idMirror

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Abstract

idMirror is an interactive installation which was previously demonstrated at Ars Electronica 2015 and at the ACM CHI 2016 and is part of the Critical Device Art series. In this paper, we describe the idMirror installation from four viewpoints: Conceptual (introduction), development (section 2), technical (section 3) and the collected data analysis (section 4). The paper also presents our study of the idMirror installation participants' emotional reactions on the idMirror installation. Artists can certainly play a role in educating the public in the sense of encourage critical thinking about the access and use of their data. The idMirror project can serve as an example of how we can use social media data to create aesthetic representations and experiences. This paper elaborates upon our earlier work, published as an extended abstract as part of the ACM CHI 2016 proceedings [1].

Keywords

Identity, Virtual World, Interactivity, Physical Reality, Mobile Technologies, Device Art

Introduction

The idMirror project opens the possibilities of how to redefine classic art with the help of new technologies. New technologies in computer systems and artificial intelligence make new directions in art possible. One of those directions is a creation of highly-interactive works based on computation. From artistic point of view, interactive art is not a new phenomenon. The questioning of the role of the artist, the work and the audience, the relationship between art and society can be traced back to the 1960s when the movements of Fluxus, happenings art, participatory art and cybernetic art already provided many ingredients for interactive art. The spectator turns into the user that provides the meanings, and in a sense creates the work at the moment of the interaction. Interactivity plays an important role in new media art as described by Turkle [2].

We are not merely viewers but also participants in the environment that the idMirror installation creates for us. The real investigation is of the life and the being itself, the virtual medium is just a tool in this investigation. This process is rather seen as the knowing of how a present action will be transformed into the future one. With the introduction of new agents in technologies, and gadgets such as the mobile phone, the hand held computers, GPS navigators, portable media players or iPads, etc. the borders between the real and the virtual world are becoming unstable and more and more indistinct. We have still not abandoned our bodies and our physical reality to set out on a never-ending spiritual wandering across virtual worlds, as it was foreseen when intelligent technology was at its opening stage – on the contrary, it was the virtual that came to us; it is here in the actual real world, surrounding and changing our physical bodies. Deleuze stated that *"The actual and the virtual coexist, and enter into a right circuit which we are actually retracing from one to the other. […]*

Pure virtuality no longer has to actualize itself since it is a strict correlative of the actual with which it forms the tightest circuit. It is not so much that one cannot assign the terms 'actual' and 'virtual' to distinct objects, but rather that the two are indistinguishable." [3]

Figure 1. idMirror effect in the mirror

From Device Art to Critical Device Art

Device Art is a concept derived from the Japanese approach to media art. It has been proposed by a group of artists, researches, and engineers. Works of Device Art involve hardware specifically designed to realize a particular concept [4]. The functional and visual design of such hardware, or a device, is an essential part of the Device Art modality. Technologies and materials are re-explored and used as an original and innovative form which stems from the Japanese tradition of respecting the tools. Device art have also an enlightening side, to make people interested in the nature of technology. Japanese Device Artists are quite often criticized for their positive attitude toward technology. That is also one of the reasons for bringing out the new term Critical Device Art.

idMirror installation is one of the first projects in the series of Critical Device Art. We have to be aware that being critical is important in art and it does not mean being negative. Artists visualize what technology means and does to us as units and to the society as a whole. Being engaged in contemporary visual practice carries along also the need for social responsibility, which at the same time is also the subject of Critical Device Art approaches. This is another form of being critical which is the key point of the idMirror device.

idMirror Design and Meaning of the idMirror Effect

Nowadays we are using our mobile devices such as smartphones and tablet computers as mirrors. By observing ourselves and others we noticed that the first thing we do in the morning is that we check our devices and the last thing we do before going to bed is again checking our mobile devices. We can say that nowadays we are using all these mobile devices as mirrors. That is the reason why we chose to design the idMirror devices in the shape of a handle mirror. Mirrors are also used to study how the brain decides what is self and what is other, how it judges distances and trajectories of objects. When a participant takes idMirror in their hands he/she can see his/her own face as in the regular mirror. But after a few seconds they realize that their face is changing. They can observe how their reflection in the mirror is getting distorted and falling apart into small fragments. This effect makes us question ourselves what is happening with us when entering in to the virtual worlds. Our identity gets spread all over social networks and other virtual environments. We noticed that the participants reacted differently to their own image/appearance in the idMirror device, which we will discuss later in this paper.

