Subjectified

Personification as a Design Strategy in Visual Communication

Richard The
Dipl. Designer (2007) Berlin University of the Arts

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of Master of Science
in Media Arts and Sciences at the
Massachusetts Institute of Technology
September 2010

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Abstract

When we encounter statistics too far removed from our personal experience, we sometimes find it difficult to imagine the real implications of that data. While we might understand the information logically, it can be hard to relate it to our immediate personal lives.
In this thesis, I investigate a novel visual representation for such data, which I call Personification of Information. This alternative form of data visualization incorporates real people within the viewer's immediate physical or social environment as part of the representation. The goal of this visualization technique is to bring information that is otherwise perceived as distant and detached closer to the viewer. This design strategy is explored in three artistic projects, "What If the World were your n Facebook friends?", "Unification-A Case Study?" And "What Was the Media Lab Thinking About In The Year _ _ _ _?"
They are complemented by two projects from other areas that investigate Personification as a design strategy to bring the abstract closer to the individual: "Omnivisu" uses Personification as an interface to architecture; "Giving Character to Characters" applies the strategy to augment digital typography with human expression. Additionally I formalize the findings of these projects as a set of generalized design parameters for Personification of Information.

Thesis supervisor:
David Small, Associate Professor of Media Arts and Sciences

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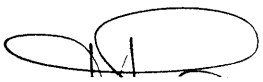

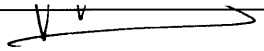

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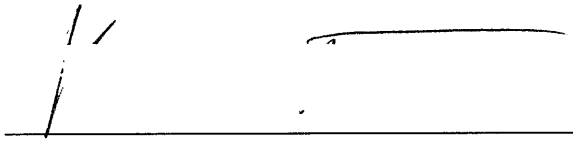

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I.
Introduction

In this chapter I describe my motivation behind the kind of work that is the most relevant to me personally, including the projects presented in this thesis. This is followed by an introduction to the main approach investigated with these projects, Personification of Information. A few notes are necessary to contextualize this approach, which are followed by a brief overview of this thesis document.

Motivation

I am interested in how technology can create intimate relationships between individuals and impersonal structures. These structures can exist physically, such as the built environment, or they can be intangible, such as communication systems or structures of information.

One important pursuit of design in general is the process of bridging the gap between humans and abstract structures. This is particularly relevant in communication design and interface design, or human-computer interaction: Visual communication allows us to navigate an airport or to understand large amounts of information in one image; With a pen interface an illustrator can generate hand-drawings on a computer instead of being constrained to geometric forms and well-designed user interfaces allow us to understand and manipulate complex documents. Even though facets of my work are related to each of these disciplines, my personal approach is grounded in the visual arts.

The main focus is not to improve task efficiency or to clarify understanding of a specific subject matter or other things conventionally described as utilitarian from a design perspective. The goal instead is to create a situation of personal resonance for the viewer with the abstract and detached. With this I hope to create a new way of seeing these structures, a sense of connectedness, and perhaps even an attitude of agency and responsibility towards the world surrounding us.

Technology, with the unique possibilities it provides to capture human expression and to create immersive and synaesthetic experiences, can be used to enable this personal resonance. In the projects described in this thesis, this intimacy with the impersonal is established through Personification - The process of transforming impersonal structures by juxtaposing them with human expression and identity.

In general terms, the ideal result of such work is a shift in the way a viewer perceives his environment. I am hoping to create transformations, from:

ANONYMITY TO IDENTITY

IMPERSONAL TO EMOTIONAL

OBJECTIVE TO SUBJECTIVE

ABSTRACT TO RELATABLE

DETACHED TO RECLAIMED

ALIENATION TO PERSONIFICATION

Personification of Information

"I had been in the industry and I'd risen up in the ranks. And I had a great job. And I had a terrific office in a high-rise building in Philadelphia. I was insulated. I didn't really see what was going on. I saw the data. I knew that 47 million people were uninsured, but I didn't put faces with that number."

WENDELL POTTER ON HIS WORK IN THE PR DEPARTMENT OF CIGNA HEALTH CARE [1]

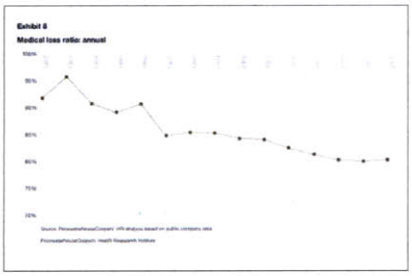


Fig. 1 A scene from the film *Sicko* by Michael Moore.
Fig. 2 A time-series graph depicting Medical loss ratio.

When we are faced with abstract statistical data to which we cannot directly relate, it is hard to translate it into meaningful information from an individual perspective. There are many different ways to learn about these data–it can be presented as written text, a graphical diagram, spoken word, or as part of a news report or documentary film.

Data visualization is an effective way to present information clearly, allowing us to compare, filter and explore the data quickly. However, traditional visualization methods aim for an objective, neutral and emotionless representation [Fig. 2]. The focus is to represent the patterns within the data, independent of what it stands for. As an opposing example, one could have a documentary film about a specific topic that shows examples of how these abstract numbers have an effect on people's lives [Fig. 1]. But represented cinematically, the viewer's experience might be almost too personal. Individual life stories become representative of abstract facts and of course their cinematic presentation is edited extensively by the filmmaker not at least to support the narrative structure of the film.

With the design experiments in this thesis I am suggesting an alternative way to experience data which could be seen as an intersection between the photographic, subject-centered format of a news report and the objective and comprehensive representation of data visualizations. Instead of representing the data in an objective, detached visualization, it is contextualized with a real group of people, literally "putting faces with the numbers".

As the objective is to bring distant information closer to the viewer, the information is mapped onto a group of people within his/her immediate personal environment. The individuals turn into symbolic representations of the data displayed, yet remain human beings he/she can personally relate to. I call this approach Personification of Information.

The goal of Personification of Information is to create a personally relevant, emotional perspective on the data without sacrificing lucidity of representation. By bringing the impersonal and distant closer to the viewer I hope to create a feeling of empathy and connectedness in the viewer. The personified representation aims at an intriguing and memorable experience that fosters reflection and contemplation.

I approached this subject with the following questions:

- For which subject matter and which audience is such an approach appropriate?

- Is it possible to map statistical information onto a real group of people? How is this achieved technologically?
- If a real group of people is to symbolically *stand for* a detached set of information, can the viewer mentally bridge this semiological gap? What design measures can facilitate this process?
- How is the juxtaposition of data and people designed visually, and how can different graphic design approaches impact the visualization?
- How are the individuals within the visualization perceived by the viewer? How is the representation affected by the perspective each individual has in relation to others?
- In what physical, social or political context is the visualization presented in, and how does this influence the overall reception?

To explore these questions, I created three projects in Personification of Information: WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS?, UNIFICATION - A CASE STUDY? and WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _?. Before dealing with data visualization, I have explored Personification as a design strategy in prior projects, applying it in the areas of architecture (OMNIVISU) and typography (GIVING CHARACTERS TO CHARACTERS). All five projects lead to the formulation of the design parameters for Personification of Information are mapped out in Chapter III of this document.

A Few Notes

ON SCOPE

Traditionally the goal in data visualization is to foster analysis and insight on data by means of an appropriate visual representation. The designer of data visualizations can be involved in data acquisition and mining, parsing, filtering and finding the appropriate representation. While my experiments necessarily encompass all of these aspects, they are not the main focus of the work. Instead, the emphasis in my experiments is on a personified representation of data: How is the juxtaposition between data and people accomplished, how can it be achieved technically, how is the user experience designed?

This also applies to the source data used in the experiments. The data sets, being not too complex in dimension and of moderate scale, could be easily visualized with more conventional graphs. My focus, however, is not on finding insights within the patterns of data, but providing a different perspective on the data through the novel personified representation technique.

ON SPECIFICITY

This thesis does not present an absolute definition for a personified, and emotionally powerful representation of information, but rather my personal approach on this topic as an interaction and graphic designer. This is reflected in the projects I created. Instead of developing a content-agnostic, generalizable technology, I consciously chose the opposite approach: With each project, I defined the topic

and developed the visual design and technology specifically necessary for it. The design parameters in Chapter III are derived from these experiments and present the aesthetic and technical aspects that I see as crucial for the Personification of Information using digital media. While these aspects may be useful as generalized design principles for other designers they represent only one approach to this topic from a subjective point of view.

ON PERSONIFICATION

This thesis suggests Personification as a design strategy in order to bring distant information closer to the viewer. Described in simple terms, Personification as it is used within this thesis is the process of rendering real individuals as proxies, stand-ins for other real or constructed individuals. The goal is to have the viewer experience these individuals *as if* they were others, which is achieved through juxtaposition of information and the individual. The juxtaposition involves the process of association. Through the augmentation the viewer is expected to associate the individual with that information and vice versa.

This understanding of Personification is to be distinguished from the conventional definition of the term even though it is related.

As a linguistic metaphor, Personification is the description of an object a living being or an animal. For example "Cancer finally caught up with him". In this case we are describing something nonhuman as human, we transfer attributes and characteristics of a human to an object in order to explain or understand it.

Within an art context, Personification can mean an artistic representation of an abstract quality or idea as a person. For example, the cardinal virtues are represented as allegorical figures in form of painting or sculpture. An allegory, as an artistic device, is a visual symbolic representation. An artificially constructed human figure becomes an embodiment for the abstract.

Both of these definitions are related to the definition of Personification in this thesis as they employ a metaphorical approach. They enable to experience "one kind of thing in terms of another"[21]. My approach differs strongly as it employs actual people in the Personification process. A real person and his/her characteristics function as a representation of the abstract. Where linguistic metaphors explain reality by means of analogy, in my approach reality itself becomes part of the analogy.

Thesis Structure

In this chapter I have described the personal motivation behind the work in this thesis and have introduced the general concept of Personification of Information. Chapter II, **Related Work** contextualizes this approach with examples from design, information visualization, art and film that employ different strategies in order to bring abstract information closer to the viewer. These strategies are part of the general design principles that are mapped out in Chapter III, **Design Parameters**. I deem the strategies outlined in that chapter as crucial components for a project investigating Personification of Information and they form the basis for the **Design Experiments** developed for this thesis, which are described in Chapter IV.
Three pieces explore Personification of Information, each with different approaches to content, context and implementation: WHAT WAS THE MEDIA LAB THINKING ABOUT IN

THE YEAR _ _ _ _?, UNIFICATION–A CASE STUDY? and WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS?. They are complemented by two prior experiments exploring Personification in other areas, in particular architecture (OMNIVISU) and typography (GIVING CHARACTER TO CHARACTERS). In Chapter IV each of the projects is discussed and analyzed and the success of each of the design strategies is evaluated from a personal point of view (**Discussion**).

Chapter VI, **Conclusion** outlines an array of future work that can emerge from the design parameters and experiments which is followed by a general conclusion for this thesis.

II.
Related Work

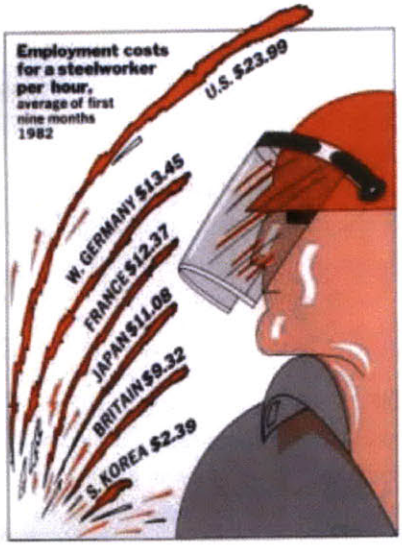
In this chapter I describe work that is related to Personification of information. The projects discussed here strive for an improved communication of abstract information. Abstract information in this case can be understood as intangible ideas, such as the values representing a corporate brand, it can be news from a distant country, or it can be statistical data on a scale too large for us to grasp.
This improved communicatio is made possible through a variety of strategies outlined in the chapter below.
Information visualization strives to explain abstract data by harnessing our visual capabilities. Complex multi-dimensional data sets can be represented in one image that enables the viewer to understand patterns within the data at a glance. One strategy in information graphics is to use the human figure as an inherent part of the graphical representation [**Visualize and Anthropomorphize**]. Another strategy is to normalize large quantities of data to a human scale in order to render them relevant to the individual [**Normalize**].
This is also supported by placing abstract information into a concrete context meaningful to us [**Contextualize**]. Another approach is to manifest information through Personification, in which a real person, or a group of people can metaphorically stand for something else [**Personify**]. One way to create this visual metaphor is to juxtapose the human body with a second layer of information in form of a graphical annotation [**Juxtapose**].
The projects discussed in this chapter span a variety of disciplines, from advertising and design to film and literature to technology and art.

Visualize and Anthropomorphize

Information visualization is the study and practice of creating a visual representation of quantitative information. The field has developed a certain graphical language to represent data, with bar charts, pie charts or time-series charts as some of the most common visual vocabulary. However, some designers have also explored different representations for a variety of reasons such as visual attractiveness, memorability and recognizability. A few, yet significant examples employ anthropomorphic form in information visualization.

The graphic designer Nigel Holmes regularly incorporates strong visual imagery in his chart designs, adding pictorial or illustrative elements that are not essential to the presentation of data [18]. While this sort of embellishment is disapproved by experts in the field, who strive for a display of data in a minimalist, objective style (see *Data-Ink Ratio* coined by Edward Tufte [8]) the designs created by Holmes and similar practitioners recurrently appear in mass media and popular publications. This has raised questions if such embellishment might not have a function after all, making data graphs more visually attractive and memorable

Fig. 3 An "embellished" graph by graphic designer Nigel Holmes. [18]



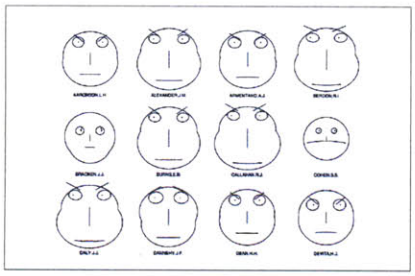


Fig. 4 *Chernoff Faces* displaying evaluations of U.S. judges

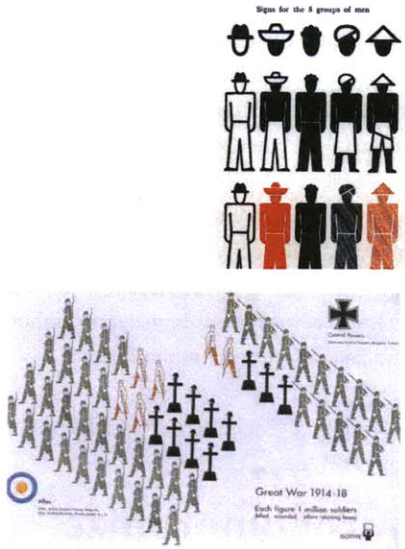


Fig. 5 Two information diagrams by Neurath using *Isotype*.

[16]. In Holmes' work, oftentimes the embellishments consist of human figures, illustrating the subject matter. For example, a chart on the steel industry might be decorated with an illustration of a steel worker. Again, such embellishment does not support the presentation of data, but draws the viewer's attention, communicates the subject matter at a glance and might make the chart more memorable for the viewer.

Another, less decorative way of employing anthopomorphic form in information visualization are the well known *Chernoff Faces* [22]. Here multiple data axes are represented in the form of a human face. The individual parts of the cartoon-like face such as nose, eyes etc. represent values by their shape, size, position etc. The original idea is that we have a unique ability to recognize and distinguish between different faces, hence the form of a human face lends itself to represent multivariate data. With Chernoff faces the anthopomorphic form does not function as embellishment–in fact it is the inherent element of the data presentation. Representing data in the form of a human face might draw a viewer's attention, but more importantly, the method harnesses our cognitive ability to distinguish the most subtle differences in human facial features.

One of the pioneers of contemporary information graphics, Otto Neurath, predominantly used the human figure in his information graphics. He developed the graphic language *Isotype*, (an acronym for "International System of Typographic Picture Education") with the goal to communicate complex information visually. The language consists of more than two thousand *isotopes*, non-realistic symbols that function as units in the visual representation of statistical data. The graphic symbols, abstract flat silhouettes are the predecessors of today's graphic icons that can be seen everywhere from lavatories to instruction manuals to the Olympic Games.

Neurath's work had a strong social and educational focus. His goal was to communicate complex information to a general public regardless of their educational background. He aimed to bring "dead statistics" to life by making them visually attractive and memorable [23]. When representing social facts, Neurath depicted certain demographics or populations as abstracted human figures. One important principle of *Isotype* is to represent quantities not by scale but by repetition. A pictorial icon always represents a fixed value within a chart, clearly communicating the distribution of quantities displayed [24]. The human figure functions as an entry point for the viewer, attracts his attention and clearly communicates the subject matter in simplified terms. Additionally, the complex quantitative source data are "transformed" in order to create a self-explanatory chart. By choosing a human figure as the unit to represent large quantities, the data are brought to a human scale in order to communicate the distribution of quantities more clearly to the viewer.

Normalize

Many artists have created projects that enable a better understanding of data that are at a scale hard to grasp from a human perspective. By harnessing the possibilities of a specific media, large quantities are represented in relation to the human scale, in order to allow comparison, understanding and reflection.

The famous film *Powers of Ten* by Charles & Ray Eames from 1968 [3]

explains the orders of magnitude of space through a revolutionary use of the film medium. The film begins by showing two people in a park seen from above. The camera zooms out, showing the surrounding geography, the continent, the planet, the solar system etc., all the way to a distance of 10^{24} meters, or the observable universe. During the film a narrator provides additional context to describe the orders of magnitude shown. Through the continuous zoom, a special effects feat of the time, the entire universe is brought into context with the human scale, the orders of magnitude become more understandable to the viewer. The zoom allows an unscaled representation of space at different orders of magnitude, seamlessly moving from the familiar scale of one square meter to the incomprehensible scale of the entire universe.

Fig. 6 Three different zoom levels as seen in *Powers of Ten*.

The performance *Of All The People in All The World* by the theatre group Stan's Cafe [25] deals with a data set of equally incomprehensible scale, namely the entire world population. In the performance, a grain of rice is used as a unit, representing one human being. Over a period of days a team of performers carefully weigh out quantities of rice to represent an array of human statistics, such as the populations of towns and cities, the amount of doctors and soldiers, the amount of births and deaths every day etc. These quantities are arranged in labelled piles on the floor, allowing the user to physically wander through the installation. Using this representation, no compression or transformation of data is necessary, figuratively the whole world population can be displayed, statistical distributions are shown unscaled.

Fig. 7 Piles of Data. *Of All The People in All the World* statistical data about the world population are represented using rice, where one grain of rice represents one human being.

Apart from the fact that this approach allows an unscaled presentation of

the data, the choice of rice as a medium has more interesting effects. The statistics are physically manifested, the viewers experience the data with their own bodies when walking by the piles of rice. Additionally, rice is a biological material and a basic foodstuff nourishing millions of people every day, making one grain of rice an adequate, emotionally touching stand-in for one human being.

The *State of the Village Report* , a text by Donella Meadows from 1990 [11] is about a similar data set. Also called *If the world were a village of 1,000 people*, the text explains statistical facts about the entire world population by normalizing it to an amount of 1000 people. The quantitative distribution of ethnic groups, language, nationalities, religion etc. are represented in numbers at a scale that is easier for us to understand. Instead of placing incomprehensibly large quantities next to one individual in order to foster a better understanding, the data are mapped to a different scale. Additionally the speculative title suggests a connectedness to the reader. If the world was this village, he/she would inhabit it together with all other "world citizens".

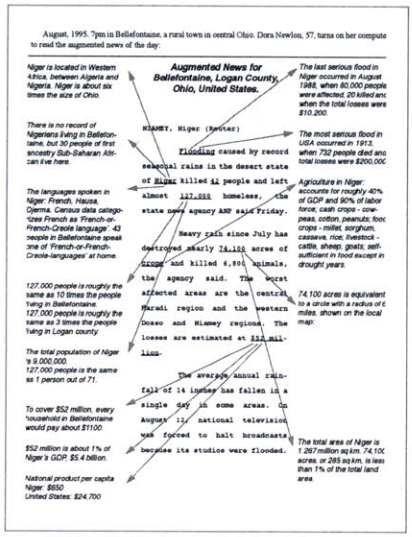


Fig. 8 A diagram visualizing the *PLUM* software functionality.

Contextualize

Bringing the data into human scale is one method to enable a better understanding of abstract statistics. This can be complemented by embedding the display of data into a concrete context meaningful to the viewer. Such a context can be of social, physical or political nature.

The project *PLUM* (an abbreviation for *Peace, Love and Understanding Machine*) by Sara Kristiina Elo [2] applies a similar strategy to Meadows' approach to world news. *PLUM* is a news reader software which augments news articles with annotations that compare facts to the reader's home community. For example, if a person in Bellefontaine, Ohio would read a news article about a natural disaster in Niger leaving 127000 people homeless, the system would provide a note stating that this amount of people is about 10 times the population of Bellefontaine, as one of multiple annotations providing contextual information. The creator's goal is to make distant information that seems "remote and irrelevant" more informative in order to create a "sense of connectedness". By placing the data from a distant, unfamiliar place into the reader's social context this project attempts to make the abstract information more comprehensible to the reader.

Fig. 9 The *Watermarks project* uses architectural projections to contextualize a visualization of predicted sea-level data.

PLUM achieves this contextualization in written form by displaying the annotations in the text-based news reader. However, the context can also be defined by a physical space. *The Water Marks Project* [12] is an ongoing public art installation that presents data about the rise of sea levels. The information display is situated in physical space in the centre of coastal cities. Using large-scale projections on buildings in the city, the installation shows how high water levels could potentially rise in the future as the sea floods the area. The architectural projections merely consist of a horizontal line with the label "Future high water level to here?" and numerical information about the height shown. "Watermarks" presents the predicted government data on seal level change in the viewer's spatial, physical context, "allowing us to measure the possible future water levels against ourselves in familiar environments". [12]. The viewer can experience the data in a bodily, visceral way, situated within his/her everyday physical environment. Further, the relationship between data source and environment is particularly interesting in this project. The information is not from a distant location or at a scale incomprehensible to us, it is disconnected from the viewer in terms of time. The dramatic predictions that might seem surreal when communicated in written form are shown directly on location *as if* they already had become reality.

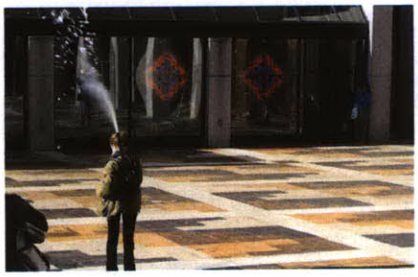


Fig. 10 *Cherry Blossoms* in action: Detonating confetti in a public space in Cambridge, U.S.
Fig. 11 A visualization of juxtaposed maps. The red dots representing recent locations of violence in Baghdad, which are overlaid with Cambridge, USA.

A similarly speculative approach is taken in *Cherry Blossoms* from 2007 by the artist Alyssa Wright [6]. The performance piece consists of a virtual map that juxtaposes the geographies of Baghdad and Cambridge, and a backpack equipped with a micro controller and a GPS unit. The map is updated regularly with recent bombings happening in Iraq at the time. The artist walks around Cambridge and if she is close to a relative location of recent violence in Baghdad, the backpack detonates confetti. The project aims to raise awareness for the deaths and violence happening in Iraq every day, by "bringing the war home". The data set is real information, even though geographically detached from us. The presentation is of speculative nature, showing us *what if* the violence was happening in the U.S., in our local community. The performance piece is supported by nuanced design decisions, such as the title and the use of confetti, which we usually associate with festivity, when communicating such a dire data set. Most of all the project gains from the personal involvement by the artist and the interpersonal constellation she creates. Wright herself, a fellow citizen from the local community, physically embodies the data. When her backpack detonates confetti in the quiet center of Cambridge, a distant, gruesome reality is mapped directly onto her body. Through this bodily Personification, the project brings distant information into a social, political and interpersonal context.

