



*“A classic fairytale in modern technology,  
encouraging people to leave the masses and follow their own fantasy”*

This project is about designing a system which leads people unconsciously, but in a playful way, to certain places in the Efteling. These places are the places that are the most quiet. The aim of our project is to create a way to guide the people without them feeling guided. In this way, the visitors will be spread more evenly over the park without a negative experience. The final concept will trigger the visitors to follow their fantasy and go on a quest to find the frog prince. They will unconsciously take the path the Efteling wants them to take

# Contents

Contents .....	3	Overview .....	14
Introduction .....	4	Usertest Prototype .....	14
Process .....	5	First Prototype .....	14
General process .....	5	Second Prototype.....	16
Teamwork .....	7	Design.....	17
Concept development.....	8	Final concept .....	17
Form development .....	9	Location.....	17
Technology .....	10	Storyboard .....	18
Interactive Model.....	11	Prototype .....	20
Overview .....	11	Use and Technology .....	20
Model out of cardboard.....	12	Design.....	21
Getting started with Arduino .....	12	Interactive Prototype .....	21
Model out of wood .....	13	Use and technology.....	22
Prototype .....	13	Design.....	23
		Conclusion and Recommendation .....	24

# Introduction

The Efteling is an amusement park for all ages. Efteling want to be park for all generations with stories that concerns us all. The Efteling is built on fairytales. You can't find anything that hasn't got a real 'Efteling feeling, everything has a magical touch. When a design is made for the Efteling, it's very important to keep that in mind.

When people go to the Efteling, they want a day with fun full of magic; they want to do what they want. They absolutely don't want everything to be figured out before like in daily life. They go to the Efteling with the idea: we will see what comes on our path. They let the Efteling lead them through the park. Right now there are visible signposts at every attraction, marking the queue time. These signposts aren't really playful and magical and the Efteling still struggles with the mass of people that are coming every day.

This project is about designing something for the Efteling to lead people in a playful, unconscious way in a certain direction. We chose to design a system to lead them away from the busiest places. Our concept is connected to Aquanura, the big water show, which has a powerful fairytale. We took the more extensive version of the story to base our concept on.

The final design is an interactive fountain system that will lead people through the Efteling by the use of water. Water has a great power of attraction on people; it has something magical in it. To show our concept, we decided to make two kinds of products: one to show the interaction and another one to show the technology behind our concept. Because we made two different products, there will be first a general part of our project and then the two products will be explained separated.

We would like to thank Mark de Graaf for his good advices and support on our project. And we would also like to thank Mariëlle Coppes; she gave us advice on how to go through the design process, and how to work with water.

# Process

## General process

This first semester started with a pressure cooker, an entire project in just a week and a half. We went through the whole design process together and had to present our ideas. We started with inventing ideas for the three different goals given:

- A group of people is visiting the Efteling. They are scattered all over the park. Attract them to a meeting area
- Divert people away from crowded attractions, towards the attractions with shorter waiting periods
- Seduce people towards restaurants or shops

After the presentation of the ideas, we choose one idea, based on the feedback we got. The listeners were most enthusiastic about the idea of the magical wind. We expanded this idea and linked it to a fairytale we made up. The feedback on the idea we presented in the second presentation was very good, but we also received some remarks. You can find the feedback we got in the appendix. After the presentation, we had to expand the idea into a real concept and present this again. People thought it was less believable and did not like it that much anymore. Complete feedback can be found in the appendix.

After the pressure cooker, we decide to think about other ideas to seduce people to take a certain road. We decided to do so because of the feedback we got at the third presentation of our concept. We noticed

that we were not that positive about the idea and agreed that we would think about an idea we liked more.

We started brainstorming with post-its. Everything which came to our minds we wrote down on a post-it and pasted it to the other post-it which inspired us. While we were brainstorming, we also searched for information on the internet. In this way we tried to get an idea of what already has been done in the directions we were thinking and if we could use these products or ideas. When we had a few ideas, we chose three ideas to elaborate on. After we had done so, we chose one idea we thought was best and made up a lot of variations. We thought about how to communicate the idea and how to test it.

