

TOUR DE SENS

Master's Thesis by Carl Ydergård 2016

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ABSTRACT

The rhythm of the observer was for millennia the rhythm of the pedestrian. By introducing vehicles, such as the bike, this rhythm changed. This master's thesis explores the spatial implications of cycling and aims to investigate architecture and cycling from a sensory point of view.

The subject of cycling was chosen due to its sustainable traits and of its unexplored architectural potential. Design for bikes today is quite uninspired and often reduced to pure infrastructural solutions.

Cycling was investigated through models, experiments and - of course - excursions by bike. The design process depended on iterative investigations and research by design. References were chosen based on how they deal with travel, notion of speed or design for cyclists.

The project program is structures for cyclists along the bike route from Göteborg to Helsingborg, *Kattegattleden*. The 400 km long site was analyzed to find suitable project locations and ten sites were chosen to exemplify ten possible types of structures.

The architectural concept is to enhance the sense of cycling. The designs are primarily meant to be perceived in motion. Like characters in a computer game or a fairy tale the structures provide the traveler with a functional as well as a poetic experience.

The final designs are mainly presented in model, section and isometric drawing. Full scale experiments inform the shape and detailing of the architecture. Design method and experiment data may inform or inspire future projects.

Keywords: Cycling, perception, architecture, motion.



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INTRODUCTION

Long-distance cycling, or *touring*, was extremely popular in Sweden before people had cars. Simply ask anyone over 80 years old and they will surely tell you about that summer they biked to Berlin, that time they moved to Göteborg on a bike, or that winter when they had to bike ten kilometers through snow to get to school. Unfortunately, touring is not what it used to be even though Sweden is full of qualitative bicycle routes. My idea is to create bike targets motivating people to start cycling again.

In a society obsessed with sustainable development, there are practically no negative effects of more cycling; it leads to less climate impact, less traffic and has numerous health benefits. In Swedish cities cycling is increasingly becoming an alternative to traveling by car, bus or tram. Since Sweden is not a dense country less is happening outside the cities. In my project I wanted to use the long distances as an advantage, and show how long distance biking is also a way to travel sustainably.

To create a realistic project I talked to project stakeholders to find out how, where and if my idea could be realized. I chose to implement my ideas on *Kattegattleden*, which is a 386 kilometer long bike route along the *Kattegatt* coast between Göteborg and Helsingborg. It opened summer 2015 and is Sweden's first national bike route.

I'm interested in long distance and endurance sports but bicycle touring was something I had not done a lot before. I was eager to find out more so I fixed my bike and started cycling down *Kattegattleden* on the most epic site visit I had ever done.

It was important to investigate this subject because bikes are, and will be, a big part of society. The aim of the thesis started out as a way to explore how architecture and tourism can create win-win effects, but ended up as an exploration of the spatial implications of cycling and an investigation of architecture and cycling from a sensory point of view. The result became a realistic design which can inspire future projects.

In part one of this book the background research is presented. The design proposal is in part two. Part one was mostly written in the autumn 2014 *matter space structure*-preparation course, the rest was done in spring 2016.

Timeless touring! Photo from the first Tour de France in 1903.

PART 1: RESEARCH



ARCHITECTURE AND TRAVEL

In this chapter some background to the project program is presented. Tourism is growing in Sweden (Petersson 2012), the value of foreign visitor spending was in 2012 50% larger than the passenger car export and twice as big as the steel and iron export. It makes sense to invest in sustainable tourism.

Architecture and travel destinations are often strongly connected. Who doesn't relate the Eiffel tower to Paris, who imagines New York without seeing skyscrapers, and why does everyone know what Dubai looks like? The question is if this effect is possible to synthesize in a smaller scale. To illustrate how architecture and travel can enhance each other two project examples are presented below.

NATIONAL TOURIST ROUTES OF NORWAY

Norway

The *National tourist routes of Norway*-project is a good example of how architecture can enrich tourism.

In 2001 the Norwegian parliament decided to invest in 18 carefully selected routes in Norway and create infrastructure suited well for tourism (Statens vegvesen 2014). Standards were set to make the routes eventful, safe and informative. Architects from all over Norway were invited to design structures along the roads. The programs of the sites varied, it could be anything between framing a nice view, designing a restroom, or creating a place to stay overnight. The project is ongoing.

Nasjonale turistveger has (so far) resulted in a synergy effect where the involved architects have received positive criticism and the tourism along the roads has increased (Statens vegvesen 2014). The publicity around

the project has been enormous and it has truly shaped Norwegian architecture over the last decade (ArchDaily 2009).

The budget for the whole project was 3,4 billion NOK (Berre; Lysholm 2010), corresponding to about 410 million euro. 2,4 billions were budgeted for renovating the roads and the remaining 1 billion was budgeted for service, activities and experiences (including architecture). The Norwegian government contributed with 900 million NOK (Fonbæk 2008), the rest of the investments were from national and regional infrastructure budgets. While Statens vegvesen estimate the project has received 120 million NOK worth of free publicity in Norwegian press alone (Statens vegvesen 2014), some traditional advertising methods were used as well.

The project has been criticized for often failing to use local materials (Bettum 2012), the most obvious example being a minimalistic stone sculpture in *Sognefjellet* by Knut Wold. *Sognefjellet* is known as the rockiest part of Norway, still this particular rock was imported from Larvik 500 kilometers south.

I'm critical against the target group of the project. While the idea of car tourism might have seemed good in 1993 when the Norwegian parliament had their first idea (Berre; Lysholm 2010), the concept seems outdated in today's sustainability-aspiring society. Norway has a renowned outdoor recreation-tradition, I find it strange how few of the stops connect to it.

BUS STOP KRUMBACH

Vorarlberg, Austria

Vorarlberg in Austria has a strong tradition of architecture. To showcase their unique mix of

Roadside restroom, Lofoten 2009. Designed by Manthey Kula for Nasjonale turistveger. (JW)

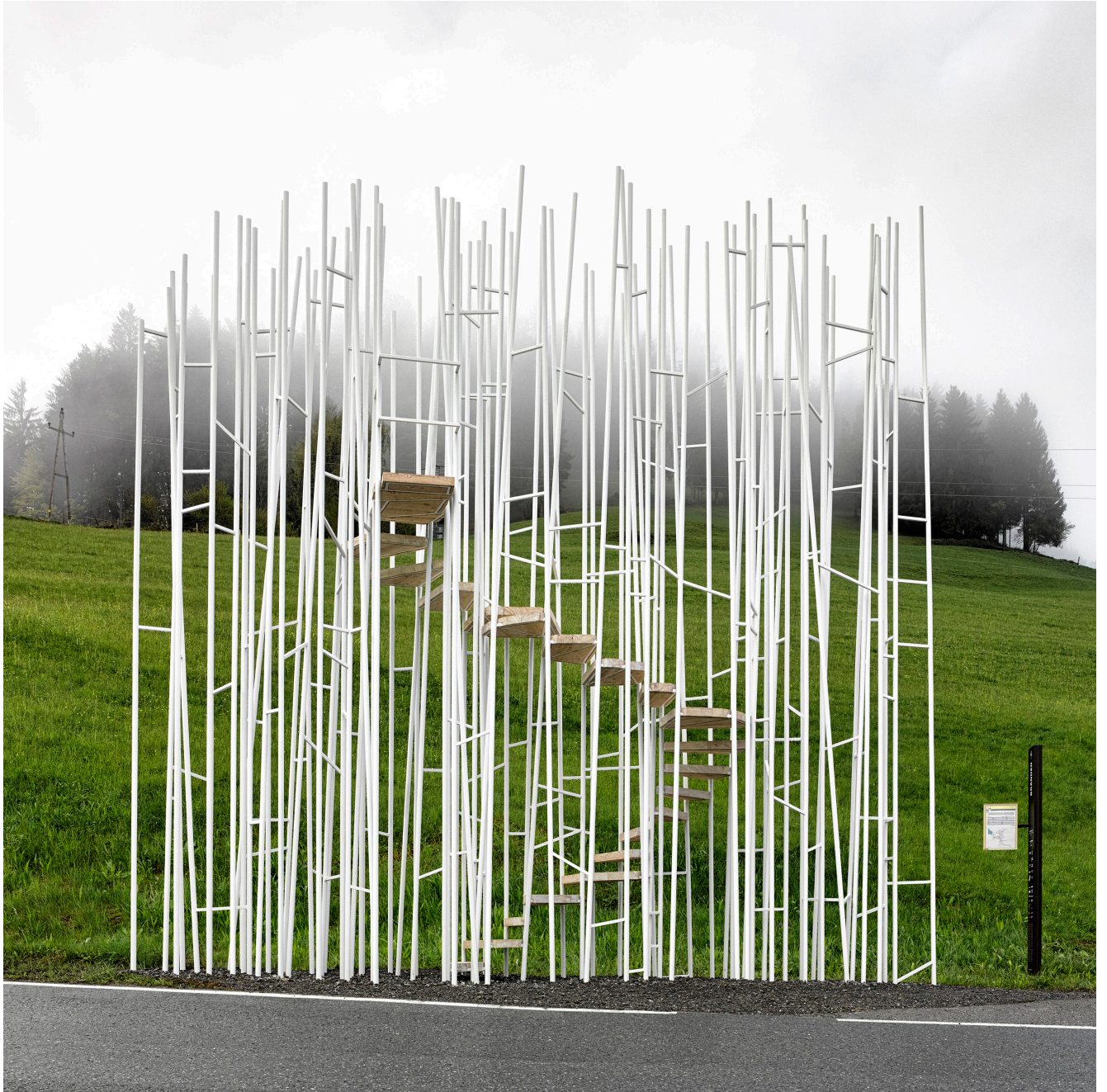
architecture and local handcraft the *Bus stop Krumbach*-project was started (Kultur Krumbach 2013). Seven internationally famous architects from all around the world were invited to design one bus stop each in the region. What these architects had in common, except for all being men, was they had all built their reputation on working in the borderlands of sculpture and architecture (Steiner 2014).

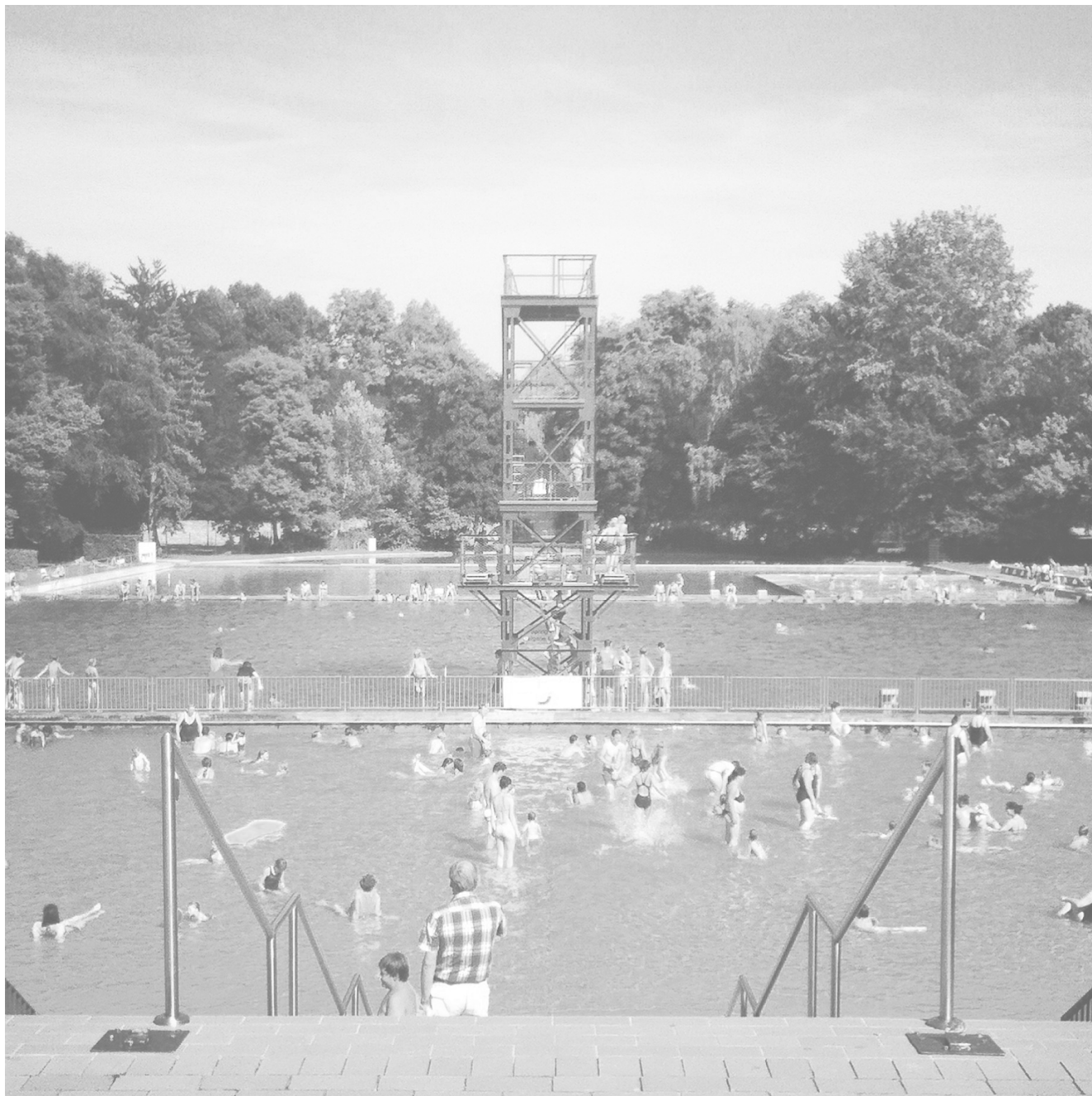
The project was mostly privately financed through local sponsors and the invited international architects were paid no money but with a holiday in the area (Kultur Krumbach 2013). Since there was so much donations and voluntary work involved, it's impossible to discuss the project budget and how it was divided on builders, material, and documentation (Bechter 2014).

Bus stop Krumbach has not experienced the same international attention as National Tourist Routes of Norway, it is smaller and more humble. The project was financed in a smart way using local handcraft, producers, and sponsors. In these kinds of projects it is often the architect fee which makes up most of the cost, eliminating it completely surely saves a lot of money.

Designing small scale bus stops with local materials is a strong idea, but even though bus is a more sustainable way to travel than car, it's still not the best form of transport I can think of...

*One out of seven unusual bus stops in Krumbach.
Designed by Sou Fujimoto 2013. (AB)*





POLITICS AND EXERCISE

Imagine if one out of ten people died premature deaths in bike accidents. Cycling surely and rightfully would be banned or at least heavily regulated. Not only helmets but full body armor would be legally required to even go near a bike. There would be government funded campaigns raising awareness, "*Biking kills!*".

Of course this is not what's happening, the reality is quite the opposite: One out of ten people in Europe die premature deaths due to *lack of exercise* (Ekelund 2015). It's hard to get a grip on how many people actually exercise at least 150 minutes a week, which is the *Public Health Agency of Sweden* minimum recommendation (Folkhälsomyndigheten 2011). People tend to over-estimate their efforts, in questionnaire-type surveys it seems like 65% are active enough, while in surveys with heart rate monitors and accelerometers the actual percentage seems to be closer to 25%.

It seems like something that kills 10% of the population would call for action. Maybe this is the reason there are so many new sport stadiums being built in Sweden? The problem with this is how a lot of people fail to see the difference between sport and exercise. In a league football match about 22 players are getting a nice workout, 50,000 spectators are not. Sports are mainly entertainment partly for the players but mainly for the audience. A clear sign of this is how e-sports are stealing viewers from traditional sports (USA Today 2015).

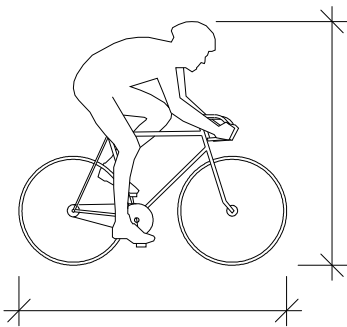
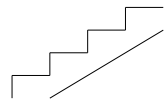
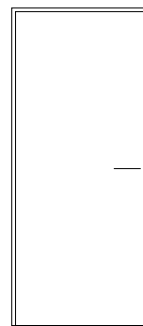
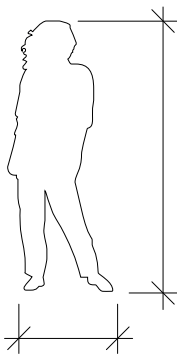
Investing in sports is not an efficient way to invest in health, to invest in exercise is. What if the VAT on running shoes was removed? What if more public swimming pools were built instead of more elite sports arenas? What if smaller companies could put their names on

outside gyms like giant corporations put their names on sports teams? The usual critique against suggestions like these is how while they in theory show society's priorities and encourage a healthier lifestyle, in practicality mostly benefits the people who already exercise regularly; it's like preaching to the choir. While this might be true short term, I believe change in culture takes a long time. Investments in health need to be long term.

The amount of exercise trends is enormous which makes long term strategies a bit tricky. I believe that's why focus needs to be on very basic forms of training. Running, lifting heavy stuff, swimming, cycling. However technology and exercise trends may evolve in the future a strong heart and compound movements will stay relevant.

The main idea of this thesis is how architecture could be a great long term investment in health. By encouraging and promoting cycling, more people will do it.

Schwanseebad public bath, Weimar.



?

DESIGN FOR BIKES

Looking through data books such as Neuferts *Bauentwurfslehre* or *Arkitektens handbok* gives a basic idea of bicycle measurements. A person on a bike has similar size to a 2000x1800x600 millimeter box (Bodin; Hidemark; Stintzing 2011) and needs to travel a path which is at least one meter wide (Neufert 2005). But beyond these minimum numbers, what could design for bikes mean?

DESIGN PROJECTS

Imagine the early modernists fascination by cars. The decision to put a U-turn in the middle of *Villa Savoye* was hardly a practical decision, but a materialization of *Le Corbusier's* love of automobiles. To him an enormous highway truly was more valuable than Stockholm's *Gamla stan*. *Walter Gropius* and *Mies van der Rohe* also designed (at-the-time) utopian car-centric projects which later came remarkably close to reality. So where are the *Le Corbusiers* of today, who love bicycles rather than cars?

There are many projects that take the bicycle concept far, usually in a realistic scale. Most contemporary bicycle design projects seem to originate from either the Netherlands or Denmark. Many have rational reasons for existing, such as *Bike apple*, a giant bicycle garage in *Alphen aan den Rijn* (Wainwright 2013), *The Hovenring*, an elevated bike roundabout in *Eindhoven* (The Guardian 2014), or *Bicycle Snake*, a bike-only bridge in central *Copenhagen* (Colville-Andersen 2014). Other projects have more visionary ambitions.

The Danish pavilion for the *Shanghai expo 2010*, designed by *Bjarke Ingels Group (BIG)*, was an example of a single building designed to be experienced on bike rather than on foot (Ingels

2009). Instead of a chronological exhibition space, the space was like a continuous loop meant to be biked around. Outside the pavilion 1,500 bikes were put for visitors to travel around the expo area showcasing the city bike, a common national symbol for both Denmark and China.

BIG later implemented ideas from the pavilion in the ten-story residential *8 House* in Copenhagen (The Guardian 2014), where a complex ramp arrangement make residents able to cycle to their front door, no matter which floor they live on.

Bicycle Club in *Hainan*, China designed by *NL Architects* is another example of a consistent design for bicycles (ArchDaily 2012). The project program was to design a café and a bike rental, and that is exactly what was designed with the addition of an open-air velodrome as roof. Worth to notice in this project are the details, for example how the bike parking is integrated in the café, and how the thoughtful staircase to the velodrome makes it easy to walk up a bike.

ROUTES

In 1897 *Horace Dobbins* - mayor of *Pasadena*, California - decided to develop a 14 kilometer long elevated bike route from *Pasadena* to *Los Angeles* (California Cycleways 2008). The wooden path would cost 10 cents to enter. Construction began in 1899 and although everything pointed to a success, the project was suddenly interrupted by the unexpected invention of the automobile. Only two out of the planned 14 kilometers were built.

127 years later, in 2014, *Foster + partners* and *Exterior architecture* presented a similar

Do different starting points lead to new architecture?

project: *SkyCycle*, elevated bike routes in central London (Wainwright 2014). The idea was to suspend steel bike highways on top of suburban railways, adding 220 miles of bike routes all over the city with the support of only one landowner. Could Dobbins' rooftop bike-commuting vision finally become reality?

The *Donau-Radweg* is one of Europe's most popular bike routes (Envall; Koucky 2005). It starts in German *Passau* and follows the *Donau* river through Austria to *Vienna* and *Bratislava*. It was built in the 80s, is 380 kilometers long and gets about 440,000 yearly users (Donau Oberösterreich Tourismus GmbH 2014), about 33% are tourists, 33% day-trippers and 34% commuters (Mitterlehner 2011). Along the route a tourist industry aimed at cyclists has grown and the *Donau-Radweg* is a great example of how a well marketed bike route can create a base for tourist industry (Envall; Koucky 2005). The project has lead to more similar projects in Austria but hasn't had the same impact abroad.

