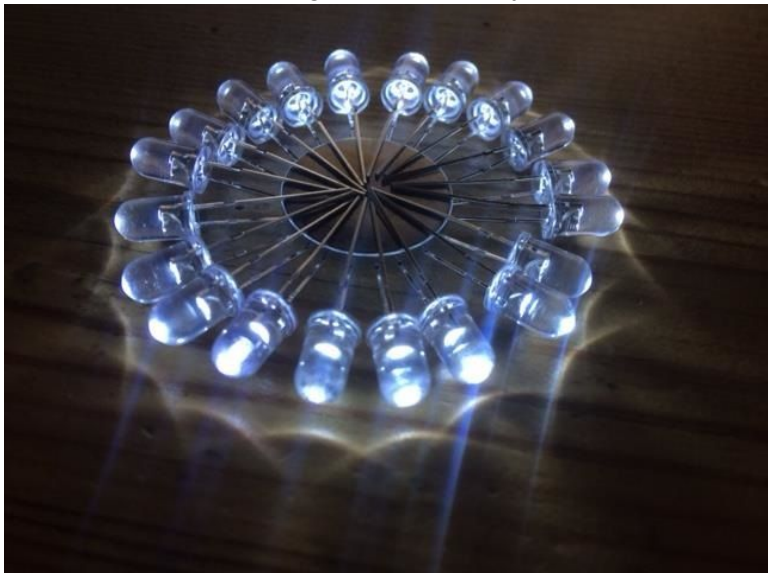
# Process Berend te Linde IDA 1

## The Light

My process started when I found out a simple CR2032 battery could power a led. this makes a very compact light source which is very cheap and easy to create movement with.


*picture of a CR2032 battery with a LED*

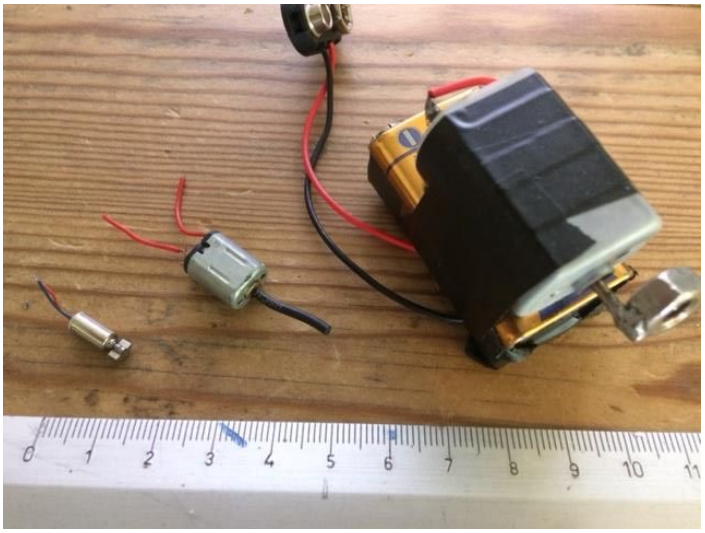
These lights weight about 3 grams and it costs around 11 cent to create. This opens up a lot of opportunities to create a light installation that has a lot of different light sources. they provide light up to six weeks, work well underwater and can they take a hit.
It is also possible to power multiple lights on 1 battery.



*Multiple LED's on 1 battery*

# The movement

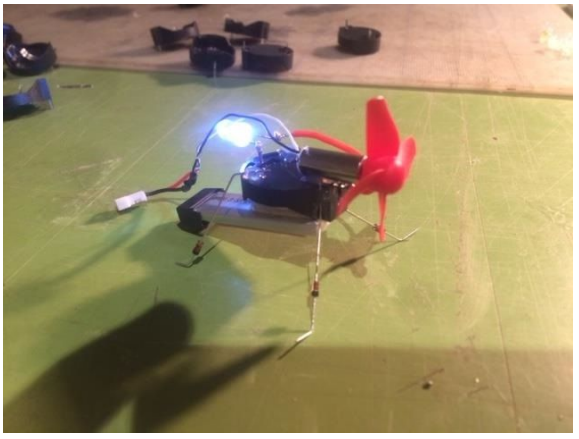
These compact light sources had me thinking about the way I could connect it to automatic movements. Like connecting it to a string on a motor or a long pole. Eventually I found out about chaos movement like a double pendulum. This will give a unique result every time which I find very interesting. I used small vibrating motors with a battery to create random sudden behavior.



*Three types of vibrating motors*

I started looking at insects and the way they behave to see if i could replicate it.
the movement of the *Gerris lacustris (common water strider)* looked super smooth and totally unlike any other robot I have seen so far.