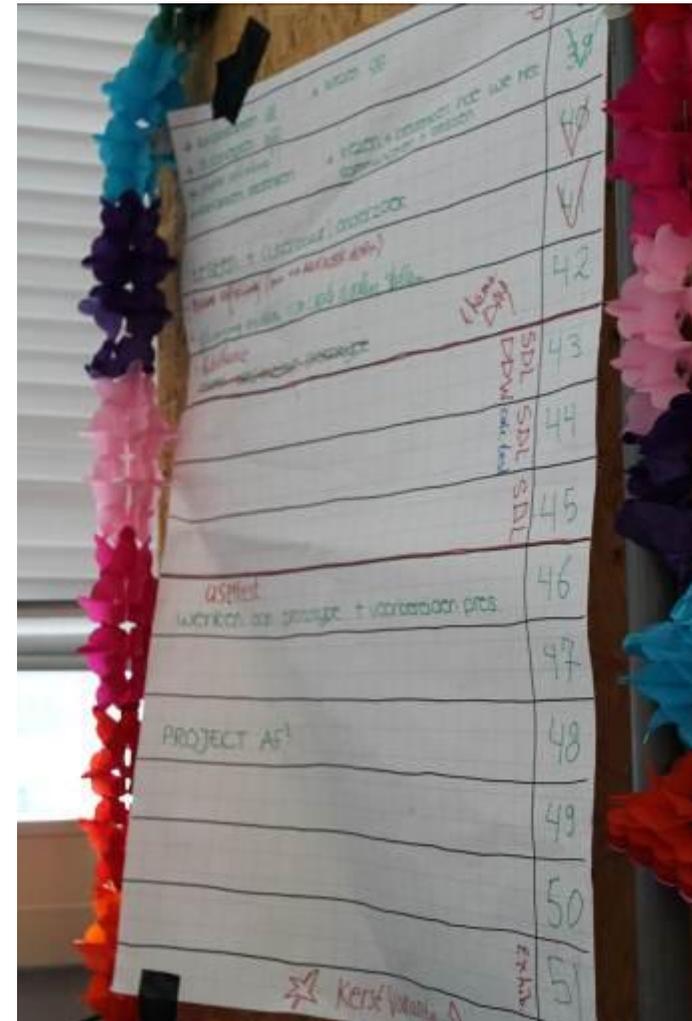


We agreed that a planning is very important to get everything done in time. We decided to get the project finished two weeks before the exhibition, in case some things would go wrong. Looking back on our first planning we can conclude that we were too optimistic. During the process we spent a lot of time brainstorming and adjusting the idea over and over. If we would have stopped brainstorming earlier and started making things, our planning would have worked out better.

When we had chosen one idea, we started thinking about the people which come to the Efteling. Which people do visit the Efteling and what will they tell at home? We wrote stories about what we thought people would tell at home, and what the motivation would be of certain groups of people to be guided by our concept. Details can be found in the appendix.

Because we are designing a product for the Efteling, we found it very important to have a clear image of the Efteling. We also wanted to know how people determine their route through the park. Therefore we decided to visit the Efteling. Before we went to the park, we made a questionnaire for the other visitors of the park and we considered where to look for in the Efteling. The questionnaire can be found in the appendix along with the results.

After this visit, we processed the results and wrote a conclusion of our experiences in the Efteling. We got a good picture of the way people behave in the Efteling and we also noticed that water fits very well in the Efteling. The full conclusion can be found in the appendix.



For the usertest we had to split up the tasks. Half of the team would look for a location to test and the other half would create a prototype to test with. It turned out to be impossible to test our idea in the center of Eindhoven, because you would need a permit to do so. We put the idea on hold and focused on making the interactive prototype.

After the SDL weeks, we had a meeting about the concept. We had to have all the same idea about the concept and we considered what to do next. Together we made up a story for our concept and we divided the tasks for the prototypes we wanted to make. The following weeks, we worked on the prototypes. In the last week for the exhibition, we had our last meeting and prepared for the exhibition.

### *Teamwork*

In the beginning of the project, we worked together. We brainstormed and chose the idea together. In meetings, we decided how to elaborate the idea and how to create a good way to communicate the idea.

In the first few weeks, our meetings were not very efficient. Actually, we did not have clear meetings. In between the conversations, we also made calculus and wasted time on the internet. This was not efficient at all and we decided to participate in a meeting workshop together. We perceived that something had to change. We appointed a chairman and a secretary. We also agreed that we would not use our cellphones or laptops during the meetings without explicit permission of the chairman. The meetings turned out to be more efficient and we stuck with this working method.

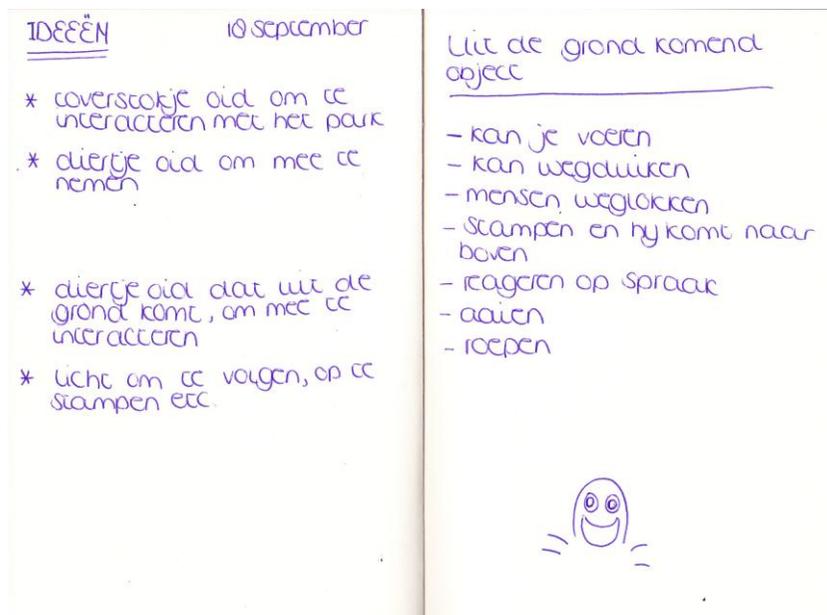
When we had a clear concept, the time came to split up tasks. During the previous weeks, we also worked on little tasks individually. Half of the team started creating an interactive prototype for the usertest, the other half started planning it. When it became clear that a user test was not possible we decided that working on one prototype with four people at the same time was of no use, so one half of the team started making a visualization of the concept.

