

Abstract

Now a days, public displays are being integrated more in the urban environment, workplaces, supermarkets, bus/train stations, restaurants and more. These public displays are vastly used as an advertising medium. Most advertisers use traditional advertising as their common driving business model, which passersby have no control over the contents, and these displays are often ignored because passersby expect uninteresting contents, which is known as *display Blindness*. On the other hand, a lot is being researched about interactive advertisements in public displays that could boost advertisement effectiveness in the form of introducing new experience to passersby with the help of new sensing technologies. From the researches that have been done so far, no empirical research has been done to compare the effectiveness and behaviors of passersby on interactive and non-interactive advertisement in public displays.

This thesis followed the HCI and Usability Engineering methods to choose, design, and develop three advertisements for *Bauhaus-Walk*, which were non-interactive, body interactive and mobile interactive. Each of them was deployed for one week in the *Weimar tourist information center*, and then the effectiveness of them were compared in between. Three measures of effectiveness were tested: the number of glances of passersby toward display, the number of *Engaged* passersby and the duration of their engagement. Besides that, the user's behaviors were observed and the two main behaviors of passersby were tested, which were the number of *Honeypot effect* and *Landing effect* towards display.

The results indicate that the body interactive advertisement increased the attention level, the number of engagements and also the duration of engagement of the passersby significantly compared to non-interactive advertisement. And along the effectiveness, the number of *Landing* and *Honeypot* effects were also improved in the interactive advertisement. No passersby interacted with the mobile interactive advertisement, and its attention level, number of engagement and users behaviors were not considerable compared to non-interactive advertisement. Based on the field observations of the display, which was situated at sidewalk, a new enhanced version of body interactive advertisement was developed to attract passersby from all display angles. The findings indicate that the enhanced body interactive advertisement significantly raised attention level and engagements than the previous body interaction, but both the *Landing* and the *Honeypot* effects were not remarkable.

I am optimistic that the future of advertising in public is tied with interactive displays. Researchers would use these methods and processes, which were followed in this thesis, to develop innovative interactive advertisement as their leading driving business models.

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Contents

Abstract	iii
Acknowledgements	v
1 Introduction	1
1.1 Introduction	3
1.2 Advertisement performance	4
1.3 Research Questions	4
1.4 Procedures	5
1.5 Methodology	5
1.5.1 Prototypes	6
1.5.2 Evaluations	6
1.6 Research context	6
1.7 Thesis outline	7
2 Background	9
2.1 Advertisement	11
2.1.1 History of advertisement	11
2.1.2 Traditional Advertising	11
2.1.3 Online advertising	11
2.1.4 Pervasive Advertising	12
2.1.5 Advertising program	12
2.1.6 Advertisement performance	13
2.2 Public displays	15
2.2.1 History of public display research	15
2.2.2 Auto-active displays	16
2.2.3 Interactive displays	17

2.2.4	Engagement with displays	17
2.2.5	Metaphors	19
2.2.6	Interaction models	20
2.2.7	Technologies	22
3	Attracting attention	25
3.1	Introduction	27
3.2	Approaches	27
3.2.1	Prototypes	28
3.2.2	Hypothesis	29
3.3	Study design	29
3.3.1	Participants	29
3.3.2	Location	29
3.3.3	Procedures	29
3.3.4	Data gathering	30
3.4	Findings	31
3.4.1	Observation findings	31
3.4.2	Interview Findings	32
3.5	Conclusion	35
4	Advertisement decision	37
4.1	Introduction	39
4.2	Research Questions	39
4.3	Study design	40
4.3.1	Participants and Environment	40
4.3.2	First session	41
4.3.3	Second Session	42
4.3.4	Data Gathering	44
4.4	Findings	44
4.4.1	First Session Findings	44
4.4.2	Second Session Findings	48
4.5	Conclusion	49
5	Advertisement Low Fidelity prototype	51
5.1	Introduction	53
5.2	Advertisement paper Prototypes	53
5.3	Requirement gathering	54
5.3.1	Functional Requirements	54
5.3.2	Non-functional Requirements	55
5.3.3	Personas	55

5.4	Goal	56
5.4.1	Questions	56
5.4.2	Mobile Interaction	57
5.5	Study Design	57
5.5.1	Subjects and location	57
5.5.2	Procedures	57
5.5.3	Display output simulation	58
5.5.4	Data gathering	58
5.6	Findings	59
5.6.1	Body Interactions	59
5.6.2	Mobile Interactions	60
5.6.3	Summary of findings	61
5.7	Conclusions	63
6	Advertisement High Fidelity prototype	65
6.1	Introduction	67
6.2	Advertisement prototypes	67
6.2.1	Body prototype	68
6.2.2	Mobile	69
6.3	Research questions	71
6.3.1	Video advertisement	72
6.4	Test Design	72
6.4.1	Participants	72
6.4.2	Task	72
6.4.3	Data Gathering	73
6.5	Findings	74
6.5.1	User performance	74
6.5.2	Usability issues	76
6.5.3	Advertisement goal	77
6.5.4	Interview Findings	79
6.5.5	Application Performance	81
6.6	Discussions	82
6.7	Conclusion	83
7	Advertisement application	85
7.1	Introduction	87
7.2	Advertisement Applications	87
7.2.1	Non-Interactive application	87
7.2.2	Body Interactive application	90

7.2.3	Mobile Interactive application	92
7.3	Interaction Design	95
7.3.1	Body Interaction Design	95
7.3.2	Mobile Interaction Design	97
7.4	Technical details	98
7.4.1	Body Interactive	98
7.4.2	Mobile interactive	99
8	Field study of Interactive and Non-Interactive Advertisement	101
8.1	Introduction	103
8.2	Advertisement	104
8.2.1	Interactive and Non-interactive Ads	104
8.2.2	Advertisement Effectivness	106
8.3	Research questions	106
8.4	Study design	106
8.4.1	Location	106
8.4.2	Duration	107
8.4.3	Internal Validity	107
8.4.4	Participants	107
8.4.5	Data gathering	108
8.5	Data Analysing	110
8.5.1	Glance counts	110
8.5.2	Interviews	110
8.5.3	Display Engagement phases and time	110
8.5.4	Honeypot and landing effects	110
8.5.5	Other observations	110
8.6	Findings	110
8.6.1	Non-Interactive findings	110
8.6.2	Body Interactive findings	115
8.6.3	Mobile Interactive findings	124
8.6.4	Comparison of advertisements	129
8.7	Discussion	134
8.8	Conclusion	135
9	Advertisement enhancement	137
9.1	Introduction	139
9.2	Enhanced attracting attention	139
9.3	Interaction design	140
9.4	Research question	141

9.5	Study design	141
9.5.1	Location	141
9.5.2	Duration	141
9.5.3	Participants	142
9.5.4	Data gathering	142
9.6	Findings and results	143
9.6.1	Attention Level measurements	143
9.6.2	Times of Engagement phases	143
9.6.3	Number of engaged passersby	144
9.6.4	Conversion funnel of engaged passersby	145
9.6.5	Landing and Honeypot effects	146
9.6.6	Other observations	147
9.6.7	Comparison	149
9.7	Discussions	152
9.8	Conclusion	152
10	Conclusion	153
10.1	Summary of research	155
10.1.1	Advertisement development cycle	157
10.1.2	Advertisement performance	158
10.1.3	Attracting attraction	158
10.1.4	Motivation	159
10.1.5	Interaction	159
10.1.6	Passersby's Behavior around display	160
10.1.7	Open Research Questions	160
A	Appendices	171
A	Attracting attention	173
A.1	Glance count sheet	173
A.2	Interview Questionnaire	174
A.3	Interview consent form	175
A.4	Interview Color codes	176
B	Focus Group	179
B.1	First sketch	180
B.2	Second sketch	181
B.3	Third sketch	182
C	Low Fidelity	183
C.1	Coded Interviews	183
D	High Fidelity	184

D.1	Body Interview codes	185
D.2	Mobile Interview codes	186
D.3	Pariticipant performance	187
D.3.1	Body	187
D.3.2	Mobile	187
E	Field Study	188
E.1	Interview Questionnaire	189
E.2	Non-Interactive glance count	190
E.3	Body Interactive glance count	191
E.4	Body Interactive glance count	192
E.5	Non-Interactive interview code	193
E.6	Body Interactive interview code	194
E.7	Mobile Interactive interview code	195
E.8	Non-Interactive observation notes	196
E.9	Body Interactive observation notes	197
E.10	Mobile Interactive observation notes	199
F	Enhanced body interactive Field Study	200
F.1	Enhanced Interactive advertisement Glance count	200
F.2	Enhanced Interactive observation notes	201
G	DVD Files and folders	202

List of Figures

2.1 Advertising Program, [37]	13
2.2 Conversion Funnel	14
2.3 Three zones of interaction, [76]	20
2.4 Four interaction phases, [76]	21
2.5 A diagram of public interaction flow accross thresholds, [15]	21
2.6 The Audience Funnel, [2]	22
3.1 Following eyes	28
3.2 Fireworks animation	28
3.3 Silhouette	28
3.4 Traditional Kasseturm Ad	29
3.5 University Mensa	30
3.6 Observation method	30
4.1 Focus group sessions	40
4.2 Discussion Session	42
4.3 Chess prototype	43
4.4 Map prototype	43
4.5 Explaining and discussions on prototypes	44
4.6 Tour participant average ages	46
5.1 Bauhaus-Walk Advertisement Prototypes	54
5.2 Paper prototypes	57
5.3 Participants interactions	58
6.1 call-to-action interface	68
6.2 Transitions of interfaces	69

6.3	Second Interface	69
6.4	Mobile interactive interface:	70
6.5	Transitions of interfaces.	70
6.6	Mobile interactive interface	71
6.7	Mobile controller interface: The left side is the cursor and the right side is the select button.	71
6.8	Participant's video recordings	74
6.9	Chart that shows each aspect with respect to duration.	74
6.10	Chart that shows each aspect with respect to duration	75
6.11	Comparison of body and mobile interaction performance	75
6.12	Comparison of the aspects of interaction among body and mobile	76
6.13	Number of words and drawings of the advertisement elements	78
6.14	Word cloud representation of the keywords	79
6.15	82
7.1	Interface flow	88
7.2	Initial Interface	88
7.3	Map Interface	88
7.4	Enlarged picture	89
7.5	Pictures on the map	89
7.6	Advertisement video	89
7.7	Advertisement video last frame	90
7.8	Initial interface	91
7.9	91
7.10	Map Interface	92
7.11	Initial Interface	93
7.12	Transition of interface	93
7.13	Map interface	94
7.14	Mobile controller	94
7.15	Body interaction design.	95
7.16	Body interaction design.	97
7.17	System architecture	100
7.18	Hardware setup	100
8.1	Body interaction	105
8.2	Mobile Interaction	105
8.3	Weimar Tourist Information Center Top-view picture, The locations are marked with yellow arrows.	107
8.4	Depth recording examples	109
8.5	Non-interactive attention level chart	111

8.6	Non-interactive Attention level percentage	111
8.7	Non-interaction Number of Engaged and Non-Engaged passersby	112
8.8	Percentage of engaged and Non-engaged passersby	112
8.9	Landing effect	113
8.10	Honeypot effect	113
8.11	Passersby Behaviors	115
8.12	Attention level chart	115
8.13	Body interactive Attention level percentage	116
8.14	Average time for each phase	116
8.15	Body interactive Number of Engaged passersby	117
8.16	Percentage of Engaged and Non-Engaged passersby	117
8.17	Conversion funnel of Engaged passersby	118
8.18	Landing effect	119
8.19	Honeypot Effect	119
8.20	Group interactions	121
8.21	Calling others	122
8.22	Playing with silhouette	122
8.23	Noticing interactivity	122
8.24	Raising hand	123
8.25	Mobile interactive attention level chart	124
8.26	Attention level percentage	124
8.27	Mobile interactive Number of Engaged passersby	125
8.28	Percentage of engaged passersby	125
8.29	Conversion funnel of Engaged passersby	126
8.30	Honeypot effect	126
8.31	Landing effect	127
9.1	Attracting attention extended version.	140
9.2	Extended Interaction design	141
9.3	Three Kinect images	142
9.4	Attention level chart	143
9.5	Attention level percentage	143
9.6	Average time for each phase	144
9.7	Number of engaged passersby	144
9.8	Percentage of engaged and non-engaged passersby	145
9.9	Conversion funnel of Engaged passersby	145
9.10	Honeypot effect	146
9.11	Landing effect	147
9.12	Calling others	148

9.13 Noticing interactivity earlier.	148
9.14 Side interaction	149
A.1 Glance count sheet	173
A.3 Interview consent form	175
A.4 Good Advertisement	176
A.5 Bad Advertisement	176
B.1 First sketch	180
B.2 Second sketch	181
B.3 Third sketch	182
C.1 Interview codes	183
D.1 Body Interview codes	185
D.2 Mobile Interview codes	186
D.3 Participant's body performance	187
D.4 Participant's mobile performance	187
E.1 Interview questions for all conditions.	189
E.2 Non-interactive glance counts	190
E.3 Body interactive glance counts	191
E.4 Mobile interactive glance counts	192
E.5 Non-Interactive interview code	193
E.6 Body Interactive interview code	194
E.7 Mobile Interactive interview code	195
E.8 Non-Interactive observation notes	196
E.9 Body Interactive observation notes (1)	197
E.10 Body Interactive observation notes (2)	198
E.11 Mobile Interactive observation notes	199
F.1 Enhanced Interactive advertisement Glance count	200
F.2 Enhanced Interactive observation notes	201
G.1 File and Folders in DVD	202

List of Tables

1.1	Thesis Outline	7
3.1	Cross tabulation of deployment and attention level	31
3.2	Cross tabulation of Following and traditional attention level	32
3.3	Cross tabulation of Firework and traditional attention level	32
3.4	Cross tabulation of Silhouette and traditional attention level	32
5.1	First persona	55
5.2	Second persona	56
5.3	Number of usability issues	61
7.1	UserMap and application color mapping	99
8.1	Week sequence	107
8.2	Landing and honeypot effects	113
8.3	Landing and honeypot effects	120
8.4	Mobile Interactive Landing and honeypot effect	127
8.5	Number of passersby in three weeks	129
8.6	Cross tabulation for each week attention level	130
8.7	Number of engaged passersby in three weeks	131
8.8	Post-Hoc Tukey's HSD	131
8.9	Number of <i>Landing effect</i> in three weeks	132
8.10	Post-Hoc Tukey's HSD results	132
8.11	Number of <i>Honeypot effect</i> in three weeks	133
8.12	<i>Post-Hoc Tukey's HSD</i> results	133
9.1	Number of people for three conditions	149
9.2	Cross tabulation for each condition attention level	150

9.3	Number of engaged passersby in three weeks	150
9.4	Post-Hoc Tukey's HSD	150
9.5	Cross tabulation for each condition Landing effect	151
9.6	Cross tabulation for each condition Honeypot effect	151
10.1	Week sequence	156
10.2	Week sequence	156
A.2	Questions	174

1

Introduction

1.1 Introduction

Advertisement is the mean of conveying message(s) to people about something from which both producers and consumers get benefit. P. Kotler [85] defines advertisement as “*any paid form of non-personal presentation and promotion of ideas, goods, or services by an identified sponsor. Advertisers include not only business firms but also charitable, nonprofit, and government agencies*”. Technology is dramatically changing our lives and it is integrating in our environment and obviously it is affecting the advertisement too. With the use of media, advertisements are published in TV, newspapers, radio, magazines, banners, mobile phones, public displays and more. Currently advertisements are found in the form of, (1) Non-Interactive advertisement and (2) Interactive Advertisement.

Non-interactive advertisement is the traditional advertisement that “*the presentation of content is linear and the consumer is passively exposed to product information*” [42]. User has no control over the flow of the advertisement. It is delivered using media like TV, radio, public displays, banners and many other various mediums. Above all, still most of these advertisements are boring, not clear for a lot of viewers. And people tend to ignore advertisements [49, 40]

Where on the other hand, with the use of innovative technologies, advertisers can make interactive advertisement. These interactive advertisements can be more attractive and interesting and open new ways and techniques to boost advertisement effectiveness [97]. Interactive advertisement is a type of advertisement that is done by using various interactive media like Internet, mobile phones and public displays. It allows users to actively traverse the advertisement content and depends on where the user want to go from one step to another [42]. Advertisers reserve appropriate website sections for their interactive advertisements. The use of interactive public displays are increasing to provide passersby opportunity to interact with advertisement contents, for example using smartphone to control interactive elements. Or by using body-sensing technologies, like Kinect¹ cameras, which could be used to allow passersby to be engaged without the use of any other device. These technologies give us opportunity to explore more possibilities of attraction methods, novel interactions and engagement techniques to provide the users with better experience and increase their interest.

There is a need to investigate that how much interactive advertisement in public displays are attractive, engaging and can change user behaviors compared to non-interactive advertisement. If they were significantly different, what kind of models and interactive design space would be suitable for future advertisements. Furthermore, this thesis explores and investigates public display advertisements in general, what makes a suitable advertisement for audience, what are the common attraction attention methods, is there a difference in body interactive advertisement and mobile interactive advertisement, and what kind of environmental setup is required.

In order to be able to conduct the advertisement comparison, there was a need to create realistic advertisement and have realistic target groups and environment. Therefore, first a small study was done on attracting attention methods in University Mensa². The advertisement content was made for *Bauhaus-Walk*³. With the help of Bauhaus-Walk members *Weimar Tourist Information Center*⁴ was contacted to install the advertisement display and

¹Microsoft Kinect: <https://developer.microsoft.com/de-de/windows/kinect>, Last accessed: 1/05/2016 at 13:21:00

²Bauhaus University Mensa: <http://www.stw-thueringen.de/english/dining-halls/facilities/weimar/mensa-am-park.html>, last accessed 25 may 2016

³Bauhaus Walk: <https://www.uni-weimar.de/en/university/profile/bauhausatelier/bauhaus-walk/>, last accessed 25th May 2016

⁴Weimar Tourist Information Center: <http://www.weimar.de/homepage/>, last accessed 10 April 2016

evaluate our applications in wild.

1.2 Advertisement performance

When a company develops an advertisement and campaigns it for long time in different locations, mainly expects to have a higher *conversion rate*, which is “*The percentage of visitors who take a desired action.*”[58]. There are different forms of action goals, like it could be buying the product, joining an event, registering for a website, paying a charity or even could be participation in a rally or protest. So it really depends on what is the main goal behind a particular advertisement, the *conversion rate* is measured by the number of people who performed the action divided by total number of visitors. Occasionally *conversion rate* is measured in Internet advertising with various metrics like, CPM, CPC, CPA and more, see page 13 for details. To understand the motive behind the conversion and what made them converted is an important question to ask. If we tackle those questions then we can create effective and efficient advertisements. Those main reasons are the level of attention, motivations, involvement and emotions of people with the advertising product [84].

Attention: “*Attention is the process that, at a given moment, enhances some information and inhibits other information. The enhancement enables us to select some information for further processing, and the inhibition enables us to set some information aside.*”[8]. Higher attention would increase the high recall of advertisement too [97], and it is the first phase that can make the user to be involved.

Motivation: To be motivated means “*to be moved to do something*”[55]. The motivation is an important thing after a person has been attracted toward display. The motivation can be achieved by many factors described in this paper [51]. (1) Making passersby be curious about the screen. (2) Challenging passersby by a game or bringing some sort of fantasy in application. In the design of body and mobile interaction models, the above factors were taken in considerations.

Involvement: Involvement describes the relationship of audience to a product and the strength can define effectiveness of the advertisement. Engagement is a form of involvement with the product. Technologies are there that can measure involvement like the attention level or duration of interaction with a product.

Emotion: “*Emotions is an affective state of consciousness in which joy, sorrow, fear, hate, or the like, is experienced, as distinguished from cognitive and volitional states of consciousness.*”[34]. These emotions always can influence users to change their attitude and how they think about a product or service. Tracking user emotions on advertisements could be adjusted in real time.

1.3 Research Questions

The *Conversion rate* for *Bauhaus-walk* advertisement would be that, how many people participated in the walk after the advertisement campaign. But in this thesis, I do not measure the *Conversion rate*, because it is possible that people maybe converted from other unknown reasons like a friend might have told or an existing advertising campaign had an influence on the people. To measure *Conversion rate* precisely the only solution is to take small interviews from each individual that joint the walk. This is a time consuming process and should be continued for long time to track all the people who were exactly affected by one of advertisement campaign.

The advertisement performance like, attention, motivation, engagement, and emotions can influence the *conversion-rate*. Therefore it would be more appropriate to compares these important aspects between interactive and non-interactive advertisement, rather than comparing the *conversion-rate* itself. The below lists the main research questions that need to be find out for interactive and non-interactive advertisement.

- How can the attention of the passersby be attracted?
- What is the attention level of passersby in interactive (body and mobile) and non-interactive advertisement?
- How many passersby get engaged in interactive (body and mobile) and non-interactive advertisement?
- What are passersby behaviors toward interactive (body and mobile) and non-interactive advertisements?

1.4 Procedures

The main purpose of the thesis is the comparison of Non-interactive and Interactive advertisement in the domain of attracting attention, engagement and passersby behaviors. But it would have not been compared unless the well functional and meaningful advertisement applications were not developed and evaluated.

Therefore, first, this thesis researches on advertisement in general to find out what are the people interests and expectations from public display. And how could the existing advertisement be changed in a way that people would like and pay attention.

Second, it investigates on attraction attention phase for public display advertisement. This helps to find out which of suitable methods attract passersby attention toward the screen.

Third, it conducts user studies and focus groups to find out what make suitable advertisements that fits *Bauhaus-Walk* theme. Two advertisements are interactive and one is non-interactive advertisement. Two of interactive advertisements consist of body interaction and mobile interaction.

Fourth, it evaluates the low-fidelity and high fidelity of the interactive advertisement applications (mobile and body). It explores that which of these interactive modalities perform better and how the participants give feedback about their usage in public space.

Finally, it conducts a comparative study on non-interactive advertisement with interactive advertisement (body and phone), which was installed in tourist Information center. The comparison was on advertisement performance and passersby behaviors.

And based on the result and findings, it proposes new enhanced interactive advertisement technique. And compares it with the previous advertisements techniques.

1.5 Methodology

Evaluations of public displays are in fact very complicated process and researchers use different methodologies to answer their research questions. This thesis performed empirical research and used a user-centered design approach in general. The research started by doing a requirement analysis of public display advertisements by conducting interviews and

direct observations in University Mensa. Another requirement analysis as a focus group was conducted on deciding an appropriate advertisements (non-interactive, body interactive and mobile interactive) for *Bauhaus-Walk*. The paper prototypes of advertisements were evaluated by conducting a formative study, which helped the design process and revealed early usability issues. When the actual advertisement applications were developed then a summative and a comparative studies were carried to see how well the design meets the usability requirements for each prototype. The final versions of advertisements were deployed in public context to perform field studies. The field studies involved direct and indirect observations with a set of interviews of passersby. The field studies assisted to compare the advertisement's performance and passersby behaviors. And finally another short field study was conducted on an enhanced version of advertisement.

1.5.1 Prototypes

In this thesis advertisement prototypes were created in each stage like, low-fidelity prototype, high fidelity prototype and the enhanced version of high fidelity prototype. Each of the prototypes had their different versions and the final versions were selected for the evaluation. Dependent on the phase and purpose of prototype they were tested in lab and also on field. Excessive efforts had been done to assure the similarities of low-fi and high-fi prototypes. And at the same time these prototypes should be robust and comply with technologies.

1.5.2 Evaluations

Before even starting evaluations, many questions arise like where to deploy the advertisement, what hardware shortcoming I have, are there other moderators to help me and so on. During the thesis work, different stages of evaluations have been completed like there were some evaluations that required only indoor in a controlled environment and some others required outdoor to get real data from public. The Low-fi and High-fi prototypes were evaluated in lab to do usability testing and do performance measuring, and the actual comparison of the advertisements (interactive and non-interactive) were done on field.

The lab evaluations were fairly easily managed. But for the onsite field evaluations I had to deal with the many responsible personals to fix a date and location. During the evaluation process in public, privacy issue was an important factor that I had to be clear about therefore I avoided taking pictures or video recordings unless if there were their permission. Kinect color silhouette recordings were used to hide identity of people.

Different methods of data gathering were used. They were interviewing people, taking onsite notes and performing observations of the passersby behaviors, capturing system logs and recording Kinect depth images and taking some pictures.

1.6 Research context

The research was carried out under Human Computer Interaction department in Bauhaus University Weimar over the course of one and half semester period. The advertisement prototype was officially made for *Bauhaus-Walk*⁵ program and the main advertisement's deployment location was in *Weimar Tourist information center*⁶.

⁵<https://www.uni-weimar.de/en/university/profile/bauhausatelier/bauhaus-walk/>, last accessed 4 jun 2016

⁶<http://www.weimar-touristinformation.de/?gclid=CKylhf7Xxc0CFSz0wodqh0NUg>, last accessed 5 jun 2016

1.7 Thesis outline

The thesis document is divided in to four main sections to make the thesis more readable and understandable. See bellow table.

TABLE 1.1: Thesis Outline

Sections	Chapters
Introduction	#1: Introduction
	#2: Background
Pre Advertisement Comparison	#3: Attracting Attention Attraction
	#4: Advertisement Decision
	#5: Advertisement Low-Fi evaluation
	#6: Advertisement Development
	#7: Advertisement High-Fi Evaluation
Advertisement Comparison	#8: Comparison of Interactive and Non-Interactive Advertisement
	#9: Design and evaluation of Enhanced Interactive Advertisement
Conclusion And Appendices	#10: Conclusion
	References
	Appendices

- **Chapter 2:** This chapter discusses in-depth on various related issues like Advertisement, how it began, why is it influential, what is pervasive advertising, what are the common metaphors. In the second part of this chapter, it discusses on Public displays, the history of it, what are common technologies, what are they mostly used for, how engaging, attention and motivation methods are being used. And finally it discusses on, what are the interaction techniques and how these displays could be evaluated.
- **Chapter 3:** This chapter focuses on advertisement to figure out what public really expect from advertisement in public displays. It qualitatively summarizes good and bad advertisement. This chapter discusses on various methods of attracting attention in public displays and as a result developed three different methods. The methods were then compared with a non-interactive advertisement in terms of the number of *Glances* to chose the one that has higher number of *Glances*.
- **Chapter 4:** This chapter goes through the process that how and why the advertisement for *Bauhaus-Walk* was selected.
- **Chapter 5:** This chapter is the paper prototype evaluation, this chapter discusses on how the paper prototype was created for interactive advertisement and what were the results and findings from the participants.
- **Chapter 6:** This chapter explains all the functionality and requirements of the applications, what technologies and hardware were being used and how to get the system running.
- **chapter 7:** This chapter conducts an advertisement high-fi evaluation and compares body interaction with mobile interaction techniques.
- **chapter 8:** This chapter makes the main goal of the thesis which is the comparison of non-interactive and interactive advertisement. The chapter explains about the study

design along with data gathering techniques and how the data were evaluated and compared.

- **Chapter 9:** This chapter is an extension of the previous chapter and discusses the issues with the body interaction and how the body interaction could be enhanced to perform better in current existing public display setup. The chapter discusses on design study and how the experiment was conducted and how the results were compared with the older version of body interaction.
- **Chapter 10:** This chapter concludes and summarizes all the results and findings of this thesis and discusses the potential areas to focus in future.

2

Background

2.1 Advertisement

Advertisement is everywhere, it is meant to provide the audience information about the product or service. The advertisers want to gain the planned goals and effects from the specific target audience. It is a mean of mass communication that is created to alter the audience's behavior and attitude [67]. In particular Kotler and Keller [85] defined the advertisement as “*any paid form of non-personal presentation and promotion of ideas, goods, or services by an identified sponsor. Advertisers include not only business firms but also charitable, nonprofit, and government agencies*”. Based on the definition firstly, advertisement is non-personal meaning it is meant to a group of people or target groups. Secondly, it should represent an idea or basically it should have something to deliver for the people that it matters to them. It normally has sponsor(s) to launch somewhere for example on TV, Radio or print a poster version outdoor. The way message is being delivered has been changing at every era of development as discussed below.

2.1.1 History of advertisement

The first paper advertisement was published at 1704 in an american newspaper called *Boston News Letter*, which ad was about houses and lands to be sold¹. After that a lot of business started to do their advertisements in newspapers, posters and banners. The first television advertisement was shown at 1941 on an american TV². That advertisement brought attention to a wide area of applications and big business industries toward advertisement. As a result the budgets raised much higher for advertisements, and later advertisement entered the World Wide Web. Online advertising has evolved now to multi-billion dollar industry. Because of the emerging new technologies and advancements, advertisements are in our smart phone applications, smart TV sets, tablet PCs and many other smart devices. From past decades display screens are replacing print advertisements because of the easy reusability of the screen and providing dynamic contents.

2.1.2 Traditional Advertising

Traditional advertising is a form of advertising that uses the media to send commercial messages to the mass audience or viewers. The media can be in any form like TV, Newspaper, Radio, public displays, bill boards and more. Traditional advertising is “*The presentation of content is linear and the consumer is passively exposed to product information*” [42], viewers have no control over the flow of the advertisement.

2.1.3 Online advertising

Online advertising or Internet advertising is a form of advertising that uses email, web, applications, or any other internet application used in mobile or computer that drive direct sales via electronic commerce [27]. As PWC [33] researched on online advertising and stated that there are two trends that give online advertising this boost: (1) increase in webpages, and (2) development in targeted advertising format. Beside that there are a lot of other ways to increase online marketing [30] such as, (1) search engine optimization that suggest websites for users, (2) email, (3) video marketing, like YouTube, (4) Blogging , (5) social media, like Facebook, and many other forms.

¹Paper advertisements: <http://infoacrs.com/a/adhistory.html>, Last accessed 16th March 2016

²First TV ad: <http://www.openculture.com/2013/08/watch-the-first-commercial-ever-shown-on-american-tv-1941.html>, Last accessed 16th March 2016

2.1.4 Pervasive Advertising

Currently computers play important role in life because it is becoming nearly common and found everywhere. These computers do not have to be necessarily like traditional computers to have keyboard and mouse. It includes laptop to smart watches, and these technologies try to blend in our environments such as displays, sensor, security cameras, fridge, washing machine and more. As a result we have ubiquitous computing environment that is supported by underlying technologies like Internet, middleware and microprocessors. Mark Weiser³[90] explains as, “*Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user*”. The term pervasive computing is also used instead of ubiquitous [72], it is constructed from basic elements [86] such as, (1) ubiquitous access, (2) context awareness, (3) intelligence and (4) natural interaction. When an advertisement is made with the help of pervasive computing then it is called “*pervasive advertising*”. This form of advertising would really help to improve advertisement in general because of the powerful properties of the pervasive computing. Mark Weiser’s [74] another central statement was “*The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it*”. Based on above explanation, “*Pervasive advertising is the use of pervasive computing technologies for advertising purposes.*”[84].

2.1.5 Advertising program

To have an effective and efficient advertising, most big advertising industries follow an advertising program after they have defined the target market and buyer motives. The advertising program is also called as *5Ms* [37], because it is composed of five steps (1)*Mission*,(2)*Money*,(3) *Message*,(4)*Media*,(5) *Measurement*, Figure 2.1 shows these steps.

1. Mission:

Advertising mission (goal) should come from prior decisions on targeted market and location. This goal can be achieved by a fixed communication process in fix duration between advertiser and audience. There are three advertising goals (1) *Informative Advertising*, it is the early advertising stage, which aims to inform target audience about a product which was not in market before. (2) *Persuasive Advertising*, this happens when there are several competitors of the same product. The advertiser persuades people that their product is the best than others. And (3) *Reminder Advertising*, the need of this type is when a product has been in market from long time like *Coca-Cola* and then there is a need to remind people about that product.

2. Money:

Decision on advertising budget is very essential for future of a company. The company should clearly invest on the advertising of certain product. It should be not less to have lower effect, nor too high to risk the company benefits.

3. Message:

The message of the advertising should be very clear, precise and innovative. The message should be generated in a way such that can impact on viewers. It should go through four stages, (1) message generation, (2) message evaluation and selection, (3) message execution and (4) social responsibility review.

4. Media:

The media selection is important because it can help to expose an advertisement message

³Ubiquitous Computing: <http://www.ubiq.com/hypertext/weiser/UbiHome.html>

with the number of desired times to the target audience. The number of exposures of advertisement can define the number of awareness of audience about product. And the effect of exposure depends on, (1) *reach*, how many times the advertiser can reach to the users through internet, banners, TV and so on. (2) *Frequency*, how many times that advertisement is going to be shown on those locations, (3) *Impact*, the qualitative value of exposure on audience.

5. Measurement:

The last step is to measure how effective was the advertisement for a given goal, location, and target audience within a specific duration of time. The measurement will state the level of achievements and what got accomplished and what not.

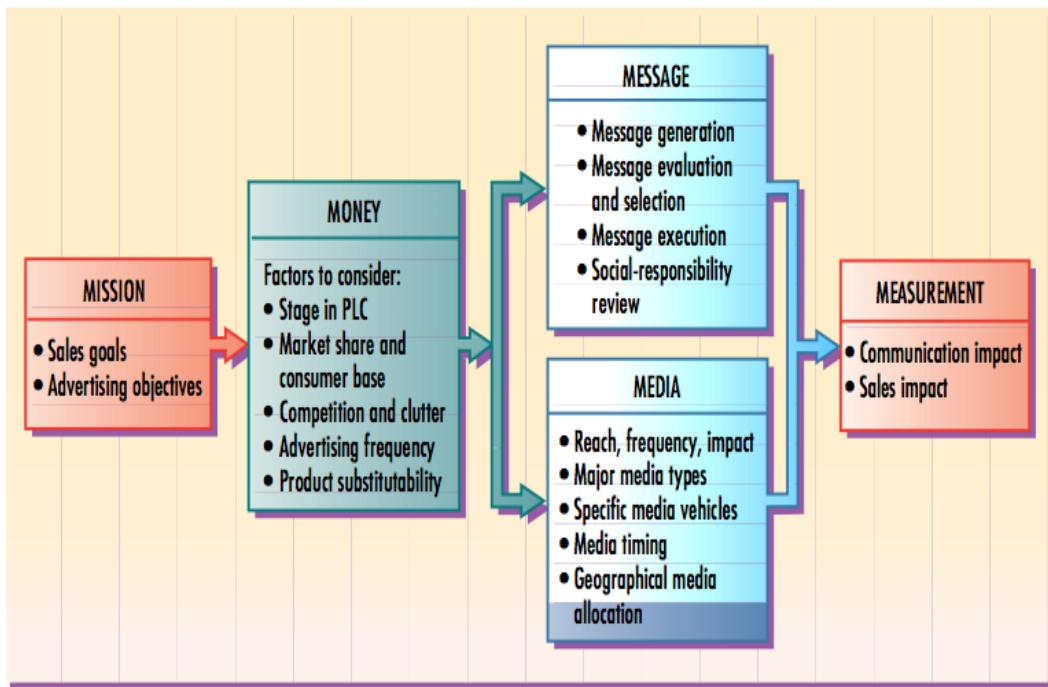


FIGURE 2.1: Advertising Program, [37]

2.1.6 Advertisement performance

Advertisers are interested in *conversion-rate*: “*the percentage of visitors who take a desired action.*”[58]. The desired action is to visit a webpage, buy a product, play a game, or any action, which is defined by the advertiser. *conversion-rate* is very important for advertiser to see the efficiency of their advertisements and how to utilize it for mass visitors that could be more effective. In e-commerce, advertisers track user’s each step or click, they track users from search engines to webpages, from webpages to contacts, from contacts to subscribers and from subscribers to *Actions* purchase or download of an application. With the help of a technique called *conversion-funnel* [22], all the journey of visitors are described in a funnel like shape, as Saad Kamal [21] describes the conversion funnel in Google Analytics, see figure 2.2. The funnel is composed of four layers: (1) *Awareness* or attention, (2) *Interest*, (3) *Desire* and (4) *Action*, and visitors would have to take these steps to reach the final goal which is purchase of a product.

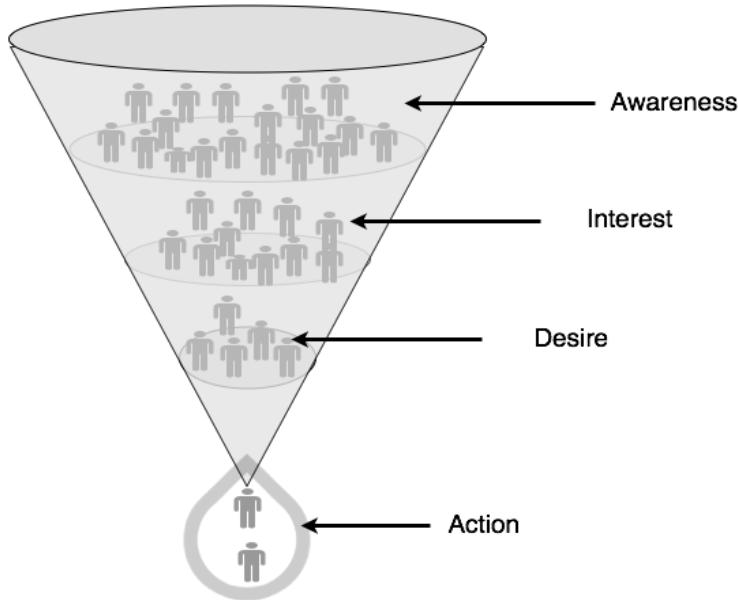


FIGURE 2.2: Conversion Funnel

The funnel shape shows the decrease of visitors in each layer of funnel because most visitors may be aware but not interested, and people who are interested are subset of the first layer of funnel. Not all interested people desire to buy a product, so people decrease in the next layer, who desire for a product and may read the details and specifications. But not all people, who desire for the product, would buy the product because maybe the person does not have money to buy or there could be other reasons. Finally very few people fit to buy the product and reach the final layer of funnel (purchase). Advertisers can aim different visitors at different layers of *conversion-funnel*, and based on analysis of the funnel advertisers can define where exactly the advertising effort should be invested, [25]

The conversion ratio is defined by *click-through rate* (CTR) metric. It is the ratio of number of clicks on advertisement to the number of visitors, who make impression (see the advertisement) [22]. Advertisers optimize their pages, by analyzing that which sections, links of web pages can result in to higher CTR. To compute the *conversion rates* the below metrics are used.

- CPM (Cost Per Thousand)

It is a benchmarking metric in advertising to calculate the cost of an online advertisement, which is defined by showing an ad to thousand of viewers. Advertisers would be charged per impression (thousand of viewers).

- CPC (Cost per Click)

The advertiser is charged when a viewer clicks on the advertisement message or link. Occasionally it is found in search engines, and famous websites.

- CPA (Cost per Action)

Advertisers will be charged if the viewer performs any form of action like click, register, subscribe, fill a form or any other.

2.2 Public displays

Displays are increasingly getting cheaper and being used in various locations such as, restaurants, hotels, sport stadiums, homes and now in public space like shop windows, supermarkets, airport and streets and roads. Most of these displays show advertisement in which dynamic or static contents are being shown. Few displays are interactive like purchasing train tickets with a touch capability, and even interactive advertisement displays in which passersby can be engaged and play game. This section discusses on the history of public displays, novel applications of displays, display's sensing technologies, attracting attention methods and interaction design of displays. This section also discusses on how to evaluate the public displays in great detail.

2.2.1 History of public display research

Various researches have been done from the past three decades and are still continuing until today on public displays. The first research was conducted in 1980 called the “*Hole-in-Space*”⁴ that connected New York and Los Angeles one side-walk with a live video and sound system. People at both ends could hear and see each other. In this research common behavior and interactions of people were explored and other similar researches had also been done.

Different sized displays were also designed to fit working area and space for various tasks. Mark Weiser illustrated in his paper “*Computer for 21th century*” [50], in which he present tabs, pads, and boards devices which could be used as a personal use. He also showed large scale displays equivalent to blackboard for public use and demonstrated that how can these technologies be integrated as ubiquitous and be adjustable based on user demands and context.

Another research on situated displays that projects content based on location. For-example *FLUMP*⁵ [29], was designed to research and illustrate the effectiveness and adaptability of ubiquitous computing systems. Many researches also conducted to design wearable displays like Meme tags and group tags [14] that by wearing the displays participants could share ideas and opinions called “memes-succinct” among themselves. Through large displays called “*community Mirrors*” these memetics exchanges were visualized live for conference audience. Another “*Name tags*” or “*thinking Tag*” from IBM [26] that could show the name of the person when facing another person and also display relevant information on who is viewing the tag.

Furthermore, ambient displays were also researched. For-example the *Waterlamp and the pinwheels* used *ambientRoom* of Ishii and ullmer [5], in which they showed how tangible bits could connect the cyberspace and physical environment like foreground and background of human activities. The room was kind of augmented space using light, sound and airflow and water movement. Another was *office plant#1* [28], which was an exploration of a technological object adapted to the office ecology. Another was *Information Percolator* [16], an ambient display designed to show expressions placed within decorative objects⁶, Greenber and Michael [24]. The study investigated on how people transition from individual interaction to group work with the use of PDAs and shared displays and based on this they introduced SharedNotes system and illustrated how people can switch to different modes.

Encouraging social interaction was another important aspect for public displays in which researchers like Chew and leclerc [19] focused conversations in a conference setting using

⁴Hole-In-Space: <https://www.youtube.com/watch?v=SyIJr6Ldg8>, last accessed 1st jun 2016

⁵flexible ubiquitous monitor project: <http://research.cs.ncl.ac.uk/cabernet/www.laas.research.ec.org/cabernet/workshops/radicals/1996/papers/flump-finney.html>, last accessed May 15, 2016.

⁶Information Percolator : <https://www.youtube.com/watch?v=9LGQWhCePc8>, last accessed:16 May 2016

display called *Sparks*. It was “*an ambient social networking and communication facilitation interface*” this had interactive features on information related to elements presented in the space. Another interactive display designed for hospital *AwareMedia* [56], which facilitated social, spatial, and temporal awareness and supported coordination at an operation ward. Gesture based interactions with ambient display was researched by Daniel Vogel [63] that developed interaction framework for sharable, and interactive public ambient displays⁷. *Blue-board* [71], which was developed at IBM Research center, was a display system for groups to exchange information in a walk-by situation. *IM here* [48] by Elaine M.Haung that researched on LDGAs⁸ and proposed a design on how to share IM⁹ on large displays by using mobile phone that helped to be an awareness and communication tool.

At end of 2000s mobile phones became popular and common among people and was also a good mean of interaction with displays. *C-Blink* [64] that used mobile phone display, which was used as light source that sent various hue color to a camera from which the camera would detect and encode information and present on large display. Another approach was the use of Flashlight of phones as a pointing device as Shirazi and winkler [81] described the design of public-private display with flashlight simple interaction. Other features of phone like Bluetooth, Infrared were also used as an interaction mean with display (e.g., [73, 82]).

Consequently advertising also became a focus for researchers. As Krüger and Müller illustrated their design of how to recognize passersby via Bluetooth [53]. A most relevant information could be shown to passersby based on their staying duration and whether they read the content or not. *BlueScreen* [32] which selected and displayed adverts in response to detected users in the audience, stepping more further it gave users choice of changing and reforming the content shown on display. *Prospero project* [54] that developed a display framework that could be configurable and controlled in public. *RunWithUs* [41] a social sport application that motivated people to do sport and share their progress. *Digiteds* [31] another plateform that users could post ads in public displays.

2.2.2 Auto-active displays

Beside hundreds of researches on public displays in universities, there are other displays that were and are made by private advertisement industries. Most of these displays are auto-active or non-interactive, they are situated in train station, airports, malls, restaurants and various locations mainly for advertisement purposes. *zipper*[89]at year 1928 made LED display at the front corner of the New York Times building, which was showing current headlines. In Olympic 1979 the very first large display was deployed, which had video enabled¹⁰. There are various other companies that until now are working like *printsign*¹¹, a big company in UK that designs and advertises in big displays for their customers. *Sony Ziris*¹², the company that sells advertising screen, and supports advertising content to be played on their screens. *BBC big screen*¹³, which started at 2013 by installing many of their big screens and shows BBC big live events. People who travel by taxi can watch on going advertising and news on go

⁷Interactive Public ambient display: <https://www.youtube.com/watch?v=aFl71SPeYto>, last accessed: 16 May 2016

⁸Large display groupware applications

⁹Internet messaging

¹⁰Olympic glory a short history of Olympic games timing. London in August 2012 <http://www.runnersworld.com/olympics/a-short-history-of-the-olympic-games>, last accessed: 18 May 2016

¹¹printsigne: <http://www.printsign.co.uk/>, last access 19 May 19, 2016

¹²Sony ziris: <http://pro.sony.com/bbsc/ssr/cat-monitors/>, last accessed 19 May 2016

¹³BBC big screens: <http://www.bbc.co.uk/blogs/aboutthebbc/entries/ea215929-b57e-3bb9-8d01-e0433f93fd62>, last accessed 19 May 2016

like *taxis TV*¹⁴. Another world famous out door advertising company are *ClearChannel*¹⁵, and *Dynascan*¹⁶ that advertise in 360 degree big outdoor and indoor screens enabled with content management system that advertisement could be edited and changed. *Kinton*¹⁷ another cylindrical LED screen company that supports for big solutions like advertising, cinema and more.

