Lost on the internet.

Gestural interfaces & ambient information.

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2012

Remember when we took a map while going into the forest? Remember the time you took out a compass while being a boy scout? Now, people seem to get lost on and with the internet.

New generations use new tools to start a fire. Whether that be in a pit, or digital on the web. From books to tablets, from LPs to Spotify, the internet has changed our world.

Abstract

This thesis is about how the new generation in the connected society uses all sorts of devices throughout the day to obtain information. It looks at the society, how we all got connected through the internet, the digital free land. How digital natives thrive in this environment and how they differ from previous generations.

It takes into account specific technological advancement in screen devices over the last 10 years. Where were we back then, where are we now, and where will we be in 10 years? Design changed over the course of those years, and how can we use lessons learned then to design for the future?

The end result is a functioning prototype of a product that enhances the life of a digital native throughout the day, encountering problems, opportunities or seize moments where it is needed.

I invite you to take a look at a video mashup[1].

[1] Thesis Video Mashup #1 - https://vimeo.com/40163672 **Accessed:** 11 April 2012

Structure / Outline

Part I

- What is today's definition of a connected society?
- Who are 'Digital natives'?
- How did screen and interface technology develop over the last few years?
- How do you design for new technology and Digital natives?

Part II

- Interviews

Part III

- Has the way we access non-obtrusive (Ambient) information changed in this connected society?

Part IV

- Develop scenarios and context in which a gesture enabled interface or screen can enhance a scenario/experience.
- Design / Prototype a product to present an 'ambient' information.
- How can we use the aesthetics of data to present an 'ambient' information?

Part V

- Discover possibilities for screens/interfaces to explore new functions in the world of 'digital natives'.

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Part I

Connected Society

> *"Major changes have occurred within the computer revolution; changes which encompass all aspects of its role. These are not just quantitative in nature, such as exponential increases in processing power and storage capacity, but are more fundamental, pointing not only to the function of computer technology, but its emerging diversity both in terms of its form and place in the world.*
>
> *[..]*
>
> *This gives rise to tensions between individuals and governments, and between globalization and cultural diversity."* [2]

Over the past decade, we have seen a shift in cultural conflicts, ethics, privacy norms & values, as a result of a technological revolution. It defines who we have become, and more, where and who we are now and later will be. The influence of the 'Millenials' or 'Generation Einstein'' has never been bigger because of the boundaries taken away through connectivity.

The internet has become a free land. A dream where anyone regardless of their vision and opinion can become relevant. It might seem like the 'Matrix' at some point, and that's exactly how it has evolved over the past years.

> *"A world without rules and controls, without borders or boundaries; a world where anything is possible."* [3]

It caused a paradigm shift in communication. Government campaigns, ethnic groups now present themselves on the internet to be heard by the public. Publicity is no longer limited to television or newspapers with selected pieces and aimed propaganda. Each person on its own decides what he or she likes to see, at what time, and location.

You are, in fact, curating your own media landscape. Are we consuming more media and do we communicate more then we did 10 years ago? Does it differ per age group? According to Jan van Dijk, the social factor has become the nervous system of the society where organization is enabled through newly found relationships[4].

You decide who you connect to, you make and break connections on a daily base. Do people from new generations add other value to connections and connectivity? Is there a

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[2] Being Human: Human Computer Interaction in the year 2020 **Accessed:** 26 February 2012

[3] The Matrix - http://www.imdb.com/title/tt0133093/ **Accessed:** 3 April 2012

[4] The Networked Society - http://books.google.nl/books?id=b7ktTPViIYMC **Accessed:** 26 February 2012

difference in the amount of communication, does it weigh up against the digital way of communicating? Do we still keep the same amount of quality when we communicate through new channels like Twitter or Facebook, as opposed to talking face to face? This is important when striving for better means.

Numbers tell us that over the last few years, the penetration of mobile communication has become abundant. Even in third world countries, mobile communication is being used for more than just communication, for example payment solutions. Next to this, it enhances the society to react more quickly in emergency situations.

Google took this logical next step, and launched the 'Person Finder' to help people reconnect with relatives after a disaster situation. Added value to existing networks is something we see more and more, either invading privacy or helping it. On the other side, there is Apple, who brought the service Find My Friends into the world, realtime geo-location through their own device, the iPhone, obviously built upon the social check-in services like FourSquare.

Not only phones are causing a revolution,but they are only a small part to take in this. Where does it begin and and where does it end? It has to do with accessibility towards technology. Moore's law, a rule of thumb for computer hardware states that over the course of every two years, the processing capability in chip performance doubles. This is exponential, and if you take into consideration that we get new devices every day, we are certainly on a ramp that provides us with technology that enhances this connectivity.

This is not only seen in mobile devices, but also in desktops, and other miscellaneous hardware that people use daily, for example a cash register, public transportation systems. This impacts every industry and requires adaptation and flexibility.

Is that what today's generation is better at? Flexibility and taking decisions in a rapidly changing environment? Adaptability? Or can we turn it around and make the environment more simple and easy to use, in combination with subtle changes over time, to gradually change the way older generations use the same information?

> *"The need to express ourselves and communicate with others is fundamental to what it means to be human. Communication technologies are now letting us stay in touch and talk in more diverse ways than ever. The emergence of new genres of communication in the last few years has not only increased the pace of communication but the amount of it, too.*
>
> *For example, messaging, texting and 'twittering' are on the rise, where groups of friends, families and colleagues keep in touch, engaging in a form of social grooming, like birds or apes, letting each other know on a constant basis what they are doing or have just done."* [5]

[5] Being Human: Human Computer Interaction in the year 2020 **Accessed:** 26 February 2012

We split the wealthy, connected, first world into 2 separate parts. On one hand, the 'digital immigrants', those who have not been raised in the era of abundant communication & computer devices such as telephones, laptops, and tablets. On the other hand there are the 'digital natives', on which this thesis is focussed. They are the new generation, as a result of the baby boomers, well-educated and capable of living in this constantly changing digital environment.

New ways of interaction

The connected society exists through the technology the 'digital natives' are always carrying with them, phones, laptops. These permanently connected devices are used to replenish connections between others, grow new ones or break them. The ease of doing so means that there is a less prominent urge to feel connected and valued by surrounding people.

All these new connections arose with the re-use of existing channels, such as the phone, but also through new ones, say for example a Poken[6] (A RFID keychain) or Cardcloud[7], used to switch out contact details on the fly.

There are already prototypes of events where you register, and on your entry you automatically check in. A motion sensor recognizes you, and a projector puts up you social profiles next to you on the floor. When somebody enters your personal space, you can easily switch out data when you shake hands. Take for example the project GoLogo from 100%Fat [8].

Did we have this vision a decade ago? According to some visionaries, we surpassed some things they thought up, but in other ways, we surely could have done a better job. I will not dive in every industry, I will focus on design strategies, communication and computer technology. Although the Moore's curve is quite interesting, there are way more important things going on with the power computers brought forward. We are giving them vision, and embedding them in everything, our daily lives.

Did we 10 years ago, think of apps on the mobile phone? I did not, surely there were some, like the calculator, but as soon as we saw the new possibilities, people seemed to grasp those more quickly. Our society lives more in a remix and re-use then a create culture. Which is strange, if we consider that we are polluting the world more then ever before, not only with an abundance of information duplication, but also in trashing away old technologies. We are now combining functions and abstractions to make a clearer understanding of how we work as an individual, groups and society.

We could not imagine all paper books in a school to be replaced by Amazon's Kindle or iPad's ten years ago. We did not think of the mobile phone to take such a big part in our society. We now see development of 'Serious Gaming' concepts that start with the Wii &

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[6] Poken - http://www.poken.com/ **Accessed:** 2 April 2012

[7] Cardcloud - http://www.cardcloud.com/ **Accessed:** 2 April 2012

[8] 100%fat - http://www.100fat.nl/portfolio/gologo **Accessed:** 2 April 2012

Microsoft Kinect platform, that reach elderly people, to get active, healthy, and re-vitalize their lives.

Social networks

There is a big difference in the amount of information transferred via text messages and social networks. They did exist in those days, but the platforms have matured over time, evermore adjusting to the end-users needs. For example, take a look at GeoCities. It started in 1994, began as a platform where everyone could build their own site, at no cost. This made the possibilities of the web accessible for everyone.

Although closed in 2009, GeoCities is still considered to have taken part in what was called the uprising of a social internet [9]. Where Facebook and Twitter are currently the two most mainstream sites to use.

Within GeoCities social connections were at the beginning non-apparent. There was some cross profile linking, but it was nothing compared to what we see today, were systems as 'Pay with a tweet' or a like of a brand on your own Facebook profile are common ways of interacting and connecting with brands.

The TV was still the main platform for public parties to present themselves. It was the first thing they thought off when they wanted recognition from the public. Then, buying space on television was still 'affordable' for parties and it still had the freedom of speech (unless censored).