It turned out to be a very good decision. We all got our work done in time and in this way, we had two things to show at the exhibition. Working in this way was also a bigger contribution to our own development, because every member got to do a lot more individually compared to four people working on the same project.

## Concept development

### Idea generation

After the pressure cooker, we decided to think about another idea. We started brainstorming in another way than during the pressure cooker. We all took a bunch of post-its and stuck post-its with everything we came up with on a cardboard and on the table. In this way, we generated a lot of ideas.

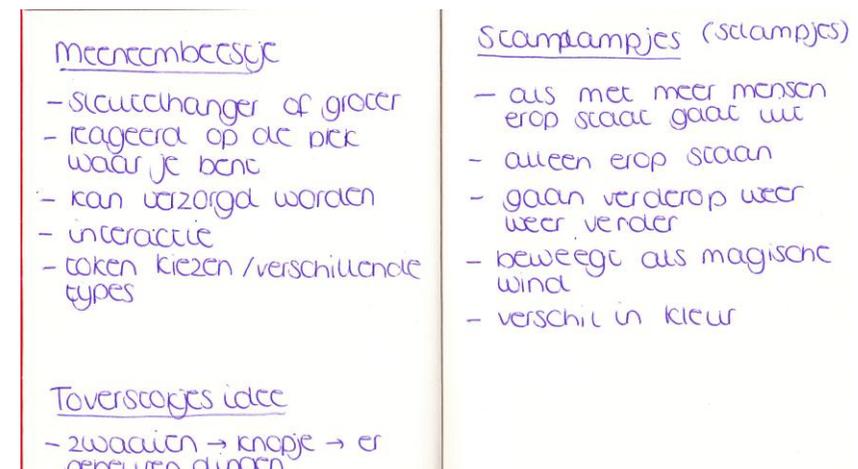


This are the ideas generated in our post-it brainstorm (right page) and the three concepts we have made up (left page)

Further ahead in the process, we generated ideas by writing down the main idea, and writing our ideas around it. In this way, we got an overview of ideas and we could easily sort them. This made it easier to choose ideas concerning several aspects of the concept.

### Decision making

After the post-it brainstorm, we ended up with three main ideas. When we stopped brainstorming, we started talking about these three ideas. How could we use these ideas? After the conversation we all had a clear view of the ideas and our preferences concerning the ideas. We all shared our preferences and distilled everything down to a single concept. It was very clear to us that we all liked this idea the most and that we would elaborate it during the remaining part of the project.



These are the other concepts we created out of the ideas generated in the post-it brainstorm