Personify

The strategy employed in *Cherry Blossoms* could be called Personification. During the performance Wright becomes a stand-in, a representation for abstract information detached from the viewer and herself respectively.

Traditionally, Personification is less commonly used to represent distant information, moreover it is a strategy to manifest or embody abstract ideas. In ancient times, abstract or metaphysical concepts, such as a deity or a virtue were represented as human figures depicted in painting or sculpture. By constructing

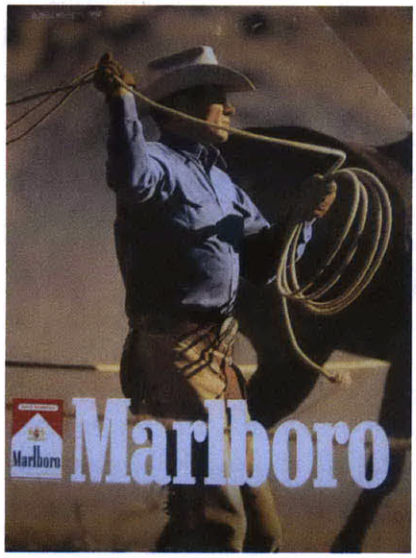


Fig. 12 The *Marlboro Man*
http://www.flickr.com/photos/myeye/220558743/sizes/l/in/photostream/

a distinct human image the abstract becomes manifest, an entity to which people can relate, recognizable and distinguishable. Unique characteristics and symbolic objects associated with these figures express the values the figure embodies further. The Personification provides a concrete manifestation of the abstract, which can be depicted, represented or worshipped.

Today, this strategy has been mainly adopted by advertising and branding. The image of a person that evokes certain qualities and values is associated with a product or brand. The hope of advertisers is that we transfer the connotations we infer from the person to the brand, associating meaning with that otherwise intangible entity.

This process happens in a variety of ways. One being an artificially constructed persona, symbolically hinting at certain qualities. For example the advertising campaign "Marlboro Man" by Phillip Morris uses depictions of a rugged cowboy in order to represent masculinity, independence and freedom [Fig. 12]. Considered one of the most successful advertising campaigns of the 20th century, *Marlboro Man* changed the brand image within months and increased sales for Marlboro cigarettes significantly. The approach of the then revolutionary campaign is described by the advertising agency Leo Burnett as changing the brand to have a "personality and a reason for being"[26]. The image of the cowboy is used to lend authenticity to the brand. The person embodies certain values and over time we start to associate the same values with the brand, even though the connection is a completely artificial construction.

Instead of artificially constructing a persona representing oftentimes a public figure or celebrity is used to give value to the abstract notion of a brand. In this case the person already stands for certain values within the general public. By depicting that person in combination with a brand or a product advertisers hope the audience associates the person's values with the brand. In this case a real person, or at least the public image of a real person is used to personify the abstract idea of the brand.

Juxtapose

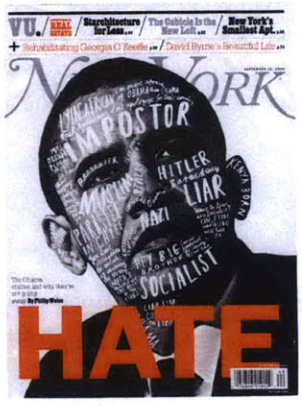


Fig. 13 Cover of New York Magazine from September, 2009.

In advertising, the association of a brand message with a real person is realized through juxtaposition of information. By graphically annotating an image of a person with typographic labels the combined message is established, and in some cases over time it becomes hard to disassociate one from the other.

But the juxtaposition of the human body with information is not always employed to sell products. In a recent cover for New York magazine, a photo-illustration shows the face of president Barack Obama covered in labels and names he has been called since the beginning of his presidency, such as "Liar", "Muslim", "Socialist" etc. The image captures the state of Obama's public image by showing the attributes and labels that other politicians and the media project onto him. The graphical annotation visually represents the labeling and name-calling the president is exposed to on in one compelling image. The typography is hand-drawn, emphasizing the fact that these labels originate from people, and that such a prominent public figure becomes a canvas onto which anybody can paint whatever they like.

The famous Vietnam Veterans Memorial designed by Maya Lin [27] employs a very different juxtaposition of information and the human body. With the

Fig. 14 Visitors to the Maya Lin Memorial see their self reflection in the black granite wall, juxtaposed with the names of dead soldiers.

Fig. 15 *Subtitled Public* randomly chooses labels for people entering the installation and projects it onto their bodies.

design the artist aimed at a neutral presentation of facts, showing the U.S. victims of the Vietnam war, not dictating any interpretation. The wall simply lists all the names of soldiers who have died during the Vietnam War without any ideological coloring; Neither are the victims presented as heros nor is any anti war message conveyed. The writer and curator Tom Finkelpearl describes the memorial as "both more personal and more abstract than the traditional memorial", imbued with "an aura of fact" [28]. One compelling design detail is the materiality of the wall itself, black granite with a strong reflective quality [Fig. 14]. When a visitor stands in front of the memorial he/she can see his/her reflection at the same time with the engraved names. The visitor sees his own image overlaid with the names of fallen soldiers, juxtaposing the alive and the dead and the past and the present.

Even though the information on display are hard facts, the juxtaposition allows multiple interpretations, giving each visitors the opportunity to find their own. The juxtaposition creates a moment of (self)reflection and contemplation for the viewer.

The public art project *Subtitled Public* by Rafaelo Lozano-Hemmer [Fig. 15] employs the method of juxtaposition of the human body to very different ends. In the installation a computer vision setup tracks people in physical space. When entering the space people are involuntarily annotated with labels that are projected directly onto their bodies.The words are chosen randomly from a list of verbs conjugated in the third person. The project "attempts to highlight the arbitrariness of computerized surveillance systems now used in public and private spaces that attempt to detect suspicious individuals and classify people by ethnic group for example" [17]. The juxtaposition represents this automated classification process to which we are, and more and more will be, exposed whenever we enter a public space equipped with surveillance technology. The juxtaposition is not primarily employed as a method to associate a person with a specific message. Instead, one could say the process of juxtaposition is the main feature of this installation. The system that arbitrarily attaches labels to real people in physical space represents the asymmetrical power relationship created with surveillance technology.

III.
Design Parameters

This chapter outlines a framework for the Personification of Information. Because my starting point for all projects in this thesis is artistic practice, the framework presented is context-specific. Thematic aspects such as choice of subject matter and audience are equally important to more methodical aspects such as the visualization technique and the technology.

In very basic terms, the approach can be described as such:

- Choose a data set, an audience and a group of people meaningful to the viewers
- Map statistical information onto the group of people
- Display personified statistics to the audience in a compelling form

In order to realize this, the following steps are necessary: The author chooses a data set and a group of people that can personify that information in a meaningful way **[Personification]**. The group and data set are captured and interpreted as "raw data" by a software system. The data are mapped onto the people in order to create an accurate representation **[Mapping]**. This results in the visualization, a graphical representation that visually annotates individual people with the data **[Legibility]**. The way individuals are shown within the visualization determines the emotional reception by the viewer **[Intersubjectivity]**. This is also influenced by the point of view the audience has in relation to the people within the visualization **[Perspective]**.

The visualization is not treated as an isolated representation that can be displayed on any device in any location. Instead, the physical and social environment of the visualization provides a pre-existing web of meanings that becomes part of the overall experience **[Context]**. Physical appearance and functionality of the display device that shows the visualization defines how the viewer actually engages and interacts with it **[Interface]**.

Personification

The personified information visualization has a peculiar approach. In order to make the information more meaningful and grounded in a viewer's personal environment, real people become part of the visualization. As the goal is to bring distant and detached information closer to the viewer, these individuals are from a group meaningful to him/her personally. With this approach, the individuals are not necessarily the origin of the information. Rather, they function as proxies, stand-ins for the individuals who are actually the source of or affected by the statistical information shown.

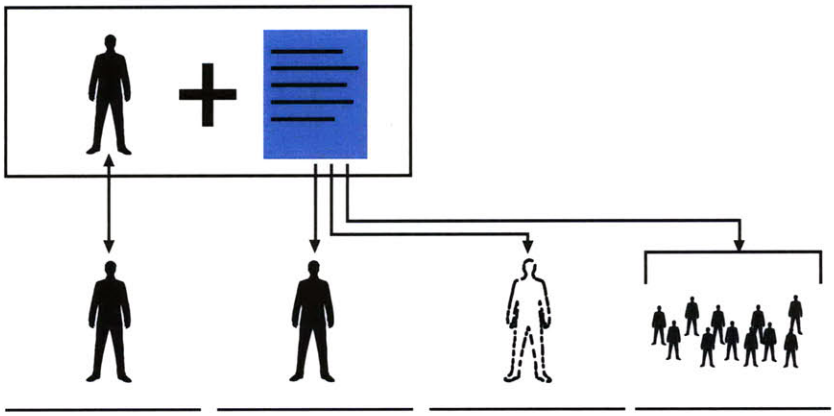


Fig. 16 The signification process-a person is augmented with information which can stand for another real or imaginative person, or even for a group of people.

In terms of communication, the concept is paradoxical, as it makes use of an individual in three different ways at the same time. This is best explained in semiotic terms: Each person is a *signified*, meaning a real human being existing in the physical world. A person can be referred to by a *signifier* such as his first name. The *signifier* can be a representation of the person, for example a photo or a video. In addition, within the piece, the person is labelled with a specific bit of information. This label is a second *signifier*, which *stands for* one data point within the data displayed. Described in simple terms, each person is perceived as the person he/she really is, but at the same time he/she functions as proxy for an abstract piece of information not related to him/her directly. Ideally the viewer perceives these modalities at the same time. If the Personification fails to communicate the paradoxical approach, it becomes unnecessary embellishment, or even worse, confusing or nonsensical.

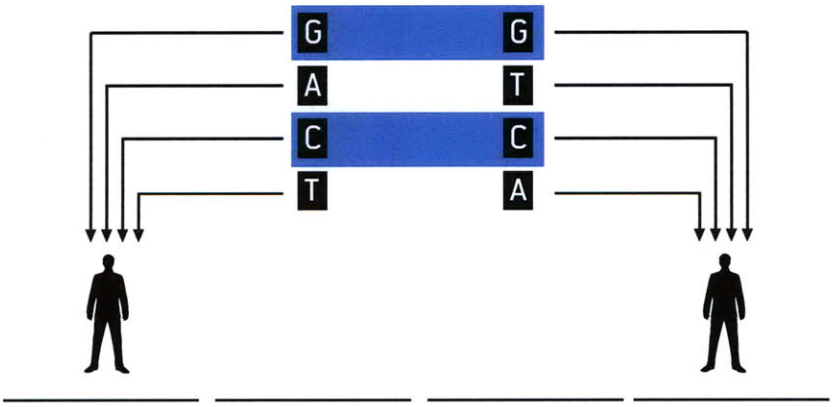


Fig. 17 Associative similarity between augmented subject and the person data are about.

This process can be simplified if an associative similarity between data and people exists. For example the information can be historical data about the population of Boston from a century ago, but is then mapped onto Boston citizens from today. This associative relationship can be of demographic, social, historical or political nature. It should be plausible that the information could be derived from the people, *as if* it is about them, at the same time it has to be clear that it is not. This

can be communicated by displaying explanatory information (see **Legibility**). The associative layer can be supported by the **Context** the visualization is situated in.

Context

Traditionally, display devices are seen as *windows into another world,* entirely independent of the physical surrounding they are placed in. But because personified data visualization relies on an interpersonal relationship between annotated people and viewer, the physical and the social surrounding play an important role.

This is especially the case when the annotation happens in a live real-time situation, where all participants are situated in the same physical space. Here the symbolic meaning of the space and its historical and institutional context has to be taken into account when designing the project. For example a university building is associated with the research happening inside of it, its history, the ideological and financial background etc., and most of the people frequenting it are students and faculty.

Consequently the physical environment does not only provide a preexisting symbolic framework defined by physical space, it also determines the group of people who become part of the visualization. As the goal is an emotional, empathetic response by the viewer, the individuals who are within the visualization have to stand in some sort of relationship to him/her. The social context is defined by a population that shares certain commonalities, such as nationality, profession, family or circle of friends. Choosing this relationship is of high importance for the reception of the visualization, because it forms the interpersonal context the data is embedded in.

Individuality and Intersubjectivity

Personified data visualization employs the experience of empathy in order to bring otherwise abstract and detached information closer to the viewer. According to the phenomenologist Edmund Husserl, empathy is at the foundation of the experience of Intersubjectivity. Intersubjectivity can be roughly described as the act of "putting ourselves into the other one's shoes". By perceiving an individual that looks and behaves more or less similar to myself, I can ascribe intentional acts to that individual immediately, without having to draw an analogy to myself [29].

However, the perception of other subjects can vary greatly. A person can be perceived as one part of an anonymous crowd, or as one individual with a unique appearance and personality. It is assumed that this variation correlates with the intensity of experienced empathy. Another phenomenologist, Emmanuel Lévinas emphasizes the face-to-face encounter with another individual in which the other's proximity and distance are strongly felt. He argues that in a face-to-face encounter, the "Other precisely reveals himself in his alterity not in a shock negating the I, but as the primordial phenomenon of gentleness."[30].

While such a strongly felt empathy might be desirable, experiencing the people within the visualization face-to-face might be problematic. If the person is annotated with very specific information, the connection between data and person might be too direct. he/she appears to be the origin of the information, instead of a proxy that *stands for* the information shown.

On the other hand, if a large quantity of people is shown at the same time, a

person becomes one of many, an anonymous entity instead of a unique, individual, fellow human being. This might weaken the experience of empathy within the viewer.

This competing tension has to be balanced carefully and can be clarified by displaying additional information [see **Legibility**].

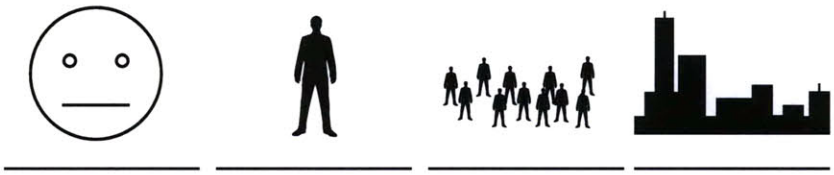


Fig. 18 Modes of Intersubjectivity

Perspective

Each individual's perspective within the visualization has to be considered. The seeing relationship between viewer and individuals can be asymmetric or symmetric. If it is asymmetric he/she is the only one seeing the annotated people within the visualization, who might even be unaware of the observation. If it is symmetric everybody sees the visualization, is observer and observed at the same time.

Similarly the spatial perspective is of importance: A view on eye level has different connotations than a top-down bird's-eye view.

While not the main focus of Personification of Information, the seeing relationship touches on notions of surveillance and voyeurism that have to be considered. The perspective has significant implications for the overall reception of the piece, as it defines a distribution of power: Who is to see and know, who is not, and why? These modalities are determined by the subject matter and the intended reception. For example if the visualization is about the data the government gathers about the U.S. population it might make sense to represent it in a top down view, only visible to one person at a time. Thus, the viewer takes on the government perspective and the asymmetric knowledge and power relationship between government and population is experienced visually.

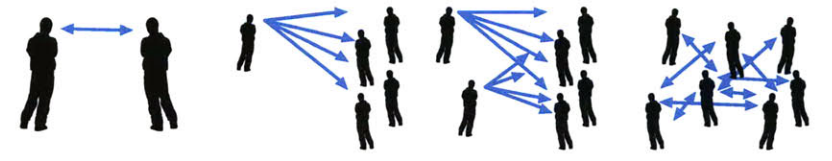


Fig. 19 Constellations of perspective

Mapping

For any data visualization, information has to be prepared in order to be displayed with a given representation. In a bar chart, for instance, the quantities are mapped to certain minimum and maximum heights the bars can have. Personified data visualization deals with different constraints: As real people function as graphic elements within the visualization, the data has to be mapped to them in a meaningful way.

One way to do this is to normalize the data set to the amount of people

present. One person represents a certain percentage, the sum of people shows the overall distribution of quantities. For example, if one item is represented with a distribution of 50%, half of the people present would be annotated with that value.

If dealing with a live situation in which people enter and leave a physical space the distribution can be mapped to occurrence. If one item has a value of 50%, every second person would be annotated with it, independent of the overall amount of people present at a given time.

Another approach is to show the data within the graphics that augment a person. The two- and three-dimensional forms associated with the body can display different quantities through scale, position or color-coding.

These different mappings can be combined in order to display multi-dimensional data sets.

Juxtaposition

In traditional data visualization the focus oftentimes is to represent as much data as possible with the graphic elements used [8]. The graphic elements are efficiently applied in order to support an unambiguous, efficient visualization.

With a personified data display, some methods of information visualization are applicable, others are not. For example, if the system annotates real people moving around in physical space, it becomes impossible to make use of two-dimensional space as data axes.

Personification of Information makes use of people as graphic elements. In order to do so additional graphic design is necessary. Typography, graphic shapes and color communicate what data set is shown, the data source and how it is mapped to each individual.

The most important aspects are the annotations mapped to individuals, and meta-information that explains the overall visualization. The annotations visually categorize people according to the distributions derived from a data set. They should support, not undermine the interpersonal context between viewer and annotated individual. Especially if information is mapped onto real people in physical space, the positioning of graphic elements and text around the body determines how legible and at the same time emotionally intriguing the visualization appears to the viewer.

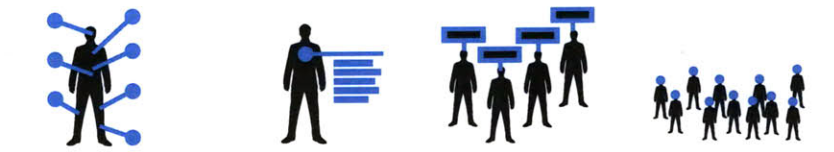


Fig. 20 Distance to viewer determines possible amount of data to display and graphic design around the body.

Additionally the display of meta-information is crucial. If the data shown are not directly related to the people within the visualization, it is necessary to clearly communicate the data source and the fact that the people act as signifiers for the actual data.

Interface

As explained in **Context**, the entire environment has to be taken into account when creating a personified data visualization. This also applies to the interface that actually shows the data, may that be a screen, a projection or any other display device. When it is embedded within a physical space, the actual shape of the interface has to be considered as well as the spatial situation it creates. Appearance, volume and shape influence the way a viewer engages with a visualization. The physical appearance might symbolically reference or contrast the topic of the piece or the surrounding it is situated in. Or it is simply designed to arouse a potential viewer's curiosity.

Furthermore, the interface can allow interaction by the viewer, such as navigation within the data set, filtering of information or the choice of different visual representations.

IV.
Design Experiments

In this chapter I describe my design experiments more specifically. Three projects investigated Personification as a strategy for data visualization:

WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS? is a web application that visualizes statistical data about a distant population by contextualizing it with a user's circle of friends on the social networking platform Facebook. Contacts in his personal "global village" become representative of a distant population, and serve as a more easily comprehensible representation for an otherwise abstract, bodiless set of numbers.

UNIFICATION–A CASE STUDY? is a proposal for a public art installation that presents public opinion data from Germany on the topic of unification to a South Korean public. It draws a political analogy between East/West Germany and North/South Korea by focusing on generational changes in public opinion on this issue. The data is presented by a graphic visualization situated within physical space. Through a graphic overlay real people in South Korea are annotated with the distant, historical data from Germany.

WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? presents historical research directions at the Media Lab by juxtaposing current researchers with that information. The project was a site specific installation set up during the Spring/ Summer Sponsor event 2010 at the Media Lab. Visitors entering the scene are augmented with historical information, becoming stand-ins for a generic Media Lab research community from a given year.

All three projects are discussed according to the framework defined in Chapter III. Additionally, sketches and experiments that lead to these projects are described in order to explain the design process. These projects are preceded by two experiments that explored Personification in other areas:

OMNIVISU employs Personification as a method to engage with architecture. It was a public art installation enabling participants to project their eyes onto the tallest building in the neighborhood. By juxtaposing architecture with people's most unique and personal features a moment of identification with the built environment is created.

GIVING CHARACTER TO CHARACTERS makes use of Personification in order to create a more expressive, personalized form of typography. Through an intuitive pen interface a user can animate a written text, resulting in a very natural, human-like motion. The user can inject personal and emotional expression into the otherwise abstract writing system.

While with these projects Personification is not used to bring abstract information closer to the viewer, they still provide insights on the design strategy. Analysis of these projects is included in this section in order to discuss aspects influential to the Personification of Information projects.

Omnivisu - Personification of Architecture

An awkward looking box is placed on the street, right in front of the well-frequented train station Warschauer Strasse in Berlin. Pedestrians are entering and leaving the station, most of them not taking notice of the strangely-looking device. If a person stops and approaches it, he sees that there is a slit at the top, emitting an alluring light. The moment he looks into the box, his eyes are projected onto the windows of the Narva Tower, the largest building in the area. Everybody else on the street can see that suddenly the building has human eyes, blinking, smiling, overlooking the neighborhood. They realize that the box is the device that gives eyes to the architecture, and they start playing with it as well.

One after the other, they take turns to briefly transform the building into a living being: One person on the street projects his likeness onto the largest built structure in the neighborhood; Briefly claiming it for himself, only then to pass it along to the next pedestrian on the street.

DESCRIPTION

OMNIVISU is a public art installation first deployed at S-Bahnhof Warschauer Strasse in Berlin in the summer of 2005 [31]. The location is well frequented by commuters changing or leaving trains and general pedestrians.

The installation consists of a viewing kiosk placed on the street, which is connected to the tallest building in the area, the "Narva" tower. If a person looks into the viewing kiosk, his eyes are projected onto the building's windows. Through the projection, the building suddenly appears to have a face, with human eyes overlooking the area. In the box, the viewer sees the building with the projection in real-time. Through this feedback he/she can see how his eye movements affect the building's appearance.

The piece provides an interface to the building, which usually is inaccessible by the general public. Now, only by looking into a box sitting on the street, everybody can interact with the distant architectural structure. Formally the installation employs anthropomorphization: Simply by placing human eyes onto the existing structure, the building comes alive; it is easy to make it look sad, happy or nervous.

PERSONIFICATION

Here Personification is not used in order to communicate a specific body of information, it merely provides a playful interface allowing the individual to project his personality onto architecture on an urban scale; Empowering him/her to personally claim the building, and thus the city, for a short moment; after which the next person takes control and does the same. The Personification functions as a means to bridge the alienation towards the built environment residents of a big city might experience. Reconnecting them with their environment, hinting at their capability to be actors who have the power and responsibility to influence the neighborhood they live in.

Fig. 21 View of the personified building

CONTEXT

Fig. 22 Satellite image of the location, a junction of the river Spree and various train and bus stations.

The installation was situated in a very specific location. There is a train, subway and bus station and people walk from one to the other. Additionally, the building is directly at the river Spree, which at this location formed the border between East and West Berlin. The Narva tower is the tallest building in the area, visible from both sides of the river, overlooking train tracks, two bridges and the adjacent neighborhoods. With the distinct cube-shaped upper part its form is slightly reminiscent of the observation towers that used to line the border two decades before.

Despite its distinct appearance and visibility, the building does not really function as a landmark for the area. It is located in a business district which is hard to reach and somewhat disconnected from the adjacent residential areas.