The marketing of the *Donau-Radweg* was done with traditional advertising (Envall; Koucky 2005). It got peoples attention, but didn't directly add value to the route itself.

BIKE STOPS

During a pub crawl in 2009 *Chad DeBaker* and *Alex Anderson* were riding their bikes around *Minneapolis*. One of them got a flat tire, and since nobody had a bike repair kit and since no bike shops were open they realized how infrastructure for bikes simply doesn't exist in the US (Bike Fixtation 2014). The experience led them to start the *Bike Fixtation*-project, self-service repair stations with air compressors, vending machines selling inner tubes and work stands with bike repair tools

attached (The Guardian 2014). Today their stations can be found along bike routes all over the US.

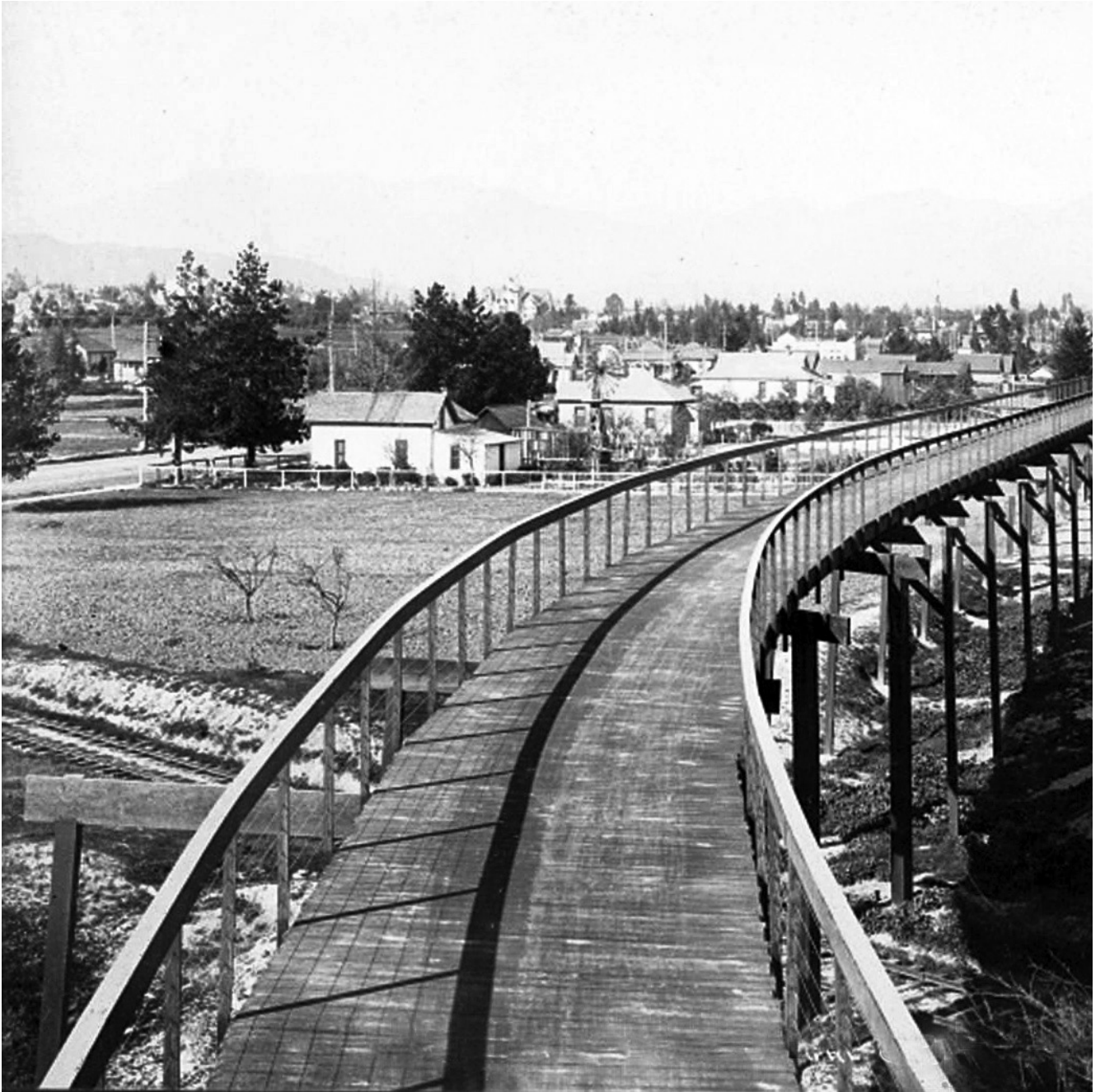
There are not many good examples of pure break areas designed specifically for bikes but that doesn't mean there's no need for it. *Sveriges kommuner och landstings* (Swedish Association of Local Authorities and Regions) views on bike stops along cycle routes are:

"Recreational cyclists often go on longer trips and want the opportunity to take a break every now and then. If the route passes villages or cities it's usually possible to take a coffee break there. In between urban areas additional stops may be necessary. Many cyclists bring kids and can't bike fast. That's why basic break areas should be available at least every five kilometers. It's important these break areas are clean and inviting and there are possibilities for restroom visits regularly along the route." (Envall; Koucky 2005, page 32. Translated by author).

Danish pavilion, Shanghai expo 2010. Designed by BIG. (WG)



Horace Dobbins' California cycleway in 1900.



	Walking	Cycling	Driving
Sight	•	•	•
Sound	•	•	•
Taste			
Smell	•	•	•
Touch	•	•	
Balance	•	•	
Temperature	•	•	

PERCEPTION ON BIKE

Senses are what helps us perceive the environment and ourselves (Damasio 2011). Beside the traditional five senses *sight, hearing, taste, smell, and touch* humans actually have several more such as *balance, pain, thermoception* (sensing temperature), *proprioception* (sensing where your body is), and *interoception* (various internal organ senses that measure for example blood sugar or oxygen levels).

Most senses have a small delay from receptor to brain, meaning the faster a person moves the number these senses get (Hansson 2003). This explains how higher speeds lead to less precise spatial perception. An infamous example of how this relates to architecture is how in modernist times enormous structures often were justified by arguments such as "*it has to be huge to be experienced from a moving automobile!*". While cycling more senses are activated than while driving, but they are somewhat damped from speed.

"The rhythm of the observer has for millennia been the rhythm of the pedestrian. Today we also have cars, trains and airplanes [...] A large urban scale is motivated like never before" (Lindström 1963. Translated by author)

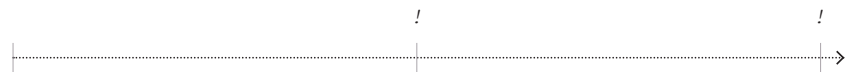
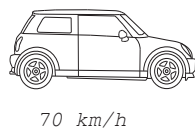
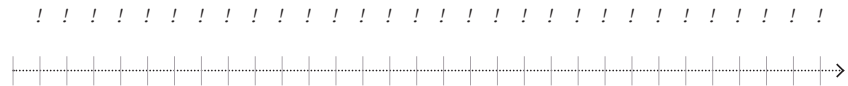
If you walk in 5 km/h things need to be close, you need lots of detail and impressions in order to not get bored (Gehl 2010). If you travel in a car in 70 km/h things are blown up in scale so you have time to see them. In 100 km/h the human eye can only register the sky and great object silhouettes comfortably (Bucht; Pålstam; Wingren 1996). A car can always slow down, but since walking can't be done in great speeds some car-scaled areas are experienced as extremely dull. Bicycle scale

is obviously somewhere between walk and car scale but still planners often confuse it with car scale. Bike paths next to or on highways are examples of functional but perceptually inadequate environments.

It only takes four minutes for an average person in motion to get bored of the landscape (Varming 1970). That means walkers need an experience three times per kilometer, a cyclist about 0,8 experiences per kilometer and a car driver about 0,2 experiences per kilometer.

External environment perception in different forms of transport.

*Stimuli per ten kilometers required to avoid
boredom in different transport types.*



10 km



KATTEGATTLEDEN

The *Kattegattleden* bike route was opened in summer 2015 (Petersson 2014). It is about 400 kilometers long and mostly car free (Region Halland 2014). It is named after *Kattegatt*, the sea area bounded by Sweden and Denmark. Presumably about 1/3 of the yearly cyclists on *Kattegattleden* are commuters and 1/3 tourists (Mitterlehner 2011). To describe *Kattegattleden* thoroughly I split the route up in eight stages. I shortly describe every stage and its characteristics, starting from the North.

Göteborg-Särö 26 km

The northernmost stage of *Kattegattleden* is mostly placed on the railway embankment of *Säröbanan*, a railroad used by steam locomotives 1903-1954 and rail buses 1954-1965 (Rosengren; Sundström; Thulin 1966). It was converted to a bike path in the end of the sixties. The route is flat and its turns have big radii. It is routed along the coastline. South of the nature reserve *Amundön* is *Kullavik*, where the road passes the *Västra Götaland* county border into *Halland*.

Särö-Kungsbacka 34 km

From here until *Halmstad* the route has a lot of roads in common with its forerunner *Ginstleden*. Between *Särö* and *Kungsbacka* the path takes an optional detour around *Onsalahalvön*. The area was important to the Vikings of the 11th century (Raiend 2009) and is named after their sacrifice grounds known as *Odens sal* (Odin's Hall). Before it reaches *Kungsbacka* the route goes through a ten kilometer long residential area. The stage has more hills than the previous one and will require some lower gears.

Kungsbacka-Varberg 72 km

After going through *Kungsbacka* the route follows *Rolfsån* to the lake *Lygnern* which is

situated around 15 meters above mean sea level, making the nearby *Fjärås bräcka* end moraine-hill the second highest climb on the otherwise extremely flat *Kattegattleden*. The stage passes a few popular summer vacation destinations such as *Åsa*, *Frillesås*, and *Bua*. It also passes by the *Ringhals* nuclear power plant. The path is flat and mostly follows the coastline. It is a pretty windy stage, with a yearly average wind speed of about 7 m/s (Alexandersson 2006). Upon arrival in *Varberg* the road passes right by *Varberg fortress*, originally built in the 13th century but heavily redesigned by the Danish in the late 15th century (Statens fastighetsverk 2013).

Varberg-Falkenberg 42 km

This stage is the flattest part of *Kattegattleden*. Right south of *Varberg* the road passes *Apelviken*, one of Hallands most popular beaches known for excellent wind surfing conditions (Lundahl 2011). The road is mostly situated on rural fields and farmlands a few hundred meters from the sea. The marathon-long stage offers relatively few chances for a break.

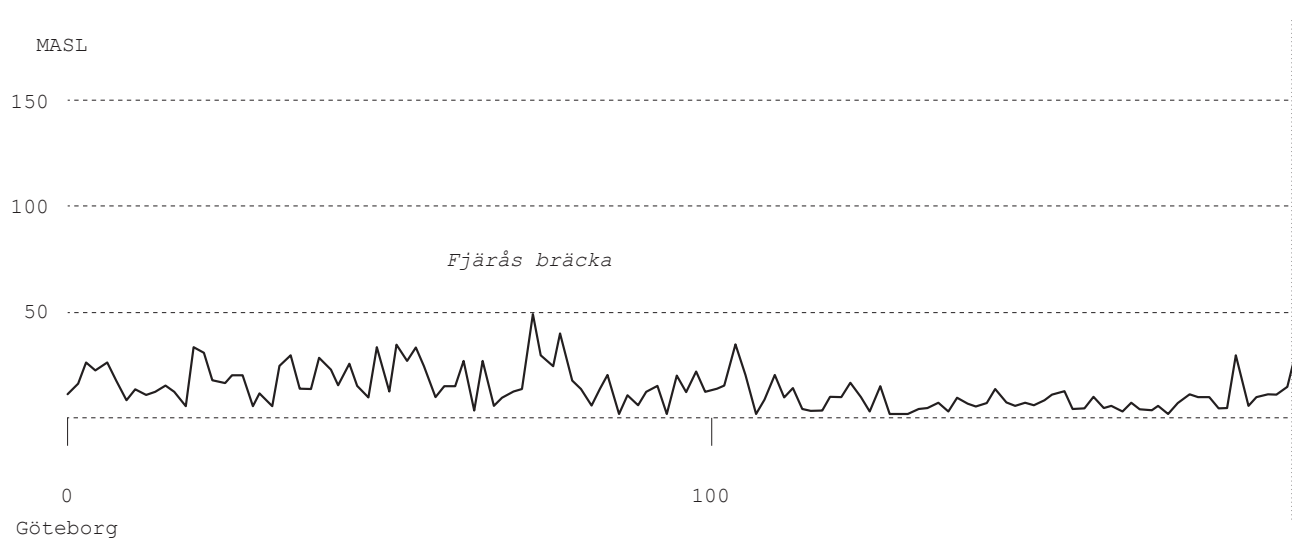
Falkenberg-Halmstad 57 km

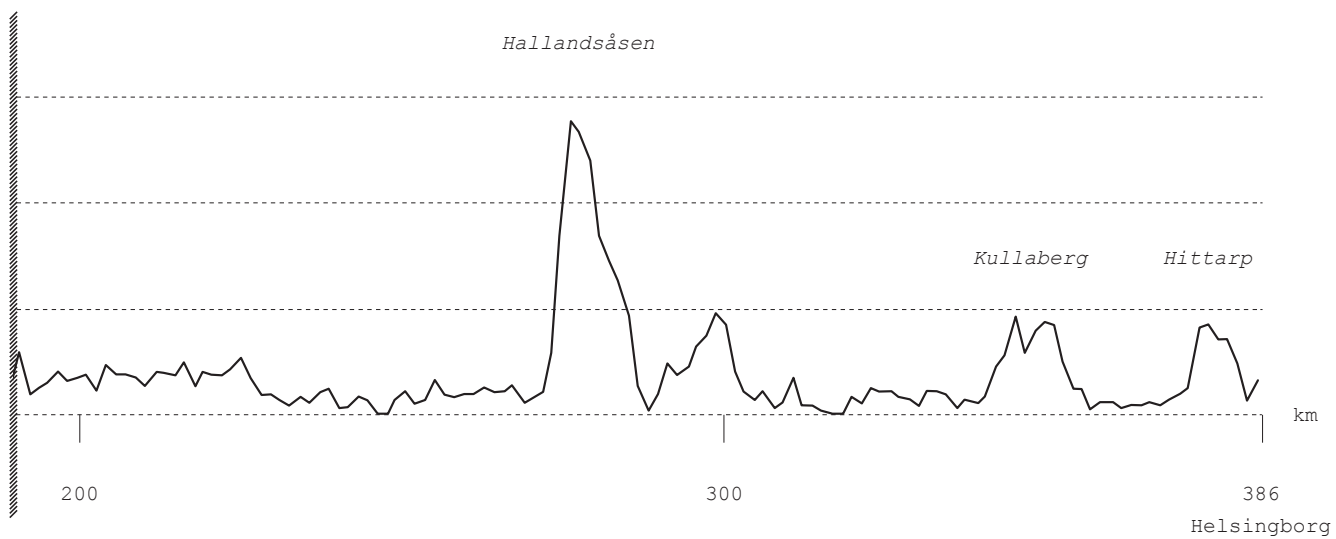
In the middle of *Falkenberg* the path crosses *Ätran*, the longest out of the four great rivers of Halland. The road south is flat and near the sea. It passes *Frösakull* and Bruno Mathssons abandoned summer house (Länsstyrelsen Hallands län 2007), an experimental ideal villa from the functionalist era designed by Mathsson himself. Before reaching *Halmstad* the route passes *Tylösand*, another popular summer destination. *Halmstad* is the greatest city in Halland and the regional capital. The route crosses the river *Nissan* right in the center of the city.

Halmstad-Båstad 42 km

Map of *Kattegattleden* and major urban areas.

Next page: *Kattegattleden* elevation profile.





This is the least windy stage of Kattegattleden, with a yearly average wind speed of 2,8 m/s (Alexandersson 2006). The river *Lagan* is passed on the E6-highway bridge. A part of the stage passes *Laholm* on the main road of *Mellbystrand*. Before entering *Båstad* the way passes the county border from Halland into *Skåne*. *Båstad* is known for its yearly tennis week in July.

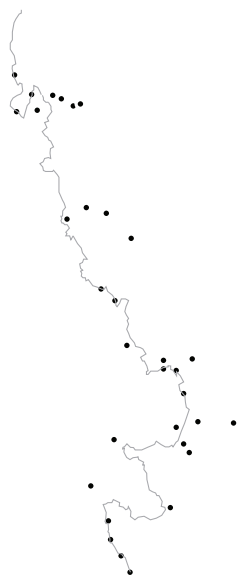
Båstad-Ängelholm 54 km

South of *Båstad* the road passes *Hallandsåsen*, by far the greatest hill on Kattegattleden with its 140 m climb. The challenge is while the climb is not steep it is long, around four kilometers on the north face and nine on the south face. South west of *Hallandsåsen* the route goes around *Bjärehalvön* and goes by *Torekov* and a possible ferry connection to the strangely named *Hallands Väderö* nature reserve. In *Ängelholm* the road passes near a somewhat unusual attraction, Sweden's only UFO-monument (!) dedicated to an alleged alien encounter in 1946 (Riksantikvarieämbetet 2006).

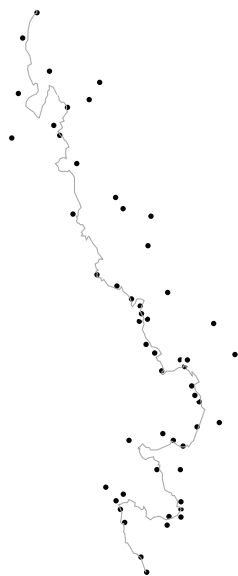
Ängelholm-Helsingborg 62 km

The southernmost stage of Kattegattleden takes a detour out on the *Kulla* peninsula where *Kullens lighthouse* and the art installation *Nimis* by Lars Vilks are situated. The route then passes through *Höganäs*, known for its ceramic industry. After crossing a minor hill in *Hittarp* the road reaches *Helsingborg* and the end of Kattegattleden.

Sights along Kattegattleden.



Historical sites.

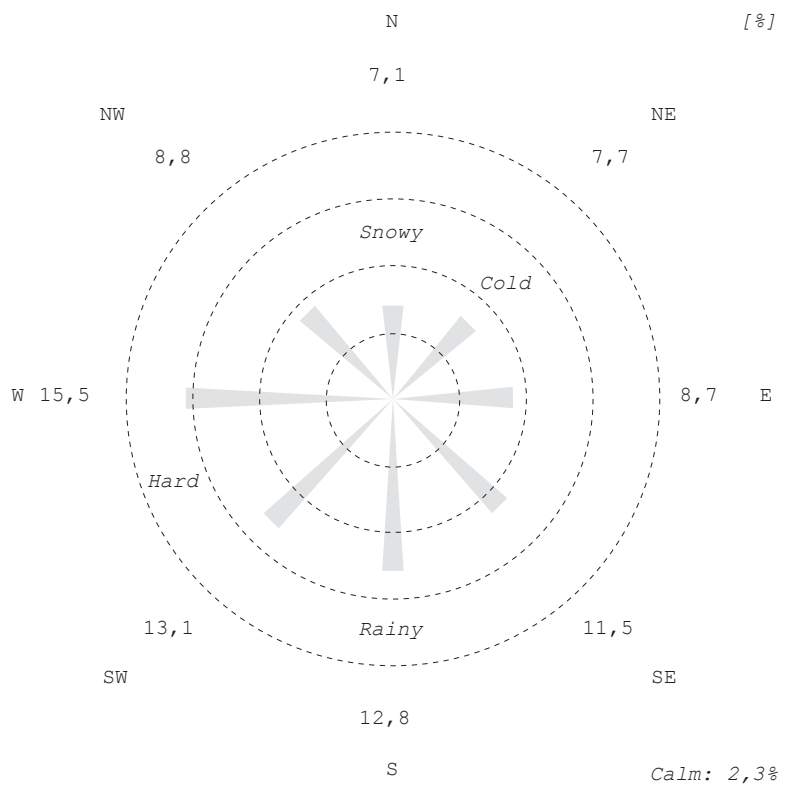


Nature sights.



Public art.

*Wind direction frequency compared to
Kattegattleden direction.*





EXCURSIONS

LOGBOOK: GÖTEBORG-VARBERG

October 28 2014

100 kilometers

Architecture projects usually start out with a site visit. If the site happens to be 400 kilometers long it shouldn't make a difference, so I got on my grandfathers old bike on a cloudy Tuesday morning and went south. I stopped every now and then to take notes and photos.

07:38 Guldheden, Göteborg

Starting from my home in Guldheden, Göteborg. Weather is cloudy and quite windy but the forecast says there's a chance of sun later. I'm excited and a bit nervous.

08:09 Askim, Göteborg

Since my parents live close to here I have traveled this particular part of the route quite a few times. Today it was a nice warm up.

08:21 Järkholmen

Dramatic sea! Until about now I've met a lot of commuter cyclists on their way to Göteborg. Right now the road is completely empty.

08:34 Amundön

A place reminding me of summer picnics with friends. Not much else reminding me of summer today though... Lonely except for a sport cyclist in color-matched 80s-gear who just passed me.

09:03 Kullavik

It's a bit windy and I can't bike as fast as I planned. Not tired but a bit bored. I've seen some runners and old people Nordic walking. Not many other cyclists around here. Lots of autumn leaves on the road, decorative but slippery.

