DESIGN REPORT

THE INTERNET OF

DPI48 GROWING SYSTEMS

PROJECT

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SCREENS

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ABSTRACT

Sharing digital media has become second nature for most of us. Throughout the day, we interact a lot with media in the cloud without even noticing it. The cloud has become an essential part of our workflows, but not of our natural behavior. The goal of the project was to share and interact with digital media in the cloud in such a way, that it becomes an integral part of our daily routines. 'Unify' aims to link our smart devices together, to make them truly an extension of each other. By knowing the relative position to other devices, we are able to connect them in a much more intuitive way. For example, you can share your digital music with someone else in a physical way by just swiping a song. Magical and meaningful interactions do appear by blending the digital and physical design space.

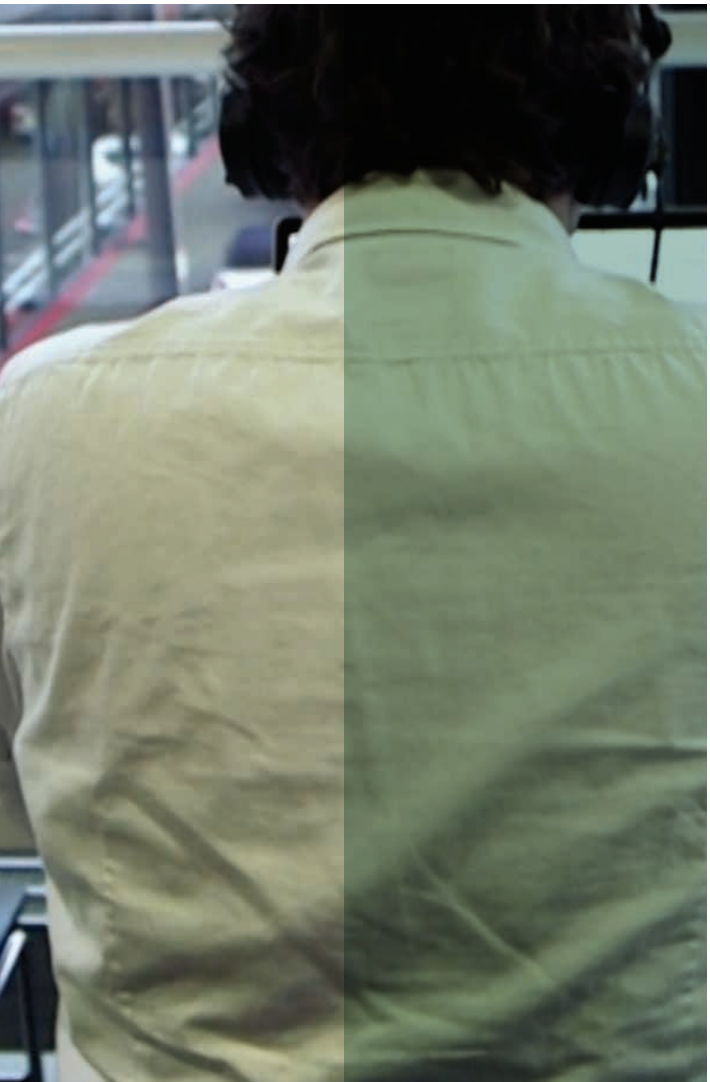
INTRODUCTION

This report is part of the first-years Master's program of the department of Industrial Design, at Eindhoven University of Technology. This design project was part of the Growing Systems project within the theme Out of Control. This project deals with system design, recognizing the growing systems as the next frontier of design.
The aim of this project was to design for meaningful interaction in this systems context [1]. The specific setting was the context of a home media center. One recognizes the problem of multiple devices with multiple remote controls. The challenge is to design a remote that offers meaningful interaction, but still has the ability to grow along the system.

Officially this design project was a continuation of the research project of previous semester. There was a strong feeling that I was not finished last semester, but the current project went into another direction already in an early phase. The current project was about sharing digital media in the cloud between our smart devices: our laptops, tablets and smartphones. These devices are already really powerful, but they are still separated islands in our environment and aren't really connected. Of course, you can connect them, but still via difficult menu structures and by looking at your screen. Wouldn't it be amazing if we can connect these smart devices in a way that they are truly an extension of each other?

The topic was mainly chosen based on personal interest and experience. If I try to explain the cloud to my own mother, this is still a really abstract term for her. Sharing digital media has become second nature for most of us. Throughout the day, we interact a lot with media in the cloud without even noticing it. The cloud has become an essential part of our workflows, but not of our natural behavior. Can we come up with new ways of interacting with this cloud and to share digital media with others in such a way, that it becomes an integral part of our daily routines?

The project ended with the concept of Unify, which aims to link our smart devices together, to open a new area of possibilities. Unify tries to blend the physical and digital worlds, to open an interesting field in the middle where magical and meaningful interactions do appear. The goal is to inspire others and to start a discussion about the new possibilities.



“Can we come up with new ways of interacting with this cloud and to share digital media with others in such a way, that it becomes an integral part of our daily routines?”

> “It is interesting to summarize the previous project to sketch the bigger picture of the design context and my personal experience in this field.”

It was important to do not treat this semester as a sequel, but to approach the previous research project as a really separated part of my personal development. This prevented a tunnel vision and kept me open for new and surprising input. However, it is still interesting to summarize the previous project and state the most important results and conclusions in this report to sketch the bigger picture of the design context and my personal experience in this field.

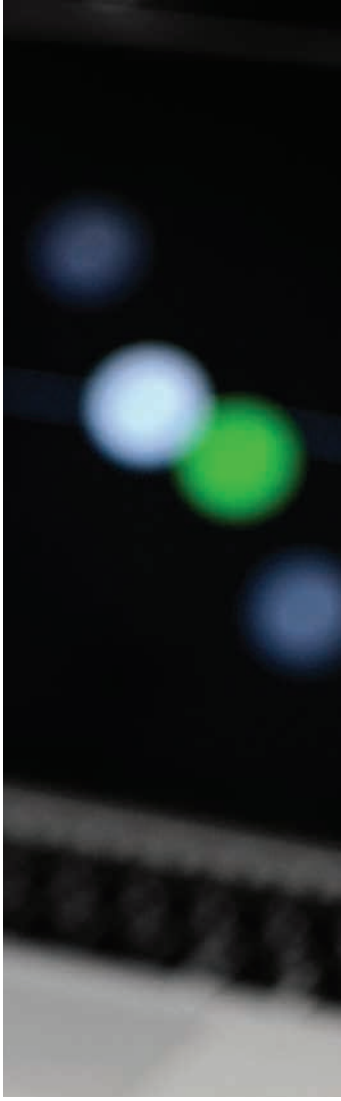
The research project focused on the dematerializing aspect of a digital media center. Since one of the main aspects of a digital media center is media in the cloud, one of the biggest design challenges is to aim for rich interaction. The ideal scenario is still how one always interacted with physical media like DVD’s and CD’s; take a disc out of its case to put it in a media player. However this interaction can’t be copied within the new context, since it does not take into account the new opportunities and problems of digital media. This opens the opportunity to discover new possibilities in this field of interaction design. Which capabilities does a new controller need within a growing digital media library? And how does one react when they’re faced with new structures within this field?

The project tried to explore the field of digital media libraries by looking at the current state and technology-driven possibilities.

This made it possible to state a definition of needed characteristics for a future digital media library in a growing context. This definition was questioned in a user test set-up by validating the user experience compared to the traditional situation.

Around 25 simple controllers were made by cardboard modeling and laser cutting. The final models were linked to a custom non-linear based interface and tested by 20 students. These were compared to a traditional controller. After each user test, contestants filled in a questionnaire to validate the user experience and usability. My final proposal was a future digital media library with generic, unlimited and organic characteristics. These characteristics aim for the concept of “usable happiness” when compared to the traditional setting: a product that is simple to use, and makes you smile every time you use it.

It was important to reflect on the potential from the perspective of the current technology industry. This industry has a strong division of software and hardware suppliers. This ensures that most applications are developed for an existing hardware platform of another supplier. The result is compromises-applications, which is fatal if one aims for synergy in experience design. The user test treated both the software and hardware aspects of a digital media library. The essence of the proposed future setting contradicts completely to the traditional ones, which makes it essential to develop software and hardware side by side. The potential strongly relies on industry standards and the structure of the industry. If one supplier can’t accomplish it, one should look at the arrangement of the technology industry. Only in this way one can affect the full experience.



Try to imagine a life without sharing. You probably can't. Sharing is an essential part of mankind. We always shared physical goods, but also thoughts and ideas with others. Nowadays sharing digital media has become second nature for most of us. Throughout the day, we interact a lot with media in the cloud without even noticing it. Everywhere we go, we are able to listen to millions of songs, watch thousands of movies, or work with our own files without dragging around terabytes worth of hard disks.

There's a growing amount of applications like Dropbox, Spotify and Netflix to support this need. These kinds of services ensure that we can reach the same files from almost every device, which blurs the existing boundaries between our smartphones, tablets and personal computers. This trend is also important for large software developers like Microsoft. The goal of Windows 8, Microsoft's latest operating system, was to offer something that would run on tablets as well as non-touch devices [2]. Apple introduced Continuity, a set of features introduced to allow interoperability between their two operating systems [3].

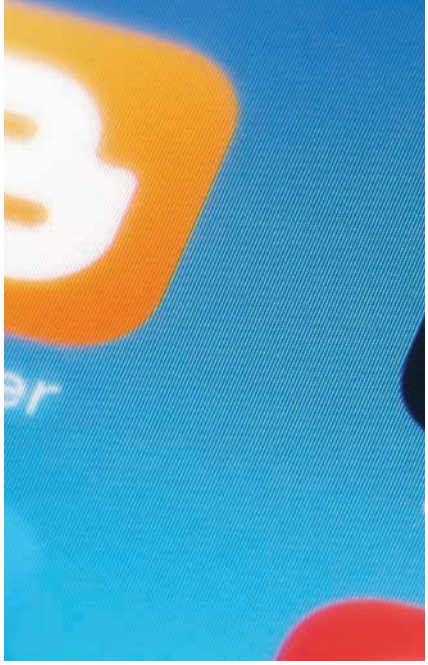
The Tangible Media Group of the MIT Media Lab is exploring the field of sharing digital media with an inspiring system called THAW. The system enables accurate position tracking of a smartphone placed on or over any screen by displaying a 2D color pattern that is captured using the smartphone's back-facing camera [4]. This lets you interaction with content and move it between your phone and laptop. Schoessler of the MIT group said he would like to see it become the next Bump. Bump is the popular file-sharing app that allowed users to share contact info, files, and photos just by bumping their devices together [5].

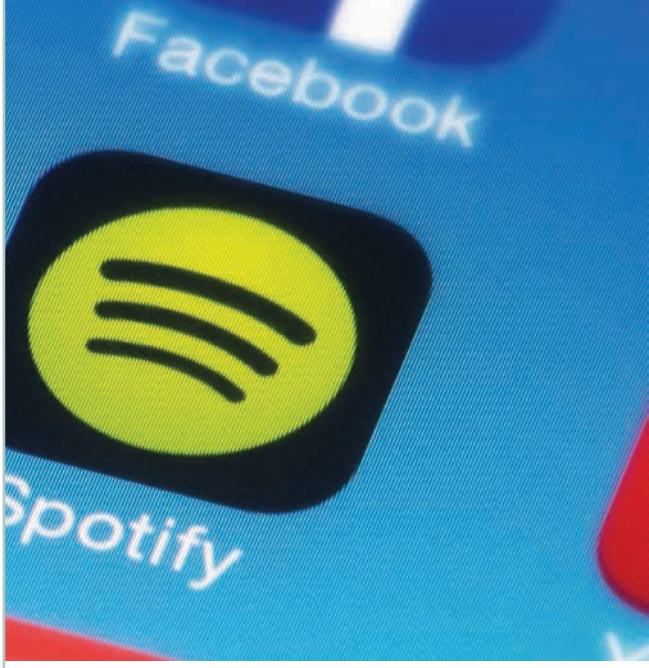
> "The material metaphor is the unifying theory of a rationalized space and a system of motion that are grounded in reality."