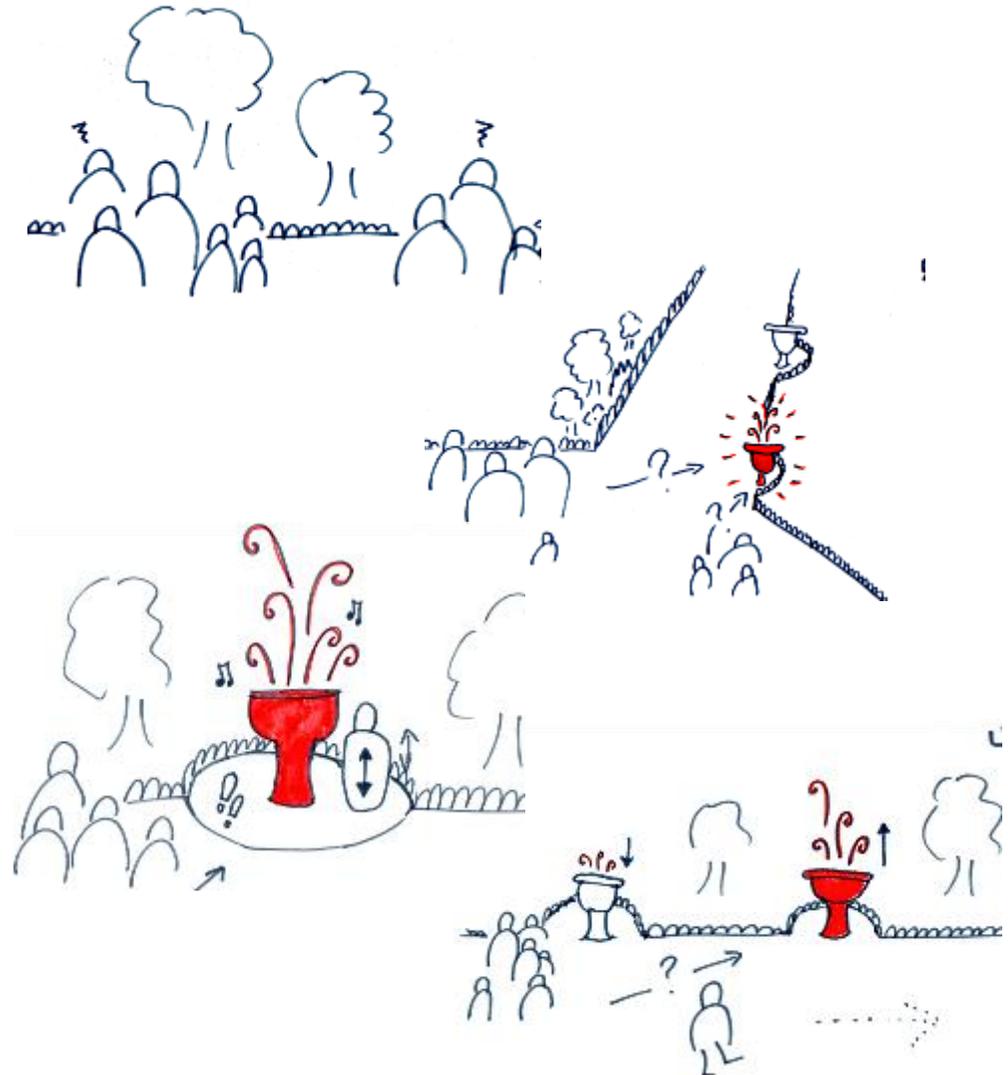
### Form development

The first concept consisted of little lights in the ground, which people had to follow. These lights will disperse all over the path, simulating water. After some discussion, we decided that LED's would not fit the Efteling. However water would.

We came up with the idea of fountains. These fountains would interact with people. We wanted to connect the idea to a fairytale, the fairytale of the frog prince. We thought of a "frog" (water stream) jumping out of the fountain, leaping to another fountain which becomes active.

But a "frog" jumping out of the fountain and leaping along the path would make people lose interest fast. This made us decide to create vertical fountains, but the water would come out of the ground. The water system will be integrated into the path and when the fountain is not working, one won't see there once was a fountain.

The idea of a fountain which becomes more active when more visitors approach the fountain stayed in the concept. Out of this fountain would jump a "frog" illustrated by a water jet and the croaking of a frog. The "frog" reacts to the speed of the visitors following it.

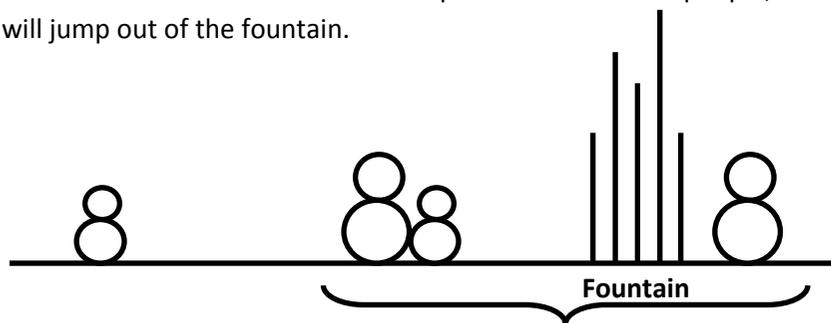


## Technology

The concepts involve several techniques. Iron Henry telling the story demands an audio installation. The puppet of Iron Henry has to move like a real human. We don't specify this technology, because it is the same as the puppets already used in the Efteling.

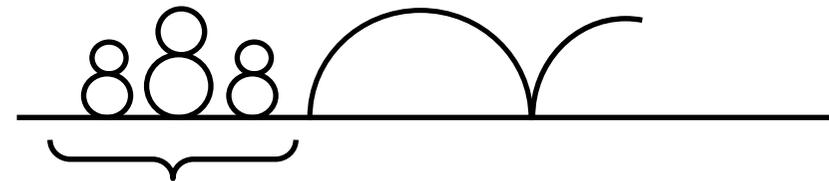
After Iron Henry stops talking, a fountain along one of the paths should be activated. The fountain which should be activated is the fountain in the direction of the part of the Efteling which is the quietest. There should be an installation in the Efteling to measure the overcrowding. This system would send a signal to the system of the fountain so the right fountain can be activated.

Visitors could also hear the croaking of a frog, so there should also be a sound installation along the paths the frog could jump. When people come closer, this will be measured and the fountain will become more and more active. When there is a specified amount of people, the frog will jump out of the fountain.



*System measuring the amount of people and their proximity to the fountain*

The frog jumping out of the fountain reacts to the people walking along. When the people walk slowly, the frog will jump slower and wait longer, when visitors are walking faster, the frog will also jump faster and wait shorter. When people approach the frog, it will jump further.



*People are detected: fountain gets activated, "frog" jumps*

## Interactive Model

After we decided on our final concept, the interactive fountains, we found that it's important to show not only the technical part, but also the interactive part of our concept. Our concept is a very large system that can't be shown at the exhibition in its total size. So we decided to make a scale model, but it has to be an interactive model. We preferred a 3D model. To make it interactive we wanted a little puppet that you can move by hand, and which can activate the fountains.

### Overview

First we made an overview what we wanted to show.