2.2.3 Interactive displays

Beside auto-active displays, there are a lot of interactive outdoor and indoor displays that is made by private companies too. For example *CocaCola*¹⁸ is involved to make interactive advertisement in public display. *MC Donald*¹⁹ allowed passersby to connect to the advertisement board and play game and by winning get a coupon number from which he/she could get something for free from MC shop. Other public awareness interactive ads are also there like *Interactive Hair-raising awareness*²⁰ an interactive ad that was installed in train station and used ultra-sonic sensor to detect the arrival of train and the model hair was beautifully blown up. Another was an interactive billboard that to let passersby stop child abuse²¹. Advertisements could be done in various forms and now are in restaurants and bars like *Clo Winebar*²² a bar that customers are able to view and select orders from an interactive screen. *pizzaHut*²³ an interactive display that allows customers to design their own pizza and order through it. Floor and wall projected interactive advertisement are also common like *Aristoz*²⁴ that illustrates various examples of projection based interactive advertisement in supermarket, hotels and airports. *JCDecaux*²⁵ a France famous advertisement company is booming in innovative outdoor and indoor advertisement. Many more interactive advertisements are out there in public that brings joys and engaging experience to audience.

2.2.4 Engagement with displays

There is not a single application which would claim to be perfect in situations because it could be good for a specific domain but would lack a lot of things from other perspectives. It also applies for public displays that are another mean of communication of passersby and is more complex than other single user device. There are many layers of complexities that needs to be addressed when dealing with public display, for-example how passersby be attracted toward display. When they are attracted toward display how to motivate them toward display to come near and interact. And how to design a better interaction medium for the users at that situation. These are all issues that need to be worked on. As Müller et al [1] illustrated a model of different interaction phases in which he called it *Audience Funnel*, as he describes there are many stages until users actually interact with the advertisement. Attention and

¹⁴Taxi TV: <http://verifonemedia.com/networks/taxi-media/>

¹⁵<http://clearchanneloutdoor.com/>

¹⁶Dynascan: <http://www.dynascanusa.com/products/360-degree-led-video-displays/>

¹⁷Kinton: <http://www.kinton.de/de/home.html>

¹⁸Coca Cola Interactive: <https://mg337group10.wordpress.com/2015/04/04/coca-cola-and-interactive-advertising/>, last accessed 19 May 2016

¹⁹MC Donald Interactive Ad: <http://en.nolapeles.com/2011/06/16/mc-donalds-interactive-ad/>, last accessed 19 may 2016

²⁰Hair awareness: https://www.youtube.com/watch?v=qqd6hg0_AOI last accessed 20 May 2016

²¹Child Abuse: <https://www.dramafever.com/news/powerful-billboard-lets-you-stop-child-abuse-/>, last accessed: 14 May 2016

²²17 Awsome bars: <http://walyou.com/bars-and-restaurants-themes-geeks/>, last accessed 19 May 2016

²³PizzaHut: <http://www.fastcocreate.com/3027282/pizza-huts-interactive-touch-table-could-be-coming-to-a-restaurant-near-you>, last accessed 19 May 2016

²⁴Ariztoz: <https://www.youtube.com/watch?v=Fh2TON7LRIY>, last accessed: 19 May 2016

²⁵JCDecaux: <http://www.jcdecaux.com/en/>, last accessed 19 May 2016

motivation will eventually lead to interaction and these stages follow each other if the first step fail the rest would not happen, so there is certain thresholds that people should exceed to transition from one mode to other.

Attention

Most devices that are being used has an owner and the owner is aware of the device and pays attention to it, for example the owner of mobile phone pays attention to phone to do certain task. But public displays do not have an owner or in other words everyone can use them if higher attention is given to them. Therefore the responsibility is on displays to be able to provide enough attraction for the passersby to be engaged. Various models of attracting attention have been developed and proposed, like Itti and Baldi [75] made the bottom-up attention model meaning that the attention could be attracted if a strong external stimuli happen. The model shows various representation of input image like color and orientation that human brain cells are capable of interpreting them and based on input images the model predicts which area of the picture could have more attention. The model is also equipped with top-down approach meaning that the brain knows or has experience to certain regions of input image before shifting attention. Florian Alt [84] stated from previous researches that the attention could be gained by behavioral urgencies and honeypot effect has also strong impact on attracting attention.

Behavioral urgencies models can predict how much a specific external stimulus can gain attention of someone. For example Franconeri and Simons [80] stated that “*Attention capture is often operationally defined as speeded search performance when an otherwise nonpredictive stimulus happens to be the target of a visual search. That is, if a stimulus captures attention, it should be searched with priority even when it is irrelevant to the task*”. Beside this may other things captures attention like sudden appearance of object [9].

Honeypot effect is described by Brignull and Rogers [15] that when ever a bunch of people gather around a display automatically other people are being attracted toward the display. They observed this effect in a party in which they had an interactive system installed called *Opinionizer*. It was a shared display in which people could type their opinion with keyboard and the opinions were visualized on to the display. By doing this people started to notice the messages and most importantly the people involved with display built an awareness of people around toward display.

Motivation

To be motivated means *to be moved to do something*[55]. Motivation is another big challenge for public displays because passersby may glance toward display but necessarily not motivated to interact with the display. There is significant need to understand how to motivate passersby toward display as Thomas [51] describes activities that motivates “*An activity is said to be intrinsically motivated if people engage in it “for its own sake,” if they do not engage in the activity in order to receive some external reward such as money or status. I will use the words “fun,” “interesting,” “captivating,” “appealing,” and “intrinsically motivating,” all more or less interchangeably,*” he states that challenge, fantasy and curiosity could be categories of motivation instructions.

Challenge is a driving force for motivation, Florian alt [84] summarizes *Flow*[52] that is state of mind in one sentence by saying “*is a state of mind where the user is fully immersed in an activity while feeling energized and focused. Simply said, flow can be achieved in a channel between too little challenge (leading to boredom) and too much challenge (leading to anxiety).*”.

So there should be balance between challenges, and to change interaction to a challenge the end goal should not be clear for participants.

Curiosity happens when something is not so clear and people tend to find what is actually happening. Some may feel insecure to or shy because of social context. Therefore proper explorative behavior is required to overcome these insecurities [55]. To increase curiosity the application should send to the participant a sense of incompleteness and at the mean time should also show how to over come that incompleteness through the use of that application [84].

Fantasy is another deriving factor to motivate people toward display. If something imaginary or unrealistic is shown people gives more attention, now with the increasing technologies and computer capabilities, virtual reality, augmented reality and others sensing technologies these fake environments can be built [60]. *BigBoard*²⁶ which was installed in a bus station and was showing the video of the side of the bus station and meanwhile was augmenting some fairies coming from sky and approach the participants. *JCDecaux*²⁷ creates innovative advertisements which most of them are full of fantasy.

2.2.5 Metaphors

Advertisements are posted in various forms and there are different mental models categorized by J. Müller [1] which are Posters, windows, mirrors and overlays.

- **Posters:**

Ghosting and peter[6] defines poster as like this, “*A poster is any piece of printed paper designed to be attached to a wall or vertical surface*”. These poster do contain texts, graphics or combination of both. They necessarily do not have to be paper based they could be digital posters that with the use of media a more dynamic contents could be shown. Most of these digital posters show traditional advertising contents that is often ignored by passersby [49]. But by integrating sensing technologies these posters could be interactive too to increase the user engagement.

- **Windows:**

There are advertisements shown at windows facing outside the shop. This type of mental model gives the viewers some sort of clue of a virtual location. The window model has two sides *the local* and *remote* sides. The window model interconnects both sides together. For example *Hole-in-Space*[83], which there were two big screens installed in two major cities and live video and audio streams was available for public to communicate.

- **Mirrors:**

Mirrors are reflective surfaces. Displays with mirror model show the reflection of the passersby and allow encouraging them for more direct interactions. This is normally done by projecting silhouette representation for example J.Müller [11] experimented by mirroring three representations of passersby as *image*, *silhouette* and *abstract*.

- **Overlays:**

Overlays model coul have various shapes and are not bounded to the fixed frame and size like screens or mirrors. It could be glass door or a part of a window or a whole wall. The fact is that they can integrate with environment. Normally these are done by using

²⁶ <https://www.youtube.com/watch?v=UIHwHqaY3SY>, last accessed: 19 May 2016

²⁷ JCDecaux Innovative ads: <https://www.youtube.com/watch?v=Gw0Gfp5LVgQ>, last accessed 19 May 2016

high performance projectors like CLD projector²⁸. For example *Jumping Frog* [14] that was projected on surface and by touching it the frog would jump to other surface.

2.2.6 Interaction models

Different interaction models are created as shown below that illustrates how passersby would behave and react at certain regions (zones) toward display. How groups of audience can form and what could be their next step for interaction.

1. Hallo.Wall [77, 76], which was a context-dependent display reflecting Identity and proximity of passersby. This was designed to communicate detailed information as it was interactive and passersby could communicate through RFID and WaveLAN technologies. The interaction was in a “distance-dependent Semantic manner” meaning that based on different distances various interactions were offered. The interaction model consisted three zones ambient zone, notification zone, and cell interaction zone as can be seen in below picture.

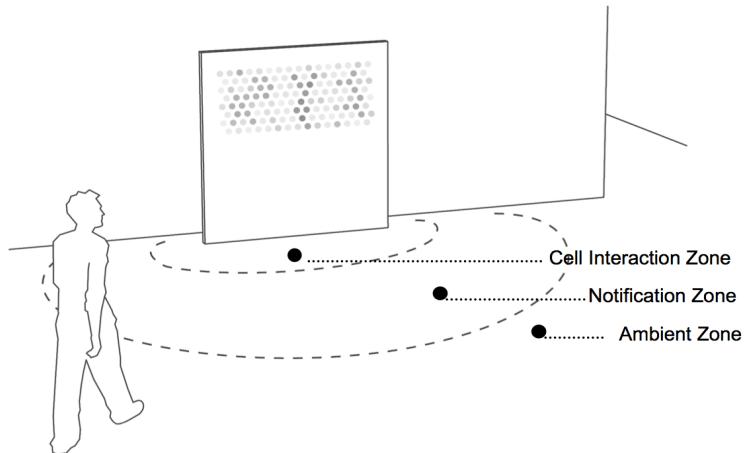


FIGURE 2.3: Three zones of interaction, [76]

Ambient Zone is outside the sensing area where people cannot be tracked or sensed. In this mode the display shows some information and content independent to the people. *Notification Zone* is the place where is under sensor range and the sensors can detect people and show particular light pattern on the display. *Cell Interaction Zone* is the zone, where the passersby are very near to the screen and can start interacting with display.

D. Vogel [63] used the same interaction design and enhanced it in a way that could support transition of implicit to explicit interaction with both personal and public information. He introduced *Implicit*, *Subtle* and *Personal* interaction zones that has smooth transitions in between. See the diagram below.

²⁸LCD projector: <http://www.projectorreviews.com/projector-categories/lcd-projectors/>, last accessed 19 May 2016

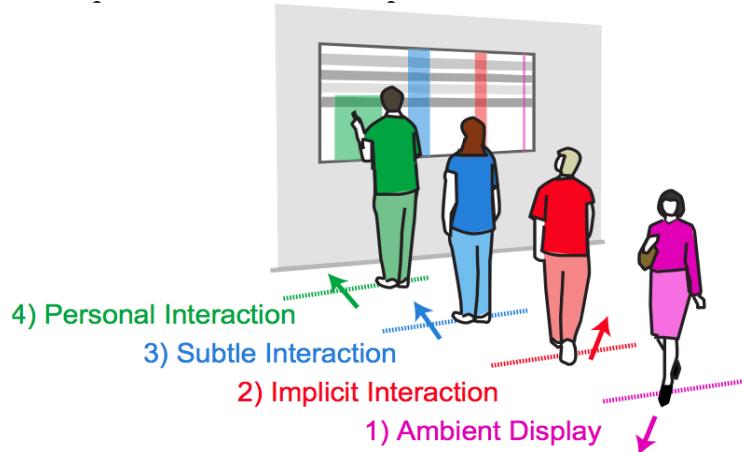


FIGURE 2.4: Four interaction phases, [76]

Implicit interaction phase is the phase where the system detects the person's position and projects notification when user passes. In this phase it could also presents a kind of representation of the person so that the passersby can see the reaction to be convinced to enter the subtle interaction phase. The *Subtle mode* activates when user give implicit hints like stopping by screen. In this mode a detailed notification or state is shown in which user can start interacting with the content and multiple users can interact too. But when exploring more personal content then the users moves closer to the screen to enable *Personal interaction phase*, in this phase the user is very close to the screen and the interaction could be done by touching the screen and exploring more personal contents.

2. Another interaction model designed by Brignull and Rogers [15] conceptualized an interaction model based on their observation they had done on *Opinionizer* system in a lunch party. They divided the space around display in three categories as space (A) *Peripheral awareness*, space (B) *Focal awareness* and space(c) *Direct interaction*. And illustrated how people switch between these spaces by crossing some thresholds. This model is limited to the interaction medium because one keyboard was used and other phases like implicate and explicit interactions are not considered. The model is made to be in an environment that people are somehow familiar with each other that remove social embarrassments and as a result people can interact freely with the system instead of ignoring it.

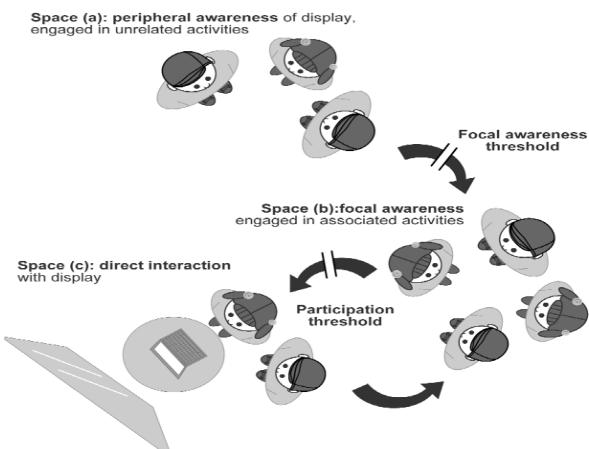


FIGURE 2.5: A diagram of public interaction flow accross thresholds, [15]

3. *Audience funnel* [2] is another design based on public interaction flow model that have several interaction phases. The phases shown in this model are linear processes in which if the first happen then next could happen. These phases are *Passing by*, *Viewing / Reacting*, *Subtle interaction*, *Direct interaction*, *Multiple interaction*, and *Follow-up actions* as shown in below diagram. This type of model is very interesting for advertising applications.

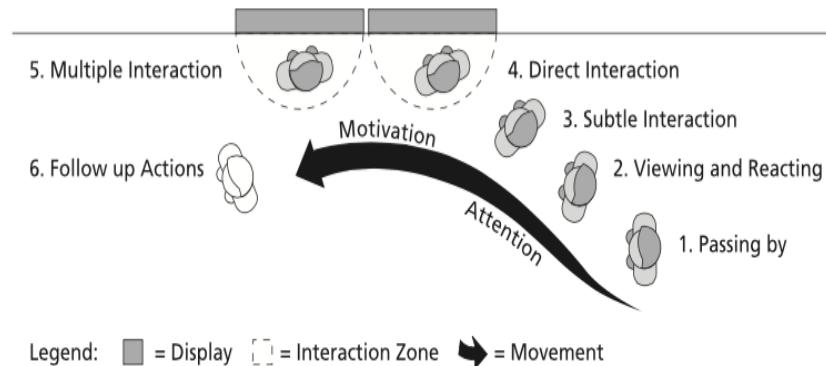


FIGURE 2.6: The Audience Funnel, [2]

2.2.7 Technologies

The driving force for all these designs and concepts and advancements are the technologies behind them. Without the use to advanced technologies it would have not been possible to implement and evaluate the prototypes and interaction designs. This section explores various technologies used for different purposes as listed below.

- Displays:

Currently four technologies are used in displays

- CRT (Cathode Ray Tube), invented by German physicist Ferdinand Braun²⁹ in 1897. It has three electronic guns (Red, Green, Blue phosphor dots) and high-speed electrons from these guns hit the flat fluorescent screen line by line by and as a result the image is created on the screen.
- LCD (Liquid crystal display), which is widely used in Television sets and other computer screens, and has almost replaced CRT. It uses Light-modulating properties of liquid crystal³⁰, which does not shot light rays to show images.
- PDP (Plasma display panels), unlike LCD display is free of distortions if seen from sides. It uses tiny neon light for each pixels in the screen and that illuminates the pixels and is designed to display both analog and digital computer inputs³¹.
- OLED (Organic Light-Emitting Diode) this technology uses light emitting diodes that allow higher resolution and screen size. It is one of the expensive displays and has wide viewing angle and has better power consumption.
- There are various other display technologies used for different purposes and screen sizes as listed below.

²⁹Ferdinand Brown: <http://www.britannica.com/biography/Ferdinand-Braun>, last accessed 21 May 2016

³⁰Liquid Crystal: https://en.wikipedia.org/wiki/Liquid_crystal, last access 21 may 2016

³¹PDP: <http://whatis.techtarget.com/definition/plasma-display>, last accessed 20 may 2016

- * E Ink (Electronic paper)
 - * PDP (Plasma display panel)
 - * ELD (Electroluminescent display)
 - * DMS (Digital microshutter)
 - * ...
- Sensors:
- Now technologies are highly advancing and day-by-day new sensors are being made for different purposes. The sensor that was difficult to use due to many dependencies and higher cost in past, is now easy to use with very limited requirements and less price. Sensors are listed based on their purposes as below.
- **Presense**
- Presence is the state or fact of being present as with others or in a place³², there are sensors that can sense if someone is at the proximity or vicinity of the display and can even sense how far the person is in meter or centimeter in relation to display.
- * Cameras:
- Now there are many cheap and powerful cameras that has built-in integrated firmware that does Human tracking so easy. For example Microsoft Kinect Camera³³, which comes in two versions Kinect xbox360(V1) and Kinect One (V2). These cameras can sense the location and orientation of the person. Other cameras could also be used to manual computer vision tracking applications.
- * Audio sensors³⁴:
- The use of microphones allows us to track sound frequencies. The distance of a device can be estimated from the source sounds originating from.
- * Bluetooth:
- Devices that have Bluetooth functionality can be another medium of detection and interaction with displays.
- * IR (Infrared):
- This could be used to sense the people around as it was used in *MemeTags* [14].
- * RFID (Radio-Frequency Identification):
- RFID serves the same as bar code it can be attached at backside of card. This technology could be used to sense if there is someone near display.
- **Body position and Posture**
- Body position can be detected with pressure sensors installed on the ground floor this would accurately detect the exact coordinate. Beside that camera can also detect exact position like Kinect camera. Body posture is the orientation of body where actually the body is facing to; this can be detected using 3D Camera or motion tracking.
- **Gestures**
- Gesture gives more control to the system while interaction, it could be used for manipulating some objects on the screen or control elements, there are many technologies that recognize gestures, like touch screens, accelerometer, and most widely

³²Presence: <http://www.dictionary.com/browse/presence>

³³Microsoft Kinect: <https://developer.microsoft.com/de-de/windows/kinect>, Last accessed: 1/05/2016 at 13:21:00

³⁴Audio sensors: <https://www.sparkfun.com/categories/186>, last accessed 22 may 2016

used now is the use of camera in which the user hand or eye or different body posture can be used as some sort of gestures.

– **Touch**

There are various touch technologies available, the use of touch technology evolved from smart phone like iPhone, and spread to screens, Now mobile screen can support multi-touch and screens beside multi-touch can even support multi-user multi touch, touch could be sensed by the display directly or by IR camera that uses computer vision software to track users finger.

• **WiFi**

WiFi allows computers, smartphones, tablets or other personal smart devices to connect to private LAN (Local Area Network) or Internet, the use of this technology has become very frequent and almost all handheld devices has the capability to connect, By using this technology people can connect to public displays and interact by using some applications or web controllers.

3

Attracting attention

3.1 Introduction

Anywhere we go our attention keeps tracks of us and make us aware of the environment around and we react differently for different stimuli. So what is *Attention*? “*Attention is the process that, at a given moment, enhances some information and inhibits other information. The enhancement enables us to select some information for further processing, and the inhibition enables us to set some information aside.*”[8]. Attention is influenced by two different processes (Top-Down & Bottom-Up) [75, 8]. *Top-Down* process happens when the user has prior awareness (goal) about where to put his/her attention. And *Bottom-Up* process happens when the users have no prior awareness and suddenly by an external stimuli move or change their attention toward something.

In *Bottom-up* approach, the attention can be captured by the different parameters of objects shown on the screen. These parameters like *Appearance*, *Sudden movement*, and *contrasting colors* of objects on a screen can capture attention quicker. Yantis and Jonides (1984) demonstrated that the detection of a target in visual search was markedly enhanced when the target was presented abruptly[9]. The type of contrast change on an object influence priority in visual search, “*Both the sudden appearance of an object and sudden changes in existing object features influence priority in visual search.*”[7]. These approaches of attracting attention are not just bounded to lab studies but public displays also inherit them.

Public displays are increasingly now being installed in most of the locations and most of these displays are full of advertisements. Passersby often try ignoring because of various reasons. As Elaine M. Huang and his colleagues researched and discussed on “*When Does the Public Really Look at Public Displays?*”[10], in which they argued that glancing and attention at displays is complex and is dependent to many factors like *Brevity* of glances, *Positioning* of displays, *content format*, *catching the eye*, and *display size*.

On the other hand, passersby also intentionally ignore displays because of two major things, (1) “*Information Overload*”, which happens when information is beyond the person capability to process in our environment[39]. Ignoring banners of webpages is also observed that is called as “*Banner Blindness*” [40]. (2) People expect “*Uninteresting contents*” from displays and as a result ignore them. Huang et al [38] investigated and explained that most public displays are ignored and receive little glances. Jörg müller and his fellow colleague [49] investigated on similar effect called “*Display Blindness*”.

I used a *Bottom-Up* approach to develop attracting attention methods for public display to grab most attentions of random passersby in front of display. This chapter conducts a comparative study of three different attracting attention methods with a traditional advertisement in public display. The comparative study was conducted in university Mensa with very large university teachers and students audiences.

Meanwhile this chapter explains the feedbacks and opinions of interviewees about advertisement in general. The interviews focused on key elements of advertisement that can influence people interest and likelihood to see advertisement. And also what other elements of advertisement exist that can have a negative impact to annoy and stop people from viewing advertisements.

3.2 Approaches

One of the most common metric in public display to measure the amount of attention is the count of *Number of Glances*. John Hardy and his colleague [36] classified the attention level in three categories, (1) *Glance*, (2) *Ignore* and (3) *Watch*.

- **Glance:** This happens when the passer-by apparently turn his/her head and stares the screen for less than 3 seconds.
- **Ignore:** This is when the person completely does not look or turn his/her head while passing by the screen.
- **Watch:** This is when the person stares the screen for more than 3 second.

I developed three interactive attracting attention prototypes to be compared with a Non-interactive (traditional) advertisement. The comparison was only on the number of *Glances* and *Ignores*. Which ever method that received the highest attention level will be selected for future development of *Bauhaus-Walk* advertisement.

3.2.1 Prototypes

The below three interactive attracting attention method prototypes were developed. See the video¹ in footnote for a short summary of each attracting attention.

First, the *Following eye* prototype shown in figure 3.1 was developed. The application performs in a way that pair of eyes suddenly pop-up when a person passes by the screen. The eyeballs follow the person movement direction. The idea behind this prototype was to test if people would react if something abruptly appear on the screen and starts to follow them. The movement in this prototype is only constraint within eye space, but the prototype shows the eyes with high contrast colors.

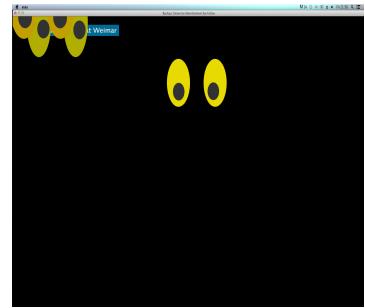


FIGURE 3.1: Following eyes

Second, was the *Firework* prototype shown in figure 3.2. It shows different colored firework animation dependent to the passer-by location in front of display. The firework animation is triggered for each individual standing separately. The idea behind making of this prototype was show more movements and color changes of objects on the screen. The picture in the right shows three blocks of fireworks for three persons.

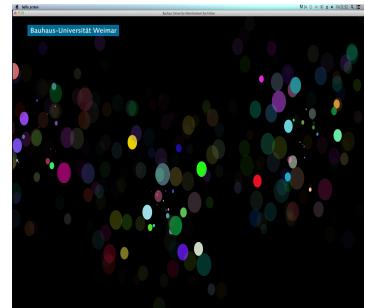


FIGURE 3.2: Fireworks animation

Third, was the *silhouette presentation* shown in Figure 3.4, which shows the colored representation passersby on the screen. The idea is derived from Jorg Müller [11], who had concluded that silhouette representation is more effective than other two body representations “*avatar-like*”representations and “*real user Image*”. This representation is understandable by passersby and at the same time it keeps privacy of people by not exposing their faces on display.



FIGURE 3.3: Silhouette

¹Attracting Attention Methods: <https://www.youtube.com/watch?v=1EtHVqS412M>, last accessed 27 july 2016

Non-interactive advertisement was a traditional style advertisement in which five pages were in loop in a slideshow. The advertisement pages consisted of pictures and mostly texts about some events in Weimar, the sequence of pages of the slideshow were fixed and would switch from one page to other within about each 15 seconds.



FIGURE 3.4: Traditional Kasseturm Ad

3.2.2 Hypothesis

- **H0:** Silhouette representation method and traditional advertising attract same number of passersby.
- **H1:** Silhouette representation method attracts more passersby than traditional advertising.

3.3 Study design

At the beginning, the idea was to conduct some experiments in lab and investigate about the attention level by doing gaze tracking. But it did not suited well for the real display scenario in which an already situated display was advertising. Therefore I conducted the study on the field, which I could compare attracting attention methods with the traditional advertising.

3.3.1 Participants

Participants were random passersby from university students, employees. The passersby were observed that passed in front of the display, not the ones who passed from the backside of the display. None of the participants knew about the attracting attention conditions in advance.

3.3.2 Location

The study was conducted in university Mensa, this location was an ideal location because many students, teachers and university employees go for having lunch and coffee breaks. The Mensa gets crowded during the lunch hours. 14-inch display, which was previously used for advertisement in Mensa by *Kasseturm*², was used to deploy our applications.

3.3.3 Procedures

The study was conducted for four continues days, and each day only one method was displayed for two hours at 14:00 o'clock. The first day the traditional advertisement was shown, and the next three days the interactive techniques were shown on the screen. One person was responsible for observing the glances made by the passersby and also noting interesting behaviors of people toward the screen. The other person was responsible to take interviews from the passersby that glanced at the screen to get more feedbacks of the advertisement in general. Some of the interviews were randomly taken too.

²Kasseturm: <http://www.kasseturm.de/>, last accessed: 26 May 2016

3.3.4 Data gathering

Data gathering consisted of direct observation of passersby from 14:00 – 16:00 for each individual day and interviews were taken which was recorded.

Observation

Observation was used to count the number of glances the passersby made toward the screen. A small pilot study was conducted for the observer to find an appropriate location in the Mensa setup to be able to count people and glances without being noticed by passersby.

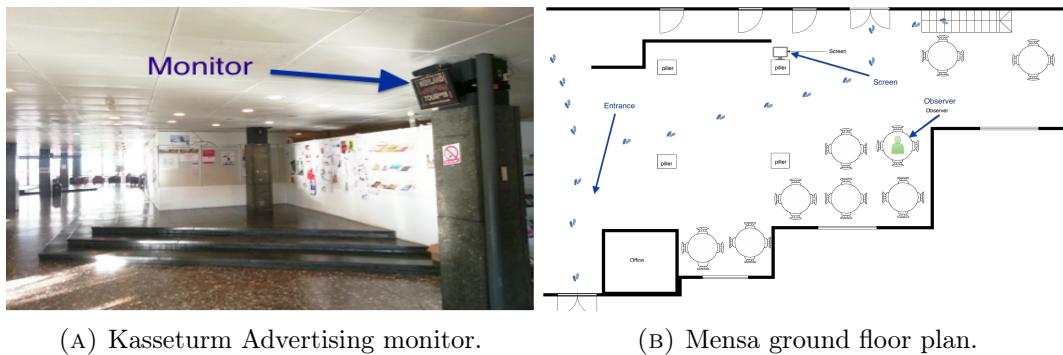


FIGURE 3.5: University Mensa

A sheet was provided to the observer to note each 5-minute time stamps for two hours. Specific letters were defined to detect glanced and ignored events of Male, Female, Unknown gender, group and individuals. To see the sheet refer to Appendix A.1.

The observer was told to write notes when he observes something interesting behaviors of passersby during the period



FIGURE 3.6: Observation method

Interviews

Before the interview began, the interview volunteers were asked to sign a consent A.3 form because the interviews were voice recorded for later analyzing. During all four day of the observations 16 interviews were taken from people inside Mensa to get general opinion about advertisement. The interview focused on people preferences, what they like and what they avoid about advertisement. Each interview took around 6 minute in average. All interviews were transcribed separately for further data analyzing. See the bellow interview questions.

- Do you like advertisement on displays?
- Which kind of advertisement do you like?
- What is that makes advertisement annoying or interested for you?
- What attracted you toward the screen?
- What do you think about this type of technique?
- Do yo have any other recommendations?
- What do you know about Interactive Advertisement?
- What is your expectation about interactive advertisement?

3.4 Findings

The findings are categorized as below.

3.4.1 Observation findings

Observational data for attention level of passersby was collected and summarized as number of *Glances* and number of *Ignores*. In table below all four methods are shown with the number of glances and ignores.

TABLE 3.1: Cross tabulation of deployment and attention level

Methods	Glanced (%)	Ingnored (%)	Total
Traditional	9 (7.6%)	109 (92.3%)	118
Silhouette	22 (15.82%)	117 (84.17%)	139
Following eye	10 (12.98%)	67 (87%)	77
Firework	6 (10.1%)	53 (89%)	59

In the table above, during the *Traditional* ad method 118 people passed from which only 9 persons glanced and 109 of them ignored. In *Silhouette* mode 139 people passed and among them 22 people glanced toward it. In *Following Eye* method 12 people glanced out of 77 passersby. And finally in *Firework* method only 6 people glanced out of 59 passersby.

Silhouette technique received the highest number of glances 22 compared to other techniques, and *Following eye* technique was the second most attracted technique. To find which of these three methods had statistically significant differences between *Traditional* mode the *Chi-squared* test was applied as below.

TABLE 3.2: Cross tabulation of Following and traditional attention level

Method	Glanced	Ignored	Total
Traditional	9	109	118
Following eye	10	67	77
Total	19	176	195

Performing the ch-squared test on above table, $\chi^2(1, N=195)=1.522$, $p > .05$ ($p=.21$), it suggests that there is no significant difference to attract passersby between *Following-eye* method and *Traditional* method.

TABLE 3.3: Cross tabulation of Firework and traditional attention level

Method	Glanced	Ignored	Total
Traditional	9	109	118
Firework	6	53	59
Total	15	162	177

After the ch-squared test, $\chi^2(1, N=177)=0.328$, $p > .05$ ($p=.56$) suggests that there is no significant difference to attract passersby between *Firework* method and *Traditional* method.

TABLE 3.4: Cross tabulation of Silhouette and traditional attention level

Method	Glanced	Ignored	Total
Traditional	9	109	118
Silhouette	22	117	139
Total	31	226	257

After performing the ch-squared test, $\chi^2(1, N=257)=4.046$, $p < .05$ ($p=.04$). It suggests that *Silhouette* representation attracts more passersby than *Traditional* method. Based on this finding, H_0 is rejected because the attention level of traditional advertising and interactive silhouette presentation are not the same. *Silhouette* representation attracts statistically more passersby than *Traditional* method, as a result H_1 is accepted.

3.4.2 Interview Findings

Interview transcripts were individually coded to generalize the responder's opinions on advertisements. I created two main sections from the interviews that what makes a *Good* advertisement, and what makes a *Bad Advertisement*. All the related all responses were collected and changed to codes and were analyzed and grouped together to make sub sections and sub-sub-sections.

Good Advertisement

A lot of categories have been found after coding the interviews. The chart in Appendix A.4 shows all the categories and sub categories with the correspondent code from the interviews

and even some codes were directly also placed as a category instance. The below list describes some of the important categories retrieved from that chart.

1. Content

Responders like to have more funny contents than any other strict informational advertisement; As responders replied like this, “*just make it funny like make a joke or something but something in a very good one that is really difficult*”, “*it should be very not very serious?*”, “*Yeah mostly I like funny things that the main concept is shown in different way like in funny things*”, “*I like advertisement that are somehow have humor*”.

At the same time responders would like to see some useful, true, sensible facts and main idea of advertisement; “*an offer if it is clearly mentions that okay that you save this much or you get this or that, that is like a clear message*”, “*You have to focus on the main things that will happen in the event which will attract people will come*.”

Furthermore, contents of advertisement should be small and understandable; “*the advertisement should be clear too*”, “*when you have too many numbers and too much to read then it is confusing*” “*Add some pictures based on the advertisement what do you want to show.*”, “*Not many text in advertisement*”, “*Have a good design, not too crowded with information*”, “*Well defined subject, and shorter contents, because we don't like reading long things usually no body likes to read*”.

Another important thing was context Based contents, the users liked to see things related to their surroundings; “*if I am standing near a shopping center it should tell me that what kind of shops are there and what I could buy from there*.” “*It should show movies of the actor I like*”.

2. Creativity

People like to see very new and creative things happening in advertisement; “*something that catches your attention in a way that you haven't seen before*”, “*like seeing something out of ordinary*” . Introducing new ideas, artistic; “*as I am musician you know kind of creative person I like if it something special inside not it is just like for example if it is advertisement of milk*” , “*Which can be something un-expectable probably also*” , “*in general I would say yes as long it gets creative*”

3. Style

The style of advertisement plays key role in terms of color and size as stated by responders; “*may be should be more should be more colorful*”, “*my eyes are attracted to so hard things unless there is something big enough things*”, “*Use the bright color.*” , “*You have to be clever in using colors okay because color mismatch does not attract the eyes*”, “*when it is really just like an art like you have a picture you some impression or illusion*”.

4. Location

Responders like to see advertisement while they are on the way, they don't get annoyed if advertisements comes on their way and some probably take a look to them too, but heavily they do not like advertisement while they are at home or watching program in TV or Internet, “*I think the street is better*”

5. Interactivity

Some liked to have some sort of interactivity to experience like playing games; “*it is good like if you have a game, it would better to have a preview of the game on the screen or just like something like even people could interact with it like get an experience of the game*”, “*if the screen will also be interactive so you can interact with the something you are advertising.*”

6. Mean

Different means were mentioned like larger screen, sound, banners for good influential advertisement.

7. Motivation

One of the responder pointed that the advertisement should motivate users in a natural way and should be from unbiased point of view; “*I prefer to buy in a natural way. The company should know who are using their product the power users who that have a lot of influence you know if you have good connections with the guitarists who have like actually like you know people listen to his opinion I think you have to reach out to the guitarist but once you know the guitarist is gaining something from that guitar maker then I don?t trust that company, It should be like completely unbiased, I think that is the kind of advertisement I listen to.* ”.

Others suggest that advertisement must motivate for healthy diet and sport; “*if it reminds me to do stuff like do more sport or eat healthier or anything that has a good purpose*”.

8. Other categories

Many other categories were also extracted for a good advertisement like Goal of advertisement, Audience, Purpose and motivation, for more detail see Appendix A.4

Bad Advertisement

The below categories were derived from the interviews that make an advertisement feel or look bad. The chart in Appendix A.5 shows all the code categories in great detail. The issues discussed below should be avoided while creating advertisements.

1. Style

There exist different styles that advertisement makers follow but texts or photos are blinking; “*try not to use anything would be blinking okay because that is really annoying okay because even so if you are not looking at it is still effecting*”. Using of mismatched colors in advertisement is certainly a bad idea; “*color mismatch does not attract the eyes*”.

2. Annoyance

Most of the responders felt annoyed by almost all advertisements because they contain some sort of similar features like repetitions; “*it should not be like repeating itself over and over and over again*”, “*I like advertisement apart from watching it again and again*”, “*Hmm if I see the same advertisement again and again that is annoying*.”.

Other feature is destruction, which does not allow a person on focusing on something; “*Not just like something popping up in front of your face*”, “*for example in middle of the serial or a movie that i am watching and an advertisement that is I don?t like because it makes me destructed now I just can?t focus on things for view minutes you have to leave what ever you were*”

3. Motivation

Advertisement in general motivate people in their own way to attract customers, which people make not like it, for example sudden appearance of something in the screen or what users do not like to see but they are forced to see; “*usually you are forced to see them because you are watching something or doing something and suddenly it comes and it disturbs you*”, “*it is trying to convince me of something only for to consume or buy and then I mean I don?t want*”

4. Content

Some advertisements exaggerate on their products or even say lie; “*it is like magnificent thing and nice pen okay and then it is just a pen, okay*”, “*They are all lies. Showing inappropriate content are heavily disliked;*” “*whenever I go and access the Internet okay A lot of advertisement comes to my face and most of them are inappropriate. Stuffs like that I don’t like them at all for example some perfume ad which would the a woman in a very degrading position or for example mocking someone believe or something just to catch the attention that is probably to offend people that is what would annoy me a lot. The use of ugly and old people is also not welcomed.*”

5. Duration

Long lasting advertisement are always boring and waste of time, most of the responders said that they would prefer short advertisements.

6. Other categories

Many other categories were also extracted from the interviews like *Location, Confusing advertisement, Controversial ads, and amount of Ads*. Other types of ads that were not liked by responders can be seen to Appendix A.5

3.5 Conclusion

At the conclusion of this study, the nature of traditional advertisement was revealed from many interviews. The summary of the interviews exposed what elements make good advertisement and what elements make a bad advertisement. Positive aspects should be taken in consideration for developing an advertisement and negative features should not be taken in mind.

A *Good Advertisement* is an advertisement that provides most relevant content, suites best to the theme of the product, considers environment where it is advertised. The advertisement should be short in length; it should deliver its precise message to audience. And it also should introduce creativity and interactivity of some.

On the other hand a *Bad Advertisement* is the advertisement that does not provides relevant and precise contents for the audience. It annoys people by repeating of certain elements or popping of an object suddenly on the screen. It uses bad style that does not match the theme and font size and color that is not readable by audience. The bad advertisement creates very lengthy advertisement in which audience get board to stay.

Regarding the attracting attention, among other techniques the *Silhouette* representation statistically attracted more passersby than *Traditional*. Based on the findings of J. Müller[11] silhouette representation is a well accepted representation of people in public displays. It can be interesting, joyful and obviously more attractive than any other representation. This technique would be used for attracting attention phase of the next (body and mobile) interactive advertisements.

4

Advertisement decision

4.1 Introduction

At the time of industrialization, industries compete on product quality, and modern organizations focused more on delivering services. But now services and products are hardly able to be distinguished because they provide various offers and consumers lose themselves in them. Peter van Waart describes in his paper that “*In the last two decades however, economical developments resulted in the experience economy: a new era of marketing and branding, in which traditional advertising is becoming less effective and meaningful experience branding is key*” [79]. Therefore economical developments have changed from time to time and are now emerging from economical experience in which factors like price-reduction is not so important. But experience factor has become the central part for the development. Any advertisement that explains a product features might fail to achieve people satisfaction because people’s experience might not have considered in it. As Joško Brakus [93] explains the measurement of brand experience and how it can effect on product loyalty.

To create a true meaningful advertisement and gain people satisfaction, the advertisement should be created so that people and stakeholders be satisfied. The development of advertisement requires many steps and the initial step is to create content. It happens normally by creating a *Focus group* of stakeholders to be able to fully discuss the advertisement requirements. *Focus group* is a small group between six up to ten participants that joint together in comfortable and quite place to discuss on a specific topic domain. As described by Jenny Cameron “*Focus groups can be exhilarating and exciting, with people responding to the ideas and viewpoints expressed by others, and introducing you, the researcher, and other group members to new ways of thinking about an issue or topic*”[20]. One of the example of a *Focus Group* is discussed in Florian Alt [45] that talks about the process of how the focus group was conducted for a mobile contextual display systems.

As a computer scientist, there had been no chance to create an advertisement, and this was the first opportunity to make one. After negotiating with University communication department and then discussing with University marketing department, finally the decision was made to make an advertisement for *Bauhaus-Walk*¹. What I knew about *Bauhaus-Walk* was that it conducts tours about Bauhaus for tourists in Weimar. But in-depth goal and motivation of this program was not clear for me. I did not know what kind of advertisement they wanted, what message they wanted to convey through the advertisement.

Therefore, there was a need to conduct a *Focus Group* to do requirement analysis on *Bauhaus-Walk* program. This was mainly meant to understand many aspects of *Bauhaus-Walk* and collect the required parameters for designing the advertisement (interactive and non-interactive). Because of time limitation and participant schedules two sessions were arranged in two different dates to cover all topics and discussions. This chapter describes the main theme and goal for *Focus Group* and reports all the processes that were taken. Like, how participants were invited and what was being discussed and more focused on each session. How data was gathered and what techniques were used to analyze them. The document presents all the findings and outcomes in details and related discussions and conclusions.

4.2 Research Questions

To design and create the *Bauhaus-Walk* advertisements, it was required to collect the below information from the *Bauhaus-Walk* members. With the help of those information a very

¹Bauhaus Walk: <https://www.uni-weimar.de/en/university/profile/bauhausatelier/bauhaus-walk/>, last accessed 26 may 2016

relevant and meaningful advertisement could be developed that could speak by itself for *Bauhaus-Walk* and at the same time it should be entertaining and funny and fit for both interactive and non-interactive advertisement. Therefore I needed to understand the bellow aspects of *Bauhaus-Walk*.

1. Who is (are) the target group?
2. What are the existing *Bauhaus-Walk* advertisement medium?
3. What are the peak times in the year and famous locations for *Bauhaus-walk* tour?
4. What are important aspects of *Bauhaus-Walk* from their point of view?
5. What could be a suitable advertisement theme and content?
6. What interactions should be integrated in interactive (body & Mobile) advertisement?

4.3 Study design

Focus group was designed in two sessions because all the participants could not be present at the same time or date. And by doing this, there was enough time to analyze the first session and discuss the findings in the second session with new participants and get their point of views. The first session was more related to gathering general information about *Bauhaus-Walk* program and second session was more in depth discussions on the advertisement decisions and prototypes.

4.3.1 Participants and Environment

The Focus Group in the first session consisted of three participants, and in the second session it consisted of two participants. The participants of both focus groups were tour guides of *Bauhaus-Walk*, they had been providing tours for more than a year and knew the aim and vision of *Bauhaus-Walk*. Participants were invited through Doodle², where varieties of date slots were available to select, in which a short introduction of the aim of the Focus Group was also described. Both sessions lasted for 90 minutes.

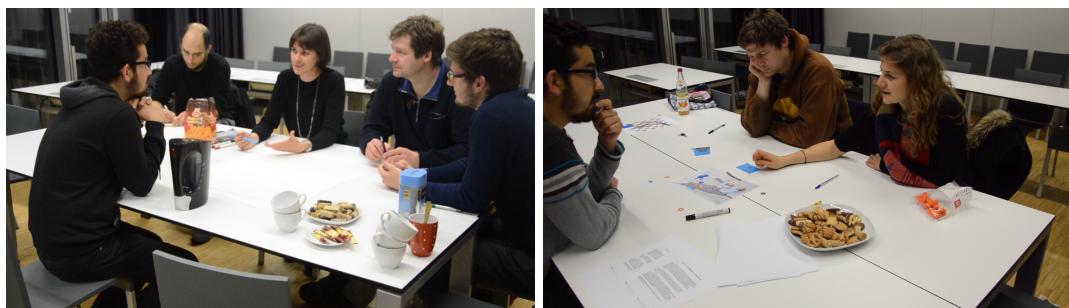


FIGURE 4.1: Focus group sessions

The Focus Group was held inside the DBL³ building meeting room, where we had enough space to make a group circle. Participants were offered coffee and biscuits at the beginning or end of the session to feel comfortable and relaxed for discussion.