The Fluid Interfaces Group of MIT explores a new method for interaction with everyday objects with their Smarter Object System. As a user points a smart phone or tablet at a physical object, an augmented reality (AR) application recognizes the object and offers an intuitive graphical interface to program the object's behavior and interactions with other objects. As such Smarter Objects combine the adaptability of digital objects with the simple tangible interface of a physical object [6]. These values can also be found in another project of the Fluid Interfaces Group. With Swÿp you can transfer any file from any app to any app on any device: simply with a swipe of a finger. The framework facilitates cross-app, cross-device data exchange using physical "swipe" gestures [7].

It is interesting to see that the current interface design trends are also about integrating the physical into the digital. Google worked three years on their visual design language called 'Material Design'. The material metaphor is the unifying theory of a rationalized space and a system of motion that are grounded in reality [8].

The magical appeal of these trends is important to mention. Most examples aim for a better user experience, by making the technique look obvious. Many would call these trend examples parts of the process towards The Internet of Things, which is a buzzword for years. It seems logical to expect that the connection between our everyday smart devices is the first step in this process. Why don't we title this step The Internet of Screens?





DESIGN OPPORTUNITY

Out of the trends research, it became clear that there's a design opportunity in transferring digital media between everyday devices. The cloud has become an essential part of our workflows, but not of our natural behavior. Nowadays almost all of our smart devices are connected to the internet, and the cloud makes it possible to access files from everywhere. It's actually nothing more than a datacenter somewhere on the world, but for most people it's still a really abstract term.

The cloud has especially technical benefits. It enables to design video and music cloud services, to watch and listen to large databases of digital media without covering a lot of personal disk space. It enables to work with multiple people on one file, by saving files not on someone's personal computer but on an independent server. But these benefits also have their downsides. One questions what happens with their files, where they're stored and who has access to them. Who will get updates if I save this file now?

Next to that it's interesting to notice that our smart devices are pretty much still separated islands in our environment. They're really smart islands, but aren't aware of other devices in the room. This ensures that we came up with workarounds to transfer files from one device to another. When I want to send a file from my notebook to the notebook of someone sitting right next to me, I grab a USB stick, send an email or use an online service like WeTransfer [9]. A service like AirDrop tries to simplify this, and enables users to transfer files directly between devices. However this service is only available for exchange between a limited selection of Apple products [10].

The design context is sharing digital media within your close environment. In this context we are able to treat digital media in a physical way. As mentioned in the trend research, MIT and Bump proved with their concepts and products that there is an interesting field in the middle of the digital and physical interaction space. Magical and meaningful interactions do appear by blending these two worlds.

Physical interactions with digital interfaces aren't new; I already gave a few examples of concepts that are working on this. However these concepts are mostly innovation-driven and explore new possibilities from a technical viewpoint. I believe there's an opportunity to look at this topic from a conceptual perspective with the current trends and smart devices in mind.

If I talk about smart devices in this report, you need to think about the devices almost everyone uses everyday. Generally speaking we divide these into three product categories: smartphones, tablets and personal computers. A product like a notebook lies also in the last category. The challenge is to design from the perspective of these already existing devices. This forces to look at the current pros and cons and take these as a starting point, while the goal is to design for a realistic product within five years. Wearable technology can be seen as a possible fourth product category. However for this project I position wearables outside the design spectrum, because the role in our daily lives is not yet clear.

I build three paper prototypes of a smartphone, a tablet and a notebook to explore possible physical interactions. This ended with ten concrete interactions between two devices, which all can be found in the appendix of this report. For instance files can be slide from one device to another. Content can shake out, float or pushed into another screen. It's also possible to extent screens or control one device with another, with respect to already existing controls like a touchscreen. All these interactions treat digital media in a physical way to deal with the laws of physics like gravity.

I noticed that we already deal with one of these interactions. Many people already work with multiple screens connected to their computer, and are used to moving a program window from one screen to another. In this way screens are really an extension of each other. This thought was an interesting starting point to build on, while we aren't used to it with completely separate devices. Many people experience this as magical, which proves the video clip of Brunettes Shoot Blondes with Knock Knock [11]. This video shows a continuous animation across 14 separate iPhones and received great online media attention.

> “Many people already work with multiple screens connected to their computer, and are used to moving a program window from one screen to another.”

FIRST PROTOTYPE

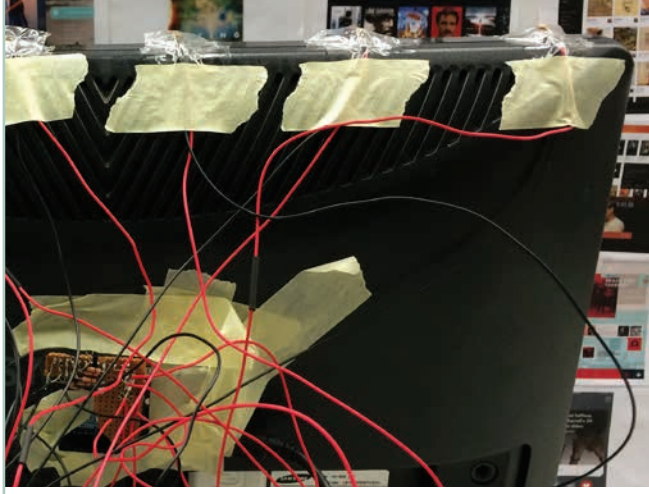
After exploring several interactions, there became a clear need clear to build a low-fidelity prototype. Until this point of the project, my imagination was enough to verify the explorations. However, a working prototype was the only way to experience the possible magic of connecting digital interfaces in a physical way. The goal was to build it as simple as possible, to go quickly trough multiple iterations. I started using a shake gesture with a smartphone, to drop an object into another screen. At this point, this object was still an abstract version of a digital file.

The first prototype was made with an external LCD screen. Multiple light-dependent (LDR) sensors were taped on the upside edge of the screen and connected to an Arduino. The position of an object above the screen could be measured, because it always covered the light above at least two LDR sensors. This was simply the most easy and cheap variant to measure the relative position of a smartphone above the screen. The node.js Javascript platform was used to easily build fast, scalable network communications [12]. This technique is comparable to the way chatboxes work with senders and receivers. In this way the sensor data could be easily sent online to both the screen and the smartphone. Also the shake gesture of the smartphone was sent to the screen. This made it possible to create a colored ball on the smartphone, shake the phone to drop the ball, and when the ball left the screen, the same ball dropped on the LCD screen. The size and color of the ball were sent to the external screen and the LDR sensors enabled that the ball dropped at the same position as the smartphone. This created the illusion of a continuous falling ball and a direct connection between both devices. I developed this into a few iterations, which made it possible to drop multiple, different balls that were bouncing at the bottom of the LCD screen.

> “A possible reason could be found in the size of a shake gesture, which is quite big compared to other actions we perform with a smartphone.”

Other people were immediately intrigued by this first prototype when I showed it to them. But this feeling faded away when someone tried to use it, which had mainly to do with the shake gesture. This gesture is already integrated in for instance smartphone games, but there were no examples found in controlling specific digital objects. The initial idea was based on the effect of dropping physical objects when the object they are attached to shakes. You can compare this thought to books falling of a bookshelf during an earthquake. However this translation to a digital interface didn’t work. The first people who tried it described it as confusing, awkward and no sense of control. A possible reason could be found in the size of a shake gesture, which is quite big compared to other actions we perform with a smartphone. A more subtle action was necessary to start the gentle dropping ball.

From a more abstract level, a smartphone is actually nothing more than a small block of metal or aluminum. One can control this abstract block by using small finger movements like for instance point, slide or pinch. Even when the smartphone’s screen is off, it feels natural to perform these finger actions on the flat surface. One of the goals of the project was to design actions on the basis of the current smart devices. That’s why sliding was the most obvious action for this project to move digital objects from one device to another. The shake gesture was removed from the prototype and replaced by a sliding action on the touchscreen. This version of the prototype was the main input for the midterm exhibition.



MIDTERM ANALYSIS

The interim concept was mainly based on physics. The digital object behaved like a bouncing ball influenced by gravity. This is heavily inspired by one of the most important interface design trends 'Material Design' as mentioned in the trend research. A material metaphor is the unifying theory of a rationalized space and a system of motion that are grounded in reality [8]. However on the other hand, the main goal of interface design is to organize information and give focus to the user. The question is whether this is still possible with digital objects that are able to move freely in space. This results maybe more in chaotic situations than in interfaces that are grounded in reality.

It was interesting to see, that others were already inspired by the abstract low-fidelity prototype and are able to relate this to a wide variety of contexts. These examples varied from watching a movie on another device, to sharing digital notes with others during a meeting. It was interesting to don't approach the project as a classic frame of problem and solution, but to build a framework on which developers can build.

The technical foundation of the concept wasn't treated before the midterm of the project. This was done on purpose, to prevent that it becomes an obstacle for creativity. However during the midterm, others raised questions about the technical solutions for the concept. I always try to approach my projects in a why-how-what way, proposed by Simon Sinek [13]. The "why" was already clear, this was the reasoning of the concept and story based on trend research. The next step was to investigate the "how", the technical explanation of the concept. I received the idea to build the electronics into a special case for a smartphone or tablet. This would make it relatively speaking easy to integrate it in the current context of smart devices. This was inspired by Squeeze Me as proposed by Marti et al. [115]. It consists of a rubbery interactive cover that can be mounted on a tablet, to enable expression-rich communication. The cover embeds two specifically designed resistive analogue pressure sensors.

I like to approach a smartphone as a combination of various sensors, like a touchscreen, accelerometer, gyro, GPS, and so on. This gives developers a wide spectrum of possibilities to build on. This perspective makes it interesting to look at the electronics on this level, to make the concept possible with every smartphone. A custom sensor case makes it possible to bring the concept to market within one year, but a new integrated sensor is a far stronger proposal within five years. Why do smartphone manufacturers need to integrate a new sensor into their devices to make new products possible? I want to answer this question at the end of the project. Before that, I will discover which specifications the new sensor should meet to make the proposed new interactions possible.

> “Theoretically it’s already possible to know the relative position of for example one smartphone to another one, by knowing both of their absolute positions.

Our smartphones, tablets and notebooks are already quite smart. These smart devices know their absolute position on the world via GPS and the way the user holds them via gyro meters. However these data are all absolute measurements, and give no clues about other devices that are around. This ensures that devices are still separate islands in our environment. To prevent this, devices need to know their relative position to other objects, which is not yet possible with current technology. That’s why it’s important to look at this theory and current technology to come up with a theoretical sensor to function as the foundation of the project: the awareness of the relative position of smart devices.

Theoretically it’s already possible to know the relative position of for example one smartphone to another one, by knowing both of their absolute positions. When we know both GPS positions, we are able to translate this to their relative positions. However the problem at the moment is their accuracy. Most GPS devices have an accuracy of 3 meters, which is precise enough for a task like navigation. But it’s not useful to use this data for the small movements of the concept.

It’s impossible to design and built a sensor within the timespan of the project. That’s why we separated the technique of the concept into two separate parts: the prototype and the future scenario. To serve this last part, a theoretical sensor was constructed together with an electronic expert. This sensor must be able to send and receive its relative position toward other devices that are equipped with the same sensor. When this sensor will be built in our daily devices within a couple of years, they will open to the interaction design possibilities explained in this report.

Technical drawings of the sensor can be found in the appendix. This sensors works via RF transmitters at the frequency of 2,4 GHz. Every sensor has one sender and six receivers, two in each three axes. These two receivers are located 6mm from one another and connected via a comparator. This comparator is able to measure and compare the incoming signal time. The protocol will receive the distance and signal strength and is able to translate this to the relative position.

QUESTIONNAIRE

At the start of second part of the project, the target group of the project became quite clear. This group exists of young adults, who are native users of smartphones, tablets and notebooks. These smart devices are an important part of their daily routines. The assumption is that the cloud is already less abstract for this user group and they're more used to a broad variety of cloud services like Dropbox, Spotify and Netflix. A questionnaire was made to frame this assumption. All questions and results can be found in the appendix of this report. These results are in Dutch, the medium of the questionnaire. I discuss the most important results in this chapter.

The goal of the questionnaire was to find out the usage of cloud services: how much and which services do most people use? Because of the target group, the questionnaire was spread via Facebook and filled in by 43 people with an average age of 24. However two persons of 56 and 67 also completed it. If we would extract these two, the average age would become 22. I only used the cleaner data of the 41 remaining respondents to analyze, to gain a better overview of the main target group.

Within the questionnaire cloud services were divided into three subcategories: storage services, streaming video services and streaming music services. The questions were aimed to find out the amount and type of usage, and the willingness to pay for such services. This information could establish a frame of reference for the final concept. The questionnaire ended with three open questions to get open input about the reasons to use cloud services.