- Iron Henry telling his story.
- After he is done, the first fountain gets activated.
- When people come closer, the 'water' will jump away from them.
- People will follow the water, when they come closer to the 'frog' he will, again, jump away from them.
- When the last fountain is activated, the whole circuit is started again, from the beginning.

In our model we want 2 fountains, at the beginning and at the end. And between them little arcs, that symbolizes the way the frog travels. First we made a drawn overview with all the different steps.



We took this to our coach and acquired some feedback how to make this a realistic prototype with all interactive characters in it. He told us that it would be way more functional to make a 2D model with a little movable puppet. Out of wood was best material option. First we wanted to do something with little paper fountains to be movable, but we concluded that the water was best symbolized with light, preferred blue light. So we need to use LED's in our concept. And to let everything work automatically, we need an Arduino.

First we need to do some tests, if the LED's give the right light. And how get the light visible when the LED have to shine through Perspex. We found out that Perspex was only the right material when it's matte. That way the light spreads through the material in a pleasing way. We also found out that the background, the material behind the Perspex, needed to be white. With these demands we could start to think about our final product.

### *Model out of cardboard*

After this we did this, we made our model out of cardboard. With this we could see how much material, wood, we need. It also allowed us to decide where to put the electronics. While making this model, we had to keep thinking ahead because it will become interactive, the cardboard model did not, for example, allow us to test the electronics.



### *Getting started with Arduino*

After we finished our model out of cardboard, we went to an expert, **Serge Offermans** to ask him for help with the Arduino. His advice was to first write down all steps we wanted to show, the order in which the LED's have to light. And because we want a lot of LED's, he gives us the advice to use Shift-registers allowing us to control them separately. The advices he gave us were very useful because our group was inexperienced in using Arduinos.

First we made a drawing of the LED's and their function and what we still needed; shift-registers, resistors, reed switches and so on. Our puppet will have a little magnet in it, and this will activate the fountains (LED's) when the puppet is moved in our model. This way the model will be interactive.



## *Model out of wood*

Now we knew what we needed to be there in our model and we were able to start fabricating it out of wood. First we made all layers of our model, out of wood, and painted them; keeping in mind that the electronic parts still had to be integrated.

The Perspex needed to be enclosed by the sides of the wood, matte, and the color behind the Perspex needed to be white. Because otherwise the light isn't reflected and you won't see the bright blue color that much.



## Prototype

When we started to plan the usertest we also started designing the prototype. We started out with a quick one that would be controlled manually, so we could do a wizard-of-oz usertest. This model would only have vertical fountains. After we decided not to do a usertest we expanded our plans and started creating prototypes to be shown on the exhibition.

### Overview

Our prototype had to meet some requirements:

- Laminar water jets.
- Arcing fountains to simulate the frog jumping.
- Vertical fountains to attract attention.
- A way to control the fountains.
- A form of interaction, to make the fountains react to people.

### Usertest Prototype

This prototype would consist out of three separate fountains simply connected to faucets. They would be hand controlled and needed three separate taps to maintain enough pressure for the fountains to attract attention.

The principle was simple: the first fountain would build up when people approached, when there would be enough attention the fountain would

be turned off. The next fountain then repeated the action of the first fountain, and so would the third.

This prototype would simply be placed on a busy street where people tend to go the same way; we would use the prototype to test if we could make people deviate from their destined path.

### First Prototype

After we decided not to do the usertest we started focusing on how to actually make the water jump when approaching. To make the water jump we needed laminar jets, so the water goes absolutely straight and can be controlled. We also needed cutters, valves that can block the water and unblock it quickly.

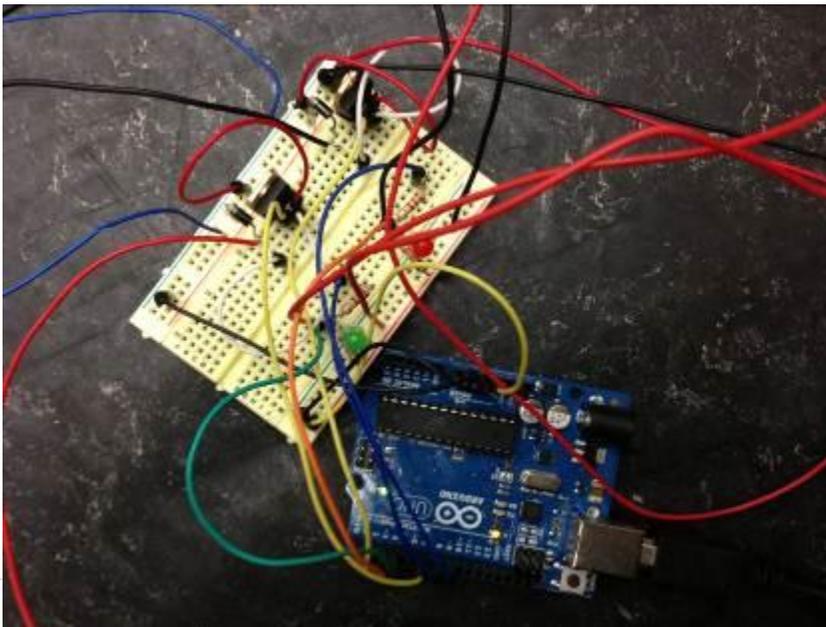
For the water jets we used big PVC pipes, they contained steel wool (to calm the water), straws (to straighten the water and were closed off with a Perspex plate. This plate had an inclined hole drilled into the center so the water can come out undisrupted. The jet could be connected by a hose adapter attached to the back. The jets would be angled for the arcing fountains, vertical fountains don't have to be laminar so could simply be hoses.

