Semantic resources

Willem Willemsen

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Student: Willem Willemsen

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Coach: Jun Hu

Clients: Gerrit Niezen
Bram van der Vlist

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Introduction

This project was my first choice in my preference list and looking back I'm glad that I got to do this project. I had a few reasons for choosing this project, first of which was sustainability. Designing for sustainability wasn't literally part of the project description, but it resource consumption was mentioned several times. Sustainability is important to me and I was glad that this project gave me the opportunity to design something to create awareness of sustainability for other people as well. Secondly I chose this project because of the involvement of SOFIA (smart devices/systems). In my previous project I was also designing something to be a part of a bigger (existing) system and this was difficult for me at that time. In realize that the world is getting more and more interconnected and the need to design for complex systems is increasing. In this project I want to learn how to design for a larger system and improve on the mistakes I made in my previous project.

The project in my previous semester didn´t go well for me and that resulted in an H-verdict for my first M11 semester. I did complete all the modules, so I decided to write an exemption proposal and request more time to spend on my project instead of modules. In this proposal I requested extra time to do research in this project. In my previous assessment, both my coach and assessor thought that I wasn't aware enough of the research related to my project. We discussed the fact that a master student should be aware of the work that other designer and researchers are doing in the context of his project. In this project I wanted to make sure that I developed awareness of the context of my project by reading up on related research. When I created my design process and planning I took this into account and allocated much time for research.

Start-up

Start-up

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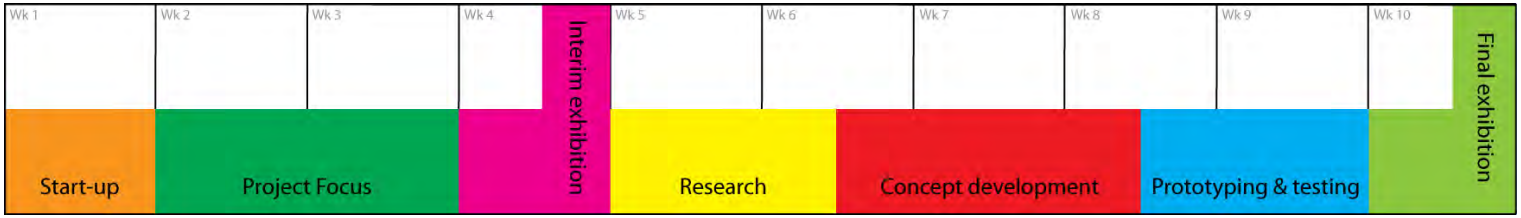
Start-up

Design process & planning

I got exemption to spend more time on research in this project, so it seemed appropriate to set this research as a key element in my design process. Although research is a key factor in this project, I realize that this is a design project, not a research project. My main goal in this project is to create a design that contributes to an existing research area by applying state-of-the-art research to an existing design/solution area. I learned in my previous projects that research is much more effective and efficient with a concrete design direction. The project description of this project was still very open/free, so finding direction will also be an important part of the process.

I set the goal to have a concrete design direction by the time of the interim exhibition, so I could present it to others and further refine it. Finding a direction will include looking for inspiration, exploring the solution area and generating first ideas. After the interim there will be time for research, concept development and testing. Compared to my previous projects, the research period is long compared to the other phases in the process. The research period will however be strictly limited in time, because a pitfall in research is continuing too long because you feel there is still more to learn. The deadline for my literature review is 1,5 weeks after the interim exhibition.



Start-up client meeting

In the first week of the project I had a meeting with the project proposers (my coach and clients). In this meeting we discussed the project description and how to approach this project. The clients in this project are 2 PHD students who, among other things, are developing applications for the SOFIA project. The SOFIA project is the starting point for this project and the goal of SOFIA is to develop an internet of things. SOFIA uses the M3 midware; a cross between hard- and software that allows all kinds of smart objects to connect to each other and communicate with each other. Smart objects can gather information about how they're used and communicate this to other devices. This communication uses triple ontologies; a way to give meaning to data that allows computers to understand what kind of data it is.

SOFIA project: Spotlight

The other part of the project description was about creating awareness of domestic resource consumption. We discussed how to approach to the project during this meeting and the outcome was that it would be better to start from the side of resource consumption rather than the side of SOFIA. In my previous project I started the development from the technology point of view, but this strongly limited my creativity and freedom. We agreed that I should start from the use(r) point of view to find a design direction that was relevant for the project as well as inspiring for me. In the later stages of the project, I will involve the SOFIA project again.

SOFIA project: Semantic connections

Project focus

Project focus

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Project focus

Interviews about consumption awareness

The main purpose of this project, as I interpreted from the project description, is to create awareness about domestic resource consumption. The first question that came to my mind, when I read this, was what this level of awareness currently is. So the first thing I did in this phase was arranging several short interviews about domestic resource consumption. For these interviews I chose 6 participants of as many different demographics and generations as possible. I interviewed students as well as middle aged and elderly people. These are the questions and a summary of the answers:

Q: Do you know how many resources your household uses every year and what the normal resource consumption is for your family size? A: None of the 6 participants were confident about this, some people estimated the normal consumption right, but didn't know if they were below or above this.

Q: Do you ever read your monthly or yearly energy bill and do you do something with this information? A: 4 of the 6 people take a good look at their energy bill, but only to check if the costs aren't out of proportion. If it's all relatively normal, there is no need to take any action.

Q: What are the 3 most important things you do to save resources in your house? A: Buy energy saving products, take shorter showers, turn down the heating (at night) and don't turn devices on standby mode.

These results showed me that there is an opportunity to make people more aware of their resource consumption, but just providing them with information is probably not going to be enough. I say this because the information is available to the people, but they simply don't use it. There are many smart meters available to buy and by looking at the meter cupboard and periodic statements, people can already get quite a lot of information. The problem is that the way the information is presented to the user with these existing solutions is too technical and complicated for most people. I think that the challenge in this project lies in making the information interesting and usable through design.

Smart meter examples

Mind maps

The goal of making domestic resources more interesting/engaging was the starting point for a project mind map. There were several directions that I was investigating simultaneously and I was keeping track of them with digital mind map software. I clustered existing systems and solutions; things that are mentioned in the project description or existing solutions/products (e.g. SOFIA, smart meters, internet of things). The content of this cluster is highly technology driven; good to be aware of, but not a good starting point for my project. I also created a cluster of things that interested/inspired me personally. Existing designs for sustainability inspired some of my first ideas in this project. Most of my first ideas had a link to natural elements (e.g. flowing water, bioluminescent creatures, year rings of a tree, etc).

To focus the project, I looked for something to connect the two clusters together; a way to add the conceptually interesting aspects from sustainability and nature to the technical and dull information about resource consumption. I found this focus in Information decoration.