The limiting factor was the accessibility. This does not mean people did not have a TV, but more that the TV was only on in the evening, when the family was home together. Which means that the time TV was effective for roughly 2/3 hours in the evening and 1 in the morning.

The Internet on the other hand, was always accessible. With phones now enabled to go onto the web at any given moment, this became even more integrated into our lives. Facebook [10], at this date, has appeared as the main social network people thrive on. Next to Twitter for quick communication, LinkedIn for professional connections and Vimeo for video, those are the main networks I use when I'm online.

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[9] The Deleted City - https://vimeo.com/29523075 **Accessed:** 9 April 2012

[10] Facebook - http://www.facebook.com **Accessed:** 9 April 2012

Conclusion

With the connected society we specify borderless communication, spontaneous or forced opportunities to be seized by new technology.

I do believe that with the connected society we reach a new level of connectivity, where we used to send letters daily, we now use Twitter to instantly pinch the other person to react. This offers us new possibilities on all areas, whether it be healthcare, business, agriculture etc. Connecting not only persons but also physical things through the Internet of Things exceeded our vision 10 years ago.

Having computers in our pockets that enable us to connect with anyone on earth in realtime, enables us to set ideas, thoughts and concepts in motion. The developing world has skipped the step of having landlines for phones. Instead, they now use mobile smartphones to have a secondary currency to use in trading and funding platforms.

Social networks became our address book and function as a base for starting a conversation these days. Ericsson has made a short documentary[11] to discuss history and future about the connected society, from a technological point of view. This sums up most of the conclusions made above.

[11] Networked Society, On the Brink - http://www.ericsson.com/networkedsociety **Accessed:** 30 April 2012

Digital Natives

When we speak of Digital Natives, what do we actually mean with that? Is this group, or definition different than normal people? Can we see a difference in ways of thinking or behaving when a piece of technology is involved? Do they think differently[12]?

Age

Claims have been made that digital natives have developed technological skills and cognitive capacities. An early statement was made by Marc Prensky, who wrote a piece in 2001, where he stated it has been called a 'Singularity'. He makes a clear distinction between immigrants and natives. Those who learned the language of the technology and those who were born and raised with it.

Is a split in generation with age we can define if the youth has spent more time over the past years behind a screen? Whether it be a television, computer or cellphone? Where exactly did this start if Prensky wrote his piece in 2001?

It has to do with the rise of the "Information Age" (Also referenced as: The Computer Age or Digital Age), that reached critical mass in the early 1990s. In those years, internet became widely available, cellphones reached the market at low prices and computers were seen more often in family residencies.

People who had access to an internet connection and a personal computer became the pioneers of the generation. They are born in the late 1960's or later. It sets the barrier somewhat safe on younger than 50 on today's date.

This change also implicates education. Sources of knowledge have become abundant, and those who can leverage it, can deliver work faster and are more flexible.
Prensky states[13] that immigrants don't believe in the new found skills of natives, who can easily switch tasks and learn at high speeds, with other media.

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[12] What Digital Natives want... - http://www.youtube.com/watch?v=7_zzPBbXjWs **Accessed:** 1 April 2012

[13] Marc Prensky - Digital Natives, Digital Immigrants - 2001 **Accessed:** 26 February 2012

Connectivity

Does this increase in use of technology under Digital Natives mean that they are more connected to society? And how do they compare to Immigrants? An investigation by people from Ericsson has basic statistics.

> *"A typical 21-year-old has, on average:*
>
> *Sent and received 250,000 e-mails, instant messages, and SMS (Text messages)*
>
> *- Used a mobile phone for 10,000 hours*
>
> *- Played video games for 5,000 hours*
>
> *Spent 3,500 hours social networking online"*[14]

For digital natives, connectivity is seen as the foundation of their social lives. The paper done by Ericsson consists of a walkthrough of the day with digital natives, and draws conclusions that seem rather accurate if I compare them to my daily life.

It looks at persons from a customer point of view, where the advantages are when selling an object or information. They conclude that boundaries between work and private relationships are fading and digital natives are both consumers and professional users at the same time.

If we look at the connected society where we live in, it is a perfect fit that these people are with head and shoulders above the mass. They adopted early or have grown up with this world where everything is connected and they can easily find the information they need. They have become digitally literate.

Digital natives are connected on a higher level than immigrants because of their affinity with networks, as producers and consumers at the same time, Immigrants have to switch between those two and often miss the opportunities which lay hidden in between.

[14] Ericsson Business Review - 2008 **Accessed:** 26 February 2012

Brain Changes

Mark Prensky not only wrote on the impact of Digital Natives in the landscape of education, but also how the brains of Digital Natives are different from Immigrants. He uses neurobiology, social psychology as the base for his statements.

He talks about a phenomenon called neuroplasticity. When our brains rewire to organize themselves. Experiments on rats and other animals prove that a change in environment can create lasting changes in the chemical structure of our brains and the ability to rewire.

On the social psychology area, children raised with the computer develop 'hypertext' minds. They do not work linear, but more parallel. Often teachers and parents complain about the short attention span children have these days. It is the children who decide not to pay attention because the material is not interactive.[15]

A more recent article from the London School of Economics & Political Science has taken a more defensive point of view, depicting Prensky. As he stated that a change in brain structure makes younger generations think and process information differently.

The article specifically targets 3 points of data, from which can be defined if a person is a digital native or immigrant (Age, Experience, Breadth of use).

They conclude with the observation to tread carefully in the world of digital natives. The survey data shows that younger people are more adapted to this media rich and connected society.

> *"Prensky, Oblinger and Oblinger and others are right - we need to understand learners in order to teach them well. We are not saying education should not change, but debates about change must be based on empirical evidence and not rhetoric."* [16]

I do not have access to apparatus to take a thorough peek into a young mind, one of this generation, but living it myself, I can agree on the conclusion made above. So I'am biased in this, but the exposure to technology is a lot higher in younger generations. It is to early too see an evolution in the brain of a person, since we don't have an accurate comparison.

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[15] Marc Prensky - Digital Natives, Digital Immigrants - 2001 **Accessed:** 26 February 2012

[16] Ellen Heslper and Rebecca Enyon - Digital natives: where is the evidence? http://eprints.lse.ac.uk/27739/ **Accessed:** 17 April 2012

Statistics

Next to the statistics from the Ericsson Business Review, there has been a lot of hard and exact statistics of digital natives. The reason is that it is hard to investigate a new phenomenon without having a baseline. Comparing to other generations usually brings more problems than results, because of the mixed experience everyone has with computers.

Eva Brumberger at Virginia Tech, has specifically looked towards visual literacy.
The designed a survey for 500 people, in age between 18 to 23 years old.

- 56% Indicated they use a computer for more then 5 hours per day.
- 82% Use a digital camera, from where 30% use it every week.
- Photos from that camera are mainly uploaded towards social networks.

Eva Brumberger also looked at skills; Photo Editing, Illustration, Website Authoring. Interesting, is that except for Website Authoring the two remaining skills seem to be a common place. More than 50% have use it on a regular basis.

Extracting facts and judging images if they are altered or not, seems to be harder than before. Of course, digital tools enable us to alter photos in a way you can hardly see it, but it is a problem. To quote Eva Brumberger;

> *"In short, although the images in the survey contained varying degrees of contextual detail, respondents were not adept at identifying and using even the most immediately visible clues."*
>
> *- Eva Brumberger [17]*

If in the same document we look at how the group extracts facts and defines the tone of a specific image, we see a new fact; The given age of the first photo by the group has a big offset (Even though this might have to do with the post-process, black & white on the photo).

The group is more skeptical about how media can be altered in every way and therefore this might be biased based on the fact that they anticipated in being tricked. However, interpreting the tone of an image is a strength of the group (the mean was 3.39 out of 5 answers possible).

[17] Eva Brumberger - Visual Literacy and the Digital Native: An Examination of the Millennial Learner
Accessed: 14 May 2012

Conclusion

So, are digital natives different than immigrants? No, they only learned or adapted to this technology rich environment. We have to take into consideration that with divide, we have to make different products, for each group. We can see the difference now in education where there is a revolution on didactical technologies.

People create a new online identity, which digital natives consciously put forward where as immigrants respond more hesitant to changes and adapt slower. They often use old fashioned ways of communicating, even through digital channels. Digital natives are willing to share their personal information, for immigrants, this is one of the big issues.

Immigrants and natives do not operate the interface differently. However, they might approach it with other incentives. Digital natives stretch the use of tools and test flexibility (So they can use it or bend it into their own advantage) where immigrants stick to regular use.

Statistics prove that the generation my work is targeted at has trouble defining the age of media, but can easily specify the tone set by the maker. I'm a digital native, using tools to my advantage, leveraging the digital to enhance my offline world. Spark conversations and ideas, to connect people and things.

