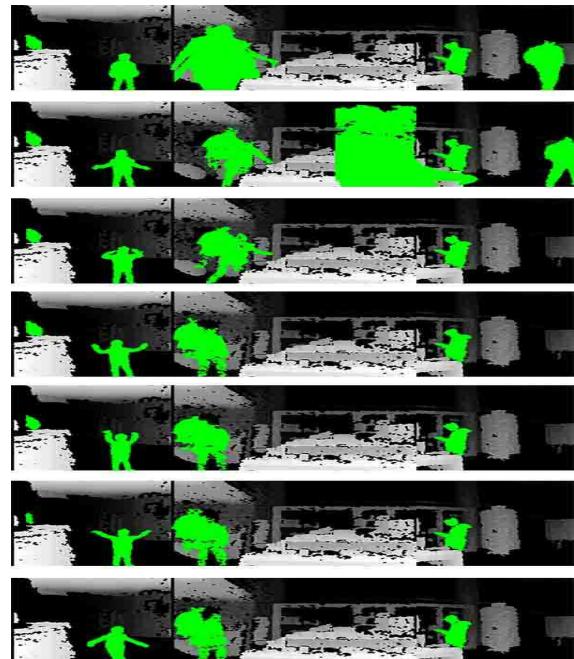


FIGURE 3.13: Side interaction

### 3.6.6 Comparison

This section compares the results and findings of the enhanced version of advertisement version with the previous advertisement, which could only track the middle screen of the display.

#### 1. Comparison of number of passers-by

To be on safe side that the number of participants were statistically the same, the below computation has been applied on three similar days, which provides the base for further evaluations.

TABLE 3.1: Number of people for three conditions

Days	Non-Interactive	Body Interactive	Enhanced body Interactive
Day 1	212	259	322
Day 2	209	216	182
Day 3	208	122	175
Total	629	597	679

ANOVA test revealed that there was no statistical significant difference between the passers-by in each of the conditions ( $(F_{2,3})=0.1449, p > .05 (p=0.868)$ )

#### 2. Attention Level comparison

The number of glances and ignores for both body interaction and enhanced body interaction were collected as below.

TABLE 3.2: Cross tabulation for each condition attention level

Method	Glanced (%)	Ignored	Total
Non-interactive	111(%28.83)	274	385
Body Interactive	106 (%41.40)	150	256
New body Interactive	115 (%51.11)	110	225
Total	332	534	866

As can be seen the enhanced body interactive advertisement has a higher percentage about %51 of the glances compared to the old body interactive advertisement, this means that there is a rise of %10 increase. To test if these are statistically significant different, the Chi-square test was applied on them and revealed  $\chi^2(1, N=481)=4.5413, p < .05 (p=.033086)$  that they are statistically different and the enhanced body attraction technique does have higher effect on the attention level.

The non-interactive advertisement was about %28 percentage in attracting attention, but the enhanced version had about %23 higher attention level than non-interactive, Chi-square reveals  $\chi^2(1, N=610)=30.2247, p < .001 (p=.0)$ , which strongly suggests that the enhanced version has dramatically increased the attention level than the non-interactive one.

### 3. Landing effect comparison

The landing effects were recorded for non-interactive, body interactive and enhanced body interactive in bellow table.

TABLE 3.3: Cross tabulation for each condition Landing effect

Method	Non-Interactive	Body Interactive	Enhanced body Interactive
Day 1	2	2	1
Day 2	0	2	2
Day 3	1	3	3

After conducting ANOVA test, it states that there is no significant different between three days for all of the conditions, ( $(F2,3)=1.857, p > .05 (p=0.236)$ ).

### 4. Honeypot effect comparison

Honeypot effects were also gathered from those days as bellow in table.

TABLE 3.4: Cross tabulation for each condition Honeypot effect

Days	Non-Interactive	Body Interactive	Enhanced body Interactive
Day 1	2	2	3
Day 2	2	5	5
Day 3	1	3	2

ANOVA reveals that there is also no statistical difference between these conditions. ( $(F2,3)=1.667, p > .05 (p=0.266)$ )

### 5. Engaged and Non-engaged passers-by

The numbers of engaged and non-engaged were recorded for all three conditions as bellow.

TABLE 3.5: Number of engaged passers-by in three weeks

Days	Non-Interactive	Body Interactive	Enhanced body Interactive
Day 1	15	26	39
Day 2	15	20	37
Day 3	15	23	28
Total	45	69	104

ANOVA reveals that there was statistical difference between these conditions, ( $(F_{2,3})=20.3154$ ,  $p < .05$  ( $p=0.0021$ )), and might be one or two of the conditions be of big difference, to find out which of them actually are statistically significant, the post-hoc Tukey HSD test was applied as shown in the table bellow.