The installation was only active in the night hours, providing a peculiar mix of people: Long-time citizens, young people and students who are the new residents of the former Eastern part, immigrants from the neighboring district Kreuzberg, and groups of people from everywhere changing trains on their way to another location, or enjoying the active nightlife.

Due to the way streets and trains are structured, there is plenty of foot traffic from one station to the other or from neighborhood to neighborhood.

INDIVIDUALITY AND INTERSUBJECTIVITY

The installation personifies one element of the detached and anonymous built

environment surrounding us. Not only does the projection add human-like features to the building, the features originate from one specific person at a time. Intentionally the installation uses a person's eyes, an identifying feature as unique as a finger print. By projecting this intimate and personal feature on an architectural scale, a personal relationship with the urban environment is established. The built environment transforms from a static and anonymous structure to a dynamic and personable medium. It is changed through the short interaction, the viewer briefly claims owner- and authorship.

While only one person at a time actually plays with the installation, people interact with each other through the spectacle. One person at a time personifies the building, simultaneously communicating with bystanders on the street. People react to the "performance", give instructions and communicate with each other. Eventually they take turns, allowing each person an opportunity to take the active role at some point.

INTERFACE

Fig. 23 The viewing interface.

The viewing kiosk placed on the street provides a very intimate interface. The physical form urges the viewer to look into it and no other action seems possible. Simply by looking into the box, a connection to the building is established. A participant's eyes–a private, personal and fragile bodily feature–is magnified to the urban-scale projection. The personal and private becomes overly public and visible to everybody in the area.

Within the box the viewer sees a live video feed of the building itself. Hence he/she is always aware of how his/her eye movements affect the building's appearance, consciously performing for the surrounding city.

FINDINGS

Fig. 24 People interacting with the installation on the street.

OMNIVISU can be described as my discovery of Personification as a design strategy. Some aspects that were identified in the process of creating this project are carried on in the following projects in this thesis.

One could have easily built a similar installation, featuring an interface that allows a person on the street to interact with a building on an urban scale. While this would have a similar notion of interaction with our built environment, the Personification created through the eye interface had a different impact. By lending their eyes to the building, the whole structure turned into a human figure, a physically embodied representation of the person on the street. By using the person's eyes as his identifying bodily feature a situation of contemplation is created. It allows a reflection on identity: Who is it that lives in this neighborhood? Who "rules" and owns it? And who is it that sculpts it, architecturally and socially?

The Personification also creates a moment of uniqueness. Each person's eyes are absolutely unique, hence each person transforms the building in a slightly different way. For a short moment, a personally customized relationship between the built environment and one person is established.

Lastly, OMNIVISU features a very specific quality of juxtaposition between person and architecture. Obviously any realistic representation of a person is entirely unique. But here, only the detail of a person's eyes are used, a reduced, yet photorealistic, real-time representation of a person. The live video feed of this detailed view covers only a part of the building's facade, sufficient to anthropomor-

phize the building but without any additional imagery. This reduced composition allows a coexistence of the architecture and the personal features and creates an interesting formal interaction between the two.

Giving Character to Characters - Personification of Typography

Finally she finds the message she was looking for among all the other ones. She opens it, and is greeted with the word "HAPPY". Just as she wants to read on, the "Y" starts move. The joint between the three strokes moves from left to right, in circles, it is dancing! It swings it's waist, shakes it's hands and taps with one foot. Then, the letters say "BIRTHDAY" and all letters are dancing together, as if to the same song, a visual melody flowing through the characters from left to right. As she laughs out the words change again to "YOUR PHIL". The "R" tip-toes over to the "P" and the lower stroke of the R playfully pokes the "P". Almost the way Phil always does when he meets her in person...

DESCRIPTION

GIVING CHARACTER TO CHARACTERS is a software system to create and animate digital typography. The starting point was to investigate the relationship between handwriting and digital text, and the characteristics of each for text-based communication. While we are communicating more and more in written form, in e-mails, instant messaging and social networks, we do this by using digital fonts with very limited influence on the actual visual appearance of the typography. This differs dramatically from handwriting, and I was mostly interested in the unintentional or accidental contextual information that is part of it: The formal appearance of a handwritten note can convey information about the person who sends a message. His/her education, social status, but also the current situation and emotive state he/she was currently in when drafting a message.

In the software developed, a person can write text and animate it using an intuitive pen-based gesture interface. The system uses the gestures in a record-and-play-back mechanism to animate written text. Because each animation is created through a person's gesture, the motion appears smooth and very natural, unlike animation created computationally or using traditional, keyframe-based animation software such as Adobe Flash or Adobe After Effects. While there have been many projects investigating computationally animated typography ([34], [33],[32]), this project focuses on the smallest unit of type, the individual letter. For this, a new parametric, stroke-based font format was developed which allows computational animation of the individual letter strokes. Through the gesture input, a user can give an animated behavior to the points and strokes forming a letter, and ultimately a whole letter or word can be animated.

While the individual letters of the Latin alphabet were originally derived

Fig. 25 Single stroke mode. One stroke with the pen defines the motion for all letters.

from representations of the real world, today they function as abstract symbols that convey meaning to us by social convention only. This animation of typography adds a second layer to the message expressed in writing. For instance, the written word "dog" can move *as if* it wags it's tail and barks, and the word "party" can appear to be dancing.

PERSONIFICATION

Here Personification is used to add a second layer to this abstract communication technology. Through the gestural input, a user injects his/her personality into the form of a written word. The resulting personalized animation (re)establishes a representative layer to the message, which communicates information about the sender, independent of the linguistic content of the message. The same text can be augmented with an animation unique to one person, and through the intuitive input he/she can express himself/herself differently than in written language. The animation can have a very emotional, representative and almost narrative appearance. For the viewer, the symbolic, abstract features and the animated, personal layer coexist at the same time.

LEGIBILITY

The font engine in this system is designed such that the letters always remain legible. While a letter's shape can be transformed flexibly, the transformations are constrained in order to prevent the letter from turning into a random accumulation of strokes. The font is stroke-based, with lines and joints defining the form of a let-

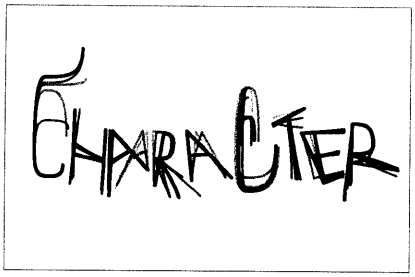


Fig. 26 Onion-skinning mode showing the shapes each character takes on over time.

ter instead of the shape that makes up a letter. This bone-like structure supports the anthropomorphic appearance of the letters when animated. For example, a "T" can punch the letter next to it with the left "arm" or the letter "Y" can appear to shake its hips.

A message created with this system allows two layers of meaning. The meaning conveyed in written text and the meaning expressed in animation. These two communicate in different modalities: Text is unmistakable and intelligible, while the gesture animation has an emotive, visceral quality that allows a more ambiguous interpretation. Similar to handwriting, the animation conveys personal information about the author that can be read, but the meaning is not as clearly definable as the written word.

INDIVIDUALITY AND INTERSUBJECTIVITY

In this system a user is author of both the text and the animation. His/her personality is expressed in the resulting juxtaposition, with the meanings of each interacting with each other. The animation itself is unique and personalized, but the author might not be clearly identifiable by the animation alone. But the combination with text also communicates his choice of meanings. For example one person might have the term "Happy Birthday" dance happily, while another makes it appear to yawn tiredly.

MAPPING

In the application, gestural input by the user is mapped to typography. The system allows for two different modes. One maps a gesture to all letters on the screen. The motion is offset from one letter to the next, so each executes the motion at a different point in time. This results in an animation that flows through all letters on the screen. This is mostly directed to animate whole words or sentences with one gesture.

The second mode provides control to the user on a micro level. Each point in each letter can be individually animated with a gesture. The user can assign a different behavior to each letter on the screen. Supported by the stroke-based structure of the font, an abstract symbol quickly turns into a living being with unique characteristics expressed in motion. One letter might scratch itself, the other dances wildly, the next one simply jumps from time to time.

FINDINGS

With GIVING CHARACTER TO CHARACTERS I explored human expression in order to augment information as conveyed in written text. By capturing the gesture, unintentional and accidental motions become part of the expression. This leads to an emotional and ambiguous appearance of the animation. In particular, the ambiguity seems to emphasize the representation of personality, and I am interested if this could be employed in other ways: Allowing unintentional human actions to become part of a representation for a more authentic expression of personality.

In addition, the anthropomorphization of written text was intriguing to me. In this project, written language, an abstract symbolic communication technology, is personified through human expression. The tool is content-agnostic, as the actual information conveyed in text is arbitrary and chosen by the user. I was interested in exploring the augmentation of information more specifically: If one specific set

of information is to be communicated, which human characteristics can create an emotional response in a viewer? A complex web of meanings emerges: The content itself, the person whose features augment that information, and the viewer. This specific approach is explored in the following projects.

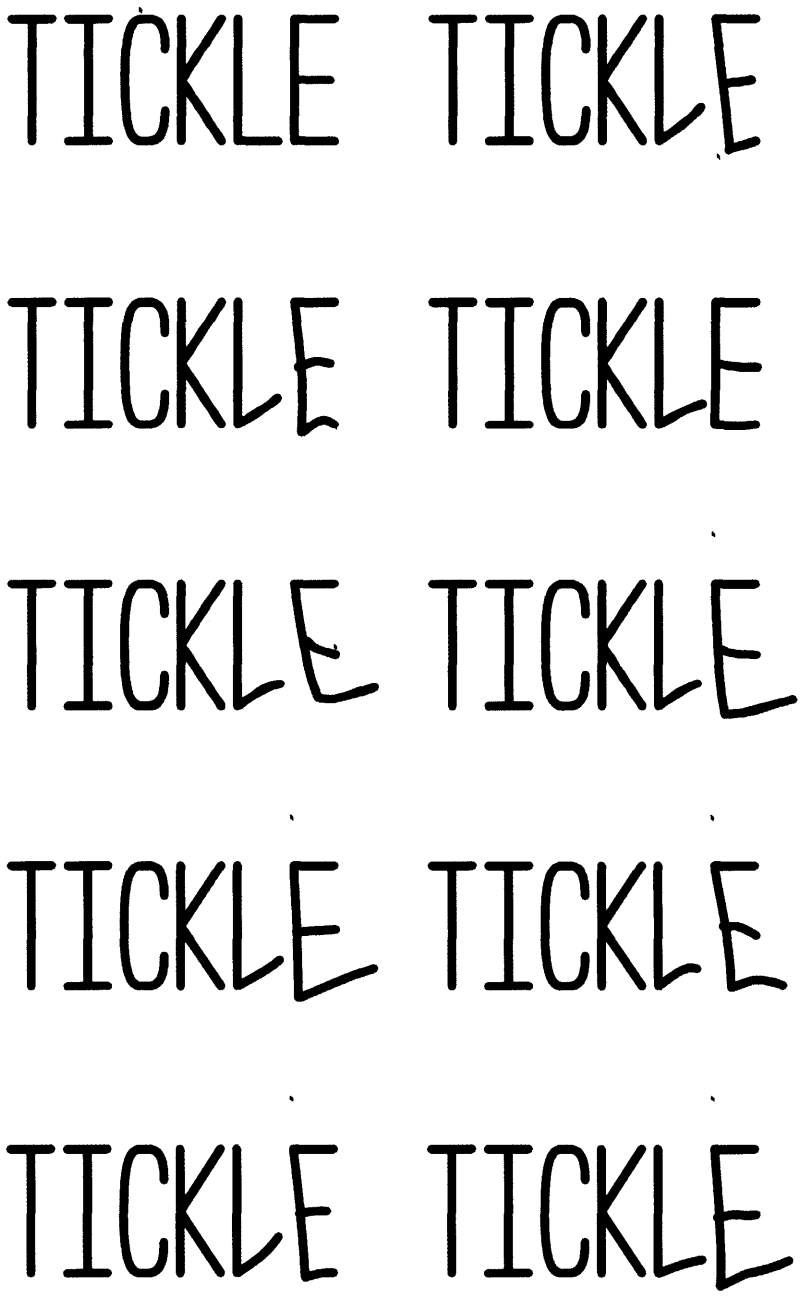


Fig. 27 In another mode individual points and strokes of a letter can be animated using a pen interface.

What If The World Were Your *n* Facebook Friends?

He pans over the map, virtually traveling from the coast over the mountains, to the forest landscape further in the South. The vivid greens suggest a dense rain forest. He zooms in, and sees dirt roads, small streets and tiny villages here and there. He finds himself in a larger town—multi-story housing, a business district, highways. The info bar provides the usual information and statistics, city name, population, average age, employment, income. But what do those numbers mean, really? He pushes the "What If" button and things get a little clearer. If this city were his Facebook friends, ten of 364 would be unemployed, thirty would have been convicted of a crime. Half of them wouldn't have finished high school, and most of them would live of less than 3 USD a day. Should he really travel there? He ponders, and clicks on the happiness index...

DESCRIPTION

WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS? is a web application for data visualization. Statistical information about a distant population is contextualized with the user's circle of friends on Facebook. The online profiles of his friends become stand-ins for a given population, and their low quantity serves as a more easily comprehensible representation of a large data set. The goal is to generate a sense of empathy and connection to what is usually a bodiless and abstract set of numbers.

This project is inspired by *The Village Report* by Donella Meadows, also called *What if the world were a village of 1000 people*. The strategy applied in the text is to normalize statistical information about the whole world population to an amount of only 1000 people in order to understand relative distributions of these statistics more easily. While in Meadow's text the reference point is a generic village of 1000 people, we are investigating if it is possible to use each viewer's personal "global village" for reference, meaning the personal circle of friends and acquaintances as defined through online social networks. In the other personified data visualization projects, the goal is to bring statistical information in context with a viewer's personal environment. In in this case the environment is not physical or spatial, but virtual: The collection of friends that a viewer has acquired through Facebook.

The project is a collaboration with Doug Fritz ('10, MIT Media Laboratory, Fluid Interfaces Group)

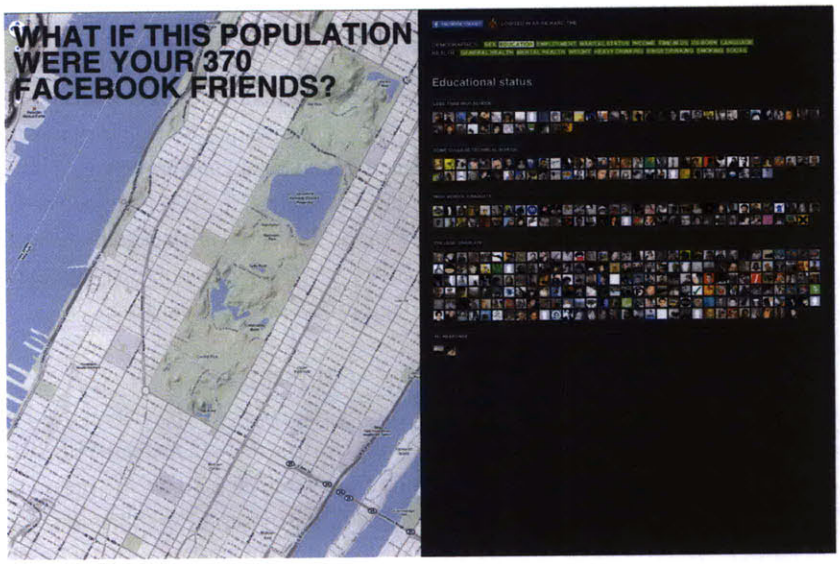


Fig. 28 Web interface for *What If The World Were Your n Facebook Friends?*

PERSONIFICATION

Since the original text by Donella Meadows, many projects have followed up presenting the same information in form of poems, animations, films and even interactive applications. Additionally, by now, the general distribution of the world population has become part of common knowledge. Hence this project uses statistics about a very specific place instead of this very generalized and averaged data set.

The data set chosen is the New York City Community Health Survey from 2008 (CHS) [35], a telephone survey conducted by the DOHMH (Division of Epidemiology, Bureau of Epidemiology Services). The survey provides robust data on the health of New Yorkers, including neighborhood, borough and citywide estimates on a broad range of chronic diseases and behavioral risk factors. This data set is available at zip code granularity which makes it ideal for this application. The viewer can zoom into specific neighborhoods and compare them, or he/she can zoom out to see the averaged data of multiple neighborhoods or the whole city. The demographic in the five boroughs of New York City varies greatly, which is reflected in the health survey results on general questions regarding age, citizenship, marital status. In addition to questions regarding general demographics, the survey includes very specific questions on health, such as "How many times in the last 30 days have you had more than 5 drinks?" or "Do you drink more than two sodas a day?"

This data set is displayed by means of the viewer's circle of friends on Facebook. His friends become representations of the survey participants. The collection of friends *stands for* the population of New York City. The visualization shows a user's friends profile pictures *as if* they lived in a specific neighborhood, *as if* they participated in the survey. The survey results are mapped to the amount of friends, statistically displaying the distribution of replies within a given neighborhood.

MAPPING

The DOHMH survey consists of multiple questions on specific topics, with multiple possible answers for each question. Because the survey results vary in amount of

participants from location to location, we use a percentage basis to represent the data. The viewer's Facebook friends are treated as the units of the representation, each person standing for a certain amount of survey participants.

For each question all Facebook friends are representative for all participating individuals, and are arranged visually according to the distribution of the possible replies. No data about the Facebook users themselves is gathered, it is not attempted to correlate the Facebook demographics with the survey demographics in any way. They are associated with the replies randomly as they function as proxies for the represented data set.

Fig. 29 early sketches investigating different representations.

INTERFACE

The interface is a web application that runs in a standard web browser. It consists of two parts: The first is a map interface, which allows the user to browse to a specific location within New York City. The user can pan to a location and can zoom in and out. Whenever the user browses to a different location, a query to the server retrieves the statistical information of all zip codes currently visible on the map. Thus, the geographic zooming functionality also filters the data by granularity. A visual zoom into the map retrieves more granular information, a visual zoom out of the map retrieves an averaged result.

The second part is the actual visualization. Here the user can choose from a number of topics from the health survey and the question and results are displayed based on the location-dependent data set. When the user chooses a topic, the survey question is displayed with the possible answers. Underneath each reply the profile pictures of the user's Facebook friends are arranged in a grid according to the survey results. For example if there are two possible answers to a question with a result of 75% and 25%, three quarters of the profile pictures arrange underneath the first reply, one quarter underneath the second reply. If the topic is changed, the headlines and questions update, and are arranged vertically to accommodate for the size of graph underneath each result.

The user can interact in two ways: Either by navigating the map (zoom in/out, pan) or by choosing one of the topics. With each interaction the visualization is updated, triggering the images to shuffle and relocate on the screen through a fluent animation.

The web application is built in HTML, CSS and Javascript (using the Jquery framework). It makes use of the Google Maps API which provides the geographic location as defined by the map boundaries. Through the Facebook API profile pictures and names of all the user's friends are retrieved.

Similar to other Facebook applications, the user has to grant access to his Facebook data in order to use this personalized interface.

LEGIBILITY

The system displays a large amount of information. It shows the map, a navigation to choose the different topics, and then the actual visualization showing one question and multiple answers. Headline and answers are organized hierarchically with clearly legible typography. The current topic is conveyed by the navigation tabs as well as the headline.

The results are visualized by using the profile pictures of all the user's Facebook friends. The pictures are arranged graphically within a grid underneath

each reply, depending on the distribution of the replies. By choosing square profile pictures it is easy to understand the quantities for each result by the accumulation of pictures associated with each result.

The information shown is not about the Facebook friends themselves, but is mapped onto the amount of friends a user has on the social networking platform. In order to clearly convey this fact two measures are taken. The first is a large headline placed on top of the map, saying "What if this population were your _____ Facebook friends?", using the amount of friends a user currently has. The noticeable text is set in large, bold text as a headline for the whole application, in order to immediately communicate the hypothetical character of the visualization. In addition, each time the display updates, the profile pictures are shuffled randomly, made visible with a swift animation. During usage of the application, it becomes clear that the association of person and survey result is chosen randomly and is not based on information about the Facebook friends directly.

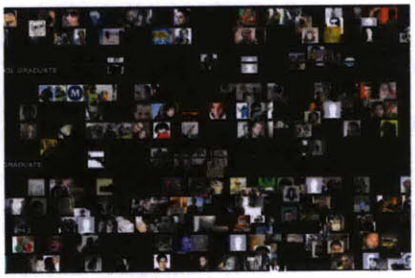


Fig. 30 On each update the display shuffles the images with a swift animation.

INDIVIDUALITY AND INTERSUBJECTIVITY

The system poses a competing tension between initiating a sense of empathy in the viewer when seeing his friends associated with the data, while at the same time clearly communicating the information. Using the small square thumbnail pictures clearly conveys the distribution of quantities for a given survey result. But the small images are problematic, it is hard to see exactly what is shown in the image and while a majority of people use photos of their face, other things, such as images of food or illustrations are popular as well. The viewer might not recognize all his friends by their profile picture alone.

Our solution is to show more information when the user rolls over an image with the mouse. A larger version of the picture with first and last name appears, which guarantees identification of each person.

CONTEXT

The physical context of the display is not applicable for this project. But the virtual context of presentation is meaningful. Through the World Wide Web we are used to having the whole world at our finger tips. We read world news, we virtually travel around with applications like Google Earth and we log on to Facebook to communicate with a circle of friends from all over the planet.

Here these processes are juxtaposed, abstract information from a specific location is contextualized with the user's social circle; One social environment such as a neighborhood or community is mapped onto a viewer's personal, social environment established through the Facebook service.

The social connection established through the Facebook service is a very loose one. Oftentimes people are connected with people that are not considered close friends. If two people are close friends, on the other hand, the virtual connection created through the service is oftentimes not considered an essential part of the relationship. Nonetheless, at least within the US, the sum of connections people have on Facebook is a good representation of the entirety of a person's friends and acquaintances.

Unification–A Case Study?

A busy public space in Seoul, South Korea. Distributed over the space are multiple peculiar-looking viewing devices, similar to binoculars, each one pointing in a different direction. On each, in large letters on the encasing, a different question: "Do you believe you will see unification in your lifetime?" "Do you think peaceful unification is possible?" When looking through the device, a live view of the space is shown: Seoul citizens walking on the street. Overlaid text repeats the question and states: "A public opinion survey from West Germany 1961 | YES: 27% NO 68%"

Each person in the image is annotated with graphics that represent one of the answers, statistically distributed. It looks as if the people on the image are part of the opinion survey, were it not for the clear statement that the data is about Germany and from the past. After a while the graphics change and it switches to the set of answers given to the same question posed 20 years later, and again the people are augmented with the data set. Each device features a different question, a different perspective, representing the hopes, attitudes and opinions of a divided people, before and after unification.

DESCRIPTION

This proposal for an interactive public installation makes use of public opinion survey data, and is based on a political analogy, specifically the topic of unification, seen from a German perspective and presented in South Korea.