²Doodle: <http://doodle.com/de/>, last accessed: 26 May 2016

³DBL: Digital Bauhaus Lab

4.3.2 First session

This session was an exploratory session over *Bauhaus-Walk* program. And it was a good start for me to investigate thoroughly on that domain to create the advertisement prototypes for the next sessions.

Procedures

Participants were warmly welcomed and asked to feel comfortable by having biscuits and coffee. I introduced myself and asked them to introduce themselves. This helped to understand each others professional background and interests.

1. Introduction

Brief introduction on advertisement and interactive advertisements were given to participants to understand the possibilities of existing technologies and the use of them in advertisement field. Some interactive advertisements were introduced with their relative interaction techniques. The agenda and goal of Focus Group was also described to have a wide picture of what is going to be done till the end of this semester.

2. Consent Form

Each participant was asked to sign the consent form before actual discussions to make sure that they agree to participate and be video recorded.

3. Discussion session

After introduction, the discussion started on below questions. Because there was limited number of participants I could not divide them in to groups to discuss in detail and do comparative study among the groups. But they were given an empty big paper sheets to draw and write what come in their mind during discussion. This kept track of their thoughts and became easy to generalize their opinions. During the discussion Patrick Tobias Fischer was asked to write notes on the discussions.

- (a) What kinds of advertisements for Bauhaus-Walk are there?
- (b) Who join the Bauhaus-Walk program in general?
- (c) What could be a suitable theme of Bauhaus-Walk for the Interactive advertisement?
- (d) What would be the content of the advertisement?
- (e) How to motivate passer-by to be engaged with the advertisement?
- (f) How to engage passersby with the advertisement?
- (g) What kind of Gesture and Mobile Interactions should be used?
- (h) How to motivate passer-by to join the actual Bauhaus-Walk tour?
- (i) Is there anything else we need to discuss on Bauhaus-Walk Advertisement? Any new angle?

I was responsible to carry on the entire discussion and Patrick Tobias Fischer was doing the note taking during the discussion. He noted important information extracted from our discussions so that I could later look at them beside that, the entire discussion was also video recorded for analyzing.

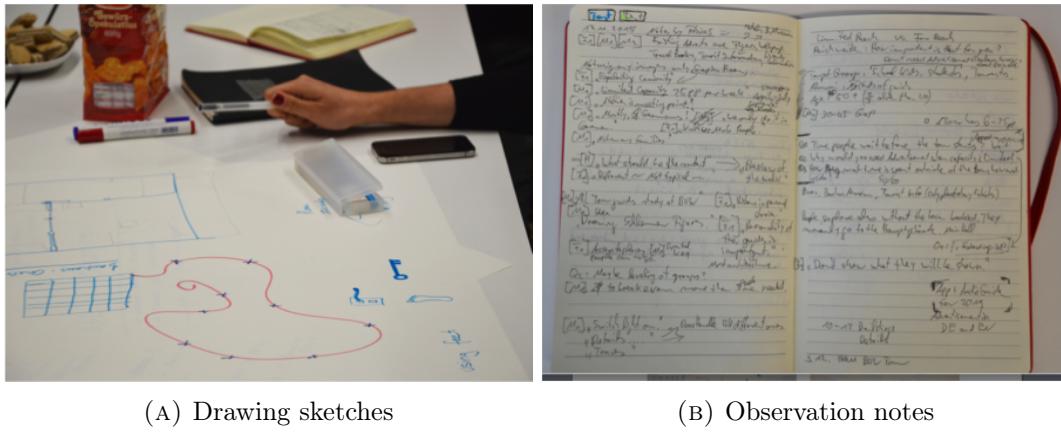


FIGURE 4.2: Discussion Session

4.3.3 Second Session

Based on the first focus group's discussions and the participant's nice ideas, which are mentioned in finding section, two different paper prototypes of advertisement were made to dig more in detail. The participants were given the prototypes to play with them and explore their own way of designing the advertisement and interaction.

The basic ideas were designed to help the participants to think more and come up with some more ideas and at the same time should be in the context of Bauhaus-Walk program.

Procedures

1. Short introduction was given on Interactive Advertisement thesis.
2. Consent forms were handed to sign for video recording.
3. Short motivational video of interactive advertisement was shown.
4. Two paper prototypes that are mentioned above (Bauhaus chess and Map) were introduced.
5. Possible interactions were shown to them.
6. Participants were asked to comment on prototypes and come up with new ideas and interactions.
7. They were asked to design their own prototype.
8. Integrate some fun ideas with prototypes.
9. What contents should be included in the prototypes.
10. How to gather and collect those contents.

Prototypes and discussion

Two functionalities prototypes were explained to the participants and how the prototype originated from the previous discussions. A short description to these prototype are give below.

- *Bauhaus-Chess Prototype*

This prototype was chosen because of the historical background of this amazing chess game that was developed by Josef Hartwig⁴. The shape of the chess piece defines the movement direction of itself on the chessboard. The goal was to show the chess on the advertisement screen and show one piece at a moment and let users to move the chess in the right direction by some sort of gesture.



FIGURE 4.3: Chess prototype

- *Map Prototype*

This prototype was to show a city map of Weimar on the screen with possible interactive famous places of Bauhaus. The interaction idea was to map physical /mobile cursor movement of a person on the map. This interaction let user to explore the target places by reaching to those locations. Maximum five places were to be explored by one person to finish the interaction.

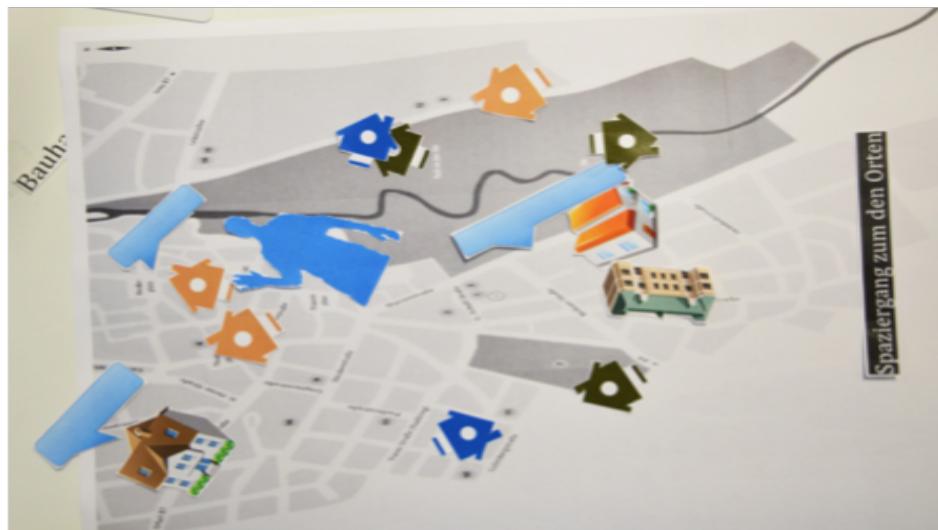


FIGURE 4.4: Map prototype

⁴Josef Hartwig: <http://bauhaus-online.de/en/atlas/personen/josef-hartwig>, last accessed: 26 May 2016

After prototype got explained to the participants, they were asked to bring their own ideas and ask questions. This phase was to find possible issues and how to enhance one of them to be used for the final advertisement. The consideration was also that any prototype selected should be valid for non-interactive, body interactive and mobile interactive advertisement all at the same time.



FIGURE 4.5: Explaining and discussions on prototypes

4.3.4 Data Gathering

The data gathering of the Focus Groups were done in a way that could be very easy to be analyzed and generalized in very little amount of time.

- The participants were encouraged to discuss the issues on a piece of chart using drawings and texts this helped the participants to focus on their ideas and build the ideas in a more better way and at the same time that helped the research to have a summary of their opinions and thoughts
- They could make summary of their discussion on the paper so that they and I fully understand the topics. see Appendix (B.1, B.2 and B.3) for sketches.
- Tobias Patrick was taking notes to cover up everything we discussed.
- All the sessions were video recorded for full detailed analyzing.
- Photos were also taken from the participant while discussing ideas, and also from the sketches they drew.

All of the above resources were analyzed by going through each of the sketches and each notes that were written. And all the videos were seen many times to check if some ideas were not clear in the sketches or notes.

4.4 Findings

4.4.1 First Session Findings

The below sections are extracted from the long discussions, and analyzing video and drawn charts.

Bauhaus-Walk

Bauhaus-Walk is a project that is run by university students to show more about Weimar and Bauhaus culture to the world. They give small tours to group of maximum 30 people. The tour shows studying conditions student, living style of people and giving excursion to historical places.

Tour guides are from different backgrounds like architecture, urbanism and design and each of them shows various aspect of Bauhaus by their own stories. And interrelate the stories with the facts and then connect them to the places in Weimar. The most important for the tour guides are not just the buildings, but also the small details inside the building that most people do not focus. The tour guides want to be the voice of those unspoken stories for the tourists.

Current Advertisements

Current existing advertisements for Bauhaus Walk is through different mean as listed below.

1. Web:

Bauhaus Walk is advertised in the Bauhaus University Weimar webpage⁵ and in Weimar tourist information page⁶.

2. Print:

Bauhaus Walk programs are advertised in flyers and leaflets at different locations. The flyers could be found in tourist information center, *Bauhaus Museum*, calendar of Weimar and in travel leaflets.

3. Books:

Bauhaus Encyclopedia has mentioned *Bauhaus Walk* too.

4. Oral:

Mostly the people, who have already taken the program once, publicize *Bauhaus Walk* to their friends, relatives.

Tour participants

Most of the people who join the tour are from elder people aged between 45-65 years old and others are adults and children. Adults largely learn about the program trough web and the elders learn from the tourist information centers and books. Often the participants are German and do not understand English language.

⁵Bauhaus Walk: <https://www.uni-weimar.de/en/university/profile/bauhausatelier/bauhaus-walk/>

⁶Weimar tourist information: <http://www.weimar.de/homepage/>, Last accessed, 4th Jan 2016

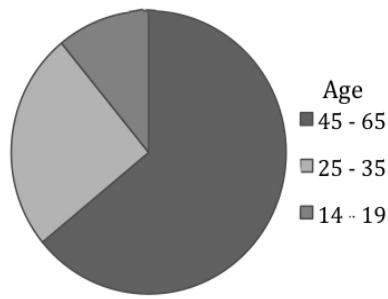


FIGURE 4.6: Tour participant average ages

Peak Tour times

In Average 5000 people take the tour each year. April, May, September and October are the peak months that people take the tour because of the good weather condition. The amount of people per tour is about 25 people, but in winter the amount declines to five to six in one tour.

Possible advertisement location

1. Tourist Information.

This is a good place to put Bauhaus-Walk advertisement because

- Random visitors from different places and cities come here and want to know about Weimar in general.
- Heavy traffic of people.
- This is the only place to get Bauhaus-Walk tickets in advance.

2. Bauhaus Museum.

This could be another good place, but people have to pay to enter to this museum, so there will be limited people but who

- Are very interested in Bauhaus.
- Likely to go on tours.

3. University main building.

Main university building is a more open place for all visitors; there are many factors as stated below.

- People from different background.
- People from different age, more youngsters like students.
- Interested people in Bauhaus.
- It is close to starting point of Bauhaus-Walk tour.

Content of advertisement

Participants pinpointed on very important things about the content of advertisement, with which the advertisement got clearer and clearer. As a result *Bauhaus-Walk* could be categorized in to many different aspects of as mentioned below.

1. Objects

There are objects that are introduced during the tour for the tourists. A good idea would be to show those objects on various locations on the map that belong to.

2. Stories

Bauhaus Walk tour guides have many stories to tell about the walk and about their own backgrounds. One of them said “*Probably our walk is to sum it up, consists of stories we are actually telling stories, not just talking about history, not just about facts but our own personal stories and stories that were told by former students, so we are kind of raping the history in to personal stories, and we want to say that hay, we are students from different faculties and we want to tell the stories by different ways, and that is not a bad thing, because based on historical fact that there has not been the same Bauhaus in Weimar, there has been so many different teachers and students and they all had a different idea that what Bauhaus could be and I think we still kind of incorporate that the fact that no Bauhaus tour would be the exactly the same like the others before.*”

3. Histories, Facts, Places

The content of advertisement could also be related to history of Bauhaus. How it is known to world, what were and are the innovations.

Interaction of advertisement

Based on the examples that were shown at the introduction, participants liked hand gesture and some other techniques and gave the below possible technique ideas.

1. Hand gesture Interaction.

The below two kinds of interactions were discussed each containing different contents.

- Hovering:

By showing the Bauhaus map on the screen with the most important elements, the users should be able to look at the items by moving their hands on top of it. The items could change its status when hovering for example if there is a light object shown it should turn on or something like that. There could be famous places shown on the map that *Bauhaus-Walk* tour focuses the most. And by hovering the hand on some more information like a picture or a related info to that places should be shown.

- Performing a specific gesture:

There are many objects that have specific characteristics and those details are described in the tour. So the idea was to bring those objects in action and allow users to perform those actions. For example, show a 3D environment and the user should be able to perform a gesture, like opening door handle, lighting up a lamp, opening a lock by a key. With *Bauhaus- Schachspiel*⁷(Bauhaus Chessboard) users can navigate the correct movement of the chess piece on to the screen using gesture.

2. Body Interaction

Bauhaus-Walk is recognized by its name which means walking to different historical places of Bauhaus. Therefore there was the idea of giving short virtual walk on the screen by moving the user's body in front of the screen and exploring some sights.

⁷Bauhaus-Schachspiel: <http://www.markanto.de/Markanto-Store/Entwurfsjahr/1920-1929/Bauhaus-Schachspiel::165.html>, last accessed: 27 May 2016

4.4.2 Second Session Findings

The second session was held after a week and half with only two participants, other participants could not come because they were busy with their studies.

Prototype discussion

The lengthy discussions on prototypes were focused on the acceptance of one of them. The main goal was to understand which of the two fit to *Bauhaus-Walk* goal and requirements. Meanwhile the discussion was also on how could they fit for mobile, body and non-interactive advertisement at the same time. The below are their final summarized comments on both prototypes.

1. Chess-Game

- Positive points:

- The idea is very nice because many of the visitors are above the age of 40 and they may be familiar with this game.
- Easily understandable by looking at the shape, because shape defines the movement.
- Suites best for *Bauhaus Museum* because there is the original chess board of Bauhaus but people are not allowed to touch the game. With this type of interaction people will have a live experience with the chessboard.

- Negative points:

- Very difficult to understand by people who have not played chess before or have not seen this special type of chess.
- Players could make a lot of mistakes while moving the chess piece.
- The idea does not really fit to the Bauhaus-Walk program.
- It does not fit the places that are being shown in the tour.

2. Map-Game

- Positive points:

- Map game idea fits a lot to Bauhaus-Walk tour.
- Portraits the idea of walking action.
- Easy interaction just by moving body or a cursor in mobile phone and navigate inside the screen.
- Understandable concept by moving on to different places and exploring them.

- Negative points

- Possible moving difficulties in a given space.

4.5 Conclusion

The two intense sessions of Focus Group helped me to understand much about *Bauhaus-Walk* and especially about the tour guides. *Bauhaus-Walk* is a program that provides tour for people who want to learn about Bauhaus and Weimar culture. Tour guides are University students that who are very passionate to convey their thoughts and stories about Bauhaus. *Bauhaus-Walk* advertise through different mediums like, *Web, Print, books and oral*. Peak tour times are in summer, which has warm weather conditions. The participants of tours are tourists that most have age between 45-65. The deployment location for my advertisement would be in Weimar Tourist information center because a lot of tourist firstly visit that location. This Focus Group assisted to answer all the relevant questions for the design and interaction of advertisement. As a result, one interactive advertisement prototype was selected, that should be able to cover all the aspects and concept of *Bauhaus-Walk* advertisement.

Based on the opinions and discussions, participants chose the *Map-Game* prototype to be developed for *Bauhaus-Walk* advertisement. Because the prototype suited better in Tourist Information center than *Chess-Game* prototype. There will be two versions of prototype, (a) Body interactive prototype and (b) mobile interactive prototype. Participants suggested the following things to be integrated with prototypes. (1) *Content of the game*, all *Bauhaus-Walk* related contents should be inserted like program name and up to five interest location names. (2) *Fun Factors*, integrating some fun factor to the game is essential. Showing a famous character face on top of the silhouette head position and giving a kind of funny movement could do this. (3) *Multiuser feature*, the game should give opportunity for multiusers to play, like for example if there are two people standing in front of the screen, the tasks will be divided among them by locking one's silhouette or interaction and allowing the other to perform the task. (4) *Defining random tasks*, the game should create the task related to a specific situations like, character, color of the body or randomly. (5) *Funny map*, it would be nice to integrate funny map, which was made many years back of Weimar city. (6) *Animation of objects*, popping up or sliding down interactive objects like houses on the map would be very interesting for users.

5

Advertisement Low Fidelity prototype

5.1 Introduction

For early application development *Formative studies* are required that would assist in design process of that application, and meanwhile it would investigate usability issues with the application prototypes. *Charles M. Reigeluth* [94] says “*Formative evaluation (sometimes called field testing or usability testing) is a methodology for improving instructional resources and curricula*”. Evaluating the paper prototype of a system can be efficient [68] and can be very effective. Conducting Low-fi evaluation can reveal potentially same usability issues as hi-fidelity usability issue, as Rober. A [47] conducted usability testing using Low-fi and High-fi prototypes of the same system. In that evaluation one group of subjects were confronted with a paper prototype and the other group with real functional prototype and both groups had the same set of tasks, as a result “*In both experiments, substantially the same sets of usability problems were found in the low- and high-fidelity conditions. Individual problems were detected by a similar proportion of subjects in both the low- and high-fidelity conditions*”.

There have been many evaluations based on public display prototypes like *Scott Carter* [44] developed prototypes for Ubicomp systems. Those prototypes were evaluated at different stages inside office places. During the early phases the 16 paper prototype technique was used. He was simulating the computer’s reactions and with his friends were playing the role of network that could update content in the display. The analysis was mostly qualitative like by taking interviews and observing participants.

Evaluation of mobile paper prototypes are very easy to be conducted as there is only one interface in which user interactions happens. As far as public non-touch displays are concerned, they are slightly different because the interaction happens outside the screen with a smartphone, hand gesture or with body movements. During the evaluation the moderator should be monitoring the interaction interface and simulate the effects on to the display, most of this kind of testing is done by *Think-Aloud* method. Robert .A [47] conducted the evaluation of electronic book player, where the keyboard and the screen were simulated on paper and participants were told to call loud when pressing a key, meanwhile evaluator was performing the action on the screen.

This chapter describes the study design, evaluation process and findings of Low-Fi (*Map-Game* prototype). The prototype was chosen by *Bauhaus-Walk* members in *Focus Group* discussions in chapter 4. The *Map-Game* prototype consisted of two different interactions (1) body interaction and (2) mobile interaction. The purpose of this Low-fi prototype evaluation was to exploit usability issues of prototype and find out the appropriate and meaningful elements, and which elements were confusing and not understandable. This document also describes the advertisement application requirements, lists all functionalities, and defines the target group that this application was going to being made for.

5.2 Advertisement paper Prototypes

The prototype showed a city map on the screen with possible interactive famous places of Bauhaus, the interaction was done with mapping physical movements of the user or the cursor movements of a phone to the virtual movement on the city map. With that interactions user was allowed to explore the target locations. Maximum five places were to be explored by one person to finish the interaction.

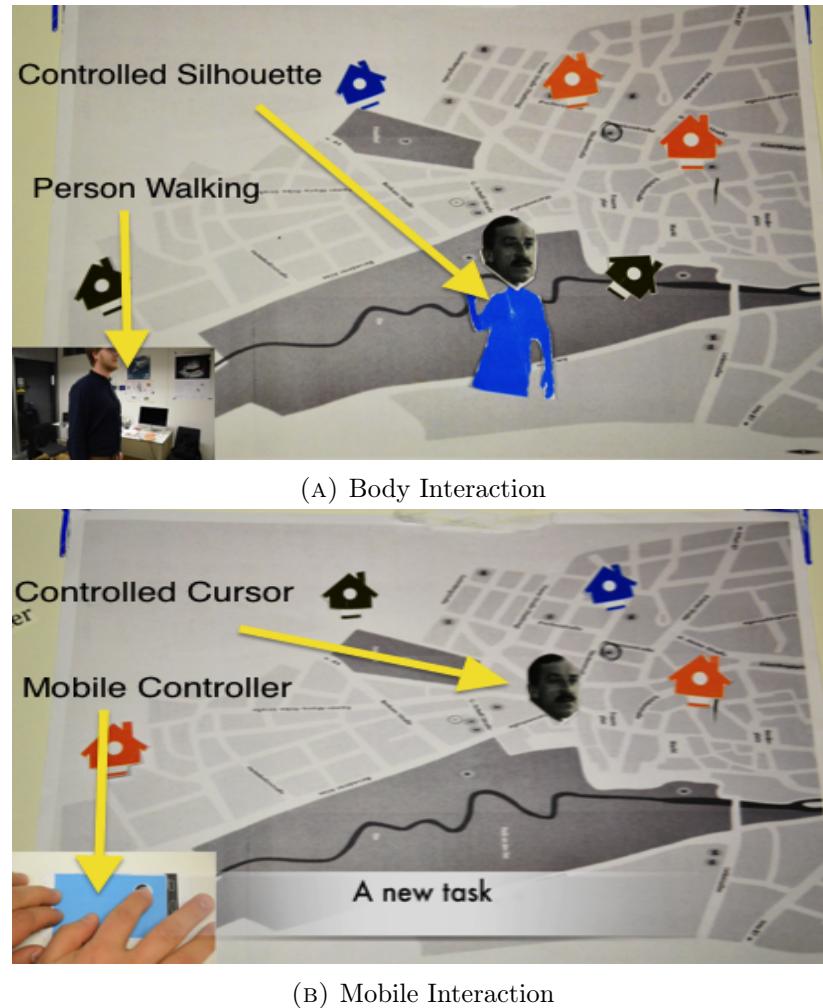


FIGURE 5.1: Bauhaus-Walk Advertisement Prototypes

As can be seen in picture (A), the person in the left corner is physically walking and his blue silhouette in the screen is changing based on his location on the map. Picture (B) show Mobile interaction, in which the changes of the cursor in phone screen affects the movement of character on the map. To have a look at the entire paper prototype interaction sequences both for body and mobile, watch the prototype video¹ for all the process.

5.3 Requirement gathering

The below lists the *Bauhaus-Walk* advertisement's functional and non-functional requirements. These requirements were the result of the focus-group and discussions.

5.3.1 Functional Requirements

1. Detect multi User.
2. Assign a character to the user.

¹Ad Low-fi:<https://youtu.be/XGBgeSGeUwQ>, Last accessed 27th May 2016.

3. Assign a task to the user.
4. Respond to each user interaction.
5. Show advertisement text.
6. End the interaction.

5.3.2 Non-functional Requirements

1. Performance

This is a very important requirement that should be wisely done. Response time should be very fast in both gesture and mobile interaction so the user could see the reaction quickly on the screen.

2. Scalability

The interaction is scalable for multi-users at the same time for body interaction and mobile interaction.

3. Availability

Kinect camera should be functional during the experiment for people detection, Access point should be running so that it could provide network access to users.

4. Usability

The advertisement interaction both mobile and body should meet all criteria of usability.

5.3.3 Personas

The below personas are created based on focus group findings since most people taking the tour are elder. The elder people build up my primary type of persona and young people build my secondary type persona as described below.

TABLE 5.1: First persona

Type	Primary
Name	Andreas Müller
Background	History teacher
Demographics	Age:.....50 Height:.....1,6 m Martial status:.....Married Kids:.....Two Profession:.....School teacher Language:.....Deutsche Computer experience:.....None Smartphone experience:.....None
Goal and Task	Experience goals: 1.Likes to learn about places in Weimar 2.Likes to have fun. 3.Does not like to feel alone and likes his wife or friend to also join. End goals 1.Wants to see his body moving in the screen. 2.Wants to explore the character's location. 3.Want to learn about Bauhaus-Walk program.
Environment	He and his friends want to learn about some good places in Weimar and explore other famous culture events. He does not use technology.

TABLE 5.2: Second persona

Type	Secondary
Name	Anna Weber
Background	Media art student
Demographics	Age:.....25
	Height:.....1,6 m
	Martial status:.....Single
	Kids:.....None
	Profession:.....Designer
	Language:.....Deutsche, English, Spanish
	Computer experience:.....Yes
	Smartphone experience:.....Yes
Goal and Task	Experience goals: 1.Avoid feeling stupid. 2.Likes to try and error. 3.Likes to have fun and laugh.
	End goals 1.To complete the task. 2.Learn about Bauhaus-Walk program
Environment	
	She is a student in Bauhaus University; she is very interested in art and design and wants to find out more about Weimar art. She loves using technologies like smartphone.

5.4 Goal

The goal of this evaluation is to find possible issues as listed below with interactive advertisement.

1. Confusing and unclear events or interactions.
2. Misconception of a function.
3. Task confusion.
4. Understandability of advertisement goal and contents.

5.4.1 Questions

The questions are divided for each individual interactions (mobile and body).

Body Interaction

- Do users understand and react to the *Call-to-Action* approach?
- Do users recognizes the character assigned to them?
- Do users understands the tasks assigned to them?
- Do users explore locations by moving their body in physical space?
- Do the prototypes raise alerts to specific user actions?
- Do the prototypes motivate participants to continue playing?

5.4.2 Mobile Interaction

- Do users understand the *Call-to-Action* shown on the board?
- Do users open the controller website by scanning QR-Code?
- Does the Webpage prototype produce alerts with incorrect user input?
- Do users rotate the mobile phone to start the game?
- Do users understand the task?
- Can users navigate the character by moving the face in mobile?
- Does application produce alerts for incorrect location?

5.5 Study Design

Bauhaus-Walk interactive prototypes consisted of two elements, (1) the screen that the users see the reaction of their action and advertisement content, (2) was the mean of interaction, body or mobile. To design the evaluation, the paper prototypes should be capable to mimic both of mentioned elements in real life scenario. Therefore I designed the actual advertisement screen paper prototype, in which the experimenter could simulate the output of all user action, even small actions like, movement of silhouette or character face on a display board that resembled a display.

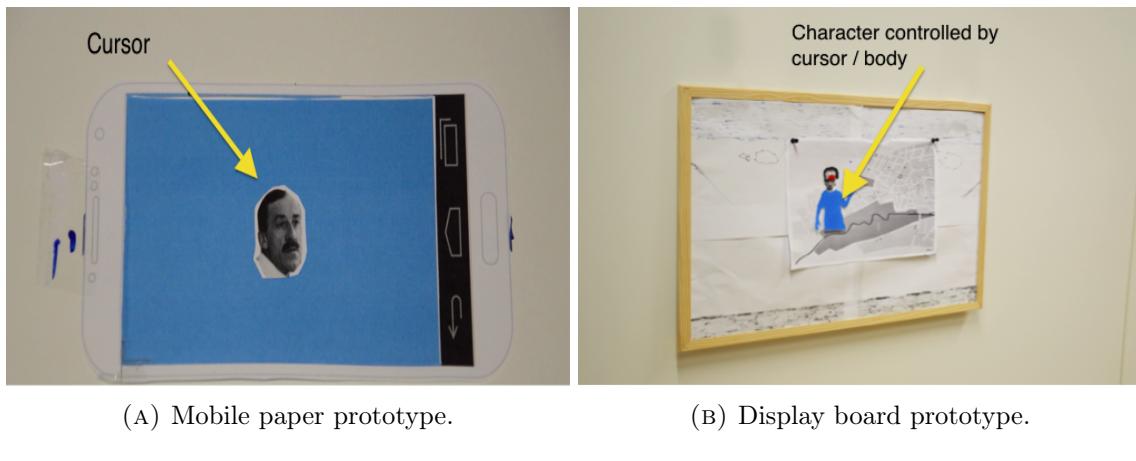


FIGURE 5.2: Paper prototypes

5.5.1 Subjects and location

The prototype testing was limited to five participants, they were from different backgrounds, like Media Art, Media Architecture and Computer Science. Participants were invited to the Digital Bauhaus Lab ground floor.

5.5.2 Procedures

The below procedures were followed.

1. Participants were handed the information sheet and consent form for video recording.

2. Short introduction was given about the goal of the thesis and this evaluation in particular. But they were not given any clue about the interactive prototypes.
3. The task for participants, were to explore the paper prototype until the game gets finished and advertisement content is shown.
4. Participants interacted with both prototype one after another.
5. They were instructed to *Think-Aloud* during the interaction to help the experimenter imitate the reactions on the board.

5.5.3 Display output simulation

The moderator is a computer between display and a user, it would receive the user's action by watching or listening to user and compute the result and show it on the display. All the interactive elements for the display were separately cut and put a side and each had a sticker at back. Whenever the user wanted to do something, for example visiting a location, the moderator would stick the picture of that place on display and also move the character based on the user's physical movement.



FIGURE 5.3: Participants interactions

As it can be seen in picture (A), the user is interacting with her body and the moderator is holding the blue silhouette on the board and would change if user changed her position. The picture on the right shows the mobile interaction, the user is interacting with phone prototype and sees reaction in the display board. The display board cannot be seen in this picture frame.

5.5.4 Data gathering

The process of data gathering was as below. The methods were designed in a way to fully answer the research questions.

1. Video Recording

Each participant was video recorded for both body and mobile interactions for later observation and analysis purpose.

2. Direct observation

Participants were observed during the interaction and users were also asked about what

they thought at that moment while interacting. When participants could not perform a task then they were asked exploratory questions on how would they do the task naturally.

3. Think aloud

Participants were asked to read their mind while interacting with the prototypes. This helped to understand what they thought about a specific interaction at that moment.

4. Interviews

After both paper prototype interactions were finished, a brief open-ended interview was taken to further learn about their experience with the prototypes. This interview was meant to get user comments and feedbacks for the prototypes.

- What do you think about this technique?
- Did you understand the blue person on the board?
- What did you find difficult while interaction?
- Did you understand that it was you but with different character?
- What was confusing about this?
- Do you like your face to be seen in public?
- What needs to be changed?

5.6 Findings

The important part for analyzing the data is shaped based on the defined hypothesis at the beginning; the below procedure was followed to best answer our open questions and to be able to evaluate both paper prototypes.

All the interviews were transcribed one by one, and then thematic coding was applied to find common codes. For both prototypes four themes were focused while coding the interview transcripts, *Likes*, *Dislikes*, *Confusing*, and *User recommendations*. See Appendix see AppendixC.1 for the codes. Here I list all the usability issues that were extracted from direct observations and from Interview codings.

5.6.1 Body Interactions

1. Confusions

- (a) user was confused of how should the user walk, because it felt that there is not enough space.
- (b) User thought that if he/she moves to the location names or the icons, someone would guide her.
- (c) User was confused on the new character photo labeled on the top of his silhouette; he thought that the new character is trying to interact with his silhouette. “*Is it like people approaching you and say hi and hello, and then ask me if I can visit his places*”
- (d) User did not know his places (the character’s places).
- (e) Could not understand the word move or walk, he taught that it is not applicable at the moment.

- (f) Raise one hand to see if the blue reacts or not.
- (g) Did not recognize the person.
- (h) Did not understand the task partially.
- (i) Did not understand what is the blue silhouette.

2. Frustrations

- (a) When the wrong house was explored, and she said “(Ohh No)”.
- (b) Waiting for the houses to load on the screen.

3. Mistakes

- (a) Entered to the wrong location.
- (b) Did not know how to navigate to the places. Although he was told that the silhouette is his body.
- (c) Navigating the silhouette was a problem for her; she wanted to go on top of the map in the screen but physically moved back. And after seeing the reaction she corrected herself.

4. Comments

- (a) There should be very clear instruction in the application on what to do, what it is about and how to do it.
- (b) I did not understand the person; maybe do not use it anymore.

5.6.2 Mobile Interactions

The below points lists all the possible issues with mobile interaction.

1. Confusions

- (a) The idea of the application was not clear for her because she taught that the mobile application could be used when she goes out in the city. But later she found out that the screen and mobile are both of them used at a place.
- (b) Navigation was a big confusion for him; he was touching the character on the mobile screen.
- (c) The turning phone as shown in arrow, since she could not turn the phone.
- (d) Did not understand what happened after the interaction was over. She did not read the texts or she did not understand why those were about.
- (e) The face in the mobile.

2. Frustrations

- (a) Entering IP address.
- (b) Visiting to all locations to finish the interaction.
- (c) Not enough things when visiting to a location.
- (d) She felt frustrated when visiting the wrong location and find the right location.
- (e) He had to re-login because he accidentally pressed cancel button.
- (f) Visited to the wrong location.

(g) Waiting for the houses to load on the screen.

3. Mistakes

- (a) Did not understand to scan QR code.
- (b) Took longer time to use the phone prototype.
- (c) Did not understand to rotate the mobile. As the instructions were shown on the phone.
- (d) Took longer time to navigate the person on the screen.
- (e) She tried to continue without putting any name in the form.
- (f) Did not understand how to turn the phone, she touched the arrow on the screen many times. But nothing happened. Later she knew to turn the phone, but did not do it because she thought that the paper prototype should not be moved from its place.
- (g) Could not navigate the person on the screen.
- (h) Entered the wrong IP address, but then changed his mind and scanned the QR code.
- (i) Accidentally pressed cancel.

4. Comments

- (a) There is no enough information about the locations; it would be good to show a short description of the place.
- (b) There could be like choices like when the opening time is for these locations.
- (c) How far are they from my current location, the distance?
- (d) View the transport possibilities to the selected locations.
- (e) It would be good to have more information about the locations.
- (f) And I would like to see the entire map on the phone too.
- (g) I like to see some more information in my phone.
- (h) There should be more guides when I use the phone, like there should be like Samsung, when you turn it on for the first time, it shows how to use what or it should have a finger picture to swipe on the face.

The below chart lists all the number of usability issues as, confusions, frustrations, and errors for each of the interactions carried by participants.

TABLE 5.3: Number of usability issues

Prototype	Confusion	Frustration	Errors
Body	9	2	3
Mobile	5	7	9

5.6.3 Summary of findings

This section summarizes the answers of this research questions based on above findings.

Body Interaction

- Do users understand and react to the *Call-to-Action* approach?
Call-to-Action of body prototype was “*To play come near!*”. All of the participants understood the it and reacted to it quickly as soon they read it.
- Do users recognizes the character assigned to them?
All the participants did not understand the character, which was assigned to them. This happens when the participants do not have knowledge to know that character. It would be better to show a character that is very famous and is known to most of the population. Using very specific character is a bad idea.
- Do users understands the tasks assigned to them?
Most users did not understand the task in the sense of the defined character, but they did understand that they should walk and explore locations.
- Do users explore locations by moving their body in physical space?
As soon as users understood that the silhouette shown are theirs and then did the task by moving them selves physically, except one participant who did not understand until the observer gave him hint to move his self physically in right or left sides.
- Do the prototypes raise alerts to specific user actions?
The application did not raise error for user’s specific interactions, for instance if the user was out of the screen or very close to the screen. Most of the participants raised their hands up, or turned around, there was no alerts for the participants.
- Do the prototypes motivate participants to continue playing?
When the users explored the first location, they were excited and tried to see the other places too. All the actions were predictable by the participants and nothing new was happening, participants expected more from their interactions to be more excited to play the whole game. They did finish the game because they were told so.

Mobile Interaction

- Do users understand the *Call-to-Action* shown on the board?
The participants were not shown the phone prototype at beginning, they were only shown the display only and were asked to react based on the messages or whatever they comprehend. After reading the *Call-to-Action*, they asked for the phone prototype and then the phone prototype was shown to them to interact.
- Do users open the controller website by scanning QR-Code?
Four of the participants understood the use of QR-code and from which two of them scanned it and other two typed the IP address. One participant did not understand the use of QR-code.
- Does the Webpage prototype produce alerts with incorrect user input?
The webpage did not produce error at many occasions while filling the form. It did not raise error when the cancel button was pressed, or when the game finished the application did not alert user to replay or leave webpage.
- Do users rotate the mobile phone to start the game?
Only two of the participants rotated the phone but the rest of the participants tapped on the icon and tried to rotate the icon in the screen instead rotating the whole phone.

- Do users understand the task?

This happened because all of the participants did not recognize the face and did not know where are his locations.

- Can users navigate the character by moving the face in mobile?

Four of the participants touched and tapped the face shown on the mobile phone many times. They expected that something would happen after they touch the character like a dropdown list would appear to edit it, and one of the users dragged it and saw the reaction on the screen.

- Does application produce alerts for incorrect location?

The incorrect locations that were explored by the participants were given an alert message.

5.7 Conclusions

Evaluation of low-fidelity prototype of *Bauhaus-Walk* advertisement was very helpful. It exploited many design and interactions issues that could have been a bigger challenge if the problems were identified at the high fidelity version. This section concludes both body and mobile prototypes as below.

Firstly, the body prototype was easily understandable by most of the participants. The interaction was more natural and can be done by different kind of participant without having any technical expertise. Both of interactions in this technique *Call-to-Action* and explore the locations were very natural and were performed faster. This low-fidelity usability testing suggested the changes needed for the next version of the advertisement i.e. the high - fidelity version. The changes would be to remove the character for users, improve alert messages for different user actions, enhance task description, and integrate features to increase interest of participants to be engaged with the advertisement.

Secondly, participants also appreciated the mobile interaction, but they were not so convinced for the usage because of many issues like logging onto web application, then navigating the face character. There were no clear instructions for how to navigate the character, and what would happen if there are many participants playing at the same time. It was unclear that what happens in web application when the interaction is over. This usability testing helped me to identify the mentioned usability problems and would help making changes for the new high fidelity version that would solve the current issues.

Thirdly, the advertisement text, which was shown at the end of interaction, did not catch the user's attention. It would be better to make a short video for the next prototype that would attract the user's attention on seeing the advertisement. After the video is over, the user continues to have his interaction to proceed with the application.

Finally, all usability related questions were taken in to account from which new decisions for the high fidelity version would be taken. The new version would overcome all the issues discovered until this stage. Participant's recommendations and feedbacks had also much value and would be considered in the development phase.

6

Advertisement High Fidelity prototype

6.1 Introduction

A follow up study is conducted when a final version of a prototype is ready. A *summative “is used to evaluate how well the design meets the usability requirements”*[70]. It is to finalize the decisions on a prototype, there have been studies like “*Sweep and point & shoot*” [43] that evaluated prototypes for interaction of personal computing device with large public displays. Another evaluation was of “*mobile interaction with live video*” [46] that used a within-subject design, where the participant’s performance were measured for automatic zooming and temporary image freezing. Sebastian .D [61] assessed the general performance of drag and drop interaction on large displays and compared it with a traditional drag and drop. Jorg Müller [11] did pre-studies (lab and field) on noticing interactivity of a display in which the time required for recognizing interactivity by participants were measured.

Based on the feedbacks from the low-fidelity evaluation in the previous chapter, I developed two functional hi-fidelity version of interactive advertisement of the body and mobile. This chapter explains the evaluation process of the Hi-fidelity prototypes of interactive advertisement both body and mobile. The evaluations were more on user performance, user acceptance and usability issues. As the application would be in public, where many people would interact, the application performance was also tested with single and multi-users to ensure application stability.

6.2 Advertisement prototypes

The prototype was to show a city map on the screen with possible interactive famous places of Bauhaus. The interaction idea was to map physical movement of the user, or map the cursor movement of a phone to the virtual movement on the city map. The interaction let users to explore the target places by reaching those locations. Five places were to be explored by one person to complete the interaction.

In this prototype there were mainly three hierarchical levels of interfaces, (1) *Call-to-Action*, (2) *Game interaction*, and (3) the advertisement video interface.

- *Call-to-Action* interface:

This interface invites participants to interact with the application. This method was first proposed by Bill Kules [69], in which the immediate usability of public accesses to a system was designed. *Call-to-Action* of body and mobile are designed differently, which are shown in below sections.

- Interaction interface:

This interface activates when the user follows the instructions of the first interface, the interface shows the interactive map with the hotspots to be explored by participants.

- Video advertisement:

After the interaction is completed then a silent video advertisement is shown for 20 seconds. The advertisement video was created in powtoon¹ with a free version account, to see the full advertisement video visit below these videos, video1² and video2³

¹Powtoon: <https://www.powtoon.com>, last accessed: 21 April 2016

²Old video version: <https://www.youtube.com/watch?v=GrWt0yjNcQ0>

³New video version: <https://www.youtube.com/watch?v=-y1Dbz6E6bU&feature=youtu.be>

6.2.1 Body prototype

This section introduces the interfaces of the body interactive prototype and the processes of how a user can start interaction. Watch this demo video⁴ to have a short glance to the interactions.

1. Call-to-Action interface:

This interface is basically attraction attention and *Call-to-Action* interface. As you can see below picture, there is someone standing in front of the screen and the interface calls the person to come near. This interface also has alert message section on the top right that alerts the participant if moved away from the camera range.

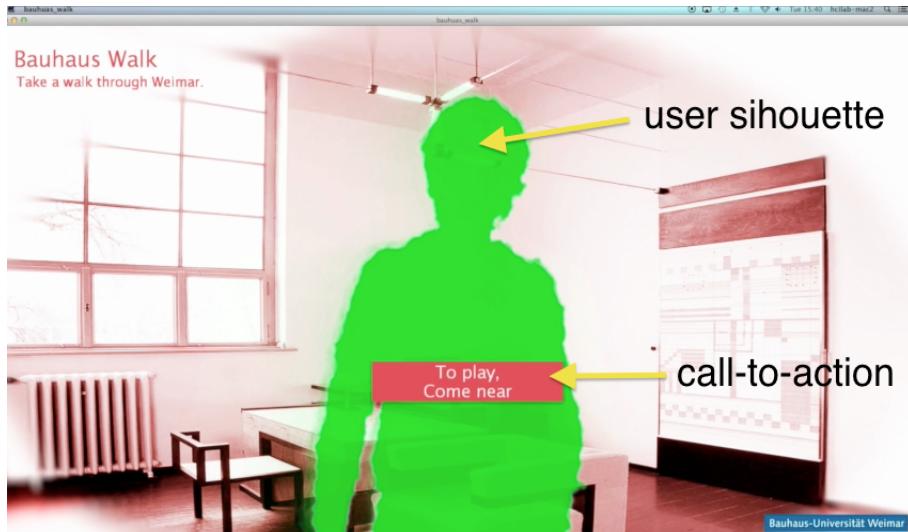


FIGURE 6.1: call-to-action interface

When a new person steps in the range of the camera, his/her silhouette is projected on the screen with a different color, and then the application calls the person to come near in order to trigger the game.

2. Transition to interaction interfaces:

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

(a) Loading animation:

The loading animation is a reaction to the action of the participants, which gives the user a clue that the interaction will be started.

(b) Scaling down the silhouette:

The participant's silhouette is scaled down to allow him/her to walk freely on the map and to give the participant the feeling of walking,

(c) Show task instruction:

Every interaction has an instruction, the instruction is fairly very easy and it is simplified in one sentence as, “*To play, come near*”.

⁴Body interaction: <https://www.youtube.com/watch?v=Uhvn43gImmk>, last accessed: 29 June 2016

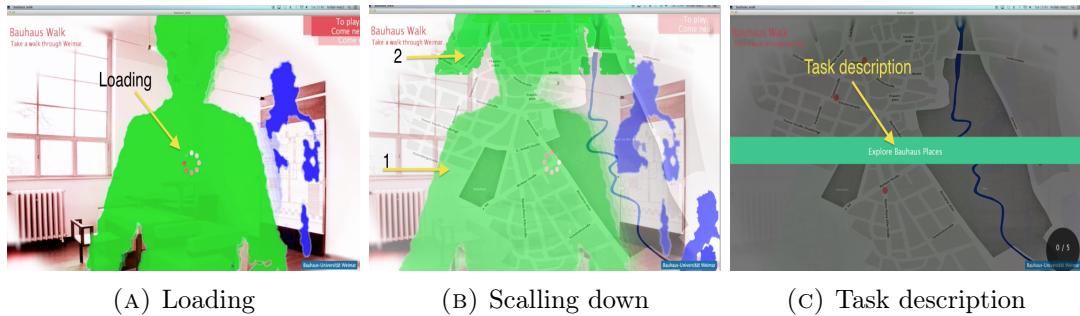


FIGURE 6.2: Transitions of interfaces

3. Interaction interface:

In this interface, participants can interact with the elements on the map. As shown in the picture below, the silhouette has visited four locations and has a score of 4 out of 5. In order to finish the interaction the user needs to visit the last location.