09:37 Särö

The air temperature is nice for biking (about 10°C). The path is still empty. I missed an exit and ended up doing a detour through central Särö. I try to listen for sounds along the way but all I hear is the wind.

09:50 Vallda

WTF. The bike path suddenly turned into a muddy horse trail. Got a bit dirty but I guess I'm lucky my bike didn't sink.

10:08 Vallda trekant

After crossing some golf courses I had to climb a pretty long hill to get here. Since I'm a bit behind my schedule I'll skip Onsalahalvön and head straight towards Kungsbacka.

10:28 Kungsbacka

Passed another hill to get here and entered Kungsbacka in a long downhill slope. The sky is gray but the weather feels warmer. The bike and traffic signs in Kungsbacka are really confusing.

10:40 Rolfsån

HEADWIND.

10:47 Myravägen

Less windy! Nice country road, shared with cars but the traffic on these kinds of roads is seldom disturbing. I think I've seen more cows and tractors than cars.

11:22 Fjärås bräcka

That hill was clearly *not* designed for two-gear bikes! It feels like I'm bleeding lactic acid from my ears. But the view is beautiful! I can see Lygnern, farmlands and... Is that some viking graves?

My grandfathers old bike.

11:26 *Fjärås bräcka*

Yes, that's rune stones for sure.

11:52 *Gas station somewhere between Fjärås and Åsa*

I think I took a wrong turn somewhere... I'm lost and my telephone just ran out of power. I bought a hot dog with mash for comfort.

13:01 *Tjolöholm*

Found the route again after memorizing a map at the gas station. The headwind is back, I feel tired and angry. Bike is heavy, running would be faster.

13:19 *Åsa*

The weather is still gray and windy. Starting to feel more tired. Åsa is not the most inspiring place I've been.

14:01 *Frillesås*

Finally some sun! The route has been truly beautiful for the last kilometers. Biking faster and feeling better!

14:11 *Stråvalla*

This is probably a nice place in summer. Now it's nothing but an apocalyptic-looking beach.

14:38 *Värö*

Missed the exit to Bua. Instead I got to see this nice inland road, part of the Kattegattleden predecessor Ginstleden. Lots of small hills with views over the farmlands.

14:48 *Väröbacka*

The weather is still nice. Starting to feel pretty tired in thighs and calves and my knees hurt. Feeling a bit done with this. A traffic sign says it's 19 kilometers left to Varberg, I feel like I can do it.

15:16 *Viskan*

Stop for banana and sports drink. Feeling pretty sore in my back and crotch. Still headwind but much less than before. Nice view.

16:00 *Gamla Varberg*

I can see the water tower in Varberg! Really tired and I look forward to sitting down on the train back... Starting to meet commuter cyclists again.

16:18 *Getterön nature reserve*

For the first time of the whole trip I can hear something else than wind, birds chirping!

16:38 *Varberg central station*

Finally here! Bought a bike-ticket but unfortunately I just missed the train. I have to wait for half an hour for the next one. A bit cold to stand around and wait. Did some stretching but my body feels numb.

18:20 *Guldheden, Göteborg*

I've done a lot of long distance running in my life, but never have I cycled this far. Almost exactly one month ago I ran the Berlin marathon, though this bike trip took more than twice as much time the bodily and mental strain wasn't even remotely close. I feel like I experienced the route in a different way than I would have done if I'd have walked, ran or drove along it. The experience of environment and weather is very strong on a bike. Some car-scaled stages were boring but as long as I kept the speed up it felt OK. In conclusion the trip was enlightening in many ways but the most important lesson is: If I could bike 100 kilometers to Varberg in headwind on my grandfathers bike, anyone can go touring!

Photos taken using the bike seat as tripod.



08:09



08:21



09:26



09:41



10:26



10:56



11:42



12:21



13:01



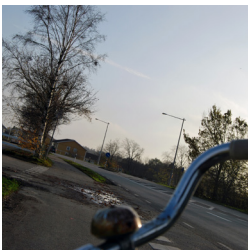
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13:38



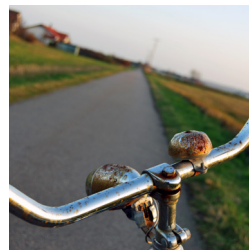
14:01



14:48



15:16



16:00



16:18

LOGBOOK: KUNGSBACKA-GÖTEBORG

May 7 2016

37 kilometers

For this excursion I decided to go for a less epic distance than last time. Since the project is due soon I didn't want to take too much time off for cycling, and I'm currently training for Stockholm ITU triathlon which happens to have a 40 km long cycling stage. For this trip I also have a more modern race bike, hopefully making the trip more enjoyable.

12:20 Guldheden, Göteborg

Leaving home. Fantastic weather, really warm (about 23 degrees). By far the warmest day so far 2016. Rolling downhill to central Mölndal now.

12:36 Mölndal station

Bought a bike ticket to Kungsbacka. Works great.

13:00 On train

Hot and empty train!

13:17 Kungsbacka station

OK let's do this! First I have to find Kattegattleden.

13:22 Kungsbacka

I think I found it? No signs to be seen though.

13:30 E6

What a great day for a bike trip! Great mood, great speed.

13:34 Rain shelter site

So this is the site for one of my ten project structures. Much nicer place in May than October! Taking some photos for future reference.

13:39 Vallda trekant

After a pretty tough climb i found the first Kattegattleden-sign. It's quite small? Hard to read in motion...

13:44 Next to 158 road

A long downhill slope! 40km/h!

13:47 Kungsbacka golf course

Lots of old people are out playing golf. Looks cozy.

13:49 Vallda

Oh no not this again, the terrible dirt road! I actually thought they would have made an asphalt path here by now. Not much to do but to pick up the bike and walk a few hundred meters. Not a great experience in clip shoes... At least the sea breeze and the smell of seaweed is somewhat comforting.

14:00 Särö

I think I misread a sign or something, ended up on a dead-end street in a residential area. Now back on the route again.

14:06 Särö north

I have no memory of this part of the route. It must look very different in winter.

14:15 Nordgården

So lets say you want to create a nice national bicycle path. Then WHY put up traffic gates every 200 meters? And WHY put them so close to each other you have to get of your bike, walk through the gate, get on the bike. It's SUPER ANNOYING! I can see the crossing, let me pass it on my own responsibility? OR, why not make the cars slow down instead of the cyclists?

Great weather, great tour.

14:16 Malevik

The site of the water fountain! Would actually be perfect here, feeling quite thirsty.

14:20 Snipen

Even more traffic gates... I'd rather bike with the cars if it's going to be like this.

14:06 Amundön

Finally no more gates! Increasing speed. Planning a fika near Askimsbadet, great motivation. Meeting more other cyclists! One of them made a hand sign to me, unfortunately I don't speak cyclist sign language. Found out soon enough he was probably warning about a big family out cycling behind the turn.

14:50 Askimsbadet

Fika! Enjoying the sun and a soft drink.

15:05 Högsbo

The example site of the distance cue. Meeting a lot of cyclists with bibs on them, probably coming from *Göteborgs Giro* which is today.

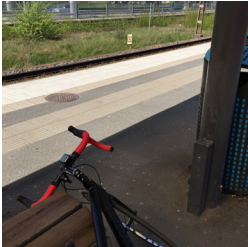
15:12 Slottskogen

OK, leaving Kattegattleden to climb Guldheden (97 masl). Taking the steep route!

15:20 Guldheden, Göteborg

Back home! This trip went way easier than expected, maybe because of the nice weather and the modern bike.

Photos from trip 2 in chronological order.



12:37



13:22



13:30



13:31



13:34



13:38



13:39



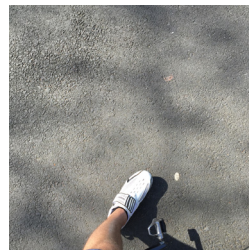
13:40



13:47



13:49



14:06



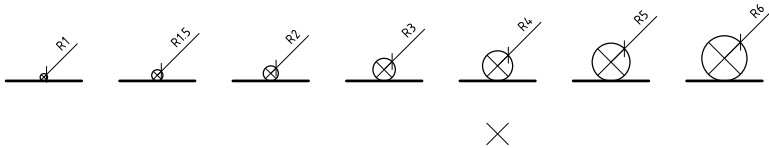
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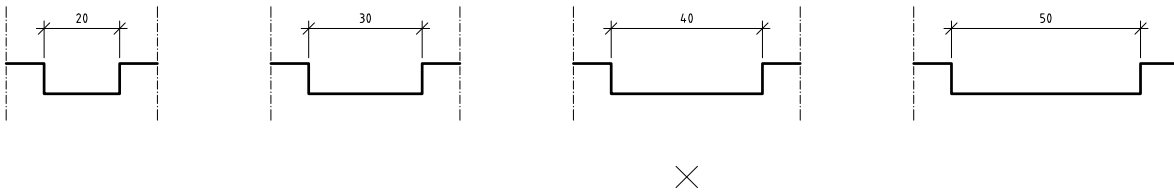
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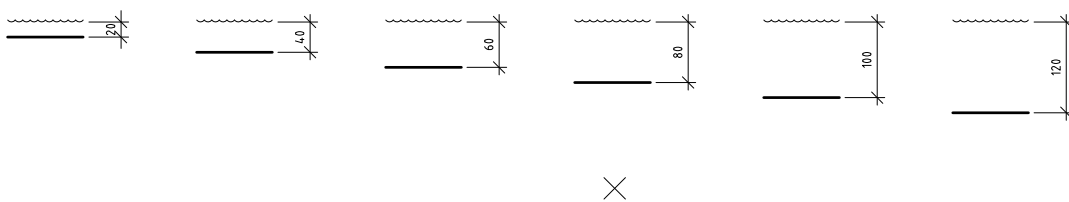
14:50



Objects with less than 8mm height are not perceivable on most bikes. Scale 1:2.



A cut in the ground needs to be at least 40 mm wide to be perceivable for a cyclist. Scale 1:2.



Maximum water depth possible to ride through on most bikes without getting feet wet. Scale 1:10.

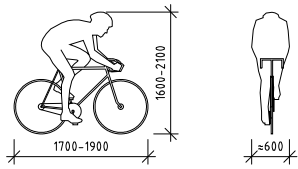
EXPERIMENT FINDINGS

When cycling environment perception is dependent several different parameters, speed usually being one of the most important ones. Most senses have a small delay from receptor to brain, meaning the faster the observer moves the more numb the senses get. This explains how higher speeds lead to less precise spatial perception.

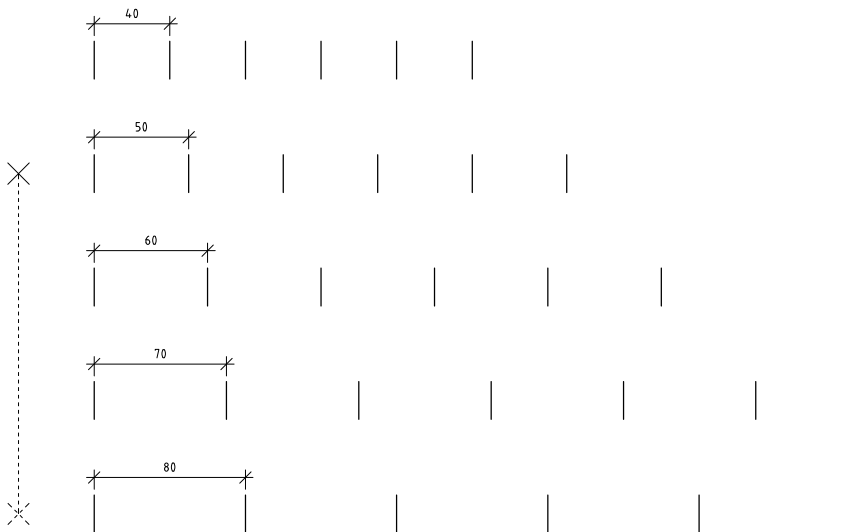
To investigate different aspects of cycling full scale experiments were conducted, results are presented in this chapter. The results are estimations of common cases but of course may vary for different people with different bikes, tires, fitness, weight, speed, weather etc.

Experiment findings explained in drawing.

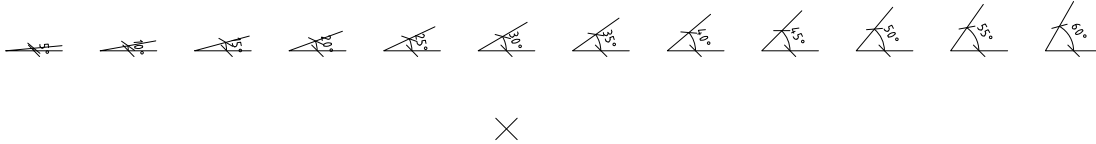
Next page: More experiment findings explained in drawing.



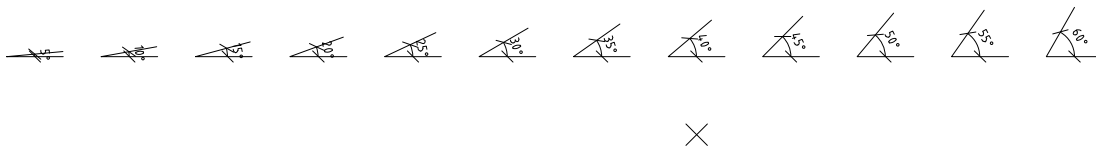
Common cyclist bounding box measurements.



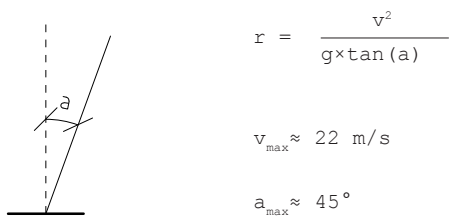
The lower limit between where ground is experienced as smooth or vibrating is c-c 50 mm but on older bikes the distance can be up to 80 mm. Scale 1:4.



Maximum uphill slope angle most cyclists can sustain for a longer time.



Maximum curve banking. Requires high speed, not likely to be achieved outside a velodrome.



Curve radius (r) on a flat surface is a function of speed (v) and cyclist leaning angle (a). Angle is limited by available traction.

RESEARCH REFLECTION

I investigated the two discourses of the project with two different methods. The research I did during the thesis (Spring 2016), spring 2016, was much more experimental than what I did during the *Matter Space Structure*-prep course (Autumn 2014). Instead of looking at architecture and travel, I went into depth with design for bikes from a sensory point of view. Moving back and fourth between project and iterations of full scale tests was an obvious example of *research by design*. The results of the tests are clearly related to the design project, and the prep course research is more related to the program.

The experimental research method I used during the thesis is in my opinion one of the best parts of the project. I'm glad I chose this playful and curious approach.

I'm interested in form and tectonics, one reason I took the prep course was to make time to get into architectural details later. Using one semester for just background studies was a good choice. During the autumn I took time to layout this book, fix formalities and create a graphic profile. Things that sometimes get rushed when working on a design project in parallel. Another good thing was how the course gave me lots of time for reflection. I thought over the idea, talked to people about it and got feedback from different directions. In my experience discussing an idea makes it stronger.

PART 2: DESIGN PROJECT



PROGRAM

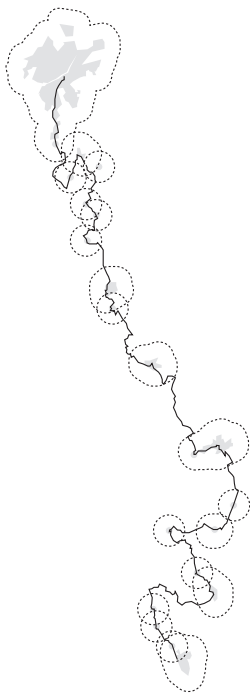
The project program is to design structures for cyclists along the new national bike route from Göteborg to Helsingborg.

STRATEGY

The bike route has been mapped and cross-referenced with cyclist needs and personal experience from bike excursions to create ten functional programs to be distributed along the 400 kilometer path:

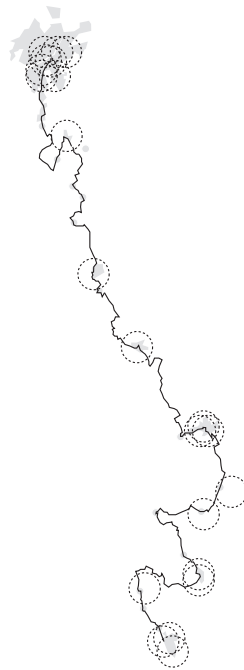
1. Distance cue
2. Fireplace
3. Water fountain
4. Rain shelter
5. Air pump station
6. Restroom
7. Open water swim track
8. Bridge
9. Workshop
10. Lookout tower

Next page: Mapping of 400 km long site



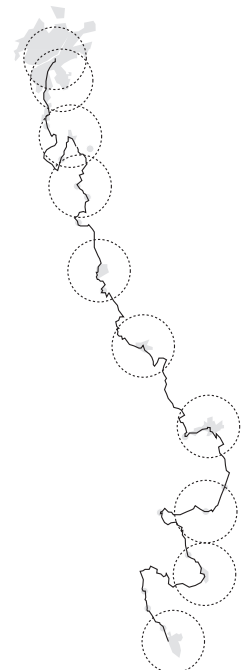
*5 kilometer radii
around urban areas.*

+



*5 kilometer radii
around bike shops.*

+



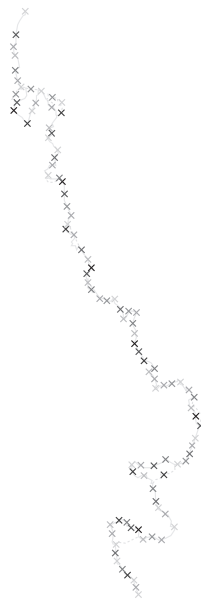
*10 kilometer radii
around train stations.*

=>



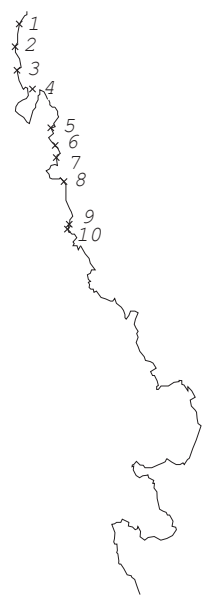
Desert stages.

=>



All possible sites.

&



Chosen project sites.



1. Distance cue



2. Fireplace



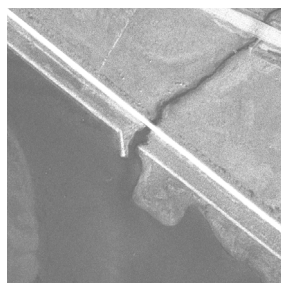
3. Water fountain



4. Rain shelter



5. Air pump station



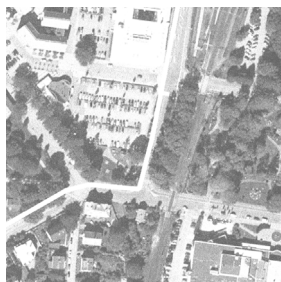
6. Restroom



7. Open water swim
track



8. Bridge



9. Urban workshop



10. Lookout tower

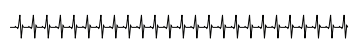
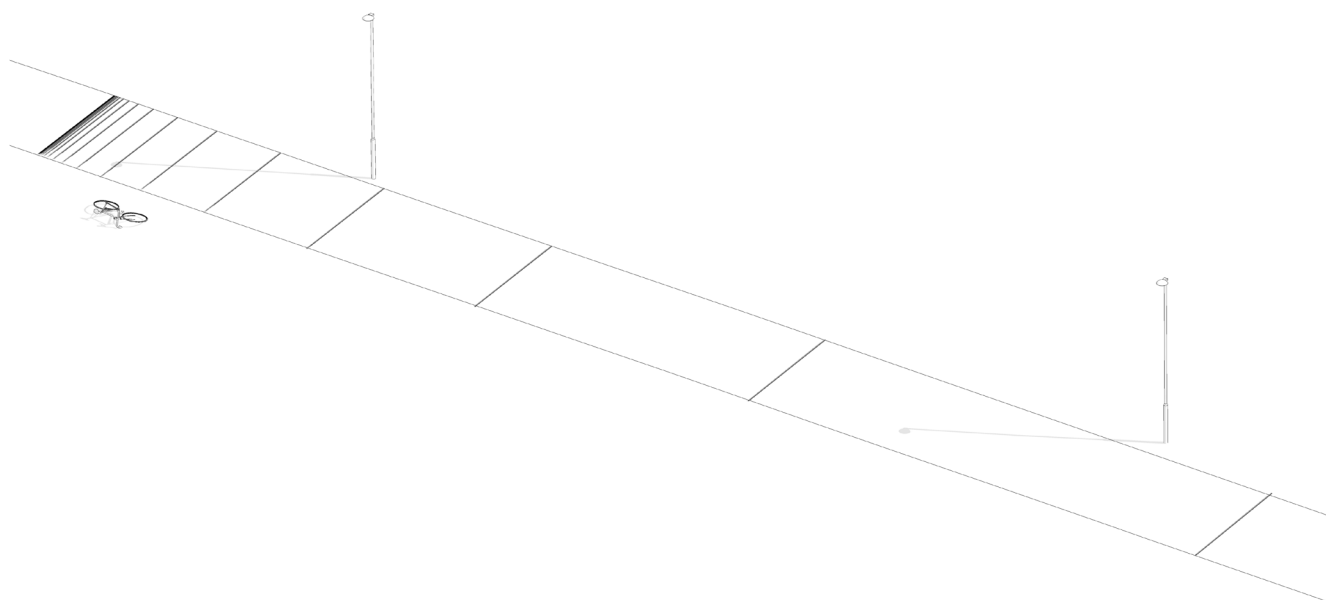
TEN SITES

The ten sites are chosen to exemplify one program each. Like characters in a computer game or a fairy tale, the structures provide the traveler with both functional and poetic experience.