Each respondent had experience with at least one of the three subcategories: 98 percent with storage, 71 percent with streaming video and 88 percent with streaming music services. If we only analyze the storage services, Dropbox and Google Drive are used convincingly the most. The respondents use these services in particular to share files with friends and to back-up their data. It is notable that only 25 percent of the people that use storage cloud services are willing to pay for it. No one pays more than 20 euros per month for such services.

The respondents make less use of video and music cloud services, but are far more willing to pay for it. When they use such services, 69 percent pays for music services and 50 percent pays for music services. However we can't compare these percentages, because they mainly depend on free alternatives. The most popular video streaming service among the respondents, Netflix, doesn't have a free alternative. Spotify, by far the most used streaming service according to the questionnaire, has a so-called freemium model in which users will hear advertisements in between songs. Almost every storage service has a free subscription with limited data space, with the possibility to pay to expand this.

All services are most used at home by far. Only music services still have a relevant usage in other contexts like study and work. To the question "What do you think is the most positive aspect of cloud services?" people mostly refer to the ease of use, accessibility from every device, no need of large local storage space and the ability to safely safe your data. Many respondents also like to have a legal alternative to access new music and movies. Among the downsides are mostly mentioned the need of an internet connection and privacy issues. Most respondents explain that they know too less about the security and privacy protection of their files, and want to have a better overview of who can access their files and where they're stored. Finally, it's interesting to notice that one still appreciate the physical abilities of physical media when they compare this to cloud services. Cloud services are user-friendlier, but respondents prefer physical alternatives when the data is security-critical.

FINAL CONTEXT

> “The ideal scenario is still how one always interacted with physical media like DVD’s and CD’s; take a disc out of its case to put it in a media player. ”

I was able to observe a clear line in the results of the questionnaire. It doesn’t only prove a lot of the assumptions I had before, but it also gives a clear overview of the context in which the respondents use cloud services. The final context aims to use the benefits and tackle the downsides of the given feedback.

The last step of the process was to work on the “what”-phase. The decision was made to come up with two different concepts. This will prevent that one relates the concept and technique to one specific context, to inspire others to come up with new ideas. One of these concepts is sharing digital music between devices in a physical way. This is inspired by the previous semester, to aim for rich interaction in a digital media library. The ideal scenario is still how one always interacted with physical media like DVD’s and CD’s; take a disc out of its case to put it in a media player. Everyone is familiar with this context and an application like Spotify is the current most popular cloud service as proved in the questionnaire. This makes it an interesting context to apply on.

Where the first context is very much familiar, the second context is more forward-looking to create a contrast between those two. The second context is based on current trends in digital payment, like Apple Pay [15]. It’s interesting to notice that we still use our physical bankcards to pay in the digital era. It was interesting to investigate this area with the interaction technique of this project. This makes it possible to check out a digital shopping cart by connecting a digital bankcard.

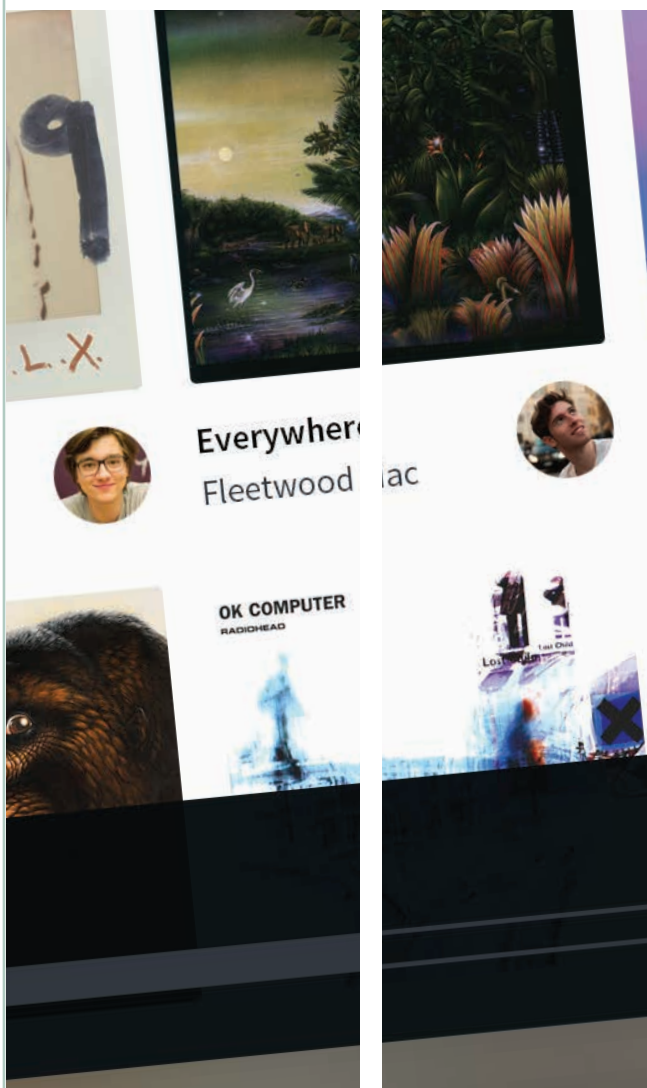
As mentioned before, one of the goals of the project was to look at the topic of sharing digital media from a conceptual level. That’s why it was important to work on a concept video, to prevent that the story became too scientific and technical. This video needed to connect the why, how and what: the current trends, the theoretical sensor and the developed concept. This was done to communicate the overall story to a broader audience, to start the discussion about this future usage of our everyday smart devices. This video can be watched via http://tiny.cc/unify [16].

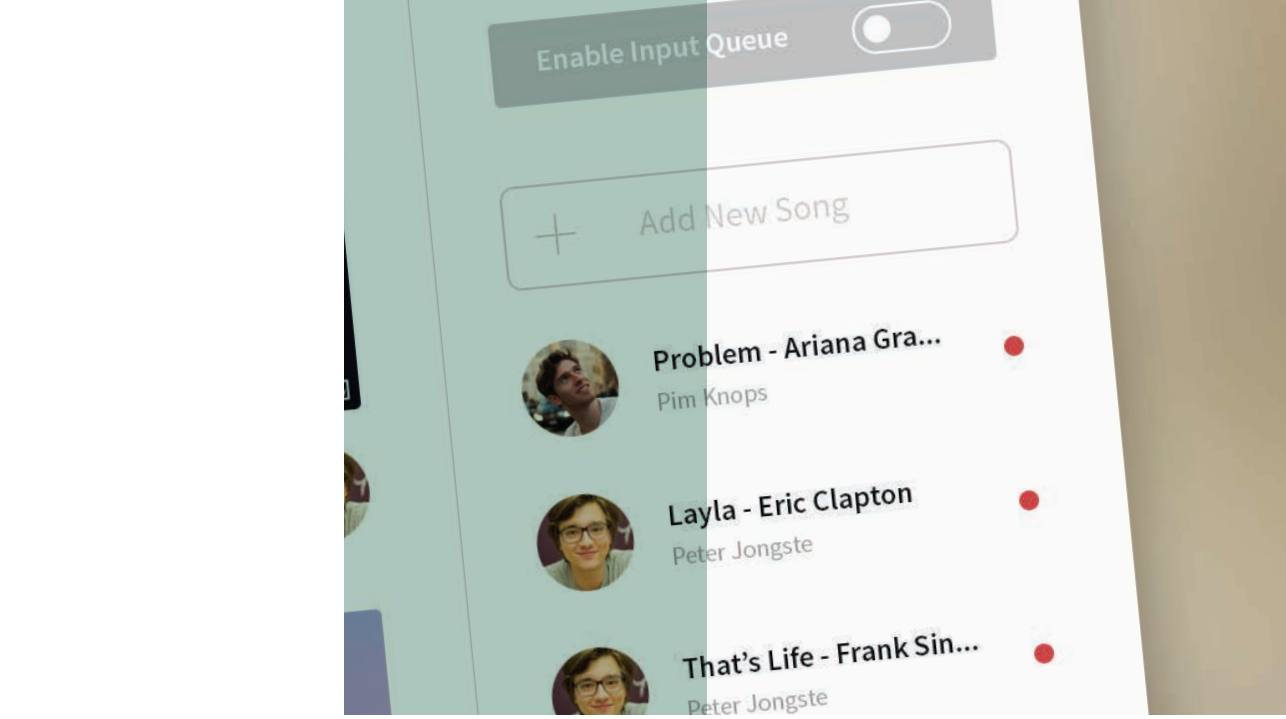
The biggest challenge was to design an interface that is aware of other devices around, without losing touch with the interfaces we're used to at the moment. I started with designing a music desktop interface, which could be related to similar ones nowadays. After several iterations, the design was observed in the real context of the operating system. This made me aware of the big influence of the desktop background on the look and feel of an interface. This background is personalized by the user, but isn't it possible to use this to the benefit of the overall experience? The desktop background is able to show clues of surrounding devices in a subtle, almost peripheral way.

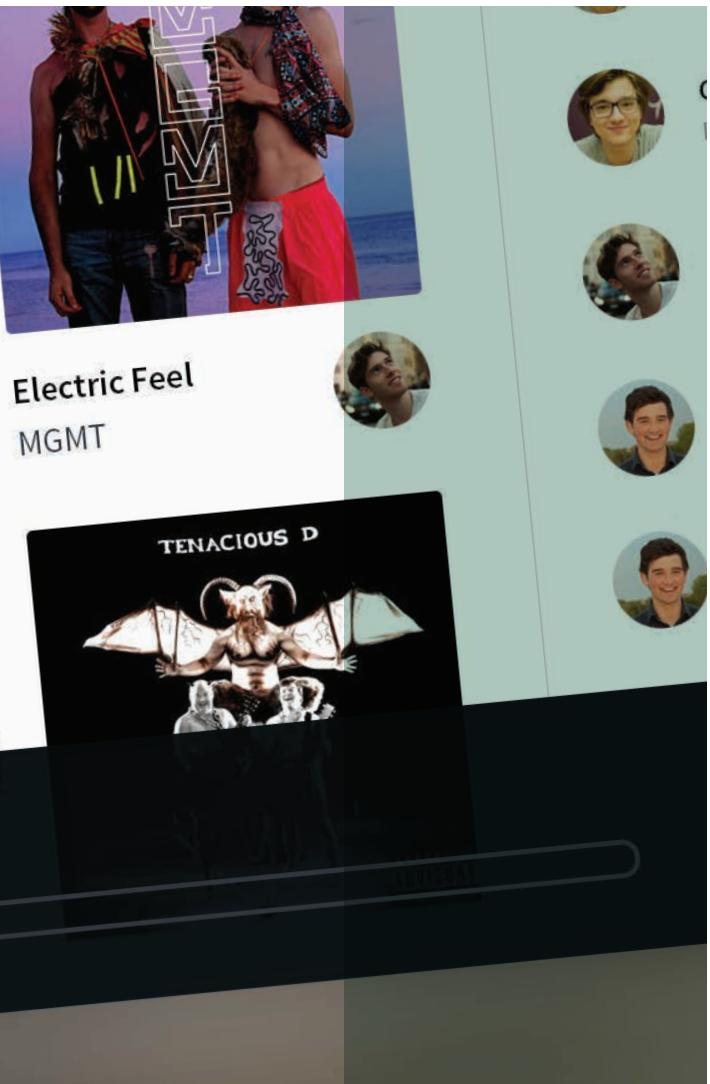
Four interfaces were designed: two smartphone, one tablet and one desktop interface. One of these smartphone interfaces was a mock-up of a music app. The user is able to scroll through a couple of songs, skip them or pause them, to mimic a real application as close as possible. When the user keeps his smartphone next to the screen of the notebook, both applications show a connected blurred white spot to indicate the direct link. If the smartphone is close enough, the current song on the phone moves gentle towards the notebook and the white spot turns green for a slight second, to express a call for action. At this moment, the user is able to slide the song to the desktop. The entire background blinks white to make a big statement when it receives a song, and this song adds immediately to the queue. The desktop interface has a button to hide and reveal the background, to disable and enable incoming songs.

The interaction of the digital payment context works quite the same. The user is able to scroll through a couple of digital cards, like a MasterCard, a PayPal card and a university card. One will get immediate information about the current account balance of every card. The other interface of the context is a digital shopping cart with CDs on a tablet. When the user slides the digital card, the same card slides in on the tablet and the check out button pops up.