TABLE 3.6: Post-Hoc Tukey's HSD

Methods	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	3.6459	0.0920761	insignificant
A vs C	8.9627	0.0017440	** $p < 0.01$
B vs C	5.3169	0.0218582	* $p < 0.05$

In the table above (A,B and C) are non-interactive, body interactive and enhanced body interactive respectively, and they are compared among each other, as you can see that post-hoc tests shows that non-interactive and body interactive were not statistically significant in those three days, but there results were strongly significant for non-interactive and enhanced body, and body interactive and enhanced body only just significant different among in between.

### 3.7 Discussions

The enhanced version of advertisement seemed to be more effective than other two conditions in terms of attracting attention. The number of glances was dramatically increased up to %51, this was higher than old body advertisement version, one of the main reason could be the wide angle of display tracking, in which participants could see themselves from different angles (left, center and right) if they had missed the left, there was still chance to see the center or vice versa, and the second reason could be the time they were exposed to their silhouette, for normal passing by the screen it takes around 2 to 3 seconds and if there was one tracking camera, then the silhouette was projected for 2 to 3 seconds only, and if there are three cameras facing (left, center, right) then for all region minimum it would take 6 – 9 seconds, this time is enough to get user attention.

The number of engaged people were also increased from %12 to %15, which was scientifically more than body interactive, and it was double in the compared to non-interactive (%7) of the engaged passers-by.

why ad video less seen because of no interest because of break in interaction because of change in interactino model

Honeypot effect in the previous body interaction experiment and in this experiment did not seemed to be more strong (meaning not more than 2 people were attracted at a time), there could be many reasons for this, (1) *Environment*, the display is situated in a touristic place, where people do not stay longer than staying in restaurant or some other gatherings, people move in and out often times, (2) *unfamiliarity*; people are not familiar with each other

to wait or come near to the shoulder of other person to look what is going on, therefor they tend to ignore, (3) *Personal interaction*, the interaction seemed more personal and single user, and was not vast to be observed by others quickly, (4) *display size*, screen size was also small and passers-by might have not noticed the interactions of people.

As mentioned before, landing effect happens, when the user notices interactivity after he passes by the screen, but in this enhanced version few honeypot effects happened, one of the reasons could be that, when the passer-by is walking from a far side of the display, he is noticing the interactivity before hand because he can see him self in the screen, and when he reaches near to the screen, he is aware of the interactivity for sure and would not perform landing, but by that time he would have two options (a) start interacting, or (b) ignore the interaction and pass by the screen.

### 3.8 Conclusion

In conclusion, this enhanced attracting attention technique for display would perform better than the technique that uses only one camera, the findings and comparison reveals that the technique has increased the attention level significantly, and consequently increased the number of engaged passers-by. Landing effect was decreased because of the tracking 180 degree coverage and passers-by early understood the interactivity and did not performed landing often.

As a future work, the silhouette color for individuals should be different and consisted to all cameras, when passing by from one side of display to other side.

# 4

## Conclusion

## 4.1 Summary of research

Public displays are in fact very complex research areas, and there are many reasons that could make the research at risk, like different backgrounds of passers-by are, display locations, display sizes, display orientation, physical setup and no commonly accepted method for evaluation. Human emotions provides important feedbacks about a display, and there exists technologies that can track the human emotions and state of their conditions[82] The location of display also has influence on the attention level and motivations, if the displays are placed in front of the passers-by, could have different attention level compared to sideway or if the display is placed in a higher compared to placed in lower place or even at eye distance [10]. Displays are found in various sizes and based on sizes they are used for various purposes, small sized displays are mostly used for single users and large displays would be suitable for more multi user interactive applications, and the size can also influence on the attention level [10]. Orientation also influences the behavior of people in various was, how display are angled, horizontal or vertical conditions will produce different results[16]. Environment also has influence, if a display is installed in a cafe or train station[3], or installed in a library or workplace [3], would produce different outcomes [56]., or if one is installed in a party compared one installed in formal meeting. Because of the problems mentioned above, most researchers limit all their findings to a fixed environment and conditions, and can not generalize their study design and findings to whole the displays, therefor there is no commonly acceptable technique of evaluation for public displays [4]

Consequently, public display advertising also inherit the above issues in research field, therefor in this study also specific conditions were taken in to account, in which the main study was conducted in Tourist information center, and the an interactive and non-interactive advertisements were developed for Bauhaus-walk and the activating components of the *conversion* (action) of the advertisements were measured and compared against each other, there are various activating components like emotions, motives, attentions and engagements of passers-by, which would eventually lead to actions like participation in Bauhaus-Walk program. The study compared the attention, engagement and other behaviors of the conditions and briefly answers the research questions bellow.