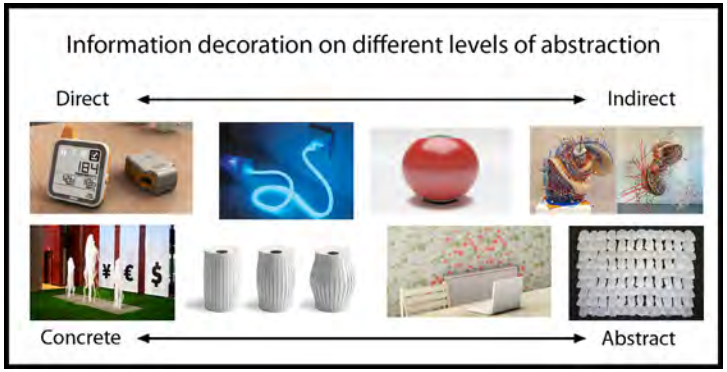
Parts of the mind maps

Information decoration

In my FBP project I stumbled upon a design field called Information Decoration. In this project I designed a lamp that simulated a sunset. During the exhibition of that project I discussed this design with several people and someone mentioned that this lamp also showed time in a decorative way. He suggested back then that I should look at information decoration which is a kind of design ideology that is being developed in this faculty. I thought this ideology would also be interesting for this project, because it could make the information about resource consumption more interesting for users by turning data into decoration.

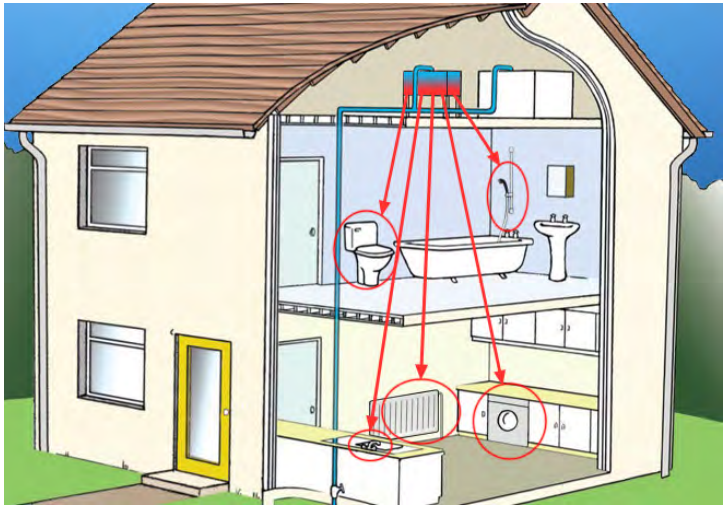
To learn more about information decoration, I arranged a meeting with Koert van Mensvoort. He is the author of the article where information decoration is introduced and coach in the Next Nature theme, where information decoration is being applied and developed. He showed me several designs that he put on the website about information decoration that he runs, which he thinks are good examples of information decoration. We talked about the origin of Information decoration and he suggested that I read some work from Weiser and Tufte to gain a better understanding of the fundamentals.

Koert also gave me some tips for designing information decoration myself. One of the main challenges he mentioned was designing something that is part of the environment and can move between the periphery and centre of the user's attention. This is something to keep in mind, because many designs are objects that actually try to jump out of the crowd and attract the user's attention. Designing something that is more passive and part of its environment is trickier than it seems. He also said that it's important to find a balance between the development of the decorative aspects and the information. In this education, the decorative aspects are often underestimated and underdeveloped. The use of scenarios is also something fundamental in information decoration. Finally the designer should be very much aware of the complexity of the information display. This information can be displayed in different ways, which is of great influence on the perception of the information.



First ideas

I started the idea generation with mood boards of decorations that people put in and around their house. I picked out 3 categories from the decorative objects: Shapes, light and water. Many of the decorative objects are actually combinations of 2 or more categories. Shape and light are often used in design, but water is a bit more uncommon. I found the use of water interesting for my design, because water is also a resource that I think people should become more aware of in their daily life. Dutch people have a special relationship with water, but also consume large amounts of fresh water (for example flushing the toilet with drinking water). There already are many devices on the market to monitor electricity consumption, but water consumption is largely overlooked (also because it's the least expensive resource for an average household). This is why at this stage of the project I was mostly focussing on creating awareness of domestic water consumption.

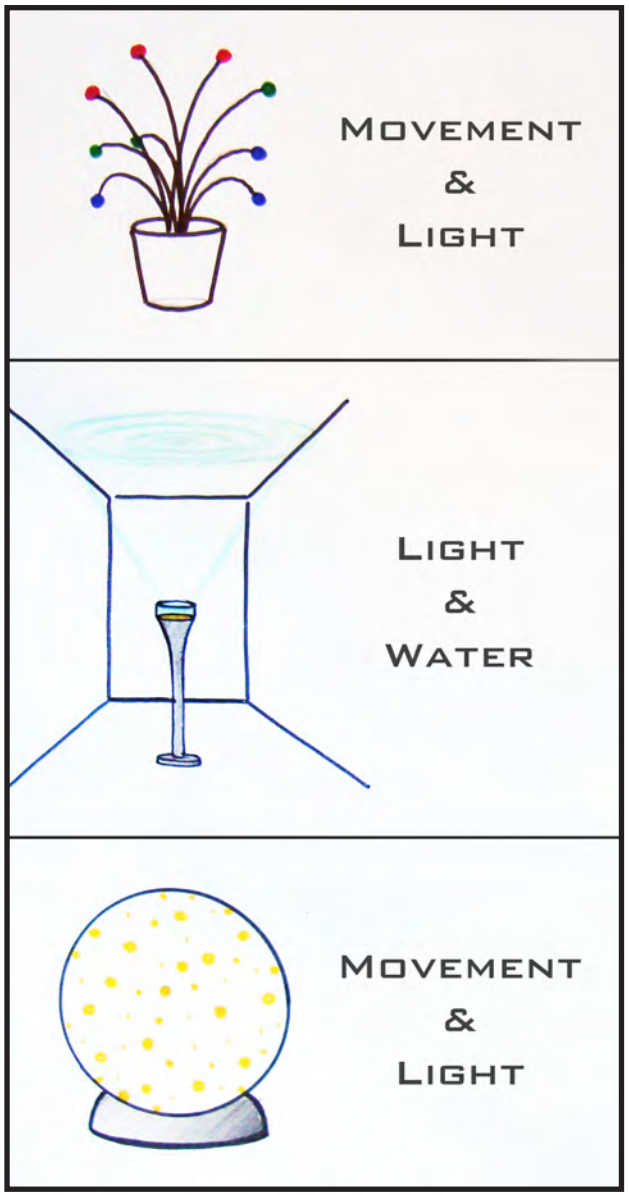


My first ideas were either water, light or shape based. In the week before the interim exhibition, I looked for interesting examples of combinations of these three modalities. In my previous module I did a module on multimodal design and I sought to apply that knowledge in this project. The main advantage of a multimodal approach is that different layers of information can be assigned to different modalities, keeping things orderly. In this project there are different information layers (resource, amount, people, time, etc), so this approach could benefit the design.
The 3 ideas that jumped out for me and that I focussed on during the exhibition were:

• A tree with moving illuminated branches. The shape of the branch indicates a level of consumption and the light can indicate the resource or person to which it applies.