The project is about the political phenomenon that Germany and Korea share historically: The division of a country and a people. As I am from Germany myself and have experienced the German unification in my lifetime, I am interested in both the differences and similarities

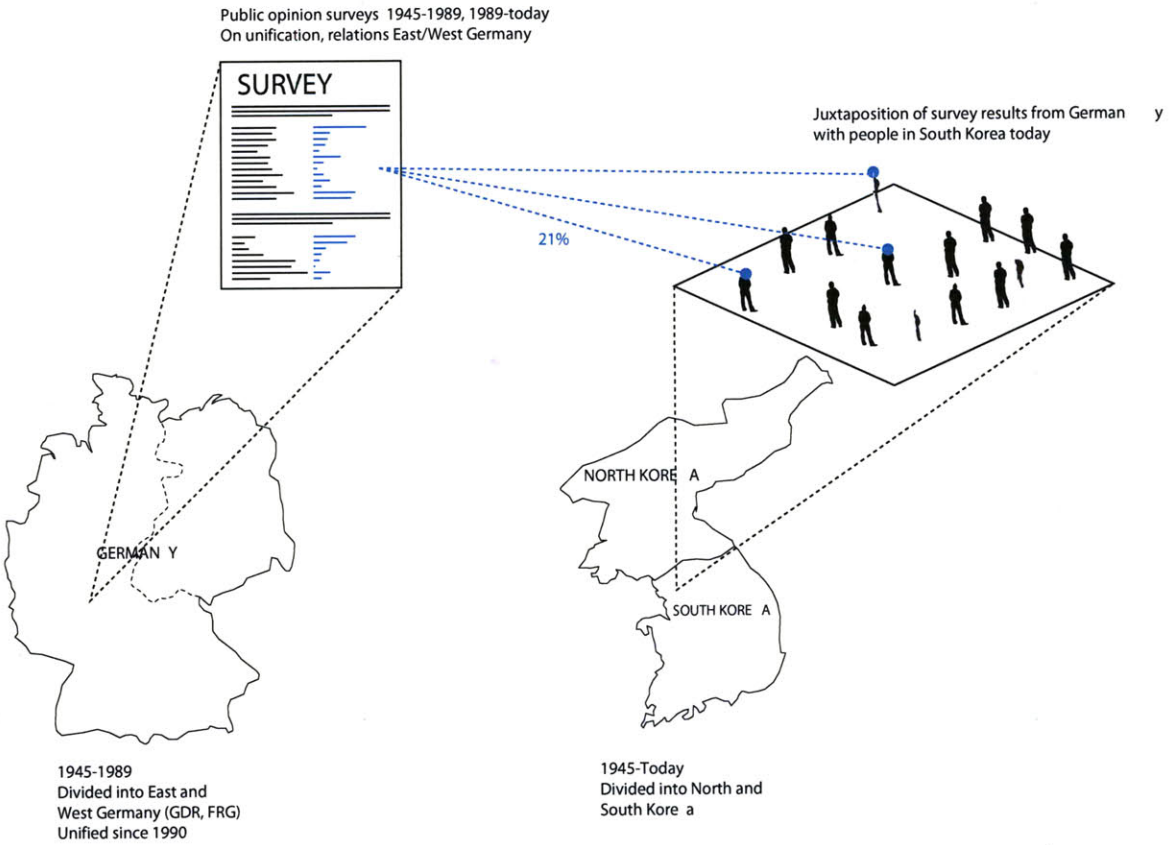


Fig. 31 An illustration explaining the approach of this project.

between both countries regarding this topic. Unification has happened in Germany in 1989 and it has been declared a historical precedent both by the North- and South Korean governments [47]. Goal of this project is to communicate the hopes, feelings and opinions that people had in Germany to the Korean public in an intriguing art installation. This is done by using data from public opinion surveys that have been conducted in West Germany before unification (from 1950-1989) and in Germany after unification (from 1990 till today). It is striking how some of the topics from the surveys can be translated directly to the Korean situation, while others cannot be related at all. In the installation, a speculative situation is established: Korean people are annotated with the public opinion data from Germany, *as if* the survey results are from Korea. While the viewer sees Korean people, the information associated with them is about the German public, which is communicated by the headline above the visualization.

Through this unusual form of presentation, the goal is to communicate this distant data set in a personal, individual way. By using the German history as an analogy, the hope is to create discourse and contemplation on the topic of unification among the viewers and to foster exchange between Germany and South Korea.

The proposal was developed in conjunction with a trip to Seoul, Korea, where I researched and presented the project, discussed my approach and gathered important feedback from local artists, curators and scholars. Due to logistical and time constraints it was not possible to realize the installation. The final piece is tied to a specific location in Seoul, Korea and to actually realize it as a public art installation would have exceeded the time frame available for this master's thesis. However a prototype installation was realized and presented locally in Cambridge to critics

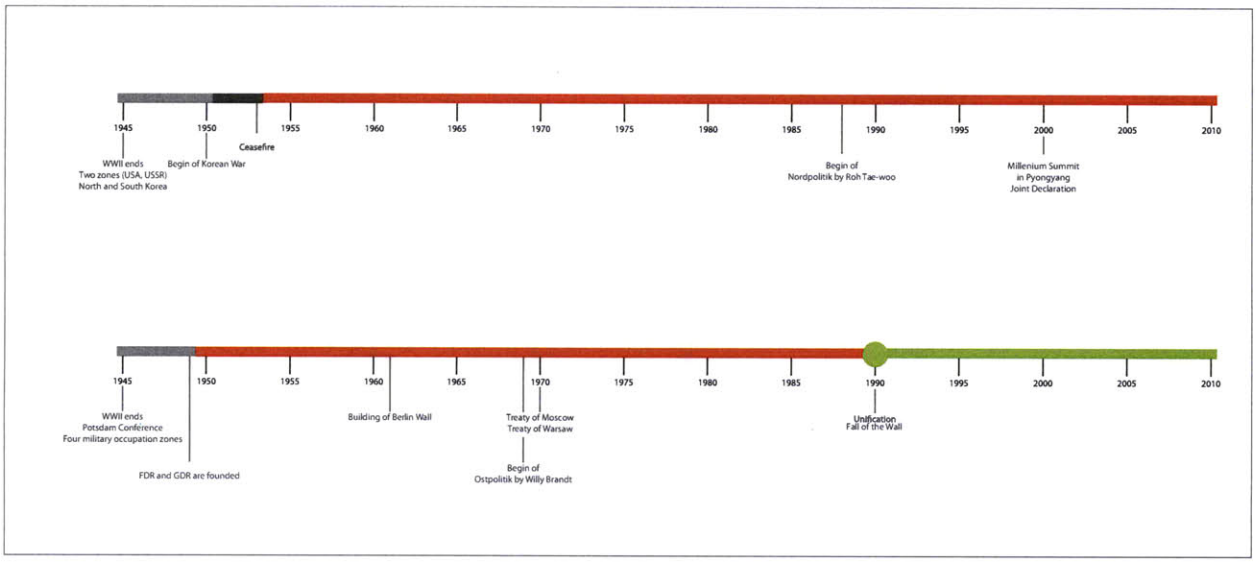


Fig. 32 Historical events regarding unification in North/South Korea and East/West Germany since WWII

from the fields of design, architecture and art.

The final design solution is discussed in full detail below. During the design process that lead to this solution, many different installations were explored and developed to a certain degree. The focus was mainly on different forms of presentation: I investigated which mapping, interface and visualization method would be the most appropriate to present this topic. Some of these design exploration are described in brief after the main design is explained.

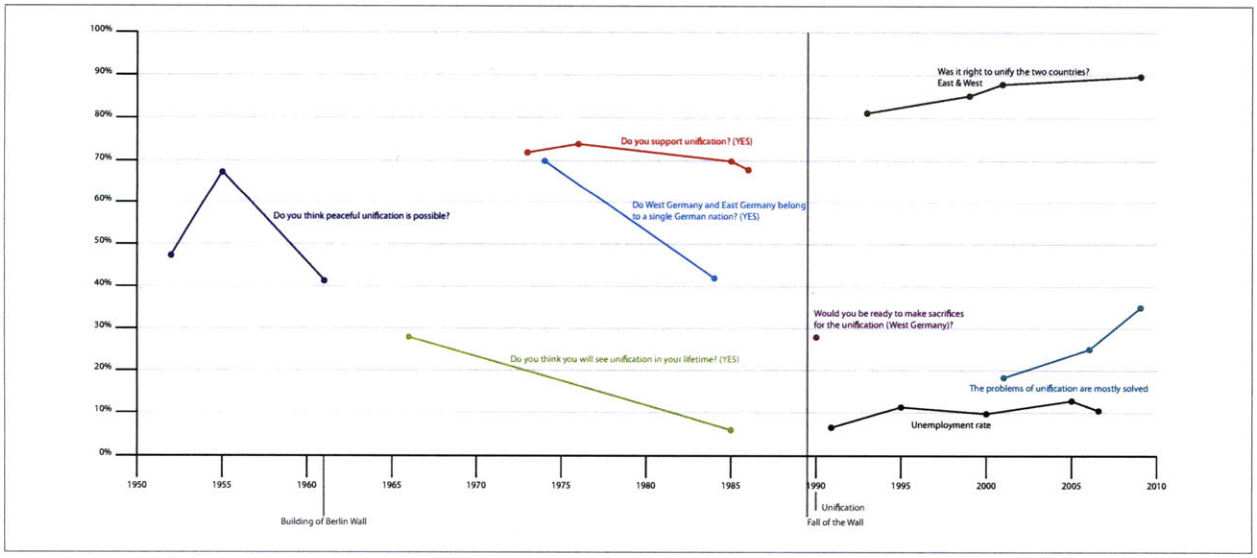


Fig. 33 Generational changes in public opinion in Germany

PERSONIFICATION

The data for this project was gathered from the Allensbach Institut für Demoskopie, a public opinion survey institute that has conducted representative surveys for the German government since 1951([36], [37],[38]). This data was chosen because multiple survey questions were asked over multiple years, reflecting generational changes of public opinion over time [48]. The questions touch on various topics regarding the German-German situation, such as the economic, social and interpersonal implications of division and it's impact on the German identity as a

whole. The data set gives a diverse perspective on the effects the division, and eventually unification, had on the individual. Some example questions include:

- Do you think you will experience unification in your lifetime?
  1966, 1970, 1976
- Can a believing Christian be a Communist as well, or are the Christian faith and Communist ideology irreconcilable?
  1959
- Would you say that the two countries have grown closer in recent years or have they grown further apart?
  1971, 1976
- After unification, would you have preferred to have a new political system, or are you satisfied that the Western system prevailed?
  1990, 1997, 2007
- The people in East Germany and the people in West Germany: Do the differences or the similarities predominate?
  1992, 2006
- How long do you think will it take to equalize living standards between the people in both sides of the reunified country?
  1991, 2006

While the survey results convey important and diverse insights about the German situation, the use of this data can also be seen as a critique of public opinion surveys. Because the institute operated from within West Germany, commissioned by the government, the data cannot be seen as a neutral, objective record of public opinion. The political and ideological framework prevalent in West Germany at the time is reflected in the choice of questions, the possible answers and their exact wording.

This data set is planned to be mapped onto the Korean public. The ideal situation is to augment people in a well frequented public space in South Korea. Quickly the decision fell on the capital Seoul, inhabited by almost half of the Korean population. In search of a specific location, two approaches were pursued: One is to identify a location which is frequented by a broad spectrum of the Korean population, representing different age groups and economic backgrounds. Here, the goal is to reach an audience that comprises multiple generations at the same time, as each is expected to have a different relationship to North Korea and the Korean/Korean situation.

The second was to seek a location which is attended by the young. Since the installation focuses on generational change in public opinion, it could be interesting to find an audience composed of the third generation after the Korean war.

CONTEXT

For this proposal the ideal situation is a well frequented public space in Seoul, South Korea. People who see the installation should be pedestrians, mostly strangers to each other, but the majority Korean citizens. With this content, the social, economic and historical context is important to consider, as it defines the demo-

Fig. 34 Seoul Train station main entrance
Fig. 35 Seoul Train station inside

Fig. 36 View onto Central courtyard at Coex Mall, Seoul.
Fig. 37 View from within the courtyard

graphic present at a location. During the trip to Korea an array of locations were visited and documented and two spaces were chosen:

The first is the Seoul train station. The station services express and local trains to various locations in Korea and additionally functions as a hub for inner city transportation. Here a broad cross-section of the Korean population would be present, representing multiple generations and economic backgrounds at the same time. If the installation would be installed in this location, it would communicate to a very diverse audience: The older generation, who has lived through the Korean War and the subsequent partition, simultaneously with a younger generation who might be less interested in, or indifferent to the topic of unification or even opposed to it. The station provides large open spaces where commuters come and go as well as a public space in front of the main entrance, which is populated by outdoor advertising in front of screens and billboards.

The second location is the CoEx Mall in Gangnam-gu Seoul, South Korea. It is part of the COEX Convention & Exhibition Centre, which is also part of the South Korean World Trade Centre complex built in 1988. The surrounding area around Teheranno is an important business district representative of South Korea's "Wirtschaftswunder", the economic growth since the 1980s. The mall is mainly attended by young people for shopping and entertainment. If the visualization would be presented in this context, the audience would mainly be the third generation after the Korean War; People who have not experienced the time before the country's division in their lifetime and who have little social connections to North Korea. This location would present the topic to an audience that is generally considered indifferent or opposed to the idea of unification between North and South Korea [48]. It would confront this demographic with a topic that is not necessarily discussed on a day to day basis.

The installation could be installed in the open courtyard connecting train station and mall which functions as a public space where people come and go and meet.

INDIVIDUALITY AND INTERSUBJECTIVITY

The way individuality is perceived in this installation is very dependent on the activity within the chosen location. Ideally the situation is a very busy, well frequented public space with many people coming and going at all times. If that is the case, people constantly enter and leave the camera view, and each person is annotated by the system. Because this liveliness requires a constrant redistribution of the visualization, the viewer's gaze does not hold onto an individual person for too long, there is always new activity to observe in another area of the view. The goal is to create a situation where each person is perceived as one of many, the only constant being the graphic annotation.

The content of each label, one possible reply to a survey question, is a definite assertion that leaves no room for ambiguity. The label is almost like a speech bubble in a comic book, as if the statement expresses the person's real opinion. Because each person is not perceived as an anonymous individual from a distance, but a clearly identifiable person, the labeling might confuse the viewer. It is important to unmistakably communicate the speculative nature of the presentation: The fact that the information shown is not at all derived from the people seen in the camera view; that this is a visualization of information from another country and another

time. This is communicated by displaying additional information (see **Legibility**).

PERSPECTIVE

At any time, each viewing device only allows one person to see the visualization. This creates an immersive, very personal experience for the viewer. On one hand, this also means that an asymmetric situation between viewer and observed subjects exists. On the other hand, each person looking through a device exposes himself/herself simultaneously, in a way performing for other people by looking through the device in front of them.

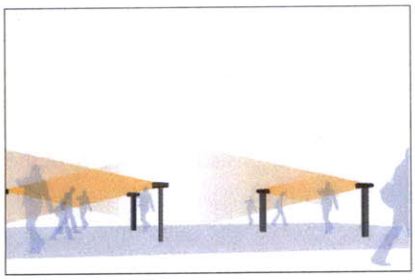


Fig. 38 Multiple different perspectives distributed over the space

More importantly, the proposed setup consists of multiple devices. Multiple people look through different devices at a time, but never are all visualizations accessible to one person only. This emphasizes the multi-layered character of the content presented. On this topic a multiplicity of standpoints exists. This multiplicity is expressed metaphorically through the spatial distribution: A comprehensive understanding is only reached if the viewer is willing to change his perspective physically by going over to another viewing device and experiencing a new visualization.

MAPPING

The public opinion data are a curated collection of questions on the topic of unification that have been asked repeatedly over multiple years. One data set consists of a question, a date, and multiple possible answers to these questions.

The quantitative distribution of survey results is displayed through labels which are mapped to individuals entering the space. Because the activity within a given space is unpredictable, this mapping functions by occurrence. For example if 50% replied with "yes" to a given question, every second person is labeled with this answer. Hence it might take a while to actually infer the presented distributions depending on the amount of people entering or crossing a scene.

LEGIBILITY

The content is communicated on multiple levels. When first approaching the piece, multiple viewing kiosks are visible, each labeled with a different question from the surveys. This provides an overview of the content body presented. When looking through one kiosk a viewer sees a camera image of the scene in front of him/her. A graphical overlay consists of a headline at the top, a legend below, date and location of the survey, a time line at the bottom and the labels that annotate people in the image.

Fig. 39 The device also functions as a sign, with large typography on the outside, visible from afar.

The labels are set in clear white typography on a colored background bar, and plainly spell out one of the possible replies. They are hovering on top of people's heads, and especially in motion it is very easy to understand which label belongs to which person, as they smoothly move along with each person walking through the space.

The headline repeats the survey question visible on the outside. At the bottom, location and time of the survey is conveyed. Set in large typography, the label communicates that the information displayed is from a survey in the past, and that it was conducted in Germany, not South Korea. A time line at the bottom supports the display of generational changes in public opinion, with a cursor indicating in which year the survey was conducted. Over time the display changes to another year and the labels are redistributed according to the new survey results.

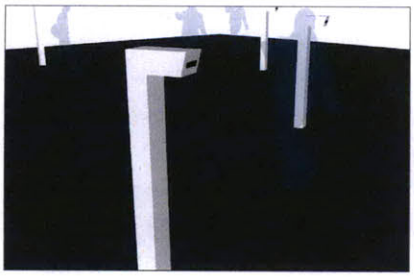


Fig. 40

THE INTERFACE

In the final design, the interface to present this information are multiple viewing kiosks reminiscent of viewing binoculars that can be found on observation decks for tourists. Each kiosk shows the visualization for one question, hence the amount of devices is determined by the amount of questions. The kiosks are distributed within the space, on eye level, pointing in various directions. When a person looks through the viewfinder, he/she sees the space around him/her juxtaposed with the graphic overlay (See **Legibility**).

Apart from functioning as the interface to view the visualization, each stand also functions as signage: Large typography on the outside communicates the question presented, which gives viewers approaching the installation an idea of the content body discussed before they actually engage with it.

The binocular form draws multiple references at the same time. A binocular is a device which allows a person to perceptually change location, to travel to a distant, inaccessible place. In this case, it is not the view that is translated, as the field of view within the device paradoxically is not zoomed, but directly shows the immediate environment. Here the distant place is understood metaphorically: The device augments the real scene with information from Germany at a certain point in history. Through the visualization he/she travels both geographically and temporarily.

Fig. 41 A Photoshop sketch of the view through the device

The binocular also has a notion of surveillance, hinting at the constant reciprocal surveillance between North and South Korea, and East and West Germany respectively. As the data body contains surveys that were conducted in former East and West Germany separately after the unification, two separate binoculars can present the public opinion from either side. Each device makes the viewer look at a topic through the lens of one side.

Multiple of these devices are distributed over a space, pointing in different directions. One person can only look through one device at a time, and can then move to another one. Each device, representing a different question, metaphorically stands for a different political perspective. In such a complex political situation many different interests are at play. For example, one person might approach the topic with economic concerns, while the next focuses on social issues. This complexity is expressed through the presence of multiple devices simultaneously. While the survey results provide useful insight into the public opinion on this topic, they do not convey the complex background that lead to a given reply. This lack of information is emphasized by showing multiple and sometimes conflicting points of view simultaneously with an equal weighting.

DESIGN PROCESS

The final design was preceded by a variety of design iterations which were developed to different stages. Some only exist as design sketches, others have been developed further technically and conceptually. These experiments will only be described in brief in order to explain how the final design was developed.

Fig. 42 Sketch of Top-Down setup at Coex Mall.

A. Top down view

The first design displayed the visualization on one large plasma screen next to a busy public space in Seoul. The exact placement should be at a distance from the pedestrians, providing an elevated, top-down view of a lively street scene. The screen shows a live camera image of the space beneath it, Seoul citizens walking on the street. The image is overlaid with a survey question, time and location of the survey, a time line at the bottom and graphic labels that annotate the pedestrians walking around. Over time the display cycles through multiple questions, showing each survey result for a period of five minutes.

Fig. 43 Working prototype of top-down view.

The main difference in this design is the perspective a viewer takes in. The viewer is situated at a distance to the annotated people. They themselves are unaware of either the augmentation or that they are being observed. This also changes the viewer's perception of individuality: By placing the annotated people at a distance, they appear as anonymous strangers within a crowd, entering and leav-

ing the screen. This emphasizes the quantitative visualization, but might weaken the personal impact the annotation could have.

After the trip to Seoul, where this concept and working prototype were presented to multiple artists, curators and general audiences, it became clear that this design will not function well as a public art project. Most of all, the form factor is not well chosen. People are so used to screen-based outdoor advertising, especially in Seoul, that a large plasma screen is easily ignored, even though it might display different content. Even if it can catch somebody's interest, one might only devote very little time to actually look at it. Too short for the amount of information that this installation is supposed to communicate.

It can be said that I expected too much from my audience: The display shows the live video, the survey question, the results, the fact that the surveys were conducted in Germany and a time line to show the temporal change in public opinion; all in combination with the unconventional visualization augmenting the live video.

I realized that this approach is not feasible. Nonetheless it is necessary to show all these components in order to explain the data visualization in an understandable way to the viewer. Hence I explored different forms of presentation.

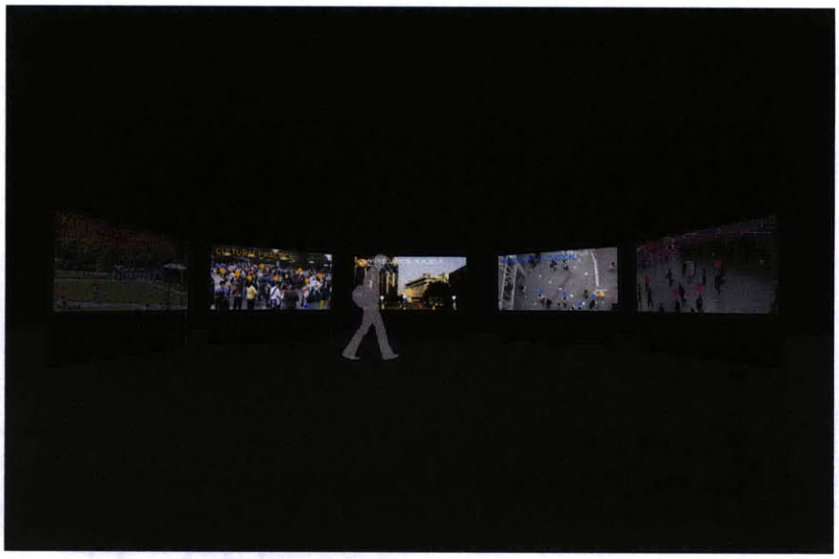


Fig. 44 Multiple screens in order to allocate for each question or topic

B. Multiple screens, multiple topics/questions

This proposal aims to break down the amount of information presented at a time. Instead of using one display that cycles through all survey questions in a linear fashion, it is also possible to use multiple displays at the same time. By distributing the individual questions over multiple screens, the amount of information is simplified noticeably. This approach also works conceptually, as each screen can be understood as one of many perspectives on the topic. The individual screens can even display camera images from different locations, with each location representative of a certain topic such as economy, society or national identity.

With this design it was also considered to remove the installation from the actual locations by placing it in a gallery context. While this would provide a more receptive audience, the site-specificity would only apply for the video seen on the screen. The viewer is displaced from the actual site. I was not satisfied to sacrifice this aspect of the project, as well as the formal aspects of this design, so another approach was considered.