To control the fountains we decided to make cutters. Valves that can "cut" the water stream, because the stream is abruptly intermitted it creates a jumping effect. We wanted to use servo motors at first but these turned out to be relatively slow and are easily damaged by water. Our coach suggested solenoids, a type of linear motor. The advantage of solenoid is that they quickly snap into place, they are simple magnetic coils encased in metal that push a rod which is in the coil but outside the casing. The coil is protected by this metal casing, and while not strictly

waterproof they are raintight to some extent. This made them perfect for use in the cutters.

To interact with the fountains we decided to use an Arduino. The Arduino could turn off the vertical fountains, then momentarily activate the first arcing fountain, etc. The Arduino was perfectly able to do all of this, except for driving the solenoids, which required 1A at 6V each. Having the Arduino drive the solenoids was slightly more complicated, after some research a fellow student pointed us towards MOSFET transistors. The Arduino could simply send a HIGH to the MOSFET which would let current from an external power supply through, for this power supply we acquired a lab power supply we limited to 6V and 2A, so it could drive 2 solenoids.

We made simple cardboard buttons people could stand on to send a signal to the Arduino that the water should jump away. The code for the Arduino can be found in the appendix.



Finally the water jets were driven by a submersible pump, which can move 5 liters per second. The jets were individually placed in tubs, these were connected by PVC pipe to move the water back to the pump after it is pumped away.

This, however, proved unreliable (we couldn't get the pipes to be waterproof when connected with the tubs). And because the jets still move over dry land the tiniest drops would result in big water pools building up during longer use (like during the exhibition). Besides this the water could not flow back through the PVC pipes quick enough for the pump to function correctly.

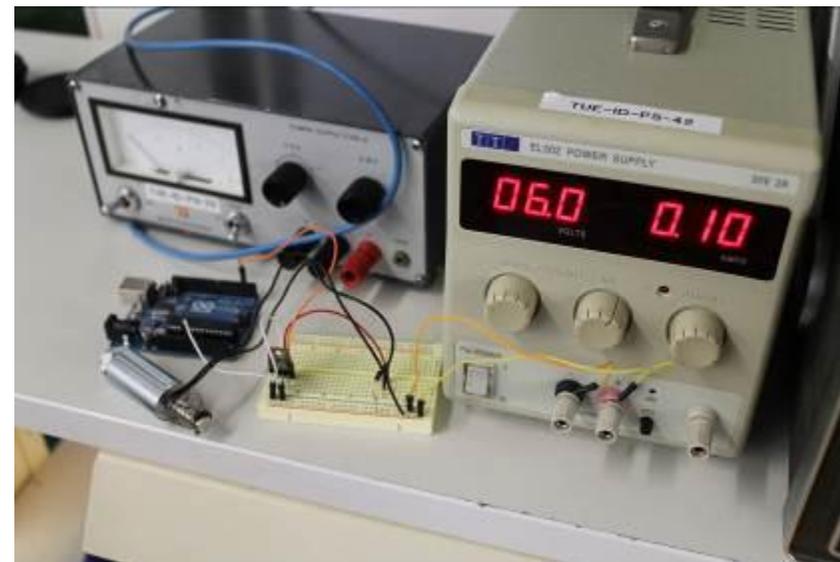
## Second Prototype

For the second prototype we used roughly the same construction as the first, but instead of three separate tubs we put the jets and pump in a children's pool. The water circulation was optimal now, and leakage was also eliminated.



We put this prototype on the final exhibition, it attracted a lot of attention, and a lot of people asked to control the water, proving even more to us that water captures human attention.

We were very pleased with the prototype, we can safely say we delivered a solid and representative prototype.



# Design

## Final concept

We choose to continue with the fountain concept because water has a great attraction on people from all ages. Our aim was to lead people in a playful, unconscious way on a certain path towards the least crowded attractions. We chose to use water to make that possible, using different types of fountains. To keep the 'Efteling Feeling' we connect our concept with Aquanura, a big water show at the end of every day in the Efteling. To this show belongs a fairytale about Iron Henry or the frog prince. We used the original fairytale in our concept. This is about a prince and his servant, Iron Henry. The prince is turned into a frog by an evil witch who is very jealous of the friendship between the prince and his servant. The servant is very sad because he can't find the prince anymore. (You can find the whole story in the appendix) The visitors will be asked to help the servant to find the prince, who is a frog now. In our concept we use the scouting expedition to lead people on a certain path. (Least crowded) The frog is symbolized with water that comes out of vertical fountains and leaping fountains. So you can't actually see the frog, except the water. And because the frog jumps in the shrubs you can't see where he's going. Only at the end of the day you can see the frog. As said, our concept is connected to Aquanura. At the end of the day you can actually see the frog in this water show. This will be the reward for your search during the day.