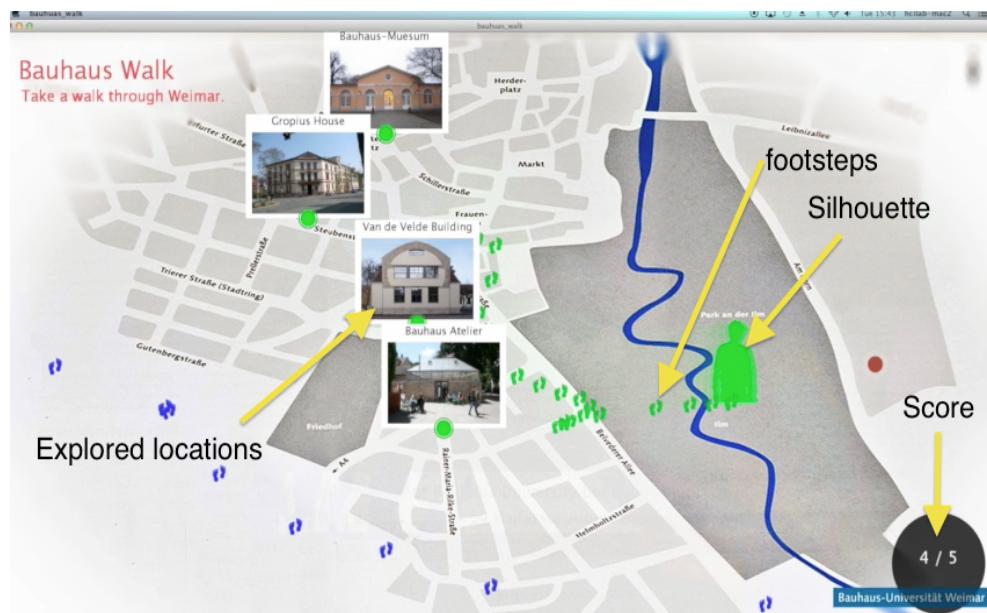


FIGURE 6.3: Second Interface

6.2.2 Mobile

Mobile interaction is possible by using a smartphone and a Wi-Fi connection to the advertisement network. The user should open the mentioned IP address in his / her mobile browser and enter a name to login. After login, a mobile controller appears by which the user can control the map elements on the screen. Watch this demo video⁵ to have a short glance to interactions.

1. Call-to-Action interface:

This interface is designed in such a way to attract passersby and also guide the participants on how to use their smartphone to access the advertisement application. The attraction is again the same method that was used for the body, the passersby silhouette is projected at the back of the Access information. The interface has a QR code that

⁵Mobile interaction: <https://www.youtube.com/watch?v=o0xWjgd0xUs>, last accessed: 29 June 2016

could be easy to be scanned instead of typing the whole IP address. There is an alert area that gets activated when a person is logged in and has not changed the orientation of the phone to landscape.



FIGURE 6.4: Mobile interactive interface:

2. Transition to interaction interfaces:

The transition happens only when the user connects to the Wi-Fi, open the controller and physically holds the phone in landscape.

(a) Loading animation:

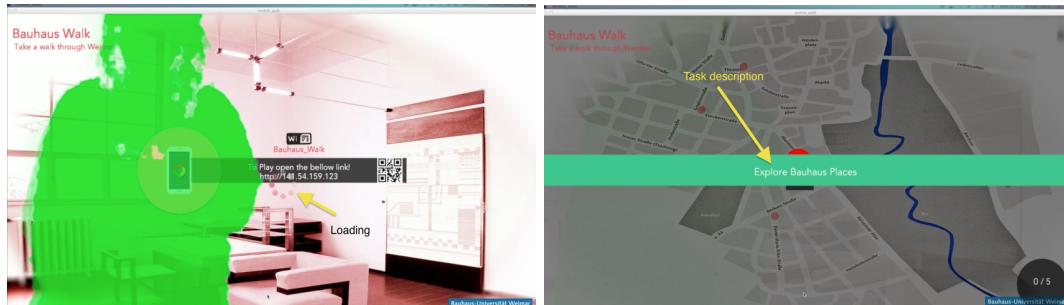
The loading animation is a reaction to the action of the participants, which gives the user a clue that the interaction will be started.

(b) Creating Colored cursor:

A colored circle is created for the participant in the center of the screen. Each participant has different color matching to his/her controller interface in his or her 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.



(A) Loading

(B) Task description

FIGURE 6.5: Transitions of interfaces.

3. Interaction interface

The second screen is the interaction screen for the participants. The participants can

navigate the cursor using their phone controller page. It can be seen in the below picture, the user is controlling the cursor and has explored one location. The user's defined name is also shown on the cursor so that the user do not lose track of his/her cursor. A small circle around the target location is shown is to determine the area of intersection. The interaction completes when all the locations are explored or the interaction time has finished.



FIGURE 6.6: Mobile interactive interface

4. Mobile interface:

This interface was designed by a student project called *MMM Ball* [12, 13] in Bauhaus University. When the user opens the webpage and enters his/her name, the below interface would appear. The interface is simply designed and has two elements, the cursor and the select button. With cursor the user can navigate inside the map to reach target locations and then presses the select button to explore that location.



FIGURE 6.7: Mobile controller interface: The left side is the cursor and the right side is the select button.

6.3 Research questions

1. How fast do users understand *Call-to-Action*?

2. How fast participants react to the *Call-to-Action*?
3. How easy it is for the participants to understand the interaction task?
4. How long does it take for the participants to complete the interaction or visit all the target locations?
5. What are the major usability flaws that prevent users from advertisement interactions?
6. What is the difference between mobile and body performance?
7. How the applications would perform in single user interaction and in multi user interaction?

6.3.1 Video advertisement

1. Do participants understand the content of the advertisement?
2. How many elements of display can participants recall after their first interaction?

6.4 Test Design

This study used a within subject design, in which each participants were asked to experience with both body and mobile prototypes. The interaction sequence was interchanged for participants in order to counterbalance the learning effect.

6.4.1 Participants

12 participants were invited for the usability testing, from which five participants were female and seven were male. Most of the participants had computer science background and were familiar with mobile and had seen or worked with body sensing technologies. All participants were familiar with QR code except one participant.

6.4.2 Task

Participants were not told about any specific task, they were asked to explore the system by their own and understand the task. To avoid different outcomes participants were told to continue interaction until they encounter back with the first stage of the application. So the tasks for participants were to start from the initial stage of the interaction (body /mobile) and continue until they reach the initial stage again.

For body interaction, no extra device was required to accomplish the task, but for the mobile interaction a mobile phone was required. The participants were not told that the use of mobile is required unless they tried to use their own phone or asked for it from me.

- **Task understandability:**

Participants were told to *Think-Aloud* on what task will they perform at each stage.

- **Performance measurement:**

- *Call-to-Action* understanding duration
The time from when the user saw his/her silhouette until he/she understood / approached to start the interaction. For body *Call-to-Action*, this duration is measured if the person intentionally moved toward the screen, and for mobile *Call-to-Action*, when the person pulled the phone out.
- Triggering game duration
This time is measured from the time the user understood how to start the interaction until the user actually starts the interaction. For example, in case of mobile interaction, the time is measured from the time the user takes out the mobile until he logs in and opens the interaction controller.
- Task understanding duration
This time is measured when the user starts the game until he/she understands the interaction task.
- Task completion duration
Task completion time is measured from the time interaction starts until the interaction ends.
- **Content recall:**
After the first interaction with the advertisement, participants were immediately given a paper and a pen to write down the name of anything that they could recall. The interactions (mobile and body) were counterbalanced between the participants.
- **Usability issues:**
Each participant was given five minutes to interact with both the mobile and the body advertisements. Then follow up questions were asked regarding the issues they faced. The usability issues like (confusing, unclear events and mistakes) were observed by the moderator at the scene and later while watching the recorded videos.

6.4.3 Data Gathering

The below data were gathered.

- Performance data:
The performance data of participants like, *Triggering game duration*, *Task understanding duration*, *Task completion duration* and *Whole interaction duration* was collected from both mobile and body interactions. To get an overview of performance in general the mean duration of the performance data were computed.
- Preference data:
The preference data is the measures of participant opinion or thought process. The below preference data were collected.
 - *Think-Aloud* quotes
These quotes were noted during the video observation. These quotes were important to check at which time users understand about the interaction and tasks. It also helped to analyze their reaction and feedbacks toward the tasks being done.
 - Interview transcripts
All the interviews were transcribed and color-coding technique was applied to analyze and comprehend different aspects and categories from the defined questions.

- Recordings

There were two different recordings done during the session, first was video recording using camera at the back of the room, that could record user actions and the computer screen and the second recording was the screen recording of the application using *QuickTIme* screen recorder. These recordings were used to analyze behavior, application performance and listen to the things participants said during interaction.



(A) Participant in body interaction mode. (B) Participant in mobile interaction mode

FIGURE 6.8: Participant's video recordings

6.5 Findings

6.5.1 User performance

- Mobile Interaction performance:

The chart shown below exhibits the performance data, when the participants used the mobile interaction. The y-axis shows duration in seconds and x-axis shows the phases(aspects). You can see performance chart for each individual of mobile in Appendix D.4.

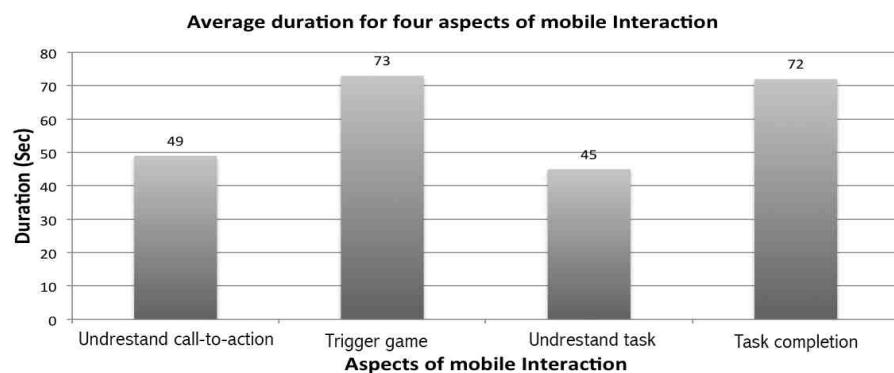


FIGURE 6.9: Chart that shows each aspect with respect to duration.

Participants took 49 seconds in average to understand *Call-to-Action*. After participants understood what to do, it took 73 seconds in average to trigger the game (*Triggering game duration*). It took 45 seconds in average to figure out how to do the task (*Task understanding duration*) and 72 seconds to complete the task(*Task completion duration*). As a result in average 240 seconds were taken for whole interaction time.

- Body Interaction performance:

The chart shown below exhibits the performance data, when the participants used the body interaction. The y-axis shows duration in seconds and x-axis shows the phases(aspects). You can see performance chart for each individual of mobile in Appendix D.3.

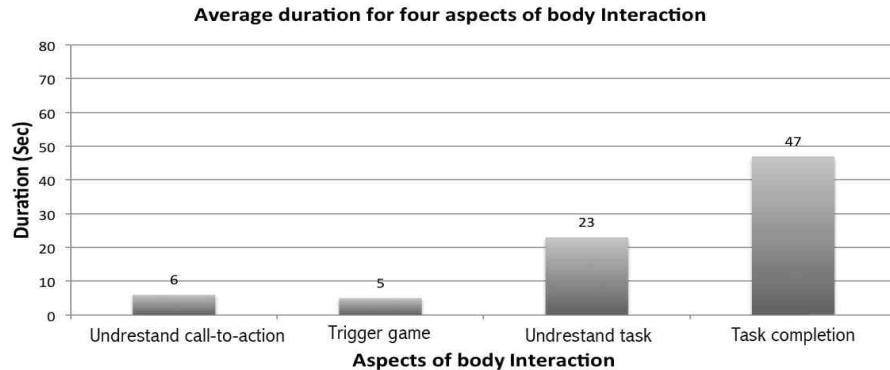


FIGURE 6.10: Chart that shows each aspect with respect to duration

As can be seen above most of the participants finished the whole interaction in approximately 81 seconds, which is much better than mobile interaction. It took 6 seconds to understand *Call-to-Action*. It took 5 seconds to trigger the interaction and start the game(*Triggering game duration*). Participants took 23 seconds in average to understand the task (*Task understanding duration*). And it took 47 seconds to complete the tasks(*Task completion duration*).

- Body Vs. Mobile performance:

The following graph shows that the body interaction is much better than the mobile interaction in terms of performance. The whole interaction time of body is less than the half of the time of mobile interaction.

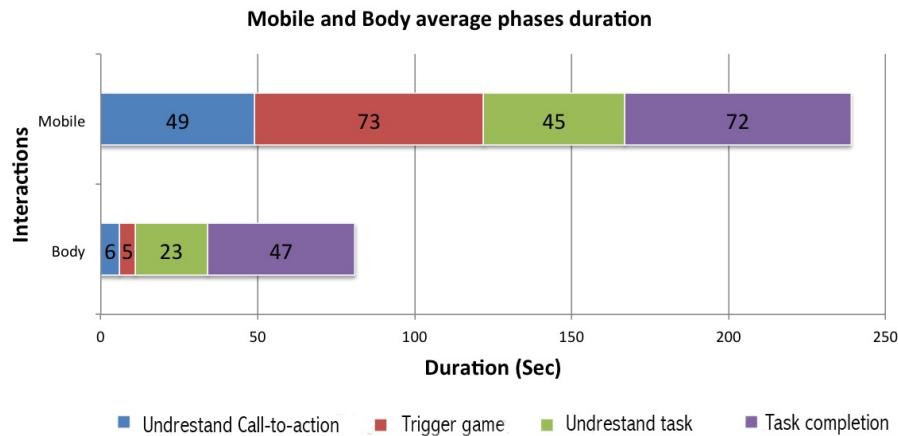


FIGURE 6.11: Comparison of body and mobile interaction performance

81 second was the mean value of the all the participants' performance with body interaction and 240 seconds is the mean value of the same participants with mobile interaction. The following chart shows other comparison of each aspect as described.

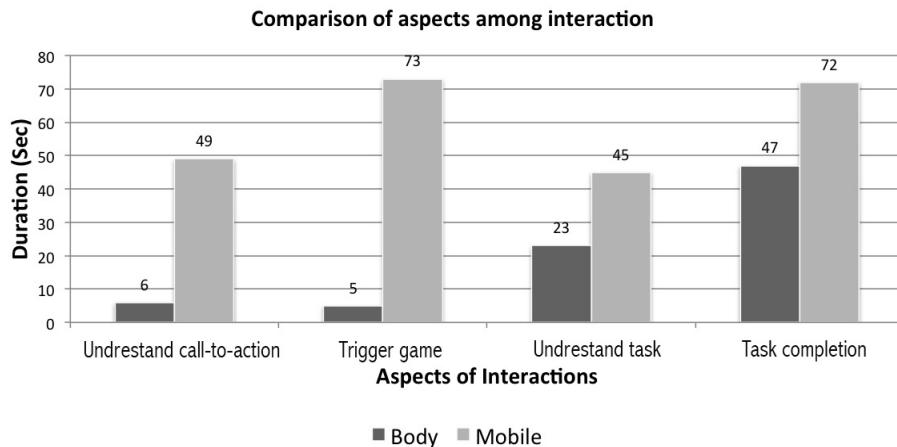


FIGURE 6.12: Comparison of the aspects of interaction among body and mobile

The mobile interaction took much longer than body interaction for each phase or aspects, as ANOVA revealed a strong significant difference of *Call-to-Action* between body and mobile interaction ($(F_{1,11})=22.4758, p < .001 (p=.0001)$). A post-hoc Tukey test shows that participants understood very quickly the *Call-to-Action* of body interaction compared to mobile interaction technique.

ANOVA revealed a significant difference of triggering game between body and mobile interaction, ($(F_{1,11})=124.1066, p < .001$). Post-hoc Tukey test shows that in body interaction the triggering happens much faster than mobile interaction.

ANOVA revealed a significant difference of task understandability between body and mobile, ($(F_{1,11})=7.1340, p < .05 (p=.0147)$). A post-hoc Tukey test shows that participants understood the task very faster compared to mobile technique.

Interaction time was also significantly different as ANOVA test strongly suggested a significant difference between the mobile and body interactions, ($(F_{1,11})=19.7000, p < .001 (p=.01)$). Post-hoc Tukey test strongly states that body interaction takes less time to complete the interaction compared to mobile.

6.5.2 Usability issues

The following usability issues are gathered from participant while observing them during the interactions.

- **Mobile Interaction:**

1. Call-to-Action
 - (a) At the first look of application, most participants did not read the text on the screen, they were expecting other way to get quick information. But after many tries with their body, they had to read the information text.
 - (b) Participants did not understand about the phone icon or the browser animation on top of it until they figured by themselves.
 - (c) Frustration of typing the IP address.
 - (d) The size of QR code was small.
2. Use of mobile phone.
 - (a) In the beginning the participants did not expect to use their own phone for the interactions; Many times participants asked, “Should I use my phone?”

- (b) Most participants did not read the instruction to tilt their phone and even if they accidentally had tilted the phone.
- (c) There was no instruction to turn-on the tilt-sensor in the mobile phone.
- 3. Login page
 - (a) Some of the participants were confused with the word Login. Participants thought that they would have to provide some sort of username and password to the system, and one participant reacted to this strictly and refused to login to the webpage using his phone.
- 4. Task description
 - (a) The task description was shown after the participants login to the system despite of whether the phone is tilted or not, most participants missed to read the task description because they were busy with their phone to tilt it and by that time the description on the screen was gone.
- 5. Controller
 - (a) Participants did not read and saw the instructions for phone.
 - (b) Many participants complained about the elasticity (automatic centering feature) of cursor. They had to reposition the cursor for another location to explore.

- **Body Interaction:**

1. *Call-To-Action*

The silhouette was projected with largest scale for attraction attention, but the silhouette scales down and adjusts to person position (x, z) on the display. When users triggered the interaction by coming close to the screen, then participants could not see themselves because the mini-silhouette would adjust outside at top of the display. If participant moved back then they could see the silhouette back.

2. Silhouette controller

There was no instructions on how to move the body physically to perform the tasks. But participants tried for themselves to find a way to interact.

3. Alert image

Alert image that shows a Hands-Up person lead to confusion at the moment where users were much closer to the system.

- Advertisement video:

1. The slides were switching fast.
2. Some did not like the colors and theme.

6.5.3 Advertisement goal

- Do participants understand the content of the advertisement?

The criteria for recalling the advertisement was that participants should recall “*Bauhaus-Walk*” word and explain what does it do. They could also explain if the interaction technique gave them an idea what could be the advertisement about. At best users can recall the date, timing and location of the tour program. The findings for these criteria are listed below.

1. Ad goal description

To find out ad goal description, what all participants experienced with the very first interaction technique, were immediately asked about the goal of the advertisement. I wanted to know if the participants would understand about the advertisement on their very first try. All of the participants were speaking in English language. The entire participants responded as they finished the interaction. 9 participants accurately described the goal of the advertisement, but 2 participants generally described the goal because at the beginning the advertisement video was in German language.

2. Ad-related elements recalled

After the participants described the goal, they were given a piece of sheet to draw and write any element related to the interaction and advertisement with in five minutes. All the sketches drawn and keywords written by the participants were manually counted. The count is in the following diagram.

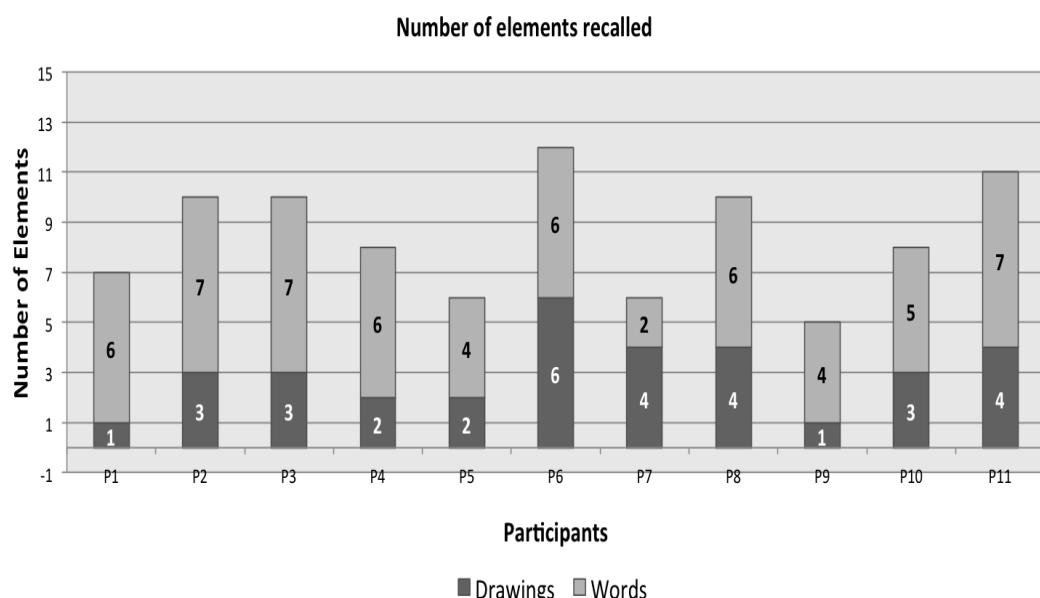


FIGURE 6.13: Number of words and drawings of the advertisement elements

- Word cloud (Wordle):

All the keywords written by the participants were collected in one text file and visualized in word cloud technique by using an online tool *Wordle*⁶. The word cloud visualizes most key words that had high frequencies. Those keywords are the ones actually related to the advertisement, it seems most location names that participants interacted with are recalled a lot like, “*Bauhaus University*”, “*Haus-am-horn*” and others. The program name “*Bauhaus-Walk*” is also in high frequency list, and even the day of the event is mentioned too.

⁶Wordle: <http://www.wordle.net/create>, last accessed: 10 May 2016

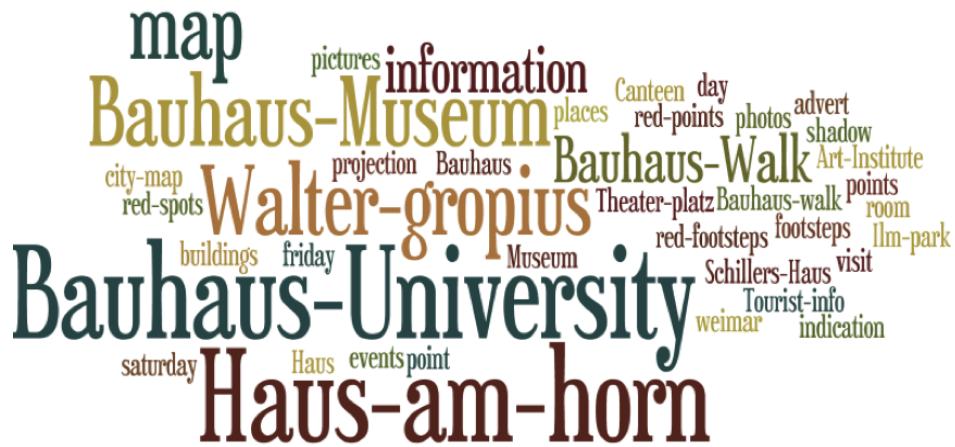


FIGURE 6.14: Word cloud representation of the keywords

6.5.4 Interview Findings

All the interviews transcripts were coded for better analyzing, appropriate connections to categories were found and these categories are shown as a diagram.

- **Mobile Categories:**

Many important categories were created from the responder's codes, see Appendix D.2 for the diagram. These categories reflect the functionality, nature, issues and complications of the mobile interaction technique. Most of them point out negative concerns and some positive feedbacks too about the interactions, which is discussed below.

1. Comfortable:

Mobile interaction is comfortable in the context of public environment, users do not feel shy to work with their phone, they have more privacy as one user said "*I think for people moving in public could be more embarrassing if you just use your phone the people passing by will not pay attention*". Users can also work with the display from a far location rather than standing in front of as one participant said, "*you can comfortably set far away see the screen and start interacting*".

2. Activity:

This method has less Activity, participants do not have to move their body to reach certain points in the map, instead they can use their phone and stand or sit steady. With the tip of their finger can easily explore locations, as one of the user said "*I could go with the tip of my finger and it helped me all the places I visited*".

3. Dependency:

On the other hand, this interaction is dependent on many things obviously a mobile phone, if the user does not have a mobile phone the interaction cannot happen, a participant asked, "*How would I have played if I have not brought my mobile phone?*" Another dependency is the WIFI connection, one participant pointed out "*And then the fact that I had to be connected to a WIFI, that was because I did not understand do we have to be in the same Internet (Network)?*"

4. Complicated:

The process seemed complicated for instance, entering the IP-Address or scanning the QR-code. Further reading the instructions, logging in with a name, tilting the phone and finally interacting with the controller elements such as the button and the cursor. Most of the participants complained about regarding this by stating, “*Because it is a headache for me to take out my phone and use all this login, and waste my time.*” another commented like “*for exploring you have to push that red button, that was a bit confusing.*”

5. Annoying:

One of the annoying things pointed out by the participant was that the QR-Code was being covered by the person’s silhouette, who was standing in front of the display, the user said, “*QR-Code was small and when I was coming near the screen to scan the code, my body was covering it.*”

6. Clarity:

There were many instructions like Access-information, mobile instruction and task instruction, but these instructions was also not clear to them as one of the participant mentioned, “*that controller was also not clear, because I though the red areas is the touch area that I can scroll and the red button was a click*” another participant replied like “*there were very few descriptions, I guess the word login was miss-phrased, it was not really a login it was just chose a name*”. Another participant was not sure whether to use mobile phone or the screen has touch capability as he replied “*at first I saw the map, and there were points on the top first I tried to touch*”.

• **Body Categories:**

Body interaction was more appreciated by the participants. From the interview transcripts an intensive color code categories were derived, see Appendix D.1 for the code diagram. The following positive and negative opinions were derived and categorized.

1. Enjoyment:

Participants had the sense of enjoyment and fun, as one of participants said, “*I liked the second one because it seemed more involving and I think it was more fun*”, another user said “*I liked this interaction; it was more good and fun.*” ,

2. Easy:

Users found the interaction to be very easy, simple and smooth, a user said, “*The body movement was good it was smooth*” another user said, “*It was much easier than the previous one, it was much better, umm it was not confusing*”. The call-to-Action seemed much easier, one user said, “*I saw saying me to come near, and when I came the game started, that was very easy to use*”, and the interaction with the game elements was also easy to understand, one participants said “*it was easy to come near to the screen and first I did not understand how to play the game but when I saw my avatar that is moving with me then I realized and did the tasks*”

3. Immersion:

Some participants said they were some how immersed with the game, like one said, “*I felt that I was really part of it*”, another said, “*With the body you look your own avatar in the map and you feel that you are in the map.*”

4. Engaging:

The body technique seemed very engaging and users wanted to play more and more, one said, “*It is so engaging and it is like that it needs you*”, another said, “*it is like you want to put the footsteps exactly on the street*” , “*it seemed more involving*”.

5. Issues:

On the other hand, the body interaction also had some issues, like one of the participants pointed out that the interaction would be difficult if it is in crowded area. One said, “*If two people interact then they can crash at each other*”. Participants complained about physical space “*I felt was the space there was not enough space in here*”. Bad tracking of the body and unexpected locations were triggered by fast movement, one participants said, “*I guess the application was tracking me really bad*”, “*when I was moving to some areas fast suddenly that point was being triggered*.”

6. Embarrassing:

Some participants said that they would not try the application at public space because it could be shame or embarrassment for themselves, “*moving in public could be more embarrassing*”

7. Confusion:

The projection of silhouette on the advertisement also made some participants get confused and that it was also distractive, like one said, “*I saw my silhouette at the last time I was playing, because I was curious that why is it there*”.

• Others:**1. Interface**

The interface was appreciated by all the participants, as one said, “*I really liked the map*”, another user said, “*the footsteps were cute*”.

2. Non-controllability

The flow of the interaction was also observed by the users, which they found annoying. As a participant stated that “*I do not want to be forced to see all the places and then see the advertisement*”. The video advertisement was also not in control a user said, “*There was nothing to answer, it gave me the impression that okay; this was an advertisement someone did it and I could not change the flow of it*.”

3. Distraction

The projection of the silhouette after the interaction body or mobile technique was a distraction factor, because participants would not notice the video advertisement but would notice themselves.

4. Speed

The pictures for the locations and the advertisement video were fast, a user said, “*The description of the places were very fast, when I was trying to read it, it disappeared.*”,

6.5.5 Application Performance

It did not crash or hang in the middle of the interaction, but during the multi-user interaction, the application faced some delay in both the body and the mobile interaction due to many participants (5-7) engaging at the same time. Changing the JRE version from 32bit to 64bit solved this issue, and along with this the processing version was also changed from 32bit to 64bit. The usage memory was increased to its maximum for better processing.



(A) Group body interaction.

(B) Group mobile interaction.

FIGURE 6.15

6.6 Discussions

The performance *Call-to-Action* (“To play come near”) of the body interaction was better than the mobile *Call-to-Action* (Connect to Wi-Fi, Login and open controller) because of many reasons, (1) *Understandable*: The sentence was clear and comprehensible for the participants, (2) *Natural to perform*: The action of walking is completely natural and easy to perform. But the mobile *Call-to-Action* seemed to be complicated and time consuming because of many preseasons. (1) *A lot of info text*, There were many text on the screen for the participant to read and understand before interaction starts. (2) *Text size*, the texts size was small and participants could not read if standing in distant to the screen. (3) *occlusion of text*, the text was occluded by the silhouette an when the participant wanted to get closer more area of the text was being covered. The users had to stay at side of display to read the information text.

Additionally, not all mobile phones have the tilting sensor enabled, which resulted to stop users from opening the controller. Participants were forced by application to enable the tilt sensor of their phone then open the controller. This extra task is in fact annoying and time consuming.

The average time for performing the interaction in body interaction was also significant faster than the mobile interaction. One of the reasons could be the live silhouette representation of the participant on the city map, which gave the clue of walking and exploring locations. But in mobile interaction the cursor representation was not obvious to the users, participants had to try to find they way of interaction.

Beside the body and mobile interaction usability issues, still the participants could understand the goal of advertisement. Here I list the key factors for advertisement understanding:

1. Game environment

The game environment designed for the interactions had a major impact for understanding the advertisement goal. For example one of the participants replied “*I saw a map and different places, so I guess touristic places that I can visit in Weimar.*”. Besides the map, there were blinking points on the map, on which most people are familiar with, showing the interest regions of the city. One of the participants replier, “*I think it was about tourist places in the city, at first I saw the map, and there were points on the top*”. Participants already linked the points with the touristic places of Weimar automatically.

2. Interaction technique

In the body interaction, where walking is involved, participants got a clue about the advertisement indirectly only by walking and linked walking as visiting locations. Like one of the participants replied “*Discovering Weimar. The Bauhaus-Walk. It was the*

advertisement about those locations that the people can visit in the tour.”. It is very fascinating to read that answer from which the whole goal of the advertisement can be derived.

3. Advertisement video

The advertisement video had an impact on the participants to be able to recall the advertisement, one of the participants replied that “*I saw many pictures coming about Bauhaus and the program times and day*”, though that the users understood a little about the advertisement they also complained about the video for being fast.

6.7 Conclusion

This chapter concludes that users performed better in the body interaction than the mobile interaction technique. Participants preferred the use of body interaction than mobile in public environment.

Body interaction was more natural and convenient for participants. This interaction had no dependency to any preferable device like mobile phone. The *Call-to-Action* was very understandable and performing of the action was very natural. Body representation on the map provided a strong clue of “*walking*”, this clue had two major benefits, (1) understanding the task and performing it. (2) Understanding the goal of the interactive advertisement. Participants felt enjoyment and immersion while interacting using their body. Despite the positive feedbacks, there were some usability issues like incorrect mapping of the silhouette when the user was standing near, not implementing alert messages, and also facing interaction difficulties if there were multi-user because the users were colliding to each other. On the whole, the overall performance and acceptability of this technique was very convincing compared to mobile interaction.

The mobile interaction had various usability issues and especially with the accessibility to the advertisement system. Participants took a long time to understand what was required to access because of unclear access-info text, unfamiliarity with QR code or phone icons, inserting name. Participants then took longer time to follow the steps to login to the system. Task completion time was also significantly low than body interaction. Beside all these major issues two participants found it more comfortable to use it in public display because it will not cause the sense of embarrassment for them. While interaction it did not require more physical body movement but only required cursor movement. The participants also understood the goal of advertisement.

Considering the above issues, the next step would be to refine both prototypes and make it ready for evaluation on public space.

7

Advertisement application

7.1 Introduction

The use of technology in advertisement plays a major role in advertisement industries. It would have been much difficult to reach to customers without technologies, and technology enhances the two-way communication with the client and the customers. The companies can now easily express their thoughts and vision to their customers with the help of the latest technologies. Advertisements are everywhere, in websites, in your smartphone, in television and radio. Since the last decade, it is more common to see advertisements on the streets, in supermarkets, airports and any place of public gatherings. So, for every context or settings there are different kinds of technology that are being used to make the advertisement more appropriate. When it comes to interactive advertisement, the use of right technology plays another major role in terms of usability and understandability. Interactive advertisements on websites are usually interactive using keyboard and mouse, whereas in smartphone, advertisements use only the capability of the touch or other sensors to make the interaction easy. Interactive advertisements in public spaces have another bunch of technologies that make the interaction usable like using face recognition, body position recognition, hand gesture recognition and also touch sensors, proximity sensors and much more.

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

7.2 Advertisement Applications

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 are included in *Bauhaus-Walk* tour, the pictures of these places are attached on the Weimar map with a name at top and a small description below of the picture frame. This technique helps participants to build a relationship of the locations and the map. Only five locations are randomly chosen by the software to be shown on the map, each animates one after another and. When all the locations are explored then the advertisement video is played and the application repeats itself again.

7.2.1 Non-Interactive application

It can be understood from the name, passersby have no control over the flow of this advertisement, but it 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. Watch this Video¹ to see the flow of the interfaces.

¹Non-interactive advertisement: <https://www.youtube.com/watch?v=ZLszzfbZJgI>, last accessed 1 july 2016

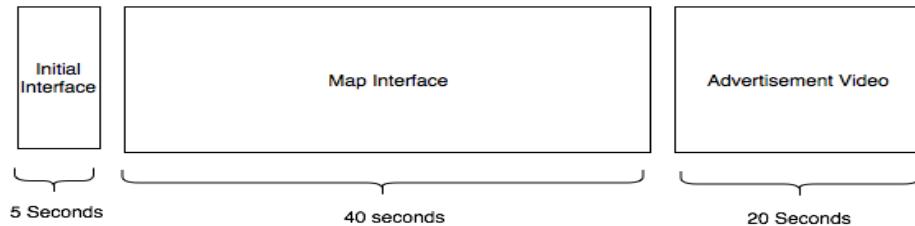


FIGURE 7.1: Interface flow

1. Initial Interface:

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



FIGURE 7.2: 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 7.3: Map Interface

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

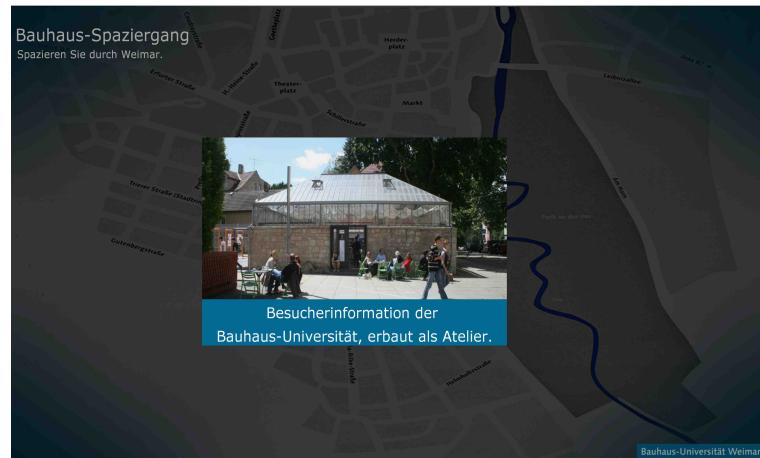


FIGURE 7.4: Enlarged picture

The resized pictures on the map looks like below.



FIGURE 7.5: 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.

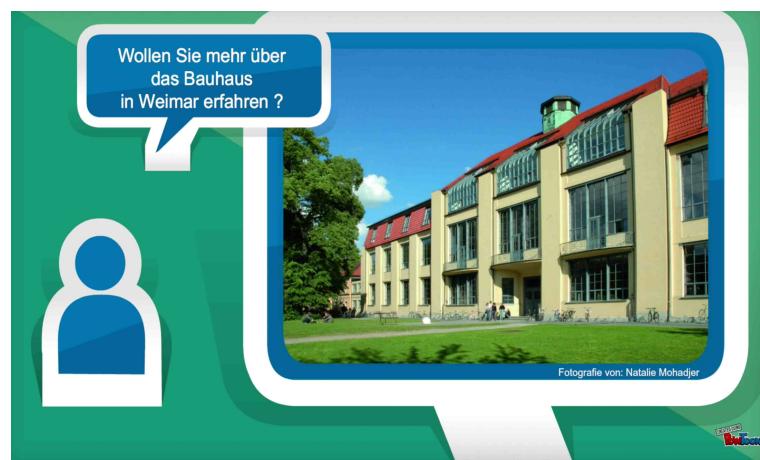


FIGURE 7.6: Advertisement video

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



FIGURE 7.7: Advertisement video last frame

The advertisement video was created in PowToon² with a free version account, visit this video³ that shows the advertisement video. See Appendix G.1 for video path in DVD.

To see the full the non-interactive advertisement flow of the interfaces and its animations visit this video⁴. See Appendix G.1 for video path in DVD.

7.2.2 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 two of them are interactive. The first two interfaces are interactive and allow participants to interact with using their body like exploring the interest points on the map by moving physically (forward, backward, right and left) in front of the screen. The last interface shows advertisement video, which is not interactive. All the interfaces are explained in the following sections.

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

This interface is basically the same interface as the non-interactive but with a difference. It projects passersby silhouette on the interface, this interface is also called *Call-to-Action* interface because it calls passersby to interact with the screen. As can be seen in the below picture, 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 corner of screen 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 has shown that message to raise his hand to be tracked again.

²PowToon: <https://www.powtoon.com/index/?gclid=CJqSqr5180CFesV0wod1u8IEQ&edgetrackerid=10083804111572>, last accessed 5 jun 2016

³Advertisement Video: <https://www.youtube.com/watch?v=-y1Dbz6E6bU&feature=youtu.be>, last accessed 5 jun 2016

⁴Non-interactive Ad: <https://www.youtube.com/watch?v=ZLszzfbZJgI>, last accessed: 5 Jun 2016

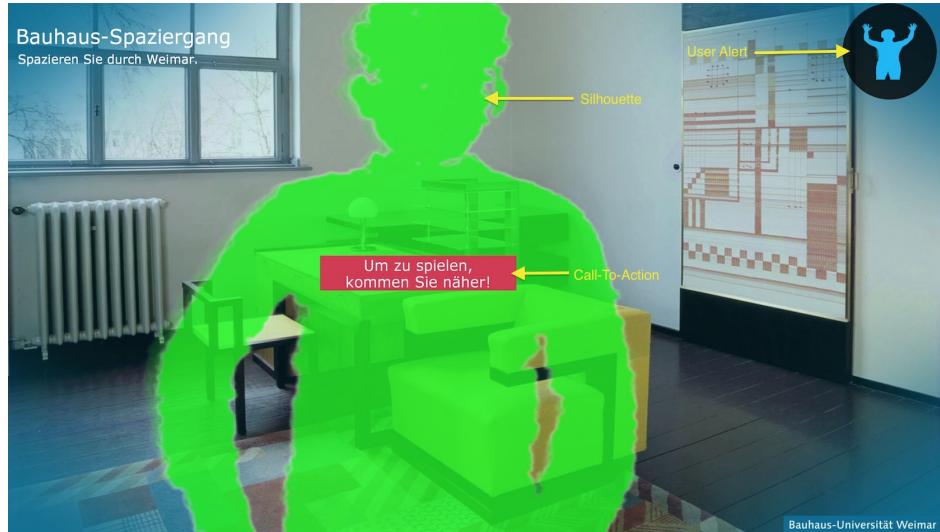


FIGURE 7.8: Initial interface

2. Transition to Map Interfaces:

The transition happens when the person stands close to the screen for more than 3 seconds and the processes is as follow.

(a) Loading animation:

The loading animation is a reaction to the action of the participants, which gives the user a clue that the interaction will be started.

(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.

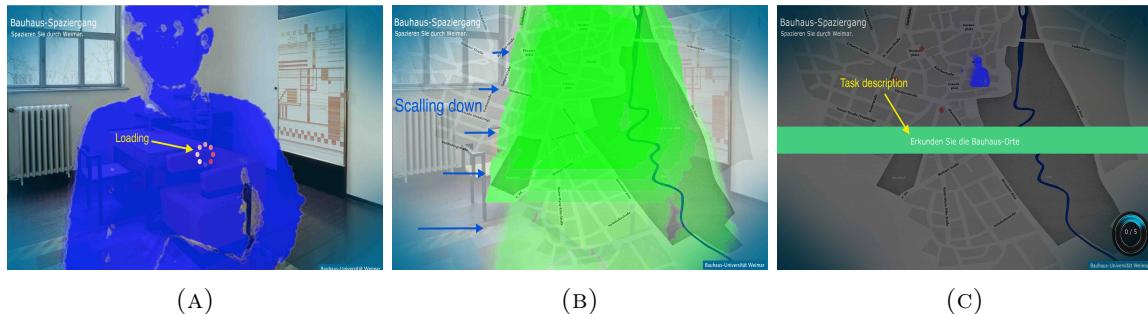


FIGURE 7.9

The picture A shows that the person is close to the screen and the loading of the animation begins. In picture B, the person's silhouette is being scaled down (in this example the silhouette color is green) and in picture C, the instructions are shown.

3. Map Interface (Interaction):

In this interface participants can interact with the elements on the map. In the below

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 7.10: Map Interface

4. Advertisement video:

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

7.2.3 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, 13] project under Mobile Media Group⁵ department.

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

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

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

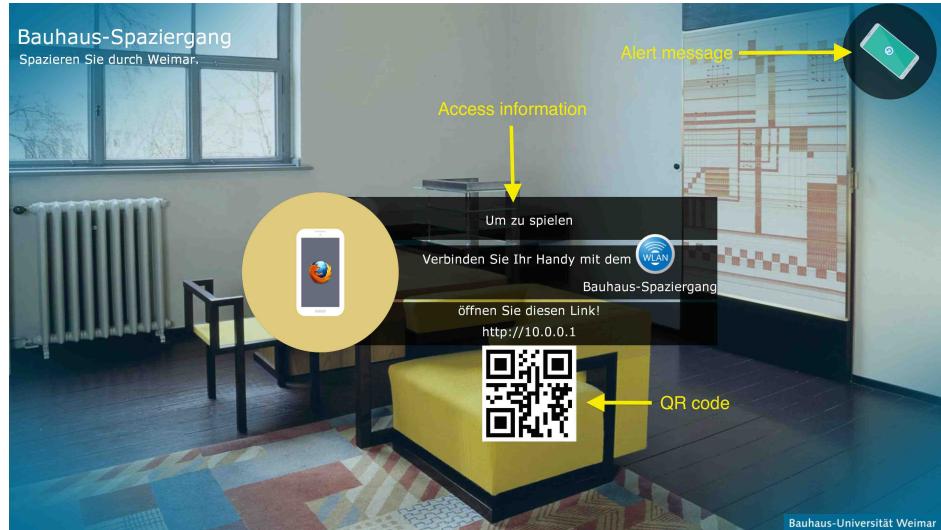


FIGURE 7.11: Initial Interface

2. Transition to Map Interface:

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

(a) Loading animation:

The loading animation is a reaction to the action of the participants, which gives the user a clue that the interaction will be started.