Design parameters, structures...

- ...Provide an experience in motion, on a bike.
- ...Provide a function.
- ...Are possible to pass without stopping.
- ...Are safe to cyclists and other visitors.
- ...Are robust and low tech to last long.
- ...Use the existing bike path as the main circulation.
- ...Tie the 400 km route together.
- ...Have rational construction, form follows (function+experience).

The ten chosen project sites.



Heart rate
50-220 bpm

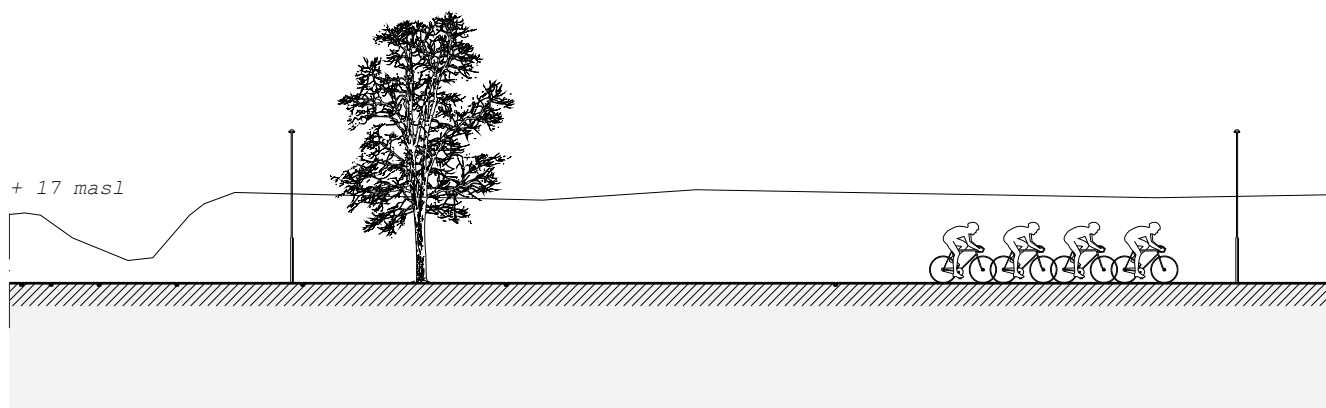


Respiratory rate
15-50 bpm



Cadence
60-120 rpm

0 ————— 5m

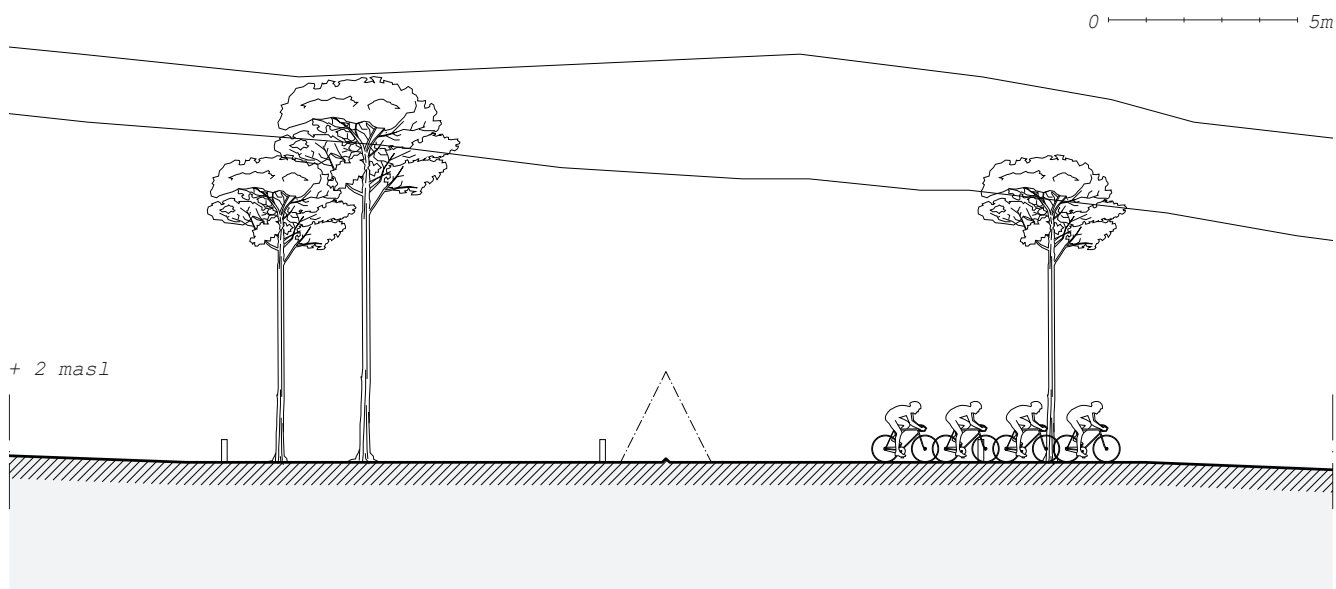
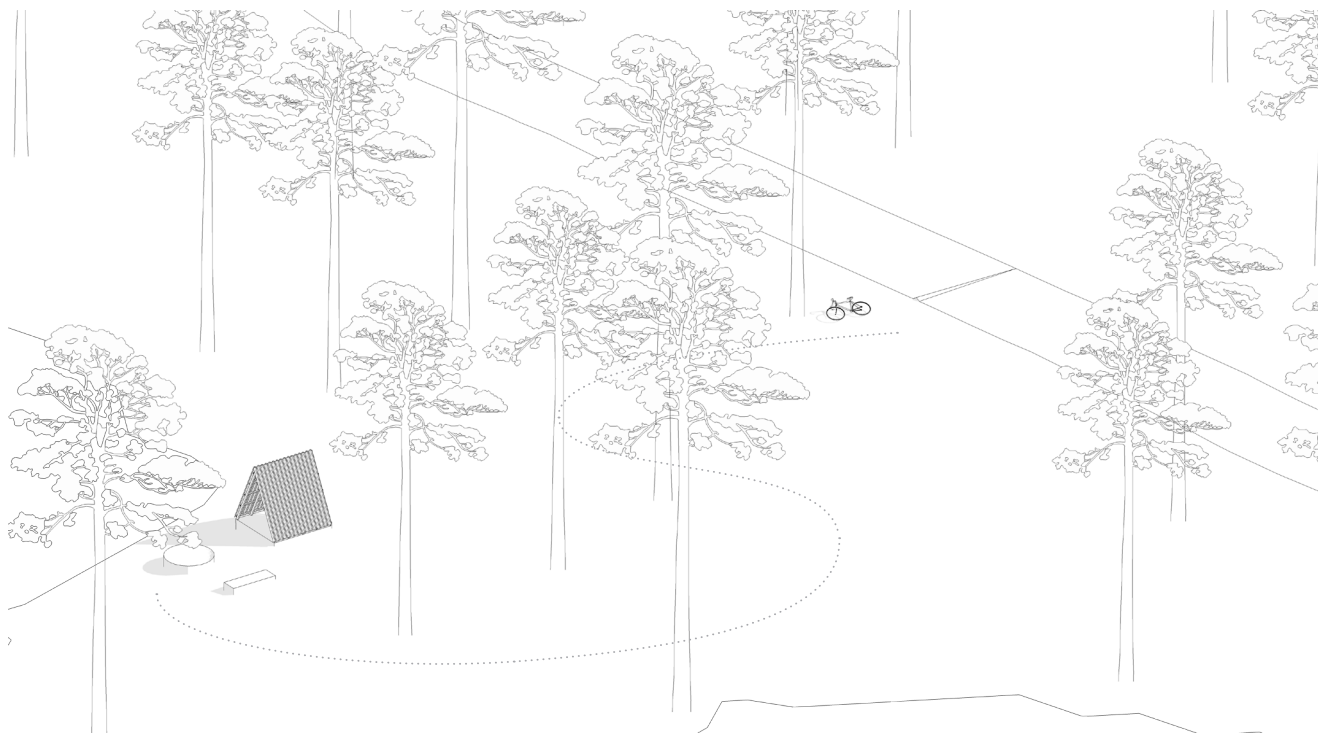


DISTANCE CUE

Landscape: Suburb
Site: Recurs every 1 km

Function: Sign, measurement
Experience: Subconscious, rhythm
Size: 40 m long
Senses: Vibration

A subtle notion activating only the cyclists tactioception. Maybe the first ones will go unnoticed, but after a few kilometers a pattern emerges. To make installation stand out from other random nudges and vibrations cut distance is based on Fibonacci ratio, creating a Risset rhythm as a result.



FIREPLACE

Landscape: Grove by sea

Site: Hidden

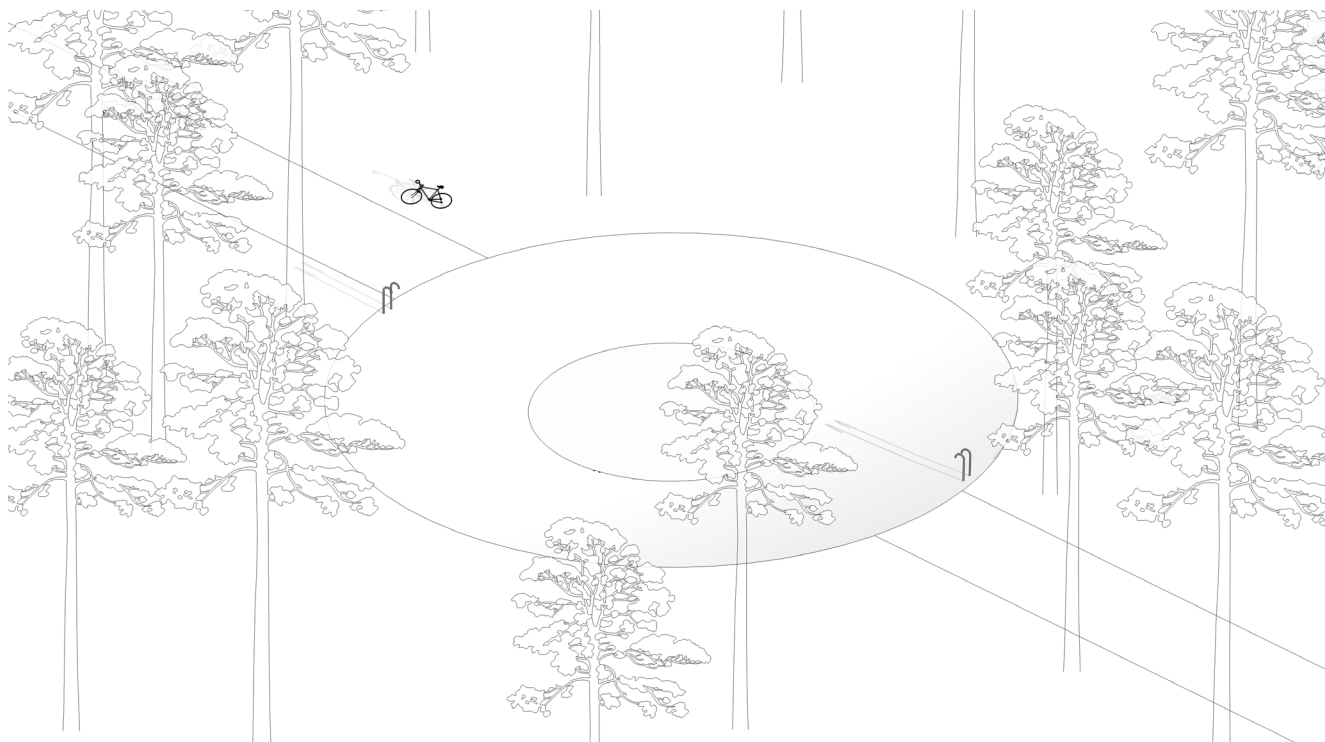
Function: Heat and social space

Experience: Slight deceleration

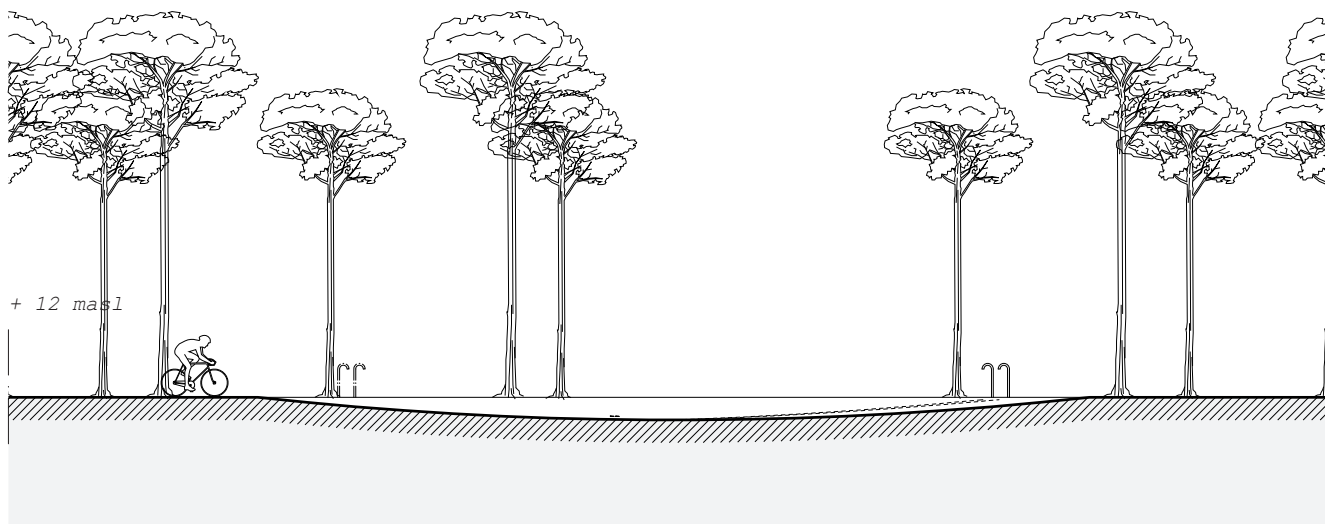
Size: 4 m²

Senses: Acceleration, touch

Fireplace and wind shelter. A speed bump in the bike path hints location and shape of shelter.



0 ————— 5m



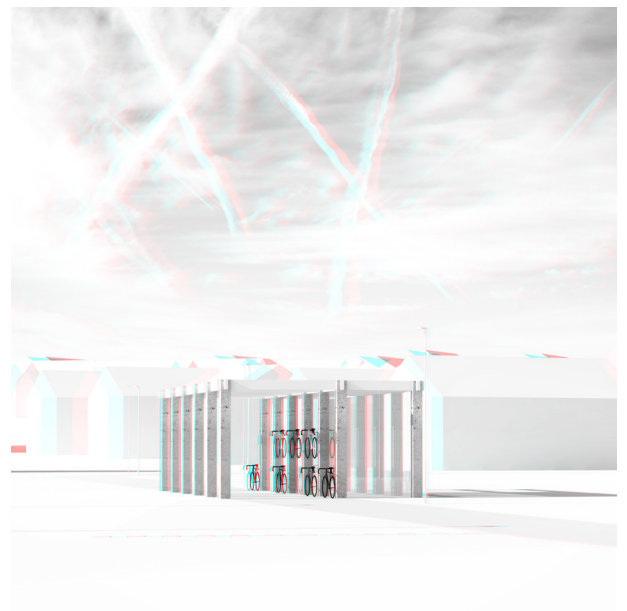
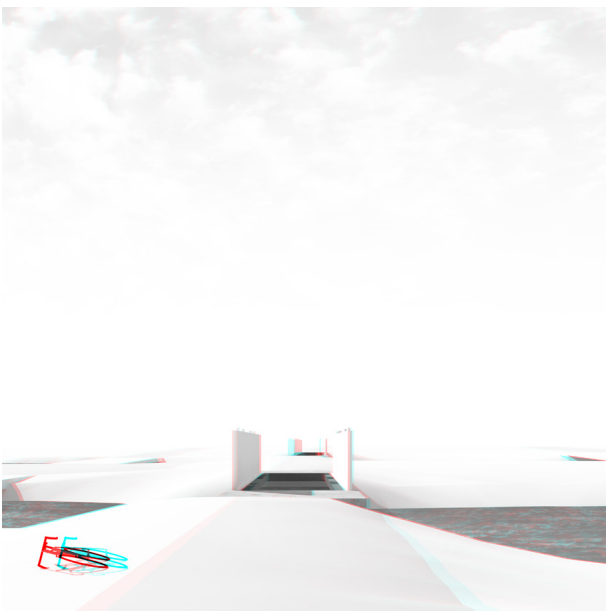
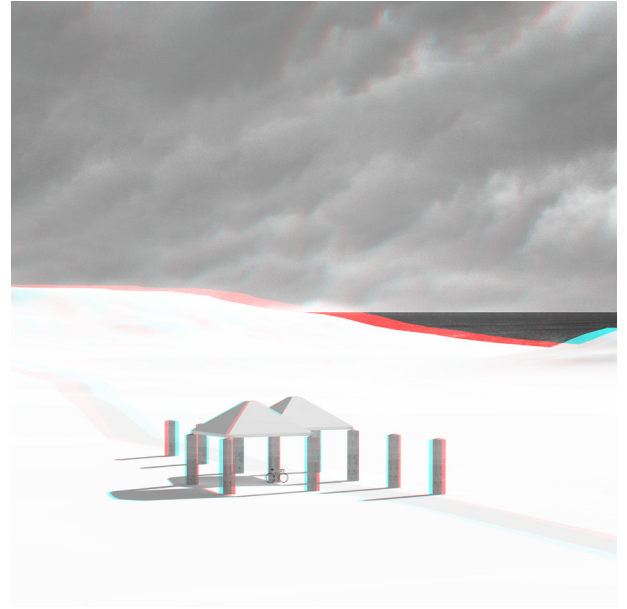
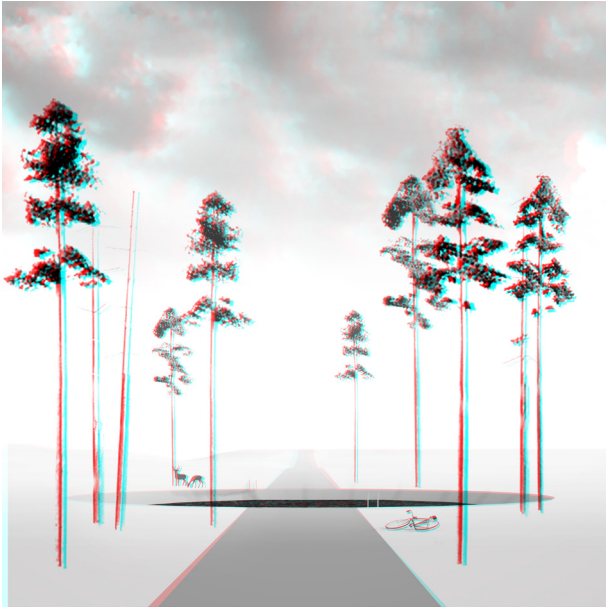
WATER FOUNTAIN

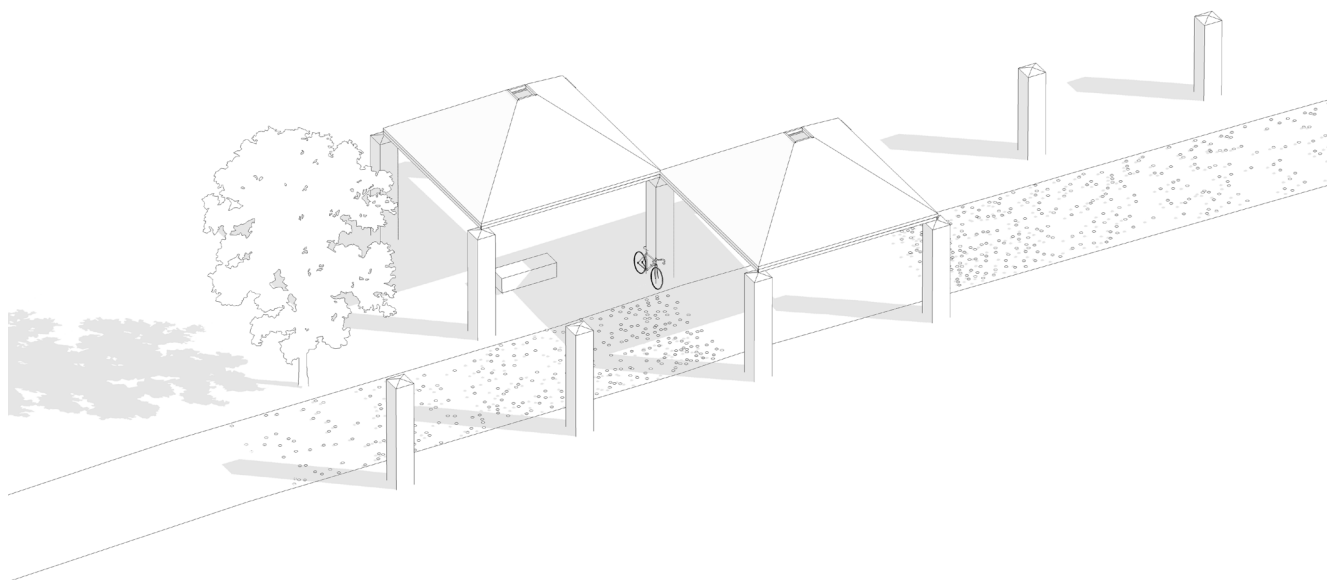
Landscape: Forest
Site: Far from public space

Function: Drinking water
Experience: Cycling through water
Size: 11 meter radius
Senses: Temperature, balance

A fountain that provides drinking water and turns into a pond. Cyclists can choose to go through or around water. The smooth concrete bowl shape is covered with a water-repellent finish to make drops roll easily.