Interface and Screen Technology

Broad spread of devices

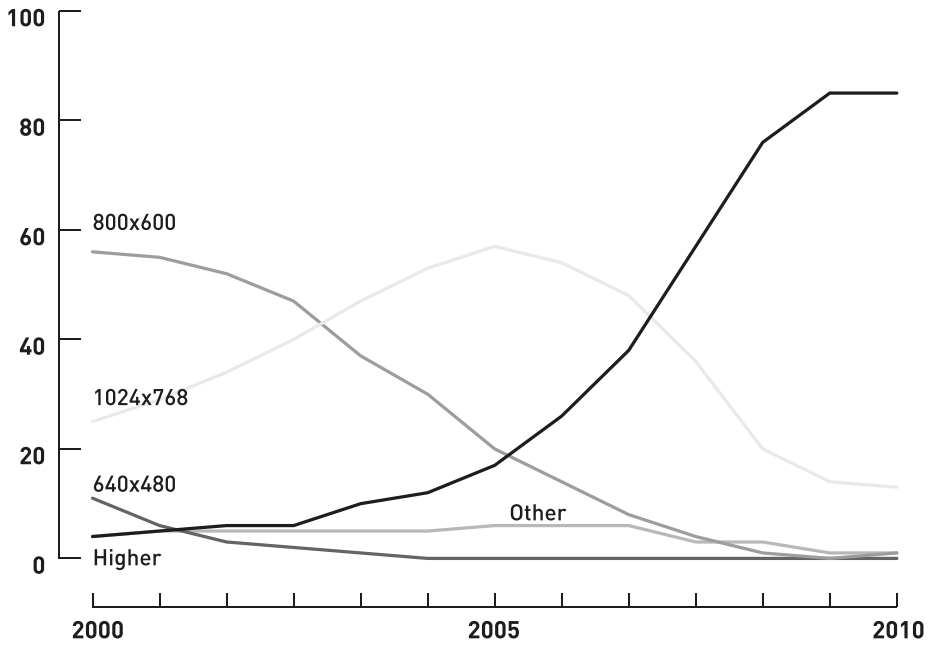
Without doubt, you can say that we have more devices and technology around us than ever before, and it will continue to grow. We will see connections between different devices we carry.

Previously where we only had a TV and a newspaper, we now have tablets, phones, electric billboards, projectors etc. Information is being thrown at us. Technology has an impact on how we receive information, and how we give attention to it.

Hardware

The amount and quality of displays, on devices has been changing over the last 10 years, we can see not only a big increase of them, but also formats, sizes and quality. I will first lay out the changes of the past 10 years, and then look forward into new possibilities.

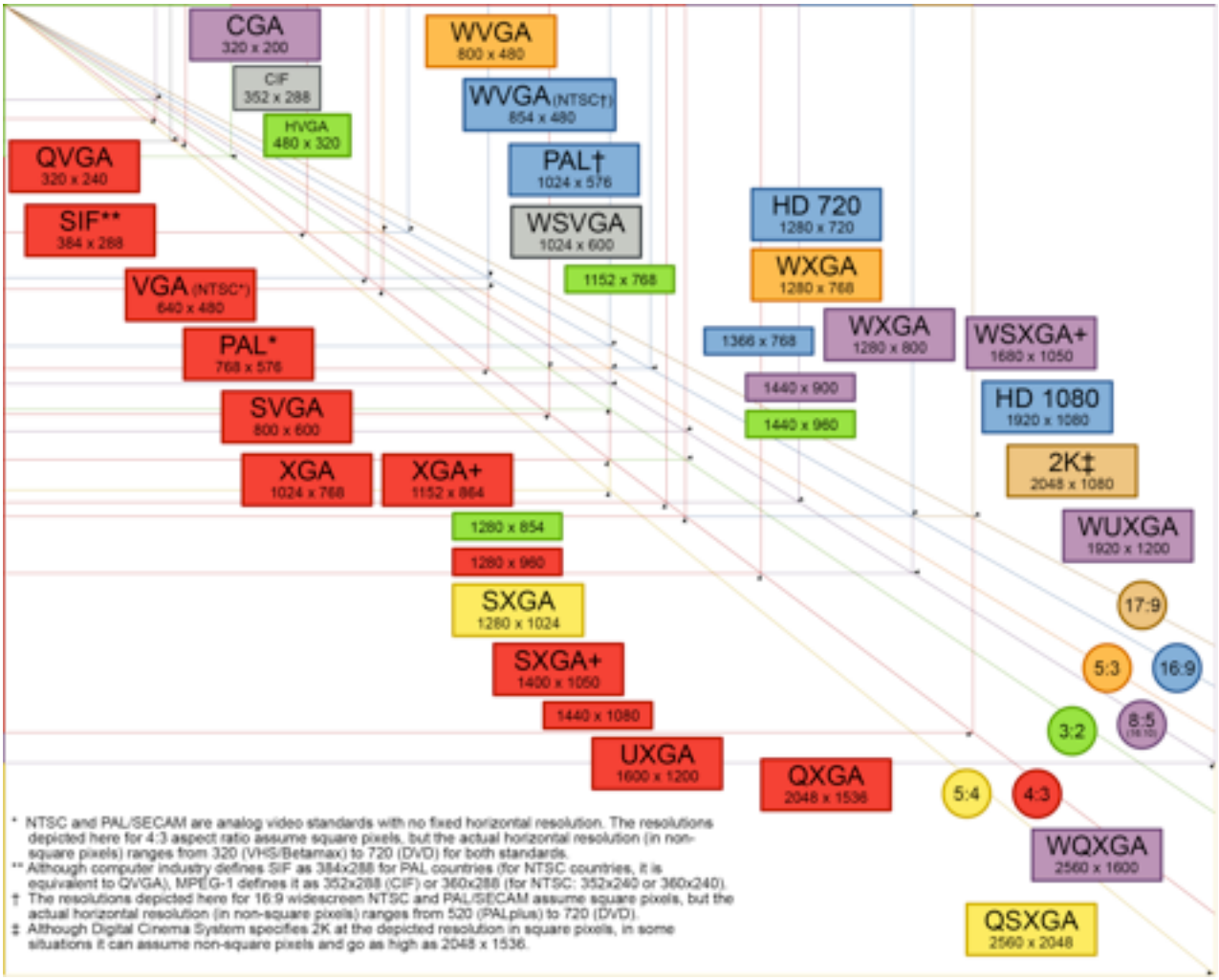
We used to have black and white displays on our phones, and LCD screens that had a resolution of 800*600, on a 15" monitor (Roughly the same as standard TV signals). These formats are still in use, and used all over the world, although the widescreen high resolution display has taken first place [18].



This graph shows the resolution change over the last 10 years. Measurements are done via the internet, where a piece of code checks the resolution of the monitor from the visitor.

[18] Graph Image from: http://www.w3schools.com/browsers/browsers_display.asp **Accessed:** 31 March 2012

FullHD is mainstream, and we even see 'HD Ready' screens on our mobile phones. They can shoot FullHD video, and deliver the content directly to an internet connected TV. To get an idea how widespread the mix of resolutions exactly is, this is a good overview from 2009. Even since then, changes have been made, and 4K and higher are possible with new cameras. [19]



This increase enables us to put more information on a smaller space, or create more details when watching a series on a 2K flat panel TV. Watch a football match, with statistics on the side of your screen, or on a secondary, like your mobile phone or tablet.

[19] Image from: http://en.wikipedia.org/wiki/File:Vector_Video_Standards4.svg **Accessed:** 31 March 2012

Television

A great exploration in next level of interaction with the TV screen has been created by Syzygy[20].

We are clearly touching on different areas of interest here. Interaction through an external device, other than a remote, and presenting essential information, but not interfering with the consumer, unless he deliberately interacts with it. A hub, for example an Apple TV can build a bridge between multiple devices, opening up a whole range of options. For example, playing a multiplayer race game on an HD TV, with controls on everyone's phone.

Computing is done on the mobile device itself, connected through the central phone, where every car is aligned in the game, this image is streamed towards the Apple TV who puts it out to the HD TV. This is way beyond the game 'Snake' everyone else played on their black and white screens on their cellphones back in 2000.

Mobile Phones

On mobile phones, the extra resolution gives us space to use for games, word processing, web browsing, building presentations, watching youtube, all on the go, from your pocket. Connecting it to surrounding devices to enhance an experience, for example show photos on an HD TV, is innovation, we came a long way from cable TV.

Mobile prices are low, because providers are linking them with a subscription for data plans. From GPRS to 3G to LTE, the quality and speed of the connections are being upgraded, bandwidth increased. We can now stream movies through our phones while on a cellular network.

Projectors

Next to displays on mobile phones, stands, tablets, TVs, computers we can see another market arising. Projectors are low cost, and the quality and brightness develop further every year. You can now bring them in your pocket with just a few cables, and connect them to your phone, or computer to have an extra screen ready for a presentation or other uses.

Particularly in this direction we see new implementations. A projector is basically a screen you can put down anywhere you like. Artists are now using it as a canvas to project work, or bring it next level through projection mapping on buildings, spaces etc. ENESS launched a projection mapped skate ramp for the first showing of Tron: Legacy[21].