(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.

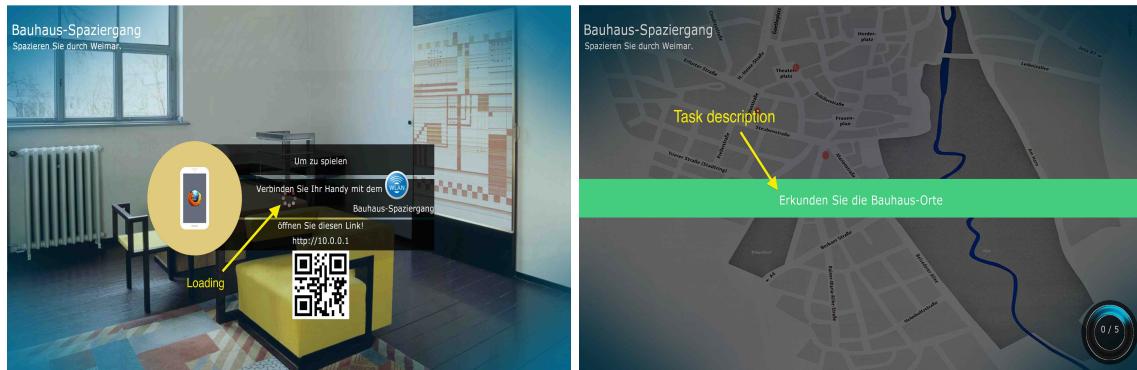


FIGURE 7.12: Transition of interface

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):

This interface is where the users interact with the map; participants can navigate using the controller page on their phones. The image 7.13 displays that the user is controlling the cursor and has explored one location. The user's defined login name is also shown on the cursor to provide a hint that he/she is his circle. To reach an interest point a small circle is shown to determine the area of intersection. The interaction finishes when all the locations are explored or the interaction time (40 seconds) gets over.

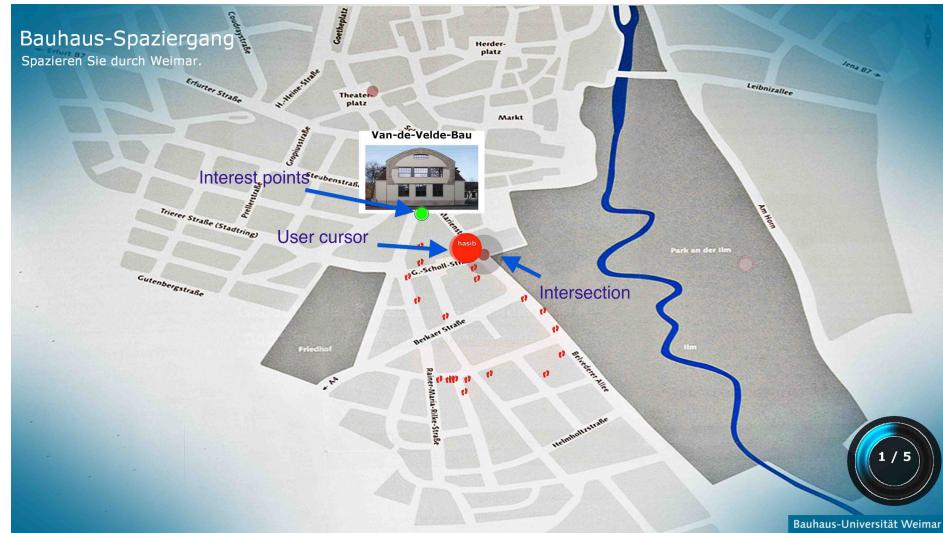


FIGURE 7.13: Map interface

4. Advertisement video:

The same advertisement video used for non-interactive is shown after the interaction is completed.

5. Mobile interface:

The interaction controller in the smartphone is shown below. The interface is very simply designed and has two elements, the cursor and the select button. With the cursor, the user can navigate inside the map to interest points and on reaching on an interest point the participant presses the select button to explore that location.



FIGURE 7.14: Mobile controller

7.3 Interaction Design

The body interaction model is designed based on *Audience funnel*, as it suites well for public setups like the 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 passersby and gradually motivates them toward the display to engage them in interaction and at the same time it is also convenient for the passersby to avoid the display.

7.3.1 Body Interaction Design

The diagram below shows the display at the top, the body-tracking area illustrated by a triangle. This triangle is divided into two sections that are 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 the display, and people in this region can easily avoid the display and the display will not motivate them for interaction, and (2) the highest interest region, it is assumed that people are aware of the display and the display would motivate them for interactions only if they are facing towards display.

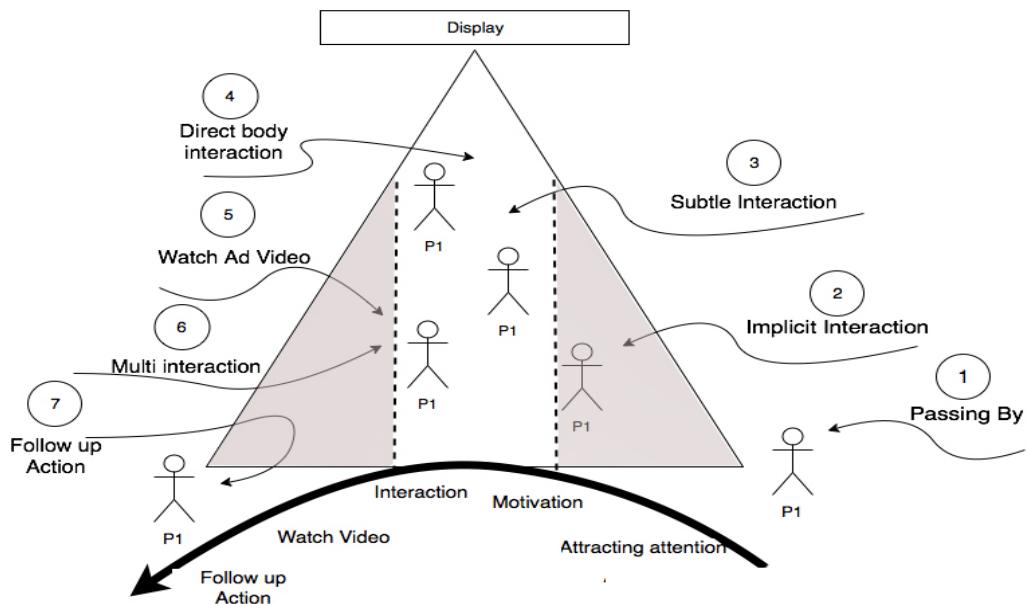


FIGURE 7.15: Body interaction design.

The model consists of seven phases, each of them are explained in the following list.

1. *Passing by phase:*

This phase demonstrates passersby, who are not in the display tracking range.

2. *Implicit Interaction phase:*

This phase starts, when passersby are in tracking range but are standing far or at side of the display.

3. *Subtle interaction phase:*

In this phase, the user is in near or 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:*

This phase happens, when the user has actively started the game interaction and is playing. At this phase the whole tracking range (gray and white color) could be used for direct interaction until the end of interaction phase.

5. *Watch ad video phase:*

When the interaction is over, a short advertisement video is shown.

6. *Multi interaction phase:*

This phase demonstrates that the user can perform interaction multiple times.

7. *Follow up action phase:*

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

The Black curve below the diagram shows the transition of the 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 the his/her silhouette in the entire tracking coverage area. After the interaction and watching ad video, the curve changes direction moving 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 passersby 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 passersby were projected on the screen, this representation can bring higher level of attraction as it is responsive to the 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[51] to the users who are attracted toward the display. In body interaction design the use of passersby’s silhouette presentation would be a good motivational force to bring passersby near the display. 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 passersby by showing a *Call-to-Action* message like “to play! Come near”, which is responsive to user movement and gives them confidence to play.

- Interaction and follow up actions:

When the user starts the interaction, the interaction being carried out should be meaningful, understandable and easy, else the user will leave immediately after some tries. Therefore 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 the interaction, the advertisement video is shown and then the user can start again interaction or leave the screen.

7.3.2 Mobile Interaction Design

Below diagram shows the mobile interaction design. The diagram shows the display at the top, and the triangle represents body-tracking range for passersby. The design has the same 8 phases as proposed for the body interaction. (1) Passing by phase, which demonstrates passersby 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.

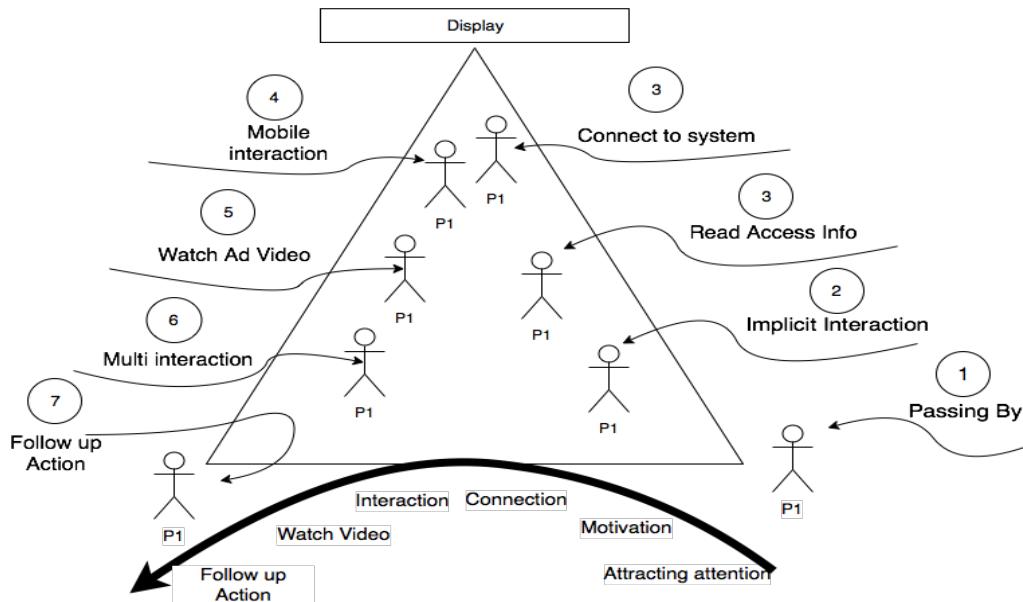


FIGURE 7.16: Body interaction design.

1. Attention:

Technologies like Bluetooth, infrared and NFC⁶ of mobile devices in fact could be used for attracting attention of passersby, but these technologies have their limitations and limited usage and not all mobile phones support all of the technologies. At the same time it is possible that the passersby have not switched on these technologies because of battery consumption or other purpose. Therefore to attract all the passersby 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. Due to the display of the silhouette, it brings curiosity and joy to the users. Besides that, an Information text is shown on the screen to give sufficient information on how to access the advertisement system and play the game.

⁶NFC: Near Field Communication

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 passersby engaged with the display. Therefore two prototype versions of the mobile interactions were evaluated to remove any possible usability issue. After the interaction is over the advertisement video and other following up action is taken on user.

7.4 Technical details

The application is developed in Processing language with the support of Kinect Library. The application can run in Windows and OSX operating systems the system should have below requirements.

1. Software Requirements:

- **Processing v2.2.2.**
Website link: <https://processing.org/>
- **Microsoft Kinect SDK**
Download link: <https://www.microsoft.com/en-us/download/details.aspx?id=40278>
- **SimpleOpenNI library for Processing.**
Documentation link: <file:///Users/hcilab-mac2/Documents/Processing/libraries/SimpleOpenNI/documentation/SimpleOpenNI/SimpleOpenNI.html>
- **OpenKinect processing.**
Documentation: <http://shiffman.net/p5/kinect/>
- **64bit JRE** (Java Runtime Environment) v1.8 or higher.
Download link: <http://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html>
- **Windows / Mac OSX** Operating system.

See Appendix G.1 for more details.

2. Hardware Requirements:

- **RAM:** 4GB or above.
- **CPU:** Core i5 / i7 2.3Ghz
- **Kinect V1 camera**
Documentation link: <https://msdn.microsoft.com/en-us/library/jj131033.aspx>

7.4.1 Body Interactive

Silhouette representation

The reason behind silhouette representation of passersby 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 Kinect⁷, that has built-in algorithm to track people. The camera

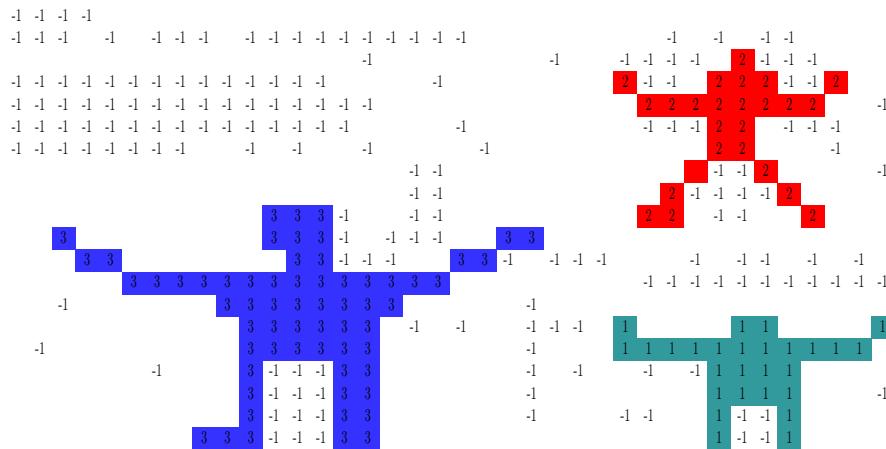
⁷Microsoft Kinect: <https://developer.microsoft.com/de-de/windows/kinect>, last accessed 5 jun 2016