All interfaces were based on current flat design trends and the visual design language of 'Material Design' [8]. This ensures a uniform and modern style, but keeps it also open for suggestion. It's hard to describe interaction and interface design by text. That's why all interface iterations can be found in the appendix. A video was made to not only explain the whole story of the project, but also to show the two built interactions [16].







“The biggest challenge was to design an interface that is aware of other devices around, without losing touch with the interfaces we’re used to at the moment. ”

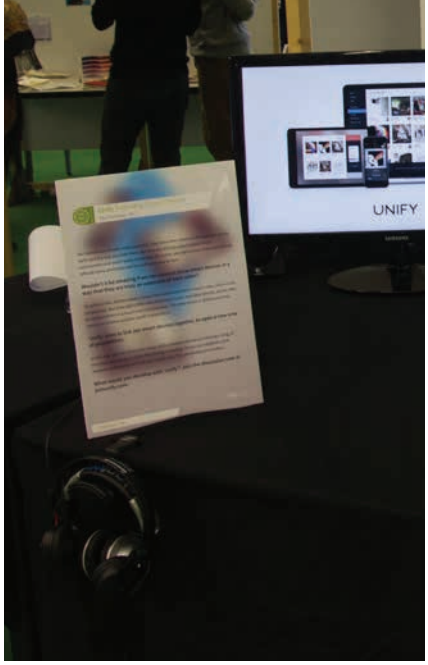
> “ This final prototype was meant for presentations and needed all the original devices that are part of the concept: a smartphone, a tablet and a notebook. ”

It was an interesting challenge to find a method to build a prototype of the concept. The method of using LDR sensors like the first prototype wasn't possible with this one. This final prototype was meant for presentations and needed all the original devices that are part of the concept: a smartphone, a tablet and a notebook. These smart devices weren't hackable or it would cost a lot of money. It was also important to make the technique invisible, to keep the feeling of a magical interaction. That's why a webcam was used, to track all devices to know their relative positions. A webcam could be placed outside the main setting, which makes it invisible to the audience.

I already had some experience with webcam color tracking with the help of Processing software. But this wasn't the right technique for this prototype, which became clear after several attempts. You always need perfect light settings and the method is not precise enough to map. That's why I made the decision to work with the open-source reacTIVion software of sourceforge. This is a computer vision framework for the tracking of fiducial markers attached onto physical objects [17]. I designed a custom smartphone case with a fiducial marker on the back, and 3D printed it in black and white. In this way, the smartphone could be tracked in a fast and robust way.

The node.js JavaScript platform was also used for the final prototype. The absolute position of the smartphone was send and mapped to all devices. A custom base plate was used to position the notebook and tablet always the same way relative to the webcam. This made it possible to absolutely map the data for each device just once. For example, this data was used to position the white blur to give the illusion of awareness of other devices. The node.js platform was also used to send a message from the smartphone to the other device when it's been slide. These messages weren't the actual songs or cards, but a unique number. This was faster to work with and good enough for a prototype.

All final interfaces were sliced in HTML and CSS. This was the easiest to integrate with JavaScript, and faster to build than a native mobile application. The JavaScript library jQuery was used to animate interface elements and to mock-up a few interactions, like the play/pause and previous/next buttons.



FINAL EXHIBITION

The final prototype was showed during the two days of the final exhibition, together with the concept video. It was interesting to experience that almost every visitor was immediately intrigued by the operation of the prototype. Most didn't observe the webcam and were searching for hidden buttons or actions when I showed them the prototype. Of course, this had also to do with the type of visitors, which were all part of the faculty of Industrial Design. But they were mainly interested in the fact that they saw new interactions with the devices they used everyday in their lives, which felt magical for most of them.

Many visitors came up with a wide variety of new contexts. For example, what would happen if you integrate this in public spaces? You will be able to grab public information or collect public data. If someone is watching an interesting movie in public transport, you can pull out the content and watch the same one. Also games could be an interesting context; digitally playing card or collect tokens together with your friends.

There were also comments on the one-directed prototype, which was mainly designed to only send digital items from the smartphone to another device. The desktop interface had the function to disable all incoming messages, but it wasn't possible to send something back to the smartphone or enable only specific users. These are interesting aspects for future development.

I had interesting discussions about the concept compared to the way we share digital files at the moment. Many people saw the benefits, but the reasoning varied from usability to user experience. It is interesting to place this project in the already existing spectrum of sharing digital media. That's why the final user test was not only an evaluation moment, but also an attempt to position the concept in the current market.

USER TEST SET-UP

After the final exhibition, the overall project was evaluated in a qualitative user test procedure. This procedure was discussed with Jun Hu, Mathias Funk and Saskia Bakker to receive valuable input. One of the main problems with the user test of the previous semester was the context. The tested interface was too abstract, and the user test took place behind the user's desk at the university. This ensured that it was impossible to translate the results to the context of a digital media library. The decision was made to only test the music interfaces and to do this in their own living room. The final exhibition proved that it was easier for others to relate to the music context, and I experienced the living room really related to this specific context. For example, you want to continue with listening to the music that you just enjoyed at your smartphone on your way home. Or a friend wants to share his new music discoveries when he is visiting you.

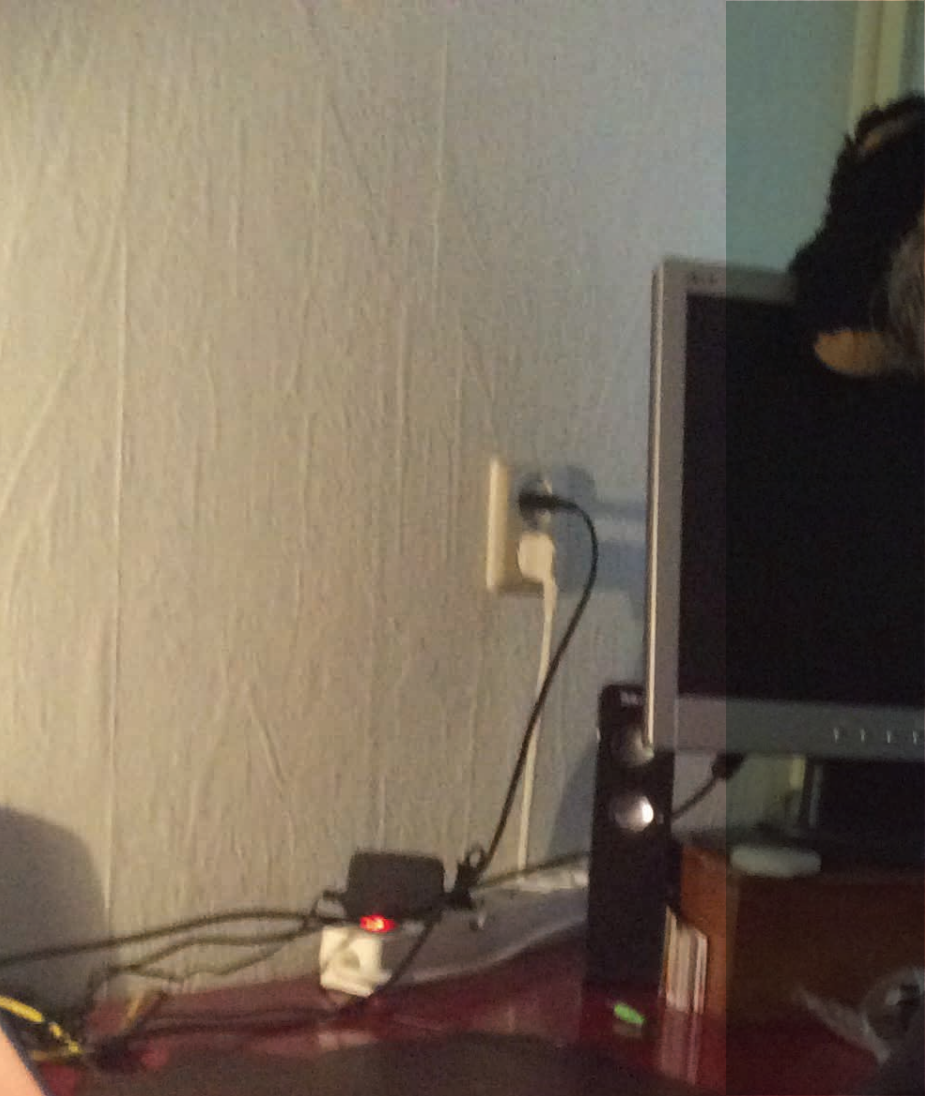
All participants were Industrial Design or Architecture students at the University of Technology Eindhoven. They were all part of the target group, young adults who are native users of smartphones, tablets and notebooks. Because of their study background, they were also able to imagine non-working functions of the prototype. I had the intention to only ask people with no foreknowledge about the project. However I tried to do the same evaluation with someone who already visited me during the exhibition. This person surprised me positively, by pointing at unexpected details. That's why I also asked someone else with prior knowledge, which makes it a total of two. All user data is treated anonymously in this report, but I will sometimes point at their knowledge before the user test.

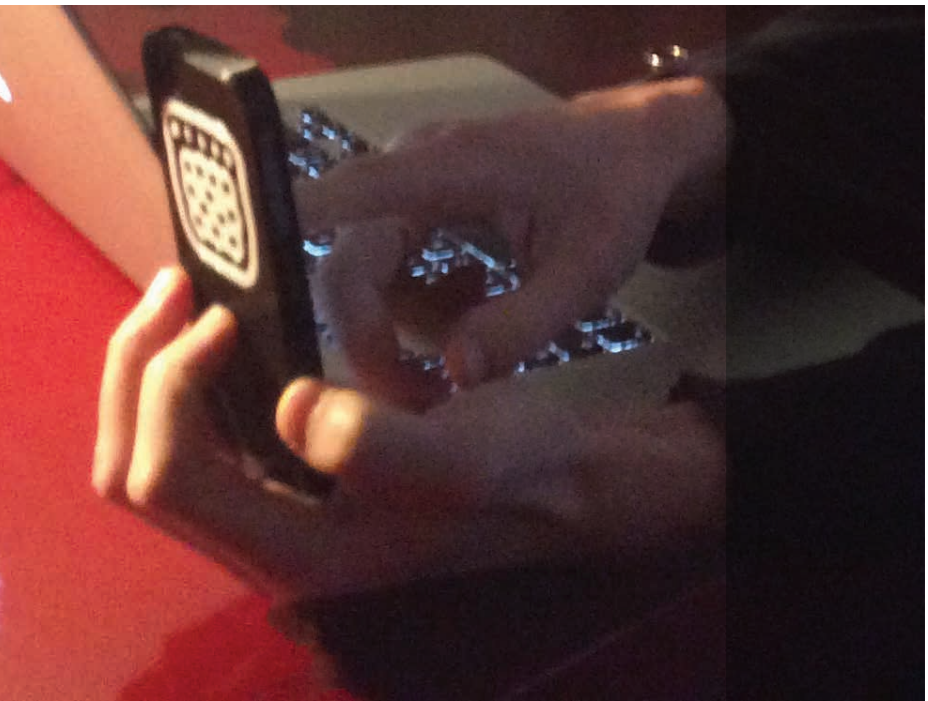
The procedure took around 30 till 50 minutes and consisted of four parts: an informed consent form, a small questionnaire, a scripted scenario with the prototype and an interview and evaluation. The consent form explained the basics of the project, the procedure, the right to make recordings for analyzing, and to publish the results anonymously. A copy of the informed consent form is included in the appendix. The questionnaire was meant to get some basic information of the user group, and to give an overview about their usage of smart devices.

Within the scenario, the user got six specific tasks to perform with only the music interfaces. I only tested these, because the exhibition proved that these were easier to relate to for most people. I started with explaining the basic principle of sharing digital media between smart devices. This was told from the perspective of the current situation like sending a file by mail or an USB stick. I explained that this prototype offers new possibilities, and they need to explore this without explaining the specific action. The consent form asked them to try to don't overthink their actions, and to speak out loud when the prototype didn't react the way they expected. Every task was explained as specific as possible, but they were free to ask any questions immediately and to take as much time as they wanted. The first task was to transfer the song of Mr. Blue Sky - ELO from the mobile phone to the notebook. Users needed to just try this, and I gave them some tips if they weren't able to find out how it works. Not every task worked within the prototype, but these were asked to question new possibilities. These non-working tasks were given at the end; to give the user the feeling they can perform everything with the prototype. All steps of the scenario can be found in the appendix. The entire scenario was video recorded by an iPad, for use during the interview.