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[20] http://lab.syzygy.de/ **Accessed:** 9 April 2012

[21] ENESS - https://vimeo.com/18525296 **Accessed:** 9 April 2012

Software

Augmented Reality

A different way to project information on an object can also be augmented reality. This technique is a combination of realtime camera tracking of an object and presenting distorted or transformed information on it. Development in processing power on mobile devices and higher resolution cameras give us new opportunities to handle data live from the camera onto the display on the device with an additional 'layer' of information.

Apps on phones have used this to their advantage. Combined with GPS location you can now easily look up a nearby restaurant, get reviews and make a decision to go. It was never this easy having the direction to the restaurant directly projected onto your screen and at the same time look up the prices.

Snow goggles now have a GPS & altitude meter, together they give you an idea of your speed, route and direction on the build-in HUD (Heads up display)[22].

[22] http://www.zealoptics.com/transcend-4752.html **Accessed:** 1 April 2012

Input Methods

Conventional

The keyboard and mouse have taken over the main space on the desk. This has not changed a lot in the last 10 years. Mostly because this input method works well with what we as humans are trying to achieve; letting the computer do the work for us. Sending commands for execution.

Another addition to this, is the trackpad, used in mobile computers. This smart surface is essentially a touch sense platform that lets your fingers perform mouse actions. Over the last years, we have developed habits and tricks to new functions. Hence the next part.

Gestures

When we look at the film 'Minority Report' from 2002, where Tom Cruise is wearing gloves to scroll through footage and investigate details about an upcoming murder, he uses gestures to operate the machine and send commands. Fluid motions, in open air, recognized by a camera. Back then, it was still a vision of the future. Right now, 10 years later, we are able to build this in our own homes, with the Microsoft Kinect.[23]

This development is a new field in interaction design. And over the coming years, more sensors will be augmenting our body to interact with computers. We can roughly define two kinds of gestures; Free-form or touch (more on this later).
We see implemented free-form gestures in public restrooms, where you wave your hand under a faucet, or towel dispensers. Thus, reducing the amount of bacteria living on surfaces.

A problem with free-form or touch gestures, is that they are often not discoverable. You can read the keys on your keyboard, and distinguish left/right different on your mouse buttons. However, this is not possible with gestures, unless it is printed on an information sign or the object itself. It all has to do with interaction design and developing the right gesture for the action so it becomes natural on first sight.

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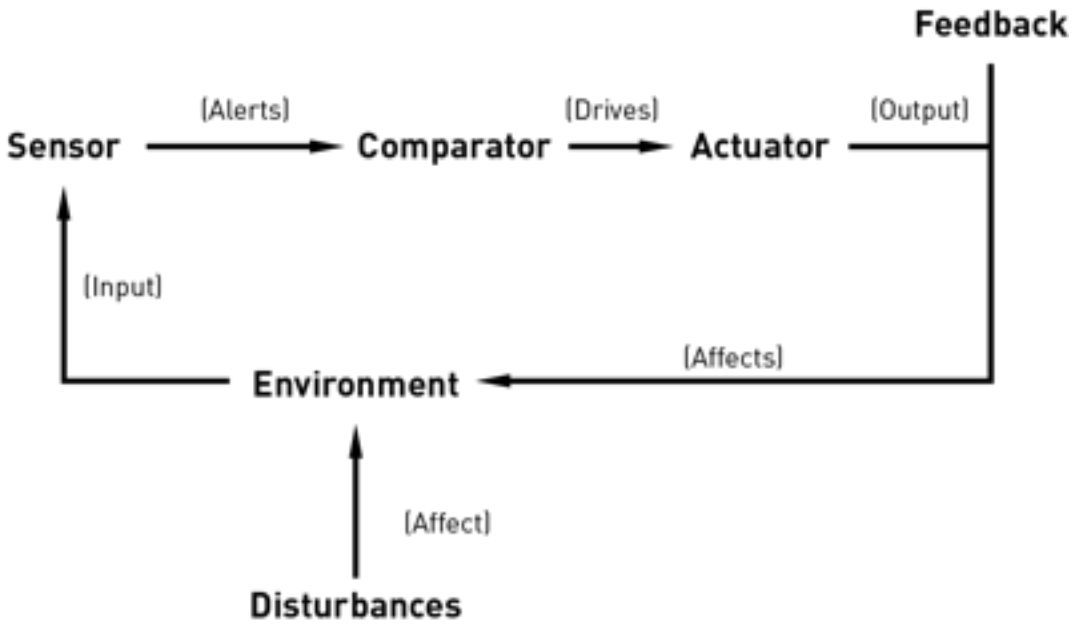
[23] Microsoft Kinect - http://www.xbox.com/nl-nl/kinect **- Accessed:** 16 April 2012

Touch

The launch of the iPhone sparked the popularity of touchscreens. They are everywhere these days, from cash registers, to information points, from phones to interactive gallery walls, to car windows. Imagine what could be next?

Corning, the company who produces high quality resistive glass panels in all shapes and sizes did exactly that. They created an impression [24] on how it could be in the next 10 years.

Gestures on a touch sensitive screen often have a more accurate feeling, due the fact they can be more responsive and precise. Gestures are easier to learn than for example typing blind, they become a natural reflex over time. Here is how the basic components of a gestural system work [25]:



[24] Fast Co Design - http://www.fastcodesign.com/1669170/corning-concept-video-please-use-more-glass-touchscreens-please **Accessed:** 14 March 2012

[25] Designing Gestural Interfaces - Dan Saffer -2009 **Accessed:** 16 April 2012

RFID

Transfer of information has seen changes over the years, from floppy, to tape, to CD, to DVD, to BlueRay, USB Storage, external disks, cloud storage, etcetera. Different formats, sizes, compatibilities and heaps of data.

One of the interesting developments of the last few years is RFID (Radio Frequency Identification) or NFC (Near Field Communication). I find the latter a better description of the function it takes. It can be embedded into devices, cards and everything you can imagine because it does not require to be powered all time.

RFID is a circuit that is enabled once powered, through a charged field, the strength of the field is determined by the amount of power supplied by the reading device. A good example of an implementation in a real-life scenario is the Oyster Card[26], it enables you to travel without hassle through the london tubes (metro).

RFID is now built in phones, used to do payments, but Nearfield did a great research project[27] to look at other possibilities to connect physical things to the Internet of Things[28]. A good example on how the connected society thrives and tries to connect everything.

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[26] Oyster Card - https://oyster.tfl.gov.uk **- Accessed:** 16 April 2012

[27] Nearfield - http://nearfield.org/ **Accessed:** 16 April 2012

[28] http://en.wikipedia.org/wiki/Internet_of_Things Accessed: 18 April 2012

Conclusion

Even though it is not possible for me to own future technology (Developer/customer is always one step behind), the remix culture can not only be found in software, art and media. Hardware is also creatively re-used and remixed. We went from Cathode Ray to LED TVs pretty fast.

Projectors are seen in home cinemas these days, and mobile phones are in everyone's pocket. The third world has skipped the landline generation and immediately started on broadband.

A good example from the re-use category are projectors. Now, projection mapping and augmented reality have become more and more integrated into our lives, through the first step: entertainment. Startups are now leveraging the digital to add a layer of media on top of our daily lives.

The Kinect and Wii marked the start of new interfaces, and there are more RFID Tags on this world then there are humans. Using your body or hands as interface for the computer. Minority Report from 2005 suddenly does not look that far away now.

Ambient Information

Digital natives excel in 'Hypertext', information gathering, processing and evaluating. Technology has changed, screens and media became embedded into our lives. But has the content changed? And does it influence us?

Hypertext is normally activated through user interaction, through an interface. Is there information that is less obtrusive? Can we consider this ambient information? When is it considered invasive, like advertisements?

Data presentation + Information value

The last years, the aesthetics of information have become an important factor to get a quicker understanding of something. Especially in this digital age, were the digital natives scan information and hyper text.