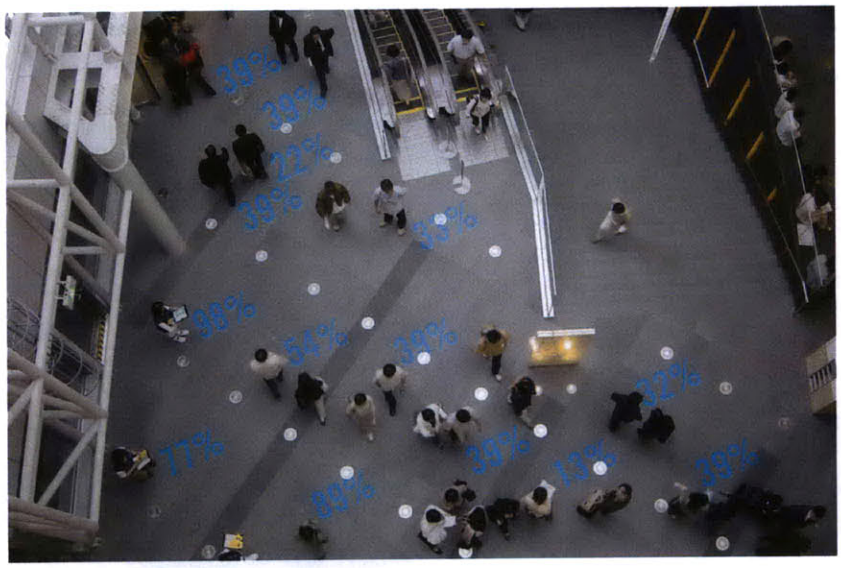


Fig. 45 Immersive projection setup

C. Immersive installation with projection

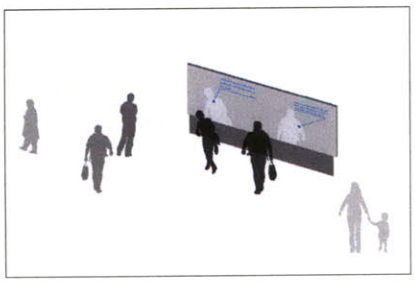
Another possibility to display the visualization is to use a projection which directly maps the information to people using light. With a projection it is possible to directly display information on individuals, or on the ground surrounding them. This would create a very immersive situation with a different perspective between viewer and augmented subjects: Each person would be part of the visualization while seeing it as a viewer at the same time.

While this is a very compelling aspect, I decided against this design for multiple reason: In order to set up such an installation a very controlled environment is necessary not least in order to control the lighting situation. It might be difficult to find a public space that can provide such an environment. While the spatial situation created through projection might foster a playful interaction for the people, it seems less adequate for a data visualization that requires time, reflection and contemplation. Additionally it would be difficult to display explanatory information. With this data body it is important to communicate contextual information, such as the year the survey was conducted in, and which question currently is presented. In a projection installation this information would have to be displayed on a second surface, which would complicate the spatial and technical requirements even more.

D. Mirror installation

In this approach, a physical mirror is the center of the installation. As soon as a person walks in front of it, he/she is augmented with an individualized testimony that reflects the survey results. The person looks at himself/herself, and the message is directly attached to him/her.

Fig. 46 Mirror setup



This approach would probably have a strong personal impact, on one hand because the presentation uses a physical mirror instead of a digital screen. The mirror metaphor has been explored many times in Media Art installations, and still succeeds to create playful interactive experiences.

But despite the emotional impact this design is highly problematic as it directly augments individuals with such unambiguous information. As the installation does not provide a generalizable visualization of a topic in all its multiplicity, the experience becomes too concrete. Even though it can be communicated that the

information is metaphorical and disconnected, the subject is perceived as a single, unique individual where a randomly chosen statement will simply be understood as wrong and untruthful.

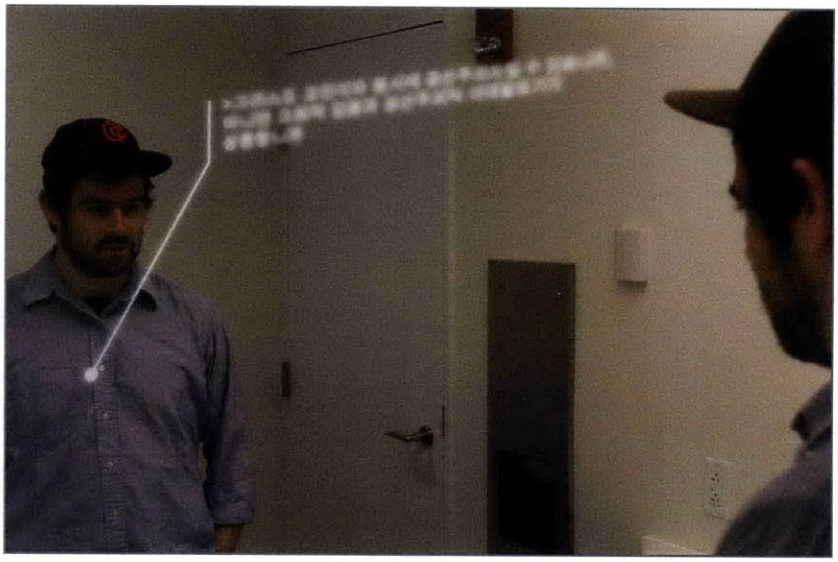


Fig. 47 Mirror setup

What Was The Media Lab Thinking About In The Year _ _ _ _ ?

This year the place is bustling with people. Businessmen, journalists, researchers, professors, hurrying from one demo to the next. Meeting, chatting, exchanging business cards, and most of all in search of the next big thing in technology. What have the students produced this year? What are the new themes they are working on? In the midst of all this is a strange object, a periscope of sorts. One takes a look. One sees the atrium and everything that is going on, but the view is labelled: "What Was The Media Lab Thinking About In The Year 1986?" Each person is annotated with words such as "Broadcast, Computation, Print" or "Holography, Telephony, Interactivity". Each person in the view seems to stand for research at the Media Lab from '86, a time before the Mobile Web or Social Media etc. It's almost like a visit to this place 20 years ago, futures invented long ago, utopias long forgotten. Then the display changes to the year 1993...

DESCRIPTION:

Due to the time constraints and the distant location chosen with UNIFICATION-A CASE STUDY?, I decided to develop a site specific installation for an environment close to me. The decision quickly fell on the place I had spent most of my waking time at, the MIT Media Lab. Instead of taking a data set as a starting point, here a specific location was chosen. The goal was to develop an installation for the Media Lab community that reflects the structure of the institution and how work and research here has developed over time.

The final installation was called WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? and was a collaboration with Doug Fritz ('10, MIT Media Laboratory, Fluid Interfaces Group). It was installed on location during the Spring/Summer Sponsor Meeting 2010.

The installation consists of a peculiar-looking viewing device prominently situated in the central 3rd floor atrium of the new Media Lab building E14. When looking through it, one sees the researchers and other members of the community within the space. These people are augmented with research topics and buzzwords that have been prevalent in past publications by the Media Lab community. By projecting this historical perspective onto the Media Lab community from today, a moment of contemplation is created. The community's current research directions and activities are brought in a historical context, in order to foster reflection about the flow of ideas at this institution.

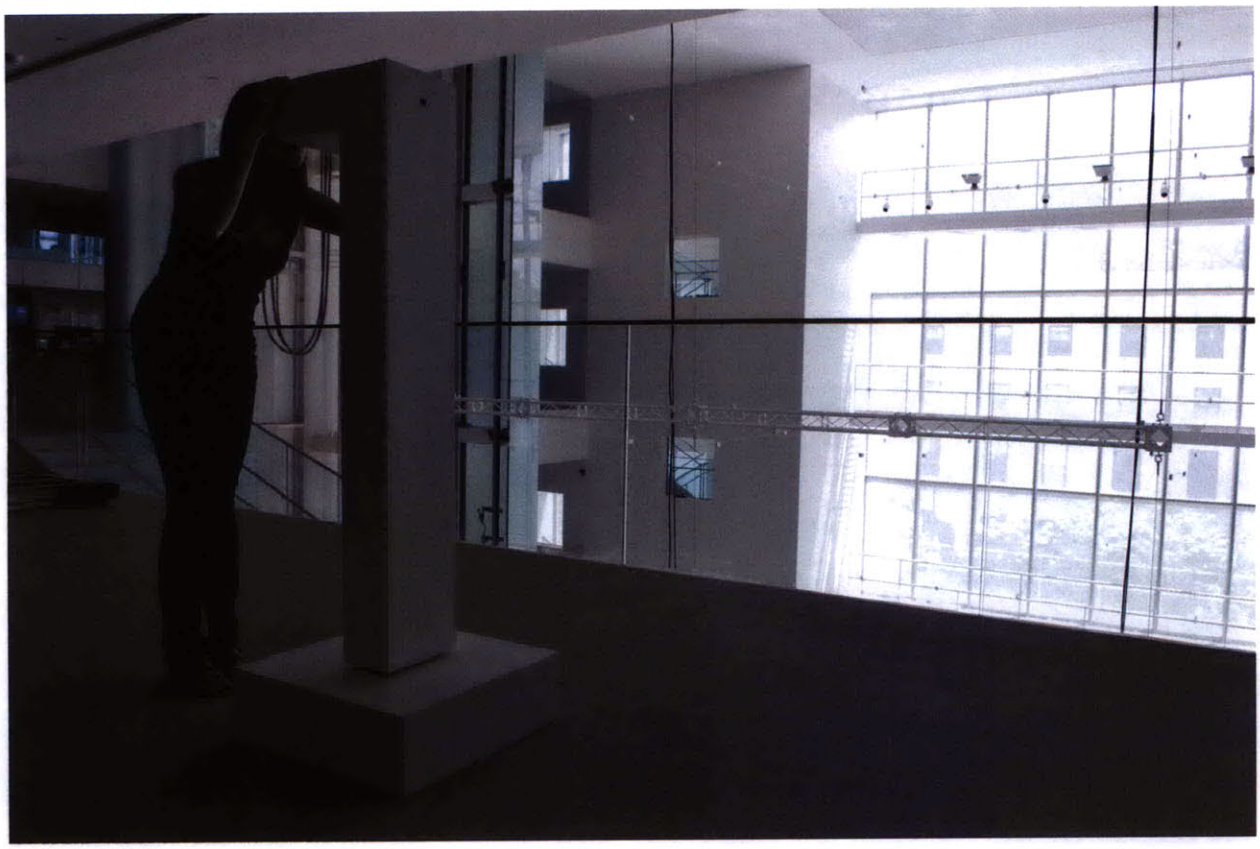


Fig. 48 Binocular interface situated in 3rd Floor atrium of the MIT Media Lab

PERSONIFICATION

The original data set is the complete collection of theses that have been submitted to the Media Arts and Sciences program from 2000-2010. For each year ten "topic models" were created, word representations of topics extracted from topic modeling (using Latent Dirichlet Allocation [39]) of the Media Lab theses.
Each topic model consists of ten keywords weighted by occurrence. For example a topic can contain the keywords "World", "Virtual", "Physical" with the weighting: 0.54,0.27,0.12. The topics are weighted by prevalence within a given year and their occurrence is different from year to year.

The people who are augmented with this information are the extended Media Lab community. Because the installation was shown during Spring/Summer Sponsor meeting 2010, a broad group of people related to the institution were present: Current students and alumni, faculty, sponsors and other visitors. Most of these people are knowledgeable about the Media Lab and the research taking place there, and not a small number of people have witnessed the work created at the lab over multiple years and are well-informed about research developments over an extended time period.

The goal of the event is to present to visitors what people in the Media Lab are working on and thinking about right now, and of course the visitor's professional backgrounds and interests relate to these ideas.

The event offers a unique opportunity to confront this specific community with a historical perspective. Visitors attend to learn about current research, and the installation presents ideas that previous generations of researchers have investigated

Fig. 49 Next page. Photo collage of views and viewers of the installation.

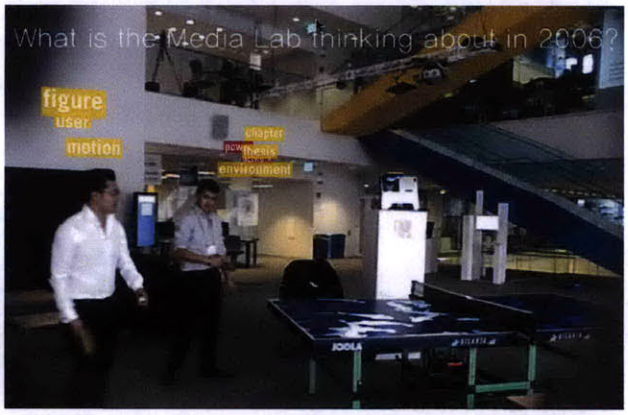

What is the Media Lab thinking about in 2007?
language
commonsense
code
int

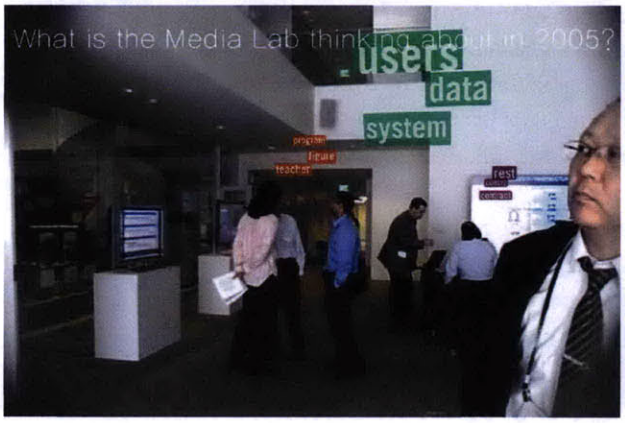

What is the Media Lab thinking about in 2008?
user
interfaces
object

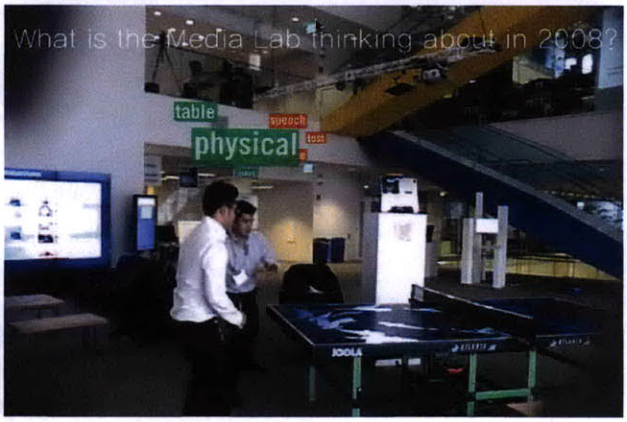

What is the Media Lab thinking about in 2001?
world
virtual
physical
play
creation
ideas

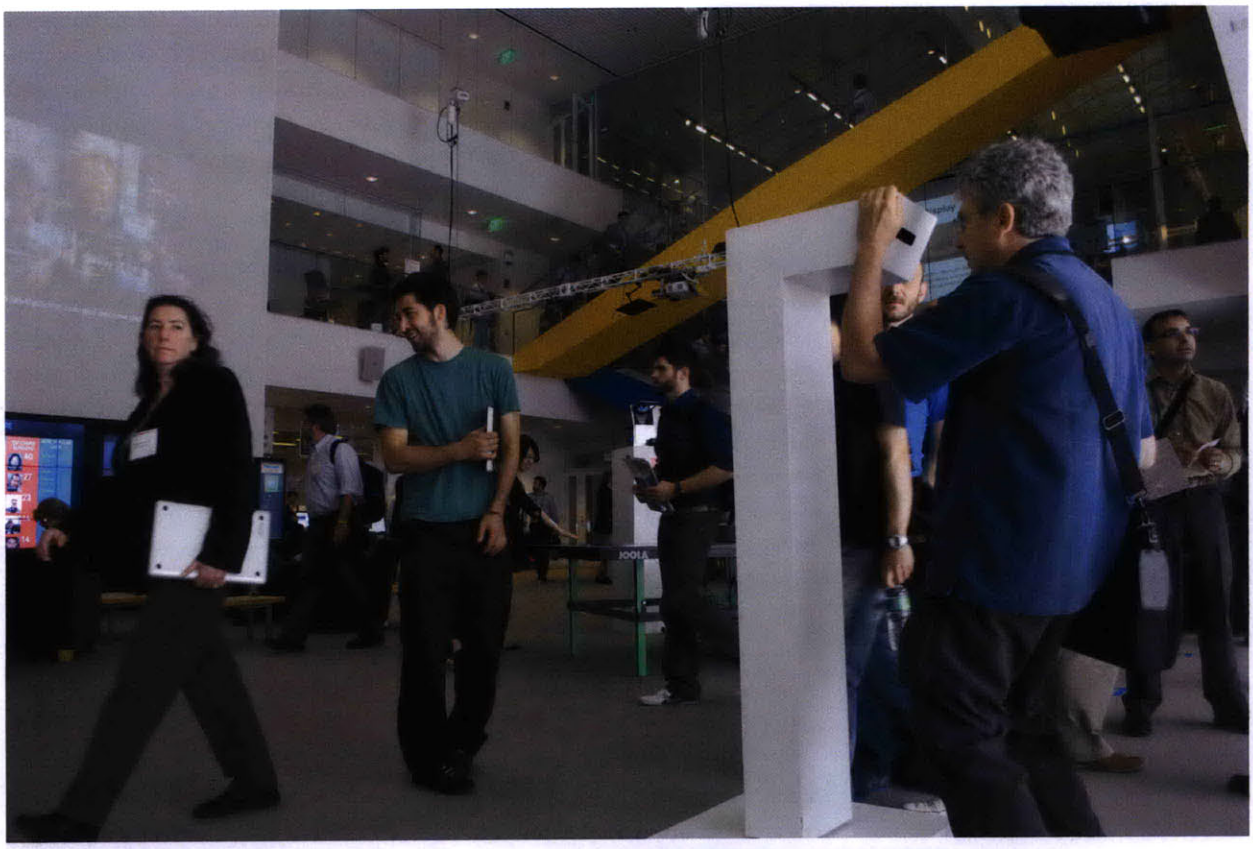

What is the Media Lab thinking about in 2001?
environment
media
world


What is the Media Lab thinking about in 2004?
people
server
location
images


What is the Media Lab thinking about in 2006?
figure
user
motion
environment


What is the Media Lab thinking about in 2005?
users
data
system


What is the Media Lab thinking about in 2008?
table
physical



in the past. Work that originated in the same location, the same academic program and mostly under the same academic supervision. By annotating today's community with these historical data, the installation offers a moment of contemplation and reflection on the historic lineage of current research. It provides an unusual lens on the emergence, dissemination and demise of specific schools of thought over time.

CONTEXT

Through the spatial setup, the viewer is situated in the same physical space as all the people who are part of the visualization. He/She looks into the device and sees the same people that surround him/her at this very moment.

The relationships between the different people attending the Sponsor meeting are manifold. Some know each other, are colleagues or fellow students, others are meeting for the first time. The important commonality between all people is not necessarily a personal, social connection, but a shared interest in the work and ideas that originate from the Media Lab. The goal of the event is to present current projects to all interested parties, and everybody attending is knowledgeable about research trends and developments in the areas investigated at the Media Lab. Even though the backgrounds and professions are very diverse, one can still speak of a community that shares similar interests, knowledge and experiences. Each viewer is part of this community and is confronted with past ideas and interests mapped onto this group of people from today.

The space chosen for the installation is the 3rd floor atrium of the new Media Lab building, E14. The three story atrium lies at the heart of the building, all research labs are accessible from it and most of them are directly visible. It functions as a space of transit from one location to another, as well as a meeting spot where people mingle. The semi-public space is easily accessible from the main entrance and the Media Lab community uses it to exhibit certain projects in a context outside of the research labs. During the event, the viewing kiosk was placed within the atrium, at a location where it is very noticeable; Through its rotation functionality it provides a complete panoramic view of the atrium (see **Interface**).

MAPPING

In the installation one topic model is associated with one person at a time. The system uses three of the ten keywords that constitute a topic model. The topic model is a generic representation of important keywords that are prevalent within a given year, independent of the individual theses they appeared in originally. By augmenting one person with this generated data set, he/she does not represent one specific person, as one topic model describes a certain research interest that was prevalent in multiple theses and research groups. The augmented person becomes a representation of a generalized Media Lab researcher from a given year. For each new person entering the scene a model is chosen dependent on the occurrence of models in that year, in order to show an overview of prevalent topics mapped onto multiple people present in the scene. Together they represent the accumulated sum of ideas that were prevalent in the community at the time.

LEGIBILITY

The visualization takes place on multiple scales. The name of the project "What Was The Media Lab Thinking About In _ _ _ _?" is spelled out on the outside of the

viewing interface in large, clearly visible typography, in order to communicate the project and to entice curiosity among potential viewers. The actual display shows the following: A large headline repeats the project name, but with a specific year in the sentence, for example "What Was The Media Lab Thinking About In 2003?". The headline overlays a camera view of the physical space the viewer is currently located in. In the camera view, each person walking through the space is annotated with text labels representing the topic model. The set of text labels hovers over a person's head and if he/she walks around, the labels naturally move with him/her in three dimensional space. Especially in motion it becomes very clear which set of labels belongs to which person. The text labels consist of three keywords placed vertically on top of a person's head. The words are set in clearly legible typography in white capital letters, with a colored bar behind each word. The size of typography and colored bar varies between keywords, depending on the statistical weighting of each keyword. For example if the keywords are "World", "Virtual", "Physical" with a weighting of 0.54,0.27,0.12, "World" is displayed in a type size twice as large as "Virtual" and "Physical" is half the size of "Virtual".

When there is more than one person present within the scene, multiple groups of keywords are juxtpasing multiple individuals. All the words displayed at the same time give an overview of ideas and buzzwords from a given year. The simultaneous presence of individuals within the space is analogous to the simultaneous occurrence of topics within a given year.

After three minutes the display switches from one year to the next. The year in the headline is updated, all labels disappear, and new topics appear with a smooth animation of opacity, in order to communicate that now a different data set is shown.

INDIVIDUALITY AND INTERSUBJECTIVITY

The viewing kiosk is placed in the middle of the third floor atrium of the building during the Sponsor Meeting event. During this time, a situation of transit exists: People are constantly walking through the space in order to go from research lab to research lab. Each person is clearly visible and identifiable, if somebody approaches from a distance even the whole body can be seen. The scene is filled with lively movement and the system annotates every person entering the field of view. Even though the graphic overlay is animated to people's movements through the space, it appears to be the only thing constant, always present independent of people coming or leaving.

Because of the constant motion the viewer's gaze does not dwell on one person for a long time, either the person moves out of sight or the viewer focuses on another part of the view. Each person in the image is perceived as one of many, constantly entering and leaving the always-present visualization.

Furthermore, the mapping of information to individuals is designed as an open system. The three keywords forming one topic are not a direct, unambiguous association between one statement and one individual. Each distinct keyword is an abstraction, taken out of context and it could refer to very different original meanings. Through this approach it is more likely that the augmented person actually could be associated with at least one of the words, even though this connection might be entirely independent of the actual origin of these keywords. For example, describing a project with "Physical, World, Sonic" is much more ambiguous than

writing "I work on a tangible music interface". Nonetheless the accumulation of grouped keywords do quite accurately describe prevalent topics from a given year.

PERSPECTIVE

By design, the viewing kiosk only allows one viewer at a time. There is always a situation of one person seeing multiple people. This design aims to create an immersive and intimate experience for the viewer. He/She literally dives into the data by lowering his/her head and looking through the device. But in comparison to a display visible to everybody at the same time, an asymmetric relationship exists: One person sees, the others are being watched, and might even be unaware of this. But the spatial setup guarantees that the viewer can be seen by all annotated individuals when he/she is observing. He/She is not an anonymous distant observer as it would be the case in a surveillance situation, in a way he/she is exposed himself/herself, using the viewing device in front of all the other people. While for a short time he/she is the only person who can see the visualization, and all people within it, it is also clear to him/her that he/she will be annotated by the system as soon as he/she walks in front of the device again. Similarly it is clear to everyone in the room that they can be the next viewer standing behind the device.

THE INTERFACE

The interface for this installation is a viewing kiosk reminiscent of binoculars that can be found on observation decks. The kiosk consists of a square base and a vertical stand, roughly in the shape of the letter "L" rotated by 180°. For a comfortable viewing height the stand is 135 cm high, and the horizontal part on top functions as the viewing interface. A viewer can look into the kiosk through a small horizontal slit on the end of the horizontal box. Looking into the slit a camera image is visible, showing the scene directly behind the stand; The view is similar to looking through binoculars, even though the field of view is not zoomed or magnified. The camera image is overlaid with the annotation graphics.