• A volume of water that is projected on a ceiling with light. The ripples in the water can communicate resource consumption in a very ambient and calm way.

• Fireflies in a jar. This is idea is based on a metaphor of light emitting bugs. The fireflies can have different colours and behaviour (flying, rest, etc) to communicate consumption.



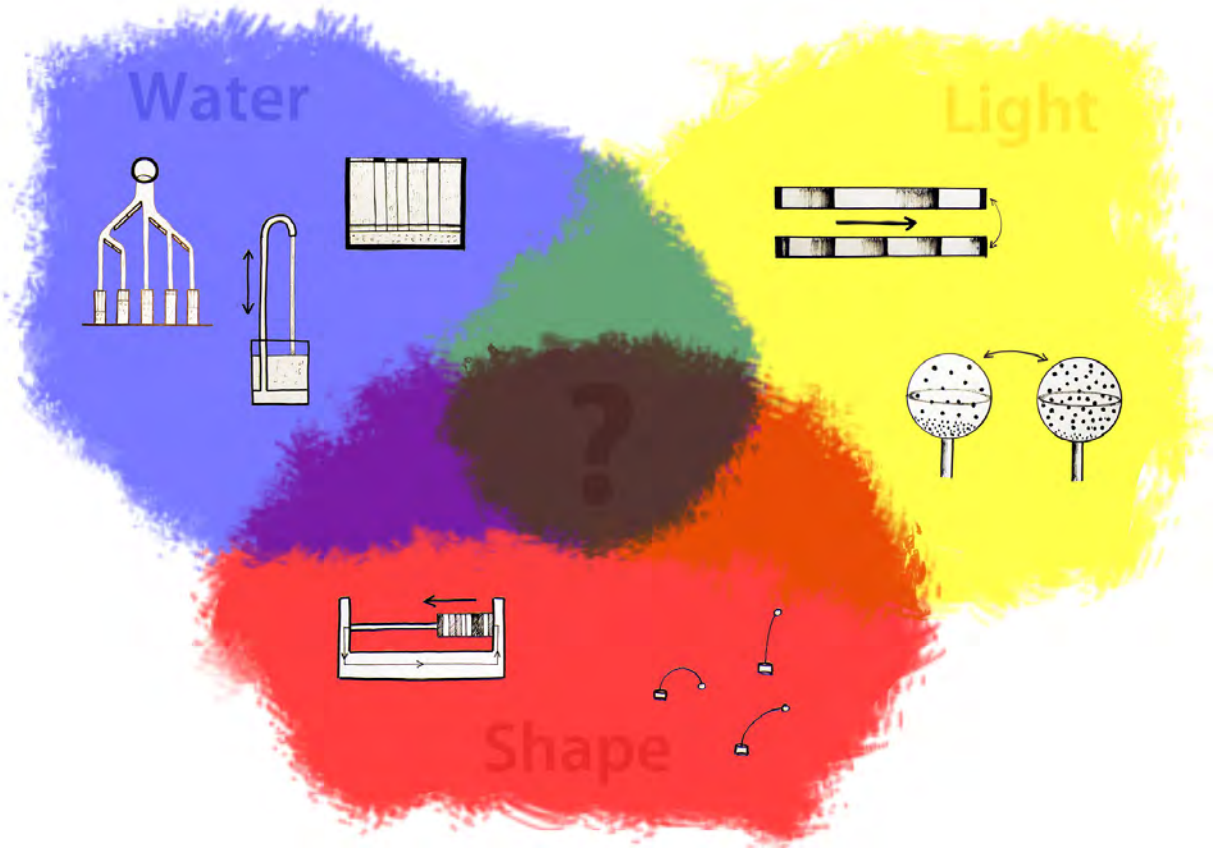
selection of 3 interesting ideas

Exhibition

The main purpose of the interim exhibition for me was to give my coach and client an overview of my project and the development of the direction that I had chosen for the project. I presented examples of information decoration to give an impression of the design style that I wanted to use in my project. I also presented the resource I wanted to focus on: (Hot and cold) water. I thought this was an interesting direction, because it involves the 3 major domestic resources (gas, water and electricity). I presented my ideas and the direction of combining multiple modalities in my concept.

In the feedback I received from my coach and clients, one word came back often: motivation. My project had developed in the direction of informing people about their resource consumption, but I should also add the aspect of motivating the responsible use of resources. Earlier in the project I already concluded that there was something missing from existing designs and this is the aspect of motivation. This was also missing in my ideas, so I felt I should incorporate this in my project.

Sustainability is a hot topic right now and many people and organisations are trying to find ways to get people to use fewer resources. This means that there must be research available and being done on this subject. I decided to focus on this topic in the upcoming research phase of my project. I wanted to investigate the science of motivation and more specifically how this is being applied for sustainability purposes.



Research

Research

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- What motivates people
- Game elements

Research

The goal of this research phase is to learn what kind of motivation would be suitable to improve Environmentally Responsible Behaviour (ERB). I made a literature review of this research. For this review I read about 30 articles. Out of these 30 articles I only included the ones in this review that had a direct influence on the concept development. The complete review can be found in an addendum to this report, this chapter only contains the conclusions I used in my project. For this review, I first studied the research on the effectiveness existing solutions to motivate ERB. Then I looked deeper into what really motivates people and finally I looked into the more current research on motivation to learn about state-of-the-art developments.

Effectiveness of existing solutions

A significant part of our total resource consumption (about 30%) can be attributed to domestic resource consumption. Furthermore, 30% of the domestic resource consumption can be attributed to behavioural choices; people can save 30% on resources by changing their behaviour. What these percentages mean to me is that it's definitely worthwhile to design something that motivates people to reduce their domestic energy consumption. The fact that simply the presence of a feedback device (mental trigger) does already reduce resource consumption is also interesting for my project.

How people receive this feedback is also of importance. Studies show that feedback on the use of individual devices is more effective than only overall feedback. However, a combination of multiple local and a central display seems to be the most effective way of giving feedback. Comparing the resource consumption of different households is considered the least useful feedback, because each household has their own composition, values and behaviour. Instead direct personal feedback is considered to be more effective. This is especially true for social feedback that comes from other people (in competition or collaboration situations).

Many studies also agree that feedback/information on resource consumption alone will not be enough to motivate significant and long-term behaviour change. People need something that is more engaging and that they can attribute real value to. The fact that information alone is not enough of a motivator is of great importance for my project. Initially I was focussing on information decoration, but this approach might therefore be insufficient for this problem; I need other motivation.

What motivates people

One of the things that many studies confirm is that social feedback is more effective than factual feedback in motivating ERB. So to motivate better ERB, a form of collaboration or competition with the people in one household might prove to be effective in this case. Research also concludes that obvious and direct feedback is more effective than indirect and ambient feedback. Improving ERB is a complex task in itself, because there are many resource consuming events in an average household. So if the feedback depends (too much) on cognitive effort, which is more likely in indirect/ambient feedback, it might not be useful to stimulate ERB. For me this is another argument that says that the use of information decoration in my design might not have the desired effect on ERB.