Figure 2. idMirror installation setting at ACM CHI conference 2016

Conceptual Design

The research is about how a human is constructed; how one perceives things in the world, how one interacts with the world, and how one is part of the larger whole. That includes not only our own position in the world, but also the mental states that we experience when we are confronted with things that we don't exactly understand e.g. self-knowledge and self-awareness. Transformation becomes a part of a future occurrence – both real and virtual must exist at the same moment.

The image is not considered to be a frozen moment or/and arrested action, or an effect of light, or anything like that. It is really conceived as existing within the spectator. In the case of the idMirror project the viewer no longer remains a passive observer, standing in front of an artwork that is not materially changed by the act of observation; rather, in the case of an interactive work of art, the viewer becomes a user whose act of observation produces material changes in the artwork.

Related Works

As a reference to the idMirror research we would like to propose the projects Wooden Mirror by Daniel Rozin

[5] and the spatial installation Desire of Codes by Seiko Mikami [6]. Both projects were inspirational to us because the authors of these projects are also dealing with information technology, image transformation and they confront us with the essential questions of 'how we retain ourselves as individuals and what brings us together in communication'.

They also claim that it is through images that our identity/we are changed into manipulative objects in virtual worlds; from real, tangible entities into coded virtual images. The very same strategy is used in the idMirror installation. The difference that we would like to expose when comparing those projects with the idMirror project is, that we have also put on the test the participants' emotional response while using the idMirror device. We have tested the idMirror device in three culturally different continents: Europe, the U.S.A. and Asia (Japan). The results will be discussed further on in this paper.

Prototyping Process

We built idMirror iteratively using a prototyping process. We developed various versions of the handle mirrors designs and visual effects. After several tests with the Future Lab collaborators we decided to use the design and effects as described in this study.

Prototype 1: Handheld Mirror

We developed various prototypes of the encasing and also experimented with the effect. In this prototype the effect would be continuous, only ending when the user left the installation. The effect would divide the face into small particle and spread around and return them back together using a pulsating animation. The feedback from the first user participants when testing this version of the installation was that it was too complex, both in terms of the design of the encasing as well as the effect.

Prototype 2: Simplified Handheld Mirror with External Projection

For the second prototype we simplified the design of the encasing and made some changes to the effect. The interaction with the device would now be more controlled, having a clear beginning and ending by having the effect fade in when first being used and fade out after a short time period. This matches more strongly with how we use our devices, checking them multiple times a day for short time periods. We also added the external projection, which represents the longer-term concept of being a user within a larger system. This is the version which we eventually showed at Ars Electronica Festival 2015 and later at the ACM CHI conference 2016.

Figure 3. The idMirror device consists of a wooden case and a half mirror. A tablet computer is inserted into the case

Technical Specification

The installation consists of two major components (Figure2): the idMirror devices and the idMirror projection. The idMirror devices are tablets embedded in a handle mirror shell. The idMirror projection is a processing application running on a computer which is connected to a projector. The idMirror devices are connected to a wireless router using Wi-Fi. The computer running the idMirror grid is connected to the wireless router using a LAN cable.

idMirror Devices

The idMirror devices (Figure 3) contain a Google Nexus 9 tablet, which has a powerful CPU and GPU. We have developed an application for the tablet using the Android SDK and OpenGL ES 3.0 [7]. The application uses face detection to react to a person looking at his or her reflection.