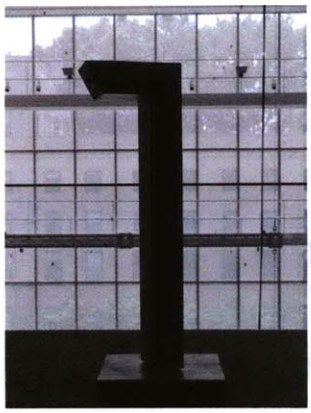


Fig. 50 The viewing device in the 3rd floor atrium of E14.

The viewer can rotate the stand horizontally by 200°, and the overlaid graphics rotate with the camera image. Through this interaction the viewer can choose the direction of the gaze and it is possible to visually follow a person walking through the space.

Purposefully this object is chosen over a standard off-the-shelf display. The object itself seems slightly out of place, almost as high as a person and situated within a space which, unlike an observation deck, does not offer any noteworthy views at a distance. Through the unusual, almost strange shape people are enticed to actually look into it, to find out more. The object also functions as signage, as the name of the project is printed in large letters on the outside. The question, "What Was The Media Lab Thinking About In The Year _ _ _ _?", clearly visible from afar, metaphorically promises an answer, enticing a passersby to approach the object and engage with it.

For the viewer, the periscope-like shape creates an immersive experience of the data set: By looking through the device he/she sees the same environment he/she is currently located in (the Media Lab from 2010), but at the same time he/she metaphorically dives into a historical data set about exactly that location.

Fig. 51 Public Presentation of *Who Sponsors The Media Lab?*

INITIAL EXPERIMENT: "WHO SPONSORS THE MEDIA LAB?"

The installation WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? was preceded by an experimental one day installation in the same location. Goal of this experiment was to test the technology, investigate the presentation method and explore a topic that is meaningful to the community.

The piece consists of a large LCD screen situated on the 3rd floor atrium showing a mirror view of the space. If a person walks in front of the screen he/she sees himself/herself in a camera image. Each person entering the scene is labeled with the name of one of the more than 60 companies that sponsor the Media Lab. If one walks around, the labels move along, hovering over one's head with a realistic 3D appearance.

Data Set

With this short term project, the goal was to explore a data set that is meaningful to the broader Media Lab community. One topic that affects all people here is the sponsorship model: The Media Lab is almost 100% industrially funded with a very unique sponsoring system: Companies do not fund per-project or per-group basis, they fund general themes explored in the lab, as defined by the research consortia. Described in very basic terms, most of the companies pay into one large pool, which pays for the research conducted at the lab. In theory, this allows researchers to create work independent of a company's particular research interests, as in a way each student is funded by all sponsor companies at the same time. The overall

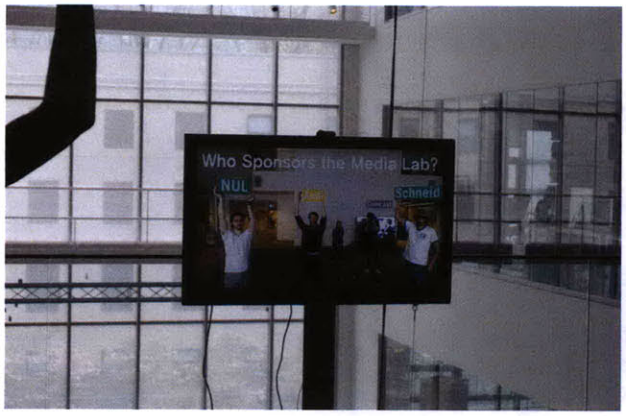


Fig. 52 People interacting with the installation
Fig. 53 People interacting with the installation

system is not as simple and there are very different ways of funding research at the lab, but the most frequently selected funding option for companies, "Consortium Sponsor", functions this way.

While every student is aware of the sponsoring model, the fact that all research is funded by industry might not be present every day. Also, some students might not be aware of some sponsor companies, simply because there was no interaction with any of it's representatives. By choosing this topic I was interested in creating a general awareness among students and raising questions about the sponsoring system. I was hoping people would ask themselves: Who is sponsoring my work and studies here? What brings these diverse companies to fund the MIT Media Lab, and what industries do they represent? Am I interested in learning more about these companies? Do I actually want to be sponsored by them, and who decides which companies are admitted as sponsors?

Perspective

This setup differs from the binocular installation in the sense that each person who is annotated by the system is a viewer at the same time. Multiple people can stand in front of the screen and interact with it, play with the mirror image and the way the label is attached to their body on screen. This approach allows for communication and social interaction among the viewers. They can refer to the labels on the screen, start conversations about the companies, their experience with them, or the company's impact on the Media Lab.

Reception

Mostly the audience consisted of students, but also faculty, sponsors and other visitors experienced it in person. Due to the mirror-like setup, a familiar paradigm in interactive art, some people expected more interactivity than the installation provided. The system showed a mirror image and attached labels to the viewers, but did not allow for any other user involvement. They could not change their label or interact with the installation in any other way.

Some people were confused by the random assignment of sponsor names to individuals. Many expected the system to identify people and to determine an appropriate sponsor name depending on information gathered from each person. For example, one sponsor representative was labelled with another company's name, and he expected the system to accurately label him with his company.

Most of all people were excited about how well the technology worked. The labels were consistently attached to the individuals and moved along with them accurately in 3D space. There was almost no delay, as the video ran at 30 frames

per second, with an even faster tracking, resulting in a very responsive experience. Many people loved the speedy performance and the visual appearance and suggested potential other uses for this technology.

Findings

Conducting this design experiment lead to multiple conclusions. I realized that the mapping approach is not a good strategy. If there is a direct mapping between one name and one individual without any process of identification, it is perceived by the viewer as completely arbitrary and simply wrong. People wonder why this particular sponsor is attached to them, what the reasoning is behind this labeling. This falsehood is perceived especially strong if the individuals in the visualization are very recognizable and identifiable, which was the case in this mirror-like setup. Particularly with this content the random assignment of labels did not work conceptually.

On one hand most of the students are equally supported by the funding provided by all sponsors, and all sponsors have rights to access the intellectual property a student produces at the Media Lab. But the relationship between sponsors and students is more complex. A student might have a very involved interaction with one sponsor company, sometimes experiences are described as close to directed research. With other ones he/she might not interact at all, and his/her work is created almost completely independent of their interests or intervention. Hence it becomes very likely that a randomly assigned label is perceived as arbitrary and untruthful.

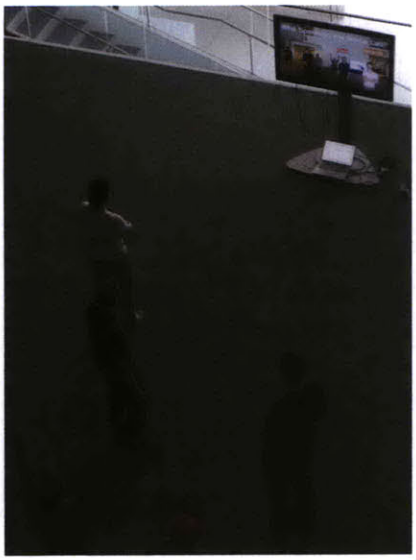


Fig. 54 Public Presentation of *Who Sponsors The Media Lab?*

Furthermore I was not satisfied with the formal aspects of the installation. Especially in the Media Lab building, a large screen is not an unusual thing to see. The display device was not an actual design decision, it was chosen as the simplest way to present the visualization. I realized that I wanted to change this aspect. Also the mirror paradigm did not seem the perfect solution. While it allowed for an enjoyable interaction between viewers and screen, as well as among viewers, I concluded that this approach has been explored sufficiently in other interactive art installations and that I should strive for a different, more immersive and unusual form of presentation.

The tracking worked very well for more than ten hours, independent of a changing light situation over the course of the day. The labels were moving smoothly along with the individuals which resulted in a responsive presentation and a satisfying experience. This was complemented with an aesthetic approach that both the audience and myself appreciated very much: The clear typography was visually pleasing and was mapped to people's bodies in an adequate graphic composition. Scaling and the billboarding method emphasized the three-dimensionality of the graphics and lead to an aesthetically pleasing experience.

Overall the experiment was a successful predecessor to the final installation WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _?. Many aspects were explored and refined afterwards. While I was not satisfied with the mechanics of the system, it became clear that this approach could be applied within an adequate context and the appropriate subject matter. This installation functions as a top-down categorization machine that arbitrarily labels individuals. Automated categorization is a method which comes into play in many areas, including surveillance technologies, and can have an enormous impact on people's lives. This could be one possible topic for the mechanics used in this installation.

The sponsorship model at the Media Lab, and industrially funded research in general, is still a topic I am interested in and might lead to future work. The way this topic was presented in the installation was certainly too simplified; A future project would have to explore industry involvement in academic research with all it's complexities and nuances, which would undeniably require a phase of thorough research not conducted for this project.

V.
Discussion and Analysis

In this chapter I discuss the Personification of Information projects within the design framework outlined in Chapter III. The discussion focuses on my personal evaluation on the effectiveness of how each of the design parameters is implemented within a project. Furthermore, I discuss feedback gathered from people who saw, interacted with or became part of the visualizations. This is followed by a general analysis of the findings from all projects and an overall discussion of the design strategy defined with Personification of Information.

What If The World Where Your *n* Facebook Friends?

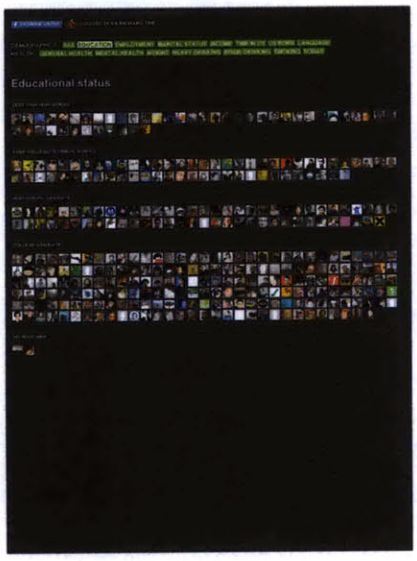


Fig. 55 The web interface for *What If The World Where Your n Facebook Friends?*

The project WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS? was implemented well technically. The navigation and interface were well designed and intuitive. Most users were familiar with the Google Maps interface so the geographic navigation was very straight-forward. The application provided a feature that the normal Facebook website currently does not provide: A visual overview of all friends on one page, organized in a clear fashion without any advertising or communication features. This functionality was unquestionably attractive to all users interacting with the project.

Headline, topic titles and interactive navigation were clearly conveyed with a hierarchical treatment of typography and coherent color coding. It was easy to understand the distribution of quantities for each topic displayed by the arrangement of the square Facebook pictures underneath each answer option to a question. Also, distinct changes between different localized data sets could be identified in a straight forward way.

However, the unusual approach of this data visualization could have been communicated more clearly. It was conveyed by the large headline shown on display, but nonetheless it was hard for people to understand where the data came from, and why it was displayed using their personal Facebook friends. Even when this was clear to a viewer, it was hard to associate the data with their own peers, even though several measures were taken to facilitate this, such as the display of larger images and names upon mouse roll-over.

It can be said that we overloaded the application with too many modalities at the same time. Apart from the unusual data mapping, people were confronted with a map showing a specific location and each step in navigating the map had an influence on the data displayed. People had to realize that the map navigation was data navigation at the same time, and in addition they had to understand that their Facebook friends were used as stand-ins for a certain population, that no information about their Face-

book friends was retrieved or displayed. All of these aspects were communicated and shown at the same time, which oftentimes led to confusion among viewers.

A solution for this would be to simplify either the application or the data set or both. In order to communicate the unusual data mapping approach, it would have made sense to use a less diverse data set, and only focus on one specific topic instead of the whole variety of survey results. In addition, we should have chosen a different interface. The choice to use Google Maps navigation inadvertently introduced a second, complex layer of information–namely the geographic location shown with all additional data, such as street and landmark names, transit stations, etc. While the combination of geographic navigation with data filtering is an interesting approach, the added complexity caused confusion, rather than enhanced the user experience.

Unification–A Case Study?

Similar to WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _?, the technical aspect of this installation worked very well and was executed sufficiently. As this project was only developed to a proposal stage, and because it is planned for realization in South Korea, it is hard to evaluate at this point. Nevertheless, the proposal was presented to a group of critics from the fields of art, architecture and design who provided useful feedback which is discussed here.

During the discussion the critics focused on these aspects: The subject matter I wanted to address with this project–drawing a political analogy between East and West Germany and North and South Korea. The technology and the design method used to communicate this topic. And last, the appropriateness of using this method and technology for this subject matter.

SUBJECT MATTER

The critics deemed the issues I was interested in regarding unification as interesting and worth investigating for an artistic project. Similar to my own reaction when researching the data, the critics were amazed how some of the issues relevant in Germany are similarly significant and applicable for Korea. Some comments pointed out that a more critical, interrogative perspective on the topic would be helpful, considering the complexity of the political situation in North/South Korea and Germany respectively. It was suggested to investigate the subject matter further with a phase of thorough, comprehensive research.

From my personal point of view, I believe the final design solution avoids a shallow or oversimplified treatment of the subject matter. Nonetheless, in current form the project indeed lacks depth. The goal of drawing a political analogy between the complex histories of North/South Korea and East/West Germany with a Media art installation would have required a phase of comprehensive sociological and political research. Unfortunately that would have exceeded the time available for this thesis. Ideally it would have been based on a collaboration with scholars on this topic, and an extended period of time in South Korea would be necessary to actually realize the installation.

TECHNOLOGY

In terms of the technology, the critics were excited about the technology and the possibilities it provides. While there were some glitches in the live demonstration

the critics thought it had a "cool" and "interesting" effect how the labels were attached to people and how well the augmentation worked spatially.

APPROPRIATENESS OF THE TOOLS

Most of the discussion focused on the application of this technology in combination with the subject matter–the political analogy between North/South Korea and East/West Germany. The majority of comments focused on the disturbing aspect the technology had, as the installation "uses real people as avatars" in order to display information. It was questioned to what ends this disturbing quality is used for this subject matter.

The original idea behind this representation was to create a moment of surprise. Ideally the representation would have enticed curiosity and wonder among the viewers, which could help to arouse initial interest. Nonetheless I realized during this critique that the way the information is presented is too direct. Individuals are juxtaposed with one unambiguous label leaving no room for interpretation. As one individual is augmented with one definite statement it might be perceived as simply untruthful and thus disturbing. I realized that either the presentation has to be less individualistic or the statement itself would have to convey a more interpretable message.

Another comment focused on participation. The technology did not provide any mechanism for the audience to influence the data display. While technology can be used to foster participation and interaction for the viewers, this installation does not allow any user involvement. The audience is rendered as a group of passive observers. The installation imposes opinions on individuals without giving them the chance to offer their own.

One suggestion pointed out that it would have been interesting to focus more on the arbitrariness of statistics and opinion polls that we are constantly bombarded with. During the presentation the tracking mechanism did not function perfectly, which resulted in labels moving from one person to another arbitrarily. This particular aspect could be elaborated into an interesting critique on the authority of statistics and opinion polls in general. The device could represent an omniscient authority that imposes statistics on us. The moment the labels travel from one person to another, it becomes apparent that these statistics are not the ultimate truth, that they are not set in stone. In contrast, this process raises questions on how statistics are created, how the information is obtained and if a public opinion poll can represent the opinion of a population at all. It was pointed out that this critique of public opinion could be investigated further.

I see both of these comments as a crucial criticism of this project. During the design process I frequently considered a participatory quality for the project, particularly as in the past I have created projects that incorporate user interaction as an essential component (i.e. OMNIVISU). Particularly the second suggestion intrigues me as an interesting idea for a potential installation.

In retrospect I believe that I constrained myself with the initial goal defined for Personification of Information. I viewed the main objective–the presentation of a distant set of information by juxtaposing individuals with that information–as mandatory for the work to be created. Particularly with this complex subject matter this might have not have been the right approach. The topic should have been ad-

dressed with a more open-ended perspective. While this could have led to a design solution entirely different from the initial approach, it could have resulted in a more appropriate design solution for this subject matter (See **Overall Analysis**).

What Was The Media Lab Thinking About In The Year _ _ _ _?

This piece was installed for the three days of MIT Media Lab Spring Sponsor Meeting 2010. Over this time period it was very popular among everybody who experienced it. The viewing kiosk was placed in the 3rd floor atrium without any further explanation or personal guidance from my side. The object itself piqued people's interest and the interaction worked intuitively. It also functioned socially: The act of one person using it aroused the interest of others who then waited in order to take their turn. People played with the device, by following people through the space using the rotation feature, and by taking turns between standing in front or behind the device. They were interested in how they would be labelled, and started conversations with each other about the topics suggested by the system.

Technically the system worked very well. The camera tracking functioned flawlessly for three consecutive days in a changing lighting situation, tracking up to fifteen people at the same time. During very crowded times, individuals within a group were not identified separately, so the system interpreted the group as one tracked object. While this is due to imprecisions in the computer vision system, it did not influence the visual output negatively: Conceptually, the generalized Media Lab research topics can be assigned to individuals as well as to groups of people.

Because the overlaid labels were noticeably attached to individuals moving in the space, it was clear to the viewer which set of labels belonged to which individual. This worked especially well in motion, as the labels hovered over a person moving about, and were animated correctly with him/her in 3D space. The accuracy of the 3D overlay was emphasized by the rotation feature of the device: When one rotates the viewing device, the virtual 3D scene simultaneously rotates in real-time.

Overall the actual information visualization performed well. The origin of the data, namely the topics of Media Lab theses from the past, was communicated clearly and the different data sets were presented in an understandable, visually pleasing form. With only a brief look through the device it was obvious that one was looking at the Media Lab community and terms and topics that are meaningful to this group of people.

While an informed viewer could recognize changes in the topics for different years, the time-travel aspect was not communicated explicitly enough, for two reasons: Graphically, the transition from one year to the next was visible, but maybe too subtle. The headline changed the year displayed, all labels disappeared and new ones appeared with different topics. But the image showed a very lively scene, with people entering and leaving constantly, so this transition was not noticeable enough. A possible solution is to introduce a new year with a full screen text slide, to communicate the change more abruptly.

The second factor is the limited data set used for this installation. We only gathered data from the years 2000-2010. In this time period, major changes in technology occurred, but using our method this is not necessarily extracted from documents

published during this time, as many terms and buzzwords remained the same. It might have been different had we accessed data from the complete Media Lab history of 25 years, from 1985 to 2010. As an alternative, a different data retrieval method could have provided information that would have made the temporal changes more obvious.

Furthermore, one might question if this form of visualization is the most appropriate and necessary for the information displayed. Choice of topic and form was led by the desire to create an installation that displays information meaningful for the Media Lab community. While this goal was achieved, the combination of this data set and this visualization method might not have been the most appropriate choice. This data body might be better explored using other visualization methods that would allow filtering, comparison and the display of large quantities. Likewise, the use of the embodied visualization approach might be more suitable when applied to a data set that is less direct and evident. Information that is distant from the audience, hard to grasp, or rarely talked about could lead to a more surprising and insightful reception by the audience and would justify the Personification method to a greater extent. In that sense the predecessor short-term installation WHO SPONSORS THE MEDIA LAB? touched on a more controversial topic, evoking critical reception and discourse among the viewers.

Overall analysis

Each of the projects created for this thesis explored different aspects relevant to Personification of Information, such as the constellation of perspective, the context a visualization is placed in combination with the content communicated, the technology used, and the data mapping.

While each project exposed interesting aspects on the topic of Personification of Information, it is questionable if any of them fully achieved the initial objective–bringing abstract information closer to the viewer by juxtaposing it with real people within his immediate environment. This results mostly from shortcomings on one or more of the individual components that each have to be designed appropriately in order to create a well-balanced and consistent experience.

In the remainder of this chapter I discuss how my experiments contributed some answers towards the original questions posed in Chapter I.

HOW TO ACHIEVE THE PEOPLE-DATA MAPPING TECHNOLOGICALLY?

The Personification of Information projects were thoroughly realized technologically. WHAT IF THE WORLD WERE YOUR N FACEBOOK FRIENDS? is a full-fledged web application viewable in standard web browsers. UNIFICATION–A CASE STUDY? and WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? feature a robust installation infrastructure that enables simultaneous real-time tracking of multiple people and a responsive juxtaposition of these individuals with three-dimensional graphics and typography.

All custom-developed software systems allow an accurate mapping of statistical data sets to the people within a visualization. In the Facebook project this requires a statistical distribution of survey data over the fixed number of a user's Facebook friends. This mapping is only updated if the user chooses a different survey or browses to a different location through the map interface. With the real-time installations this process is more complex, as the statistical data has to be re-calculated constantly to the amount of people present at any given moment. For

these setups the ideal solution proved to be a mapping by occurrence, which allows for an accurate statistical display independent of the amount of people present. A shortcoming of this approach is that it is time-dependent, which might require the viewer to watch the visualization for a certain period of time in order to gather a comprehensive understanding of the statistical distributions of a chosen data set.

CONSTELLATIONS OF PERSPECTIVE

With the design experiments I investigated different constellations of visual perspective between the viewers, which has a strong impact on the way the viewer(s) experience Intersubjectivity. It might be appropriate to say that I underestimated the influence that perspective has on the overall experience for the viewer. With Unification and the Media Lab installation the focus was on the individual user experience, creating a feeling of "diving into the data set". While this proved successful, the relational constellation between all individuals–the ones observing and the ones observed–was not taken into account sufficiently. Both installations created an asymmetric power relationship between the observed and the observer. This was at times met with confusion or bewilderment by the audience, who deemed this setup unbalanced or even unfair. Hence the perspectives created for the audience has to be considered as a major design decision for such a real-time spatial installation. In the design experiments the constellation of perspective was consciously constructed, yet the original conceptual motivations were overshadowed by the effect of this asymmetric viewing relationship. In the future it would make sense to reconsider some of the sketches developed for UNIFICATION–A CASE STUDY? which explored different constellations of perspective and thus different experiences of Intersubjectivity.

CONTEXT AND CONTENT

Part of the original motivation was to not create a content-specific technology, tailored to the subject matter presented and the situation in which it is displayed. This was attempted by defining both of these aspects for each project anew. I deem the installations created for the Media Lab as conceptually consistent in regards to content and context.

Both WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? installation and the WHO SPONSORS THE MEDIA LAB? addressed topics specifically relevant to the entire Media Lab community. One is the body of research that is and has been produced at the lab and how past work influences current trends. The other is the sponsoring model and how this system does or does not affect the work produced here.

As UNIFICATION–A CASE STUDY? was only brought to a proposal stage it is hard to gauge how the content/context balance would have ultimately played out. However, the fact that the Media Lab projects were so appropriate is telling: This context is one I am personally familiar with, which allows for a sophisticated and nuanced approach to both subject matter and presentation context. A similar familiarity with topic and environment would be desirable for future projects.

"AS IF" - THE PERSON PARADOX

In some way, the main approach used in the projects is the main source of difficulties. With all Personification projects the goal was to bring information that is dis-

tant and detached closer to the viewer by mapping it onto a group of people within his personal environment. This metaphorical approach is easily understood when expressed in language (i.e. "If your friends lived in country XX only half of them would have access to clean water."), but in my projects real people were directly visually assigned with the distant data. It was tremendously challenging to communicate the speculative quality of the presented information: The labels assign information to people *as if* it was information about them directly, while at the same time this is of course not the case. While I was aware of this paradoxical approach from the beginning, I think it was not sufficiently solved with the projects in this thesis; nonetheless, it was a necessary and insightful process. During this process a variety of alternatives emerged, but were not realized to a sufficient degree. One approach that I would be interested in exploring further is to create a more open-ended situation: Language employs the imagination of a recipient, "half of my friends" refers to a generic group of people in a person's life. If at all, a direct assignment to specific individuals happens in the recipient's mind. This indirect and imaginative assignment could be employed, even when dealing with a real-time spatial installation with real people (See proposed auditorium installation in Chapter VI).