## Location

When we look on the map of the Efteling, you see that on Brink, a great area in the middle of the Efteling, there are many paths coming together. Therefore it is a good place to let our concept start. First Iron Henry will tell us his sad story. We want a big statue of him and his carriage in the middle of Brink. The paths which start from this point will have fountains across the path. You only see them when they are activated. How it further works is shown in the storyboard.



## Storyboard

In this storyboard is shown how the interaction works in our concept.



1. Iron Henry tells his story about him and the prince. People will have a closer look at Iron Henry and listen to what he has to tell us.



2. After Iron Henry told us his story, you will hear a croaking frog and one fountain, will give a little water show with lights and sound, to attract our attention. People will walk to that beautiful fountain. When there are more people, the water will come higher. The people have influence on the show they see.



3. When there are enough people brought together by the fountain, the fountain stops and the frog jumps away from you. (A leaping fountain) You will see the frog as a little spurt of water.



4. You want to find the frog so you will walk into the direction the frog jumped in. but just before you can come closer, the frog is already jumped away from you. In this way, people will be led unconscious on a certain path

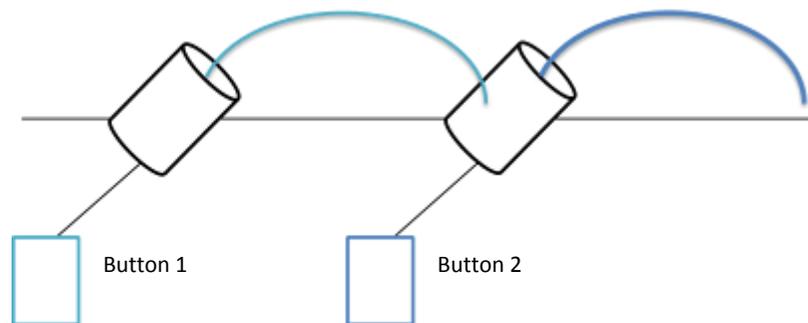
Result: people are led into a less crowded direction.

## Prototype

### *Use and Technology*

The final prototype we made is interactive fountain system to show people how it would work and look like in the Efteling. By listening to the story first you can actually experience the whole concept as you would in the Efteling.

The prototype consists of two laminar water jets driven by a submersible pump. By stepping on one of the buttons with your foot you will activate and de-activate the laminar water jets, so that the water is always a little ahead of the people interacting with it.



The first button will activate the first laminar water jet. When the button is pressed a solenoid (push magnet) will open a valve so the water can pass through. A timer deciding for how long the water jet is active to create an illusion of a frog that jumps away from you.



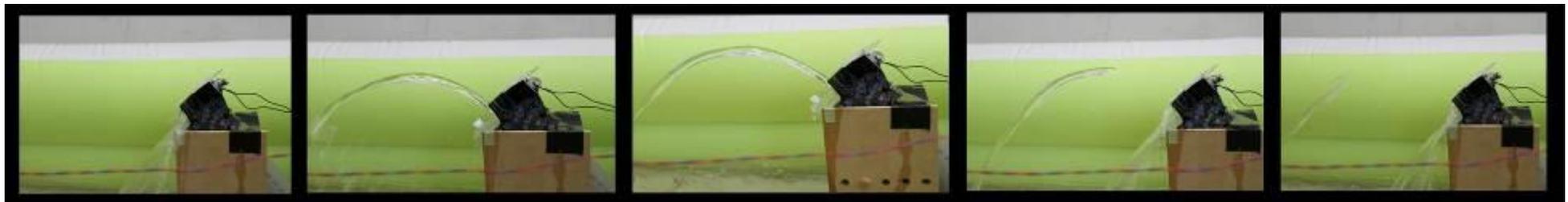
Above you see the solenoid push magnet that controls the amount of water that you will see. We used a solenoid because of his high speed and simple one direction movement. We made a valve at a pivot point so the solenoid wouldn't directly be over the jet and would only have to move a short distance.

## Design

The prototype consist a few key parts. We started building the laminar water jets. The two laminar water jets are made out of a PVC pipe, a hose adapter to connect a garden hose to it, steel wool to slow down the water in the pipe, straws to create the laminar flow and a Plexiglas plate with a nozzle drilled in the middle. PVC glue was used to attach the parts to each other, duct tape insured water tightness. The jets were held at the correct angle by wooden stands.



Because we wanted people to interact with the fountains we made two buttons. These buttons are just simple circuit closers. Two pieces of cardboard with aluminium foil glued on it are separated a small amount of foam. If you step on it the two aluminium sides of the cardboard will close the circuit and send a signal to the Arduino.