Studies show that intrinsic motivation, motivation from the rewarding qualities of experience that they provide, lead to more sustained behaviour change than extrinsic motivation does. Extrinsic motivation (e.g. money or facts) might seem to be a logical choice to use as motivation for ERB, because it appeals to everybody, but it's unable to produce durable behaviour change. With intrinsic motivation the motivation comes from within and allows the user to set their own goals and make their own decisions on how to improve ERB. Studies show that the freedom to make your own choices in how to improve ERB, had positive effects upon their degree of internalized motivation.

Many people associate ERB with discomfort and less luxury in daily life. This doesn't have to be the case, because we can achieve significant improvements by eliminating the wasteful behaviour without compromising "normal" consumption of resources. It's important that people get the feeling that they're not punished for not being perfect, but rather feel rewarded when they do act responsibly. But even if people want to act well, there sometimes are other influences which make people act less sustainable. This phenomenon is also called Citizen vs. Consumer dilemma. People always have to make the choice between the good thing (citizen) and the easy thing (consumer).

Game elements

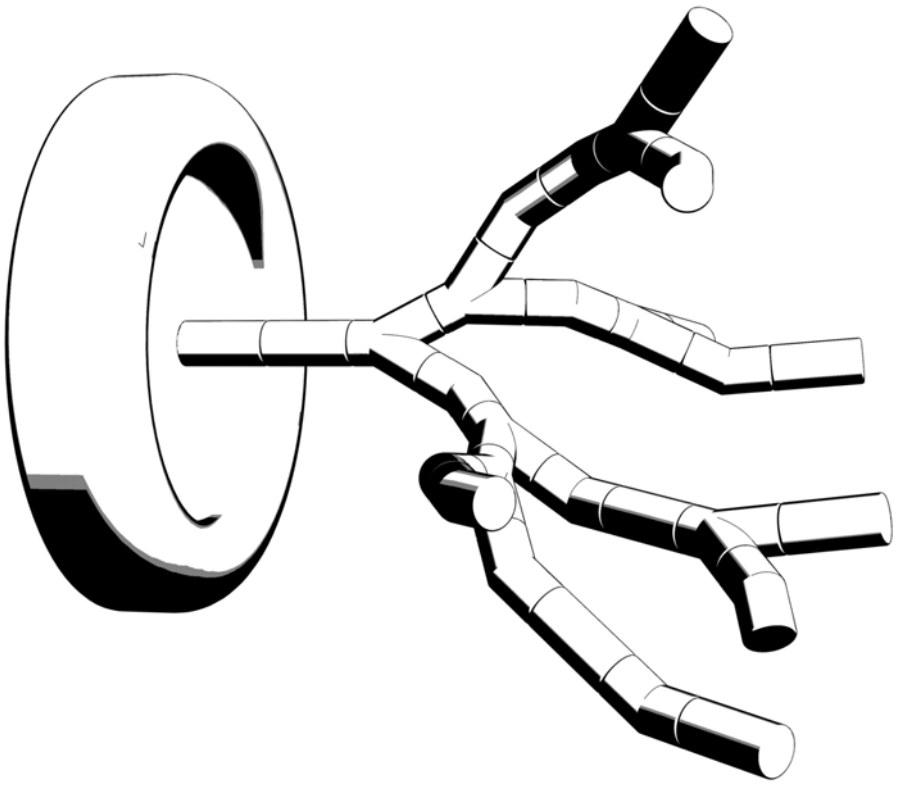
Current research (presented at TED) shows that extrinsic motivation is suitable for simple straight forward tasks. Intrinsic motivation is more suitable for complex long term tasks (the case for ERB). Intrinsic motivation is only being considered for ERB since a few years and the field is looking for concrete solutions to use as input for research. Aspects that are important for intrinsic motivation, which are also mentioned in several articles are autonomy (freedom to choose), mastery (getting better at it) and purpose (contributing to a bigger problem). These aspects have a strong connection with motivation in games. Computer games have 7 elements that make them so motivating: gaining levels, long and short term goals, always reward effort, rapid, clear and frequent feedback, an element of uncertainty, windows of enhanced attention and involving other people.

Games stimulate a level of motivation that enables players to do things that they didn't think they could do (in real life). Applying game elements to big real world problems could be an effective way to solve these problems. Games create this effect because gamers are willing to collaborate, get more motivated for difficult tasks and are willing to work hard and consistent to achieve their goals. The extraordinary effect of games on motivation has been proven many times over, but it hasn't really found a way into the real world. This is something that I want to change with my design. The concrete solution that I proposed during an expert meeting was a growing plant that indicates resource consumption. This metaphor has been thought of before, but never really worked out, so from the research point of view, that concept is worth developing and prototyping.

Applications of game elements to stimulate ERB

I've looked for designs that aim to improve ERB using game principles/elements. I found several online games and board games that focus on promoting ERB, but these had no connection to real life events. Jane McGonigal is a researcher who is developing games that influence real life as well, but this is still in development. For me this means that my approach of adding gaming elements to everyday resource consumption is still a new design direction that needs to be explored.

Development



Development

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Development

Design requirements

My research resulted in many pieces of information that could serve as design guidelines in the concept development. I therefore translated the results from my research into design requirements:

• A combination of central and local feedback seems to be the most effective way of giving feedback. My design should also consist of (multiple) local devices and a central device.

• The presence of a feedback device, a trigger, already reduces resource consumption, so the local devices should attract the user's attention when (s)he's consuming resources.

• The design should contain a social aspect, either from competition or collaboration. The users within one household should be able to compare their efforts to improve ERB.

• The design should offer something more than just information. Extra engaging elements will increase the user's awareness and pro-activity of ERB.

• The feedback should be immediate and straight forward. Feedback that requires (much) cognitive effort to interpret is not very effective in this context.

• Intrinsic motivation is preferred over extrinsic motivation in this context. This means that the user should feel in control and feel free in their actions and their goals to improve ERB.

• In the long term it's better for motivation to reward the good than to punish the bad. My design should therefore respond to the efforts of the user to save resources.

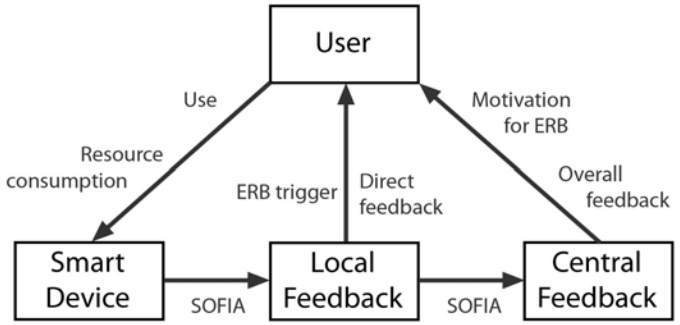
• Important aspects for intrinsic motivation are autonomy, mastery and purpose. This means that the design should: allow the user to give personally preferred input, show the progress the user is making and show what the effects are of the user's efforts.