After the scenario the procedure ended with an interview, to evaluate the scenario with the help of video recordings. The iPad made it possible to immediately watch their actions after the scenario. I asked them to explain not only what they did, but also why they performed these actions with a reference to their feelings. The interview was semi-structured on the basis of a list of predefined questions. These questions are included in the appendix and were not only about the evaluation of the concept, but also to position it in the perception of the user. The goal was to ask objective questions as non-targeted as possible, to receive new, surprising and honest input. The audio of all interviews was fully recorded to analyze them later on, which made it possible to fully focus on the interview.

The user test was meant to evaluate the concept at this stage. Users are confronted with their own actions when they observe themselves using the prototype. This method is often used in analyzing peripheral interactions and prevents that users are too much aware of performing actions, because they reflect on it afterwards. The method of a semi-structured interview is used to analyze patterns, but still get surprising results (hence the semi-structured). To analyze these interviews, I listened to all recordings as objective as possible by writing all keywords one used to describe their actions, feelings and ideas. This was translated to a final analysis.





USER TEST ANALYSIS

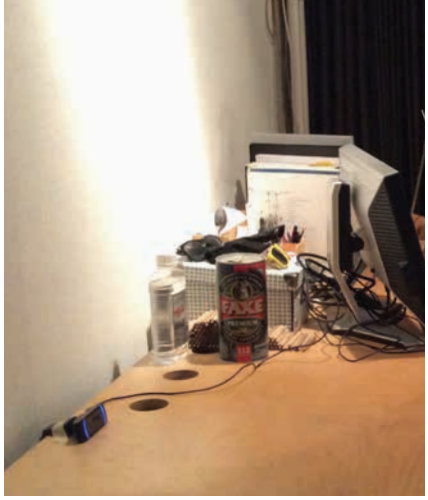
The short questionnaire was meant to give a global overview of the eight users, four men and four women. Their average age was 22.5, which varied from 21 till 25. Seven of them were students Industrial Design or Architecture, and one just finished studying. They all used their smartphone and notebook on a daily basis, and none of them owned a tablet. The prototype during the user test didn't include a tablet, so their personal experience of working with smart devices was not a big influence on the results of the user test.

The first part of the analysis was to look for patterns during the scenario on the basis of the video recordings. After giving the first task, transfer the song from the mobile phone to the notebook, five users started with holding the smartphone in front of the screen of the notebook to slide the song towards the notebook. This is an interesting action, while it approaches the smartphone on the same abstract level I described before: an abstract block with the ability to slide. When they tried a few things, I told them to think about the metaphor of using a screen to extend your main monitor. This ensured that they all hold the smartphone next to the notebook to slide the song. When they analyzed their own video footage, comments were aimed at the fact you always hold your smartphone naturally in front of you to use it. That's why they mostly tried to slide the song from this position. Three users said they missed in both interfaces visual clues that aimed to this interaction. The notebook showed awareness when the smartphone was already close to the notebook. Everyone liked this white blur and metaphors as door, gate and bridge were used to describe it. However it would be nice if the next iteration shows this awareness already when the distance between both devices is bigger. This will guide the user more towards possible call-to-actions.

> "I believe the most interesting conclusion of the user test is that the prototype stayed in the perception of all users. Many compared it with the technique of AirDrop."

Five users interpreted the green blink as a call-to-action, two did not use it and one did not saw it. One of the users with prior knowledge was even waiting for this blink to slide, a situation that also occurred a couple of times when I gave everyone the same task again. This guiding of behavior was really interesting within the overall context of the project. It requires another mindset to interact physical with digital media. But when I asked them with the fifth exercise to pull a song out of the notebook, which was not possible with this prototype, they came up with way more creative solutions than after the first task. Many solutions were comparable to the THAW project of MIT [4], whereby they placed the smartphone on the notebook screen to pick up content. I was surprised by this fast change of mind, which is promising for the potential of such interactions within a couple of years.

Everyone recognized the struggles of sharing digital files in your near environment. They now tackled this problem with USB sticks, Airdrop, WeTransfer, by sending an email or message via Facebook or by sharing it with a cloud service like Dropbox. When they compared the concept with the services they used normally, they mostly pointed at the benefits of ease-of-use and speed of action. These usability benefits were quite surprising, because I expected more indications towards rich interaction and user experience. This has probably to do with the limited new-factor for most users, which I will explain more extensive later on in this analysis.



One of my personal conclusions out of the user test was that the interfaces need a serious iteration in the sense of animations. Some users commented specifically on this, but it was also my own conclusion after watching the video footage. During the process of the project, I made the decision to limit the animations of the files, which had the risk to clutter the interface. But it was not always clear that the song was added from their smartphone directly to the queue of the notebook. A subtle animation with the already existing white blur from the smartphone to the queue can already benefit this understanding. This is also in line with the Material Design guides. Files don't just appear and disappear, but behave in a certain way that it becomes understandable for the user what happens with them. All users said in the interview that they had the feeling there was a direct coupling between the smartphone and the notebook, which one of the most positive results of the user test. This can be interpreted as the biggest advantage when compared to abstract cloud services.

I believe the most interesting conclusion of the user test is that the prototype stayed in the perception of all users. Many compared it with the technique of AirDrop in combination with the context of Spotify. In line with this, two made a really interesting remark about the integration in existing operating systems. It's essential to integrate it on the level of the complete system, not within just a single application. Only in this way it has the potential to become part of our routines. Four people pointed at three problems with AirDrop: it's a separate piece of software, it only works with Apple products and the technique often doesn't work. Especially this last one gives a lot of struggles, because it reveals flaws in the back-end to the user. This ensures that users are no longer part of the magic user experience the service needs to be.

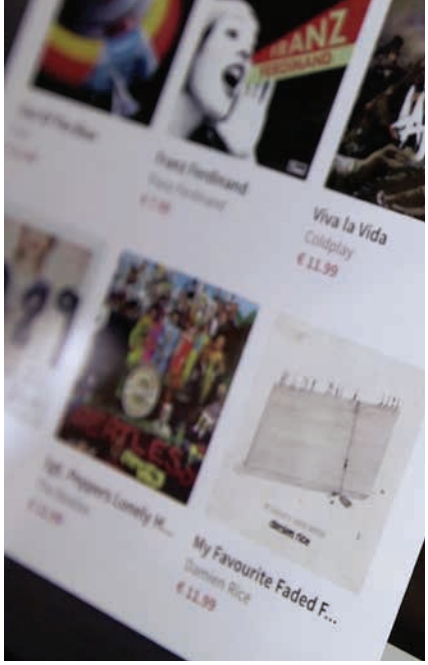
An interesting last remark is that no one experienced it as completely new, however they all said that they can't compare this specific interaction to someone they did before. But they were continuously trying to compare it to other services like AirDrop, Continuity or Vigour or thinking about other possible contexts like transferring a video from a smartphone to a bigger screen, photos from your camera to your notebook, or sharing specific elements in a website with a friend. I want to highlight one comment of a user, who experienced it in some way as normal that this is already possible with only Apple products. The user test was done with an iPhone and an Apple Macbook, and it's an interesting discussion whether this influenced the results of the evaluation. Anyway we can conclude that this is certainly in line with the current work of Apple, in which they try to blur the boundaries between our everyday smart devices.

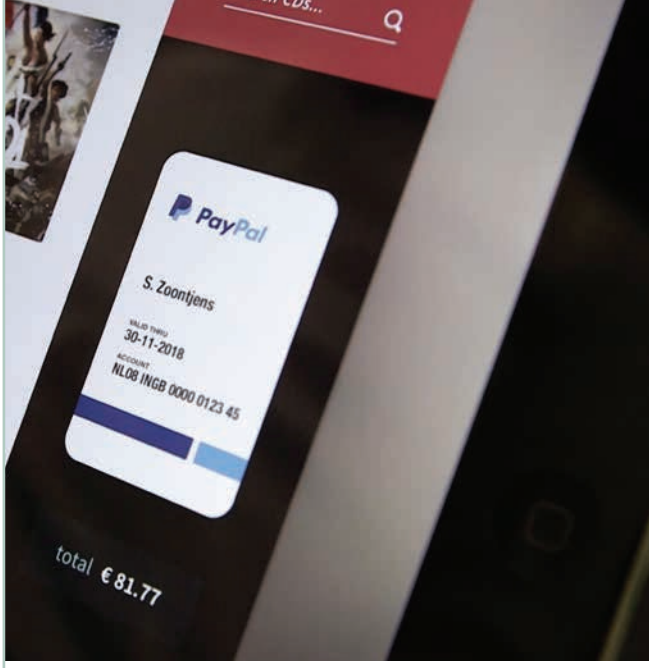
> “When these devices will shift more towards the periphery focus of the user, the role of smartphones in our daily lives will change radically.”

During the project, the topic of peripheral interaction was slightly explored. The decision was made to don’t focus on this, but it is still interesting to approach the project from this perspective. Many people are struggling with the position of smartphones in current society, and see it as a social blockade for personal one-to-one contact. This has mainly to do with the in-your-face interactions of the touchscreen. When these devices will shift more towards the periphery focus of the user, the role of smartphones in our daily lives will change radically.

I’m currently working on the website joinunify.com, a platform to facilitate the discussion about the relevance of Unify and the future usage of our everyday smart devices. It’s important to share new ideas, concepts and visions widely, to prevent them to only exist within the usual boundaries of a project. The concept video needs to give context and input to the discussion. I realize it is also important to look for new ways to communicate the magical experience of the Unify interaction. In this way it does not only exhibit the project, but also my vision as a designer on the magic of user interaction design.

The most important future step is to link the still conceptual project to an existing context, product or company, to design a business case around the concept. It would be interesting to explore the user experience when implemented in a service like AirDrop [10]. This was one of the goals at the start of the project, but it wasn’t possible to investigate this direction within the time-span of the semester. I want to use this project as the main input for the direction of my Final Master Project. I feel that there are more opportunities in this area, and I want to use this project as some sort of advertisement for companies to join my journey.





CONCLUSION

It is important to form a conclusion about the innovative relevance of the project from the perspective of the current design trends. While it is in line with innovations from companies like Microsoft, Google and Apple, it also touches the opportunities of emerging cloud services and future concepts in the area of sharing digital media. It is important to don't approach the cloud as an unwieldy and abstract existence, but use the potential to build technology-driven concepts. This mindset is essential to design future concepts that are grounded in reality, to dream with a foundation.

The most important conclusion of my previous project was the importance to develop software and hardware side by side, because only in this way one can affect the full experience. The potential of this project relies also strongly on the structure of the industry. AirDrop is an Apple service, a unique selling point to buy Apple products. This is a big contrast with the idea of Unify, a service to share digital media between devices without looking at the type of device or brand. This requires industry standards that are integrated on quite a deep level. The question is whether this possible is in the current technology-driven industry, which is arranged around patents and unique selling points. It seems that a framework like Unify is only possible when developed as a third-party, to license it to electronic suppliers.

This project was mainly about blending the digital and physical design space, where magical and meaningful interactions are possible. This has the potential to give users a stronger feel of control in the middle of the emerging information overload. The world is getting more and more complex; cloud services, as described in this report, store more digital information than ever before. It is the role of designers to bring clarity to users, to make them more curious and surprised about the little things. It is absolute essential that technology will shift more towards the peripheral attention of users, where it becomes obvious and not a distraction.