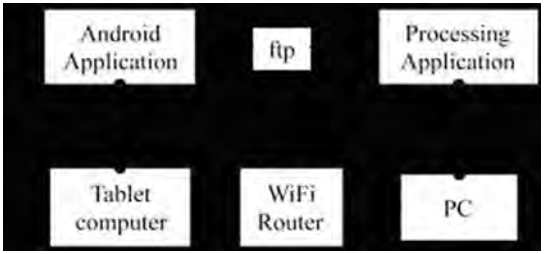

Figure 4. System overview

When users interact with the device the application renders an effect (Figure 1). When starting the idMirror application, it divides the screen into a 40*40 grid of polygons. The application disables all the polygons which do not overlap with the visible area using some basic trigonometric operations. During the startup we also enable the camera, start the face detection algorithm and add a listener for the face detected occurrence. We used the face detection algorithm supplied in the Google Android's Camera API, which proved to be robust enough for our use. During the interaction the application randomly moves the corners of each cell. Because each corner is randomly moved, the shape of the cells changes individually, forming random four-corner polygons. When a face is detected, the appearance occurs, starting the animation. We take the x, y, (width, height parameters) of the face location the image in the picture frame returned by the face detection algorithm and use this to extract a picture of the detected face. We then stretch this picture to fill the entire screen. The picture is divided among the grid polygons. For each polygon the application loops through the eight parameters specifying the location of the edges and randomly increases or decreases these by 2 pixels per second on average. This is demonstrated by the following pseudocode:

```
params = {top_left_x, top_left_y, top_right_x, top_right_y, bottom_left_x, bottom_left_y, bottom_right_x, bottom_right_y}
face_time = time_now - start_time

for parameter in params:
if rand_bool():
parameter = parameter + 2 * face_time else:
parameter = parameter - 2 * face_time
```

The total duration of the effect is 20 seconds, including a 5-second fade-in time and a 5-second fade-out time. After two seconds a picture of the user is taken and transmitted using an FTP connection to the idMirror projection running on a PC. The source code for the idMirror Android application and idMirror grid can be found under the MIT license on GitHub [8].

idMirror Projection

The idMirror projection is a collage of participants' faces which are metaphorically presenting their traces that we are all leave when entering virtual worlds.

The idMirror projection (Figure 5) runs on a PC on which we also installed an FTP server to allow file transfer from the idMirror devices. In the grid, we show the latest 20

pictures transferred, and we show one picture in which we overlay the recent faces using transparency.

Data Analysis

The idMirror project was presented in Europe (Ars Electronica Festival in Linz, Austria, 2015), in Japan (Tsukuba Media Art Festival, Empowerment Informatics studio opening, 2015) and in the USA (CHI conference exhibition, San Jose, CA, 2016). At those exhibitions we collected thousands of participants' face images. As previously described in this paper, the idMirror installation takes facial photos of the participants. The image of the participant's face is taken 2 seconds after they see themselves in the idMirror mirror. In those 2 seconds we captured and measured the participant's emotional reaction on seeing themselves in the idMirror device.

Figure 5. Projection showing total number of participants and pictures of recent participants

Problems Encountered

One challenge in implementing the idMirror device has been to reduce the power consumption of the backlight. We managed to reduce the power consumption without negatively affecting the usage by dynamically changing the backlight based on whether the device was in use (100% brightness) or idle (0% brightness). We also added a wireless Qi charging to the tablet, using an external charging receiver and transmitter.

The implementation of the face detection API returned 2D location of the person's face, but did not return any parameters regarding the orientation (i.e. yaw, roll and pitch). For the current implementation we did not need to use any face orientation parameters, however these parameters could be useful for future improvements. After developing the idMirror application using Google's Camera API, we have tested the Google's new Face API and noticed that this does offer functionality for detecting head orientation and landmark positions such as mouth, eye and nose. To improve positioning of the idMirror devices with respect to the chargers we were considering various options. The simplest option we came up with would be to draw the outlines of the idMirror device on the surfaces on which they are placed. Another option would be to place the idMirror devices in an alcove.

