Aeolis_Gap the Border

Landscape Architecture On Site, Oerol Festival 2018

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AEOLIS

GAP
THE
BORDER

AEOLIS
GAP THE BORDER

www.gaptheborder.wordpress.com

Result of the elective course AR0148 “Landscape architecture ON site - being part of Oerol Festival 2018”
MSc2/Q4
Chair of Landscape Architecture,
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Gap The Border

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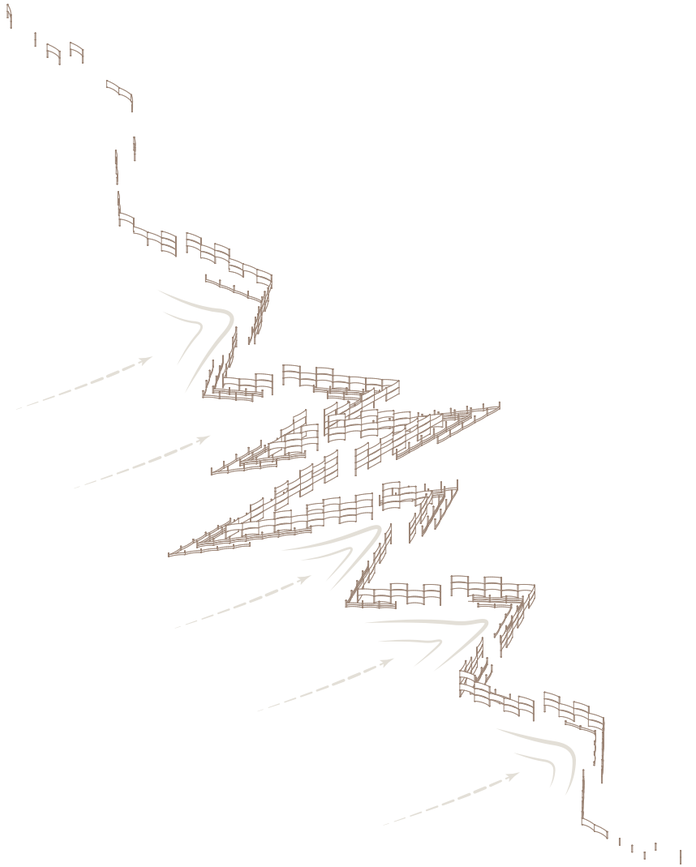


AEOLIS

GAP THE BORDER

Expected sea-level rise poses an increasing threat to Dutch coastal areas. Continuous human interventions in these areas aim to prevent the low lands from drowning.

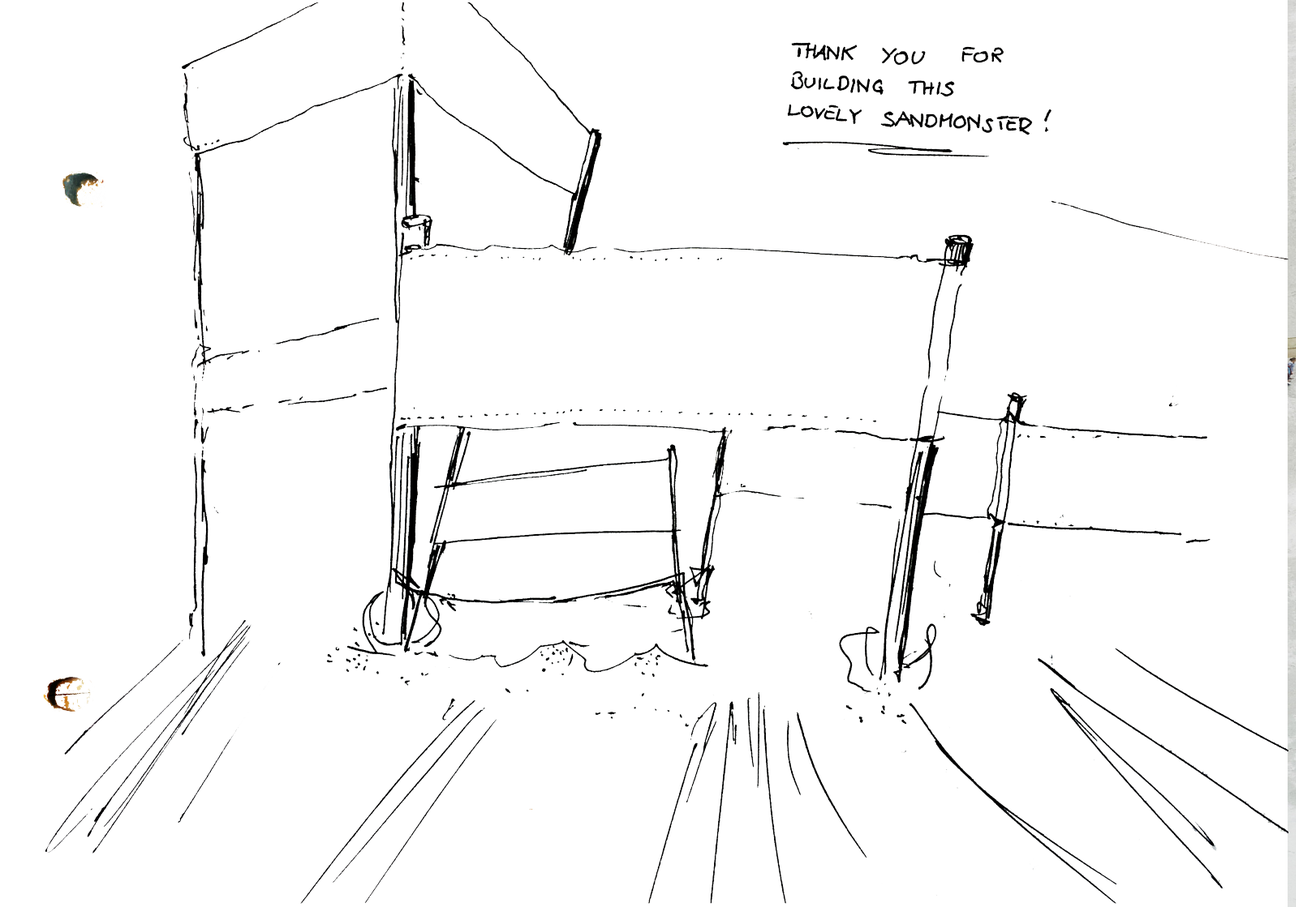
This booklet shows the process and results of AEOLIS-GAP THE BORDER developed during the elective course Landscape Architecture ON Site, offered by TU Delft MSc Landscape Architecture. As part of the research program related to coastal defence, our group has developed an architectural intervention as a prototype for these areas.