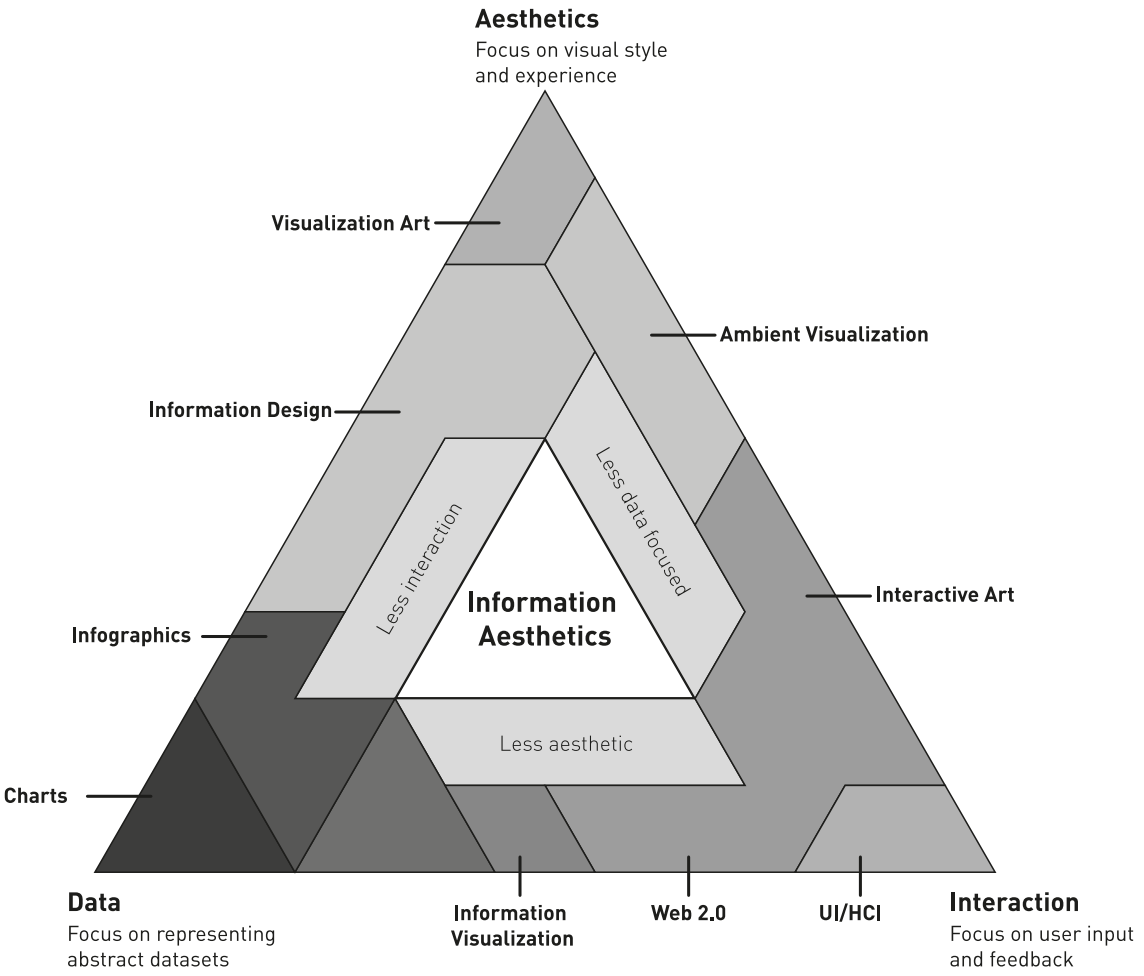
Visualizing information has emerged as an independent field of research. Developing images or media to give insights that can be further augmented in years to come. But when does the value of the information come at the cost of a visualization? Where do we draw the border when it does become abstract, or rather, information art?

The data visualization culture has gained larger audience thanks to software availability, broad accessibility of datasets, internet speed and distribution, interdisciplinary skills. (Designers & signal processing for example.) and evolving aesthetics.

The evolving aesthetics also targets younger generations, who handle hypertext quickly and process media on a higher rate.

Andrea Lau and Andrew Vande Moere at the University of Sydney, Australia, have developed a model [29] to connect the three main factors: data, aesthetics and interaction. The triangle shows the opposites, but also combinations.

[29] Towards a Model of Information Aesthetics in Information Visualization - Andrea Lau and Andrew Van de Moere **Accessed:** 16 April 2012



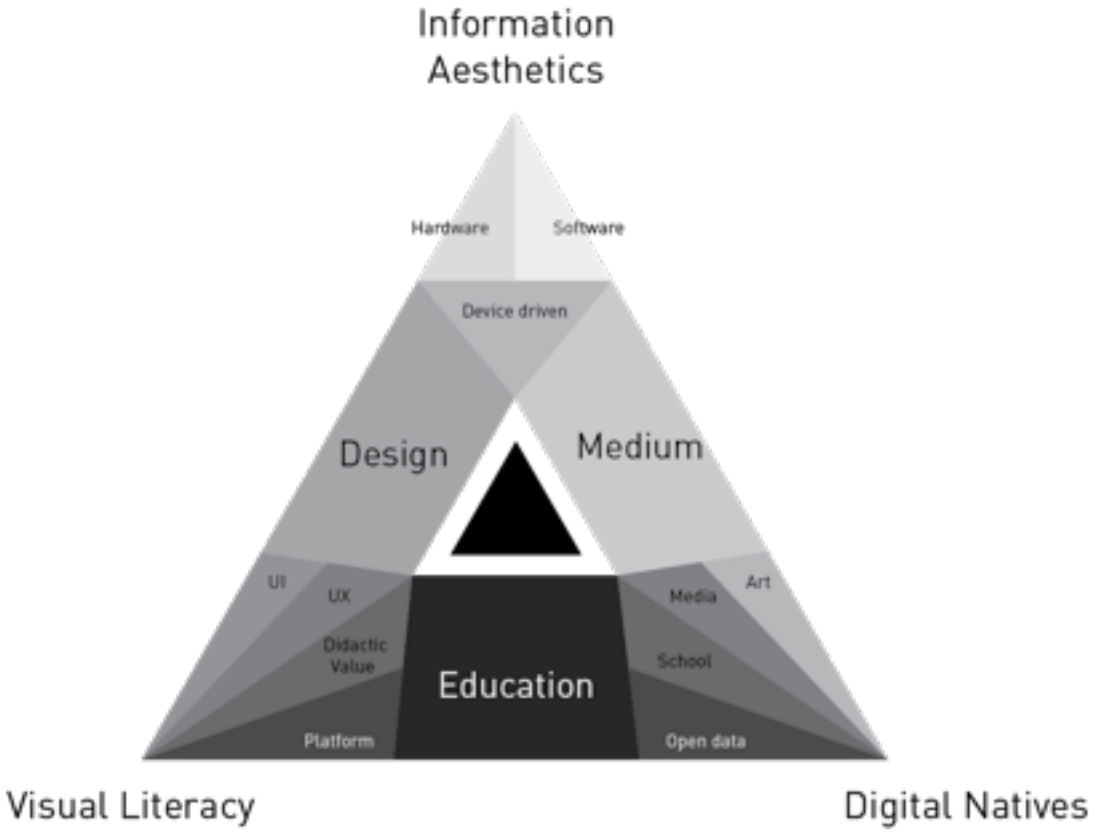
You can clearly see overlapping factors, and their elements in the diagram above. What is interesting is that the middle, is the perfect match. A blend between interaction, data and aesthetics.

With good aesthetics and interaction you can create a meaningful experience. So it adds value (either in knowledge, inspiration, entertainment), to a persons time. The value of information depends on the situation, targeted person or group, and quality. Where quality can be set by using the right mix of visual elements.

The new model

If we combine the facts from the previous parts, we can make a new model or map that helps us to design for a more digitally literate person. This is the way to enhance an experience through UX, UI, Technology and literacy to discover the next step in designing for the new generation.

The three outer ends are; information aesthetics, visual literacy, and digital Natives. This new triangle is connected through three main pillars: design, medium and education. As opposed to the model for Information Aesthetics, this triangle does have an open center, where my product or prototype will reside.



The prototype will be a combination of all the factors involved. Covering the medium, design and educational part. The new model does not cover every edge related to building a new installation, but rather my personal preferred factors.

The new model helps to develop interface or object of interaction where the end user; a digital native, can filter information, and learn about a specific subject, all while being undisturbed throughout the experience.

Conclusion

To design for new technology, interfaces and information types we have to take into account the many factors that influence this. The new model helps me capture the possibilities and functions as a guideline for the prototype I will build.

Ambient information requires less interaction, or no interaction. This literally stands opposite to ‘Gestural interfaces’ where interaction is done by a part or whole human body. To discover possibilities to bridge these two ends, I decided to interview people in the industry.

Also, hypertext is not style or framework for design, it is simply a definition within a medium (internet), where a button can either be round or squared, it still functions as one. This is important, as natives will try to interact the same way they are used to on other devices to discover new experiences.

The prototype will have to speak to the digitally literate person, using new interactive ways to explore information. This information is transformed from data and other sources and presented to a user through a new interface.

Part II

Previously, we looked at society as a whole, digital natives in person and technological advancement over the last decade. We can now raise a new question; 'What do digital natives want from their devices in this connected society?'

I've interviewed digital natives who build interactive and new media products that connect or use devices that they use in a daily life. For example, their mobile phones, but also the software on it.

Interviews

The transcribed interviews can be read in attachments folder named: interviews. I've narrowed it down to abstracts with the main knowledge extracted from them.
Each interview is completely transcribed and checked by the person who is interviewed. This way they could add in sources and links.

Abstracts

Interview - Josué Ibanez - 26 April 2012

Josué Ibanez is an interaction designer and educator based in Mexico City, co-founder of the studio Hotpixel [30], and moderator of the EXPM channel [31] on Vimeo. He likes to experiment in the fields of art and technology.