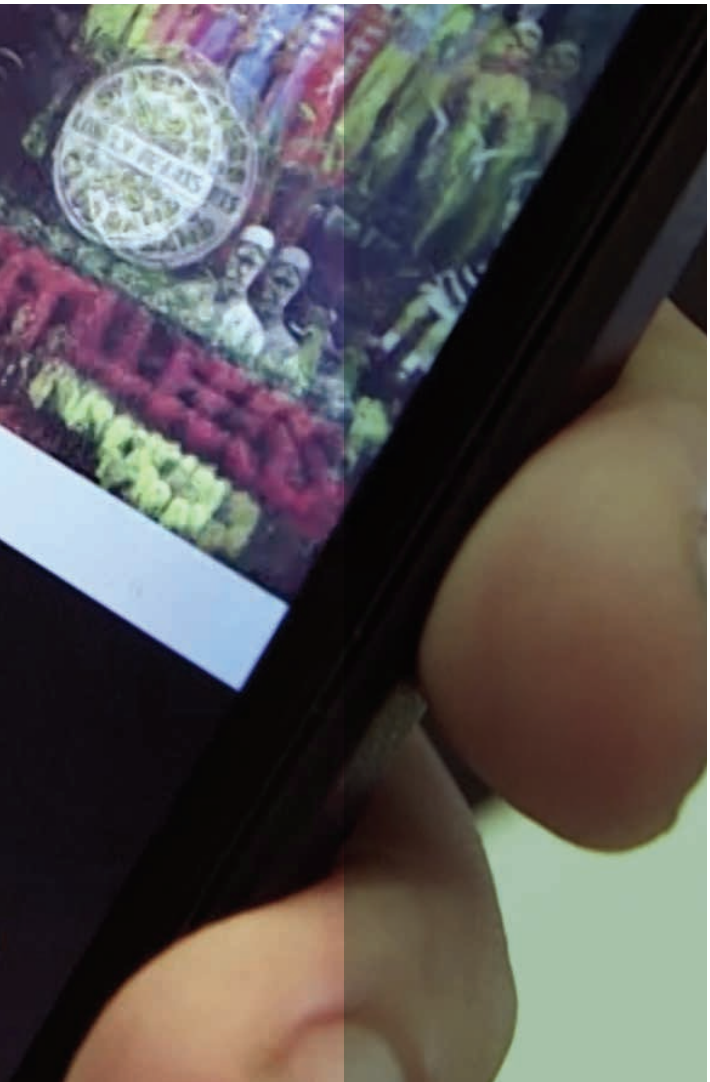
SHORT REFLECTION

After all I'm pleased with the "5-years approach". This ensured the perfect balance between working on out-of-the-box concepts, without losing sight on the current trends and innovations. I now realize this requires a constant shift between two perspectives. My personal perspective ensures a creative view with the possibility to dream and work on details. The second perspective is needed to see the bigger picture: to place it in the current market and to analyze the work of my other perspective objectively. I'm curious if this insight will influence the way I work in the future, when I'm more aware of consciously shifting between these two viewpoints.

The storytelling was really important for the result of the overall project. The "why-how-what"-approach prevented that the project was not just a concept, but also a statement on sharing digital media. I realize the video was the most important aspect to communicate the vision. A future vision could function as the start of a new design process where this dialogue is the start for decision-making. This approach is an extremely powerful tool to reconsider in future projects, as an extra possibility. But it is also important to use this tool thoughtful within the right projects; otherwise a design really turns into an art project without any added value.

I noticed that within the project the big responsibility of designers nowadays, in which smartphones and the internet are essential aspects of our lives; applications and websites have a great impact. This makes it really easy to make a change in the lives of others for everyone with a little bit of knowledge about web design. Nowadays there are just too many products with only a wow-factor, without thinking about the effects on society. This thought made me aware to consider constantly the why-factor and the importance of the actual users during a design process. Designers have a natural open-minded attitude, but they need to treat the sensitive values of others with respect.

The last semesters of Industrial Design, I always approached a project from my own personal perspective. I like to work on a topic that could potentially add value to my own life. From this perspective, I like to extrapolate my ideas, thought and findings to make them also valuable to others. I want to investigate this "design-for-myself"-perspective during my Final Master Project, to gain a better understanding about the power of this approach. I believe it could be really valuable to use this as a starting point, but I also need to be aware of the probable downfalls and assumptions.



“This ensured the perfect balance between working on out-of-the-box concepts, without losing sight on the current trends and innovations.”

ACKNOWLEDGEMENTS

> “I want to thank the other Master students in the Out of Control space for their interesting feedback and inspirational discussions.”

I would like to thank my coach Jun Hu for his critical and inspirational view and the interesting discussions.

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I would like to thank Frank van Valkenhoef for his technical input on the project and help with the theoretical sensor.

I want to thank the other Master students in the Out of Control space for their interesting feedback and inspirational discussions.

Last but not least a special thanks to the many people I talked with during the project and who participated in the user tests. You proved to me a serious need for the project.

Stijn Zoontjens

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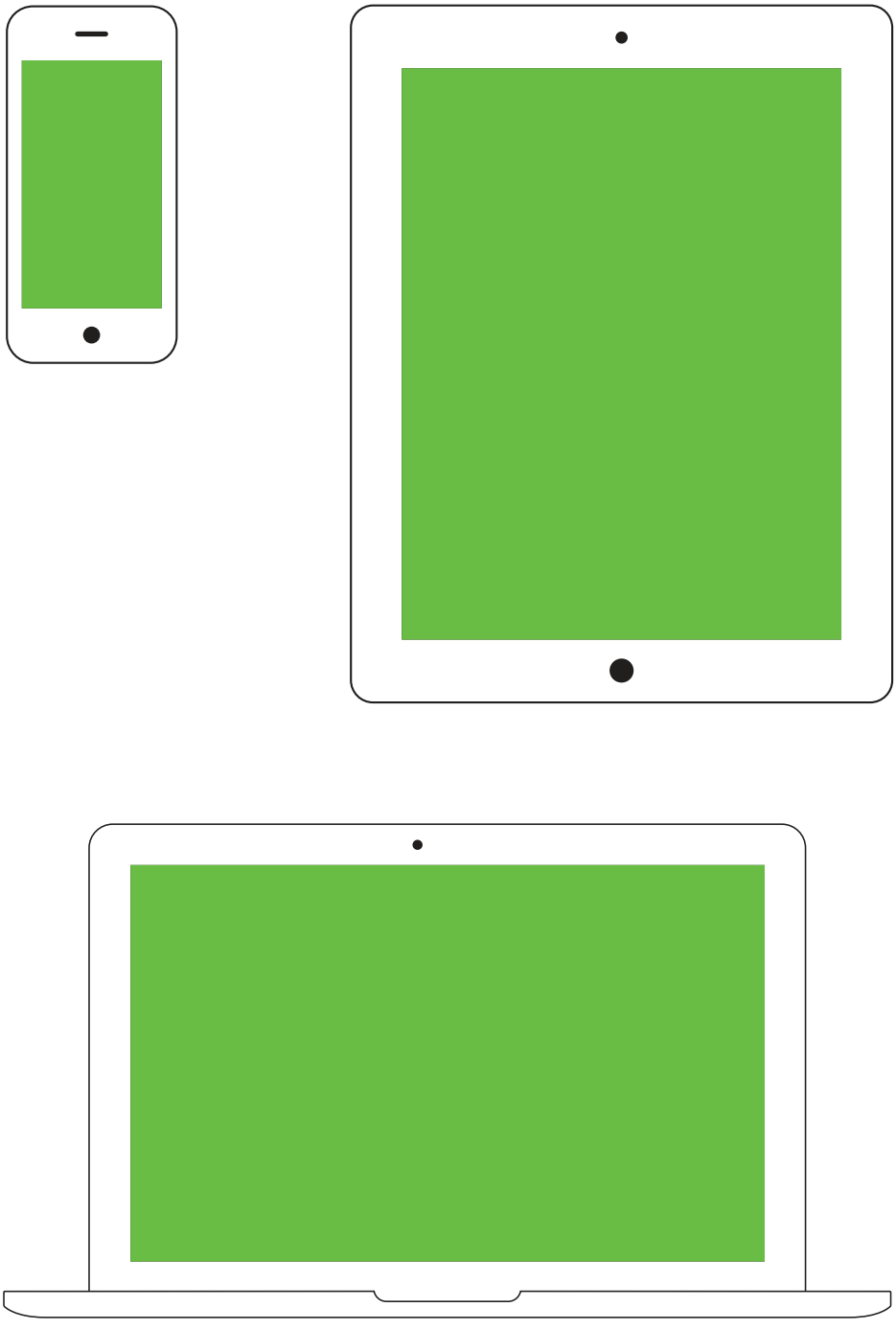
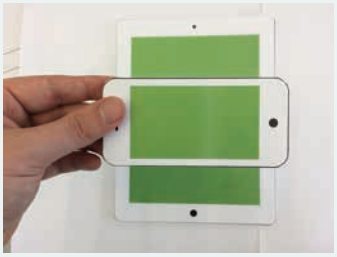
APPENDIX: EXPLORATION DEVICES



The Internet Of Screens

Interaction possibilities with multiple screens

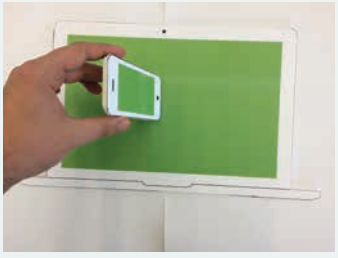
Slide
Slide from one screen to another



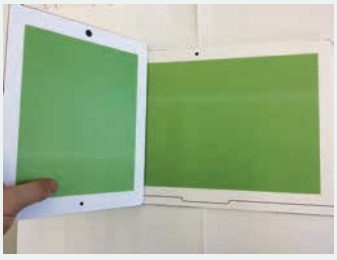
Scroll
Use one device to scroll through the content of another

Place
Place a digital item on another screen

Push
Push digital content into another screen

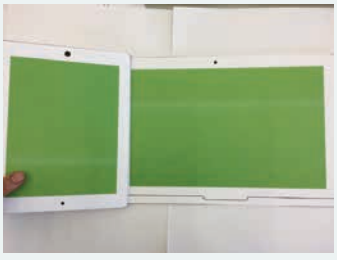


Float
Float content from one screen to another

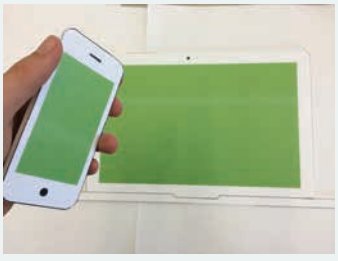


Shape
Shape forms of multiple screens

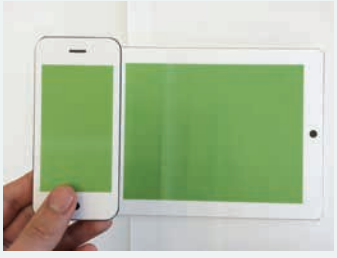
Trace
Control the content of another screen with a touchscreen



Control
Control the content of another screen with a moving screen



Shake
Shake content out of a screen into another screen



Extent
Extent the content on a second screen

Gebruik je een opslag clouddienst zoals Dropbox, Google Drive of iCloud?

43 van 43 mensen hebben deze vraag beantwoord

1	Ja	41 / **95%**
2	Nee	2 / **5%**

Welke opslag clouddiensten gebruik je dan?

41 van 43 mensen hebben deze vraag beantwoord

1	Dropbox	38 / **93%**
2	Google Drive	37 / **90%**
3	iCloud (Apple)	20 / **49%**
4	Copy	11 / **27%**
5	OneDrive (Microsoft)	9 / **22%**
6	Anders	4 / **10%**
7	Box	1 / **2%**
8	Mega	1 / **2%**

Waarvoor gebruik je deze cloud opslagdiensten vooral?

41 van 43 mensen hebben deze vraag beantwoord

1	Het delen van bestanden met vrienden en bekenden.	38 / **93%**
2	Als back-up van mijn bestanden.	35 / **85%**
3	Het delen van bestanden met klanten.	14 / **34%**
4	Om opslagruimte te besparen op mijn pc of notebook.	10 / **24%**
5	Het delen van bestanden met iedereen online.	8 / **20%**
6	Anders	3 / **7%**

Betaal je voor een opslag clouddienst?

41 van 43 mensen hebben deze vraag beantwoord

1	Nee	30 / **73%**
2	Ja, gemiddeld 1-20 euro in de maand.	11 / **27%**

3	Ja, gemiddeld 20-50 euro in de maand.	0 / **0%**
4	Ja, gemiddeld 50-100 euro in de maand.	0 / **0%**
5	Ja, gemiddeld meer dan 100 euro in de maand.	0 / **0%**

Gebruik je een streaming videodienst zoals Netflix, Pathe Thuis of Popcorn Time?

43 van 43 mensen hebben deze vraag beantwoord

1	Ja	30 / **70%**
2	Nee	13 / **30%**

Welke videodiensten gebruik je dan?

30 van 43 mensen hebben deze vraag beantwoord

1	Netflix	24 / **80%**
2	Popcorn Time	10 / **33%**
3	Anders	1 / **3%**
4	Pathe Thuis	1 / **3%**
5	Videoland On Demand	0 / **0%**

Waar kijk je films of series met een streaming videodienst?