• I want to use motivation elements from games, so I should try to apply as many of the following guidelines as I can: gaining levels, long and short term goals, always reward effort, rapid/ clear and frequent feedback, an element of uncertainty, windows of enhanced attention and involving other people.

Design specifications

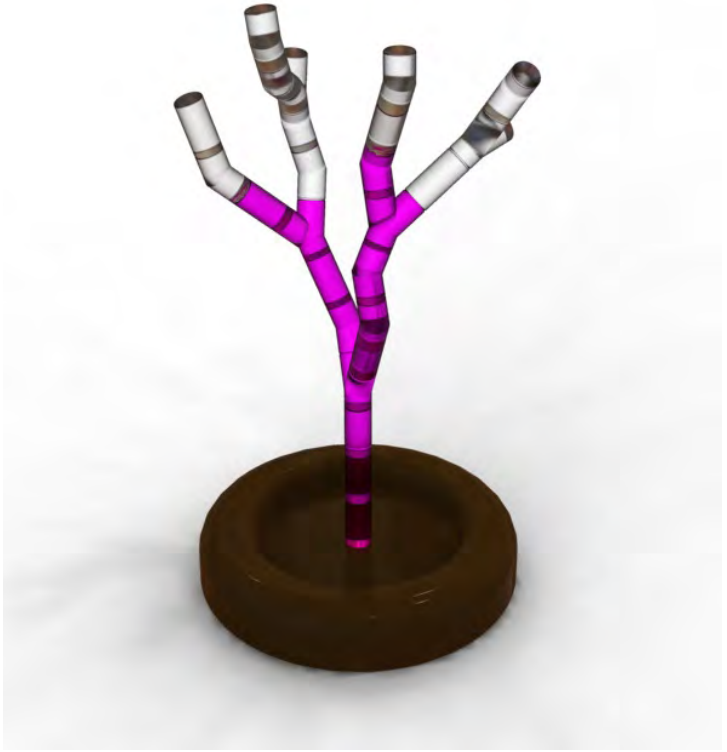
The next thing to do in the process was translating the requirements into a concrete design. Besides the choices based on the requirements, there also were some design choices that I made during the previous phases of the project. Firstly the choice of target group. I chose to focus on families with young children (8 - 12 years old, end of primary school and start of high school). The reason I chose this target group is that I'm focussing on changing behaviour and children from the age of 7 or 8 are starting to develop behaviour on how they use devices in the home. I think it's important to involve the entire family as the target group, because the social aspect of motivation is very important.

At first I made the choice to focus on (hot) water consumption, but this choice is not relevant anymore for my design. Designing for motivation has become the focus of the project, so in the development of this design I will focus more on the output from the system to the user than on how the user gives input to the system. The starting context for this project was the SOFIA system and based on this system, I made some assumptions about the input for my design. Firstly I assume that within the SOFIA system all devices will be smart. They'll get improved sensor capabilities and the capability to communicate with other devices. Each device can communicate who is using it and how much resources that person consumes. This means that the input for my design will come from interaction with everyday objects (smart devices):



With this general description of my design, I could start to focus on the design of the central feedback device and of the local triggers. The function of the central feedback device is to give long term feedback on overall behaviour of the different people in a household. It must keep track and display how well the ERB of each person is. Because I want to focus on the positive, I decided to use a scoring system and give points for trying to responsible with energy. The central feedback device will display the overall score and the local triggers will show when a person gains points with their (good) actions. I based my points system on the levelling principle that many games use. People can gain points with their actions and these are shown by the triggers. Whenever a person gets enough points, (s)he gains a level. This level is then displayed in the central display. This way the users get immediate feedback on their actions and cal also see and compare the overall results of their actions.

I chose to base the design of the central feedback device on the metaphor of a tree or plant. I chose this metaphor because trees are associated with the environment and the better you do the better your tree (representing the environment) gets. The size of the tree doesn't only represent the environment, but also the user's personal effort on reducing resource consumption. Plants are also something that people use a decorative objects in their houses, so the object wouldn't be an alien object in-between the rest of the objects in the house. The way it works is that the user can build the tree with building blocks. These blocks have a light source inside them that will light up when a level is gained. Each time a level is gained the next block turns on until all blocks are turned on. When this happens the user can add a piece to the tree, and the level starts over again. This means that the system has no levelling limits and can keep growing indefinitely with enough pieces.



One thing that was hard for me to define at this point was the trigger. Both the form and functionality were still very open, so this part of the concept needed some more development. The design of the trigger strongly depends on how the point system is implemented. I also knew that it should attract attention, because it has a behaviour triggering function. The feedback it gives should also be very clear in whether an action was good ERB or not. To find a form that supports this functionality I planned in a prototyping week and a small test at the end to compare different solutions to this problem.

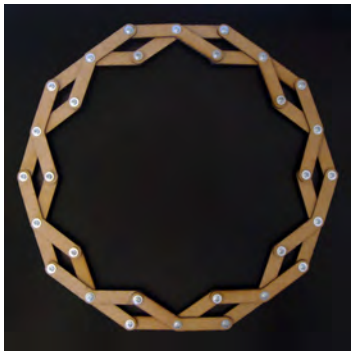
Trigger Prototypes

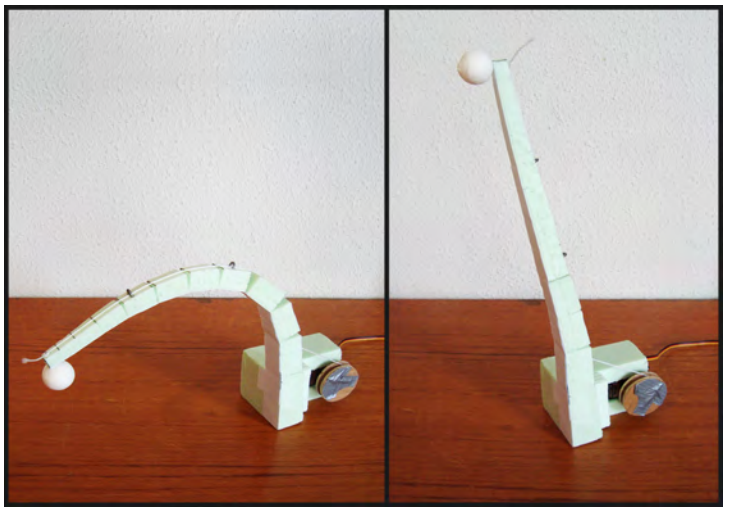
This semester I did a self-organized module about prototyping. In this module I spent one week on building prototypes to solve a concrete design challenge (in this case a camera for use during winter sports). I learned that this prototyping approach is suitable for small design challenges where the context and functionality are already reasonably well defined. I used this method to create many possible shapes for the trigger and do a small user test to see which one worked best.