*Gerris lacustris*

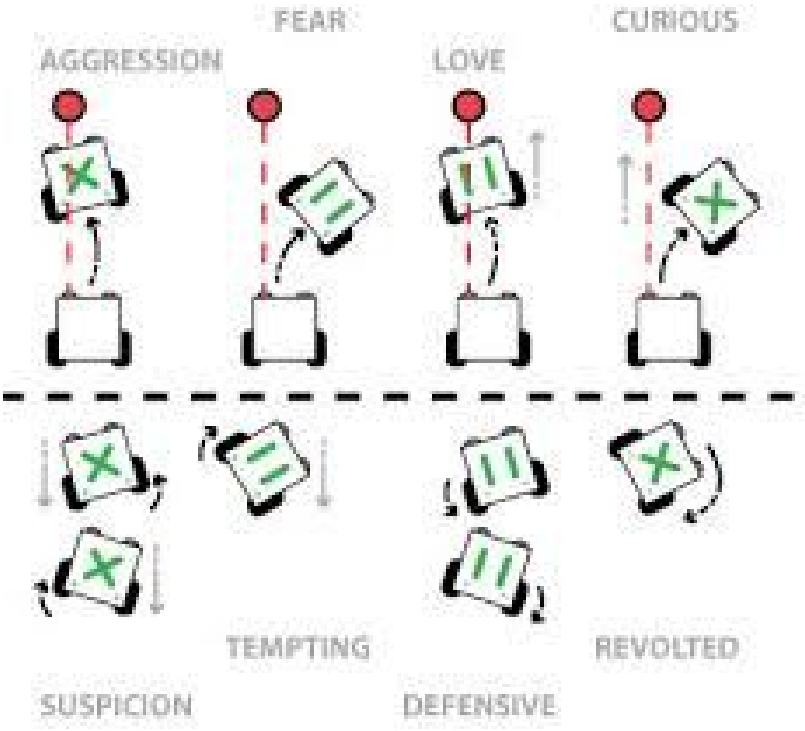


*Robot water strider.*

I created a small robot with a propeller that moved a lot like the water strider. But it was uncontrollable. It would glide around the room until it hit something. This was the next problem I had to find a solution for.

## The behaviour

I was reading more into behaviour and found videos of huge flocks of sparrows. This looked so beautiful and it something that really gave me inspiration. Some more examples that are interesting are schools of fish and groups of *Lampyridae* (Lightning bugs).
Upon looking further into flocking I found a talk from Steven Strogatz. His research proved that even inanimate objects can show behaviour of flocking. This seemed very interesting to my project and research.
Another really interesting research paper is from Valentino Braitenberg. Valentino Braitenberg is a neuroscientist and he wrote a book about autonomous agents. His idea was that with a very simple sensor and a source the sensor can react on you can create complex behavior like aggression, fear, love, curious and even suspicion. But all his tests where with computer simulations. I thought it would be interesting to test this principle out in real life.

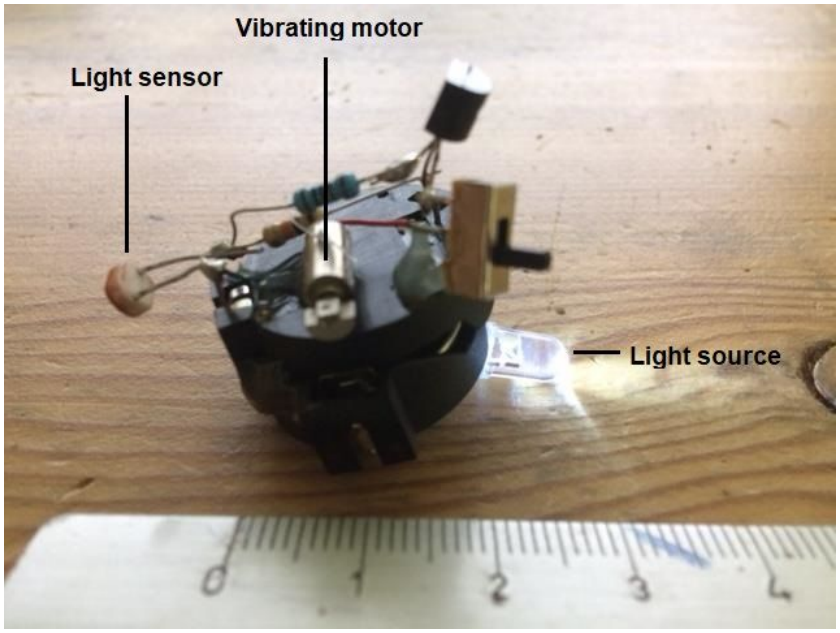



*Braitenberg vehicles*

Besides Braitenberg I also really found the work of Rodney Brooks (complex animal behavior) inspiring because all his robots react on the surroundings, look really complex and behave very nature like.
Karl sims is also someone I really appreciate, he is taking it one step further, he doesnt design the behaviour of his robots but with a generative algorithm they develop themselves.

## The robot

So I started combining my research to build a robot that could show behaviour and patterns of flocking. I decided on my vibrating motor instead of the propellor based design because it was more relaxed and better to control. Then I bought light sensors and designed a circuit that would read the sensor and give a certain amount of power to the motor depending on how much light there was behind it. The robot also has a light as a tail.




*Robot with a sensor and a source.*

These robots will now react on light. If they are in a dark place they will not move. But as soon as a light source comes close it will started moving and the closer it gets the faster it get. This means it starts showing fear behavior to the other robots. Ofcourse the behavior is not perfect. The design is based on chaos movement so it looks like its panicking instead of fleeing. This can be fixed in a future version.

## The installation

The installation will be presented in a totally dark room. It will have a “playing field” for the robots that is 80cm x 80cm. The playing field is raised to amplify the sound the robots make. In the playing field there will be a total of 64 sensored robots facing away from each other so they start in a off position. One more robot is added without a sensor that will always move. This is the main light source. In the most optimal scenario it will start of the whole chain reaction. Each robot creates a soft buzzing sound, if this is multiplied by 64 and placed on the playing area you get a low rumbling sound.

The total installation can take up to an hour. And it's completely over when all the robots have died out.

*The playing field design*

## Conclusion

In the end it is not for certain if the robots will show a clear behaviour. There is a high chance that the chain reaction will die out and that's the reason why there is one robot without a sensor. But it is not a failure if there isn't clear behavior. It just means my hypotheses turned out to be negative.