30 van 43 mensen hebben deze vraag beantwoord

1	Thuis	30 / **100%**
2	Onderweg	6 / **20%**
3	Studie	6 / **20%**
4	Werk	1 / **3%**
5	Anders	0 / **0%**

Betaal je voor een videodienst?

30 van 43 mensen hebben deze vraag beantwoord

1	Ja, gemiddeld 5-10 euro in de maand.	18 / **60%**
2	Nee	9 / **30%**
3	Ja, gemiddeld 10-30 euro in de maand.	3 / **10%**

4	Ja, gemiddeld meer dan 30 euro in de maand.	0 / **0%**

Gebruik je een streaming muziekdienst zoals Spotify, Deezer of Grooveshark?

43 van 43 mensen hebben deze vraag beantwoord

1	Ja	37 / **86%**
2	Nee	6 / **14%**

Welke muziekdiensten gebruik je dan?

37 van 43 mensen hebben deze vraag beantwoord

1	Spotify	35 / **95%**
2	Soundcloud	17 / **46%**
3	Grooveshark	8 / **22%**
4	Last.fm	7 / **19%**
5	8tracks	5 / **14%**
6	Anders	4 / **11%**
7	Beats Music	0 / **0%**
8	Deezer	0 / **0%**
9	Google Music	0 / **0%**

Waar luister je muziek met een streaming muziekdienst?

37 van 43 mensen hebben deze vraag beantwoord

1	Thuis	36 / **97%**
2	Studie	30 / **81%**
3	Onderweg	29 / **78%**
4	Werk	19 / **51%**
5	Anders	1 / **3%**

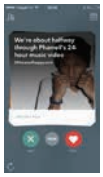
Betaal je voor een muziekdienst?

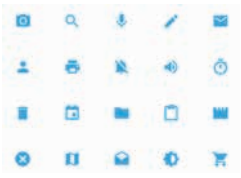
37 van 43 mensen hebben deze vraag beantwoord

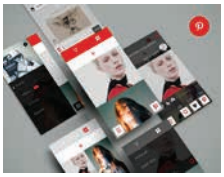
1	Ja, gemiddeld 5-10 euro in de maand.	19 / **51%**

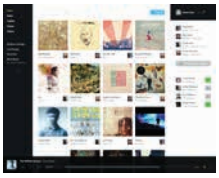
2	Nee	18 / **49%**
3	Ja, gemiddeld 10-30 euro in de maand.	0 / **0%**
4	Ja, gemiddeld meer dan 30 euro in de maand.	0 / **0%**

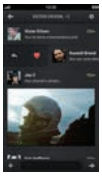
APPENDIX: UI INSPIRATION

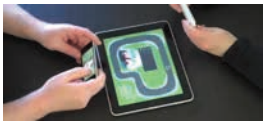


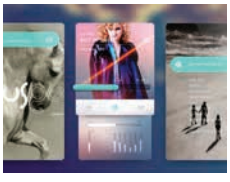










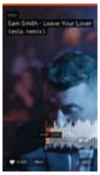




rdio

22TRACKS

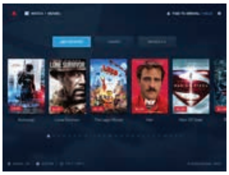
22TRACKS


Sam Smith - Leave Your Lover (esta. remix)

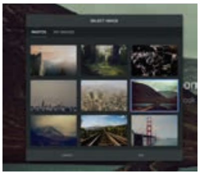


07:30
20







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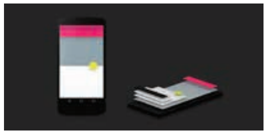
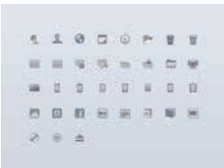
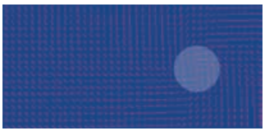




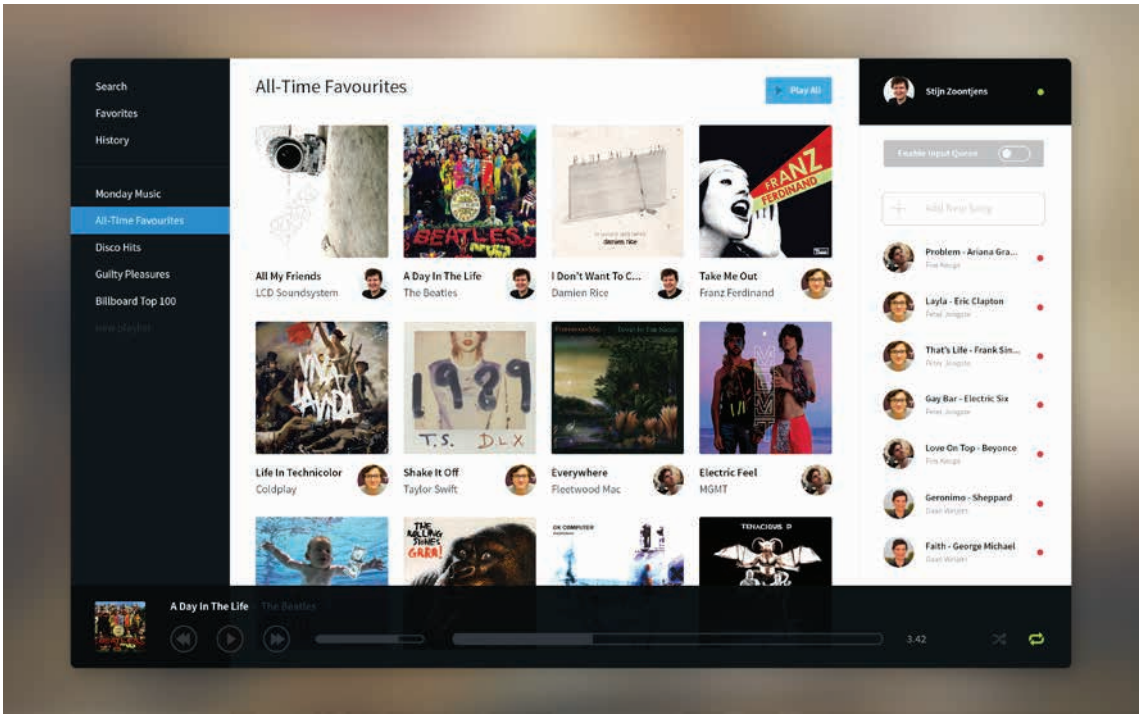
Welcome to Heartbreak
Kanye West

We need your billing info.

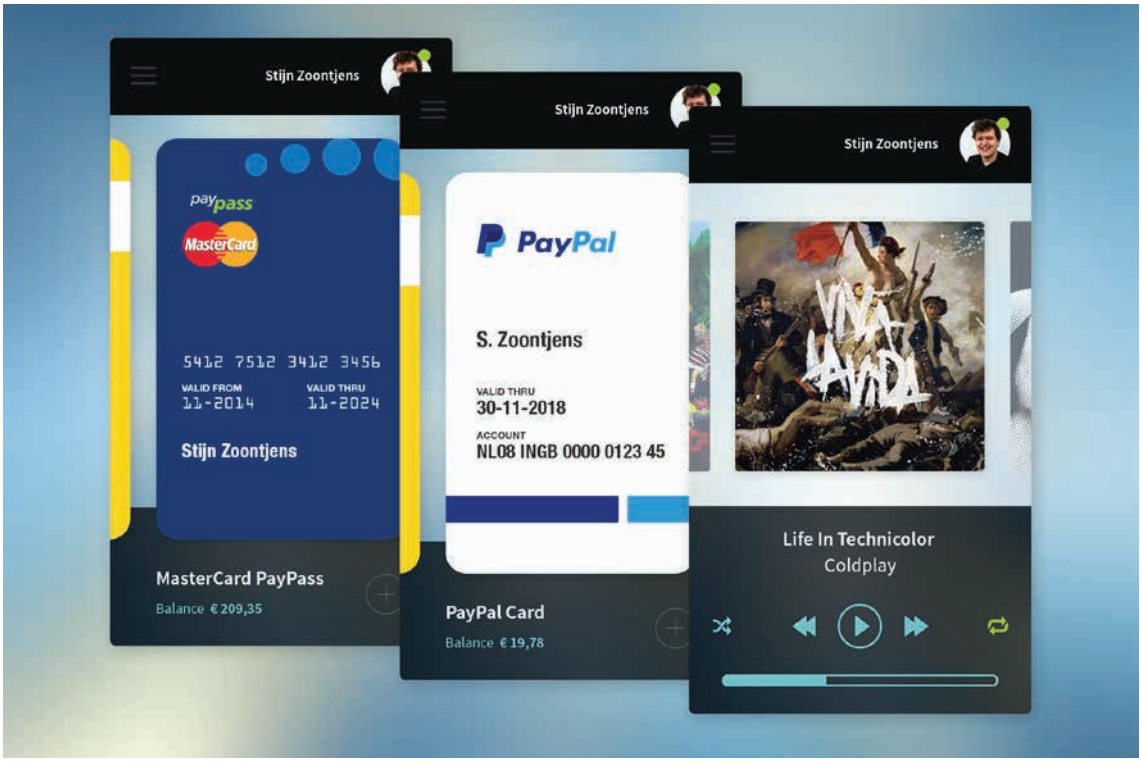
New Ticket
History
Status New
I was double billed. Please help
Lost login information
Getting stuck with new UI

Custom
Iconography

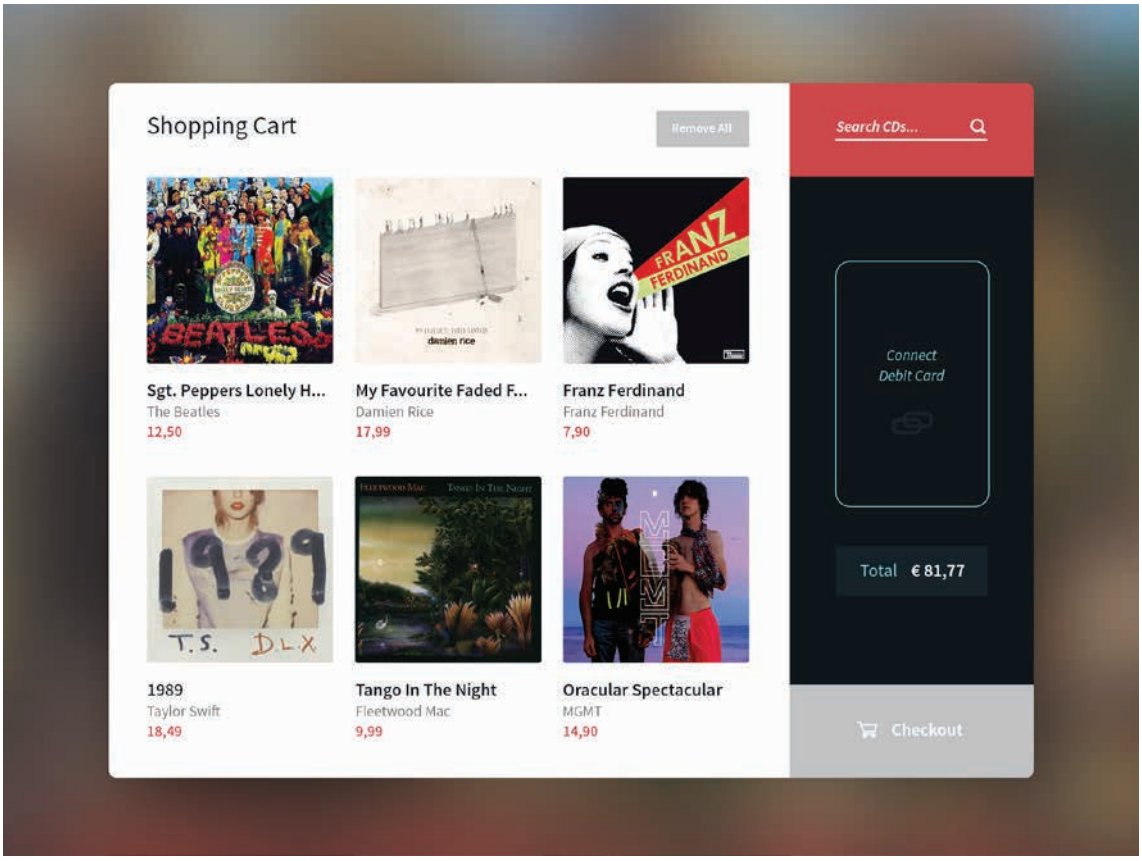
one
funeralone



DESKTOP INTERFACE DESIGN



MOBILE INTERFACE DESIGN



IPAD INTERFACE DESIGN

3D PRINT IPHONE CASE


UNIFY
a concept by stijn zoontjens

Unify Extending Smart Devices

Stijn Zoontjens - M1.2

Our devices are already really powerful. They know their absolute GPS position on the earth and the way you hold them. But they are still separated islands in our environment and aren't really connected. Of course, you can connect them, but still via difficult menu structures and by looking at your screen.