ENVIRONMENTAL PREREQUISITES

A general issue with the projects that augment people in a physical space in real-time are the requirements for a specific spatial and social situation. The technical setup requires an environment and the infrastructure that allows the installation of two cameras, particularly the tracking camera which requires specific positioning. Moreover, a very specific social setting is required: The visualization works best if a large amount of people is present, ideally in lively motion entering and exiting the space. If only a few people are present, or none at all, the visualization might simply not be experienced. These prerequisites make the projects not very flexible and tied to very specific types of locations.

DESIGNER VS. AUTHOR VS. TECHNOLOGIST

With the projects created in this thesis I was not only a designer and technologist, I was also in the role of an author choosing a specific content appropriate for each experiment. I intentionally rejected developing a content-agnostic system. But choosing the right topic and fully investigating a specific social and political context while at the same time developing technology and design ,was a novel and difficult process for me, best reflected in the Korea/Germany project. On one hand I am very intrigued by the idea of "Designer as Author" and will likely pursue this approach further. On the other hand, for the variety of projects created here it would have made sense to collaborate with experts for the subject chosen, in order to focus on the design-related and technological aspects. Such a collaboration could have achieve the necessary depth for the topics.

VI. Conclusion and Future Work

With the projects created for this thesis I identified and defined Personification of Information as a design strategy. The work investigated a variety of aspects that have to be considered when applying this strategy, the most crucial being Intersubjectivity, perspective and appropriate choice of content and context. While each of the projects partially fulfills the initial goal–making abstract and distant information more relatable to us by mapping it onto people in our immediate environment–this work is a contribution in at least two aspects: It provides a thorough definition and discussion of components such a project should or could entail such as contextualization, Intersubjectivity, juxtaposition, etc. and the possibilities and difficulties that accompany each of these components. Furthermore, a variety of technological, visual and spatial principles were explored that might lead to successful applications in this and other areas. I hope both these aspects can be helpful for future designers and add to the design vocabulary in digital media.

An overall shortcoming for the Personification of Information projects is that with each project I predetermined an invariable set of components that necessarily had to be included. I predefined a subject matter, a context and the method of presentation all the way to the resulting experience for the viewer. These fixed components inhibited certain other aspects that could have resulted in successful art projects. For example, people missed the possibility to change or influence the data presented. However, the goal was to communicate a predetermined data set, hence a user-created data set could not be incorporated in a piece. The design process could have allowed for more flexibility in this regard.

In the following paragraphs I address these shortcomings and offer potential solutions, which sometimes sacrifice aspects of the initial design goals. This is followed by a general conclusion and future outlook.

Future Work

COMMUNICATING "WHAT IF"

One common concern of viewers was confusion over the speculative nature of the projects, which was merely communicated through additional text-based information. The formal design of an installation would incorporate this speculative perspective in order to allow an open-ended interpretation and avoid confusion for the viewer.

One possible way to communicate the speculative nature of the projects is to incorporate surreality. An aspect that was considered within the design process was to create a surreal, impossible image by multiplying the people seen within it, using a digital compositing system. The embodied data visualization could consist

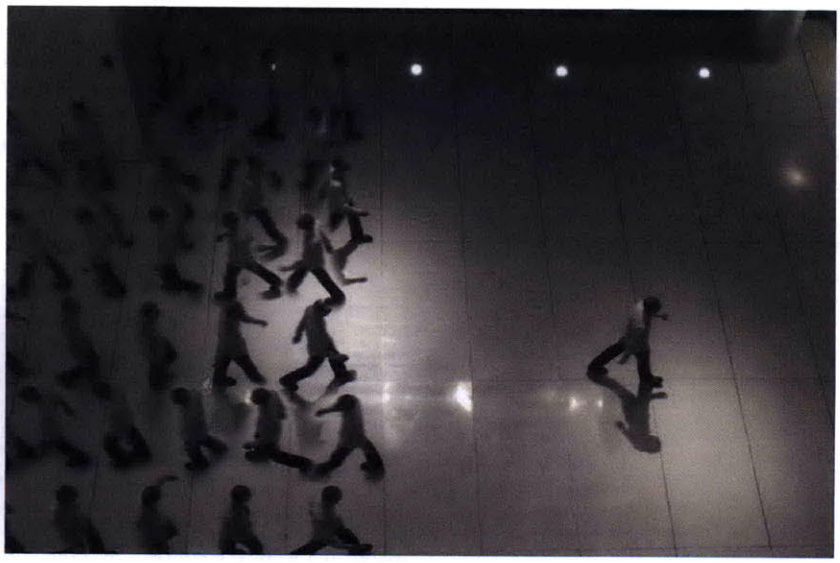


Fig. 57 Creating a surreal image using a custom-developed real-time compositing tool.

of one person only, distributed within the image multiple times. Such a surreal, playful image could entice curiosity and could, from the beginning, render the viewer more receptive to the speculative nature of the data visualization.

Alternatively, the speculative approach could be communicated by avoiding specificity. Instead of directly juxtaposing specific bodies with labels, the visualization could be mapped onto spaces inhabited by people. Similar to the Watermarks project [12] in which large-scale projections entice people to imagine the consequences of rising sea levels on their hometown, one could use a spatial setting that similarly indicates "people-space" symbolically. One such space is an auditorium filled with seating. Each chair could *stand for* one person, as the object itself has the affordance of "sitting" for a viewer. In an installation setup, a projection could visually map quantitative data onto the space, with rows and columns of seating functioning as a display of distributions. A viewer standing next to a chair would know that he/she *could* be sitting on the chair, while at the same time no real person is directly augmented with a label, allowing a visceral, bodily experience of the speculative approach.

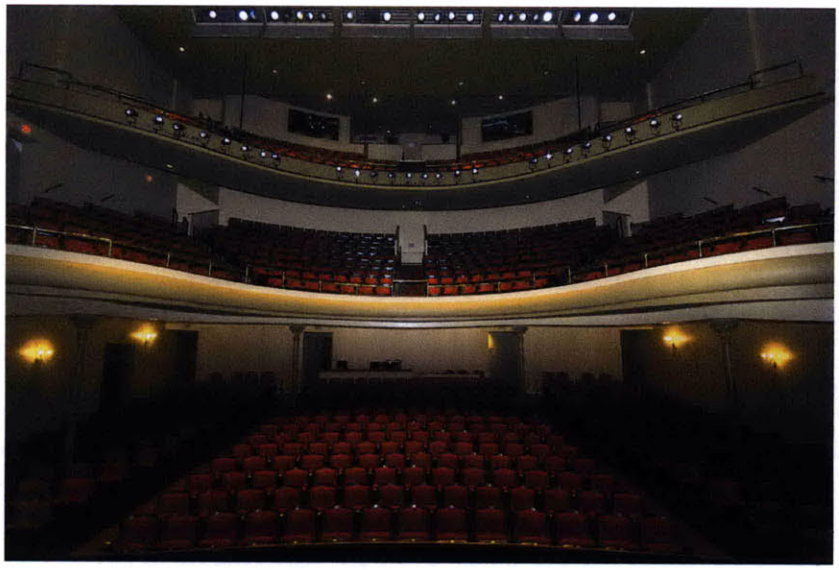


Fig. 56 The ideal canvas for a non-specific personified data visualization? http://blog.svconline.com/briefingroom/2009/03/27/kudo-system-sings-at-lexington-opera-house/

PERSPECTIVES

As pointed out in the previous chapter, the asymmetric viewing constellations in the design experiments were at times problematic. The next step would be to realize an installation that allows all participants to experience the visualization together at the same time, establishing a fully symmetrical viewing relationship. While this idea was conceptually explored in sketches, it would be worthwhile to bring it to realization.

As an example, one could have a setup with a large screen surface in the center of a given space. On the screen the viewer sees a live camera view of the space from the top, including himself/herself standing in front of the screen. All people in the camera view are annotated with labels. The resulting experience would be a combination of the distant top-down perspective–showing many people at once and representing statistics well–and the mirror situation. The viewer sees himself/herself and others at the same time.

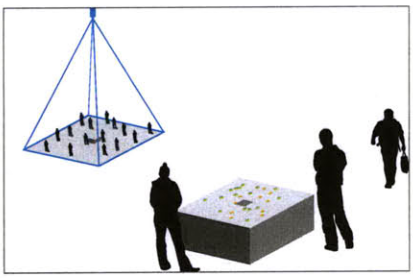


Fig. 58 A setup for a different constellation perspectives.

INTERPRETATION

The projects created presented the viewers with a pre-determined data set, providing no or little space for interpretation in the viewer. However, it would be possible to create a more open-ended situation which allows the audience to find its own meaning of a presented visualization.

A simple example of such an installation could be a "categorization machine". People within a given space could be augmented with non-specific colored labels that distinguish one person from another and naturally divide all people present into groups. If the installation does not directly disclose additional information describing the reasoning behind the categorization, viewers would read their own meaning into it; questioning the system, wondering why one person belongs to this camp and another to the next. This installation could still be a data visualization based on a real data source. It could also be context-specific, representing information relevant to the space it is shown in. However, simply by not knowing all answers to start with, the viewer would be in a more active, engaged stance towards the visualization.

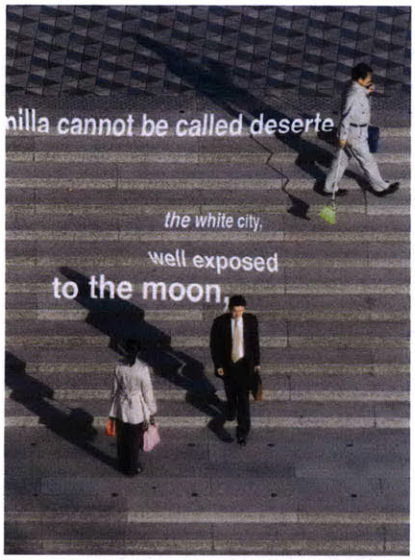
Fig. 59 Sketch for a "categorization machine".

PARTICIPATION

Another shortcoming of the installations was the lack of participation provided for the audience. While a viewer could physically play with the labels attached to his/her body in the juxtaposition, he/she could not influence or comment on the data visualization itself. One example of such an installation could be a "Polling space". Instead of predefined statistics within the visualization, they could be generated in real-time by the audience itself. This could be realized by providing a polling station, for example with a digital kiosk. Each person could vote on a specific question and his vote would be reflected in the embodied data visualization. Over time this installation would capture and visually reflect the opinion of the people frequenting a space, automatically generating a location-specific data set, to which the next visitors can react in turn.

ALTERNATIVE APPLICATIONS

The technological aspects of the real-time installations such as "What Was The



Media Lab Thinking About In The Year _ _ _ _?" could be used for a variety of alternative applications different from the embodied data visualization pursued within this thesis. To this day there are very few technologies on the market that employ augmented reality in a mid-distance spatial environment. It is mostly used in object-based interaction physically close to the viewer or for geographic navigation on an urban scale. In particular, real-time 3D graphics around the body seems an interesting area to be explored further. I imagined a variety of areas where this could be applied, such as visual mid-distance communication, virtual fashion or embodied storytelling in space. These topics were briefly captured in sketches in the beginning of this thesis and are shown here.

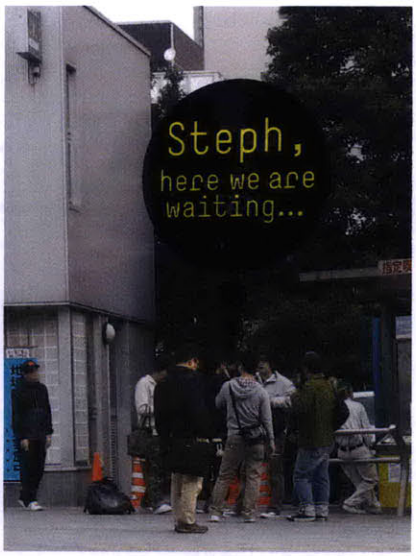
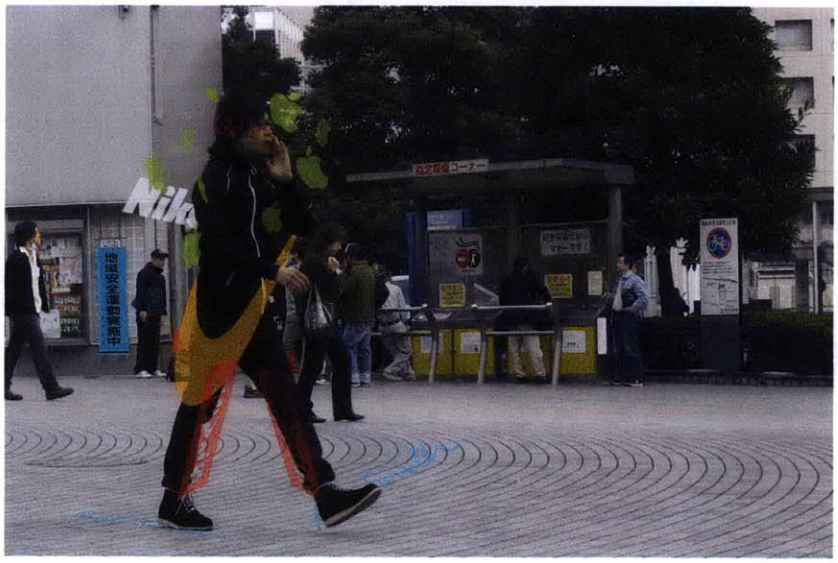


Fig. 60 Sketch for storytelling applications. Streams of text representing different characters within a narrative juxtapose people in the realworld
Fig. 61 sketch for AR Fashion
Fig. 62 Sketch for MID-Distance AR communication
Fig. 63 2nd Sketch for AR Fashion



Conclusion

Digital data visualization uses the computer to translate abstract data into an understandable visual representation and to provide an interface for filtering, analysis and interaction with the data. In this thesis I explored wether or not the computer can also play a role in the aesthetic experience of data. I used the unique capabilities of digital media to capture and represent human expression in order to personify information. By digitally augmenting real people with information, the goal was to create a visceral and personal experience of data.

Personification of Information is an attempt to use digital media to bring distant information closer to us. I hope that it can serve as one example of technology establishing an intimate relationship between individuals and impersonal structures. Whether they are informational, organizational or physical, I believe in the potential of digital media to provide new ways of seeing these structures. I believe it can create a situation of personal resonance for the viewer, a sense of connectedness and perhaps even an attitude of responsibility and agency.

VII. References

[1] PBS Trainscript of Interview by Bill Moyers with Wendell Potter on July 10, 2009 http://www.pbs.org/moyers/journal/07102009/transcript2.html

[2] Sara Kristiina Elo *PLUM* Thesis (MS) - Massachusetts Institute of Technology, School of Architecture and Planning, Program in Media Arts and Sciences, (1995).

[3] Charles & Ray Eames *Powers of Ten* (1968) http://en.wikipedia.org/wiki/Powers_of_ten

[4] Otto Neurath *Isotype* http://en.wikipedia.org/wiki/Isotype_(picture_language)

[5] Hyebin Park *If the world were a village of 100 people* http://binsworld.com/100 (2008)

[6] Alyssa Wright *Cherry Blossoms* (2007) http://web.media.mit.edu/~alyssa/about.html

[7] Tufte, Edward R. *Envisioning Information* Cheshire, Conn.: Graphics Press, 1990.

[8] Tufte, Edward R. *The Visual Display of Quantitative Information* Cheshire, Conn.: Graphics Press, 1992.

[9] http://en.wikipedia.org/wiki/Augmented_reality

[10] http://en.wikipedia.org/wiki/Information_Visualization

[11] *Village Report*, a text by Donella Meadows http://www.sustainer.org/dhm_archive/index.php?display_article=vn338villageed

[12] *The Watermarks Project* (2009) - Chris Bodle http://watermarksproject.org/images/

[13] Maya Lin's Vietnam Memorial: From "Public Art" by Cher Krause Knight:

[14] Vande Moere, A., & Offenhuber, D., 2008, *Beyond Ambient Display: A Contextual Taxonomy of Alternative Information Display*. International Journal of Ambient Computing and Intelligence.

[15] *Energy Fame* http://www.pixelache.ac/2010/miska-fame.html

[16] *Useful junk?: the effects of visual embellishment on comprehension and memorability of charts*

[17] *Subtitled Public*-Rafael Lozano-Hemmer Sala de Arte Público Siqueiros

(curators: Itala Schmelz, Jennifer Teets), Mexico City, April-May 2005 http://www.lozano-hemmer.com/subtitled_public.php

[18] Holmes,N. *Designer's Guide to Creating Charts and Diagrams,* Watson-Guptill Publications, 1984.

[19] *Otto Neurath's Universal Silhouettes*, Cabinet Magazine, Issue 24 Shadows Winter 2006/07 http://www.cabinetmagazine.org/issues/24/pendle.php

[20] Film *Stranger than Fiction* (2006) http://www.imdb.com/title/tt0420223/

[21] *Metaphors we live by*, George Lakoff and Mark Johnson. Chicago: University of Chicago Press, 1980.

[22] Herman Chernoff *The Use of Faces to Represent Points in K-Dimensional Space Graphically* Journal of the American Statistical Association (American Statistical Association) 68 (342): 361–368 (1973)

[23] Nader Vossoughian, Otto Neurath, *Otto Neurath-The Language of the Global Polis* NAi Publishers (2008) ISBN-10: 9056623508

[24] Otto Neurath, *International picture language.* London: Kegan Paul, 1936.

[25] Stan's Cafe Theatre Company (UK) *Of All The People In All The World* http://www.stanscafe.co.uk/ofallthepeople/

[26] Brandt, A. (2006). *The Cigarette Century.* New York: Basic Books.

[27] *Vietnam Veterans Memorial* designed by Maya Lin (1982)

[28] Tom Finkelpearl *Dialogues in Public Art.* The MIT Press. ISBN-10: 0-262-56148-4

[29] *Edmund Husserl* (Chapter 7 Empathy, Intersubjectivity and Lifeworld) Stanford Encyclopedia of Philosophy http://plato.stanford.edu/entries/husserl/#EmpIntLif

[30] Emmanuel Levinas http://en.wikipedia.org/wiki/Emmanuel_Levinas

[31] Willy Sengewald, Richard The *Omnivisu* (2005) http://www.thegreeneyl.com/omnivisu

[32] Francis Lam *CHEIRO* Thesis (MS) - Massachusetts Institute of Technology, School of Architecture and Planning, Program in Media Arts and Sciences, (2006).

[33] Peter Cho, *Pliant Type: Development and Temporal Manipulation of Expressive, Malleable Typography* Thesis (MS) - Massachusetts Institute of Technology, School of Architecture and Planning, Program in Media Arts and Sciences, (1999).

[34] Ishizaki, Suguru. Typographic Performance Thesis (PhD) - Massachusetts Institute of Technology, School of Architecture and Planning, Program in Media Arts and Sciences, (1995)

[35] New York City Community Health Survey (CHS), New York City Dept, of Helath and Hygiene. http://www.nyc.gov/html/doh/html/survey/chs-data.shtml

[36] *The Germans--public opinion polls*, 1947-1966 /edited by Elisabeth Noelle and Erich Peter Neumann ; [translated from the German by Gerard Finan]. Westport, Conn. : Greenwood Press, 1981, c1967.

[37] *The Germans--public opinion polls*, 1967-1980 /edited by Elisabeth Noelle-Neumann. Westport, Conn. : Greenwood Press, 1981.

[38] *Die Deutsche Wiedervereinigung im Spiegel der Demoskopie*, 2008, Dr. Rüdiger Schulz

[39] http://mallet.cs.umass.edu/topics.php

[40] *OpenFrameWorks* openframeworks.cc/

[41] *Community Core Vision* http://ccv.nuigroup.com/

[42] Open Sound Control http://en.wikipedia.org/wiki/Open_Sound_Control

[43] *OpenCV* http://en.wikipedia.org/wiki/OpenCV

[44] Billboarding Algorithm as described in http://www.lighthouse3d.com/opengl/billboarding/

[45] http://en.wikipedia.org/wiki/Pepper's_ghost

[46] Frank Nielsen *Visual Computing: Geometry, Graphics, and Vision*, ISBN: 1-58450-427-7 Charles River Media, Inc.

[47] *Deutschland, Korea - geteilt, vereint.* Koschyk, Hartmut (Hrsg.). Olzog Verlag (2005). ISBN 3-7892-8173-5

[48] *Generational Dynamics and the Politics of German and Korean Unification* Jin Min Chung and John D. Nagle in The Western Political Quarterly, Vol. 45, No. 4 (Dec., 1992), pp. 851-867

Appendix

Implementation of Real-time Augmentation

For the projects WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _?, WHO SPONSORS THE MEDIA LAB? and UNIFICATION–A CASE STUDY? a similar installation infrastructure for real-time augmented reality was developed. The technological implementation is described in broad strokes in the next paragraphs.

All three installations consist of one display showing a live video feed of the space. Whenever a person enters that view, a label appears on the screen, graphically annotating the person's body. If the person moves through the space the label moves along in perspective. This augmentation is achieved by an infrastructure consisting of these systems:

- The tracking system which tracks all people moving around in the space using computer vision.
- The AR system which uses this tracking data in order to augment the people with digital labels.

Both systems are implemented in C++ using the OpenFrameworks [40] library. The two systems are deployed on two different machines, the communica-

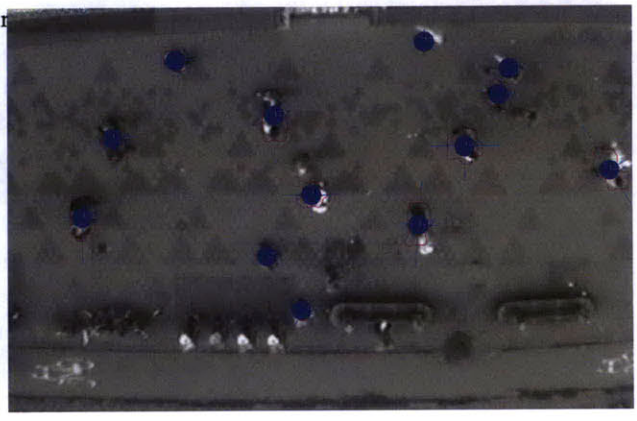


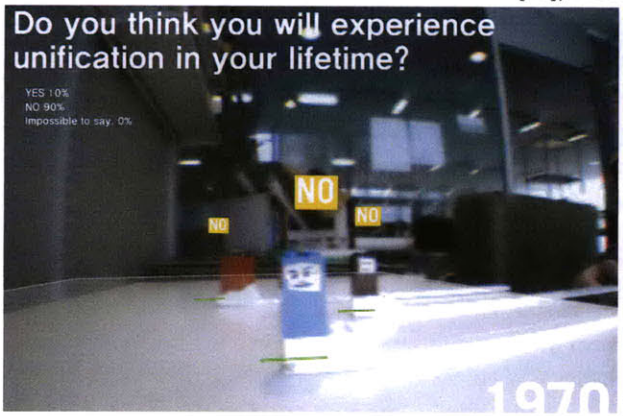
Fig. 64 Initial tracking test at the Media Lab
Fig. 65 Initial tracking success with test video. Blob position and sillhouette, Unique Ids, implemented.