*Anaglyph 3d-perspectives: Water fountain, rain
shelter, bridge, workshop.*

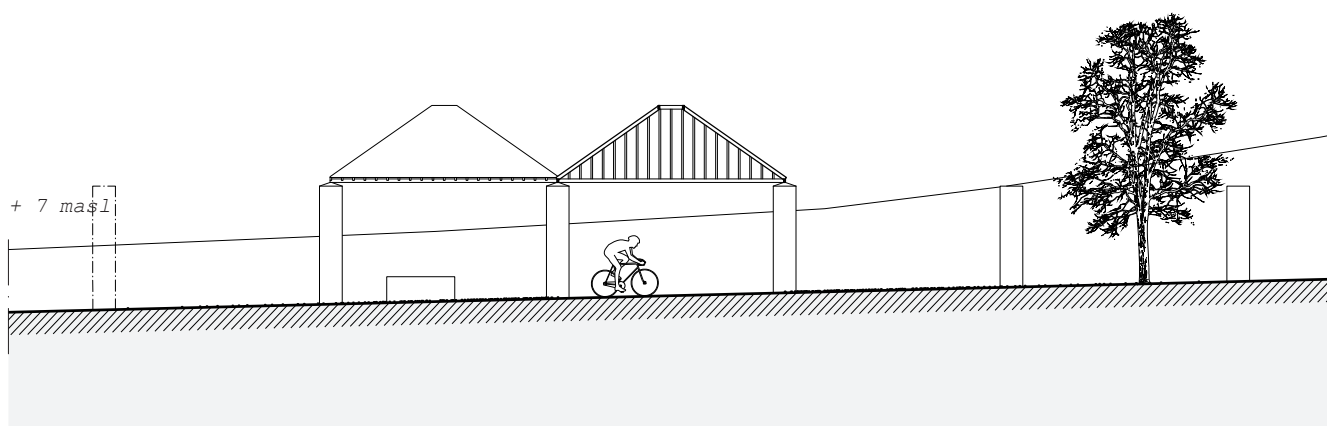




Rain



Tire on gravel

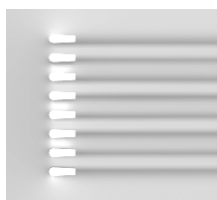
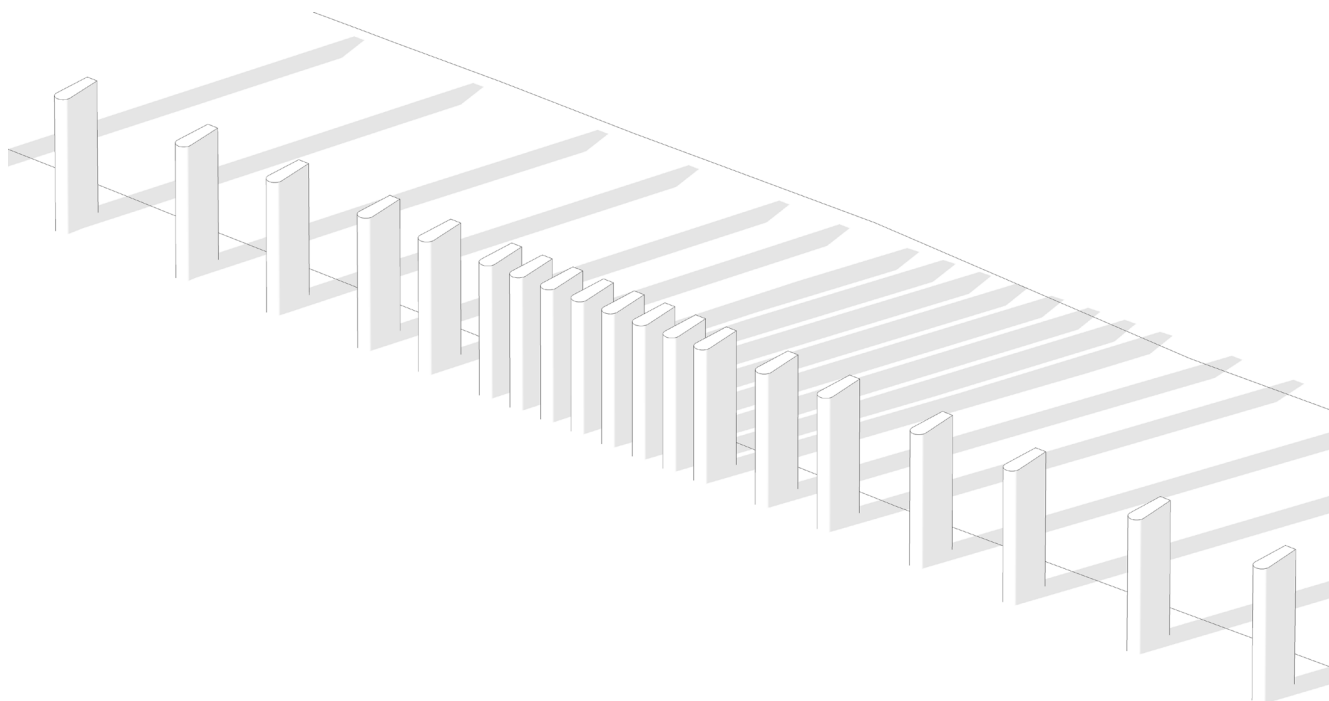


RAIN SHELTER

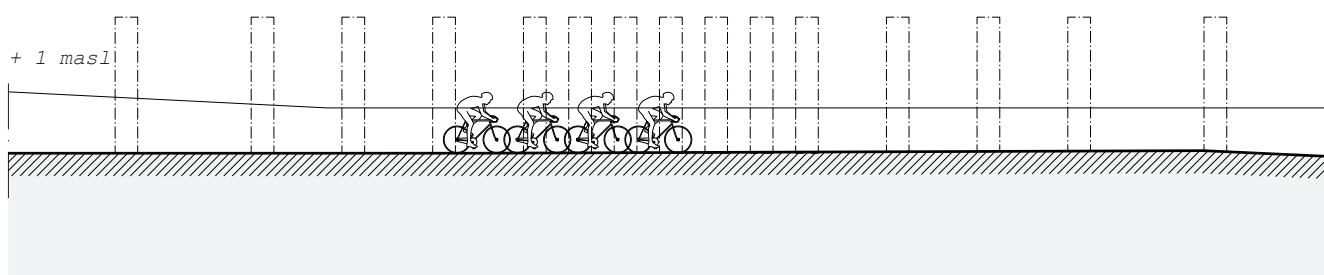
Landscape: Field
Site: Open, monotonous

Function: Weather protection
Experience: Sensory symbolism, sound
Size: 70 m²
Senses: Sound

The sound of rain is synthesized by cycling on the ground material, hard gravel.



0 ————— 5m



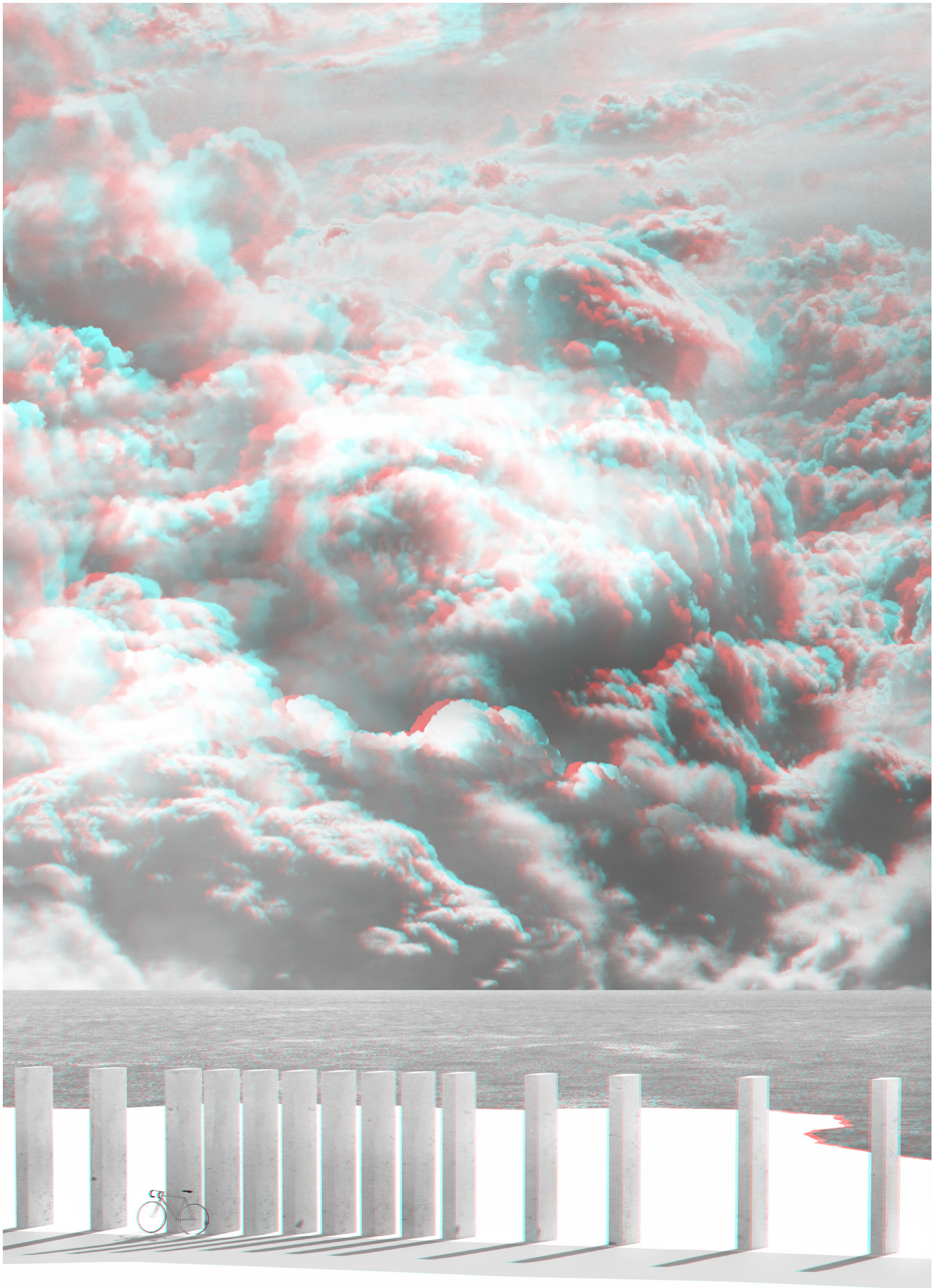
AIR PUMP STATION

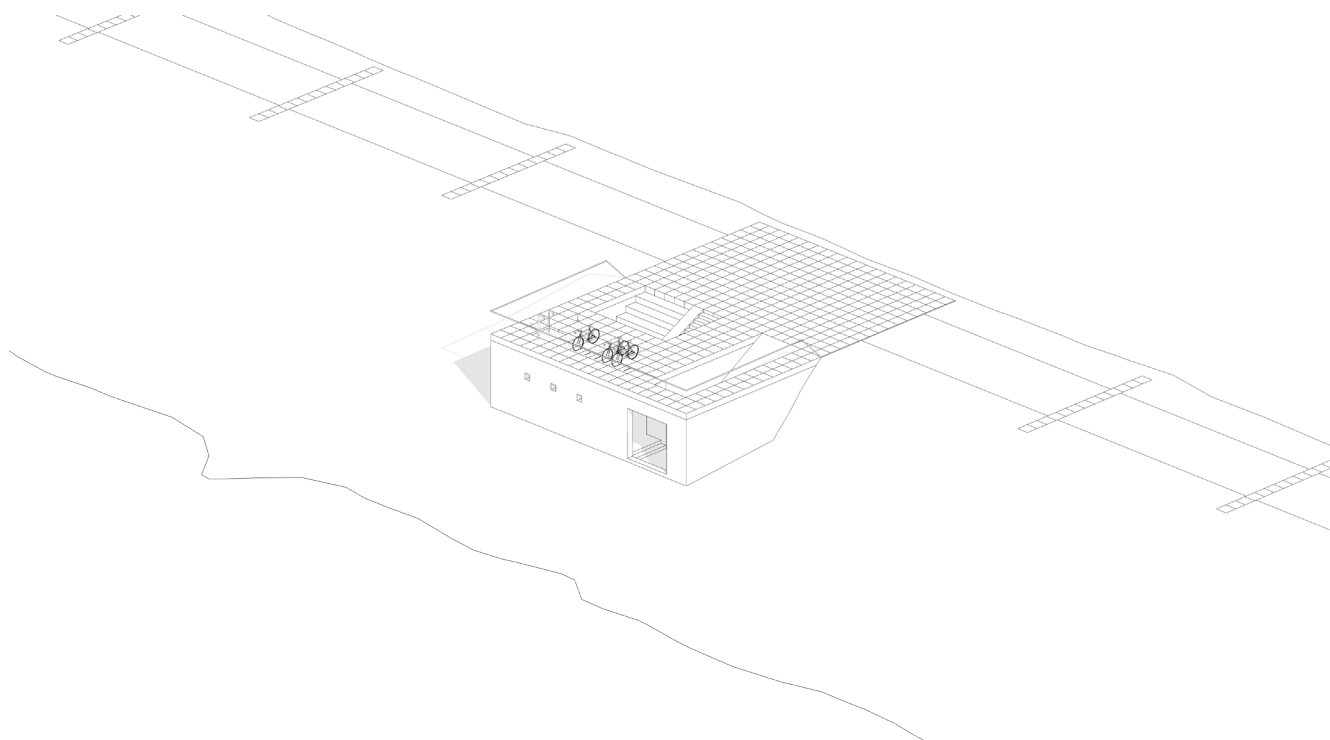
Landscape: Seaside
Site: Windy, detached

Function: Simple workshop
Experience: Rhythm, aerodynamics
Size: 100 m
Senses: Touch, balance

Cycling is rhythmic: Breath, heart rate, cadence. This structure crosses rhythm with a strong characteristic of the route, the wind. To make the traveler notice the wind is remixed. Air pump hidden in one of the pillars.

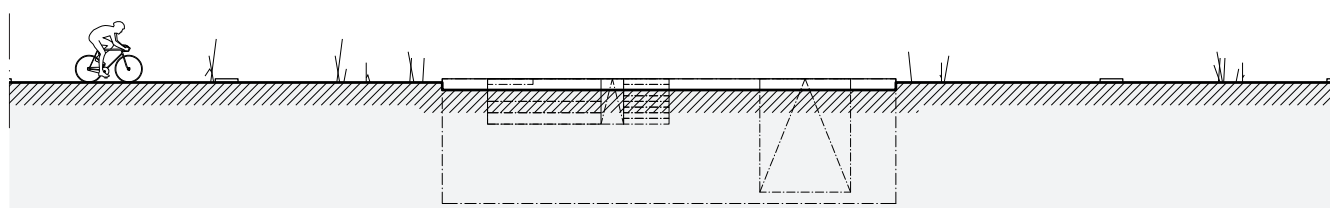
Anaglyph 3d-perspective, air pump station.





0 ————— 5m

+ 4 masl



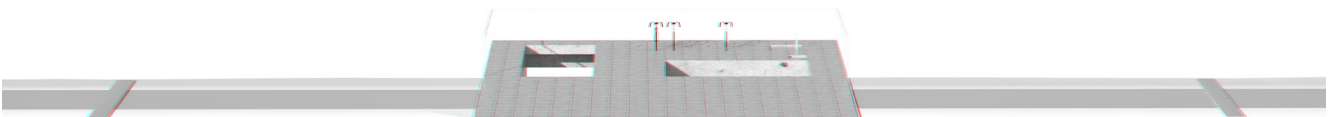
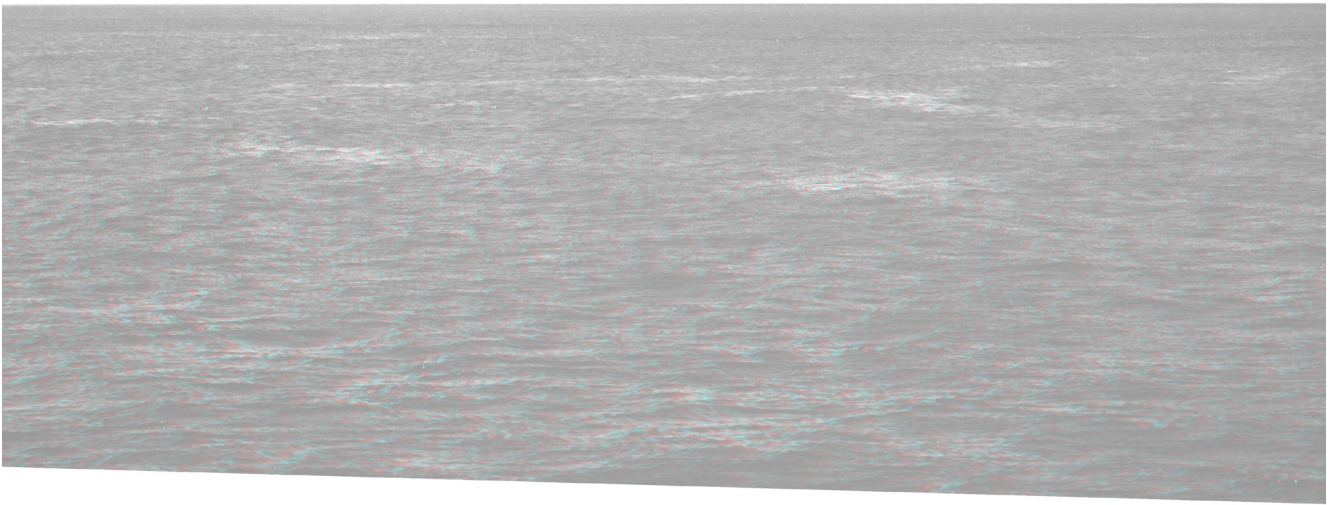
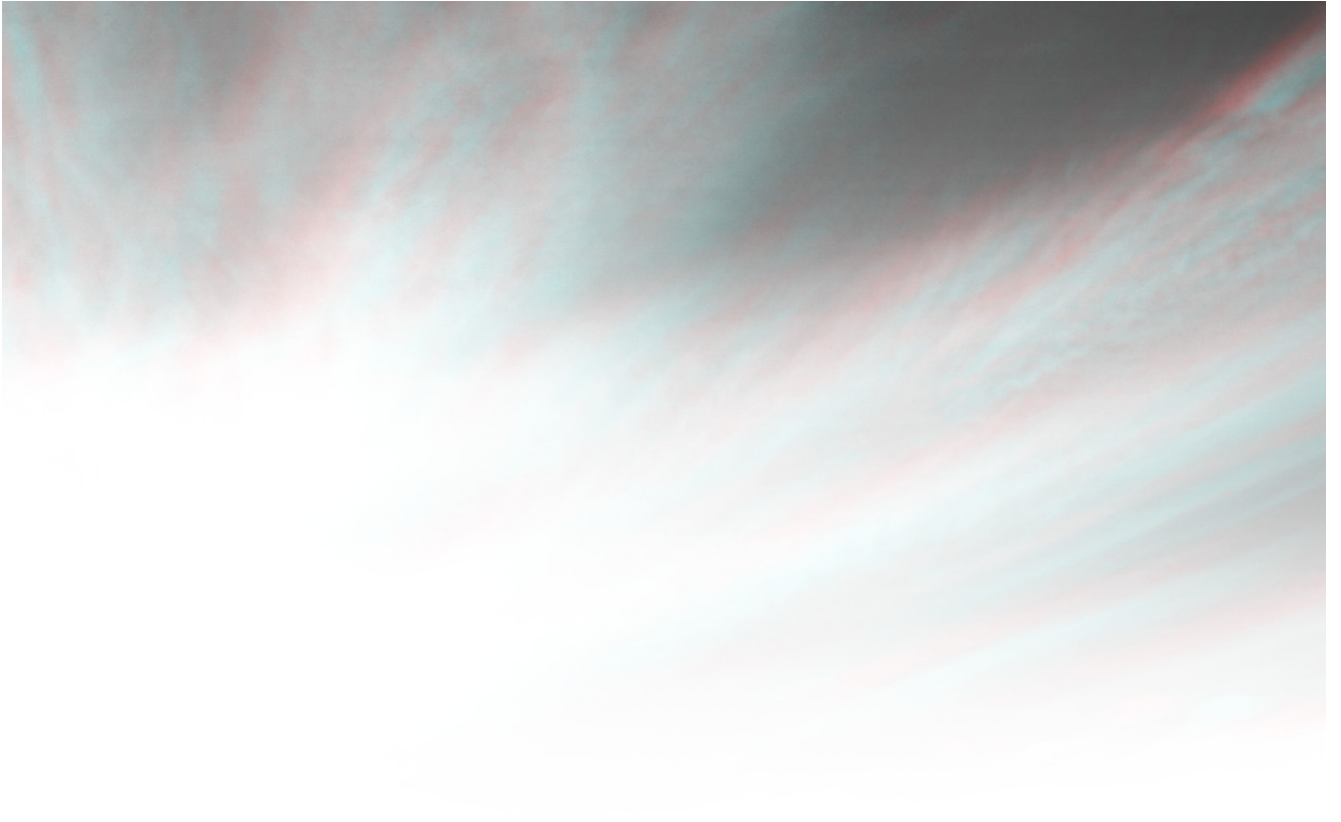
RESTROOM