Wouldn't it be amazing if we can connect these smart devices in a way that they are truly an extension of each other?

To achieve this, devices need to know their relative position to each other, which is not yet possible. But if we add a little extra technique to our everyday devices, we are able to connect them in a much more intuitive way. This new sensor is able to send and receive its relative position via RF-transmitters.

'Unify' aims to link our smart devices together, to open a new area of possibilities.

In this way, you can share your music with someone else by just swiping a song. It becomes way easier to share files during a meeting. Or you can establish a link between a shopping cart and your credit card. The possibilities are endless.

What would you develop with 'Unify'? Join the discussion now at joinunify.com.

Coach: Jun Hu

TU/e

APPENDIX: VOICE-OVER UNIFY

Try to imagine a life without sharing. You probably can't. Sharing has become an essential part of mankind. We always did it and nowadays even more than ever. Sharing digital media has become second nature for most of us. Throughout the day, we interact a lot with media in the cloud without even noticing it. Everywhere we go, we are able to listen to millions of songs, watch thousands of movies, or work with our own files without dragging around terabytes worth of hard disks.

Our smart devices are the center within this system: our laptops, tablets and smartphones. All these devices are connected to an abstract cloud, which is actually nothing more than a data center somewhere in the world. The question is not why we use the cloud, but how we use it. The cloud has become an essential part of our workflows, but not of our natural behavior. Can we come up with new ways of interacting with this cloud and to share digital media with others in such a way, that it becomes an integral part of our daily routines?

Our devices are already really powerful. They know their absolute GPS position on the earth and the way you hold them. But they are still separated islands in our environment and aren't really connected. Of course, you can connect them, but still via difficult menu structures and by looking at your screen. Wouldn't it be amazing if we can connect these smart devices in a way that they are truly an extension of each other?

To achieve this, devices need to know their relative position to each other, which is not yet possible. But if we add a little extra technique to our everyday devices, we are able to connect them in a much more intuitive way. This new sensor is able to send and receive its relative position via RF-transmitters.

'Unify' aims to link our smart devices together, to open a new area of possibilities. In this way, you can share your music with someone else by just swiping a song. It becomes way easier to share files during a meeting. Or you can establish a link between a shopping cart and your credit card. The possibilities are endless. What would you develop with 'Unify'? Join the discussion now at joinunify.com.

APPENDIX: USER TEST PROCEDURE

1. Informed Consent Form

2. Questionnaire

3. Scenario

STEP 1
Transfer the song of Mr. Blue Sky - ELO from the mobile phone to the notebook.

STEP 2
Transfer the song of A Day In The Life - The Beatles from the mobile phone to the top of the notebook.

STEP 3
Disable the function on the notebook to receive files from other devices.

STEP 4
Transfer the song of Franz Ferdinand from the notebook to the mobile phone.

STEP 5
Pull the song of Life In Technicolor - Coldplay with the notebook out of the mobile phone.

STEP 6
Can you come up with another action you want to perform?

4. Semi-structured interview

QUESTION 1
What were your first thoughts when you used it?
Your first reaction?

QUESTION 2
What do you notice when you observe yourself using the prototype?

QUESTION 3
Did you have the feeling the devices were connected?
Why? From which moment?
Where did you have the feeling the song were transferred to?

QUESTION 4
How do you share files at the moment?
Hoe do you experience this?
How do you experience this compared to this prototype?

QUESTION 5
Do you think this is new?
Do you this this is visionary?
Why?
Can you compare it with another product or concept?

QUESTION 6
In which contexts would you imagine this concept?
What would it add?

Informed Consent Form

January 2014

Project: Growing Systems
Researcher: Stijn Zoontjens (s.zoontjens@student.tue.nl)
Responsible academic: Jun Hu (j.hu@tue.nl)

Faculty of Industrial Design, University of Technology Eindhoven

Introduction

My name is Stijn Zoontjens, I am conducting the Master Program in Industrial Design at Eindhoven University of Technology, currently commencing researching sharing digital media supervised by Jun Hu. The purpose of this study is to explore a new way of sharing digital media between devices. You will get limited information about the goals of the project before and during the procedure in order to prevent any influence on the results of the experiment. If you are interested in my project after the experiment, please do not hesitate to contact me for further information.

Information

By signing this form you agree to participate in an experiment. The study will involve a prototype to share digital media in a new way. Photo and video recordings will be made and results will be written down. These recordings and results will only be used for research purposes. The results will be processed anonymously; no names will ever be attached to the results of the experiment in any way. Your participation in this experiment is entirely voluntary. It is your choice whether you would like to participate or not. You may change your mind later and stop the participation or at any moment throughout the experiment, even if you agreed to it earlier. You are free to ask questions at any time during the process and test. You do not have to answer any question or take part if you don't wish to do so. You do not have to give any reason for not responding to any question.

Procedure

The procedure takes around 30 till 45 minutes and consists of three parts: a small questionnaire, a scripted scenario with the prototype and an interview and evaluation. The questionnaire is meant to have an overview of the user group. Within the scenario, you will get specific tasks you need to perform. Sometimes these tasks could be quite abstract, but don't try to overthink your actions. Every task will be explained as specific as possible, but feel free to ask any questions immediately. You can take as much time for it as you want. After the scenario, the procedure will end with an interview. In this part we will evaluate the scenario with the help of video recordings. Try to explain not only what you did, but also why you did these actions with a reference to how you feel.

The prototype is designed to get the subtleties of the basic interactions. However it's still a prototype and can't do everything. When you're in the situation you want to perform certain actions and the prototype doesn't react the way you expect (or doesn't have any reaction at all), please speak this out loud.

Confidentiality and publication of research results

Results of this study may be published in reports, professional and scholarly journals, students thesis, and/or presentations to conferences and colloquia. In any publication, data will be presented in aggregated form. If personal quotes are published, it is guaranteed that this will be anonymous, no names are published. All the collected data will be processed with respect to both information about the participant and information that the participant shares. Any information about you will have a number on it instead of your name. Your name will not

be published in any of the publications. Images or recordings of you or your property will not be published without your permission.

You will be able to access the results of this study by contacting Stijn Zoontjens via s.zoontjens@student.tue.nl or by calling +316-12253341.

I _________________________ (participants name) agree to participate in the experiment of the project “Growing Systems” being conducted by Stijn Zoontjens <<s.zoontjens@student.tue.nl>> under supervision of Jun Hu <<j.hu@tue.nl>>.

I understand that the procedure will be video and audio recorded, and that the data will be saved anonymously.

I am aware that I can contact Stijn Zoontjens or his supervisor Jun Hu if I have any concerns about the research. I understand I am free to withdraw my consent and participation at any time I wish, without giving a reason.

Hereby I declare to have read this form, I agree to its content and to participate in the study. I may withdraw this consent at any time by contacting the person listed on this form.

Participant……………………………………………………………….. Number……………………

Date…………………………………. Signature………………………………

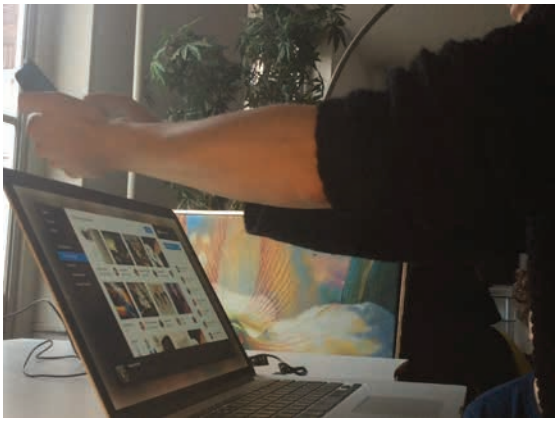
Researcher………………………………………………………………..

Date…………………………………. Signature………………………………

Thank you for your assistance in this project.

APPENDIX: USER TEST FOOTAGE

USER NUMBER 1



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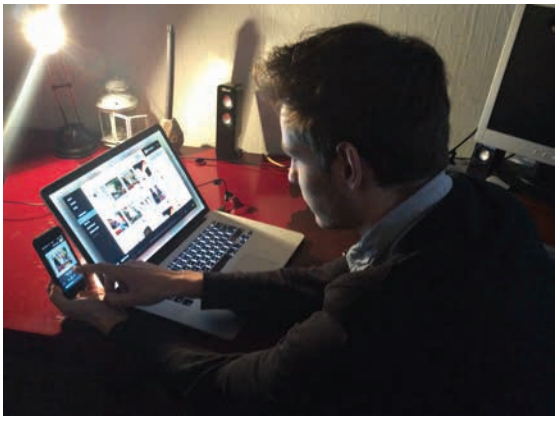

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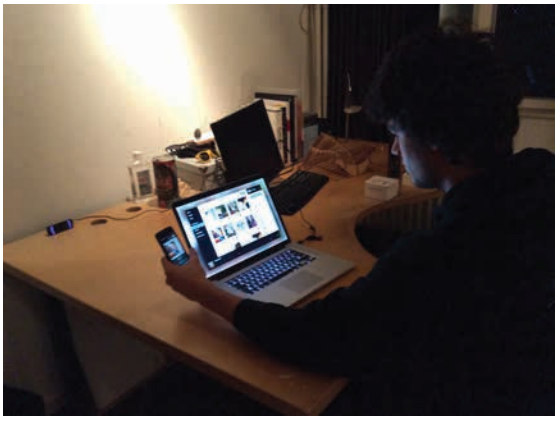

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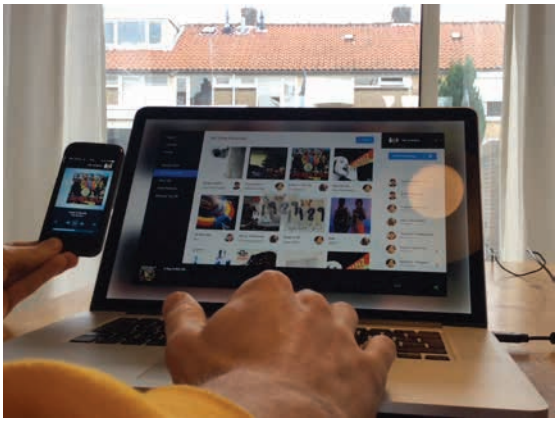

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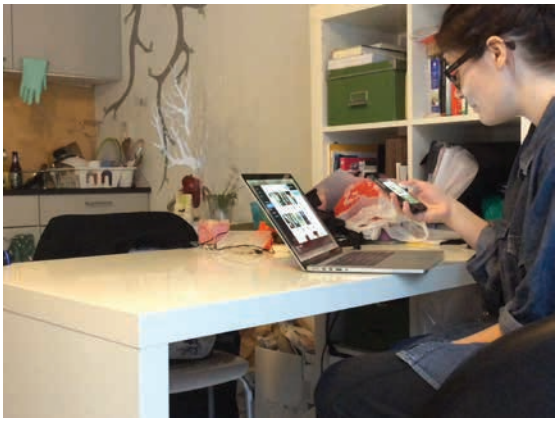

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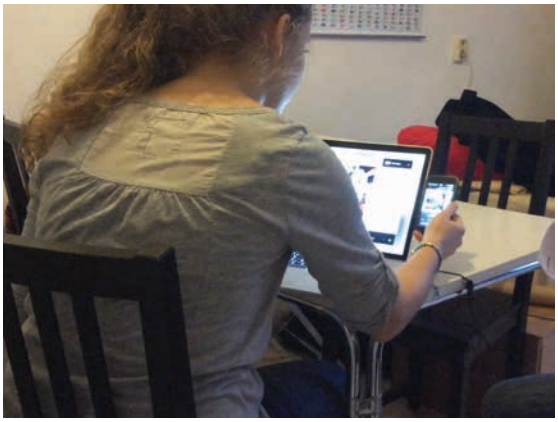

USER NUMBER 7

USER NUMBER 8

MAIL@STIJNZOONTJENS.COM • STIJNZOONTJENS.COM