- **Which method is better to attract passers-by's attention?** To design an attracting attention method for interactive advertisements, an intense background study was done on attention and based on that three methods (moving eye, firework and silhouette) were proposed and compared against non-interactive advertisement, and among the three, the silhouette representation attracted more passers-by than other two, and beside that this method was a more widely acceptable method for interactive displays from the literatures. As a result the silhouette representation was used for the rest of interactive advertisements.

- **How is the attention level in interactive (body and mobile) and non-interactive advertisement?**

Glance is when a user look at display for less than 3 seconds in an observable manner by moving the head orientation toward display.

In non-interactive advertisement %28, in body interactive %41.41, and in mobile version %33.76 of the passers-by glanced toward the display, among which body interactive showed higher amount of glances. Enhanced interactive advertisement strongly increased the number of glances by %50 compared to non-interactive and body interactive.

The studies suggest that interactive advertisement in all the conditions like body, mobile and enhanced body version had higher attention level compared to non-interactive advertisement.

- **How many passers-by are engaged in interactive (body and mobile) and non-interactive advertisement?**

Involvement of passers-by with the display in some form, defines the effectiveness of advertisement, this can be achieved if the passers-by engage by viewing the screen, reading or interacting with the advertisement display. In this study a person was marked engaged if stood for more than 3 seconds in front of display.

In non-interactive advertisement people were reading or viewing the content of advertisement and only %7.66 of the whole passers-by were engaged, and the average duration for engagement was 34 seconds.

In body interactive advertisement, users were reading the content and at the same time they were motivated to play with the silhouette and start the game interaction and let them explore the locations with their body. From the whole passers-by %11.56 of them were engaged with the display and the average interaction was about 42 seconds, in which 19 seconds were spent in attraction/motivation part, 18 seconds in interaction and 4.6 seconds in advertisement video.

In mobile interactive advertisement, users were only reading or viewing the display, they had little interaction with their silhouette, but no interaction with the mobile devices, and %9 of the passers-by were engaged and took 22 seconds in average for the engagement duration.

In the enhanced advertisement version, passers-by were also engaged with reading, playing with the silhouette and interacting with the game element, and %15 passers-by were engaged with the average duration of 32 seconds.

This recommends that enhanced and body advertisement version engaged more participants than other advertisement techniques.

- **What are passers-by behavior toward interactive (body and mobile) and non-interactive advertisement?**

In non-interactive advertisement, the behavior of passers-by toward display was more passive, calm and natural, passers-by selectively came near the display and used it as a source of information, and at the same time neglected it easily. There was no influence of display on the environment around.

On the other hand, in body interactive advertisement, passers-by were attracted quickly toward display, passers-by were curious about their silhouette representation; they were waving hands or moving their body explicitly and learning about the interactivity, they felt the sense of joy and fun and reacted according to the call-to-action, they explored the interactions and played the game, the interaction was in groups and individuals, and the people were calling other friends to join. When the game was over, the advertisement video was shown but people tried to ignore that by leaving the display or standing one side until the video was over and start over the interaction. The dominance of the display over the area was felt if a person noticed the screen, the person had to leave the area or start the interaction.

In mobile interactive advertisement, the passers-by had some similar behaviors like, they were being curious about their silhouette representation, they were waving their hands to confirm interactivity and coming closer to the screen to understand the interactivity of the system, but quickly left the display, maybe because of being skeptical about

technology usage like using phone in public, and not understanding the connectivity to system, feeling unsecure or feeling inappropriate interaction in that space.

In the extended advertisement version, the behaviors were very similar to body interactive advertisement, in which people felt the sense of joy, fun and play, passers-by played the game and started exploring the locations, group interactions and individual interactions were also seen, in this extended version people noticed the interactivity earlier and came toward display with very less landing effects. Side interactions were also observed, in which the people stood at side of the screen and were still playing with their silhouette.

#### 4.1.1 Attracting attraction

Attracting attention of passers-by is the most crucial phase for the public display advertising, while most of the passers-by ignore the displays because of many reasons like, information overload [30], they think they are irrelevant, boring and distractive to them [31, 40]. There are two approaches of influencing the attention top-down and bottom-up, in top-down approach the passer-by has prior awareness of the display and change attention toward display, and in bottom-up the passer-by is unaware of the display and change attention toward display in case of an sudden external stimuli like color [7] or position [9] change of an object in display.

The Top-Down approach cannot work for public display even if passers-by know about display because passers-by have those negative thoughts about displays, therefor bottom-up approaches suites best in public display scenarios, but non-interactive advertisement can not use this approach because it can not sense passers-by and does not change anything related to the passers-by. Interactive advertising can use this approach and react based on passers-by and drag their attention toward it.