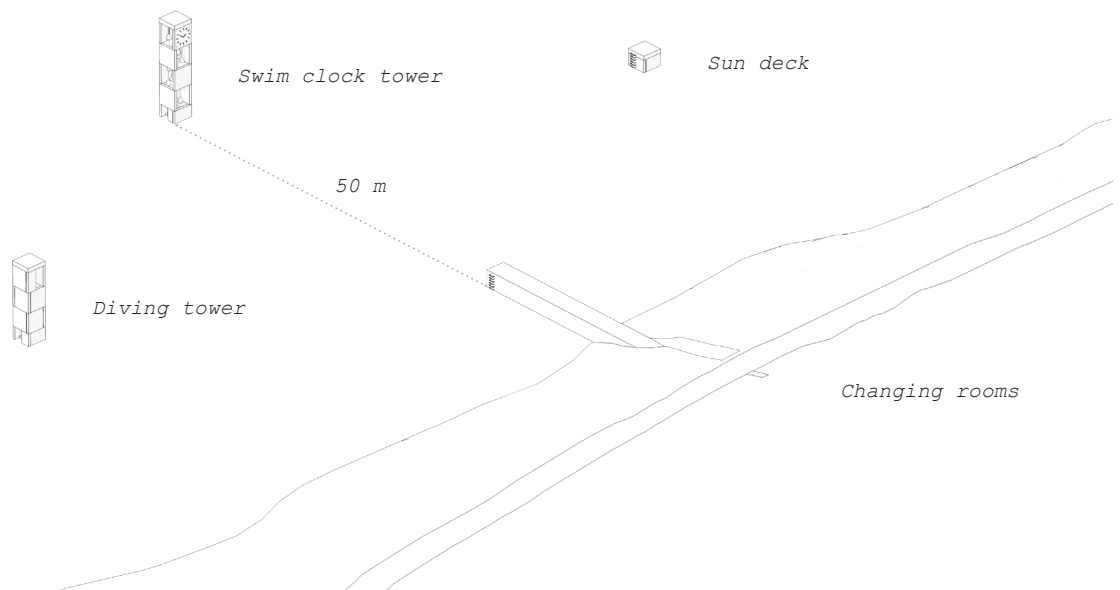
Landscape: Former railway embankment
Site: Detached, near plumbing

Function: WC, water
Experience: Wheel architecture
Size: 100 m²
Senses: Vibration, touch

Underground structure with a view. Cyclists feel the building, and hints of it, through their wheels.

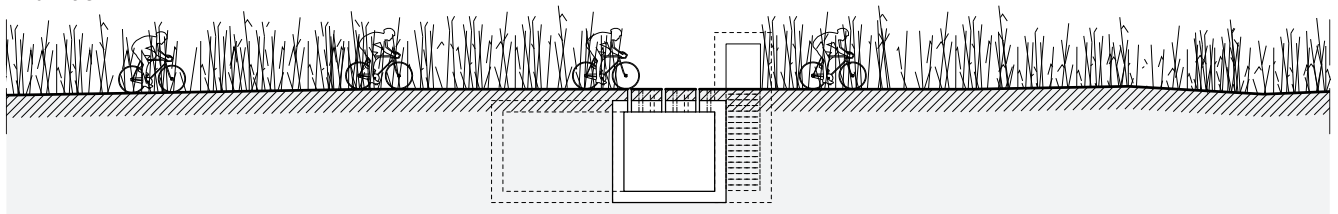
Anaglyph 3d-perspective, restroom.





0 5m

+ 6 masl



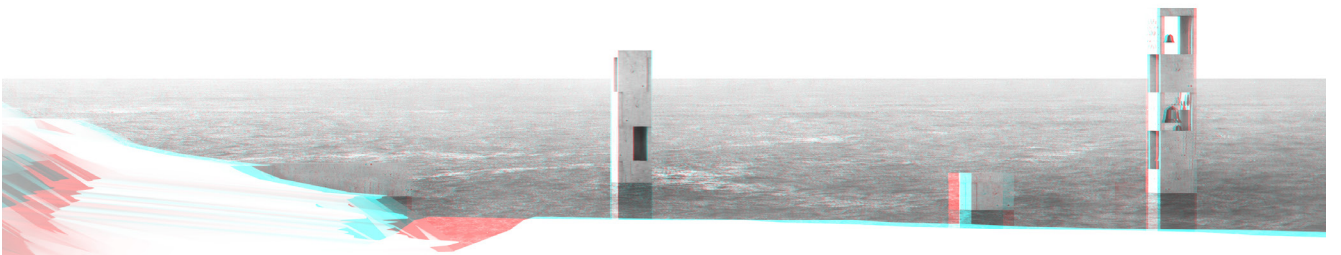
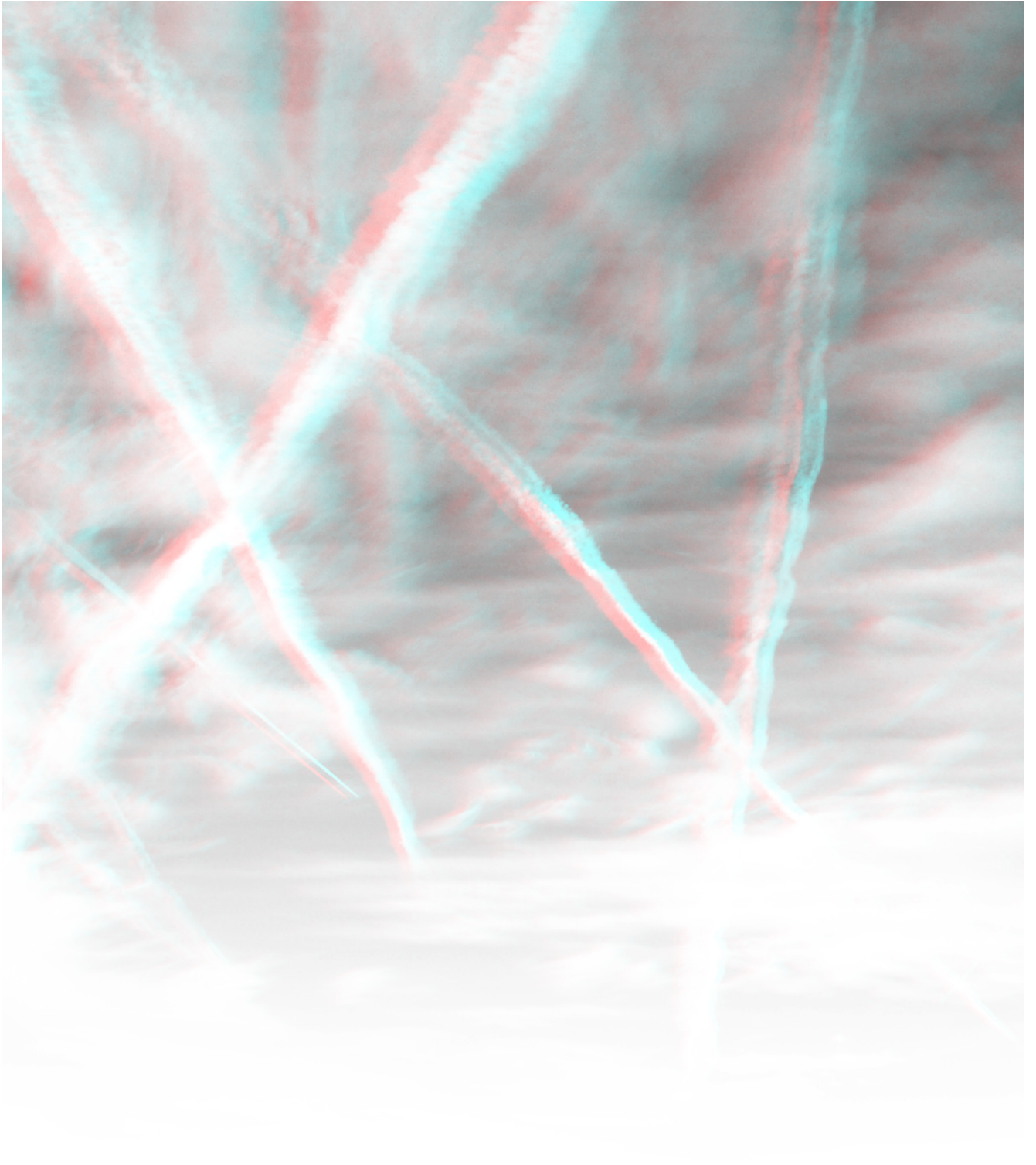
OPEN WATER SWIM TRACK

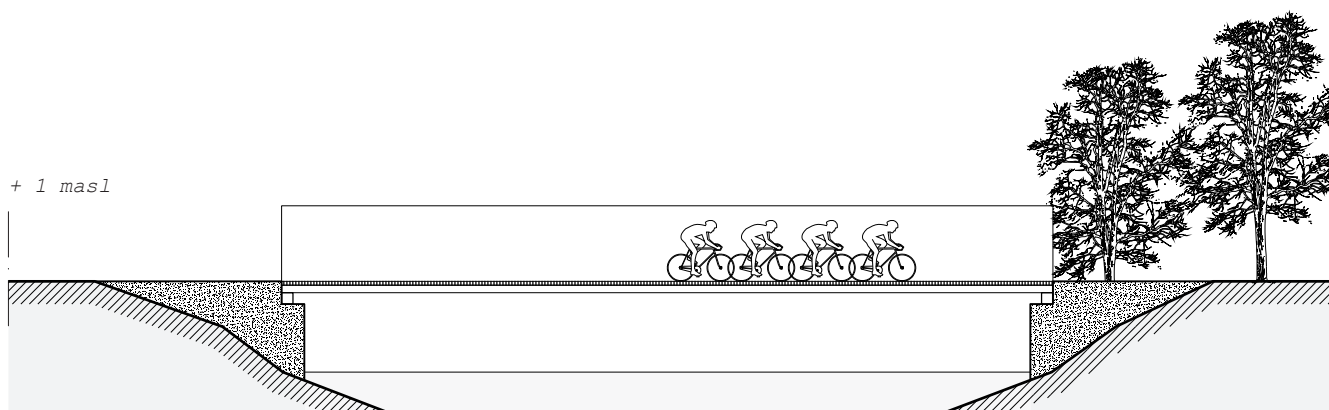
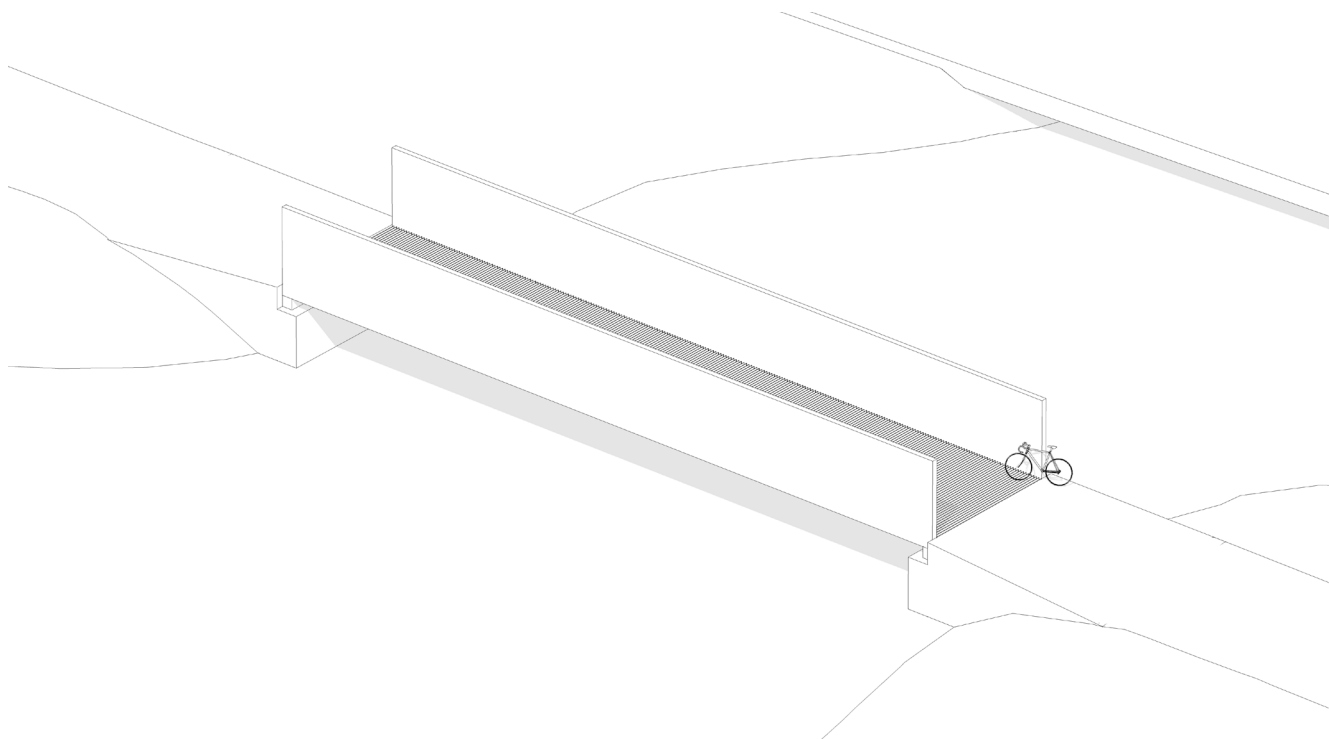
Landscape: Beach
Site: Calm waters

Function: Swim track
Experience: Element change
Size: 100x100 m
Senses: Sound, temperature, pain

The distance between the towers is 50 meters, like a swim track. Depending on wind and waves swimmers can choose different paths. Underwater chains help navigation between towers. The towers have three individual functions; A sun deck, a diving tower and a swim clock tower with bells chiming in the wind.

Anaglyph 3d-perspective, open water swim track.



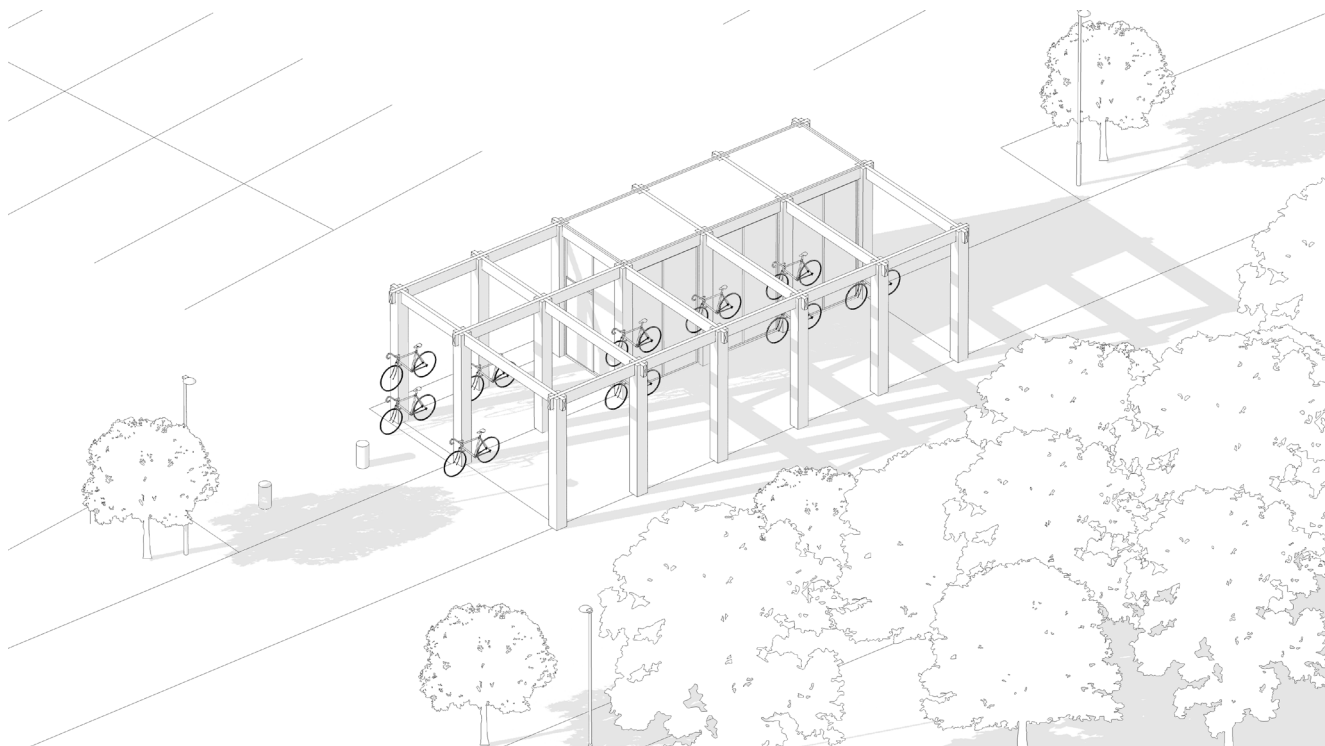


BRIDGE

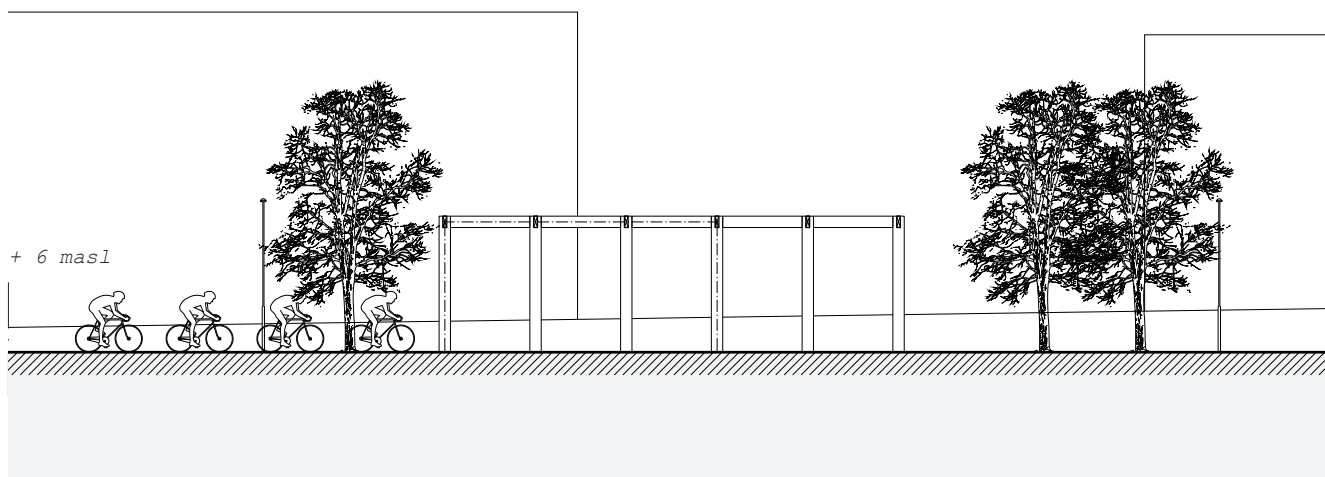
Landscape: River
Site: Water crossing

Function: Bridge
Experience: Vertigo
Size: 30 m across
Senses: Vision, balance

Bridge over Viskan river. The current bridge, originally a railway bridge, is over dimensioned and not designed for cycling.