has a resolution of 640x480 pixels. I created the colored silhouette representation from the *UserMap* array sent by the camera, which was a 1xD integer array that corresponds to the pixels of the image. The array looks like below

```
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 the array correspond to the pixel number of image, and the element values correspond to the user ID tracked by the camera. The user ID is always above zero, any value that is not above zero could be related to background or non-user pixel. The example shows that there are at least two people standing in front of the camera, which have 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. After assigning the color value to each user in the picture and leave out the background as null, the below picture will be created.

TABLE 7.1: 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. From the above picture, the white areas or the -1 values are background and non-user and the remaining positive numbers represent the pixels related to the user. Check the Silhouette video⁸. For more information about the source codes, please refer Appendix G.1 to find the source files in the DVD.

7.4.2 Mobile interactive

Requirements

- Apache webserver:

The web server is running mobile web controller. It is using *WebSocket* client at the backend. I used XAMPP server for windows in which the Apache server was running.

XAMPP website link: <https://www.apachefriends.org/de/index.html>

⁸Attraction attention method: <https://www.youtube.com/watch?v=1eTHVgS412M>, last accessed 5 jun 2016

- **WebSocket:**

Mobile interactive advertisement application and *WebSocket* application should be running simultaneously.

Websocket website link: <https://www.websocket.org/>

- **Access point**

An access point is necessary to allow mobile users connect to the webserver. The access point should distribute from the same range of IP addresses to clients as the advertisement application has.

Check Appendix G.1 for more details.

Software setup

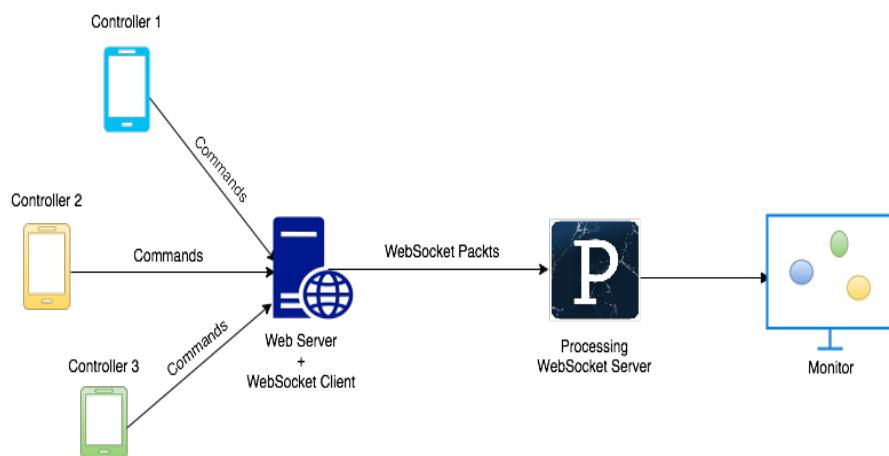


FIGURE 7.17: System architecture

Hardware setup

The hardware required for mobile interactive application, is to use one *Access point* that enable participants to connect to the system, and a *Kinect* camera to record colored user images. See the below hardware diagram.

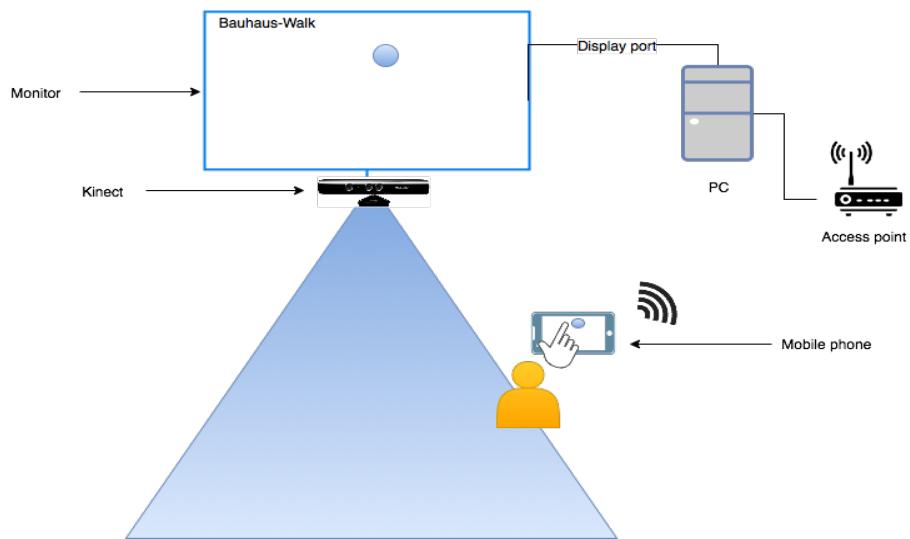


FIGURE 7.18: Hardware setup

8

Field study of Interactive and Non-Interactive Advertisement

8.1 Introduction

Norman [91] describes that there are three different levels of an interactive computer system. (1) *Visceral level*, it is about the first impact or impression of a product, it is about its appearance and look, (2) *Behavioral level*, it is about the usage and experiencing something, like *how it feels*, and finally the (3) *Reflective level*, it is the highest level of feelings, emotions and thoughts on something from others when we use it. Taking these levels in consideration, non-interactive advertisement can only reach the first *visceral level* because it only shows content on the screen and cannot go further than that. But Interactive advertisement can reach the behavioral and reflective levels too, because it can build strong experience in which people would behave and threat the screen differently by interacting with it. To observe these experiences and behaviors field studies are normally conducted.

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 [88]. 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 [62] in which the user behavior and user experience was compared between flat and cylindrical displays. Müller, J [11] did a study on how passersby notice interactivity of public displays. Another study conducted by Anthony Tang [23] 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 [17] researched on how different display angles could impact social behaviors of people around displays, and also in one of his another paper [18] 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) reacts around a situated display, these behaviors can result in higher attentions. For example the (1) *Honeypot* [15], it 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 passersby 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* [62], where is a location that most people stand in relation to the display.

Effectiveness of public display is defined by many factors (also discussed on chapter 3) like, (1) Number of passersby [36, 59], (2) among passersby how many glanced [36, 38, 49] to display, (3) how many started interacting [11, 36], and (4) how long passersby were engaged with display. The advertisement will be called effective if the above factors are higher because if an advertisement has impressive effects and engaging experience, there will be a higher attention level toward the advertisement. Higher attention level would consequently equate to higher advertisement recalls [97]. And the increase of involvement of users with products in an advertisement is believed to be an effective advertising to convey the advertiser's message [96].

This research want to find out that how much public display advertisements would change the attention level of passersby, how long passersby would be engaged and which behavioral levels *visceral, behavioral and reflective* and other behaviors these advertisement would reach. 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 display effectiveness, passerby's different behaviors and their feedbacks on these advertisements. And if there are

differences, how significant are these changes and what could be done to increase the 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.

8.2 Advertisement

After several small to medium studies, which are described in chapter 4, 5 and 6, the final versions of advertisement for Bauhaus-walk¹ were deployed in the Tourist information center. The below three types of advertisements were deployed, which were meaningful and attractive, but the only differences were in being interactive and non-interactive.

8.2.1 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 passersby. I also call it auto active advertisement. The first phase shows only the screen with the *Bauhaus-Walk* title and after few seconds, it switches to the second phase. In the second phase the locations are automatically explored in random sequence and has expiration time of 40 seconds. After that, the advertisement 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 Video²

- **Interactive advertisements**

Two interactive advertisements were developed, first body interactive and second the mobile interactive. Both of them were designed to have three phases as non-interactive. (1) First phase, which was also called the *Call-to-Action*³ 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 projects their silhouettes 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 seconds time gets over, and the Ad video is shown.

¹Bauhaus Walk: <https://www.uni-weimar.de/en/university/profile/bauhausatelier/bauhaus-walk/>, last accessed 30 May 2016

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

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



FIGURE 8.1: Body interaction

2. Mobile Interactive:

As you already got the idea that this technique works with smart phone, the system also shows partially passersby silhouette for attracting attention. The *Call-to-Action* asks passersby to use their phone to interact with the advertisement, the screen gives instruction on how to access the system. Passersby should connect to the wireless local area network and browse the controller website from their phone. When the control opens in their phone, users can use it to navigate to different regions on the map and explore interest locations. The interaction is also constraint to 40 seconds time, and after that the Ad video is shown.



FIGURE 8.2: Mobile Interaction

8.2.2 Advertisement Effectivness

All the public advertisements like poster, banners and displays want passersby attention, 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[97] 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 relationships could be[95]. The strength of relationship can moderate the effectiveness of advertisement message [96], 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.

8.3 Research questions

1. For which of the three conditions (non-interactive, body and mobile) advertisements, passersby
 - (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 do passersby think and feel after having experience with these advertisement techniques?
3. What are other passersby behaviors around the advertisement display?

8.4 Study design

8.4.1 Location

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



FIGURE 8.3: Weimar Tourist Information Center Top-view picture, The locations are marked with yellow arrows.

8.4.2 Duration

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

TABLE 8.1: Week sequence

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

8.4.3 Internal Validity

To be confident that the change in the weeks would not affect the findings, therefore 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. The tourist information center's employees were asked not to change the screen surroundings. The luck was also with me that almost the weather conditions were the same too. But the only thing I could not control was the number of passersby. The number of passersby might affect the attention level might be different for different numbers of passersby.

8.4.4 Participants

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

8.4.5 Data gathering

Several types of data from different aspects were gathered for each individual week for analyzing, and also be able to answer new arising questions after the onsite evaluation. The below 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 the Saturday and Sunday, where the tourist information center was open only until 14:00. The observation periods were from 10:00-12:00 and 13:00-14:00. During these time slots the below two types of observations were made on all passersby.

(a) Attention Level measurement

Attention level is how much a person gives attention to the display, which consist of the number of *Glances* and the 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 [35] that can not only detect glances but also human emotions at the time. But because of high flow rate of passersby, that method was not used. Instead another *Glance* counting method was selected, which was proposed by [36] that had formalized a ranking system from which *Glance* is considered if a person reacts to the display by turning his/her head toward display 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 A.1

(b) Passersby behavior and Interviews

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

Interviews were taken from the passersby that had some sort of engagement with the display. In 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 described the thesis goal and an interview consent form were handed to the participants, after their signature the interview was conducted. All the interviews were audio recorded and later transcribed for analysis, the interviews took in average 4 minutes. The reason I 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, please refer Appendix E.1 to read all the interview questions.

2. System Logs

The Advertisement application can generate the below 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. Depth recording

Depth recording from Kinect camera was done during entire three weeks for non-interactive and interactive advertisements for many reasons as below.

- Passersby engagement measurement

As discussed earlier, engagement was defined as involvement of audience with the display. The passersby 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.
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 passersby behavior in detail.

Because of limited space and processing power, the actual depth information (x,y,z) for individual points were not stored, but a 2D colored silhouette was recorded per second. Another post processing script was applied to integrate a static background for colored-silhouettes using Adobe Photoshop application. To match the data logs and the image frames each image name consisted a date and time as (day.hh.mm.ss.png).

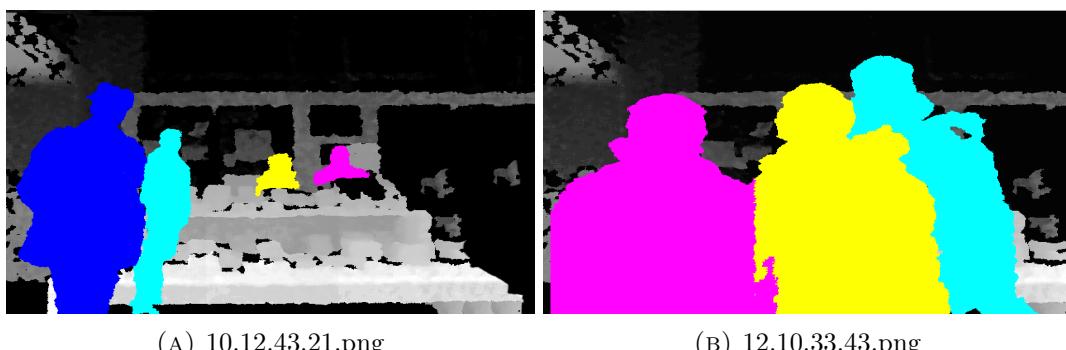


FIGURE 8.4: Depth recording examples

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

8.5 Data Analysing

8.5.1 Glance counts

The Glance-counts were transformed from paper to spreadsheet in which number of *Glances* and *Ignores* were recorded individually for each day. See Appendix E.2, E.3 and E.4 for non-interactive, body interactive and mobile interactive *Glance* counts respectively.

8.5.2 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 diagrams see Appendix E.5, E.6 and E.7 for non-interactive, body interactive and mobile interactive advertisement respectively.

8.5.3 Display Engagement phases and time

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

8.5.4 Honeypot and landing effects

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

8.5.5 Other observations

The observations were done onsite, the observer wrote down any important event happened at that moment in time. These notes also include observer's own point of view of understanding the scenario during the entire day and week. See Appendix E.8, E.9 and E.11 of non-interactive, body interactive and mobile interactive onsite observation notes respectively.

The depth recordings were also observed frame-by-frame to see anything that was missed, when the observer was not present at the tourist information center. Different behaviors were explained from the observation, which you will find in finding sections.

8.6 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 as non-interactive, body interactive and mobile interactive separately, and the second section compares the findings of these conditions among each other.

8.6.1 Non-Interactive findings

1. Attention Level measurements

The number of *Glances* and *Ignores* were observed for two hours in five consecutive days as shown in following chart. Each bar represents two hours of one-day observation.

The dark gray area is the number of *Glances* and bright area is the number of *Ignores*. Within five days of observation 111 people glanced among 385 passersby.

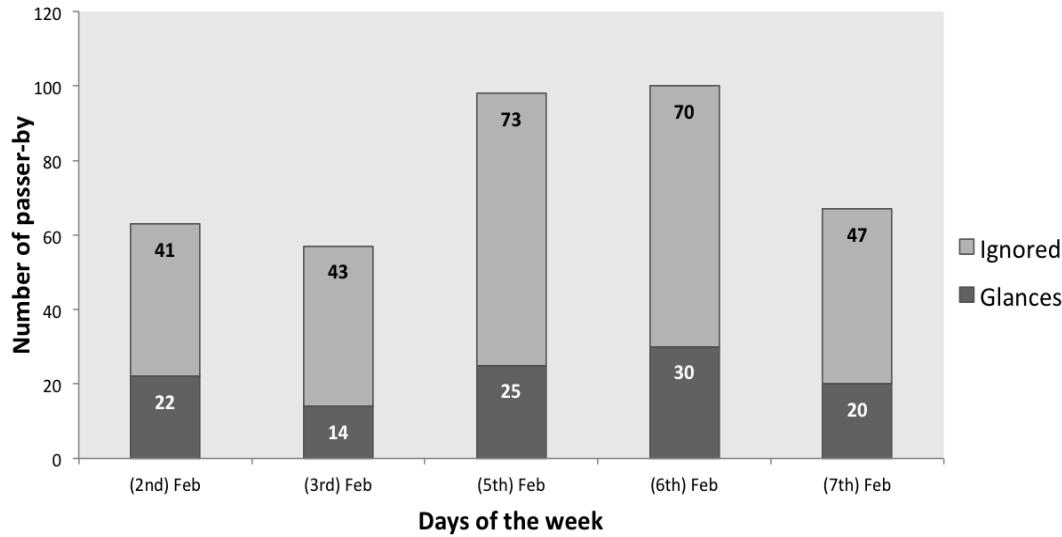


FIGURE 8.5: Non-interactive attention level chart

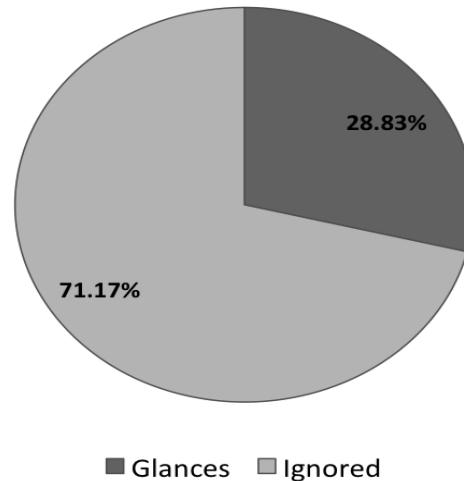


FIGURE 8.6: Non-interactive Attention level percentage

The above pie chart is generated from five-day observations. In average 28% of people glanced and 71.17% ignored the display.

2. Engagement Time

Not all people took the same time to see the advertisement, there were variations of engagement time between (5-100) seconds dependent to the interest of the people. Passersby took 34 seconds in average to be Engaged in non-interactive advertisement.

3. Number of engaged passersby

Each day's depth recordings were watched and the numbers of passersby were counted manually. The people who stood in front of the screen for more than 3 seconds were flagged as *Engaged* and the rest who ignored were flagged as *Non-Engaged* passersby. In total 79 passersby were engaged among 1031 passersby with in five continues days. The below chart shows the Engaged and Non-engaged passersby for each single day.

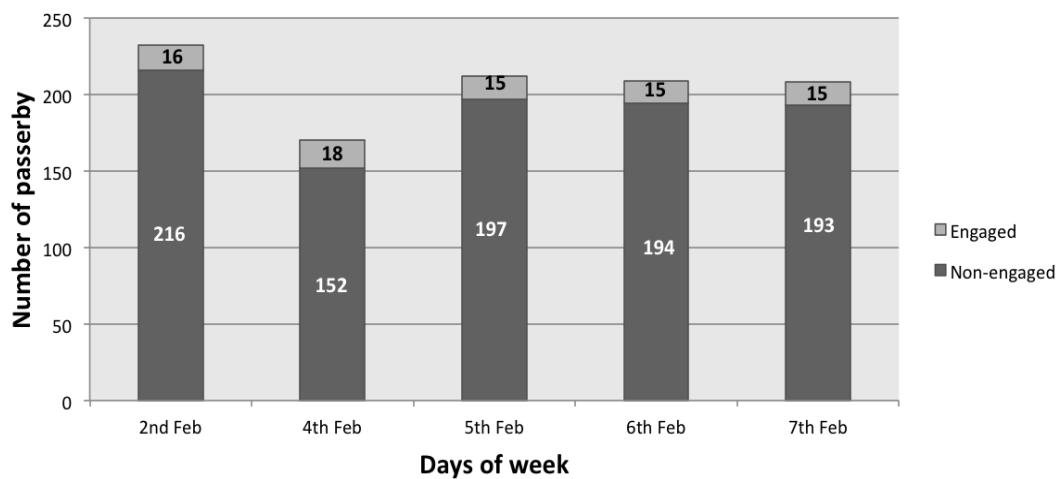


FIGURE 8.7: Non-interaction Number of Engaged and Non-Engaged passersby

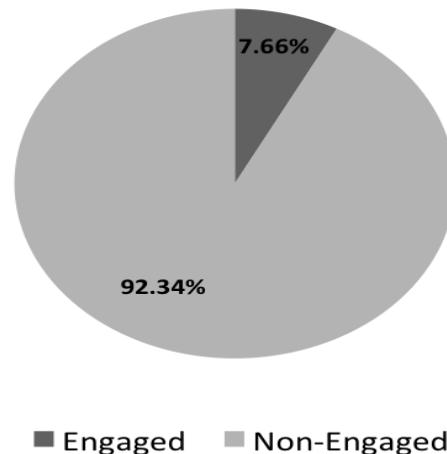


FIGURE 8.8: Percentage of engaged and Non-engaged passersby

The above pie chart is generated from all five days. It shows the percentage of passersby who were Engaged and not Engaged. As an average 7.66% of the whole population was Engaged and 92.34% were Non-Engaged.

4. Landing and Honeypot effects

Some might argue that *Landing effect*[15] do not exist in non-interactive displays because the displays do not react suddenly when a user passes by the screen. But at the same time users may react to the visual stimuli that is generated by the non-interactive advertising by showing random contents.

In the non-interactive, the silhouette is not projected and the passersby do not see themselves in the screen. But still for some other reasons passersby 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 passersby 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.

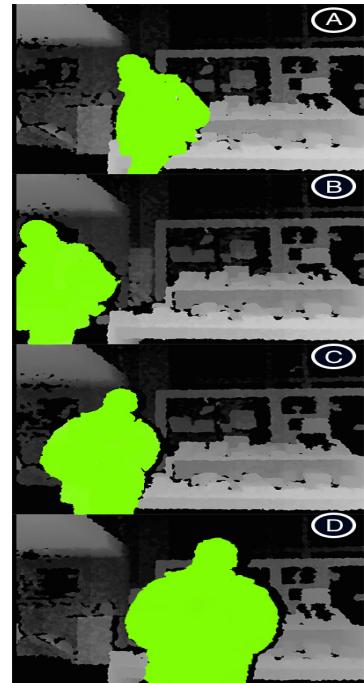


FIGURE 8.9: Landing effect

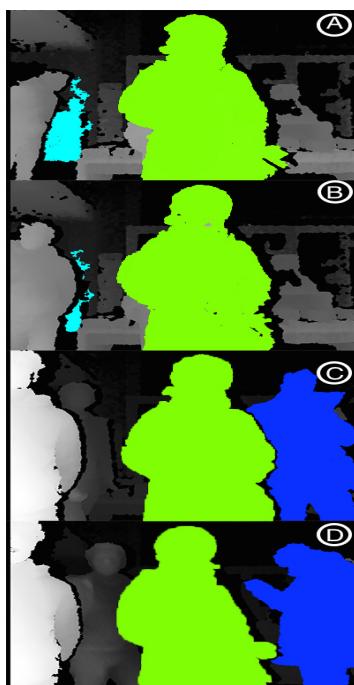


FIGURE 8.10: Honeypot effect

Honeypot[11] effects in non-interactive displays are rare because they do not make passersby become curious about themselves, and passersby do not react differently that could be noticed by other passersby. Therefore all of the observations on this effect seemed to be more passive and personal because it could be due to engagement of a friend or a family member with the screen and as a result the person got attracted, or other personal reasons.

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 8.2: 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
Total	4	9

5. Interviews

Each interview was coded individually (see Appendix E.5) and as a result the below categories are extracted. These categories are mainly taken from the questions and others are from the replies of the participants.

(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 did not mention that they are sure to participate in *Bauhaus-walk* program. 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.

- Passive:

The behaviors of passersby toward non-interactive during the 5 days observation seemed to be very calm and passive. Passersby 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 the participants that was looking for some events, 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 passersby were busy with

their own personal activities and discussions even though they were standing in front of the display facing toward it.

- Display blindness

Passersby 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 passersby 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.

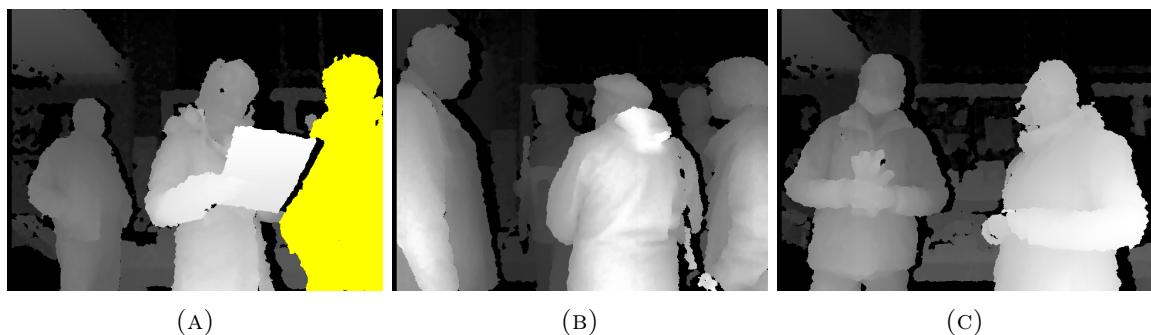


FIGURE 8.11: Passersby Behaviors

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

8.6.2 Body Interactive findings

1. Attention Level measurements

The number of *Glances* and *Ignores* were observed for two hours in five consecutive days as shown in below chart. Each bar represents two hours of one-day observation. The dark gray area is the number of *Glances* and bright area is the number of *Ignores*. Within five days of observation 106 people glanced among 256 passersby.

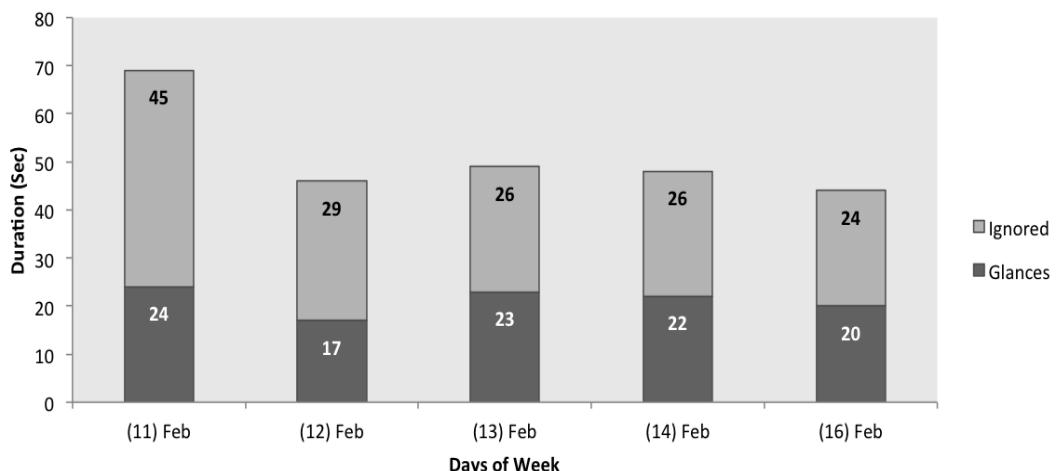


FIGURE 8.12: Attention level chart

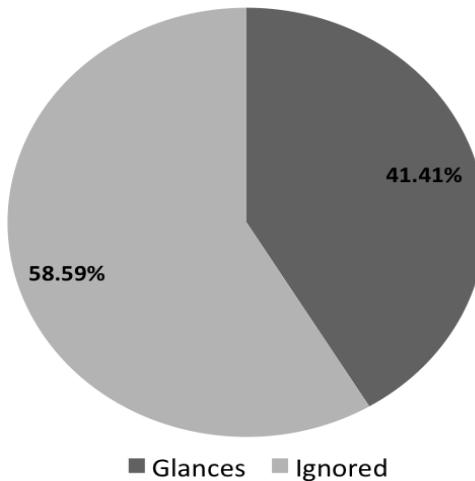


FIGURE 8.13: Body interactive Attention level percentage

The above pie chart is generated from five-day observations. In average 41.41% of people glanced and 59% ignored the display.

2. Engagement phases and time

There were passersby, 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. Therefore people were engaged in different stages of the game and spent between (10, 200) seconds. In average passersby spent around 42 seconds in front of the screen.

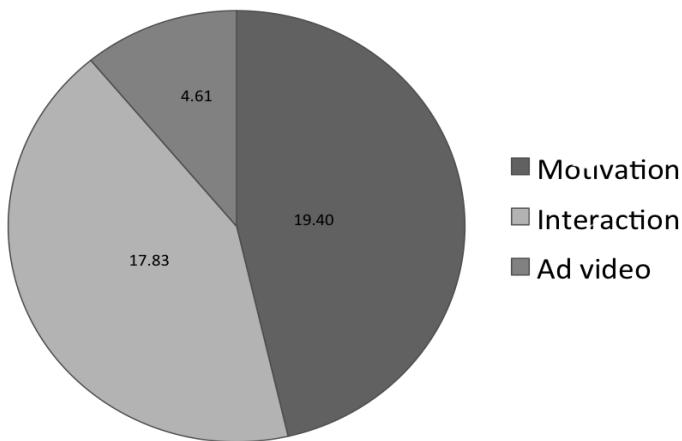


FIGURE 8.14: Average time for each phase

The advertisement was divided in three main section (1) *Attention / Motivation*, which is the pre-interaction phase that the participants has not started the game, passersby are just playing with body or looking to the screen or reading the *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. So in average it took around 4.5 seconds for participants to watch the advertisement video.

3. Number of Engaged passersby

Each day's depth recordings were watched, and the numbers of passersby were counted manually. The people who stood in front of the screen for more than 3 seconds were flagged as *Engaged* and the rest who ignored were flagged as *Non-Engaged* passerby. In total 115 passersby were engaged among 995 passersby with in five continues days. The below chart shows the *Engaged* and *Non-engaged* passersby for each single day.

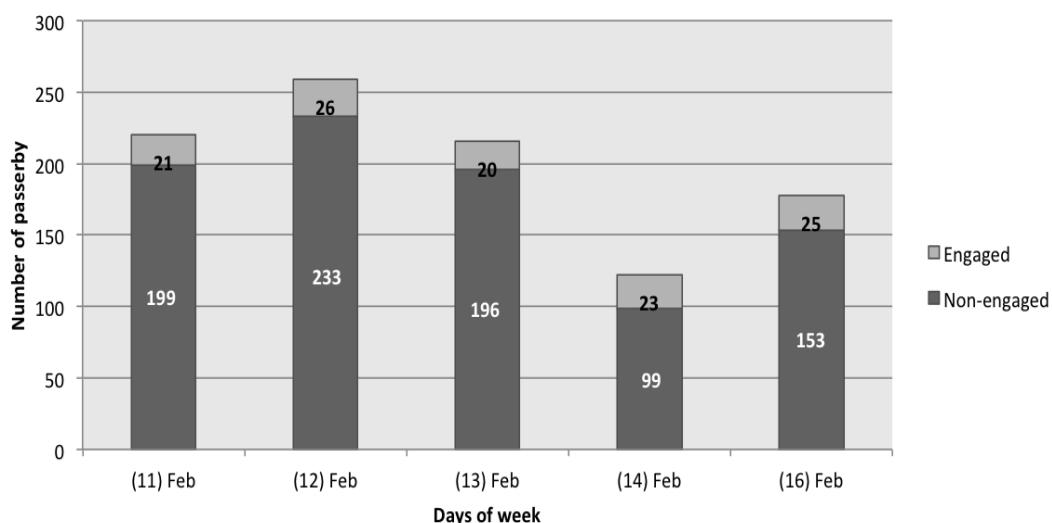


FIGURE 8.15: Body interactive Number of Engaged passersby

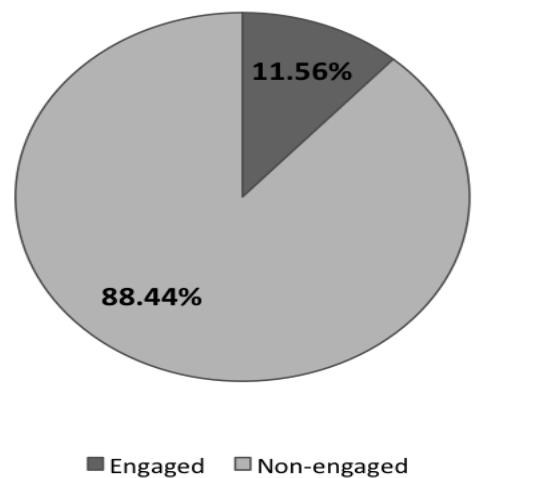


FIGURE 8.16: Percentage of Engaged and Non-Engaged passersby

The above pie chart is generated from all three days. It shows the percentage of passersby who were *Engaged* and not *Engaged*. In average 11.56% of the whole population was *Engaged* and 88.44% were *Non-Engaged*.

4. Conversion-funnel of passersby

To observe the depth of engagements, I used a *Conversion-funnel* [22] technique to illustrate how much passersby were engaged with the body interactive advertisement. The *conversion-funnel* presents the three layers of advertisement, *Attention*, *interaction*, *ad video*, and *Action*. *Action* is the ultimate goal of *Bauhaus-Walk*, which is participation of passersby in the tour program.

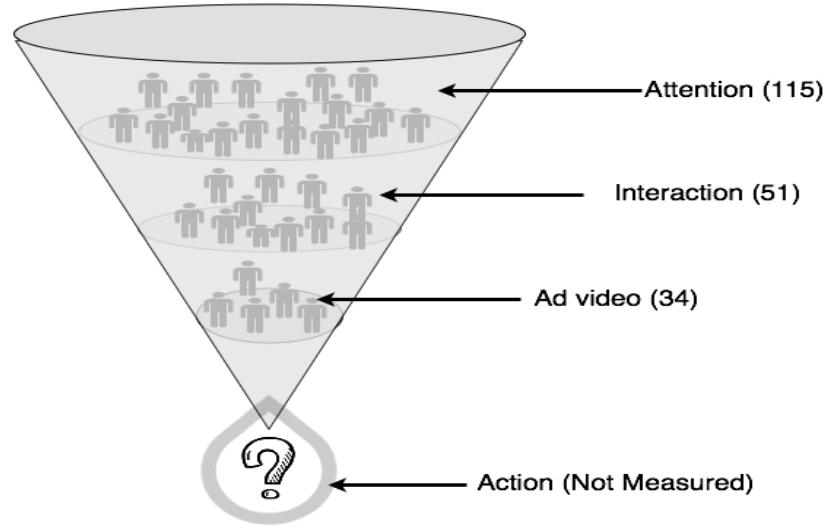


FIGURE 8.17: Conversion funnel of Engaged passersby

As seen from the above chart, 115(100%) passersby have been attracted and engaged to the advertisement, but not all passersby were interested to start the interaction. Only 51(43%) passersby started the game interaction and had experienced with further advertisement elements. And among 51 participants, only 34(51%) of them successfully completed the interaction and were exposed to the advertisement video, the rest of participants had left the interaction in the middle. The *Action* (tour participation) was not counted because that could be influenced by many other existing advertisings from *Bauhaus-Walk* in other locations.

5. 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 passersby attention significantly so that the passersby be involved. In body interaction both of these effects were observed while direct observation and while depth recording analyzing. This 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 walks back to confirm if the interactivity is there and check what the display is about. In body interaction all of the *Landing effect* has happened by noticing their silhouette on the screen and has turned back, these effects were observed for individual and group passersby.

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. The second person, who has yellow color, notices the interactivity in frame (A) while his friend is still continuing to pass in frame (B, C). The guy, who has noticed,stops in frame (C, D) and as a result drags his friend attention and at this point his friend notices the display and walks back to see his self in the screen (E).

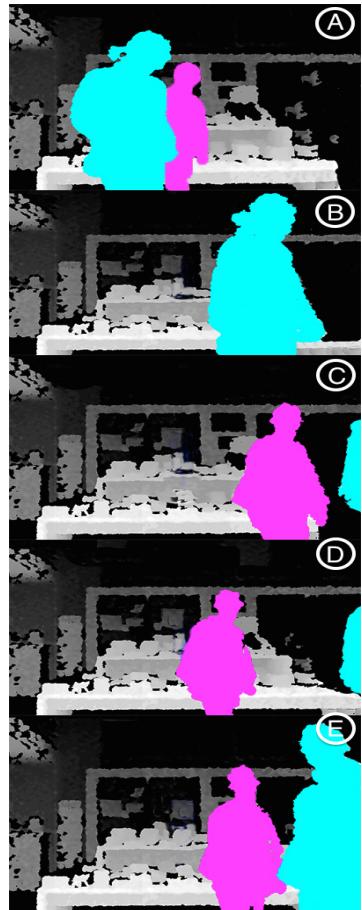


FIGURE 8.18: Landing effect

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 notices 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 below chart lists all the frequencies of honeypot effect and landing effects that was recorded from the depth recordings and onsite observations.

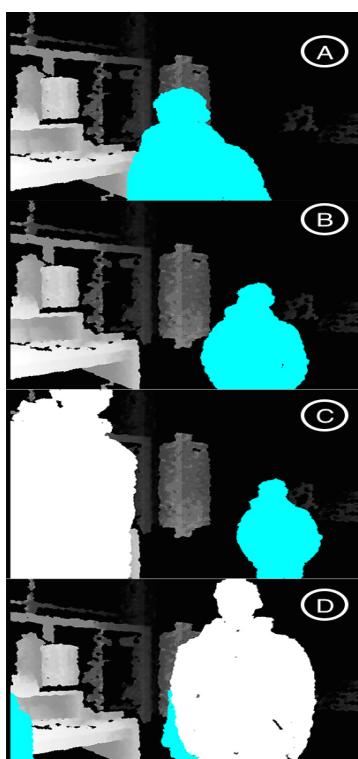


FIGURE 8.19: Honeypot Effect

TABLE 8.3: 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
Total	12	15

6. Interviews

Each interview was coded individually (see Appendix E.6) and as a result the below 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.

7. Other observations

During the body interactions despite *Honeypot* and *Landing* effects, other different kinds of behaviors have been observed. These observations on how passersby reacted when there was an interactive display, the behaviors with the interactive display was much different compared to non-interactive as listed below.

- Group and individual interactions:

Passersby 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 below pictures show group interactions happening between friends or relatives. In picture (A and B) there are two person interacting and another three persons interacting in picture (C, D).

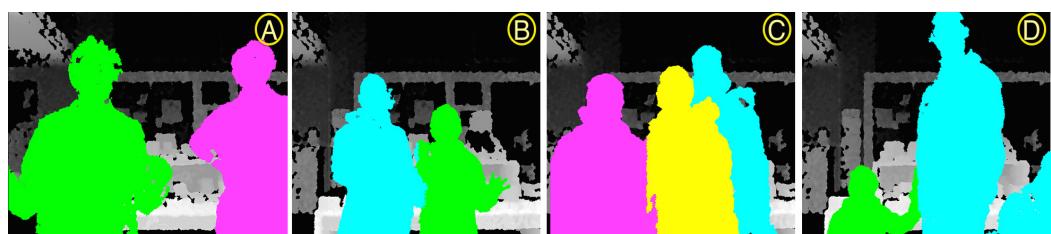


FIGURE 8.20: Group interactions

- Calling others:

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

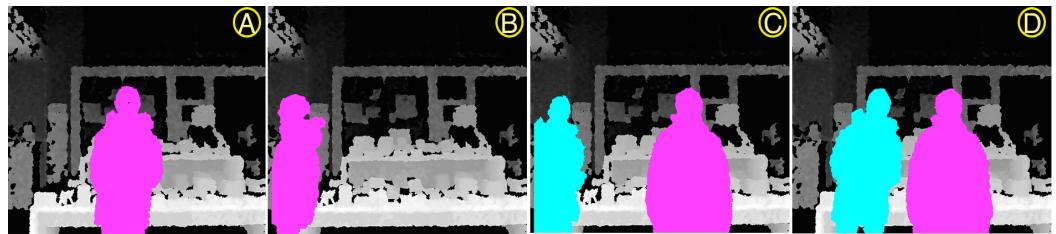


FIGURE 8.21: Calling others

- Playing with silhouette:

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

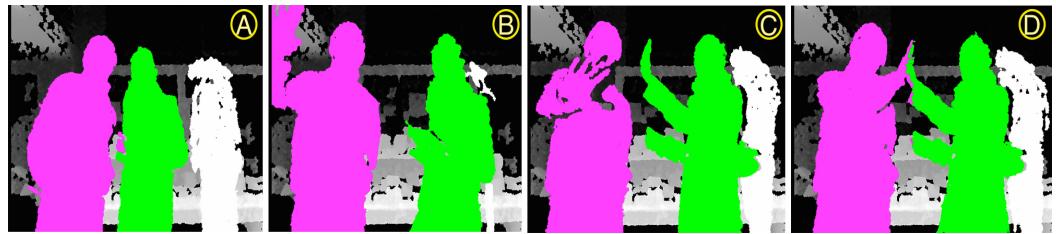


FIGURE 8.22: Playing with silhouette

- 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 act but progressively came near to screen like (spying) and then left. As can be seen in the below frames. In frame (A), a person notices his/her silhouette and immediately raises hands in frame (B). His fellow friend also notices and raises hand up, which are seen in frames (C and D).

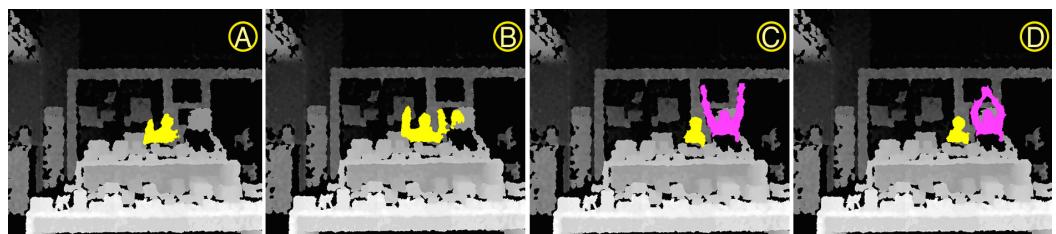


FIGURE 8.23: Noticing interactivity

- 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.

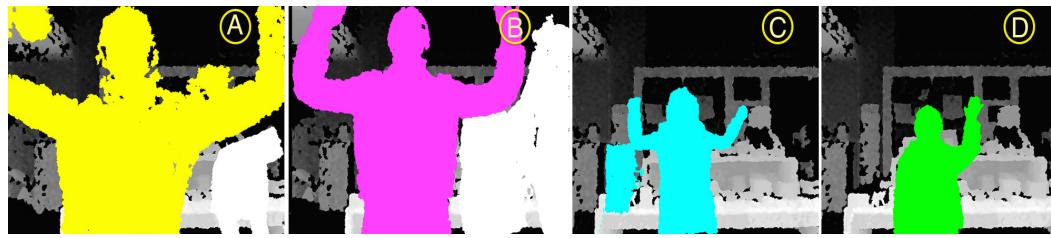


FIGURE 8.24: Raising hand

- 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 display.

- *Call-to-Action* reaction

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 to have a better interaction with the advertisement.

- Interactions behaviors

The movement of silhouette during interaction was 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 passersby 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. They felt more personal with the display, and the display that was small in dimension also provides the hint of being personal interaction. Touch interaction is known 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*. After interviewing them, they responded that they did not know how that thing works. An employee of the tourist information center said that the elders are a bit skeptical about the use of technology.

8.6.3 Mobile Interactive findings

1. Attention Level measurements

Attention attraction technique was quite similar to body interaction technique, which was the projection of passersby's 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 number of *Glances* and *Ignores* were observed for two hours in five consecutive days as shown in below chart. Each bar represents two hours of one-day observation. The dark gray area is the number of *Glances* and bright area is the number of *Ignores*. With in five days of observation 80 people glanced among 237 passersby.

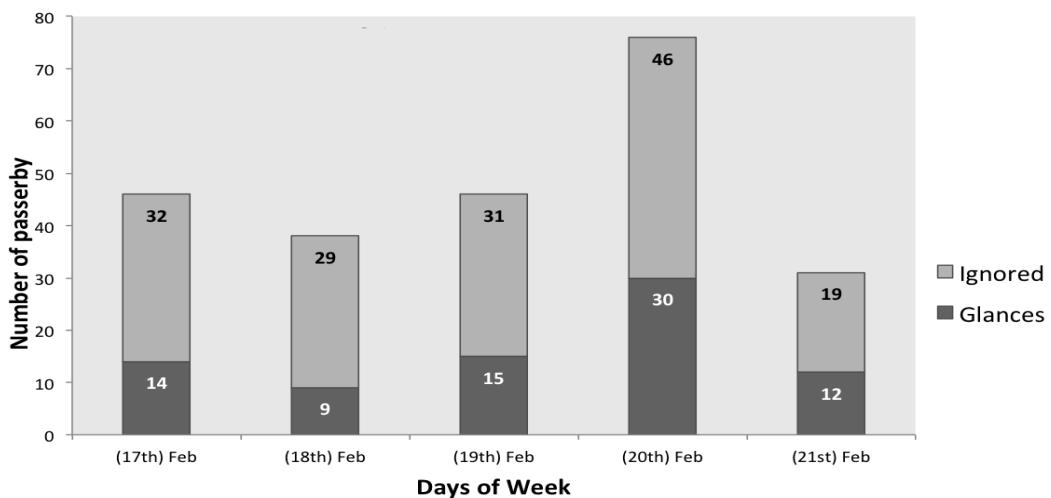


FIGURE 8.25: Mobile interactive attention level chart

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.

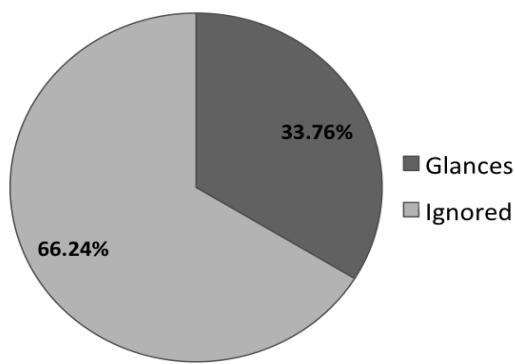


FIGURE 8.26: Attention level percentage

The above pie chart is generated from five-day observations. In average 34% of people glanced and 66% ignored the display.

2. Engagement time

Although no passersby 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 was less than non-interactive and body interactive advertisements.

3. Passersby and engagements

Each day's depth recordings were watched and the numbers of passersby were counted manually. The people who stood in front of the screen for more than 3 seconds were flagged as *Engaged* and the rest who ignored were flagged as *Non-Engaged* passerby. In total 77 passersby were engaged among 852 passersby with in five continues days. The below chart shows the *Engaged* and *Non-engaged* passersby for each single day.

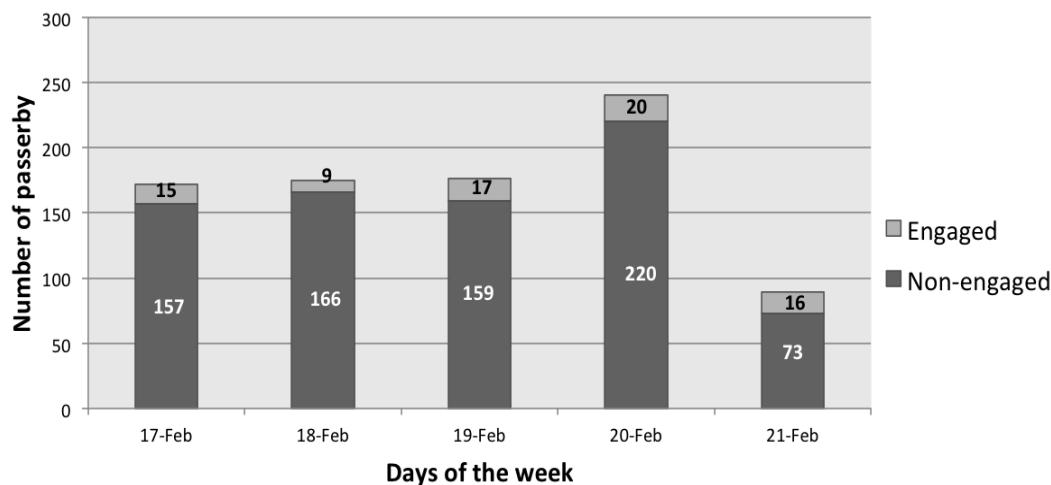


FIGURE 8.27: Mobile interactive Number of Engaged passersby

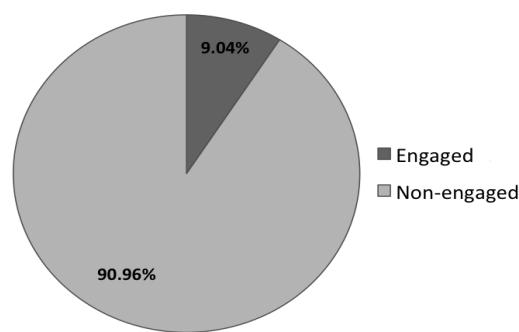


FIGURE 8.28: Percentage of engaged passersby

The above pie chart is generated from all five days. It shows the percentage of passersby who were Engaged and not Engaged. As an average 9% of the whole population was Engaged and 90.96% were Non-Engaged.

4. Conversion funnel of engaged passersby

The *Conversion-funnel* for mobile interactive remained only in the very first layer. As seen from the below chart, 79(100%) passersby have been attracted and engaged to the advertisement.

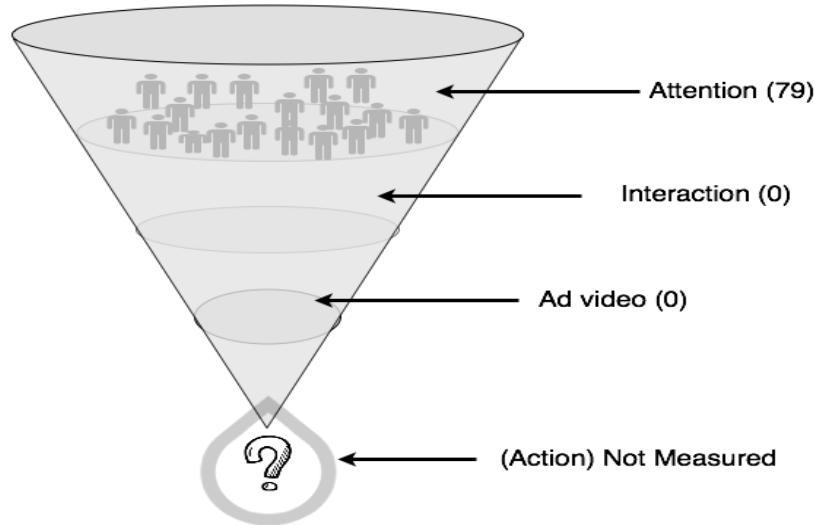


FIGURE 8.29: Conversion funnel of Engaged passersby

5. Landing and Honeypot effects

Landing and *Honeypot* effects in this technique were very not strong enough mainly because no passersby interacted with the system.

The *Honeypot effect* was mainly because of the silhouette representation, as said before this effect was very week because of info-screen showed partial body representation. Passersby 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 passersby had actively participated to play game. The picture below shows a green colored person at frame (A), at this point he was watching the screen for a while. When he moves out of the screen in frames (B, C), another yellow colored person appears from the back side shown in frame (C). The person walks toward the screen in frames (D, E), and gets very close at frame (F) to the display.

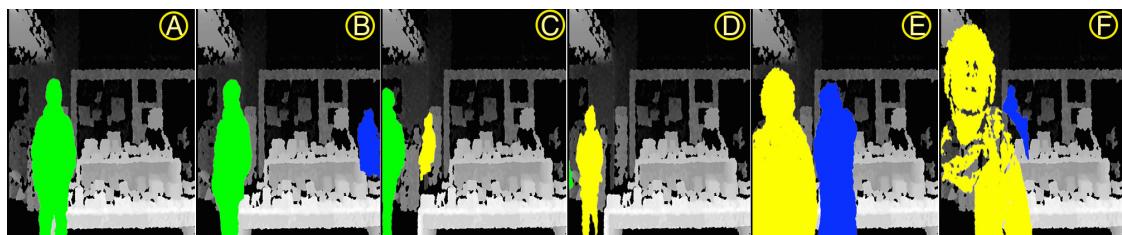


FIGURE 8.30: Honeypot effect

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 following picture from right to left, a person is crossing the screen from frame (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 passerby left after standing in front of the screen without any interaction.



FIGURE 8.31: Landing effect

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

TABLE 8.4: 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
Total	4	2

5. Interviews

Each interview was coded individually (see Appendix E.7), and as a result the below categories are extracted. These categories are mainly taken from the questions and others are from the replies of the participants.

- Dislikes:
Some participants did not even like the smartphones to use. As one said “ *I do not like the handy, and It does not look good to use handy*”. They said that use of phone in public is not a good idea. One interviewee said that “ *I do not like to use it for an advertisement*”.
- Phone usage:
Some of interviewees did not even have smartphones as one pointed out, that “ *yes I saw it once but I do not have a telephone*”. Some interviewees use the phone only for calls as one replied like, “ *I want my phone only to call*” and some have a smartphone but do not carry it with themselves outside as one replied, “ *I have one smartphone but I put it at home*”.
- Noticing:
One of the interviewees noticed the interactivity of display with the silhouette representation one interviewee said, “ *Actually I saw my shape on the screen from far a way and I came near to it.*”
- Ad recall:
Some of the interviewees could mention what was the advertisement on the display. One person said, “ *it was about spaziergang in Weimar city*”.

6. Other observations

Passersby 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

Passersby 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. One of the passerby was 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.

8.6.4 Comparison of advertisements

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

Number of passersby

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

Hypothesis:

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

The below is the table of passersby for three weeks.

TABLE 8.5: Number of passersby in three weeks

Days	Non-interactive	Body	Mobile
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
Total	1031	995	852

ANOVA test revealed that there was no significant different of passersby 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 me confidence to proceed the comparisons.

To find how small was the difference between the weeks, the eta squared(η^2), which is an effect size index for ANOVA, in which the SS_{effect} (sum of squared) between conditions is divided by SS_{total} (sum of total) as below.

$$\eta^2 = \frac{SS_{effect}}{SS_{total}} = \frac{7293.3332}{42506.9332} = 0.1716 \approx 0.18$$

The 0.18 value means that 18% was the difference between the weeks, which is relatively small amount of percentage and is not a matter of concern. As a result, there was no statistically difference between the numbers of passersby of each conditions between the weeks.

Attention Level Comparison

As can be seen Non-interactive had 28.83% number of *Glances*, the Body-interaction had more than 10% higher number of *Glances* (41.41%) than non-interactive. The mobile Interaction had higher *Glances* (33.75%) from non-interactive, but still it was less than body interaction.

To compare which of the three methods drove more passersby attention, the data of the number of *Glances* for each of the weeks were gathered as below. *Chi square* test were applied to find if they were statistically different or not.

Hypothesis:

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

TABLE 8.6: 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
Total	297	581	878

The *Chi-squared* test reveals that $\chi^2(2, N=878)=10.863, p < .05$ ($p=.004376$), meaning that there was a difference so $H0$ is rejected and $H1$ 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.

$$\chi^2(1, N=641)=10.863, p < .05 \ (p=.00437653)$$

2. Non-Interactive Vs Mobile Interactive

The finding suggests that there was no significant difference of the number of *Glances* between Non-interactive and mobile interactive.

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

3. Body interactive Vs Mobile Interactive

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

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

Engaged and Non-engaged passersby

This test is to compare if there was a difference between number of engaged passersby or not between the conditions.

Hypothesis:

- **H0:** There was no difference between the numbers of engaged passersby between the conditions.
- **H1:** There was a difference between the numbers of engaged passersby between in each conditions.

The below table lists all number of engaged and non-engaged passersby for three weeks.

TABLE 8.7: Number of engaged passersby 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
Total	79	115	77

To determine that whether there were any significant differences between the means of these three conditions (groups). I conducted *one-way ANOVA* test. The test strongly suggests that there was a significant differences of the number of Engaged passersby between these three conditions, ($F_{2,5}=11.20$, $p < .05$ ($p=.002$)).

To find where were the main difference between them, a *Post-Hoc Tukey* test was carried out. The *Post-Hoc Tukey's HSD* would likely identify which of the pairs of conditions were significantly different from each other. The critical value of the *Studentized Range Q* statistic was computed as , $Q_{critical}^{\alpha=0.01,k=12} = 5.0430$. The significance can be determined if each pair's critical value (*Tukey HSD Q* statistic) is bigger than *PStudentized Range Q* statistic. $Q_j^i > Q_{critical}$, and the strength of difference is determined by the *P* value as shown below.

TABLE 8.8: 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 subsequently. As can be seen from the above chart, there is no significant difference between group A and C because the critical value is not bigger than 5.0430, and also the *p* value is bigger than 0.5. But group B shows a highly significant difference between A and C because the critical value is higher than 5.0430, and the *p* is smaller than 0.01. It shows that the body interactive advertisement engaged significantly more passersby than other two types of advertisement.

To find out how big is the difference between engaged passersby in non-interactive and body interactive conditions, the *eta squared* (η^2), which is an effect size index for *ANOVA* that the SS_{effect} (sum of squared) between conditions is divided by SS_{total} (sum of total). The below was calculated by an online tool *Easycalculator*⁴.

$$\eta^2 = \frac{SS_{effect}}{SS_{total}} = \frac{129.6}{162.4} = 0.798 \approx 0.8$$

The 0.8 means that 80% of total variance is accounted for by the conditions (body interactive, non-interactive) effect.

⁴easycalculator: <https://www.easycalculation.com/statistics/eta-square-calculator.php>, last accessed 15 jun 2016

Landing effect

The below table shows how many *Landing effect* 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 Passersby for each condition.
- **H1:** There was a difference between the number of *Landing effect* of Passersby for each condition.

TABLE 8.9: 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
Total	4	12	4

ANOVA test reveals that there was a strongly significant difference between one or two above conditions, ($F_{2,5}=7.5294$, $p < .05$ ($p=.0076$)). So I reject the Null hypothesis and state that one or more of the above conditions were statistically different from the others,

To confirm that which of the pairs were different significantly. I run *Post-Hoc Tukey's HSD* test, the critical value of the *Studentized Range Q* statistic was computed as, $Q_{critical}^{\alpha=0.05,k=12} = 3.7711$. The significance can be determined if each pair's critical value (Tukey HSD Q statistic) is bigger than *Studentized Range Q* statistic. $Q_j^i > Q_{critical}$, and the strength of difference is determined by the *P* value as shown below.

TABLE 8.10: 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 subsequently. 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 effect* than other two conditions.

To find out how big is the difference between number of *Landing effects* in non-interactive and body interactive conditions. The *eta squared* (η^2), which is an effect size index for ANOVA that the SS_{effect} (sum of squared) between conditions is divided by SS_{total} (sum of squared total). The below was calculated by an online tool *Easycalculator*⁵.

$$\eta^2 = \frac{SS_{effect}}{SS_{total}} = \frac{5.12}{7.84} = 0.6531 \approx 0.66$$

⁵easycalculator: <https://www.easycalculation.com/statistics/eta-square-calculator.php>, last accessed 15 jun 2016

The 0.66 means that 66% of total variance is accounted for by the conditions (body interactive, non-interactive) effect.

Honeypot effect

The below 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 8.11: 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, ($(F_{2,5})=12.29$, $p < .05$ ($p=.001$)). As a result, I reject the null hypothesis and accept that there was a statistical difference between one of the conditions in the number of *Honeypot effects*. To find which of the pairs were significant different the *Post-hoc Tukey* test was applied as the following.

TABLE 8.12: *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	** $p < 0.01$

Group A, B and C refers to Non-interactive, body interactive and mobile interactive advertisement subsequently. *Post-hoc Tukey* computed the critical value (*Studentized Range Q* statistic) for A and B as, $Q_{critical}^{\alpha=0.05,k=12} = 5.0430$ for and another value for B and C as, $Q_{critical}^{\alpha=0.05,k=12} = 3.7711$. The significance can be determined if each pair's critical value (*Tukey HSD Q* statistic) is bigger than *Studentized Range Q* statistic. $Q_j^i > Q_{critical}$, the strength of difference is determined by the *P* value as shown above. From the diagram above it is very clear that non-interactive with mobile interactive is insignificant, but the non-interactive with body is significant and body and mobile is strongly significant too.

To find out how big is the difference between number of *Honeypot effects* in non-interactive and body interactive conditions, the *eta squared* (η^2), which is an effect size index for ANOVA

that the SS_{effect} (sum of squared) between conditions is divided by SS_{total} (sum of total). The following was calculated by an online tool *Easycalculator*⁶.

$$\eta^2 = \frac{SS_{effect}}{SS_{total}} = \frac{6.4}{13.6} = 0.4706 \approx 0.47$$

The 0.47 means that 47% of total variance is accounted for by the conditions (body interactive, non-interactive) effect. Because the effect size is low, only one (*) is given in above inference column that is still a significant result. But the comparison of body and mobile has two (**) which means that body performed much more better than mobile and is assumed to have a larger effect size.