- **Silhouette representation**

Silhouette is a colored 2D shape of a person standing in front of a camera, many researcher prefer the use of this representation in public display because of many reasons that are linked to attraction, (1) sudden appearance of the silhouette when the person gets closer to display, (2) color contrast of silhouette in relation to other silhouettes and background, and (3) responsiveness of silhouette, so by combining all these elements this representation is the most attractive methods for body interactions [11]. The Bauhaus-Walk interactive advertisement used this silhouette representation of passers-by to get their attentions the most.

- **Extended silhouette representation**

This method was used to get passers-by attention before they reach near the display; the method is using three cameras in the sides (right, left) and in the center to cover 180 degree in front of the display. This method increased the attention level dramatically then the previous method.

#### 4.1.2 Motivation

To be motivated means *to be moved to do something*[46], if someone does something like interacting with the display, it is because something else has moved or peacefully forced him to do so. Various forms of motivation exists and affects differently it depends on person to person, something like (1) Fun, (2) interesting, (3) captivating, (4) appealing, or a system that has (5) challenges, (6) fantasy or even (7) curiosity [42].

In the design of body and mobile interaction models, the above factors were taken in mind for motivation and two features were implemented as described below.

- **Silhouette representation:**

The silhouette representation was not just meant for attracting attention but also for motivation for many reasons, (a) it can become a fun and interesting factor for people, because it is not a common thing to see a colored image instead of a full video image, and the different color of partner would become more interesting and playful, (b) it triggers curiosity among people and they would question that why are they shown in the display, or what is more to explore from the display.

This representation was used in all interactive advertisement like in body, extended body and even mobile interaction techniques.

- **Call-to-Action:**

Even if passers-by got motivated with silhouette representation, but they might still leave the display because they fear if they do something wrong or awkward, therefore to give them confidence and trust, call-to-action feature was developed. This is a responsive feature that follows with the silhouette of the person together and shows this text "*To play! Come near.*", this text gives the user a goal for staying in front of display and at the same time it is a challenge for him/her to complete the task.

### 4.1.3 Interaction

When the passers-by encounter with the interactive display for the first time, then there are many things that the display application should be ready for in terms of interaction, (1) Meaningful content for interaction[69], if the user does not feel comfortable with the content with which he/she is interacting, the user will ignore, (2) Meaningful interaction, it is not a good practice to create interactions that does not fit to the advertisement content and goal and make the interactions in a way that it makes the user feel shy or embarrassment in public [14], and (3) the application usability, The application should be able to provide an easy to use interaction, so that the users has full control and be able to complete the task, the use of right technology and technique is required to achieve this.

Based on many Focus group discussions and prototype (low-fi and high-fi) evaluation, I decided to create interactive advertisement for Bauhaus-walk, in which I developed two different interaction techniques, (a) body interaction and (b) mobile interaction, and both of them fit on the theme and goal of Bauhaus-Walk, the body & mobile interaction techniques resemble the virtual walking of users in Weimar city and exploring Bauhaus locations, read chapter 7 for complete description of the interactions.

### 4.1.4 Passers-by Behavior around display

Passers-by behave differently for certain types of display[52] and certain physical setup or environment [55, 11], and it is very crucial for advertisers to understand and know how the people react in front of their advertising displays and to develop an engaging and entertaining advertisement that could positively affect passers-by perception and attitude toward their products and services. In this thesis I compared the behaviors of people in front of non-interactive advertisement and interactive advertisement in Tourist information center. The below two effects were investigated in depth for all the advertisement conditions.

### Landing Effect

In non-interactive from 79 people, who were engaged only 4 (%5) events were because of landing effect were observed during the entire week, and same amount was observed in mobile interactive, which even had used body silhouette, this was because of the access information page shown on top of the screen that might have caused less amount of landing effect, but in body interactive 12 (%10) events of landing effects were observed which is 2 times higher than non-interactive, this is considered because of the clear silhouette representation and the call-to-action text that made passers-by to land back. The comparison between the conditions was significant, and it concludes that silhouette can introduce more landing effects. On other hand the extended silhouette representation, which was in extended interactive advertisement, could not bring more landing effects (5 times), because people might have noticed themselves before they reach the end of display.

### Honeypot Effect

The honeypot effect increases the attention level of the people toward the display, this effect in non-interactive display was weak (7 times) compared to body interactive display (15 times), which almost was double, the statistical analysis revealed that they are different significantly and it can conclude that the interactivity can increase the number of honeypot effects, but this effect was not statistically higher in extended body interaction (10 times) during 3 days, and it could be because of little number of days during the comparison, but it is certainly higher than non-interactive advertisement.

#### 4.1.5 Advertisement performance

how to assis the advertisements

#### 4.1.6 Advertisement development cycle

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