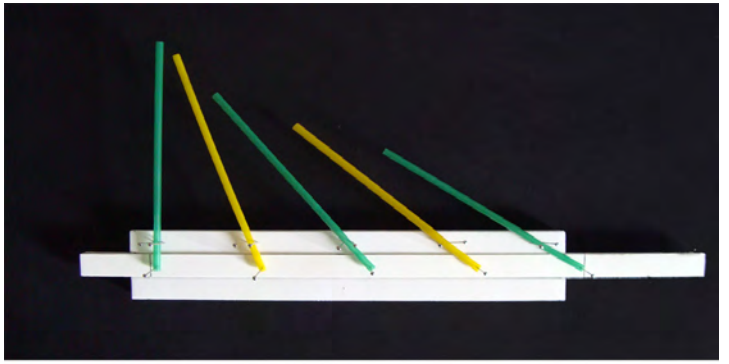
I chose to use inspiration from plants and trees for this part of the concept as well, to create a (mental) connection between the trigger and the central feedback device. I started by sketching plants and trees and possible shape changes and behaviour that they could have. I made prototypes from the ideas that I thought had some potential. Out of these prototypes I chose 3 for

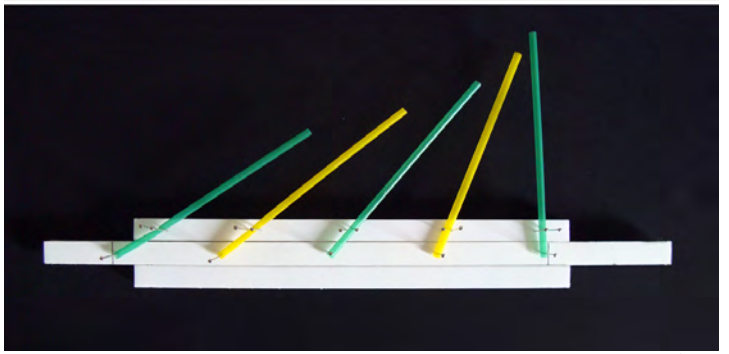
a small test. For this selection I chose 3 prototypes ranging from more abstract to more concrete shapes. I wanted to do a small test with children to learn which design worked best as the trigger and whether an abstract or concrete metaphor was most suitable in this context.

For the test I invited 4 children (Siem, Mario, Huub and Evi, age 9 – 12) to participate. I explained that my concept was about giving feedback on ERB and that these prototypes could show them how well they´re doing. I showed one prototype at a time and it´s behaviour to each person separately and asked them if the prototypes communicated good or bad behaviour. For the flower/ star shape the opinions were divided, some thought the open shape was positive and others the closed shape. For the waving grass prototype, the test users did assign one side as good and one as bad, but some thought left high was good and others bad. The sagging branch proved to be most clear, because everybody thought that a hanging branch was bad and an upright branch was good. It reminded some of a plant that hangs down when it hasn´t had any water and getting back up again when you give it water.









Game elements

The last requirement I mentioned is applying as many of the 7 design guidelines as possible. I have applied 6 out 7; using windows of enhanced attention did not seem of added value to this design.

• Gaining levels: the size of the tree represents the level of good ERB from a person.

• Long and short term goals: The trigger represents a short term goal and the illuminated building blocks and size of the tree the long term goals.

• Always reward effort: points are awarded for trying to do good (turning off the light, taking short showers), the effective results of the actions are of less importance.

• Rapid, clear and frequent feedback: The trigger responds to each resource consuming event.

• An element of uncertainty: The user doesn´t know what kind of building block (s)he will get next.

• Involving other people: Each person has their own tree, so people can compare and compete.

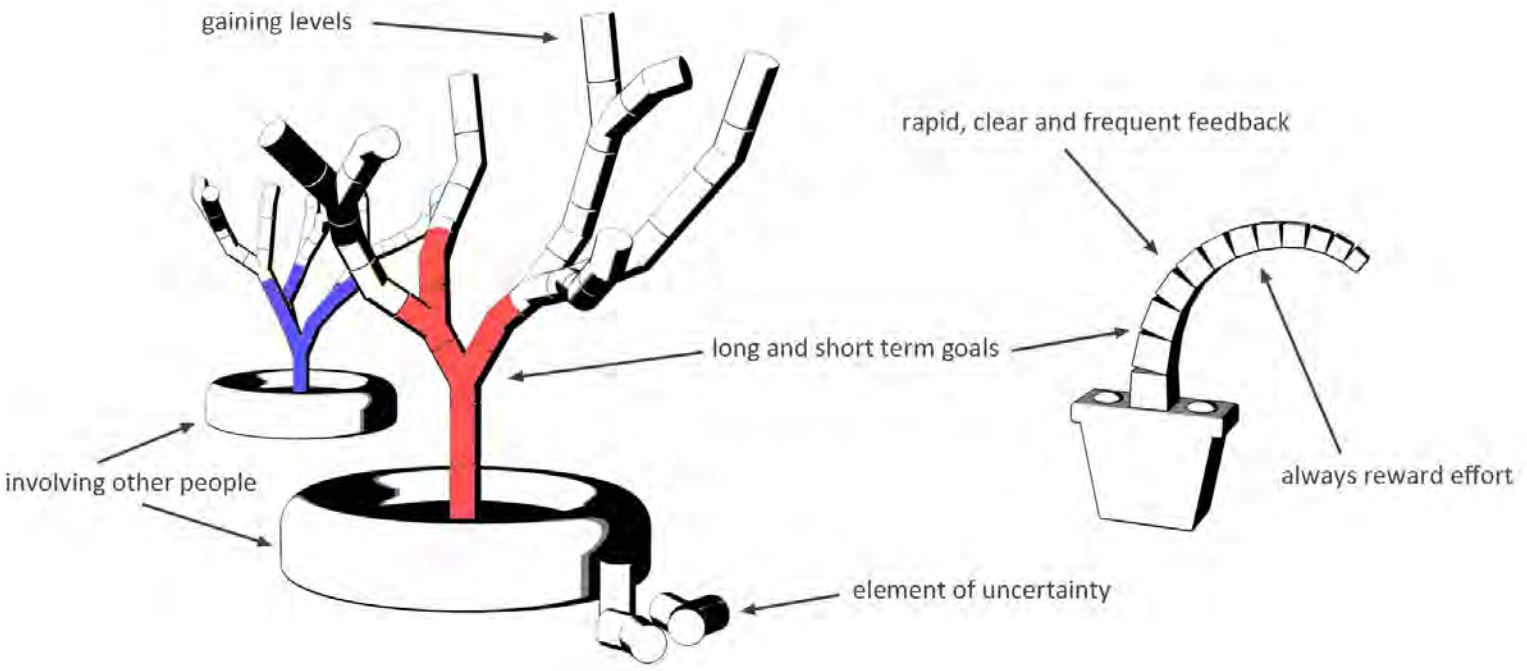


Photo Scenario

I've created a short photo scenario of my concept. The motivation for ERB is hard to capture in pictures, so I will give an overview of that in words. The two main motivators (especially for children) are competing with others and building your own tree. Each time the tree gets bigger, it will take longer to earn another piece, so it starts easy and becomes more difficult over time. For the parents these aspects might be less motivating, but their motivation also comes from teaching their children about ERB, seeing them improve and saving (money on) resources. The children can learn from their action, because of the direct feedback, without being told what to do. By using this design from an early age, children can make good ERB part of their normal behaviour.