8.7 Discussion

As in non-interactive, the phases were automatically triggered one after another in sequence of time. Passersby 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. There was a higher chance of encounters of passersby with the second two interfaces because of the durations they were shown. The first phase was only for 5 seconds and the others were for 20 to 40 seconds. While on the other hand in interactive advertisements, passersby had more encounters with the first phase because of the projection of silhouette representation until the interaction is not started.

Because of the interactivity and non-interactivity the engagement definition was not the same for these three conditions. As in Non-Interactive people were engaged in watching the two phases (map and video phases). But in body-interactive the engagement was more in interactions with the silhouette and game elements. In mobile interaction, the engagement was only interacting with the silhouette representation. Despite these differences in all the phases the Bauhaus-Walk logo and goal of the event was mentioned and people still could understand that what was the advertisement about.

The *Honeypot effect* was more seen in interactive advertisement compared to non-interactive one of the reasons could be *Interaction movement*, passersby 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 passersby could have encountered in different phases of display and some of the phases might have been interesting or more attractive and they performed landing, and in other phases they might have not performed *Landing effect* at all, while in interactive advertisement, passersby 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 the 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 because they wanted to proceed instead of passively watching a video. (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*

⁶easycalculator: <https://www.easycalculation.com/statistics/eta-square-calculator.php>, last accessed 15 jun 2016

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 the 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 the 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 passersby.

8.8 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 the tourist information was very quite, 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% passersby were engaged among all the passersby in the entire days of week, and spent around 34 seconds in average. People liked the design of the interface, but complained about the speed and theme of content.

The body interactive advertisement started with joy and fun, the behavior toward the screen was different from the non-interactive. The attention level was about 41.41% that passersby glanced toward display. People among all passersby during the week, 12% of them were engaged that took around 42 seconds in average in front of display.

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 attracting attention method was appreciated and participants understood how to trigger the interaction mode. In this technique a lot of passersby seemed to be active in 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.

The mobile interaction technique was one of techniques that did not really find its value in the environment, except for the attraction attention method. 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 passersby glanced,

and among all passersby during the week only 9% of them were engaged within 22 second of average duration.

At the conclusion from the findings and observations and comparisons of all three different techniques, the body interaction technique was the most statistically attractive, which received higher number of *Glances*, increased the number of whole passersby 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 advertisement 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, while it should not occlude the silhouette so that the person do not feel disconnected with the advertisement. The non-interactive and mobile interactive 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.

9

Advertisement enhancement

9.1 Introduction

The very first phase to get passersby engaged with the display is the getting their attention. In previous experiment (chapter 8) during the course of five days, only 12% of the entire of passersby were attracted and engaged because of many reasons. (1) The passersby could not see their silhouette until got very close to the display and camera, when by that time the passersby might have turned his/her face from the display without looking to their silhouette. (2) Passing by the screen happens within a short amount of seconds and that is not enough time for passersby to understand interactivity quickly. If the screen is large and placed in front, it takes about 1.2 to understand interactivity [11]. But the previous display was located in sideways and was small, so I assume that it took longer than 1.2 seconds to understand interactivity and by that time the passersby had passed the screen. (3) From the observations made during three weeks, most passersby turned their faces toward the table, which was located in front of the display. Passersby used to walk around the table to look for books and other materials.

The place, where I conducted the study, the display was placed at sideways and there was no other way to change the location of display to be more in front of passersby to have more of their attention. Therefore I took this real time problem and proposed an extended version of attracting attention design, to enhance the attention level of passersby. This enhanced version could track and show passersby on the display, who were far or at corner of display. The chapter also discusses the study design and evaluation of this technique, and compares this technique with the previous techniques to see the effectiveness and advantages.

9.2 Enhanced attracting attention

The change in the new version was to extend the tracking area about 180 degree around display. This change overcame the issue of limited tracking range, and provided passersby enough time to be attracted toward display and understand the interactivity cue of the display. To achieve this change, three Kinect cameras were integrated in two sides and in the center of the display. Physically the cameras were positioned side-by-side that had small range gaps in between, which was not perceivable by passersby. The tracked passersby silhouette images were stacked together and shown on the display, a person passing from the side could see its silhouette at the side of the screen. When moving from one side to the other side of the screen, the application could smoothly transition the person's silhouette from one section to the other section of the screen. Each Kinect camera was tracking the users individually, the user in the first Kinect was not the same user in the second Kinect and as a result Kinect would produce different colors to the same user while passing by each camera. Therefore only one color was chosen for all users to avoid the change of colors of the same user from camera to other.

See the following diagram that shows the physical setup including Kinect cameras and their ranges. The diagram shows three different persons standing at each camera range and the system has mapped their silhouette representation relative to their distance to the screen. As can be seen that all users have the same color on the screen sections

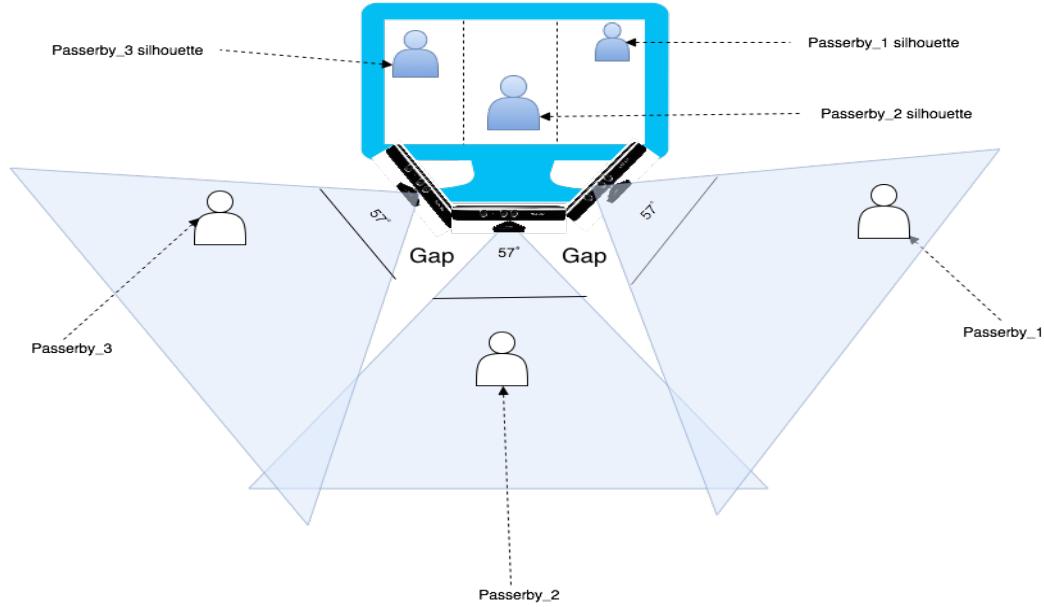


FIGURE 9.1: Attracting attention extended version.

9.3 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 shown in figure 9.2.

1. Passing by phase:

This phase demonstrates passersby, who are not in the display tracking range.

2. Implicit interaction phase:

This phase starts, when passersby are in tracking range but are standing far or at side of the display. The range of this phase is extended in two sides shown in gray color.

3. Subtle interaction phase:

In this phase, the user is in near or 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:

This phase happens, when the user has actively started the game interaction and is playing. At this phase the whole tracking range (white color) could be used for direct interaction until the end of interaction phase.

5. Watch ad video phase:

When the interaction is over, a short advertisement video is shown.

6. multi interaction phase:

This phase demonstrates that the user can perform interaction multiple times.

7. Follow up action phase:

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

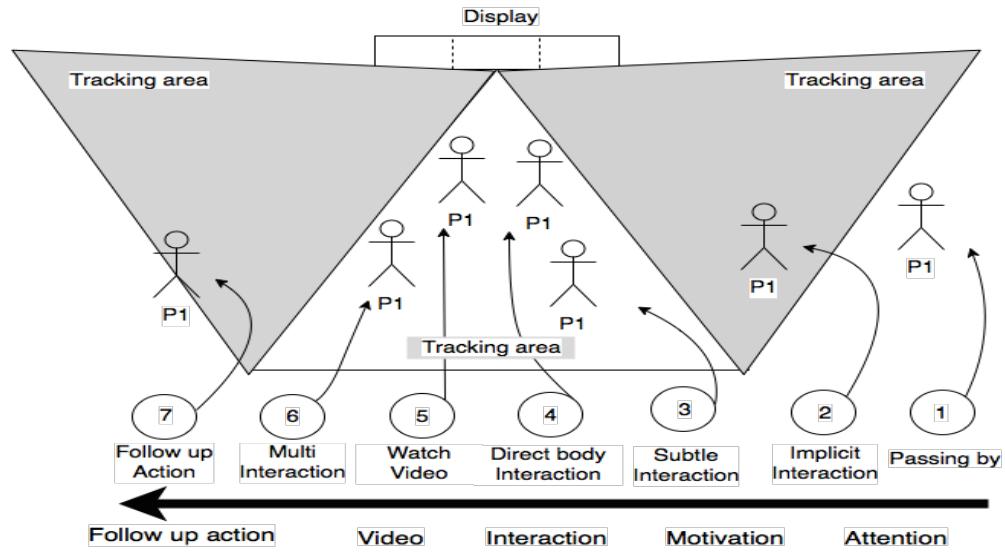


FIGURE 9.2: Extended Interaction design

9.4 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. This study compares the findings with the previous body interaction.

1. Would the attention level change?
2. Would the number of engaged passersby 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 passersby behaviors to the display?

9.5 Study design

9.5.1 Location

This experiment was conducted in the same location that was chosen for previous setup. It was positioned in the same pathway of passersby with the same height and screen brightness. The surrounding of the display was also kept similar like the previous setup.

9.5.2 Duration

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

9.5.3 Participants

The participants were from Tourist information center. They were not informed that there was an interactive screen. Most of the participants were of old aged between 45-60, and the rest of participants were middle aged between 20-45 and.

9.5.4 Data gathering

The below types of data were gathered during three days.

1. On-Site Observation

Two Observation slots were chosen, the first was from 10:00 – 12:00 and the second was from 14:00 – 16:00. During these two slots the below observations were made.

(a) Attention Level measurement

Number of glances and number of ignores were counted by observing the passersby from a fixed location. Anyone who turned his/her face toward the display for less than 3 seconds were counted as *Glanced*, and those who had not turned their faces at all were selected as *Ignored*. See the full sheet of glances in Appendix F.1.

(b) Passerby behavior

The behaviors of the passersby were observed by direct and indirect observations in onsite and from camera depth recordings. From the observations two important effects were taken in consideration, *Honeypot* and *Landing* effects. See other observation notes in Appendix F.2.

2. Depth recording

A 2D colored image was recorded per second from each of three cameras simultaneously, which meanwhile were staked together side-by-side. At the end of day, another post processing script was applied to integrate a static background using Adobe Photoshop application. To match the data logs and the depth frames, each image name consisted timestamp as (12.43.21.png). The below picture shows 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.

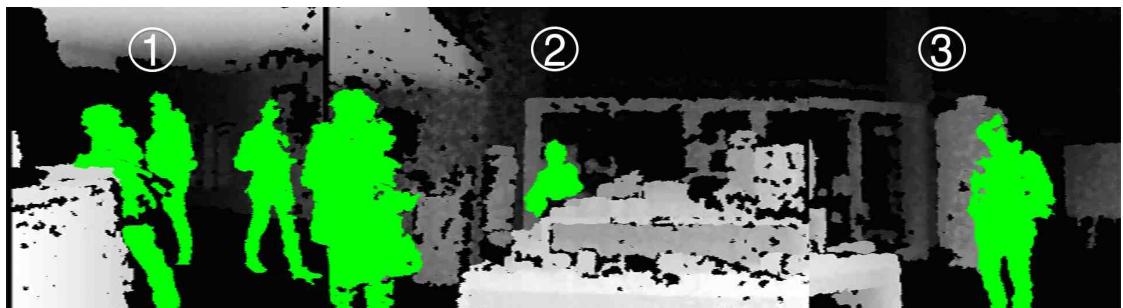


FIGURE 9.3: Three Kinect images

9.6 Findings and results

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

9.6.1 Attention Level measurements

The following chart shows the number of *Glances* and *Ignores* for the consecutive three days.

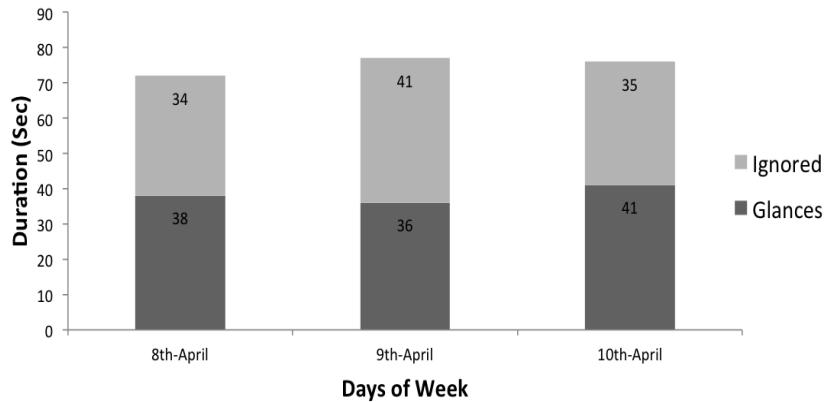


FIGURE 9.4: Attention level chart

Each three days has almost similar number of *Glances* and *Ignores*. In average 51.11% of passersby glanced and 49% of passersby ignored the display.

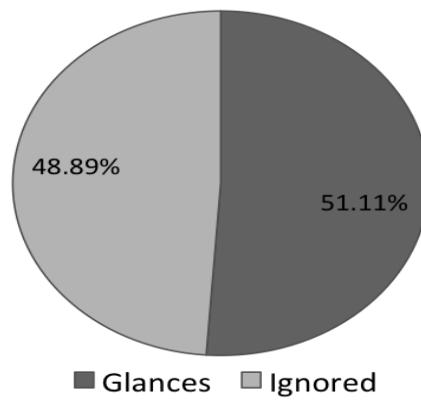


FIGURE 9.5: Attention level percentage

9.6.2 Times of Engagement phases

The engagement time for each phase was counted from system logs and depth recording manually. The passersby spent 16.10 seconds in average for the first phase (*Attraction/Motivation*), which had no specific duration to expire. The same amount of average time (16.20 seconds) was spent for the *Interaction phase*, which was restricted to only 40 seconds in max. And finally passersby spent only 3.63 seconds in average to watch advertisement video advertisement, which was limited up to 20 seconds.

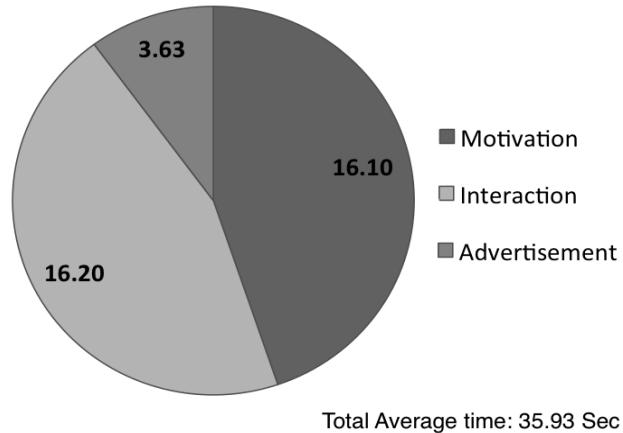


FIGURE 9.6: Average time for each phase

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

9.6.3 Number of engaged passersby

Each day's depth recordings were watched and the numbers of passersby were counted manually. The people who stood in front of the screen for more than 3 seconds were flagged as *Engaged* and the rest who ignored were flagged as *Non-Engaged* passer-by. In total 104 passersby were engaged among 679 passersby with in three continues days. The below chart shows the *Engaged* and *Non-engaged* passersby for each single day.

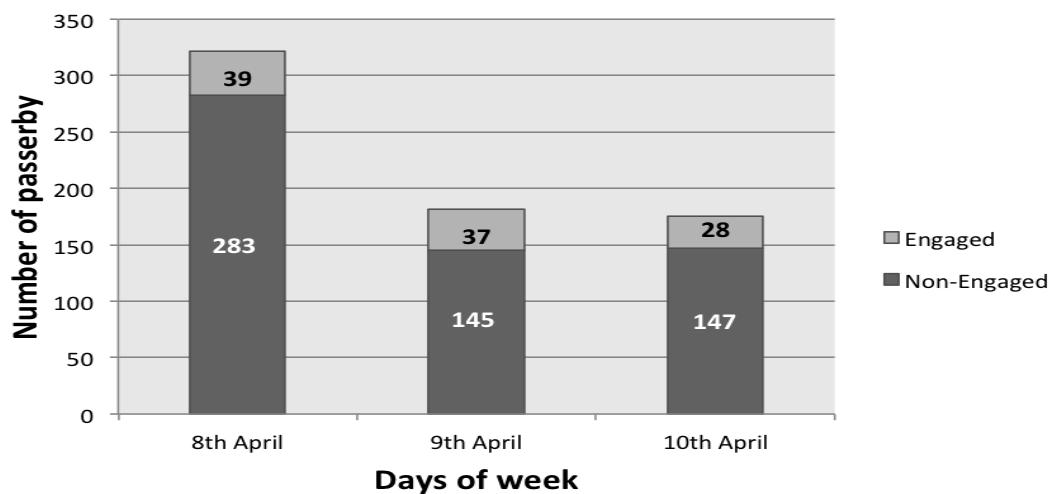


FIGURE 9.7: Number of engaged passersby

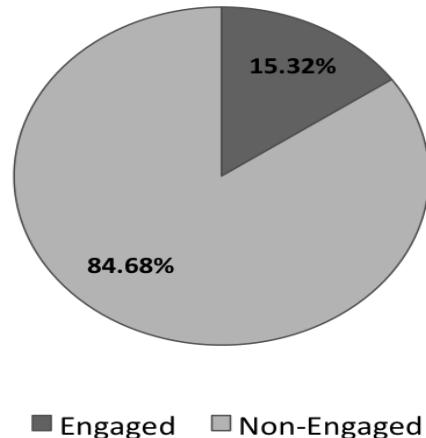


FIGURE 9.8: Percentage of engaged and non-engaged passersby

The above pie chart is generated from all three days. It shows the percentage of passersby who were *Engaged* and not *Engaged*. In average 15.32% of the whole population was *Engaged* and 84.68% were *Non-Engaged*.

9.6.4 Conversion funnel of engaged passersby

To observe the depth of engagements, I used a *Conversion-funnel* [22] technique to illustrate how much passersby were engaged with this enhanced body interactive advertisement. The *conversion-funnel* here presents the three layers of advertisement, *Attention*, *interaction*, *ad video*, and *Action*. *Action* is the ultimate goal of *Bauhaus-Walk*, which is participation of passersby in the tour program.

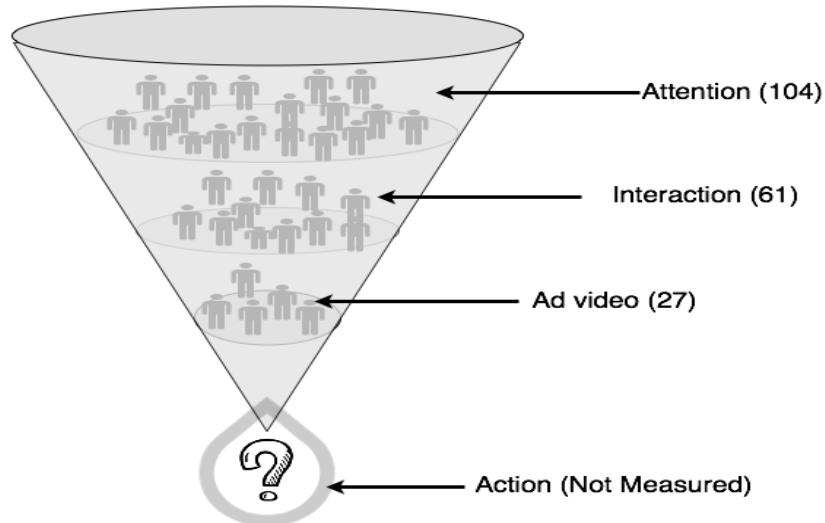


FIGURE 9.9: Conversion funnel of Engaged passersby

As seen from the above chart, 104(100%) passersby have been attracted and engaged to the advertisement, but not all passersby were interested to start the interaction. Only 61(58.6%) passersby started the game interaction and had experienced with further advertisement elements. And among 61 participants, only 27(44%) of them successfully completed the interaction and were exposed to the advertisement video, the rest of participants had left the interaction in the middle. The *Action* (tour participation) was not counted because

that could be influenced by many other existing advertisings from *Bauhaus-Walk* in other locations.

9.6.5 Landing and Honeypot effects

Tow passersby behaviors were observed during the onsite and depth recording observations. These effects were *Landing effect*[11] and *Honeypot effects*[15]. But these effects were not as strong as in previous body interaction technique. See the example frames below.

- 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 sometime. 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. She has looked many times toward the engaged people in previous frames. In frame (B) the two guys leave the interaction and walk away from the screen and the application is left alone. In frame (C) the women in the left is alone and is watching her self in the screen. She 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 frames (E, F) she comes closer and starts actively interaction.

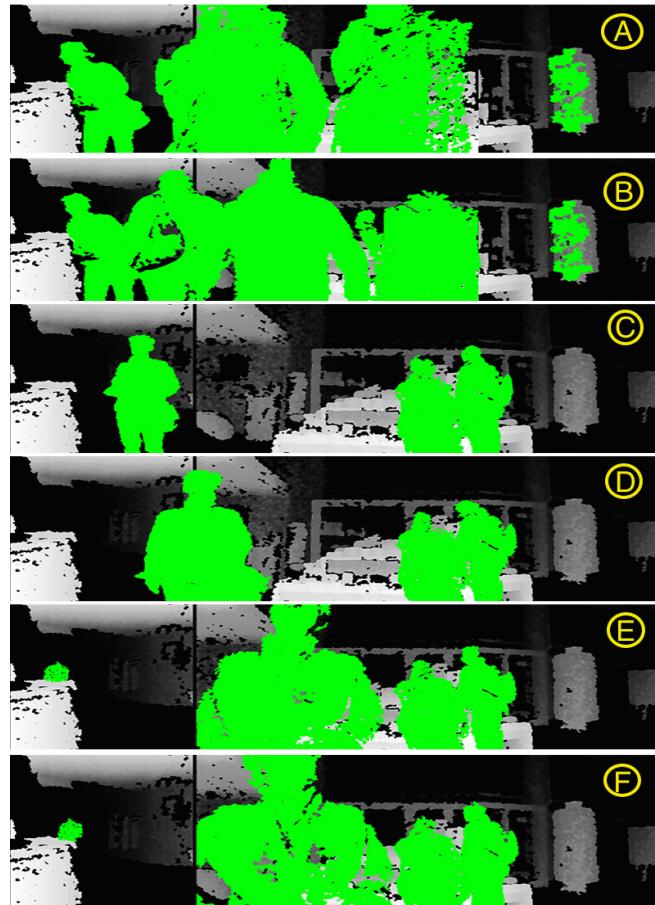


FIGURE 9.10: Honeypot effect

- Landing Effect:

Few *Landing effects* had also happened, which were similar to the previous experiments. The *Landing effects* 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 the screen. As can be seen in the picture in the right, a lady is passing by the screen from frame (A – D) continuously without noticing anything. But she notices the screen interactivity at frame (E). She stops at her position for a second and when she realizes the interactivity then she moves closer to the screen in frame (F). She reaches the middle of the screen at frame (G) and starts to explore the game by interacting.

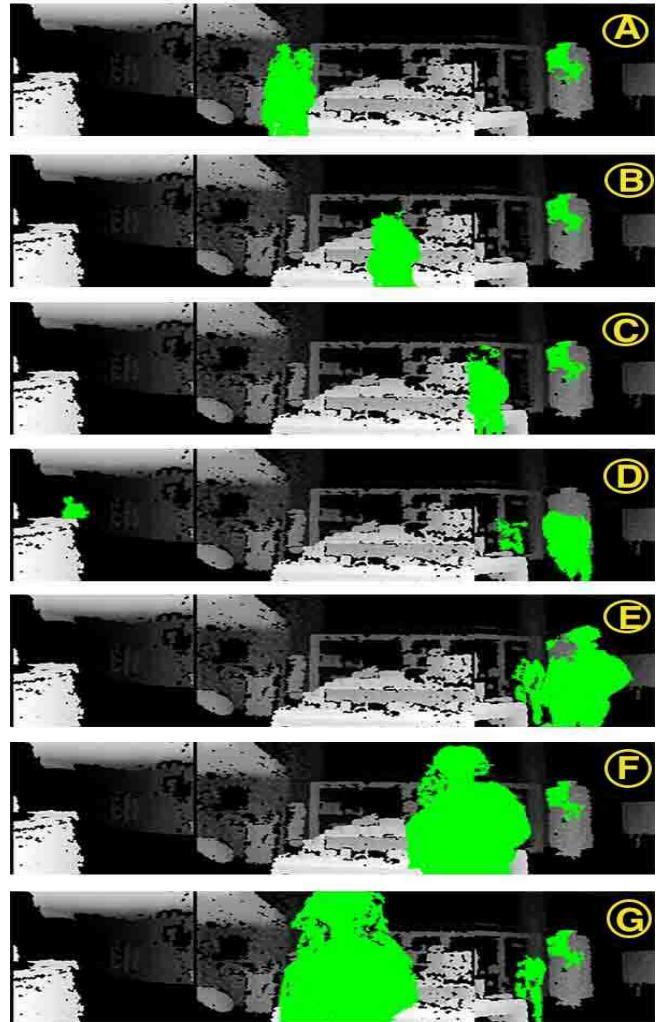


FIGURE 9.11: Landing effect

The chart below shows the frequencies of *Landing* and *Honeypot* effects for three days.

Days	Landing effect	Honeypot effect
8th April	3	3
9th April	2	5
10th April	1	2
Total	6	10

9.6.6 Other observations

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

- 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 effects* have occurred in this enhanced version too, as can be seen in the picture in the right. A lady was engaged with the screen for a while in frame (A), she was standing in the middle of the screen. In frame (B) she turned herself and called her friend, who was standing very far from the display and was busy looking to some books. In frame (C) her friend left the work and started to look at her and moved toward the screen. In frame (D) the lady was back busy with the screen, when in frame (E) her friend came closer to the screen. In frame(F) she gave a bit space for her friend to let him see the screen. And finally her friend also started interacting and experiencing with the advertisement in frame (G).

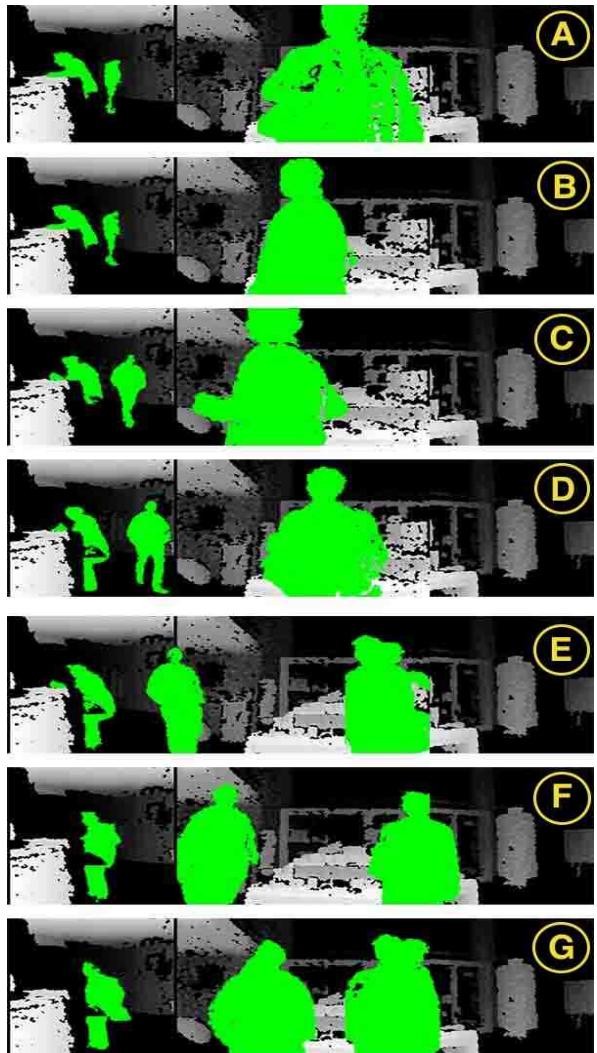


FIGURE 9.12: Calling others

- Noticing Interactivity earlier:

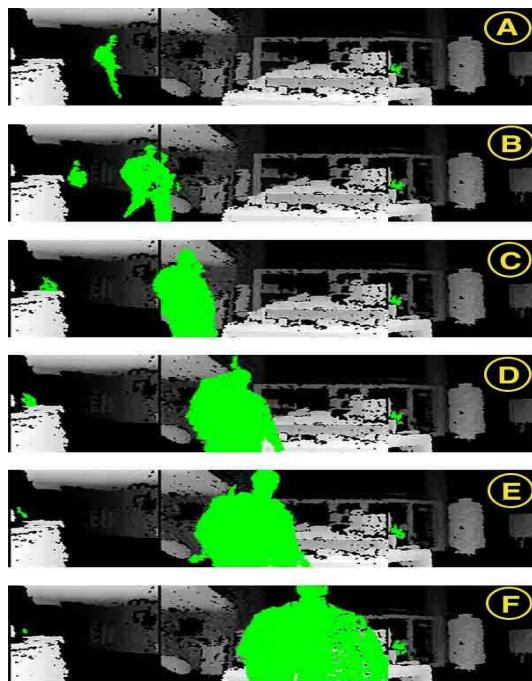


FIGURE 9.13: Noticing interactivity earlier.

Passersby also directly came from the corners of display without any sign of *Landing effect* toward the display and started interacting. This effect might have occurred because passersby had noticed themselves on the screen by 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 was walking by from the left side in frame (A) and continued his walking toward the screen until the person got closer and closer toward the middle of the screen. It is obvious that he is not passing by the screen, but he intentionally

stopped in the middle and started interacting.

- Side interaction:

The integration of Kinect cameras at the side provided people with some sort of passive interactions. Passersby or people, who were standing at the side of the display and could not come close to the screen, were still able to have some sort of connections with the system because they were tracked and shown. 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 was a girl standing at the left side of the picture. She was standing with her parents at the information desk, and she recognized herself in the screen by waving her hand to confirm if it is actually her. And then she started to play with the silhouette on the screen and had fun for a while without coming closer.

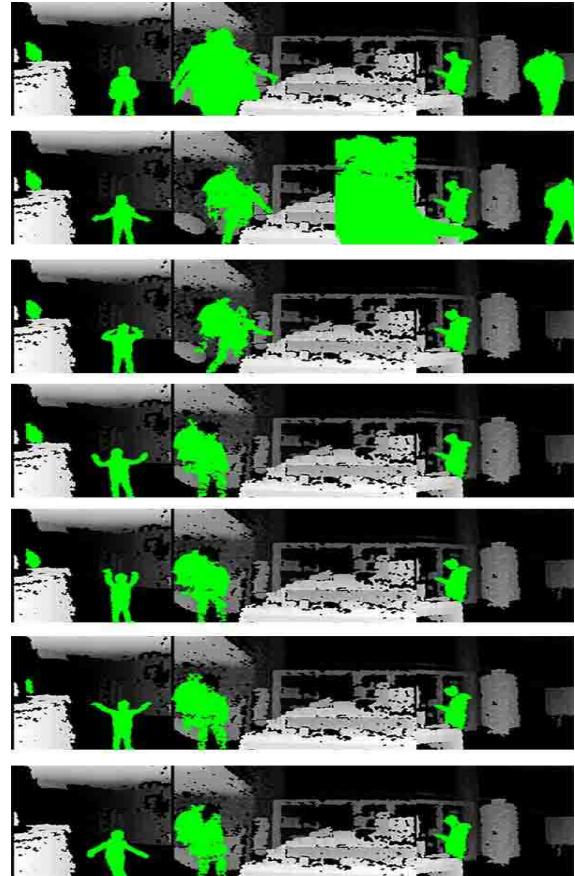


FIGURE 9.14: Side interaction

9.6.7 Comparison

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

1. Comparison of number of passersby

The number of passersby for different conditions may affect the findings. 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 9.1: 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 passersby in each of the conditions ($(F_{2,3})=0.1449, p > .05 (p=0.868)$). Because now the number of passersby were the same, I can perform other comparisons as below.

2. Attention Level comparison

The number of *Glances* and *Ignores* for both body interactive, enhanced body interactive and non-interactive advertisements were collected as the following table lists.

TABLE 9.2: 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
Enhanced 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. The test revealed $\chi^2(1, N=481)=4.5413$, $p < .05$ ($p=.033086$) they are statistically different and the enhanced body attraction technique does have a higher affect on the attention level.

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

3. Engaged and Non-engaged passersby

The numbers of *Engaged* and *Non-engaged* were recorded for all three conditions as below table demonstrates.

TABLE 9.3: Number of engaged passersby 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

To find if the amount of *Engaged* participants are different in these three conditions, *ANOVA* test was applied. The test reveals that there was statistical difference between these conditions, ($F_{2,3}=20.3154$, $p < .05$ ($p=0.0021$)). But still it is unknown that which pairs were statistically different, therefore I run Post-Hoc Tukey's HSD test as below.

TABLE 9.4: 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	* $p<0.05$

Group A, B and C refers to Non-interactive, body interactive and enhanced body interactive advertisement subsequently. Post-hoc Tukey computed the critical value (Studentized Range Q statistic) for A and C as, $Q_{critical}^{\alpha=0.01,k=6} = 6.3250$ and another critical value for B and C as, $Q_{critical}^{\alpha=0.05,k=6} = 4.3341$. Based on the values, the significance can

be determined if each pair's critical value(Tukey HSD Q statistic) is bigger than Studentized Range Q statistic. $Q_j^i > Q_{critical}$, and the strength of difference is determined by the P value as shown above.

From the diagram above it is very clear that non-interactive with body interactive is insignificant because their critical value is smaller than 4.3341 and $p > 0.05$. But the result was significant in the previous chapter because of all five days together but became insignificant with less number of days. On the other hand, the Non-interactive with enhanced body interactive is strongly significant because their critical value is bigger than 6.3250 with $p < 0.01$. The result of enhanced body compared to body interactive is also significant with $p < 0.05$. As a result the enhance body interactive had strongly increased the number of *Engaged* passersby compared to Non-interactive advertisement. The effect size between them are measured as below.

To find out how big was the difference between number of engaged passersby in non-interactive and enhanced body interactive conditions, the effect size by *eta squared* (η^2) was calculated. (η^2) is an effect size index for ANOVA, in which the SS_{effect} (sum of squared) between conditions is divided by SS_{total} (sum of squared) total. The below value was calculated by an online tool *Easycalculator*¹.

$$\eta^2 = \frac{SS_{effect}}{SS_{total}} = \frac{580.1687}{648.8354} = 0.8942 \approx 0.89$$

The 0.89 means that 89% of total variance is accounted for by the conditions enhanced body interactive, non-interactive effects.

4. Landing effect comparison

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

TABLE 9.5: 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

To find if the *Landing effect* was different between these conditions. ANOVA test applied, it states that there was no significant different between three days for all of the conditions, ($(F_{2,3})=1.857, p > .05 (p=0.236)$).

5. Honeypot effect comparison

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

TABLE 9.6: 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 three conditions too. ($(F_{2,3})=1.667, p > .05 (p=0.266)$)

¹easycalculator: <https://www.easycalculation.com/statistics/eta-square-calculator.php>, last accessed 15 june 2016

9.7 Discussions

The increase of attention level in enhanced body interactive advertisement version could have many reasons. (1) *Wide angle tracking*, the wide angle of display tracking in which participants could see themselves from different sides (left, center and right), if they had missed the left there was still two chances to see the center or the other corner. (2) *Exposure time*, the time passersby were exposed to their silhouette in three cameras facing (left, center, right) was longer than exposure time with only one camera. Normally it takes around 1.2 seconds to understand interactivity with silhouette with large screen that is in front of passersby [11].

Honeypot effect in both body and enhanced body interaction evaluations did not seem to be strong. There could be many general reasons for this effect, (1) *Environment*, the display was 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. (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, as a result they tend to ignore display. (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 passersby 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 *Landing effects* happened. One of the reasons could be that when the passer-by was walking from a far side of the display, he was already noticing the interactivity because he could see himself in the screen. And when he reached near to the screen, he was aware of the interactivity for sure and would not perform landing. And by that time he would have two options (a) start interacting, or (b) ignore the interaction and pass by the screen.

9.8 Conclusion

In conclusion, the enhanced body interactive version performed significantly better than body interactive technique. It has increased the attention level of passersby and dramatically raised the number of *Engaged* people in front of display. But the number of *Landing* and *Honeypot* effects were not significant compared to previous body interactive advertisement.

In enhance version, the number of *Glances* were 51% against the number of *Ignore*. It was very effective in attention level than other two conditions (non-interactive and body interactive), because the number of *Glances* were almost double than Non-interactive and 10% increase than body interactive. The findings show that for a display positioned in a sideway, this technique can increase the attention level significantly than non-interactive display.

The enhanced version also increased the number of *Engaged* people up to 15% of whole passersby during three days, which the body interactive could not achieve in five days. The findings state that the enhanced version significantly engaged people than body interactive, but the significance was not as strong as compared to Non-interactive which was above the double of percentage of engaged.

The above percentages could have increased if the silhouette color was not the same for all passersby. Representation of different silhouette colors can have effect on the attention level, and it might motivate passersby to get closer and get engaged. it would be very effective if this concern gets improved in future.

10

Conclusion

10.1 Summary of research

Public displays are in fact very complex research areas, and there are many reasons that could put the research at risk, for example, *display locations*, *Display sizes*, *Display orientation*, *Physical setup* and more. Additionally there is no commonly accepted method for public display evaluation. *Display locations*: the location of display also has influence on the attention level and motivations. If displays are located in front of the passersby could have different attention level compared to at sideway, or if the display is placed in a higher compared to placed in lower place [10]. *Display Size*: 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. The size can also influence on the attention level [10]. *Display orientation*: orientation also influences the behavior of people in, how they are angled (horizontal or vertical). Each condition will produce different results[17]. *Physical environment*: environment also has influence on attention and user behaviors. A display installed in a cafe or train station[3] would result in different outcomes compared to if installed in a library or workplace [3, ?]. Because of all the issues, 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. Therefore there is no commonly acceptable technique of evaluation for public displays [4].

Consequently, advertisings in public display also inherit the above issues in research field. Therefore in this study, specific conditions were taken in to account. The main study was conducted in *Tourist information center*, and interactive and non-interactive advertisements were developed for *Bauhaus-Walk*. 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 passersby, which would eventually lead to actions like participation in *Bauhaus-Walk* program. The study compared the attention, engagement and other behaviors of the advertisement conditions and briefly answered the research questions below.

- **How can the attention of the passersby be attracted?** (Chapter 3)

To design an attracting attention method for *Bauhaus-Walk* interactive advertisements, an intense background study was done on attracting attention. Based on the reviews three attracting attention methods (moving eye, firework and silhouette representation) were developed. The number of *Glances* of passersby were compared between these three methods and Non-interactive advertisement. Among the methods, only the silhouette representation significantly attracted more passersby. Additionally, this method is one of widely acceptable methods for interactive displays. As a result the silhouette representation was used for the rest of interactive advertisements.

- **What is the attention level of passersby in interactive (body and mobile) and non-interactive advertisement?** (Chapter 8 and 9)

The body interactive advertisement had the highest amount of *Glances* compared to the other advertisements. In Non-interactive advertisement 28.83%, in body interactive 41.41%, and in mobile version 33.76% of the passersby glanced toward the display. Enhanced body interactive advertisement strongly increased the number of *Glances* by 51.11% compared to Non-interactive and body interactive. The studies suggest that the interactive advertisements in all the conditions like body, mobile and enhanced body version, had higher attention level compared to non-interactive advertisement.

TABLE 10.1: Week sequence

Advertisement	Glanced passersby(%)	Ignored passersby
Non-Interactive	28.83%	71.17
Body Interactive	41.41%	88.44
Mobile Interactive	33.76%	66.24
Enhanced body Interactive	51.11%	48.89

- **How many passersby get engaged in interactive (body and mobile) and non-interactive advertisement?**

Involvement of passersby with the display, defines the effectiveness of advertisement. The involvement can be achieved if the passersby engage by watching the screen, reading or interacting with the advertisement display. In this study a person was marked as *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 passersby were engaged. 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 the game interaction using their body. From the whole passersby 11.56% of them were engaged with the display. The average engagement duration 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 with less interaction with their silhouette. But no interactions with the mobile devices were observed. Only 9% of the passersby were engaged with engagement duration of 22 seconds in average.

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

These findings recommend that enhanced and body advertisement engaged more participants than other advertisement techniques.

TABLE 10.2: Week sequence

Advertisement	Engaged passersby(%)	Engagement duration
Non-Interactive	7.66%	34 sec
Body Interactive	11.56%	42 sec
Mobile Interactive	9.0%	22 sec
Enhanced body Interactive	15.0%	32 sec

- **What are passersby behaviors toward interactive (body and mobile) and non-interactive advertisements?**

In non-interactive advertisement, the behaviors of passersby toward display were more passive, calm and natural. Passersby selectively came near the display and used it as a source of information. The *Display Blindness* was often observed, because a lot of passersby neglected the display. There was no influence of display on the environment around. Fewer *Landing effects* and *Honeypot effects* were also observed.

On the other hand, in the body interactive advertisement passersby were attracted quickly toward display. Passersby were curious about the display and they were waving hands or moving their body explicitly to learn 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 interactions were individuals and also in groups by calling other of their friends to join. Among 51 Engaged passersby, 17 of them ignored the advertisement video 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. Higher *Landing effects* and *Honeypot effects* were also observed.

In mobile interactive advertisement, the passersby's behaviors were like, 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. Not interacting could be because of being skeptical about usage of phone in public, not understanding the connectivity to system, feeling unsecure, or feeling inappropriate interaction in that space. Fewer *Landing effects* and *Honeypot effects* were also observed.

In the extended advertisement version, the behaviors were very similar to body interactive advertisement. People felt the sense of joy, fun and play. 61 Passersby 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. Less *Landing effects* and *Honeypot effects* were also observed.

10.1.1 Advertisement development cycle

The advertisement development cycle should mainly follow the advertising programs[85], and be evaluated with the use of HCI methods. The advertising program is defined with series of steps to take. (1) *Mission*, define the advertising objectives and goals. (2) *Cost*, define the budgets for advertising location, medium, duration etc. (3) *Message*, create advertising content, and evaluate the contents. (4) *Media*, select an advertising medium for advertising campaign. And finally (5) *Measurement*, to answer how the advertisement was effective. This thesis also partially followed this program for advertisement development and evaluations, which are discussed as below.

First and foremost, after many trials with university, I found *Bauhaus-Walk* program that provides short tours for tourists in Weimar. This program became the advertiser and this was the start of communication process with them. By conducting *Focus Groups* with *Bauhaus-Walk* team members, I decided various things like, target group, location, duration of advertising, advertising message of *Bauhaus-Walk* advertisement. The discussion was completed on two advertising prototypes and interactions techniques, which was body interactive and mobile interactive prototypes. These steps covered two essential programs (*Mission*, *Message*).

Secondly, the *Cost* was another issue, with which many things needed to be invested on like, (1)*advertising location*, but with the support of *Bauhaus-Walk* and Weimar tourist information center and university management, we could get the advertisement deployment for free which was for more than three weeks. Money needed to be spent on (2) *Devices*, I needed a large LCD monitor, computers, Kinect cameras and other electronic devices for implementation. But I managed to get them from the University different departments. If

the advertising were meant for long time and multiple locations, then it would have been expensive.

Thirdly, the advertising prototypes (body and mobile) were evaluated using usability and HCI methods, in which the advertising message, interaction and usability issues were evaluated. This consisted two evaluation of, (1) Low-Fi prototype evaluation and (2) Hi-fi prototype evaluation. These evaluations were very helpful to decide for the correct *Media, Message*. As a result three advertisements were developed which had the same content but different in interactivity, (1) Non-interactive, (2) Body interactive, and (3) mobile interactive.

Eventually, three of advertisements were deployed in Weimar Tourist information center each for one week. During those weeks different data gathering techniques were used like, direct observation, interviews of passersby, depth recording and system logs. After that based on some observations on attention another extended advertisement application was developed and deployed again in tourist information, and followed the same data gathering techniques. The new evaluation helped me to later assess the advertisement performance for each of the conditions.

10.1.2 Advertisement performance

The advertisement can perform better if the *conversion rate* is higher. The *Conversion rate* for *Bauhaus-walk* advertisement would be that, how many people participated in the walk after the advertisement campaign. The comparison of interactive and non-interactive advertisement of *Bauhaus-walk* was not to measure the final *conversion rate*, because of many reasons. (1) There were already other existing advertising campaigns for Bauhaus-Walk. (2) The duration of advertisement was limited to five days each. (3) Limited reachability to wide range of people in city. (4) You may never know the reason of a person joining the walk; it could be because of interactivity of advertisement or because someone has told the person a month before the advertisement campaign even started. (5) Might be the people are motivated by the advertisement but does not have time to join this week and might join the other week.

Instead of measuring the *conversion-rate*, the reasons that the conversion happens should be considered more. And if those reason are tackled then an effective and efficient advertisements can be developed. Those main reasons are the level of attention, motivations, involvement and emotions of people toward advertisement [84], that can positively change people's perception and attitude toward the product. This thesis compared these factors between Non-interactive, body interactive, mobile and extended body interactive advertisement, as discussed below.

10.1.3 Attracting attraction

Attracting attention of passersby is the most crucial phase for the public display advertising, while most of the passersby ignore the displays because of many reasons like. *Information overload* [39], they think advertisements are irrelevant, boring and distractive to them [40, 49]. 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 passersby know about display because of *display blindness*. Therefore *Bottom-Up* approaches suites best in public display scenarios. Interactive advertising can use this approach and react based on passersby 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. (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 passersby to get their attentions the most.

- **Extended silhouette representation**

This method was used to get passersby 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.

10.1.4 Motivation

To be motivated means *to be moved to do something*[55]. 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 exist and affects differently, which depends on person to person. Motivation is (1) Fun, (2) interesting, (3) captivating, (4) appealing, or has has (5) challenges, (6) fantasy or even (7) curiosity [51].

- **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 an 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 passersby 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.

10.1.5 Interaction

When the passersby 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 [79], 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 makes the user feel shy or embarrassment in public [15]. (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*. 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.

10.1.6 Passersby's Behavior around display

Passersby behave differently for certain types of display[62] and certain physical setup or environment [65, 11]. It is very crucial for advertisers to understand and know how the people react in front of their advertising displays, and that assists to develop an engaging and entertaining advertisement that could positively affect passersby perception and attitude toward advertiser's 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 and mobile interactive only 4 of engaged passersby performed *Landing effect*. Because passersby have not seen any obvious relation to the screen, even in mobile the access information page shown on top of the silhouette. But in body interactive 12 (10%) events of landing effects were observed which was 2 times higher than non-interactive. This is considered because of the clear silhouette representation and the *Call-to-Action* text that made passersby to land back. The comparisons between the conditions were 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.

10.1.7 Open Research Questions