0 ————— 5m

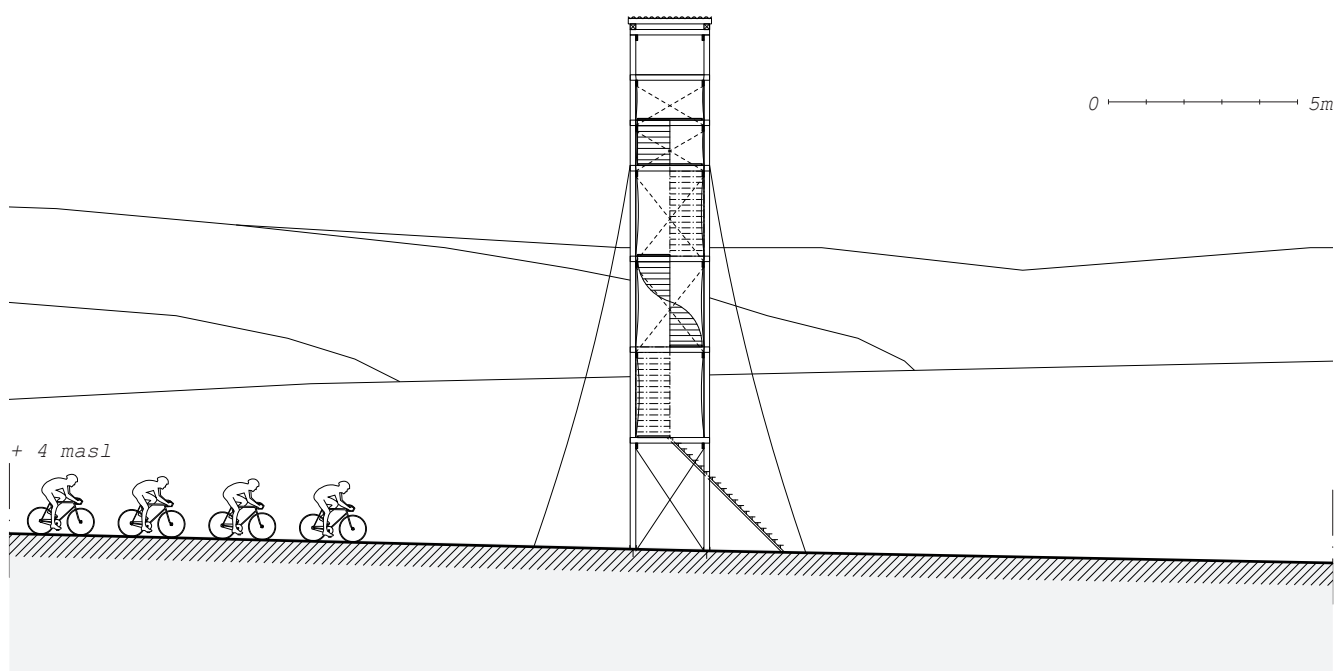
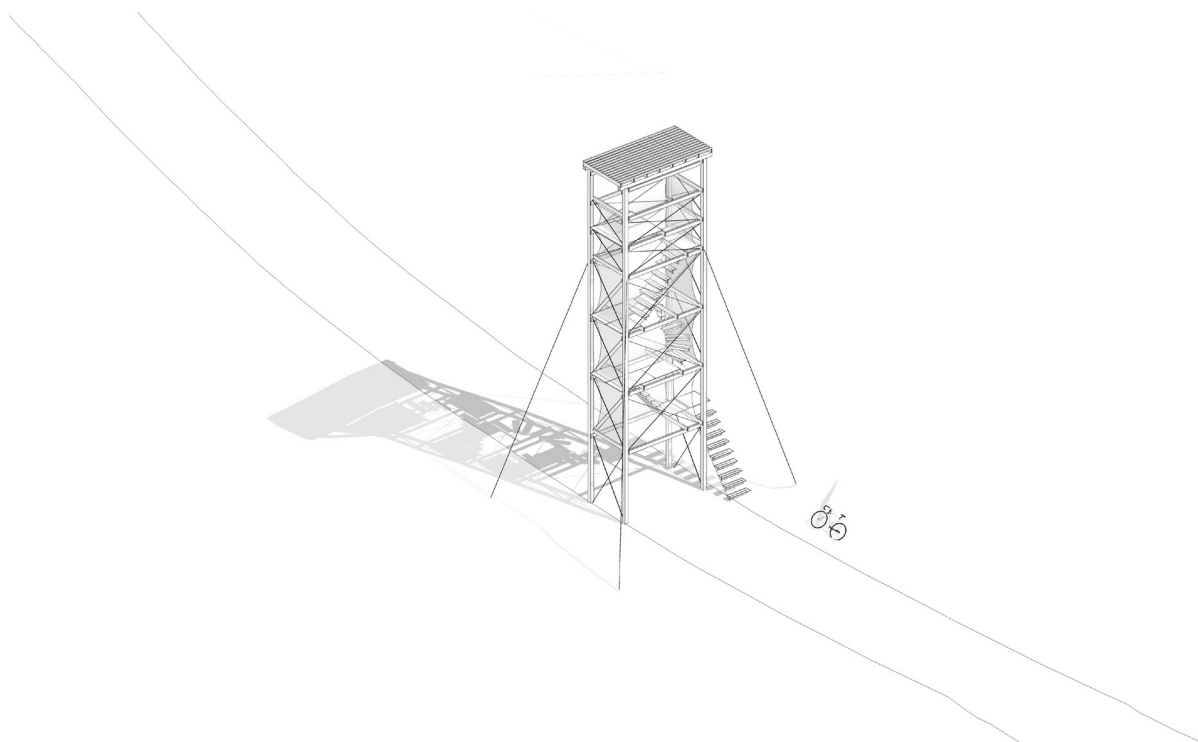


WORKSHOP

Landscape: Urban
Site: Transport node

Function: Workshop, storage
Experience: Busy, social
Size: 70 m²
Senses: Vision, speed

Ties cities along the bike path to the rest of the route. Built to be biked through, like a tunnel. For parking and fixing bikes.



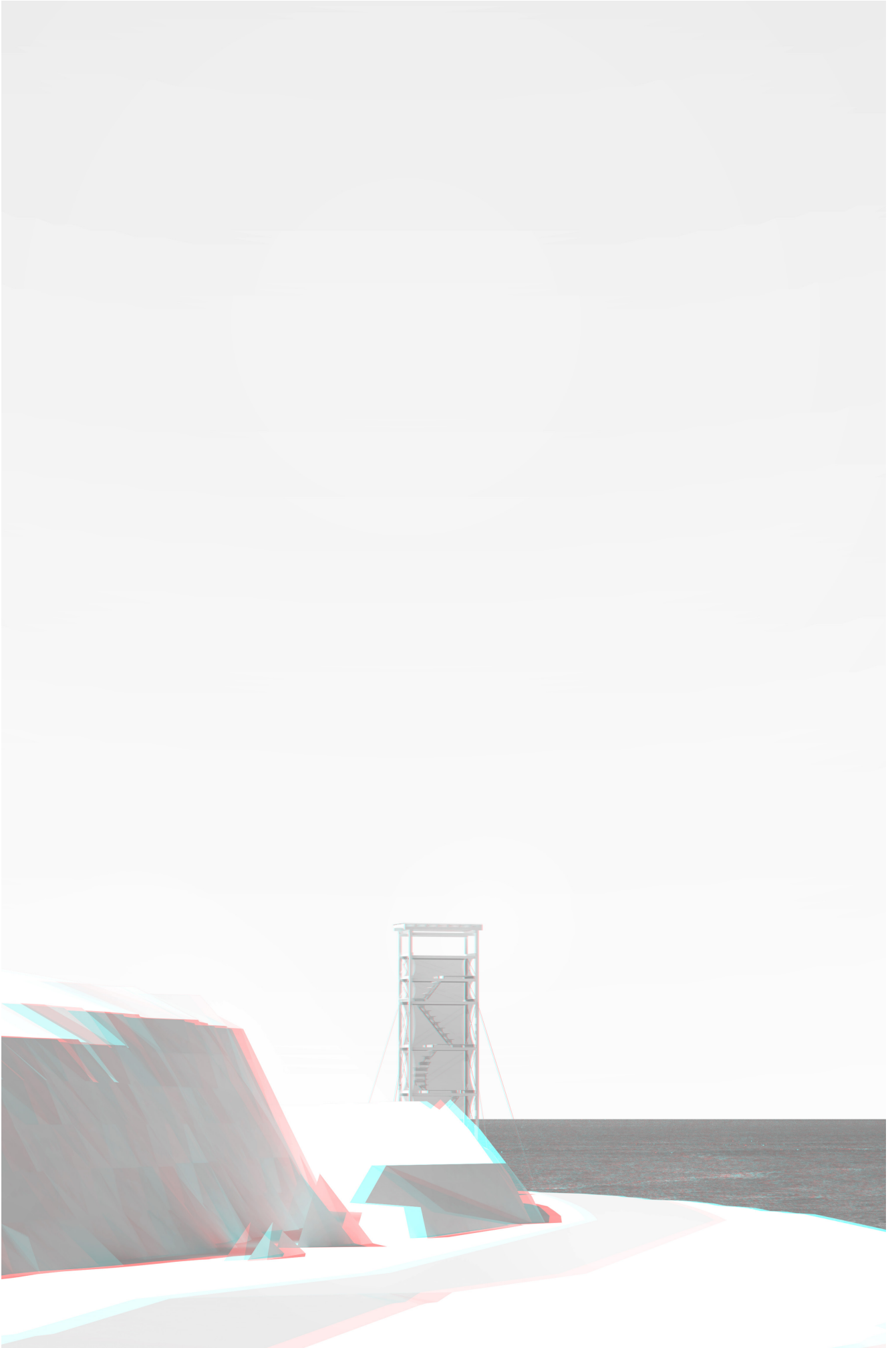
LOOKOUT TOWER

Landscape: Cliff hill
Site: View

Function: Lookout
Experience: Change in direction
Size: 14 m tall
Senses: Vision, orientation

Something to look at and look out from.
Provides a contrast from open, linear motion
with complex vertical movement.

Anaglyph 3d-perspective, lookout tower.



PROJECT REFLECTION

When I first started the design project I thought I was going to design a maximum of four structures, break areas and cabins. I had a more infrastructural approach than towards the end of the projects. References such as *National Tourist Routes of Norway* and *BUS:STOP Krumbach* ended up being used more as programmatic precedences rather than architectural. The inspiration for architecture was found on a more conceptual level, in Kraftwerks *Tour de France Soundtracks* and Iannis Xenakis *Philips Pavilion* to name a few.

I am glad I let experiments inform the detailing of the structures and let the sense of cycling and motion influence the design program. I believe this method lead to more generally applicable yet less generic project.

The thesis raises questions on how bikes are generally treated like any other vehicle today. It also works well as a starting point for discussing design for bikes in detail.

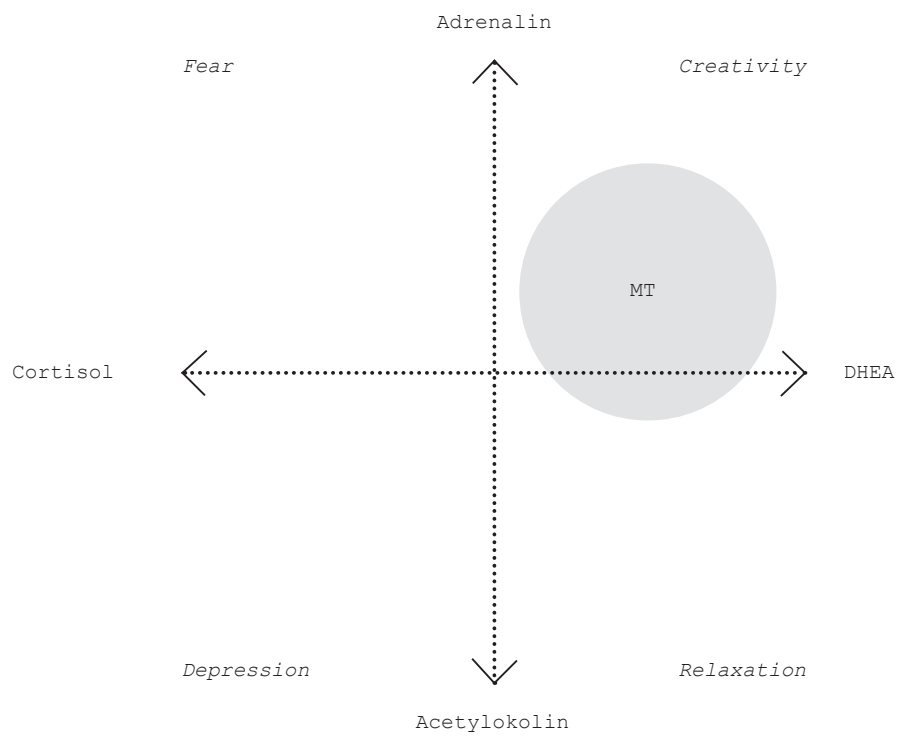
The jury in the final exam were mostly positive to the project. They especially appreciated the project program and the main idea of investigating cycling from a sensory point of view. Jury member Frida Rosenberg pointed out how the project could be more political and question health politics and infrastructure more. Jury member John Ross called for more detail drawings. Examiner Morten Lund wanted, as always, more dirt in the presentation.

The next step of the project would be to present it to Region Halland to raise ideas about its realization. Even though it might not be built the way it is presented in this booklet I am sure it would inspire future break areas and projects along the route. If

nothing else it works as a way to promote the *Kattegattleden* bike route, which still nobody seems to have heard of.

Hopefully this thesis can affect future architecture aimed at cyclists in general. Design method and experiment data may inform or inspire future projects.

PART 3: NOTES

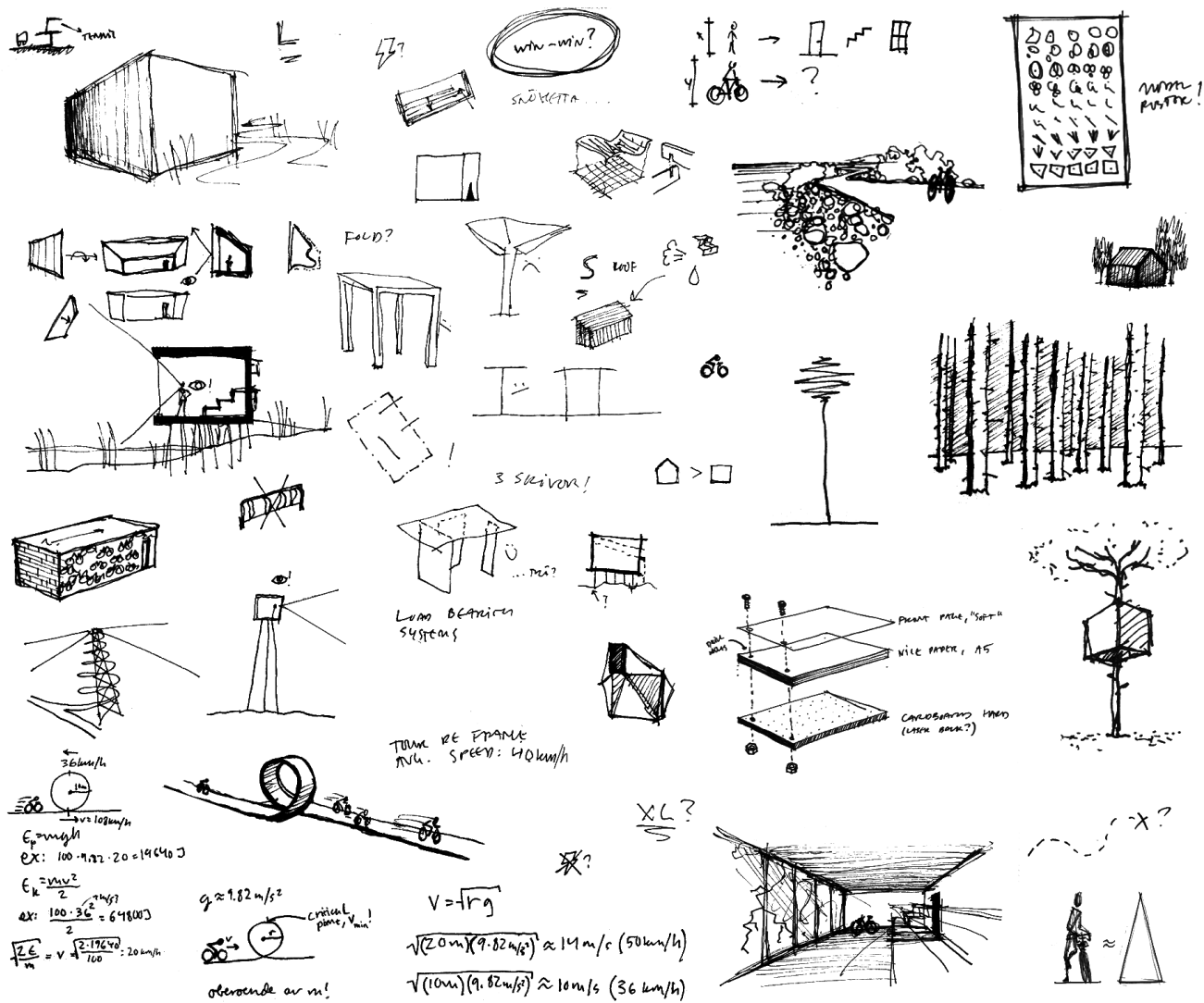


PROCESS

A notorious Chalmers professor once said
"The student who uses the most tracing
paper becomes the best architect". In this
chapter documentations of the design process
are presented in chronological order, from
September 2014 to June 2016.

*September 2014. Process planning. Diagram shows
how master's thesis scientifically should
relate to personal nervous system for optimal
result and well-being.*

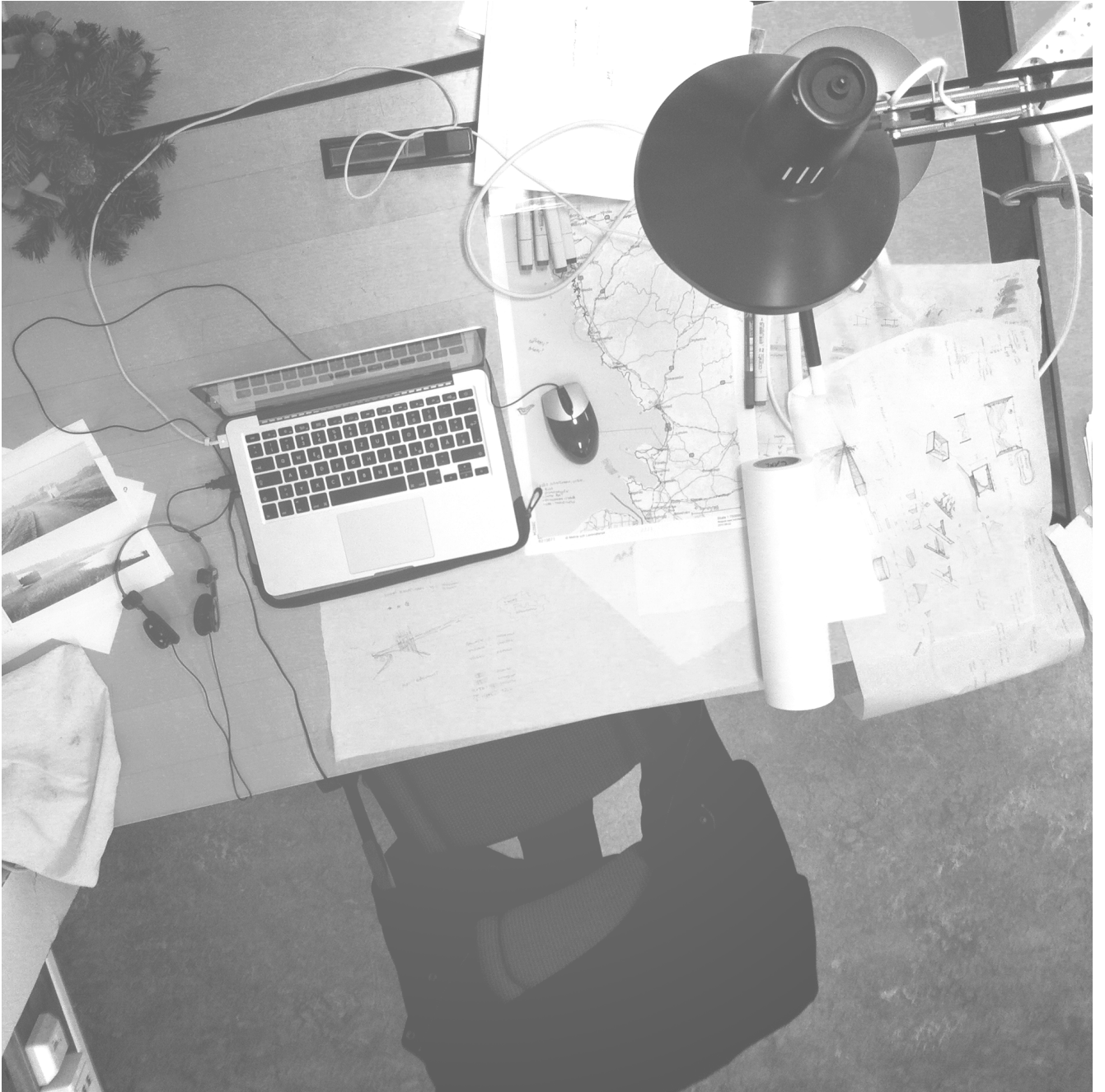
October 2014. First idea sketches.