Photo scenario on next page

Future development

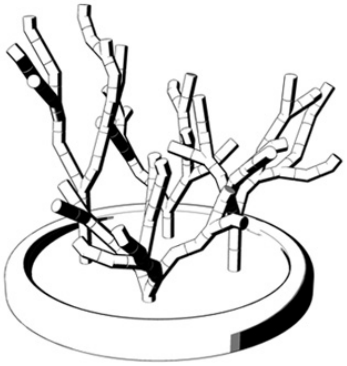
I have created a fairly complex design, because it's connected to many devices and used by multiple users. Because of this complexity I could only develop a limited part of the concept in this project. If this design would be applied and tested, there are a couple of things that need to be developed further. Earlier in this project I had an expert meeting with Cees Midden about his work in the field of motivating ERB. I've had contact with him again at the end of the project and he also gave me some input on what I should do to get this design to a level on which it can be tested.

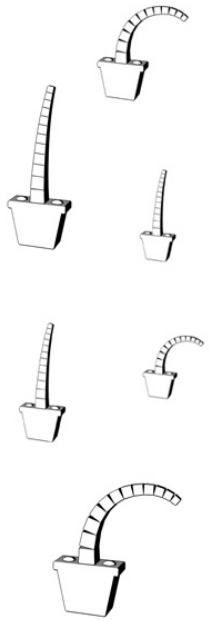
One aspect that still has to be worked out is how points are awarded for ERB. There are some straight forward examples, like turning off a light or taking a short shower, which are good ERB. However, right now the system is vulnerable to abuse by simply turning on the shower for a few seconds and that would indicate that you took a very short shower. Also if someone does not take a shower every day, that would be good ERB and needs to be rewarded by the system. The system almost has to be able to read the mind of the user and determine whether a person is really trying to save resources. The user's intentions can be determined to a reasonably high degree with advanced sensors and intelligent software, but this will require a more development.

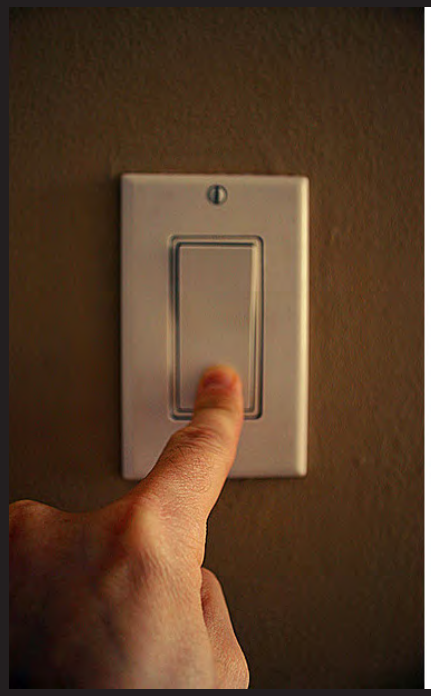
As I'll mention later in the user test chapter, further investigation is needed to determine if gaming elements really are useful to motivate ERB. As far as I can tell this is a new design direction, so not much is known about it (in research). To test the effects of design properly, a working prototype is needed. This means that domestic appliances also need to be connected to this system, so the resource consumption can be monitored. Smart devices and smart homes (as envisioned in the SOFIA project) are still something of the future, so until then longitudinal testing is unrealistic. There are several smart home prototypes in the world (e.g. Philips' Home lab), but testing in these situations would require users to live in these laboratories for unrealistic periods of time.). I did do a simple on-the-spot test with prototypes, which I will describe in the next chapter.

1

The design consists of one miniature garden with trees (one tree per person in the house) and multiple triggers (one per room).







2

Turning off a light will earn you points in the system

The system is connected to a smart home, so it knows who does what

3

The triggers remind the user of their behaviour and give them feedback on the actions directly

The design works for all devices in the house (using water electricity and gas)

4

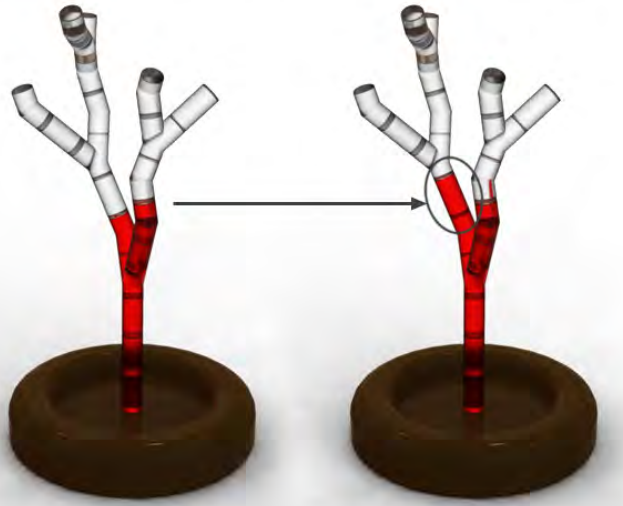
5

Once the user has done enough good things they will earn a point.

This is indicated directly by the trigger, which is upright and gives a colour signal.

6

This point is also shown in that person's personal tree in an extra coloured piece.



7

Once the tree is completely coloured, the user may add a piece and (re)build.

8

Each person in the household has their own tree and they can build it any way they want.

The motivation for ERB comes from creating the tree and competing for the biggest tree.

User testing

User testing

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User testing

Test setup

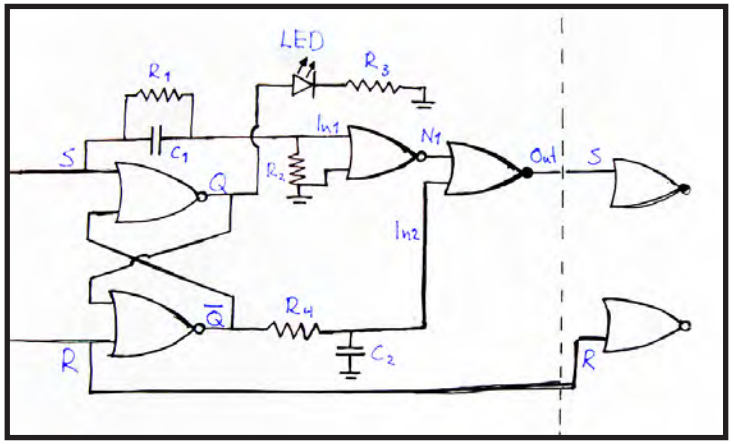
In the final phase of this project, I wanted to test some aspects of my concept. Firstly I wanted to test the effectiveness of what I consider to be the two main motivators in my concept. These two motivators are competition with other people and building your own tree by earning the building blocks needed for that. I wanted to test the motivators especially with children, because for me it was hard to foresee if this design appeals to them. Parents have many extra motivators like educating their children and using fewer resources; children really have to get the motivation from the design itself. Secondly I wanted to test the technical feasibility of the design by making a proof-of-concept prototype. The user has a large amount of freedom when building their personal tree, so the technology needs to be flexible. With this prototype I wanted to test if it's possible to build modular building blocks that can be assembled randomly and still light up incrementally.