TRACKING SYSTEM

The tracking system is a computer equipped with camera and computer vision software that determines the position of people within a given space and provides this data to the AR system. By placing the camera facing down onto the space it is possible to track all moving objects in two dimensions only. The custom software is a combination of *OpenCV* [43] and CCV [41] for computer vision and blob track-

ing. In order to recognize moving objects, a model of the non-moving background image is generated. Using only a monochrome camera image, the background is subtracted, and the resulting image is adjusted by filtering (blurring, noise reduction and image thresholding). The filtered image is analyzed by a blob tracking algorithm which calculates a 2D vector contour shape and assigns unique IDs for each moving object within the scene.

Two functionalities were added to these standard computer vision functionalities. One is a custom tool to exclude certain areas of the camera image from the tracking, using polygonal shapes that can be adjusted depending on the situation. This is necessary to compensate for elements in the scene that can lead to errors with the background model and blob-tracking algorithms, such as screens or static objects that can be moved such as furniture. The second is a homography algorithm in order to compensate for angular viewing angles by the tracking camera (as described in[46]). The resulting selection of blobs is transmitted to the AR System.



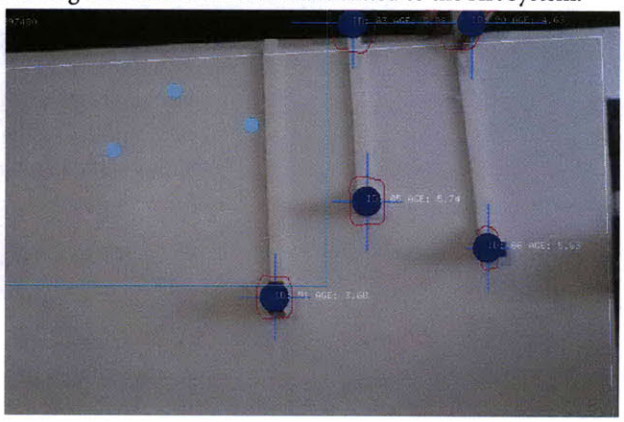


Fig. 66 Small scale Two-camera tracking setup. View from tracking camera.
Fig. 67 Small scale Two-camera tracking setup. using legos as people. Augmented view from eye-level camera.

AR SYSTEM

The AR system is a second computer with presentation display, camera and custom software. In order to create a "look-through" effect with the screen, the camera is placed behind it and the live camera feed is shown on the display. The AR system stores a virtual 3D model of the physical space. The 2D tracking positions are placed into that virtual scene, so each person walking through the physical space has a corresponding representation in the virtual space. In order to achieve the augmentation, a view of the virtual scene is overlaid with the live camera image. The virtual view can be adjusted to correspond with the parameters of the live camera, such as point of view, angle, field of view, etc. When the virtual view is perfectly aligned with the camera view, a virtual object rendered in the overlay appears to be situated in the physical space. For each person walking through the physical space a label is rendered in the virtual presentation. When a person can be seen in the camera view, the label appears to be attached to him/her. When that person moves around the label moves along smoothly in a correct 3-D simulation of the physical space.

For What Was The Media Lab Thinking About in The Year _ _ _ _? an additional feature was implemented. Using a rotation sensor and micro controller in the binocular stand, the horizontal turning of the device is monitored. The rotation data is mapped to the virtual camera rotation.

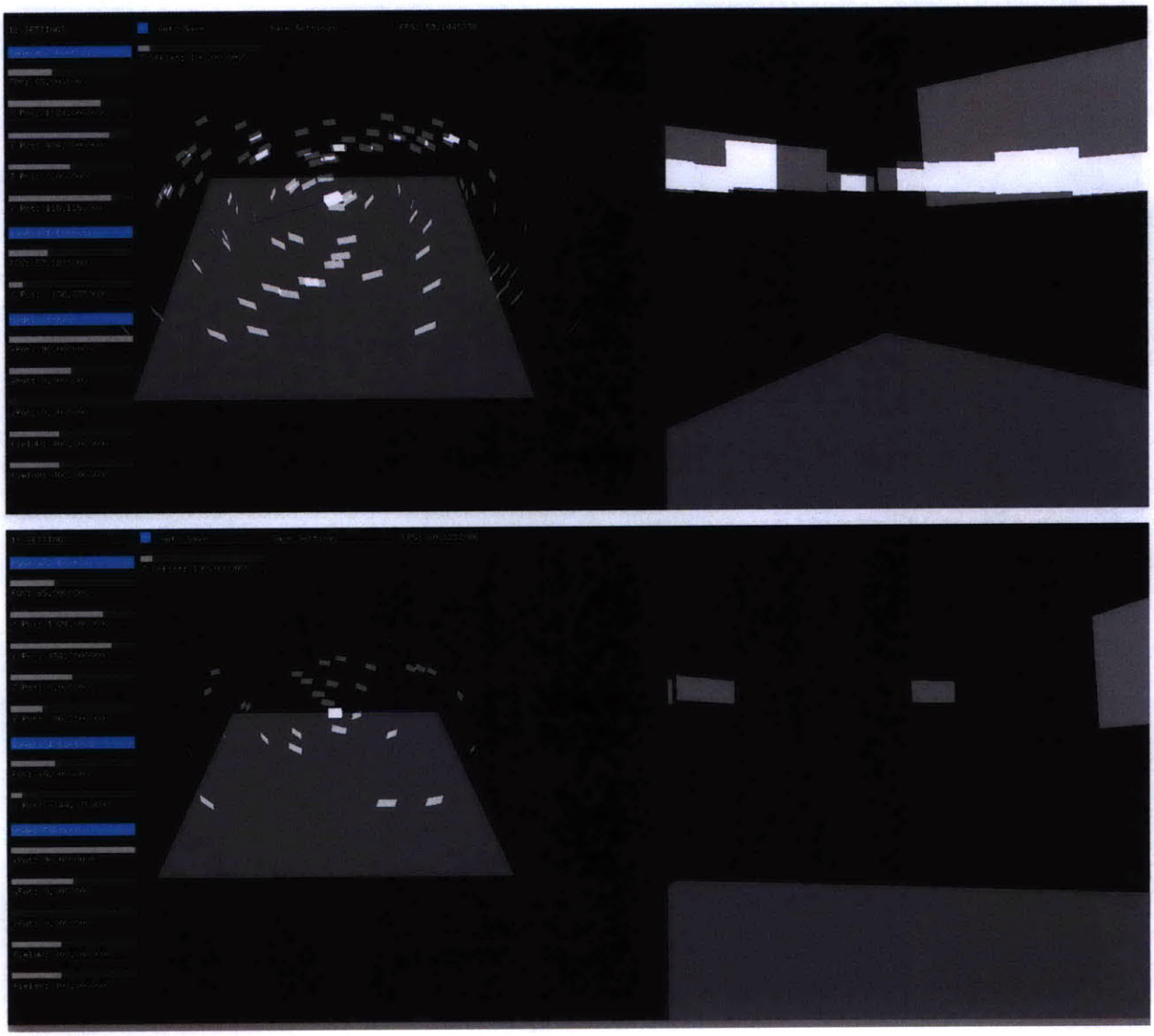
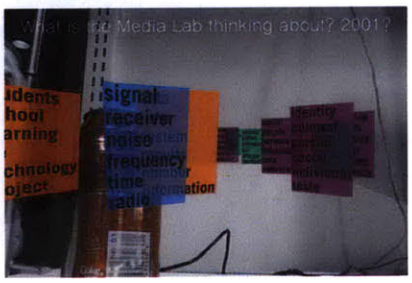


Fig. 68 Interface to adjust spatial and optical settings for virtual representation of 3D space. Right shows eye-level camera view.
Fig. 69 Different perspective shown with same interface.

Fig. 70 Billboarding algorithm in 3D to ensures legibility of labels at all times.



LABELING

In addition to an accurate illusion of perspective, the labels have to be legible and visible to the user at all times. While it would be possible to align the labels with the direction people are facing this is not desirable as sometimes labels could not be read by the viewer. Hence the labels are rendered using a billboarding algorithm [44] so that each label always faces the viewer.

The vertical positioning of the labels can be adjusted in order to react to a given situation and viewport. This helps to create an aesthetically pleasing appearance of the juxtaposition of graphics and body. In all installations the labels are hovering above people's heads with a noticeable distance in between.

The labels themselves are color-coded by the data point they represent in order to make the visualization as apparent and legible as possible. This is also supported by clear sans-serif typography.

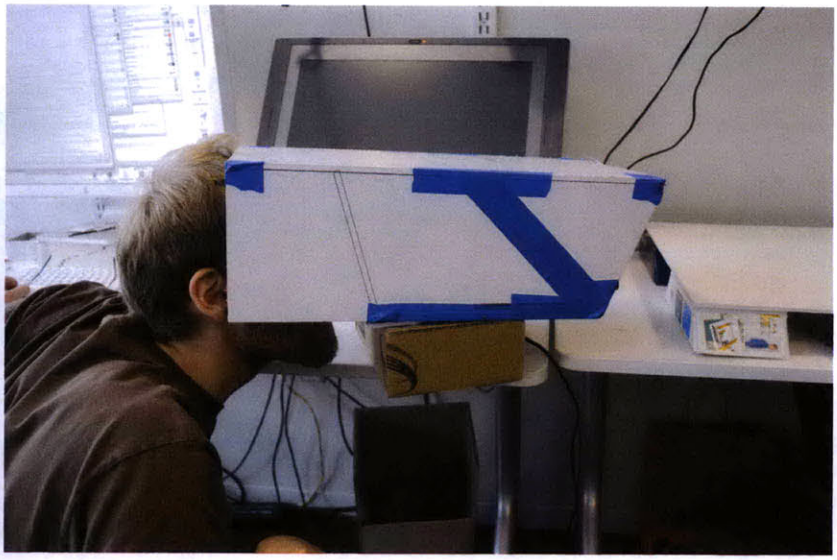


Fig. 74 Matt Hirsch testing a prototype of the viewing device incorporating the pepper's ghost setup.

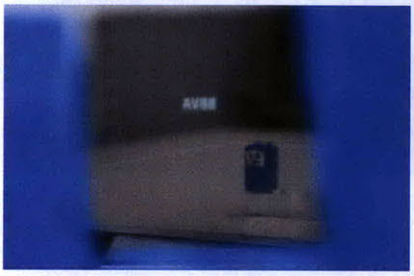


Fig. 71 View 1 of depth perception with Pepper's Ghost
Fig. 72 View 2 of depth perception with Pepper's Ghost
Fig. 73 View 3 of depth perception with Pepper's Ghost

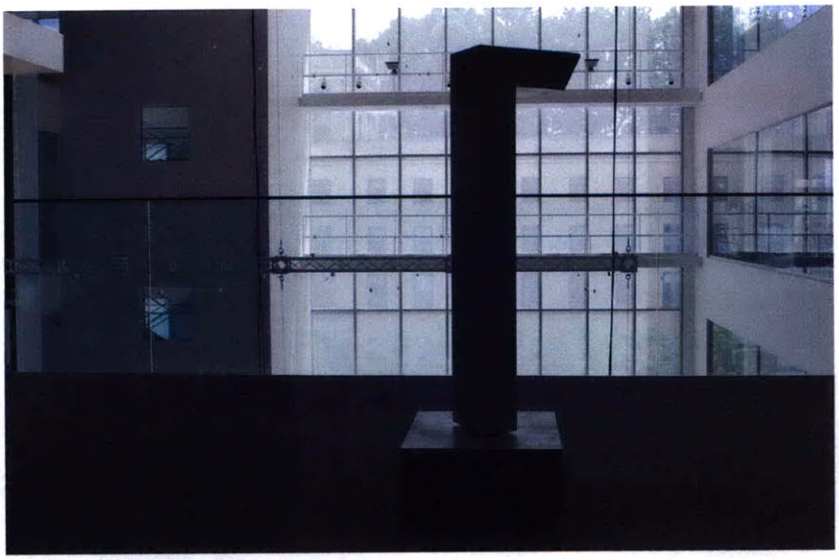
VIEWING EXPERIENCE

For WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? an immersive viewing experience is established through the viewing device. In the final solution the viewing device consists of a screen inside the box, with a viewer looking into it in order to experience the installation. Initially, a different approach was pursued.

For aesthetic and conceptual reasons it was investigated if the viewer could look at the scene directly without the mediation of a screen. The hope was to show the augmented layer by employing the Pepper's Ghost effect [45]. By placing a beamsplitter mirror at a 45° angle between the scene and the viewfinder and a hidden screen below the mirror, the real scene is seen directly through the mirror and it is possible to show imagery displayed on the screen as a reflection on the mirror surface.

Unfortunately this approach proved unsatisfactory due to the perception of depth. A Pepper's Ghost setup requires both scenes–the one a person sees directly and the one which is only reflected in the mirror–to be located at an equal distance to the mirror. This was not possible to for my purposes as objects in the real scene could be as far as 20m and the screen had to be located closely to the mirror. Even with monocular vision the difference of distance between mirror and augmented object was perceived to strongly, and the eye switches back and forth between augmentation and object within the scene.

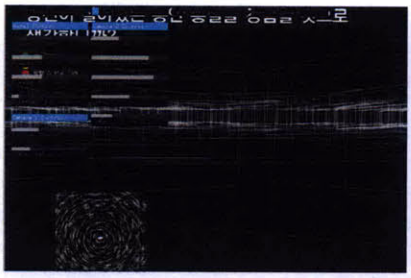
Fig. 75 Documentation of building the binocular device.

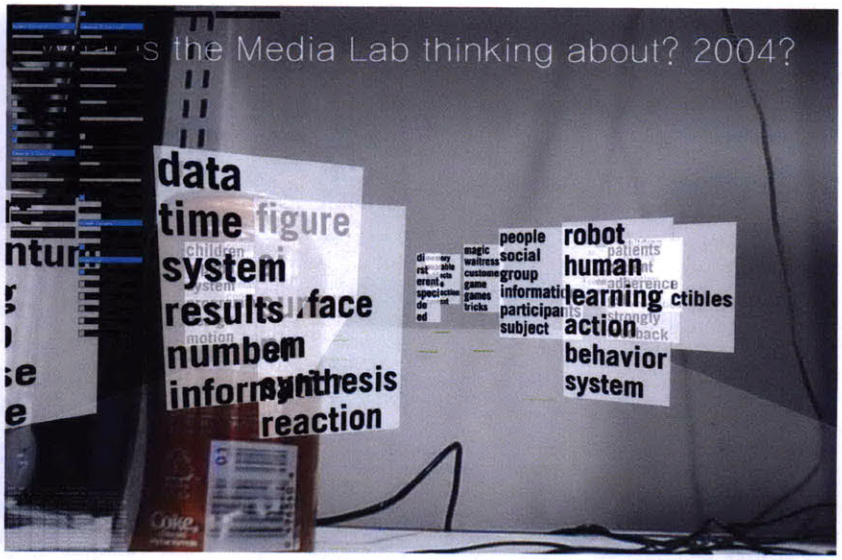


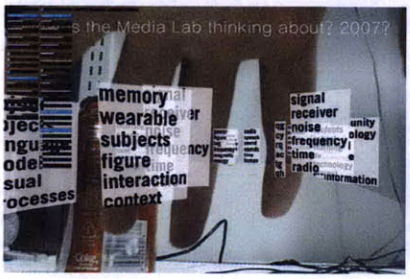
HARDWARE

The viewing kiosk for WHAT WAS THE MEDIA LAB THINKING ABOUT IN THE YEAR _ _ _ _? is specifically built for the installation. Built from 1/4 inch MDF, the outside consists of a square base and the actual viewing stand, shaped similar to an L turned by 180° degrees.

The kiosk is painted white and vinyl typography is placed on the rear end of the stand. It is centered by an aluminum stand built with 80/20 material, which forms the structural skeleton of the object. The stand is placed on two "lazy susan" bearings, which allow it to rotate by 200° around the Z axis. The base houses a Mac Mini computer connected to a variety of electronics in the top part by four cables threaded through the 80/20 stand. The top houses the display providing the view, a camera which films that view, an Arduino micro controller and a potentiometer which senses the rotation of the stand.







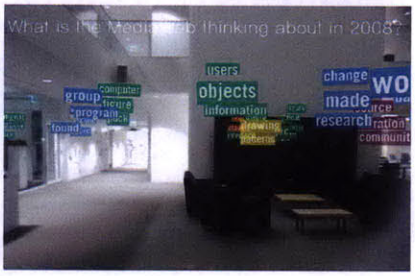
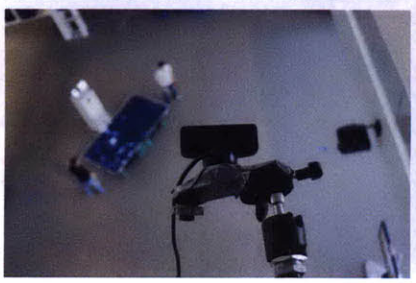
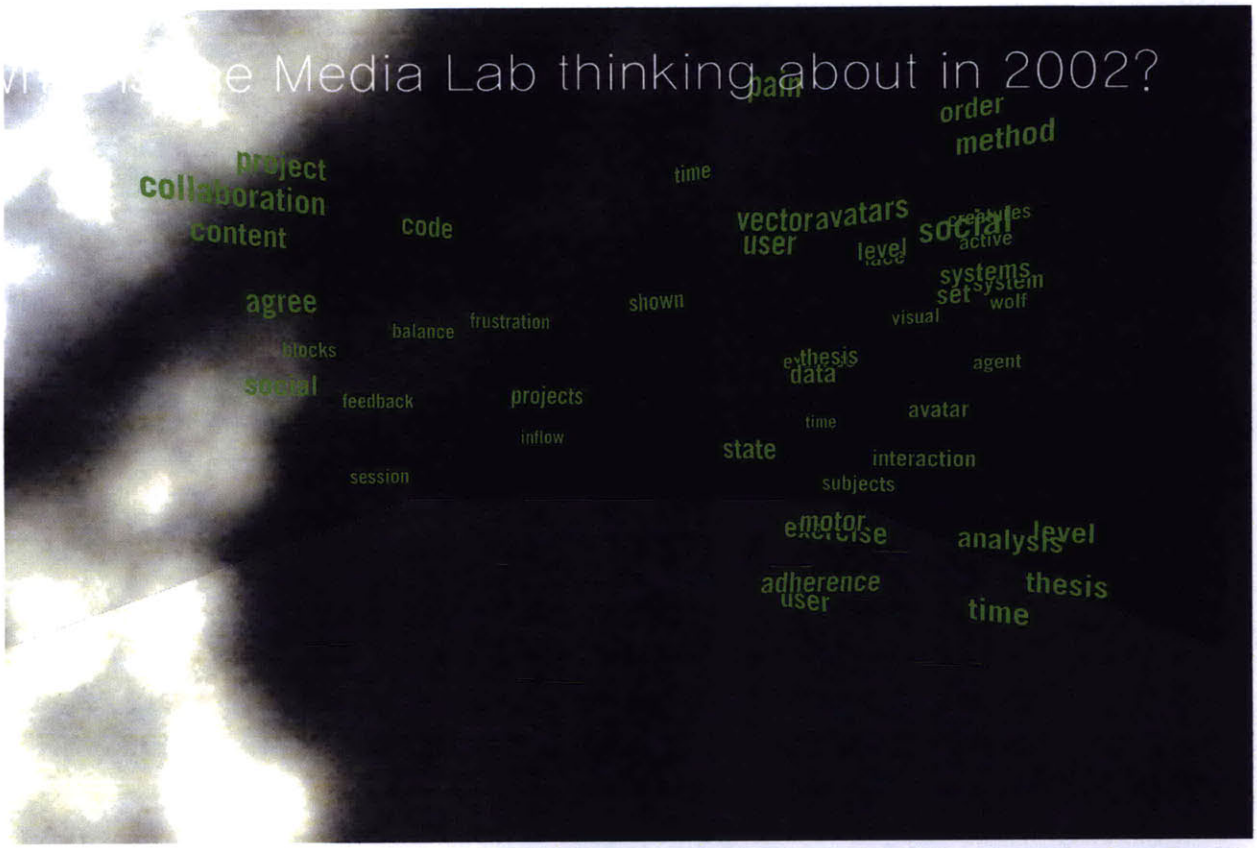


Fig. 76 A variety of sketches and test screenshots.




e Media Lab thinking about in 2002?
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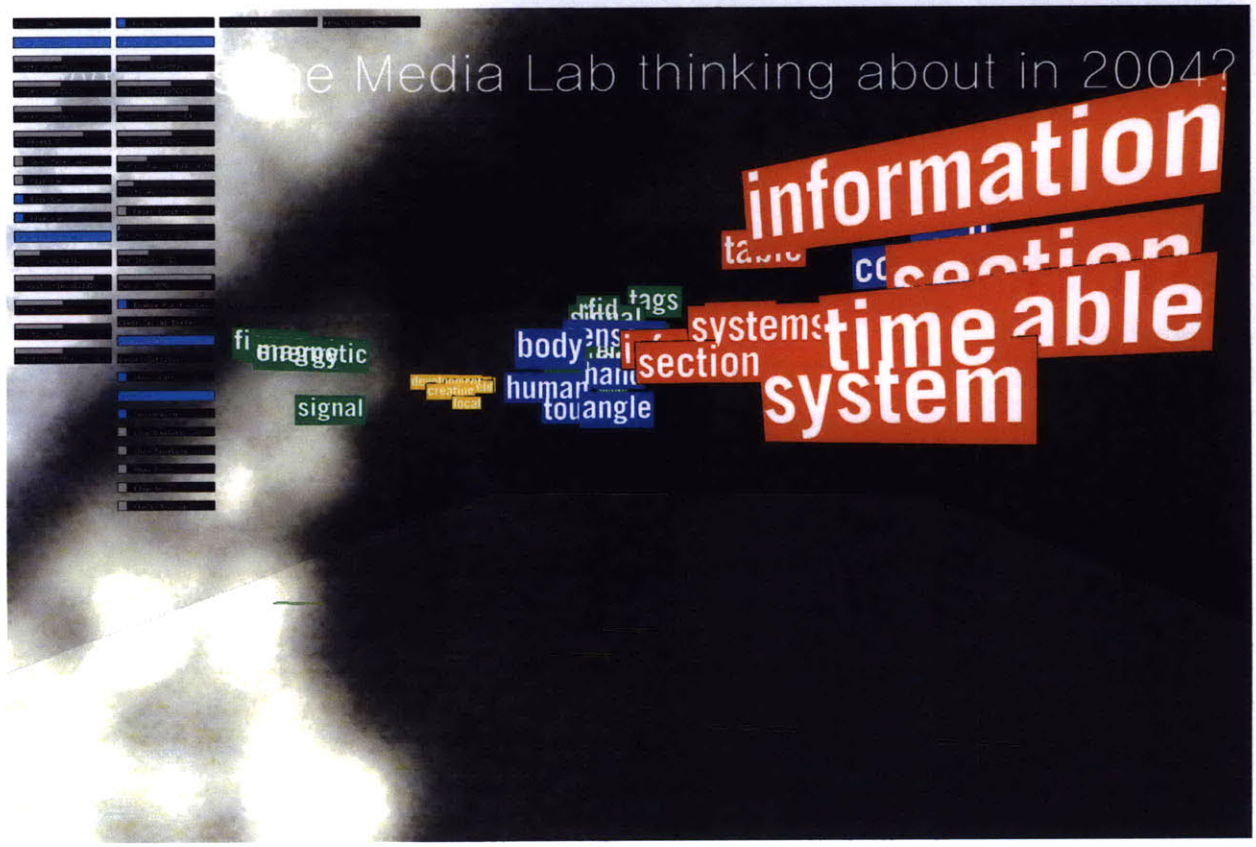
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