*November 2014. Photoshop montages. Early ideas
applied on photos from trip 1.*

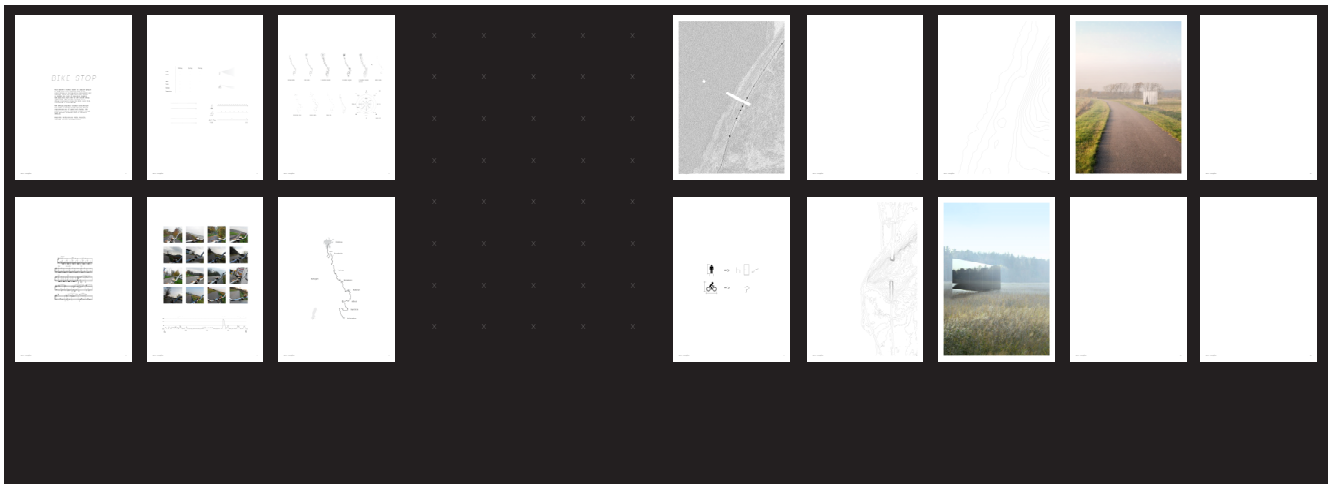


*December 2014. Research. Photo of my prep
studio desk.*

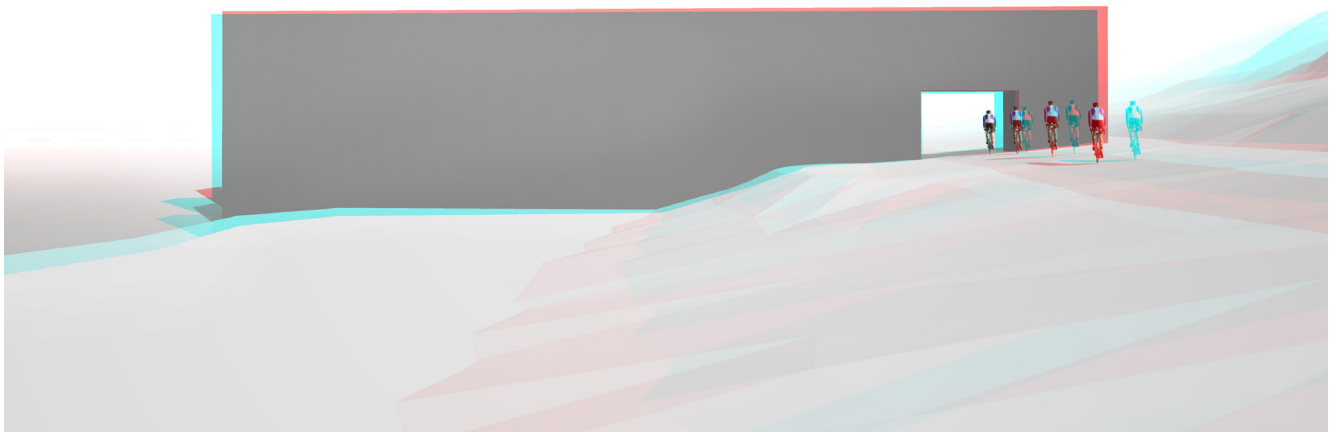


*January 2015. Started an internship, MT on hold
for one year.*

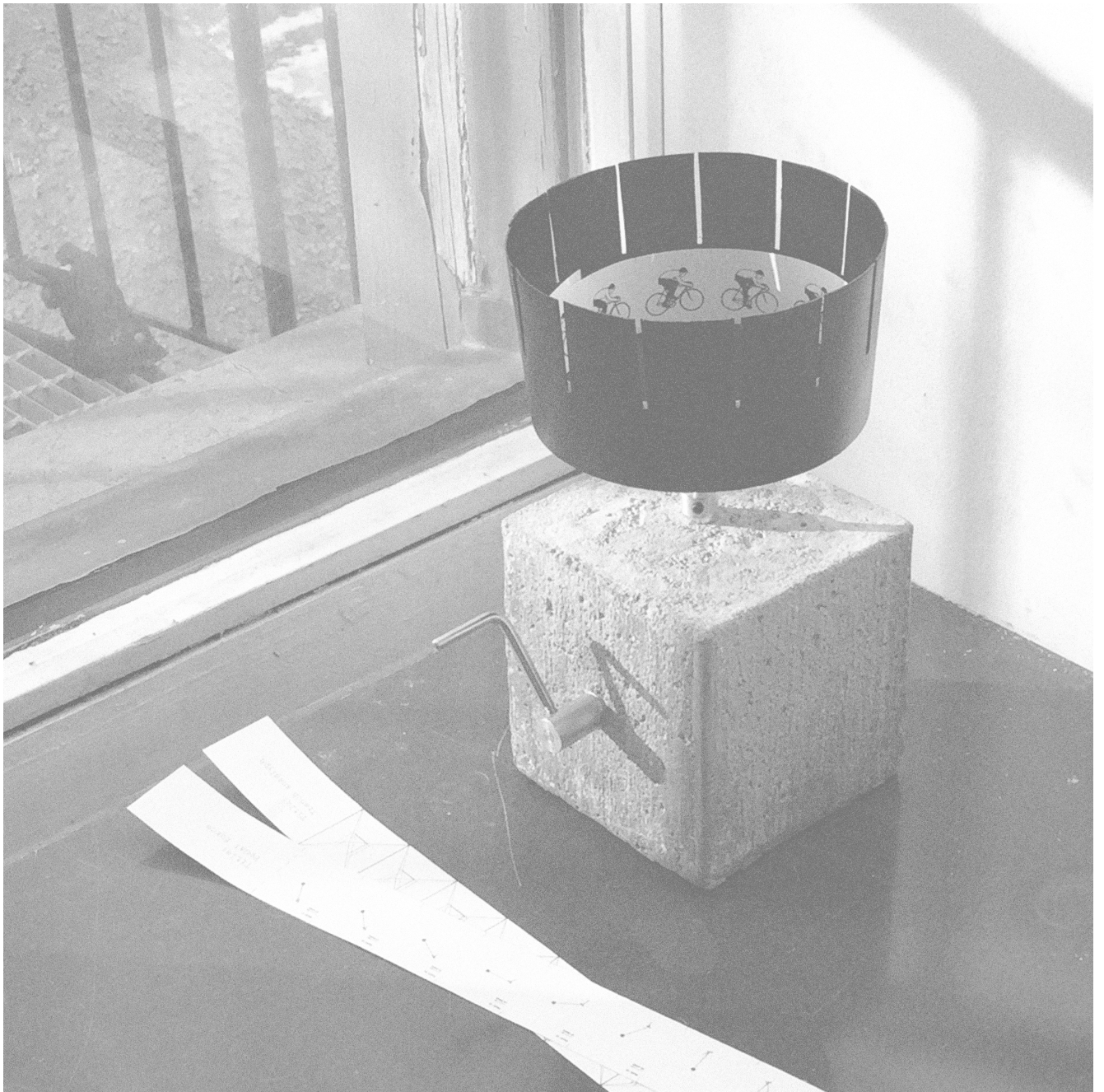
*January 2016. MT reboot! Work on thesis program
and mock-up presentation boards.*



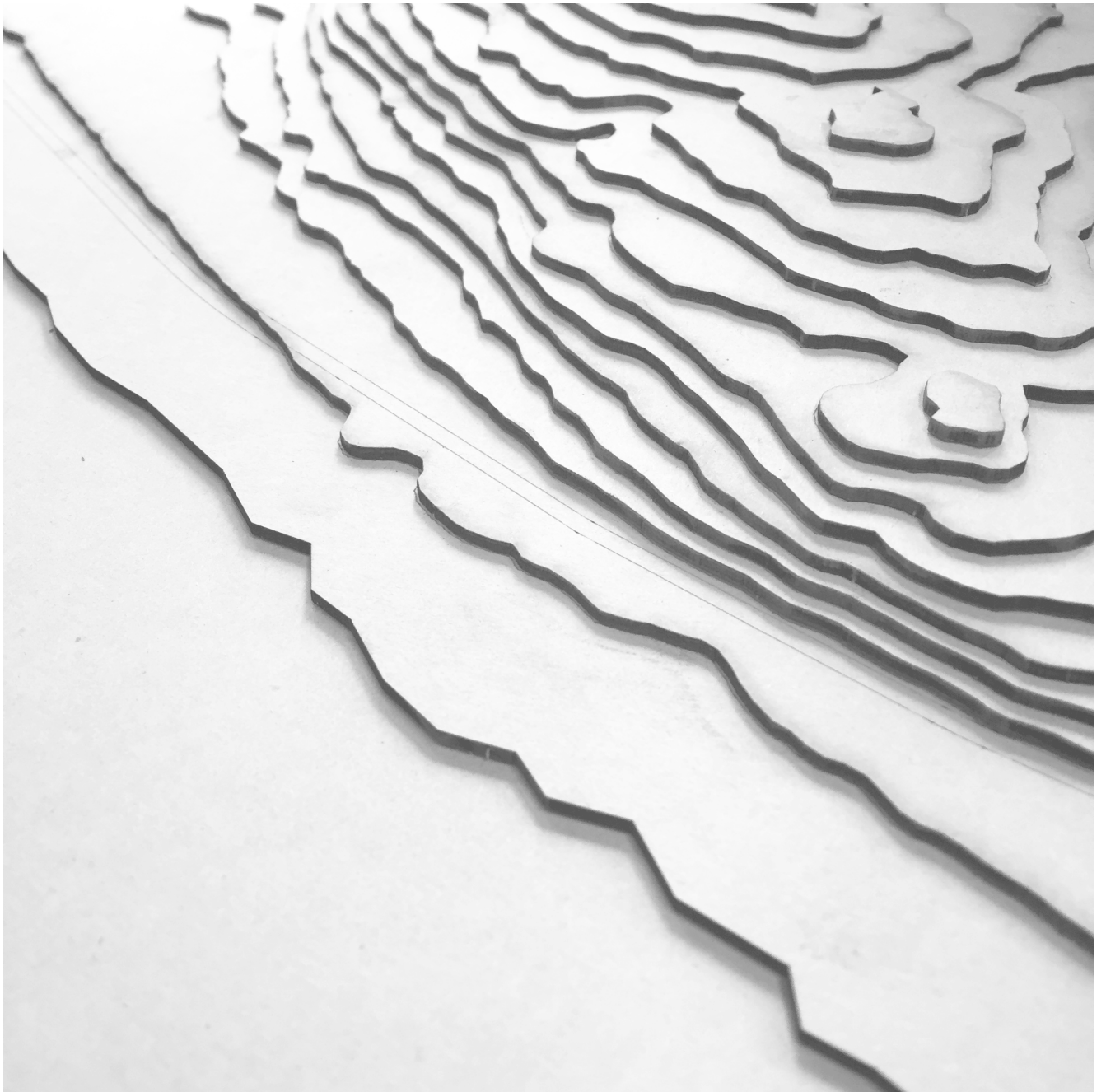
*February 2016. Kraftwerk-inspired anaglyph
3d-sketch, tunnel building.*



*February 2016. System model: Zoetrope, a
mechanic film device.*



February 2016. Landscape model 1:1000.

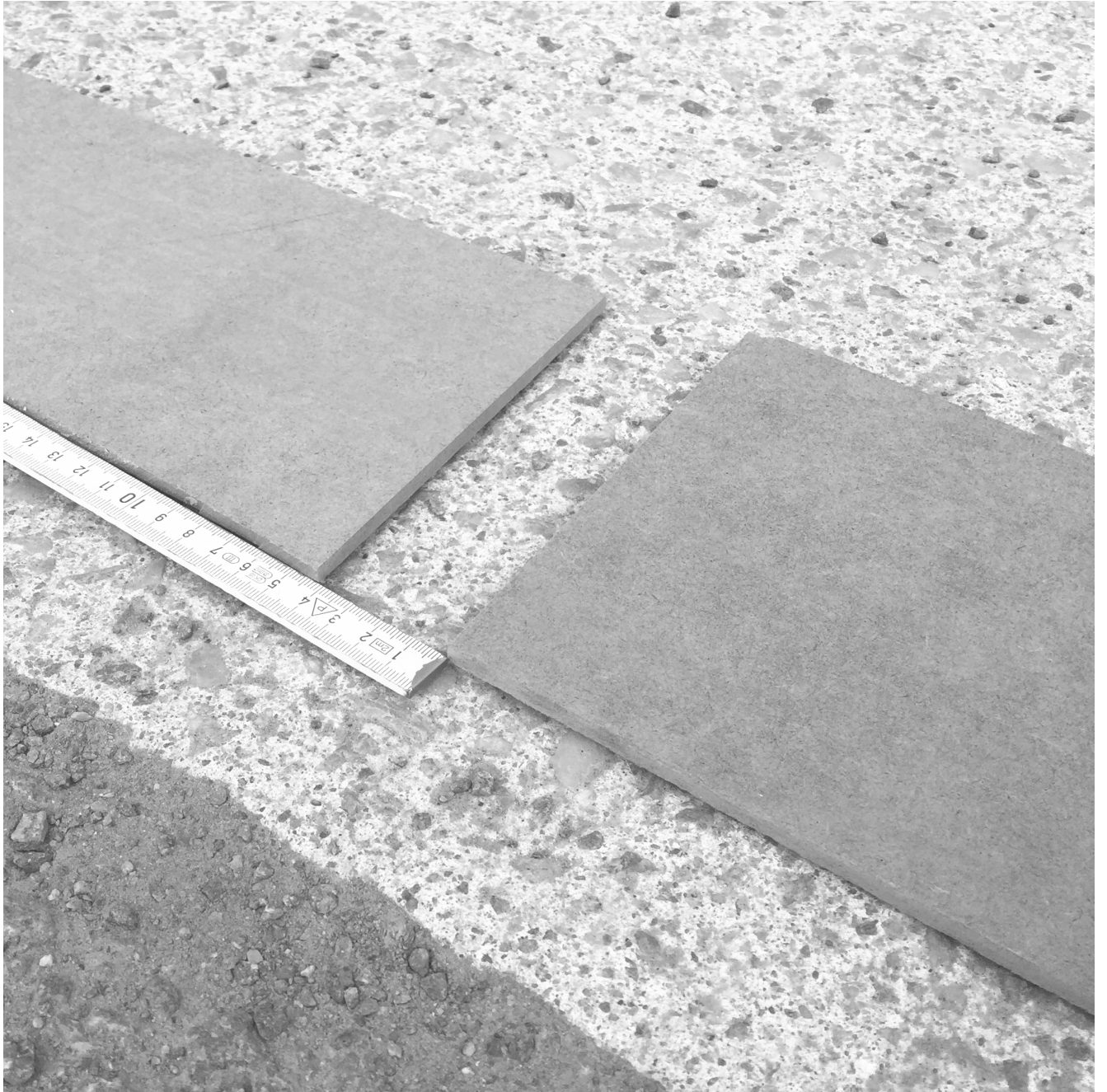


March 2016. Structure sketches.

March 2016. Mid-term and drawing mid-critique.



April 2016. Full scale experiments.



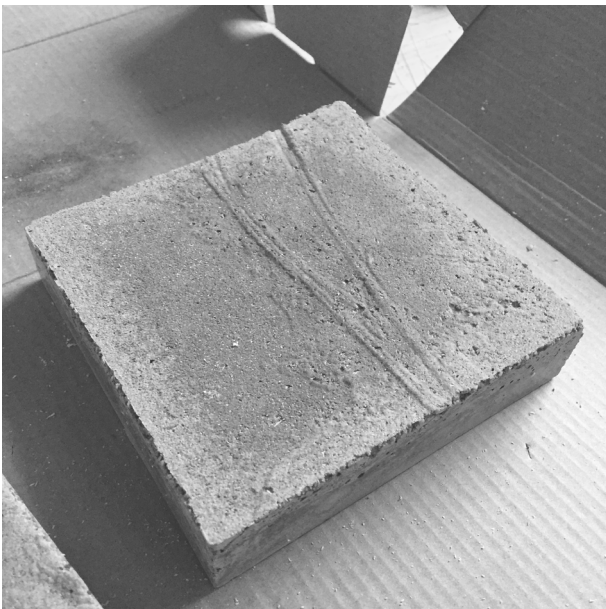
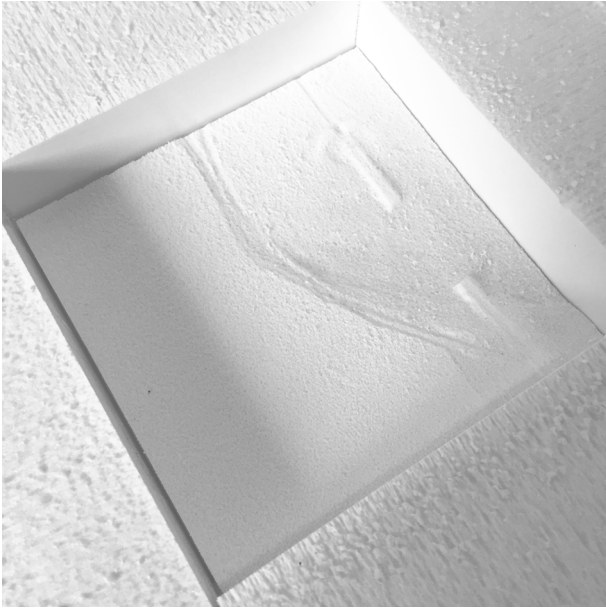
April 2016. Contrary to what Morten and Kengo believe, I have the messiest desk in the studio.



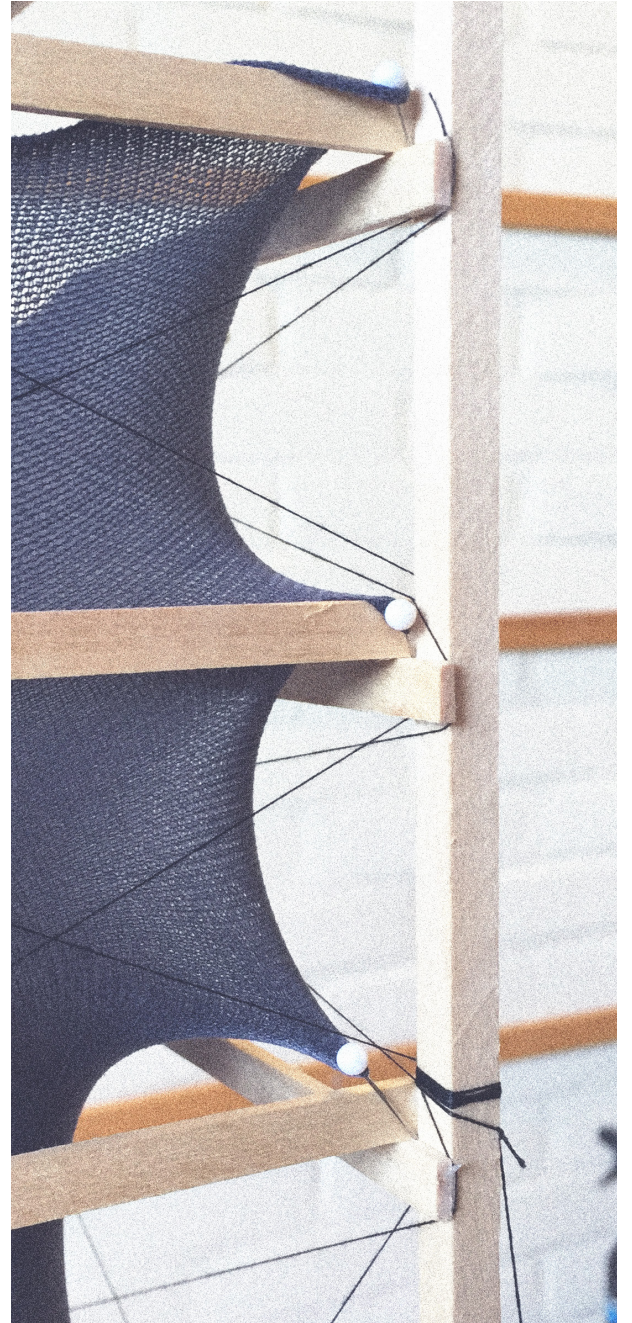
April 2016. Adding "dirt" to the project.



*May 2016. CNC-milling forms for ten tiny 1:5000
concrete landscape models.*



*May 2016. 1:20 tower model. Using a nylon sock
as fabric.*



May 2016. Final seminars (the exam).



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C.Y., June 2016

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