Data gathering

The data gathered in this thesis was more from direct and indirect observations, which involved manually going through all depth images frame by frame to refine the data logs for accurate measurement. It would be more effective to create advanced techniques for data gathering in

public spaces in real time with high accuracy and less errors, there have been works on this as below.

Quantifying attention, there are many applications that count glances, like *IntraFace*¹[35] that can detect gaze direction by obtaining head orientation, extracting eye corners, detecting pupils and then finds out where is the person's gaze direction, But this works only for in a controlled environment with multi users. Another application was introduced in 2011 about the real world application of glance counting by F. De la Torre [36] that could measure the person glance toward display, record passersby speed and emotions. But I still personally doubt on these sort of applications in terms of accuracy and handling large amount of people glances and repeated glance of the same passer-by. With the use of new technologies in future these gaze detections would be more precise and stable.

It is easy to measure the *duration of engagement* with interactive advertisement In online marketing, and is easy to measure how often the person interacts during day, week or month. It is easy because the individual computers can be traced using their IP or Mac addresses or even user accounts in social medias. But in public displays the situation seems difficult because unknown people pass by the display, and it is hard to keep track of one person during the day or week to measure the duration of engagement. There are applications [36] using face detection algorithms that count the engagement durations but it is only for one time, the second time the person come is treated as a new person, or even there are a lot of false detection of faces and makes it hard to measure accurately. In future technologies I believe there will be more stable tracking applications to track users, but the display owners should deal with legal issues if people would allow to be tracked or not.

Impact of Advertisement types

This thesis compared the non-interactive and interactive advertisement in terms of performance and effectiveness, but has not quantified the amount of impact of advertisement on passersby, *Attitude* toward a the product, or *buying decision*. A very clear and precise evaluation techniques should be developed to assess the impacts of interactivity and non-interactivity of advertisement from various viewpoint and angles.

Enhanced silhouette color

The extended version was in fact a good solution to attract attention in the side way public display. The integration of multiple Kinects extended the range, but all the passersby had the same color because of the lack of implementation. An algorithm is required to keep track of passersby in all three cameras and give one consistent color to each individual. In this case every person will have their own dedicated color.

Mobile interaction improvement

The usability testing, which was conducted in the thesis showed that the mobile phone had performed extremely worse than body interaction technique. This is a major issue for public displays that use mobile phone interaction, and there is a need to research in this area from different perspectives like. (1) *usability issues*, the usability issues are shared with mobile device and public display at the same time, there is a need to create usability evaluation techniques to tackle usability issues on both devices simultaneously. (2) *Interaction technique*, create and develop interaction techniques that could be as easy as body interaction technique

¹Intraface: <http://www.humansensing.cs.cmu.edu/intraface/>, last accessed 12 jun 2016

with less amount of cognitive load to user. And (3) *Technology support*, the use of technology should be in a way that could support most famous platforms and at the same time it should be secure and reliable.

As stated before, the finding in tourist information center shows that no one interacted with mobile devices during the five-day deployment. Some of the apparent issues regarding mobile interaction, were *Physical setup, security, limited technology knowledge, lack of smartphones*, this raises questions that how to design a space for mobile interaction and increase trust between advertiser and passersby to allow them interact without any doubt.

Advertisement interaction design

The *Audience funnel*[2] interaction model consisted of 6 phases *Passing by, Implicit interaction, Subtle interaction, direction interaction, multiple interaction and follow-up actions*. But in this thesis the body interaction model design had one extra phase called *Ad video phase*, which was after the *direct interaction* phase. The findings show that people did not stay longer than 4 seconds in average to watch the advertisement video. This feature was a disturbance for the people, who were interacting and were engaged with the display. This feature leads to a point that people would not be engaged anymore and future interaction designs should not include this phase in interaction design. A better solution would be to integrate short video clips inside the interaction phase, so that the people do not feel disconnected with the application and can still continue interaction and watch video.

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Appendices

Attracting attention

A.1 Glance count sheet

Glance Count sheet

Date:
 Location:
 Observer:

Hour: minute			
:00			
:05			
:10			
:15			
:20			
:25			
:30			
:35			
:40			
:45			
:50			
:55			
:00			
:05			
:10			
:15			
:20			
:25			
:30			
:35			
:40			
:45			
:50			
:55			

Findings:

	Male	Female
Glances		
Ignored		
Total		

Symbols:

(F) === Female
 (M) === Male

(FFMMMM)
 (E)

== Group
 === Glanced Female

(M)
 (EFMMMM)

== Glanced Male
 === Glanced Group

FIGURE A.1: Glance count sheet

A.2 Interview Questionnaire

TABLE A.2: Questions

No.	Research Questions
1	Do you like advertisement on displays?
2	Which kind of advertisement do you like?
3	What is that makes advertisement annoying or interested for you?
4	What attracted you toward the screen?
5	What do you think about this type of technique?
6	Do yo have any other recommendations?
7	What do you know about Interactive Advertisement?
8	What is your expectation about interactive advertisement?

A.3 Interview consent form

Date: / /

Bauhaus-Universität Weimar

Human Computer Interaction Questionnaire Consent Form

This is a study of attention attraction toward screen, conducted by **Hasibullah Sahibzada** because of his thesis research on Interactive Advertisement Vs. Traditional Advertisement. The purpose of this study is to help improve advertisement using existing technology. You are being requested to **answer** the questions in the interview and at the same time being **audio recorded** to assist us in the study.

The identities of all people who participate will remain anonymous and will be kept confidential. Identifiable data will be stored securely in a password protected computer account. Your participation is entirely voluntary and you may quite at any time from the study.

Contact Information About the Project

If you have any concerns about your rights as a research subject, you may contact directly Hasibullah Sahibzada at Hasibullah.sahibzada@uni-weimar.de or at phone # 015216967648.

Signature: -----

FIGURE A.3: Interview consent form

A.4 Interview Color codes



FIGURE A.4: Good Advertisement

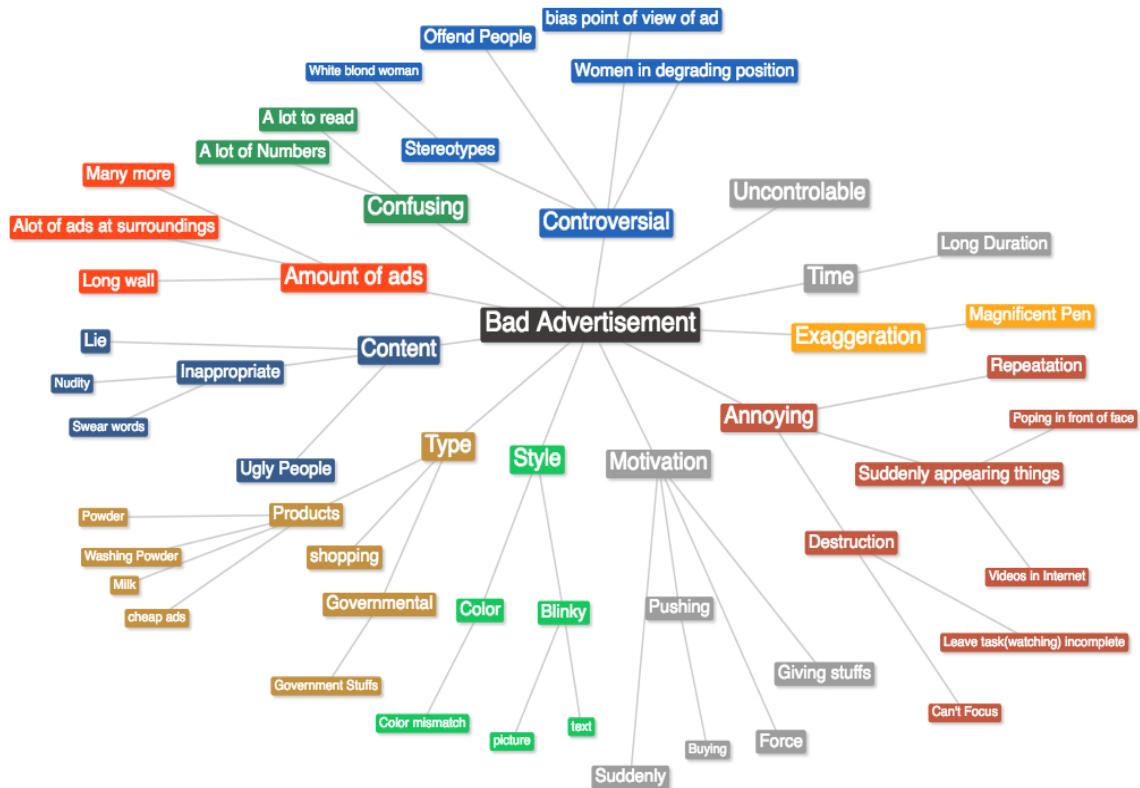


FIGURE A.5: Bad Advertisement

\mathcal{B}

Focus Group

B.1 First sketch

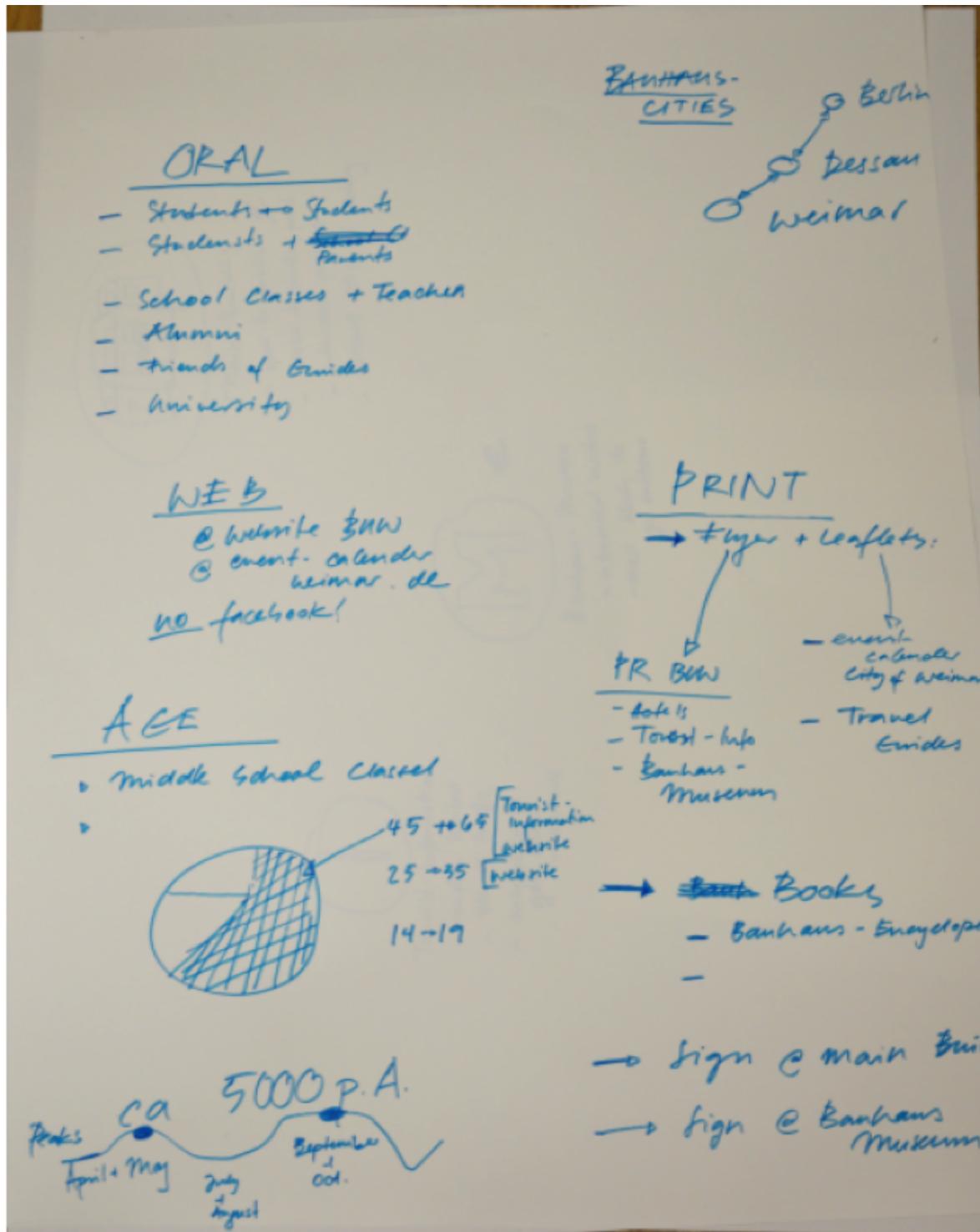


FIGURE B.1: First sketch

B.2 Second sketch

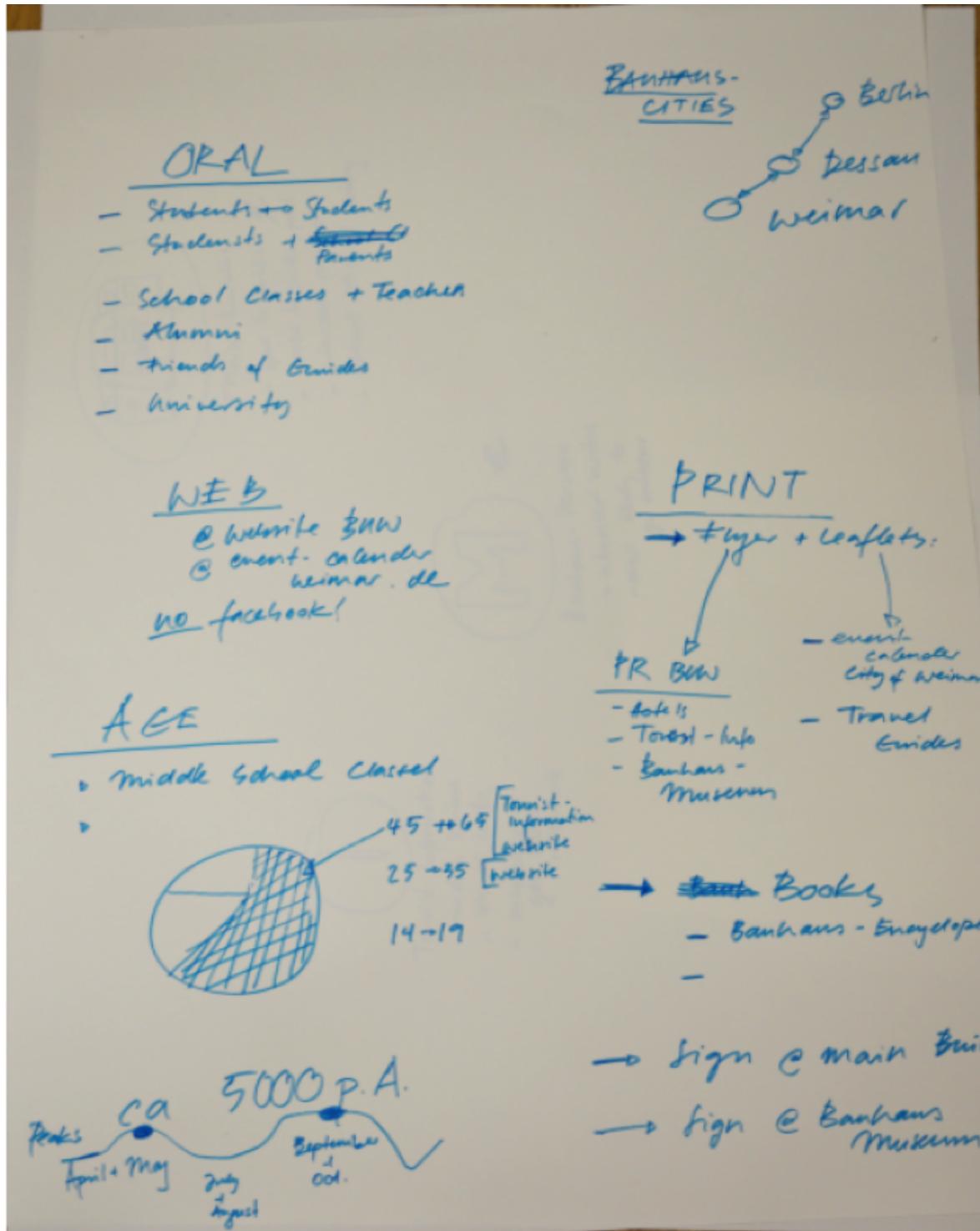


FIGURE B.2: Second sketch

B.3 Third sketch

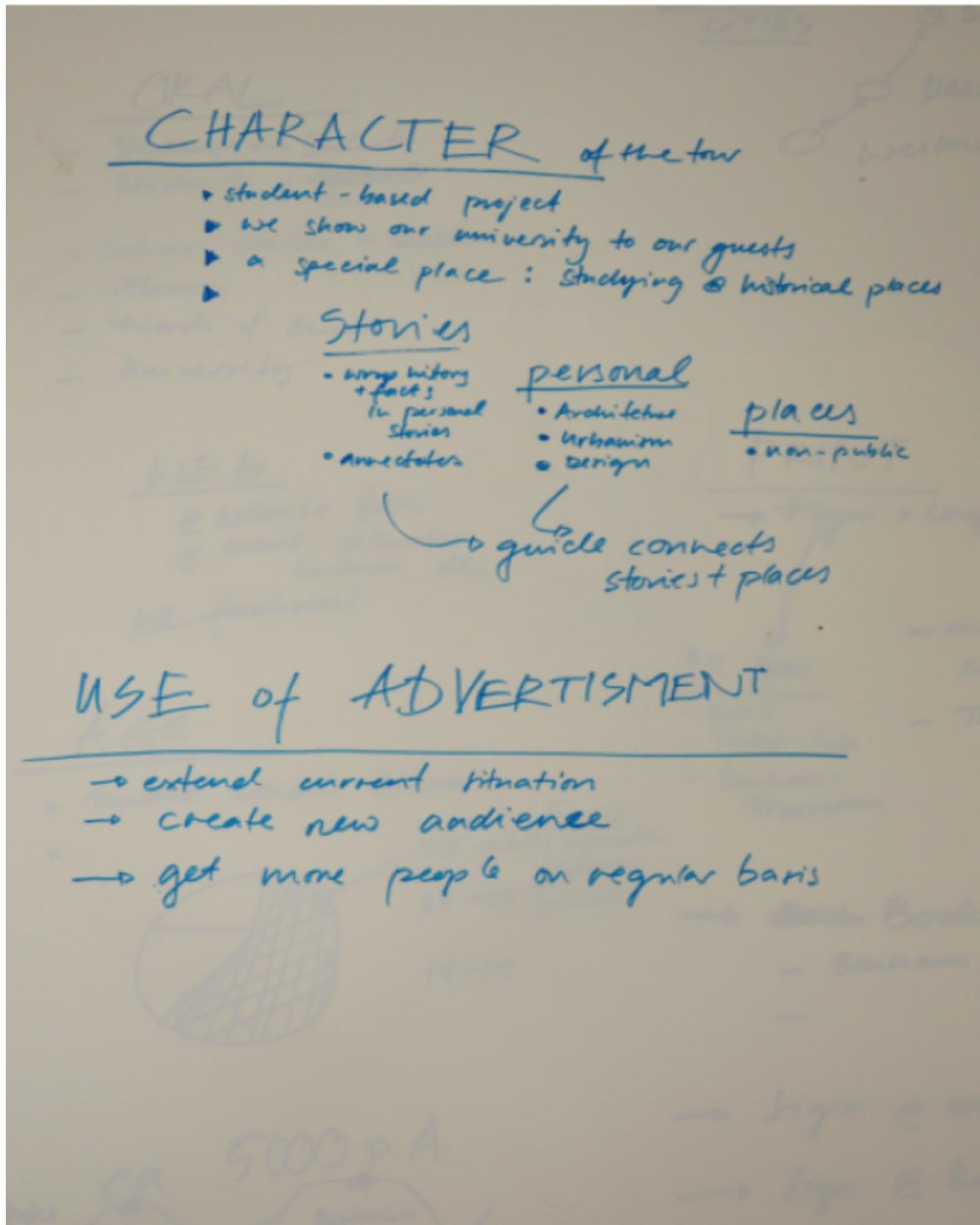


FIGURE B.3: Third sketch



C.1 Coded Interviews

	Like	Dislike	Confusing	Recommendations
Body	<ul style="list-style-type: none"> • Physical walking / Moving • Funny. • It is a good technique. • Interesting. • I liked obviously the body interactive prototype. • Easy fun and interesting. • Coming near to screen is a very nice. • Fast and easy. 	<ul style="list-style-type: none"> • Understanding the role or task. • Face was not understandable. • The face was so confusing. • I did not know him 	<ul style="list-style-type: none"> • Face character. • Not really sure what you are making. • But it makes people confused in the sense that if it is you then why not your face. • I did not get that the blue picture. • I did not understand that I am on the screen. • I did not know when I saw myself on the screen. 	<ul style="list-style-type: none"> • Show the route that we can follow • There I should be able to choose then it should show me like house of Goethe. • Change some colors. I do not have any other idea. • There could be instructions for that • If there are more colors and good design for the application would be more attractive,
Mobile	<ul style="list-style-type: none"> • It is good that you visit this place • Interesting. • Mobile was also fine. • I liked the QR code. 	<ul style="list-style-type: none"> • Not enough instructions. • A bit difficult. • Face was not understandable. • Mobile wanted a lot of login to write. • I do not like that the login part. • I do not like the login. • I guess typing the IP address was difficult for me 	<ul style="list-style-type: none"> • I did not understand what to do. • I could not understand what to do with it. • It said visit my houses or locations, but I had no houses. • I did not know how to change the face position. 	<ul style="list-style-type: none"> • It would be also good to show information about the locations I visited. • Some changes you can bring like more information about the houses. • I should not be forced to write my name or other information. The system should automatically get my phone IP address or something else. • I recommend about good fonts and design. • There must be like Do you want to try again after the game is over. • There should be instructions on how to use the face in the mobile.

FIGURE C.1: Interview codes

\mathcal{D}

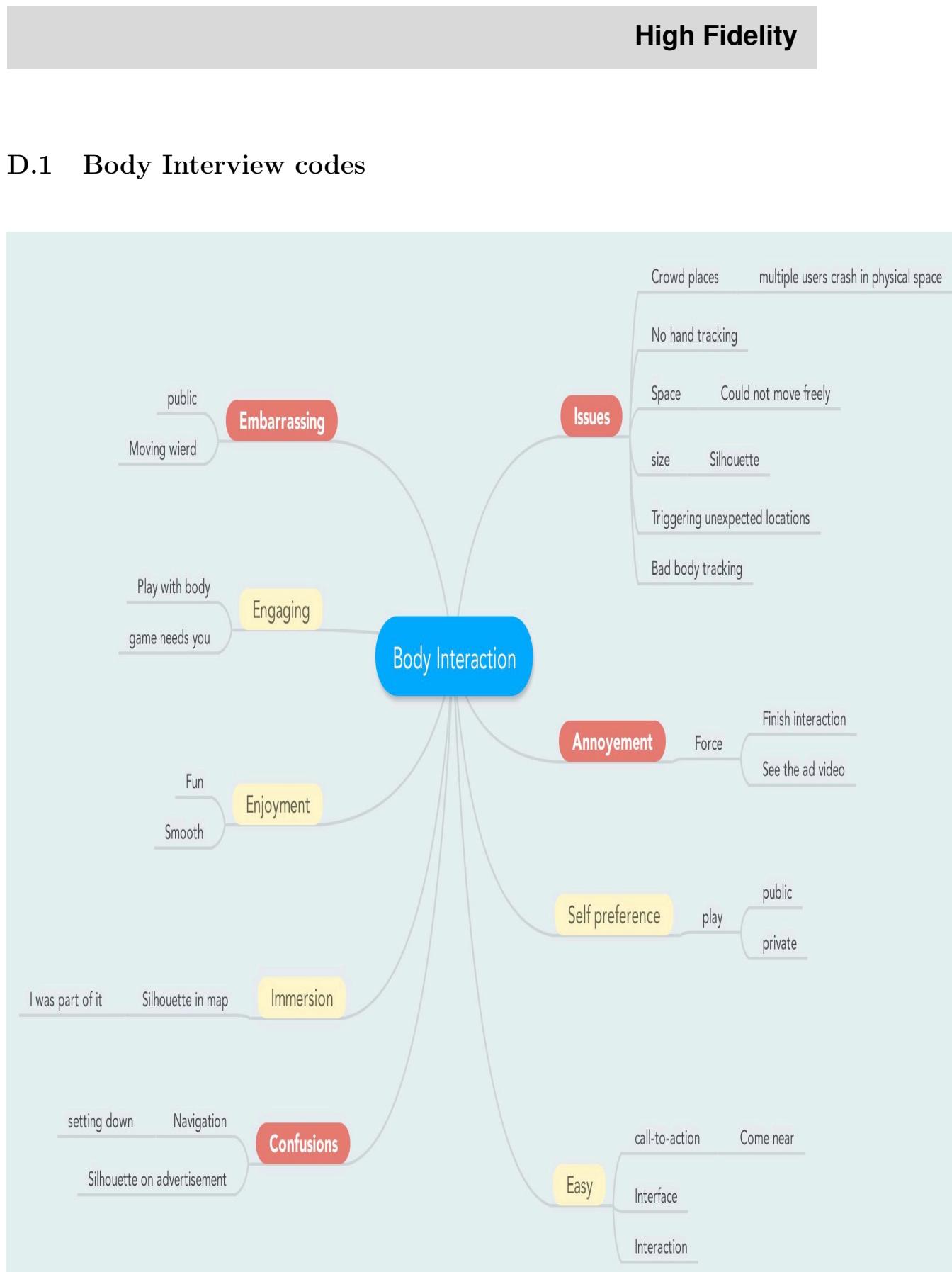


FIGURE D.1: Body Interview codes

D.2 Mobile Interview codes



FIGURE D.2: Mobile Interview codes

D.3 Participant performance

D.3.1 Body

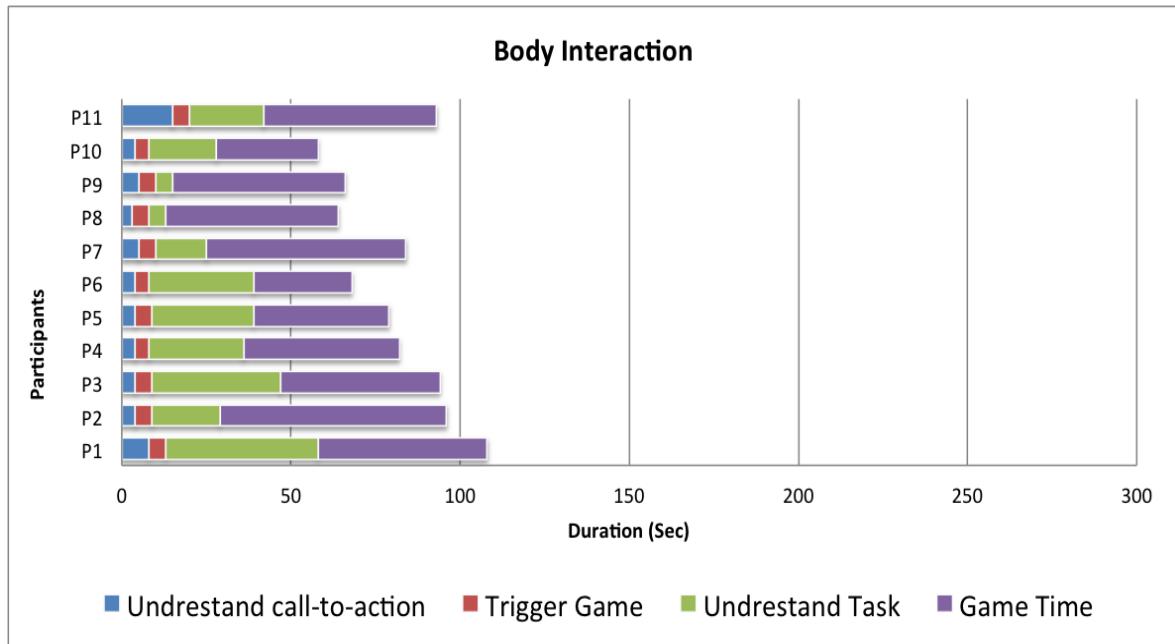


FIGURE D.3: Pariticipant's body performance

D.3.2 Mobile

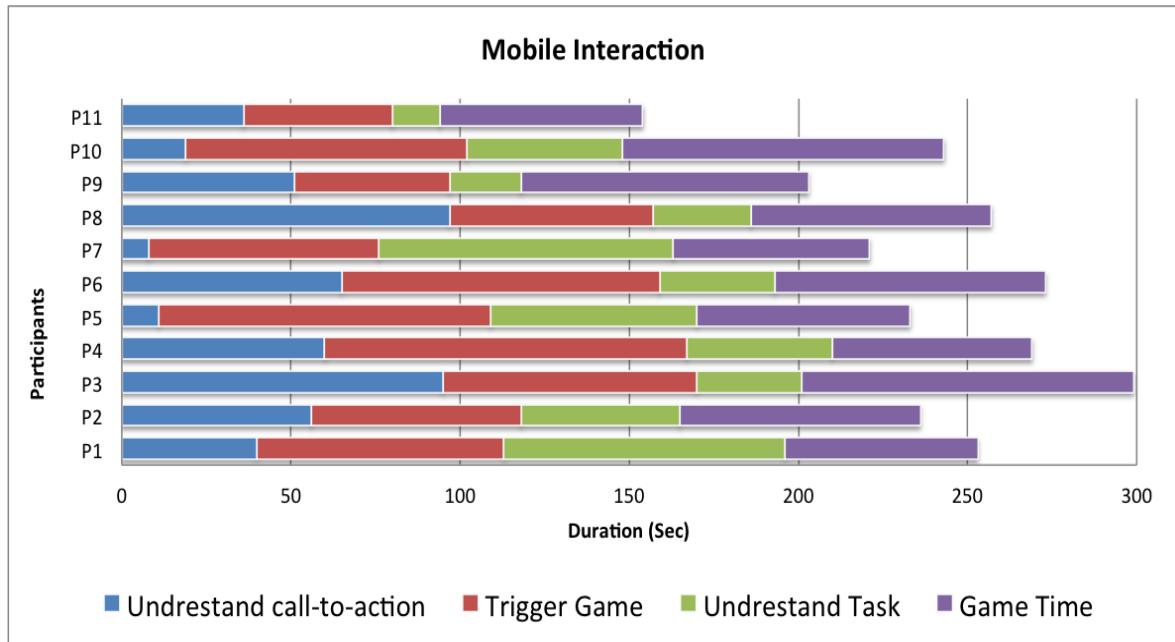


FIGURE D.4: Pariticipant's mobile performance

\mathcal{E}

Field Study

E.1 Interview Questionnaire

Non-Interactive questionnaire

(German version)

1. Um was handelte es sich bei der Werbung?
2. Würden Sie am Bauhaus-Spaziergang teilnehmen?
3. Hat Ihnen diese Art der Werbung gefallen? Bitte begründen Sie Ihre Antwort.
4. Haben Sie weitere Anmerkungen oder Verbesserungsvorschläge?

(English version)

1. What was the advertisement about?
2. Would like to take a tour with Bauhaus-Walk program?
3. Did you like this technique of advertisement? Why? Or Why not?
4. Do you have any other feedback and comments?

Body interactive questionnaire

(German version)

1. Haben Sie gesehen sich auf dem Display?
2. Wie haben Sie sich zum ersten Mal gesehen?
3. Um was handelte es sich bei der Werbung?
4. Würden Sie am Bauhaus-Spaziergang teilnehmen?
5. Hat Ihnen diese Art der Werbung gefallen? Bitte begründen Sie Ihre Antwort.
6. Haben Sie weitere Anmerkungen oder Verbesserungsvorschläge?

(English version)

1. Did you see yourself in the screen?
2. How did you see yourself at first time?
3. What was the advertisement about?
4. Do you want to take part in Bauhaus-Walk?
5. Do you like this kind of advertisement?
6. Do you have any other feedback and comments?

Mobile interactive questionnaire

(German version)

1. Um was handelte es sich bei der Werbung?
2. Möchten Sie Ihr Mobiltelefon für die Interaktion zu nutzen, warum / warum nicht?
3. Würden Sie am Bauhaus-Spaziergang teilnehmen?
4. Hat Ihnen diese Art der Werbung gefallen? Bitte begründen Sie Ihre Antwort.
5. Haben Sie weitere Anmerkungen oder Verbesserungsvorschläge?

(English version)

1. What was the advertisement about?
2. Do you like to use your mobile phone for interaction why/why not?
3. Would like to take a tour with Bauhaus-Walk program?
4. Did you like this technique of advertisement? Why? Or Why not?
5. Do you have any other feedback and comments?

FIGURE E.1: Interview questions for all conditions.

E.2 Non-Interactive glance count

Date	Timings	Glance counts				Total			
			M	F	Total		M	F	Total
2-Feb	10:00— 11:00	Glanced	10	7	17				
		Ignored	13	14	27				
	14:00— 15:00	Total	23	21	44				
		Glanced	2	3	5				
3-Feb	10:00— 11:00	Ignored	5	9	14				
		Total	7	12	19				
	15:00— 16:00	Glanced	2	3	5				
		Ignored	5	10	15				
4-Feb	11:00— 12:00	Total	7	13	20				
		Glanced	3	1	4				
	14:00- 15:00	Ignored	10	14	24				
		Total	13	15	28				
5-Feb	11:00— 12:00	Glanced	7	6	13				
		Ignored	14	16	30				
	15:00 – 16:00	Total	21	22	43				
		Glanced	4	8	12				
6-Feb	10:00— 12:00	Ignored	20	23	43				
		Total	24	31	55				
	11:00— 12:00	Glanced	15	15	30				
		Ignored	32	38	70				
7-Feb	11:00— 12:00	Total	47	53	100				
		Glanced	11	9	20				
	11:00— 12:00	Ignored	19	28	47				
		Total	30	37	67				

FIGURE E.2: Non-interactive glance counts

E.3 Body Interactive glance count

Date	Timings	Glance counts				Total			
			M	F	Total		M	F	Total
10-Feb	11:00— 12:00	Glanced	8	7	15	Glanced	10	8	18
		Ignored	8	8	16	Ignored	12	14	26
	15:00— 16:00	Total	16	15	31	Total	22	22	44
		Glanced	2	1	3	Glanced	13	11	24
11-Feb	10:00— 11:00	Ignored	4	6	10	Ignored	18	27	45
		Total	6	7	13	Total	31	38	69
	15:00— 16:00	Glanced	7	3	10	Glanced	6	8	14
		Ignored	10	13	23	Ignored	8	14	22
12-Feb	11:00— 12:00	Total	17	16	33	Total	14	22	36
		Glanced	4	6	10	Glanced	2	10	12
	14:00— 15:00	Ignored	2	10	12	Ignored	5	12	17
		Total	6	16	22	Total	7	17	24
16-Feb	10:00— 11:00	Glanced	4	9	13	Glanced	4	9	13
		Ignored	6	7	13	Ignored	6	7	13
	14:00— 15:00	Total	10	16	26	Total	10	16	26
		Glanced	4	3	7	Glanced	4	3	7
13-Feb	10:00— 11:00	Ignored	3	8	11	Ignored	3	8	11
		Total	7	11	18	Total	7	11	18
	10:00— 11:00	Glanced	12	11	23	Glanced	12	11	23
		Ignored	11	15	26	Ignored	11	15	26
14-Feb	10:00— 11:00	Total	23	26	49	Total	23	26	49
		Glanced	7	15	22	Glanced	7	15	22
	10:00— 11:00	Ignored	12	14	26	Ignored	12	14	26
		Total	19	29	48	Total	19	29	48

FIGURE E.3: Body interactive glance counts

E.4 Body Interactive glance count

Date	Timings	Glance counts	Total																																
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FIGURE E.4: Mobile interactive glance counts

E.5 Non-Interactive interview code



FIGURE E.5: Non-Interactive interview code

E.6 Body Interactive interview code



FIGURE E.6: Body Interactive interview code

E.7 Mobile Interactive interview code



FIGURE E.7: Mobile Interactive interview code

E.8 Non-Interactive observation notes

Date	Notes
1 st Feb	<p>Observations:</p> <ul style="list-style-type: none"> • There are many people but no one watch the screen. • 14:20: A man is reading the screen. • The woman waiting long time in desk watched the advertisement once for 10 sec. • 15:36: People do not look at advertisement at all. <p>Comments:</p> <ul style="list-style-type: none"> • People lose interest after some pictures popping up.
2 nd Feb Cloudy	<p>Observations:</p> <ul style="list-style-type: none"> • 10:28: an employee noticed and came back to see the content of advertisement for 4 sec. • A man noticed for 15 sec. • 10:43: A man busy with his phone in front of the screen is waiting for his friend. He started reading the advertisement and came near, he is curious about Kinect Camera. 14 sec • A man is watching screen from information desk location. • 11:21: Two couples saw ad completed two times, the woman asked the man to see the ad. • 14:51: Two people watched the ad two times; they stopped looking when it repeated for the third time. • 12:36: A group read the advertisement. <p>Comments:</p> <ul style="list-style-type: none"> • People look at the interesting objects in front of the screen.
3 rd Feb Cloudy / cold	<p>Observations</p> <ul style="list-style-type: none"> • 14:41: The weather is sunny and a bit warm. • Asked the employee, how many people come per day? She replied that around 100-120 people from which some come to get information and some only see around. • 14:46: an interviewee asked me about the advertisement to give him some more detail, so I showed him the screen. • 15:30: A woman stood with her phone and glanced. She is talking while standing near screen.
4 th Feb weather cloudy cold	<p>Observations</p> <ul style="list-style-type: none"> • 11:14: An employee is standing to see ad for one time complete. She came again to see advertisement she is reading the content. She came to ask me about the price and I approached to take her interview, but she refused to sign in the consent form and she left. • 11:58: A man reads the entire ad and for second time. He approached after talking receptionist again and asked his friend and laughed. • Another man saw the previous man and saw the screen.
5 th Feb Cloudy and warm	<p>Observations</p> <ul style="list-style-type: none"> • 10:52: A woman looked the advertisement for a while (half). • 11:20: A woman saw the ad and pulled her husband to see the ad and kept looking for brochure around. • 11:40: A man came after a while again and fully saw the advertisement. • 11:53: The man saw the ad and came closer to ad and looked for complete and then the friend came also and joint to read for two times. They also asked about ticket from help desk. • 11:51: A man saw ad while his wife was playing the music with handle. • 15:15: An employee first time noticed the advertisement while passing the screen. And then walked back to see the content. • 15:35: A couple see ad and standing to see more about the city from the screen. And later they asked about the Bauhaus Atelier from help desk. <p>Comments</p> <ul style="list-style-type: none"> • Normally people come in couple, ones ask questions from information Desk while the other looks around, and finishes when questions or work is done by the first person. • Today there are many people coming inside. • In front of monitor on the table there is an interactive music player that with handle movement music plays. • People are looking things random and want to find something interesting.
6 th Feb Partially cloudy Warm	<p>Observations</p> <ul style="list-style-type: none"> • Two men want to see map with advertisement. • 10:40: A woman looking at the screen. • 10:58: A man looked the entire ad. <p>Comments</p> <ul style="list-style-type: none"> • Today a lot of people coming inside. • 11:30: The people are less; no one looks to the screen to read.
7 th Feb Warm / cloudy	<p>Observations</p> <ul style="list-style-type: none"> • A man is standing and read the entire ad. • 14:40: People are very less now. <p>Comments</p> <ul style="list-style-type: none"> • People are coming and the center is very crowded. • A lot of people are playing piano with the handle. • People look for brochures.

FIGURE E.8: Non-Interactive observation notes

E.9 Body Interactive observation notes

Date	Notes
10 th Feb Sunny / cold	<p>Observations:</p> <ul style="list-style-type: none"> A boy noticed himself and then showed others that there is a Kinect camera. 11:44: A man saw himself and starred for a while and moved out. 14:23: Two office employees passed by screen and saw themselves on the screen and the first woman told and pointed on the screen and showed his partner. 14:05: I was working in the screen. 14:27: A man saw the screen but did not perceive even his silhouette was projected on the screen. 14:47: A man saw himself on the screen, but turned back. Two couples noticed the screen. 15:49: The man noticed and ignored <p>Comments:</p> <ul style="list-style-type: none"> People are very less. System got overloaded because of the recording silhouette. The reason people do not notice is because it is at corner of desk and people tend to change their head orientation toward the table, which has items.
11 th Feb Sunny / cold	<p>Observations:</p> <ul style="list-style-type: none"> 10:15: an employee is arranging books in front of the screen. 10:22: A woman saw and then ignored to interact. 10:47: A man noticed and attempted to start the game, but left quickly less than 2 sec and the game could be started. 10:59: Three young boys saw the Kinect and stood for a while beside the screen, and did not understand how it works because they were out of camera range and Kinect could not project their silhouette. 11:08: A girl saw herself and then did not approach. 11:17: A couple noticed themselves from back side of the table in the screen, to confirm if actually they were, they started waving to see the feedback, then both of them came near to screen, the boy started the game by coming more closer and completed one task, but left because he was called by her friend to leave for city tour. 11:46: A man noticed and then stood in front of the screen but did not proceed to trigger the game, instead he called his child to play. The girl triggered the game but she was standing very close to the screen and camera could not track her, she saw the alert message to raise her hand and so she did, but nothing happened because she was close. Then she tried to touch the screen on the locations that were blinking in the game. But nothing happened she got frustrated and left. 12:52: Three of the employees tried the system individually, Each had the touch event on the screen. 14:42: Two people noticed and approached to the screen, but could not open because they were very close to the screen. 15:10: An employee started the game but did not know how to work because she could not see her silhouette. She started to touch the screen thinking that it is touch. <p>Observations</p> <ul style="list-style-type: none"> 10:10: A man saw himself but he ignored 11:26: A child saw her in the screen and moved toward the screen and smiled. 11:40: Eva Hornecker came; we slightly changed the camera angle toward the entrance. 14:15: A man standing beside the screen, accidentally triggered the game, because camera was facing to the right side. A boy is looking the screen from far away 14:18: The man noticed the screen after he triggered the game accidentally, but then he did not continue and surprisingly came near to the screen and completed a task without noticing. 14:22: I showed the advertisement for two people that asked me how it works. 14:36: A man saw the screen and stood for a while and seemed he read the Call-to-Action text but he did not approach and then left the screen. (I wanted to know the reason by taking interview but he did not participate because of the city tour he had at that time.) 15:16: A girl accidentally triggered the game. 15:22: An old lady noticed herself in screen and moved a bit to confirm but turned away. 15:27: A girl noticed herself but did not understand what to do the instruction was not shown because she was beside the screen. <p>Comments</p> <ul style="list-style-type: none"> Some people see a lot of detail in the posters and brochures and wall in tourist information center.
12 th Feb Sunny / cold	<p>Observations</p> <ul style="list-style-type: none"> 10:00: The monitor face slightly changed to the entrance. 10:12: A man approached but was not able to play with the game because he was close enough to the screen. 10:25: A woman noticed and moved a bit to confirm and left. 10:27: The above woman saw her again but did not do anything. She was waiting for information desk. 10:42: Two couples tried to interact, the girl started interacting and the boy kept looking the girl's interaction, the boy left because of a work the girl continued to do a task. And then left. 10:48: Two boys came to try the application but application crashed. 11:32: A woman accidentally stood beside table and triggered the game 3 times and left without noticing it. Because the camera and screen are not in right orientation. 12:00: The screen rotated opposite to the entrance. Two people noticed and looked at screen but did not approach to play. 13:15: The system crashed for the second time while I was introducing the system to an employee. <p>Comments</p> <ul style="list-style-type: none"> People wait at information desk and their first priority is to get their job done, and interaction with the game comes in their least priority. Path way is a problem for people in order to use the body interaction, because people do not want to block others way by interacting. Application should not be at side of information desk. People avoid these sides, because they might feel to be noticed or asked questions (may I help you?). People take much more time looking things on the tables, which is in front of the monitor. People always try to interact with their hand, like raising their hand that could be also the effect of the alert function.
13 th Feb Sunny / warm	

FIGURE E.9: Body Interactive observation notes (1)

	<ul style="list-style-type: none"> The employee liked it to be with a keyboard like buttons or different buttons not with body, because body seemed difficult. Use basic elements that could be easy to understand like handle or moving hand, touch or something other.
14th Feb Cloudy / Rainy and cold	<p>Observations</p> <ul style="list-style-type: none"> 10:03: Very less people coming currently. A person looking at the sides and wall, now interacting with the headphone. 10:17: A woman noticed someone else in the screen from information desk. 10:19: A girl noticed herself others also saw it, and pointed to the screen meanwhile another boy noticed from her pointing and went near to the screen and triggered the game and left because he was called by his friend. 10:22: Two couples played the game, the girl played most of the tasks. 10:24: Another girl did interact when the interaction finished, after a second she left because she lost interest to see the advertisement. 10:25: A man stood to see what is going on but did not interact. 10:30: Weather became cloudy. 10:42: A girl interacted with the screen, but could not play because she was touching the screen. She kept reading and watching the screen. 10:50: A woman triggered the game but did not succeed to play, she understood that she could play with body, but could not because of the space, which was occupied by other person. 11:00: The sun is shining on the Kinect camera, makes it difficult for people detection. 11:33: A girl saw and told to other girl to play with and did two tasks. And the time passed they left. Meanwhile another girl noticed them interacting with the screen. 11:50: A boy noticed himself and wanted to interact, his sister held him up to be visible for the screen, he asked his father to show him how the system works, His sister triggered the game and did two tasks and when got over they left did not completely saw advertisement. 12:00: A man tried to play, his silhouette was projected on the screen, but he did not understand and kept touching screen and when the game time elapsed he left. 12:02: A woman triggered the game. She had tried it before with her daughter too she saw the advertisement too. 12:07: The employee was curious and tried to trigger but did not do it and saw me. 12:10: A woman noticed the screen, but did not approach the screen, and she turned back. 13:55: A man came near and triggered the game and did one task but did not continue then left with his two kids. <p>Comments</p> <ul style="list-style-type: none"> The instruction while playing the game should be visible and clear; the time for game instruction is not enough. Attraction and engagement rate is higher but people take less time to see the entire ad.
15th Feb Partially cloudy Warm	<p>Observations</p> <ul style="list-style-type: none"> 11:43: A man saw himself stood and then left. 14:18: A woman approached to screen but did not understand what to do she was touching the screen. 14:35: A man noticed the screen, triggered the game and explored some locations by moving his body, but was not interested and left with his two kids. 15:17: An old woman noticed herself and pointed for her husband and read the Call-to-Action but she did not approached and laughed. <p>Comments</p>
16th Feb Cloudy / cold	<p>Observations</p> <ul style="list-style-type: none"> 10:05: A group of students noticed and then explored locations, a participant tried to lean down to reach to the objects then she learnt by moving her body. Another group saw the first group and came to check out what is going on. This group just played with the body silhouette. 10:22: A woman saw her in the screen. 10:42: A man tried 4 times to get to know the functionality of the system and now he is trying again. 10:57: A girl saw herself but did not come in center to Call-to-Action be triggered. 11:40: A boy noticed himself and looked strange on the screen. 11:42: Another group noticed and triggered the game. A boy triggered the game and did two tasks but his mother was angry on him and did not allow him to play. 15:53: Two boys noticed, triggered and explored the game and saw the advertisement. The above boy's father also noticed and was looking to the boys interaction. <p>Comments</p> <ul style="list-style-type: none"> With small sized screen, it is good not to show a whole group because they do not seem to fit in the screen and physical area. May be show a circle like alert around small silhouette while playing to drag user attention two or three times. Alert participants to move back if they are very near to the screen.

FIGURE E.10: Body Interactive observation notes (2)

E.10 Mobile Interactive observation notes

Date	Notes
17 th Feb	<p>Observations:</p> <ul style="list-style-type: none"> • 10:47: A man saw by waving his hand but did not continue to approach. • 10:51: Another man also saw the screen and his silhouette too. • 11:29: A woman noticed her but did not do anything, probably because of the phone. • 11:30: Another woman notice again but did not approach. • 14:03: A kid saw her and then her mother noticed that they are playing with their image. • 14:50: The employees are arranging the books on the table. • 15:00: No one has played with the advertisement until now. <p>Comments:</p> <ul style="list-style-type: none"> • Because of the books and other items on the table people look down most of the time, which drives their attention away from other things, placed up (screen). • I approached to a person for an interview but he denied and said I do not have any idea how it works. • Most old people do not have a phone, or if they have one, they do not know the functionality to use. • The mobile is a big restriction for old aged and youngsters for interaction.
18 th Feb	<p>Observations:</p> <ul style="list-style-type: none"> • 10:00: Screen orientation changed toward entrance. • 11:56: A man glanced two times (1st non-intentionally, 2nd time intentionally). • 14:00: Screen orientation changed opposite to entrance. • 14:05: Man saw himself when turned him self from front table. But did not interact.. <p>Comments:</p> <ul style="list-style-type: none"> • For mobile maybe people do not prefer to stand and interact, It is better to give people enough time somewhere to sit and make decision to interact with their phones. • It does not make sense interacting with their phones while the monitor is at their hand reach. • Mobile phones should be used for far hand reach and big screens or projection wall. • Because of amount of less people, very less glances were observed and no one has interacted with advertisement.
19 th Feb	<p>Observations:</p> <ul style="list-style-type: none"> • 10:00: Monitor positioned back to its original position. • A woman noticed the screen, and read the information text on the screen, but could not interact because she had an old Nokia phone, which was not compatible to operate. She was one of the guide tour who had seen the body interaction too. • 14:00: I interacted with the advertisement many times to drag people attention and the usage and give them some sort of encouragement. • 14:35: I played once again while 4 people were standing behind me. <p>Comments:</p> <ul style="list-style-type: none"> • Mobile phone takes longer time to operate. • Less glances made to the screen, maybe because of the access information text rendered on top, which blocks full silhouette representation. • In tourist information people tend to get information as quick as possible; to restrict the advertisement with mobile phone, which consumes time, would not be a good choice. • Mobile interaction is very private to one person and does not drive others attention toward the people interacting.
20 th Feb	<p>Observations:</p> <ul style="list-style-type: none"> • 10:05: A boy noticed and took his phone out and scanned the QR-Code but his mother called him and left. • 10:25: A girl and a boy are seeing their body and having fun many times, just playing with their silhouette. Which drove their mothers attention too. • 10:45: I played in crowd and some of the people around noticed, but no interaction happened. • 11:00: Many children are playing with the screen using body and jumping up and down. • 11:35: A man waved on to the screen and came near to the screen, after reading the information text he left. • 13:15: Two people discuss on the application, they are curious about it. <p>Comments</p> <ul style="list-style-type: none"> • Do a survey for mobile usage in public displays in places like tourist information center.
21 th Feb	<p>Observations</p> <ul style="list-style-type: none"> • 10:00: The screen height got reduced and the screen and Kinect is facing diagonal. • 10:46: A man saw the screen for 3 seconds but did not play. • 10:48: Another man also noticed but did not approached to play. <p>Comments</p> <ul style="list-style-type: none"> • The diagonal setup of the monitor suites where people see things facing down on the table.

FIGURE E.11: Mobile Interactive observation notes



Enhanced body interactive Field Study

F.1 Enhanced Interactive advertisement Glance count

Date	Timings	Glance counts				Total			
			M	F	Total		M	F	Total
8-Apr	10:00—11:00	Glanced	7	9	16	Glanced	20	18	38
		Ignored	4	10	14	Ignored	13	21	34
	15:00—16:00	Total	11	19	30	Total	33	39	72
		Glanced	13	9	22	Glanced	16	20	36
9-Apr	10:00—11:00	Ignored	9	11	20	Ignored	19	22	41
		Total	22	20	42	Total	35	42	77
	14:00—15:00	Glanced	8	10	18	Glanced	16	25	41
		Ignored	10	13	23	Ignored	16	19	35
10-Apr	10:00—11:00	Total	18	23	41	Total	32	44	76
		Glanced	8	10	18	Glanced	9	19	28
	11:00—12:00	Ignored	9	9	18	Ignored	13	11	24
		Total	17	19	36	Total	22	30	52

FIGURE F.1: Enhanced Interactive advertisement Glance count

F.2 Enhanced Interactive observation notes

Date	Notes
8 th April Sunny /cloudy	<p>Observations:</p> <ul style="list-style-type: none"> • 9:56: A man tried to trigger the game, he really liked the system and he played two times, and he later explained to other of his friends. • 10:00: A woman is playing, and her husband is standing behind to see her playing. • 10:31: A man triggered the game, and played the game. • 11:08: The man triggered the game and when advertisement came, he left. • 11:11: A man accidentally triggered the game. • 11:13: Two girls noticed the screen and are playing together, they were having fun and stop seeing ad. • 11:33: Two couples noticed themselves from the corner and then started the game and played. • 11:48: Man triggered the game and is now playing, after that his wife came to interact too. • 14:19: A man saw and triggered the game. • 14:26: Old people ignored the screen the woman saw herself and then ignored the screen. • 14:45: Two groups started the game, but could not play because they were very near and they started touching the screen. • 14:48: Two people played, the woman cloud not but the man did play two or three tasks, he came again when ad finished to play it was interesting for him and then he came for the third time. • 14:55: The woman saw from the information desk. • 15:08: A man played and after sometimes, he realized that all his friends have left. He was so immersed. <p>Comments:</p> <ul style="list-style-type: none"> • If people are more targeted to a direction or work, then there is very little glance, but if they are looking around in the center then there is possibility of glancing toward the screen. • Most young audience interacts with the screen. • The interaction is memorable, a girl who had already interacted with the system came again and saw the screen and did another interaction. • Participants come very near and cannot see their silhouette. • People tend to bend to navigate back and they learn after they move a bit.
9 th April Sunny	<p>Observations:</p> <ul style="list-style-type: none"> • 10:17: A woman triggered the game while a man standing beside the screen. • 10:21: A man played with the game, but left it after a while. • 10:28: A boy noticed and brought his parents to play. • 10:30: The boy is playing and while standing a man noticed himself. • 11:32: The man called his wife to see the screen. • 10:34: A couple was waiting and saw themselves. • 10:36: A woman saw herself from far and then ignored the screen. • 10:51: A man triggered the game and he was standing very near, and he starting to touch the screen and he felt bad. • 11:03: A man triggered the game and called his friends too, they left when they saw the advertisement.
19 th April Sunny	<p>Observations</p> <ul style="list-style-type: none"> • The man is looking a lot now he started the game and he is not moving to play the game. <p>Comments</p> <ul style="list-style-type: none"> • Some participants only stare the screen and not doing any physical activity like moving even the silhouette is projected on the screen. They think a lot and when nothing happens suddenly the move away and do not see the screen afterward. • I guess the people that stand still and think could actually reading the map contents.

FIGURE F.2: Enhanced Interactive observation notes



Title	Path
Attracting attention	1. ./Researchdata/AttractingAttention/DataGathering/Pics/ 2. ./Researchdata/AttractingAttention/DataGathering/Interviews/ 3. ./Researchdata/AttractingAttention/Analysing/Glances 4. ./Researchdata/AttractingAttention/Analysing/Interviews/result/ 5. ./Researchdata/AttractingAttention/Analysing/Interviews/Coded_transcripts/
Focus Group	1. ./Researchdata/ FocusGroup/FocusGroupParticipationConsentForm.pdf 2. ./Researchdata/ FocusGroup/Session_1/ 3. ./Researchdata/ FocusGroup/Session_2/
Low Fidelithy	1. ./Researchdata/Low-Fi/Interviewcodings/ 2. ./Researchdata/Low-Fi/Materials/ 3. ./Researchdata/Low-Fi/participants/ 4. ./Researchdata/Low-Fi/pictures/ 5. ./Researchdata/Low-Fi/usecase_diagram/
High fidelity	1. ./Researchdata/Hi-Fi/Ad_Undrestanding/ 2. ./Researchdata/Hi-Fi/coded_transcripts/ 3. ./Researchdata/Hi-Fi/Duration_spent/ 4. ./Researchdata/Hi-Fi/Ad_Undrestanding/ 5. ./Researchdata/Hi-Fi/Interview Coding/ 6. ./Researchdata/Hi-Fi/Participants/
Onsite study	1. ./Researchdata/Tourist Information Center/Body_Interactive/ 2. ./Researchdata/Tourist Information Center/Mobile_Interactive/ 3. ./Researchdata/Tourist Information Center/Non_Interactive/ 4. ./Researchdata/Tourist Information Center/Enhanced_body 5. ./Researchdata/Tourist Information Center/pictures 6. ./Researchdata/Tourist Information Center/video
Software	1. ./Software/Attracting_Attention/Eyes/ 2. ./Software/Attracting_Attention/hello_screen/ 3. ./Software/Attracting_Attention/silouttee_new/ 4. ./Software/bauhuas_walk/ 5. ./Software/bauhuas_walk_v2/ 6. ./Software/mobile_walk/ 7. ./Software/Webserver/ 8. ./Software Programming languages and libraries/
Videos	1. ./Videos/Advertisement_video/ 2. ./Videos/Attracting_Attention/ 3. ./Videos/Body interactive/ 4. ./Videos/mobile interactive/ 5. ./Videos/Non interactive/ 6. ./Videos/Paper Prototype/ 7. ./Videos/Enhanced body interaction/

FIGURE G.1: File and Folders in DVD