> *"Perhaps at one time there was the iPad for touch screens, but the thing is, how can use these devices to build and communicate within a space."*

The main drive should be that you design a space that is involving or telling the end-user information that makes them think about a specific subject or target.

> *"It's like a computer, it depends on how you use it. For notes, writer, designer, it's just the medium that is there, being able to be taken and made useful to build something that you want to do."*

We have only had the iPhone and iPad for some years now, but people are already so used to the gestures on them, that you can not divert from it. Even if you do, you have to take care of the user and explain to them why, otherwise it will fail.

The fully transcribed interview is available in the interviews folder. [32]

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[30] http://hotpixel.mx **Accessed:** 12 June 2012

[31] https://vimeo.com/channels/motiongraphics **Accessed:** 12 June 2012

[32] External Document: Thesis/Media/Interviews

Interview - Heinze Havinga - 14 April 2012

Heinze Havinga[33] tries to make other people enthusiastic about the possibilities in technology. He notes that a cellphone in your pocket is like smoking, you take it out too often, because it became a gateway to the internet. It deforms conversations, and finds answers without discussions.

Displays are being taken out of the pocket by the Pebble Kickstarter Watch [34] and Google Glass. Talking is still too far away, and can lead to awkward situations. Platforms such as Kickstarter enable people to try out new inventions made in garages, by home inventors.

Personalizing the data landscape and personal triggers with new interfaces is a must. People want to customize for different situations, people and devices. A good example is the data platform for public transportation in Amsterdam. Maybe your next cellphone will ask you to plan a route back while standing in front of a bus stop. You nod, and you'll get a notification on your watch saying how much minutes until the next bus comes.

It's all about customizing, ease of access and way of using the available information in your advantage.

The fully transcribed interview (Dutch) is available in the interviews folder. [35]

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[33] http://heinzehavinga.nl/ **Accessed:** 14 June 2012

[34] http://www.kickstarter.com/projects/597507018/pebble-e-paper-watch-for-iphone-and-android **Accessed:** 14 June 2012

[35] External Document: Thesis/Media/Interviews

Interview - Steven Dean - 23 April 2012

Steven Dean [36] is a designer, educator and entrepreneur with a passion for new digital products and services for health and wellness brands. He teaches at NY ITP and Parsons School of Design.

Steven is actively involved with the Quantified Self Group in New York [37], and aims to help people with products that help them to design their own life. He says that we will see more startups that are focused on personal data capture, such as the Fitbit [38], Zeo [39] and Nike Plus [40], but the real challenge lies in the answer how to give people a way to interpret their data.

> *"They need a way to both filter and curate the data to understand and make sense of it in the context of their daily lives."*

Also, we are seeing more ways of data being presented than just on a display. A good example is the Pebble Watch on Kickstarter [29] (also noted in the interview with Heinze), which a lot of people are interested in; bringing their data from their pocket directly onto an often used interface (the watch).

Being able to control which information is presented is vital, users want control over the end, so that is becomes a push instead of a pull action. Interacting with a physical, 3 dimensional environment is different than screen devices.

> *"Most of the things that I've seen today feel like a natural evolution from a screen device to control via space."*

The fully transcribed interview is available in the interviews folder. [41]

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[36] http://www.g51studio.com/ **Accessed:** 12 June 2012

[37] http://quantifiedself.com/newyork/ **Accessed:** 13 June 2012

[38] http://www.fitbit.com/ **Accessed:** 13 June 2012

[39] http://www.myzeo.com/sleep/ **Accessed:** 13 June 2012

[40] http://nikeplus.nike.com/plus/ **Accessed:** 13 June 2012

[41] External Document: Thesis/Media/Interviews

Interview - Victor Martins - 21 April 2012

Victor Martins [42] is a generative-art lover. He codes interactive media and realtime computer graphics for Minivegas. He has been involved with an underground digital art movement called Demoscene [43], which has been around since the rise of computers.

He states that work done or shown for the Demoscene is not interactive. However, due to the heavy processing done by the computer on images, you can leverage the same techniques to do image processing for Computer Vision.

> *"The computer world moves really fast. You can see that just looking at your 1-year-old phone and how many new ones were released after yours."*

The hard part is to develop for every platform and have compatibility to switch between different formats and devices. iOS [44] is a good example of a unified system which makes it easier for designers and developers to craft new things, as opposed to Android.

Shifting platforms and incompatibility shout out that there is need for a unified developer and designers guide for interactive products.

The fully transcribed interview is available in the interviews folder.[45]

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[42] http://www.pixelnerve.com/v/ **Accessed:** 14 June 2012

[43] http://www.scene.org/ **Accessed:** 14 June 2012

[44] http://www.apple.com/nl/ios/ **Accessed:** 14 June 2012

[45] External Document: Thesis/Media/Interviews

Conclusion

What are the essentials that could make a new product work?

A digital native wants personalized content, set with triggers they defined up front. Whenever digital natives are communicating with a device, they expect it to behave in the same way their other devices do.

A good example is the ‘Pinch to zoom’ gesture defined on Apple’s products. You can pinch to zoom on your iPhone, iPad but also the Apple Mouse. Apple has made a unified platform and API through which developers can use gestures. Something similar is required for the prototype.

Data is more and more being taken out of your pocket, you become a sensor yourself, pushing out data. To comprehend this data, you set up personal triggers and preferences and connect a display device, such as the Pebble Watch, digital natives expect their data to be presented when they expect it to.

Part III

Conclusion

Previous in part 1, we analyzed our users, redefined our boundaries and looked at the technological advancement. In part 2, Interviews highlighted practical examples, pointed out problems and predictions when dealing with new technology.

- Has the way we access non-obtrusive (Ambient) information changed this connected society?

Yes, it has, in an interesting way. Looking back, 10 years, without touch screens for the general public, motion sensing and augmented reality it is a big leap forwards. Technological and cultural developments require new frameworks for designing these newly found areas of interest.

Digital natives are the influencers of the society of today. They leverage the connected society towards a new revolution. Screens and displays have developed into gateways to imagination for digital natives. Urban screens populate cities, forests, fields and pockets of people.

Moore's law[46] still stands, display and imaging technology are developing in a rapid scale, open-source projects enable everyone build new applications and tools for everyday purpose. Technology allows us to connect this layer and use it to enhance experiences that we go through in daily life.

The new model for information aesthetics can be used to discovery new possibilities for technology in specific situations. For example, adding educational or environmental data. So, can we build a device that is immersive, does not disturb the user and can be triggered by custom presets defined by the user?

[46] https://en.wikipedia.org/wiki/Moore's_law - **Accessed:** 19 June 2012

Part IV

Concept Development

I do think that the future is bright. Accessibility and longevity will once again be raised to new limits, third worlds will slowly catch up, skipping lessons learned from the first world. (As stated in the example of mobile connectivity).

Talking with external people and friends about my thesis narrowed down the concept towards a specific area: Travel. Information has always been tricky when it comes to moving your bodily self towards an unknown area.

One of the more interesting stories revolved around a thing we as Dutch people should be familiar with, a remnant of the old way finding days in the forest [47]. Literally translated to English, it is called Mushroom (Paddestoel). These uniquely numbered objects were placed in nature reserves and forests.

They had a single purpose, to specify the direction to a point of interest, with the distance simply added as the number of kilometers. Number 2000 was placed in 1942, currently, there are about 5500 of them in the Netherlands [48].

[47] http://commons.wikimedia.org/wiki/File:ANWB_paddenstoel.JPG **Accessed:** 14 June 2012

[48] http://nl.wikipedia.org/wiki/Paddenstoel_(wegwijzer) **Accessed:** 14 June 2012

The mushroom however, has a big design flaw. Once your on you're bike, you have the option to stop and look up the data on it, but there also is the possibility that you just cycle past it, since it's not within the sight of your eyes.

It only offers one kind of information, and once it is placed, you can not move it, since all the data is printed onto it. Can we develop a new device that helps way finding?

Prototype

Imagine, a transparent display, on a single pillar, that can rotate, to change perspective. On the display, relevant data is presented facing the user. The user can influence the visual elements through gestures, rotating the display or using his/her mobile phone to connect social channels.

The display only contains a receiver for the computed images, and sensors to detect gestures and multiple users, which send data towards the device of the user through a web protocol.

A second version of the display is used as a wall on top of a cliff. Situation based design allows this display to take different forms. The display is long, and interactive. A user walks by, and gets fed information and data layers from the surroundings, friend check-ins and weather forecasts.

(Sketchbook photo from the concept)

The prototype I will build will function as a working example, even though not with the technology in reach, it still can be a viable concept to work on, and experiment with data presentation. It will bring the new generation a new tool for interacting with the environment around them; gestural way finding.

> *"One's destination is never a place, but a new way of seeing things."*
>
> *- Henry Miller* [49]

[49] http://en.wikiquote.org/wiki/Henry_Miller **Accessed:** 28 May 2012

Technology today

We used to walk and bike through forests, roads next to farms, wilderness. How did we find our way? Today we pick up our phone, open up the Google Maps app, and the phone locates itself using GPS.