## Interactive Prototype

### *Use and technology*

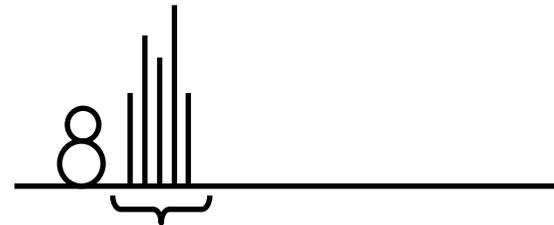
To communicate our idea, we conceptualized an interactive model. This model provides people the ability to shift a wooden figure along fountains. The fountains will react to the figure. This visualizes the interaction Froque offers in the Efteling.

The model consists of a wooden figure with a magnet attached to it. When the figure is placed in front of the first vertical fountain, this fountain will be “active”. LED lights, which are placed behind the fountain of perspex turn on and off alternately.

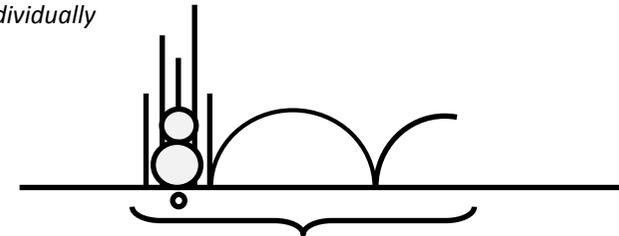
The magnet attached to the figure triggers two reed switches. The first reed switch is triggered when the figure is shifted along the first vertical fountain. By triggering this reed switch, the frog will jump out of the fountain; LED lights placed along two arcs made out of sand blasted perspex turn on and off in a row.

This will proceed until the figure triggers the second reed switch. After this switch is triggered, the last arc of perspex will be lit up, in the way described above. This curve ends in another vertical fountain, which will be activated and lights up the same as the first vertical fountain. After a while, the first vertical fountain will be light up again. The figure has to be moved back to the start.

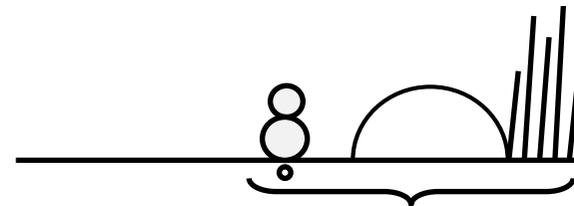
The model is driven by an Arduino. In order to work with this much LED lights, we made use of four shift registers. The Arduino code can be found in the appendix.



*The first vertical fountain will be active; each vertical stream will light up and dim individually*



*Figure triggers the first reed switch and the first two curved pieces of Plexiglas will light up. The lights placed along the Plexiglas will turn on and off individually.*



*Figure triggers the second reed switch and the last curved pieces of Plexiglas will light up. The lights placed along the Plexiglas will turn on and off individually. When the curve is light up one time, the second vertical fountain will light up.*

## Design

The model we created is made out of wood and perspex. It consists of several layers, made out of wood. These layers are painted.



The perspex is sandblasted, to make it matte, and glued behind the wooden layers. The LED lights are attached underneath the Plexiglas for the vertical fountains.



At the back of the model, we attached a box for the Arduino. So the finished model looks neat, it also prevents the wires from loosening from the breadboard.



The whole model is completed with a framework, for the final finishing touch.

## Conclusion and Recommendation

The main aim of our project was to guide people in a playful and unconscious way towards the least crowded areas in the Efteling. We wanted to use one of the key values of the Efteling, a fairytale and tried to reach all ages, which was also a key value of our concept. These things were in the back of our mind during the entire project.

Our concept relies on the social goodness and the power of human imagination. These two factors are highly promoted within the Efteling, something we discovered this while visiting the Efteling.

During our visit to the Efteling and the survey we did, we discovered that most of the people don't plan their route through the Efteling beforehand. This result was really useful for our project.

As with any project not everything went according to plan. After two weeks we were already deviated from our schedule. We spent a lot of time figuring out what the user would and should experience and our meetings were inefficient. Because of this we had less time for making the prototype and were not able to set up a good usertest. But based on conversations and reactions of people playing with our prototype before and during the exhibition, we can say we reached our goal in effectively communicating and illustrating our concept.

The choice for using water, something that appeals to all ages, was a fun but often very challenging. For example creating, testing and immediately adjusting the prototype was quite difficult and time consuming, because water is a fairly unpredictable material.

Our stakeholder was the Efteling, so our concept is especially designed for the Efteling. However, the concept can be used universally by adjusting the story, the main goal (leading people towards the least crowded attractions) and the appearance.

If we had to do this project again we would have made a scaled prototype or animation instead of the prototype we made now so we could have done a usertest. We really have to consider if the time we put into something is used well. Afterwards it's obvious where we could have saved ourselves time, we learned a lot from it. From business perspective: time is money.

If we would want to actually implement our concept into the efteling, we really would have to test our concept in the Efteling to find out where our concept could really function in context. If we look at further developments we can try to make our interaction stronger and more fun. The interaction part of our concept is very important because that is one of the things that determined if people will follow our concept more than once.

All things considered, we went through most stages of the design process and handled quite some problems. After the meetings skills workshop our

teamwork and decision making improved drastically, we learned how to approach a design problem and go through the process from idea to final prototype. Looking back we can say we delivered a successful B1.1 project.