Many participants tried to use the idMirror devices in small groups of people (e.g. in pairs). Because we only selected the most prominently available face using face detection, the idMirror devices could not be used to make group pictures. We have not yet come up with a good solution to allow participants to interact with the idMirror in this way.

Figure 6. The data referring to the default analyzed types of emotions, stated in the figure above generated by the Microsoft emotions API

For this study, we have analyzed face images of 150 participants, aged between 18 and 75; among them 50 (25 females and 25 males) participants' face images collected in Europe, 50 (25 females and 25 males) participants' face images collected in the USA and 50 (25 females and 25 males) participants' face images collected in Japan.

Cultural Differencies in Facial Expressions

Psychologists have long debated whether emotions are universal, versus whether they vary by culture. When analyzing idMirror we were aware of Holfstede's dimensions that can be used to generate specific hypotheses with respect to cultural differences in the perception of facial expressions. That is, there are cultural differences in the prevalent, modal and normative emotional responses. Emotions are biological as well as socio-cultural in nature.

Culture regulates emotions by elaborating on subjective experience. Cultures affect the relative intensity of emotional experiences. Cultures also facilitate the emergence of cultural emotions, which are unique to human cultures and require cultural knowledge for elicitation.These emotions may be universal, but not necessarily biologically innate and may be somewhat different in different cultures.

Facial Analysis Procedure

When choosing the suitable system for face analysis, we were considering the following conditions for facial expression classification in general. The following requirements were; the system should be capable of analyzing any subject, male or female of any age and ethnicity. After having tested several facial analysis systems we decided to use Microsoft emotions API. The Microsoft Emotion API takes a facial expression in an image as an input, and returns the confidence across a set of emotions for detected face. The emotions detected are anger, contempt, disgust, fear, happiness, neutral, sadness, and surprise. These emotions are understood to be cross-culturally and universally communicated with particular facial expressions [7]. These expressions are muscularly defined, and have been linked to specific and differentiable affective states by people in cultures around the world. In our study we focused on emotions that express happy or sad reaction on the idMirror device.

We have inserted 150 participants' photos into the Microsoft Emotion API. After the presence of a face

is detected in the observed scene, the next step was to extract the information about the shown facial expression. For the analysis, we chose to collect the emotions of happiness and sadness of the participants' faces.

In general, the intensity of the emotional response of happiness is much higher than the intensity of the emotional response of sadness in the case of all participants from all the three analyzed continents.

When we compare the participants from all the three continents it is quite evident that in the analysis of happy emotions the Japanese (females and males) react substantially less intensely that their peers from both, Europe and the States.

When comparing the participants from all the three continents with regards to sad emotions we can see that the differences exist, but they are lesser than in case of happy emotions. We should, however, point out that the European participants (both; females and males, react sad emotions to a much lesser extent than the participants from the other two continents.

In general, there is the smallest amount of sad emotional response with the European population, with hardly any difference between the European females and males.

The neutral response of the participants accounts for the difference to the 100% in the analyses.

The participants from all the three countries/ continents are very uniform and low (about 1 person) in their reactions of sad emotions.

In the case of happy emotions, we find that the European and American women react quite similarly (12 women in both countries), whereas the number of Japanese women who would react to idMirror with happy emotions is only a third in comparison to their European and American peers.

The difference in the male population from all the three countries is rather different in their happy reaction to idMirror. The Japanese do not express their happy feelings much (only 1 person out of 25), and when comparing the Europeans and Americans, we find that the European men react happily to almost twice the extent of their American peers; 8 Europeans to 5 Americans.