Google Streetview[50] enables us to look at streets on the other side of the earth, where as we could only buy a map from an other place earlier. The internet has made way finding easier, but not necessarily less complex. Technology can be set to work for us, crunching the data, and as this concept allows; telling you more than you might want to know.

A good example in interactive billboards was designed by Art Lebedev[51] studio. You can find their impression on a navigation object.

However, this example is limited to historic information and basic directional navigation. Google Glass is using a HUD to present new information. Let the computer calculate a new route, when a subway is broken down, is one of the key features shown in the first promotional video.

Google Glass[52] is a good example of how we are being fed information through customized triggers as stated before by Heinze Havinga and Steven Dean in the interviews. Familiar designs are taken from Google Maps to ensure fast adoption from new users, also take note of the icons instead of text.

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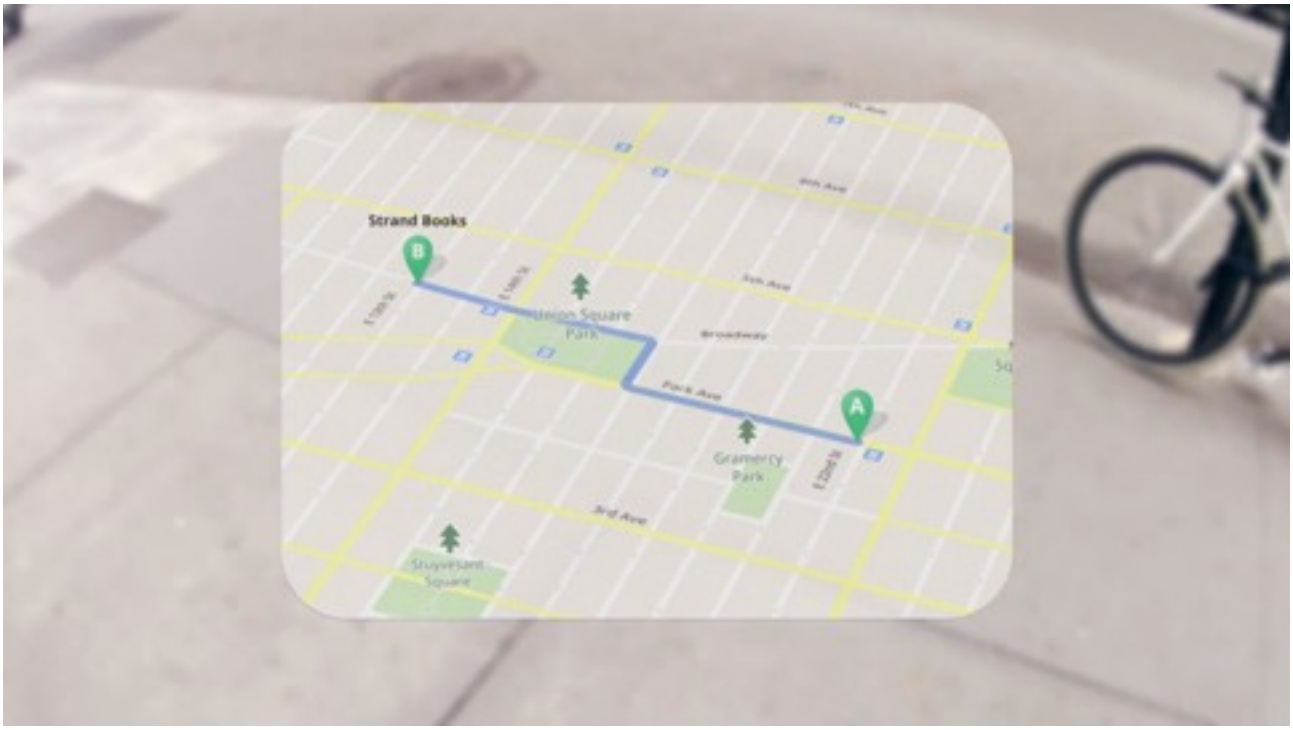
[50] http://nl.wikipedia.org/wiki/Google_Street_View **Accessed:** 12 Juni 2012

[51] http://www.artlebedev.com/everything/moscow-navigation/ **Accessed:** 26 May 2012

[52] http://www.youtube.com/watch?v=9c6W4CCU9M4 **Accessed:** 14 June 2012



These customized triggers link back to the conclusions from the interview, where the digital native wants his customized environment. The prototype will enable users to overlay their preferred dataset, whether that be check-ins, directions, environmental data or weather.

To see how this new device and the customized triggers can be used in daily life, some scenarios were developed.

Implementation in the future

Scenario 1.

Sophie arrives at her destination, she traveled over 7 hours by plane to arrive at her destination. The Grand Canyon in Arizona, she easily found the lodge she is staying at, near the edge of the reserve. She decided today that she is going to take a well-known hike that has nice views along the way. Her guide, a GPS enabled phone, that carries an interconnectivity chip that enables external devices to access some of her information.

As soon as she reaches a certain point, a connected wall senses the data being broadcast from her phone. The transparent wall shows her route, and points out more information access points on the route. As she stands in front of the wall, she sets a takes steps and sees her mirrored silhouette move on the screen.

She understands that her hand can be used as pointer for the interface. She points towards the weather icon and immediately the weather broadcast is shown. She uses her two hands to control the period over which the prediction is set. From 24 hours to the end of her stay.

She decides to move on, and takes the route the wall presents to her. As soon as she walks away from the digital fence, the information is downloaded towards her phone so she can use it offline.

Scenario 2.

David is a local broker seeking opportunities to buy a new house in this rural area of Penrith(England). He discovered this place after seeing many photos on Flickr and being an enthusiastic photographer himself, he decided to take his camera along.

Standing on a road on the top of a hill, with green fields on both sides, he takes out his phone to locate the nearest information wall. At the end of the road is a turning wall. He takes a walk, takes some photos. When he arrives, his phone sends over the data and sets the info on the screen, showing the relations his friends have to the environment (liking a building etc). He sees geo location check-ins from Facebook and FourSquare, with tips where to go and what to do.

He switches modes by swiping in mid air with his hands and turning it physically to the nearby town of Penrith. Using his hands, he zooms in, and discovers that there are a few local events scheduled for today. He makes a note in his calendar, and reserves a spot for a football match in a local pub with live music & commentary, exciting!

He quickly takes note that the farmers market on the central square is open until 4. He sets a notification to leave at 3, the screen confirms as he takes off, already sure of the appointment being made by technology.

Scenario 3.

Jan invited three friends over to have a mountain bike experience on the Veluwe (The Netherlands) today. He already planned his route and breaks, on the internet, and synchronized them to his phone. Knowing his habit and already breaking two phones earlier in the process of enjoying a day off with friends, he connects the phone wirelessly to his bike to transfer the connectivity settings.

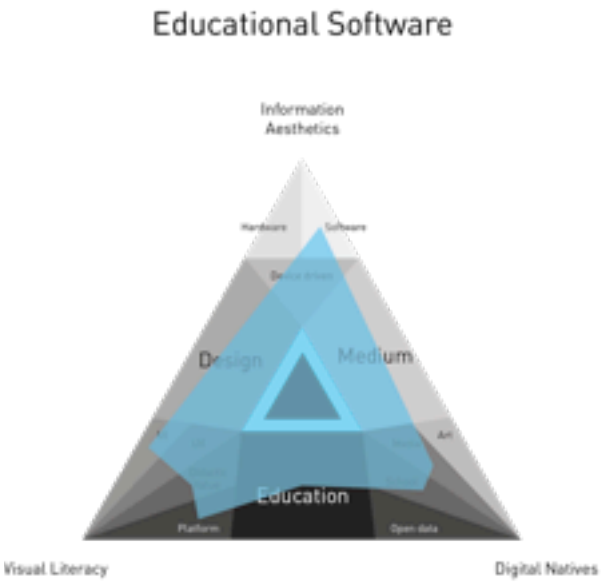
He arrives in the morning, and checks in at the starting point, where he sees that one of his friends is still not there. The rotating information screen allows him to check his friends current location using the zoom function with two hands. Five minutes later, their ready to step on the bike!

The preplanned route is being projected on his visor in his helmet. After an hour of biking, they pass by a fixed information wall, presenting statistics from every team member. Halfway through, at a glance, it changes towards the amount of KM left on the track, and the immediate direction in which they need to go. The bike syncs before leaving the geo fence of the screen.

After lunch they check up the statistics on a rotating information panel, which allows them to put graphs on top of each other, comparing the statistics. It is synced with everyones phone and service, for Jan, that is RunKeeper.

Design

I design this prototype with a behavior and mindset of a Digital Native. To clarify; I use synonyms to point at the concept, such as interactive wall, or transparent screen. To develop the concept into a prototype, we take the new model for information aesthetics to define ground rules where it is built upon and compare it to products that are available now.