For these tests I built 2 separate prototypes. I built 2 prototypes because it was too difficult (within the time I had left) to combine the desired shape of the design with the desired functionality. I therefore made one proof-of-concept prototype that consisted of 5 building blocks, with LEDs and electronics inside, which could be stacked in any order and still turn on sequentially. The second prototype did not contain any electronics, but rather consisted of over 30 building blocks that could be assembled in any order to form a tree. For this prototype I build 3 kinds of building blocks to get the variation needed to create a random/organic shape; straight, bent and splitting pieces.

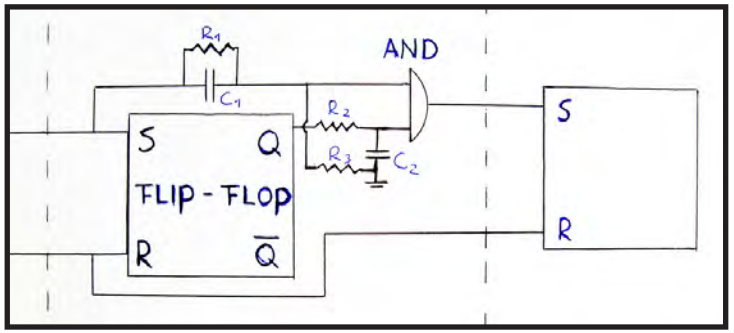
Proof-of-concept

Designing the electronics for this prototype was a little beyond my capabilities, so I asked for help in the E-atelier. I contacted a student assistant with very specific requirements and together we looked for a solution to this problem. In short, the requirements were 5 modular units that could be connected in any order and a base unit with one signal (to turn on the next block) and one reset button. We designed two versions of the circuitry; one elegant but complex version and one simple but wasteful version. The elegant version used only 1 IC and fewer components, but the complete circuit was more complex and more experimental. The simple approach used 2 ICs and more components. The circuit was simple and guaranteed to work, but the package of electronics would be bigger than the elegant solution.

Elegant solution

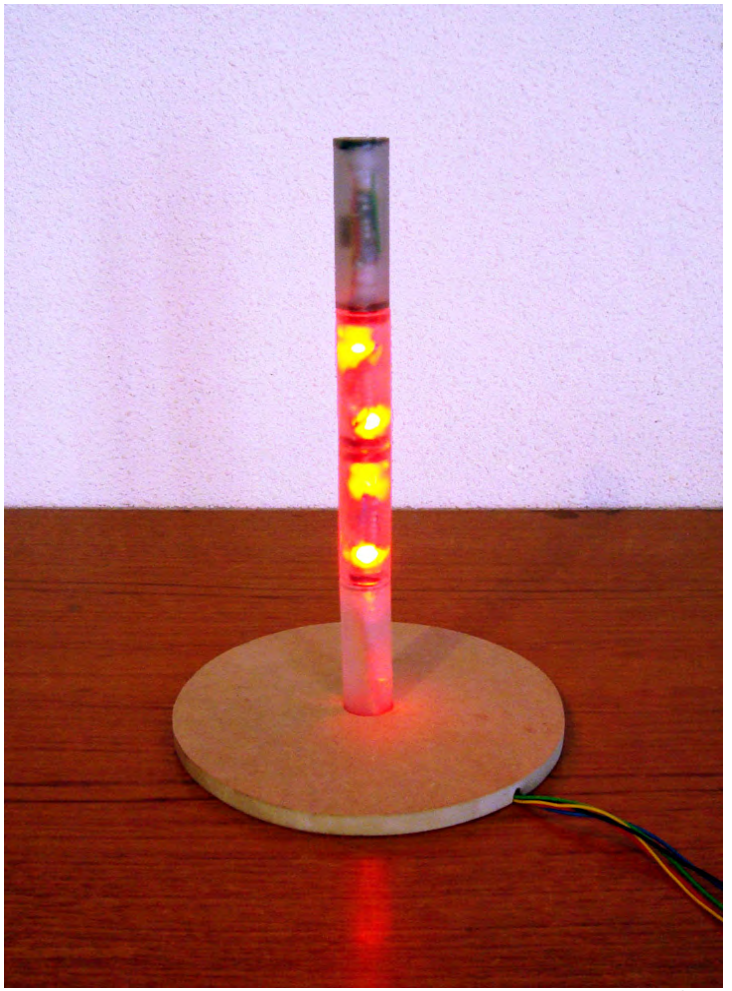


Simple solution



I wanted to keep the building blocks as small as possible, so I started with the elegant approach. Unfortunately I couldn't get this working, even with the help of electronics experts, so I had to switch to the other solution. The bigger package of electronics meant that the building blocks became larger than I wanted them to be, but at least I had proof of concept. The people from the e-atelier also ensured me that when this circuit would be built for a mass produced product, it wouldn't be larger than the two LED's and would fit easily in a much smaller casing.

Proof of concept



User test

For the user test I built a prototype that allowed users to assemble their own tree. This prototype consists of a base unit and 30 building blocks in different shapes. The blocks can be connected by pressing wooden pins in corresponding holes (like LEGO) and each piece could be rotated in 5 different positions. The construction of the pieces allowed for endless building variation and the complete freedom to build a tall, wide, symmetric or irregular tree.

For the test I had the part of building the tree covered, but I still had to simulate the competition element to test this as well. I decided to simulate this by letting the test subjects do a short written test. In this test they had to think of ways to save to save energy in the house. The person with the most (correct) answers would get the most blocks to build a tree. After this question, each person (in turns) got the opportunity to build a tree and in the end the person with the nicest tree would "win". Judging the beauty or quality of a tree is impossible, but for this test the purpose was simply to create the element of competition between the participants.

I invited 5 children from my neighborhood for this test and first we talked about why it's important to use fewer resources in the house. From this talk I learned that children of this age (9-12) know that this subject is important, but don't really do anything to save energy themselves. This was a good outcome for me, because this means that these children need an incentive for better ERB. After this short talk we did the written test and these are the outcomes:

- Mario: 7 right answers
- Dimme: 8 right answers
- Siem, Huub and Evi: 9 right answers

Common answers were: Turning off TV when not watching, turning off all lights during the day, taking short showers, No lights in the Christmas tree, only having 1 computer in the house, wearing an extra sweater when it's cold and turning devices off instead of on standby.

After that each person got to build a tree. This was the most interesting part for me (and also for the children), because now I could see whether the design motivated them. I observed that everybody was very involved when other people were making their tree and that everybody wanted their tree to be different from the other ones. The kids were enjoying this part of the test and were curious who won. Of course everybody thought that their own tree was the best and in the end we voted, including a few bystanders, and we agreed that the tree that Evi made was the nicest one. Of course this was a very simple and limited test, but I did get the impression that both the competition and the building of the tree were very motivating for the children. Whether this would really lead to significant and sustained behaviour change is something that needs much more research.