Discussion

Dealing with intermedia art practice carries an important responsibility, which itself is a subject of exploration of contemporary society. In the idMirror project we tested the working principles of intermedia artistic practice which with social responsibility. We have analyzed relations among the responses of the statistical population from different parts of the world to see whether the differences in their cultural background affect their responses to idMirror. idMirror represents Critical Device Art production. These same relations among different scientific practices present new dilemmas and questions to people today from which new knowledge and new disciplines are born.

The central part of the idMirror project is showing how variable are human identities in the age of information societies and what humans reactions to these issues are. Artists can certainly play a significant role in enlightening the broader society in the sense to trigger their critical thinking about the access and use of their own personal data in the internet. Art should not become just an ornamental style used for making data more pleasing or consumable but a powerful statement about the world we live in. The idMirror project can serve as an example of how we can use social media data to create aesthetic representations and experiences while also provoking a critical thought about the world we live in.

Conclusion

By turning the participant's face into the object of manipulation and observation, the idMirror project aims to redefine the human position in the contemporary world when all kinds of environments – including those of everyday life – are particularly information-oriented in a society. The analysis of collected facial images of the participants who interacted with the idMirror device provided us with the information how humans of different gender and originating from different continents react to the metamorphosis of their own face. The idMirror project can give us the background to understand and to become aware of all these transformations, and to understand the complexity of the contemporary world around us.

Future work

In the further development of Critical Device Art series we would like to continue exposing the importance of the interaction between art and new technologies on the one hand and art's critical reflection of science and technology on the other hand for the beneficial development of "information societies" that we live in.

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References

Jazbec, M. and Erich, F., Investigating Human Identity Using The idMirror Interactive Installation. Proceedings of the 34th Annual ACM Conference on Human Factors in Computer Systems, 2016.

Turkle, S., Second Self: Computers and the human spirit, The MIT Press, 2005, p. 279

Deleuze, G., Cinema II., chapter The actual and the virtual, p. 150-151

Kusahara M., Device Art: A New Approach in Understanding Japanese Contemporary Media Art, In Miedia Art Histories edited by Oliver Grau, MIT Press, 200, p. 277-307

Daniel Rozin wooden mirror http://www.smoothware.com/danny/woodenmirror.html

Seiko Mikami Desire of codes http://special.ycam.jp/doc/work/index_en.html

https://www.microsoft.com/cognitive-services/en-us/emotion-api

Ginsburg, D. and Purnomo, B., OpenGL ES 3.0 Programming Guide, Second Edtion, Addison Wesley, 2009

GitHub, idMirror, Available at: https://github.com/FlorisE/idMirror

Authors Biographies

Maša Jazbec, after finished the study of Fine Arts at the Faculty of Education Maribor (Slovenia) continues her study at the post-graduate department of Interface Culture, at the University of Arts and Design Linz (Austria). During her study, she completes a residence at the Institute of Advanced Media Arts and Sciences IAMAS (Japan). Her projects, exhibited as artworks, have always shown her understanding of new media as a research artistic practice, stemming from the tradition of the video and the new artistic thought, linked to the current situation in the contemporary society. She is currently a Ph.D. candidate at Empowerment Informatics, University of Tsukuba, Japan and a visiting researcher at ATR (Hiroshi Ishiguro Laboratories).

Floris Erich is a Special Fellow in the Empowerment Informatics program at the University of Tsukuba in Japan, researching Software Engineering for Robotics. Before joining Empowerment Informatics, Floris got his Master in Computer Science (Cum Laude) and Master in Business Information Technology from the University of Twente in the Netherlands.

Hiroo Iwata has been conducting research on virtual reality. His research interests include haptic interface, locomotion interface and spatially immersive display. He exhibited his work at the Emerging Technologies venue of the SIGGRAPH every year from 1994 to 2007. He also got honorary mentions at Prix Ars Electronica 96 and 2001. He launched Device Art project in 2004. He has been leading Ph.D. program in Empowerment Informatics at the University of Tsukuba since 2013