The model for the concept balances out on both sides, where the top is actually no longer depending on software, because it is device driven. This way, applications can be build upon the device that interact through the screen as display, similar to the Pebble Watch.

This way the variable of using a different platform can be taken out. Also, the interaction with the software written on the phone for example, can be accessed with the same gestures, in front of the phone, and in front of the screen.

The personalization is solved through settings made by the user who setup the device with the screen. They connect the services they want. So in the end, it will only become a hub that can be initiated through a connected device.

Information Design

Digital natives excel in hypertext [53]. It is essential to take this into consideration when we design the final interface, but also the way of presenting information. Using icons is a good choice, and setting a small text underneath also enables other users to comprehend the information (See the Google Glass screenshots earlier).

Hypertext is information tailored towards the internet, and requires interaction to be explored. The transparent wall is more of a responsive surface, that requires hardly any input, even though, it can be adjusted and controlled in various states using gestures.

The scale of the information depends on the size of the device. You design differently for a mobile screen than you would do for an interactive, gesture enabled transparent wall at the size of a building.

Gesture Design

Designing for a device that is being used with gestures is hard. From the interviews, It was clear that reusing the gestures and their functions, should be implemented in the same way across multiple formats, sizes.

But does this system need gestures at some point? In an ambient version of the wall, it does not. It just uses the triggers set by the phone to show data in a non-interactive way. Similar to a billboard. However, customizing this on the spot, and triggering new layers when prompted by gestures, requires interaction.

If we look at the scenarios listed earlier, we can list some specific actions that we can enable using gestures.

- Select using your arm with the hand/fist as confirmation.
- Swipe using a hand to select modus.
- Two hands (like pinch) to zoom in a map/statistics/weather.

These gestures partially come from touchscreen interfaces, but are naturally transported towards the gestural counterpart, due to the fact of their logical result. If you pull something with both hands, or fingers apart, the object will stretch and become bigger for example.

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[53] http://en.wikipedia.org/wiki/Hypertext **Accessed:** 14 June 2012

UX/UI

User Interface

The transparent screen does not have a visible interface when in non-active mode. It's always on, meaning, when a user passes by, the selected information will show. This selected information is chosen by the user beforehand, and can be switched off when the user stops in front of the screen, and swipes either left or right, to switch modes.

The only interface that is visible is on the users phone, or device that connects to the screen. It also is the base for the data used to compute the pictures on the screen. It knows where your friends are.

You operate the screen using gestures. The scenarios written down above contain several examples of how they are implemented and taken from touch-screens and already existing motion capture sensors, such as the Kinect and iPad.

User Experience

When the transparent screen in inactive mode it is an ambient experience. It activates when a user passes by, presents information fluidly, tracking the users position and it disperses once the user leaves the canvas.

The experience is customizable by the user. Taken from the interviews, this is what the new generation wants, a customizable access protocol for each of their preferred data streams, from weather, directions, geo location of friends and points of interest, whatever they prefer. They could even read a newspaper on it, if that is what they would like, or look up their calendar.

The experience should feel as a gateway to information, with the main focus on ambient data when in inactive mode, projected near the user. Or the focus on sending the customized information specified by the user.

Production

Hardware

The Microsoft Kinect has been on the market for two years already. Within 24 hours of releasing the device to the public, a hacker enabled use via USB to have it connected to a computer instead of the XBox.

The Kinect technologies and frameworks have matured over time, enabling users to quickly take the data and use it for new purposes. Microsoft released a separate Kinect for Windows with a SDK (Software Development Kit) later on. The ease of access through all sorts of libraries and tools without too much configuration, makes it my tool of choice.

The final visual is presented through a projector. In the final product, it is supposed to be on a see-through display where it is combined with augmented reality. Technical limitations and cost effectiveness are the weaknesses, however, I expect a similar product to be launched and commercially available within 10 years.

Software

Laying the connection between the Kinect to a computer and producing an output in realtime requires resources from a computer system. There are countless options to choose from when developing interactive installations. I'm an Apple user, so Mac OS X is my platform to build upon.

To choose the right toolkit, language or platform to build in, we have to look at the end result, time and initial knowledge of the product. The end product is a visual representation of data, initiated by the user. Limited time to build the product also asks for logical workflow and simple tweaking of values and settings.

Quartz Composer, Touch Designer, MaxMSP/Jitter, are node based environments where you connect nodes to process data, input, information and visuals to generate output.

TouchDesigner is Windows only, MaxMSP/Jitter requires knowledge about algebra and transformations, and is mostly aimed at musicians. Quartz Composer is based on native Core Animation for Mac OS X, and thus preferred for quick prototyping.

Quartz Composer however, does not offer direct access to a Microsoft Kinect. To connect Quartz Composer with the Kinect I created my own version of OSCeleton[54], adapting initial settings from the writer of the code, fitted towards the purpose of this prototype.

Computing

In the perfect scenario, the computing for the visuals and data landscape connected to the final hardware would be done on the device used to connect to it; The mobile phone or tablet. To experiment with this concept, I'm using the same signal as OSCeleton to control different layers via the connected device, and through gestures.

The computing is still done on a workstation or laptop, due to the heavy data crunching and mashup construction of the whole concept. When it will be commercially available, standards will be set, and visuals will be generated on the fly, instead of the now raw animations.

More detailed information from this chapter is available in the Design Document [55].

[54] https://github.com/Sensebloom/OSCeleton **Accessed:** 12 June 2012

[55] External Document: Design Document

Part V

Conclusion

During the development of this thesis, new products have been launched, software has been developed, time has passed. Almost 30 years ago, we switched from ARPANET to the TCP/IP protocol, that marked the start of internet [56].

Since then, we have managed to ditch printed maps, discard the compass and fully rely on our cellphones and computers to do most of our work. I set out to discover how digital natives access information, and see if there are new possibilities to explore. The main goal i tried to achieve with my thesis is:

- Discover possibilities for interfaces to explore new functions in the world of 'digital natives'.

When developing a new device/interface for digital natives to use, it is essential to use familiar gestures and designs from previous objects they use, or to spark interest and guide them through getting to know the new interactions they can have.

During the development of the prototype built next to this thesis, icons from the internet, and keywords from hypertext are essential to bring along to the new platform. It has to invite the user to interact, by letting interaction start from the device, the chain of communication is started. New users grant their cellphone access towards the screen, and immediately see the result they set up on the display.

Digital natives demand interaction and familiarizing them with a new generation of a remnant of old ages is more than logical. It came forth from a problem they have, not being able to customize their trip/travel experience, something where Google Glass has stepped in.

New experiences is where the prototype will excel in. It will be adjustable to the kind of public, but also to the information asked by the user. It has a social aspect through being transparent and open, a crowd can easily fit behind a wall as seen in the Corning: A day made of glass 2 video[57].

New functions will be developed for countless purposes, whether that be educational, informational, or entertainment. Possibilities for the clear canvas are nearly endless, thus adding an extra experience, where the 'mushroom' failed for the generation of today. To discover and implement these new uses, you can use the new model for information aesthetics.

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[56] http://nl.wikipedia.org/wiki/Internet **Accessed:** 15 June 2012

[57] http://www.corning.com/ADayMadeofGlass2/ **Accessed:** 16 June 2012

Feasibility

With strong glass panels and see-through TV being made by companies such as Corning and Samsung, it is possible that we will see this being implemented within 10 years. Hardware is the limiting factor now, software-wise, a standard can easily be decided. You can compare it to todays debate about RFID/NFC standards. The development of a standard feature and connectivity rules is important, as noted earlier in the interviews.

The concept is extensible, as the scenarios show, there are many more datasets that can be used for this device. Local events, history/augmented reality, air quality, population density, general warnings(environmental), etc.

> *"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."*
>
> *- Mark Weiser* [58]

[58] The Computer for the 21st Century - Mark Weiser **Accessed:** 18 June 2012

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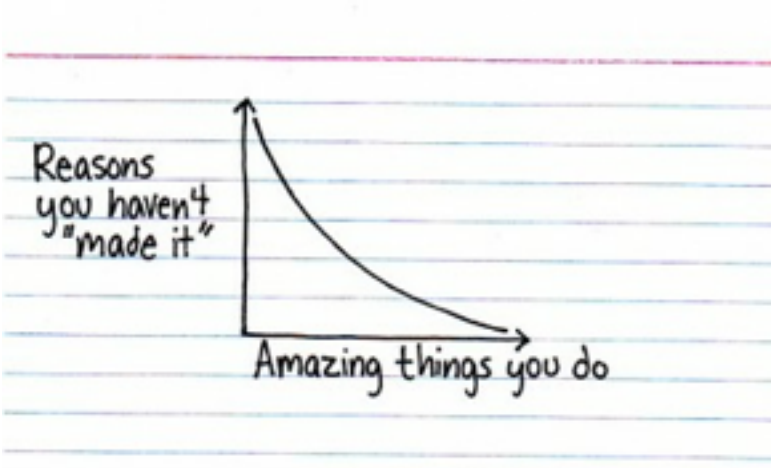

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