The Wadden islands have been the barrier forces for the entire Netherlands for hundreds of years but due to the rising sea level they are under great pressure. Therefore, the Oerol Festival at Terschelling is a great platform to experiment and understand this concept and interweaving it with art.

Landscape, art and science come together in this project. The design process is based on experiences of the place, experiments, prototyping results of theoretical and landscape studies, workshops and brainstorm sessions.

Content

INTRODUCTION


THANK YOU FOR
BUILDING THIS
LOVELY SANDMONSTER!

COURSE GOALS

This elective course revolves around the realization of a temporary, ‘design-and-build’ project in a landscape setting. The backdrop of this project is the annual Oerol festival on the island of Terschelling. Within this subject, 15 master students research, conceptualize and construct an installation to be visited by the festival public. The project combines specific landscape conditions of a site with the interaction of visitors and the dynamics of on-site construction, exploring the role of spatial designers in situated interactive projects.

The focus of the project is the concept of PLACE: understanding how landscapes form specific places and what we can do as a designer to reveal and engage a ‘sense of place’. Each year, students explore the stories of a particular landscape setting in inter-disciplinary teams, mapping and conceptualizing spatial, ecological, cultural and historical narratives. Site and location form a critical part of this process; students visit the site to explore the place ‘in person’, developing an individual interpretation of its identity, structure and meaning. These insights are translated into a conceptual project, elaborated on a contemporary issue such as climate change, as well as engaging with the public in an interactive way. The final part of the project is about ‘design-and-build’ and ‘curation’. Students detail the project, source materials, do prototyping, manage logistics, prepare the location, build the installation, curate the work and communicate with the public in person and on-line.

PROJECT INTRODUCTION

This years contribution to the ‘expedition program’ of Oerol festival is called AEOLIS-GAP THE BORDER: an informative and scientific art installation.

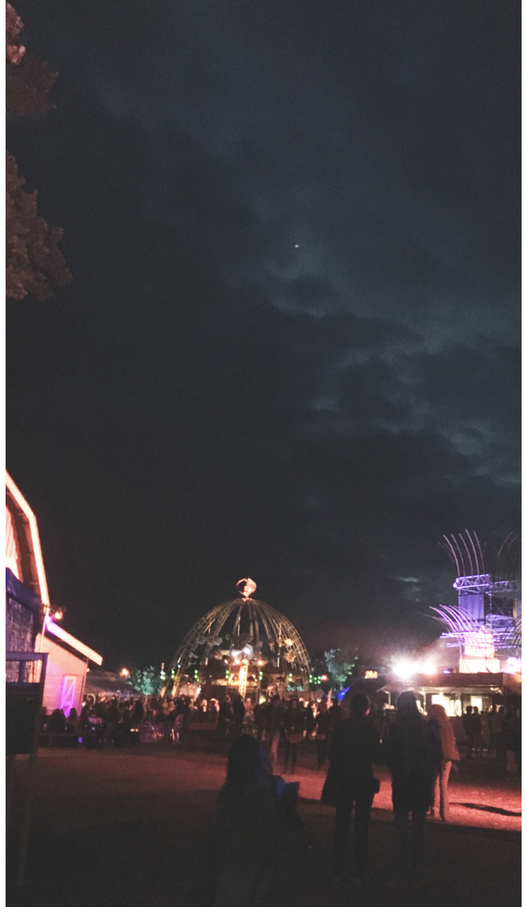
The project aims to give insights into cultivation of the dynamic coastal landscape alongside the principle of ‘*building with nature*’.

This design derives inspiration from the site at Formerum and its historic context. The site for the proposed installation is located at the point where the two islands of Wexalia and De Schelling merged and grew into one- the present day Terschelling. This specific location is highlighted with the impression of a metaphorical stitch, which translates and showcases this geological history in the form of an artistic intervention.

The public becomes aware of the effect of human interventions on the natural processes by using the border as a catalyst to interfere with the dune landscape.

Research theme

This year the research theme focusses on sedimentation processes. The dune landscape of Terschelling forms the setting. The goal of the course is to introduce students to the coastal landscapes of the Netherlands: their role as flood-barrier infrastructures, cultural-historical environments, recreational networks and ecological systems, and to their conservation and future development. A further narrowing of the focus of the elective is on built environment elements and their impact on the (historical and future) development of the dune landscape of the island. Of interest here is the role of built features such as structures, settlements and other infrastructures in the (historical) development of the seaward side of the island and what can be learned from this. This topic is further problematized within the broader frame of dune landscape development as a complex set of factors or 'layers'. Built environment features can be said to form part of series of layers that interact together to form dune landscapes, the other layers being abiotic processes of sand and soil development caused by wind and water etc., and biotic processes of vegetation growth (and decay), soil development by organisms, and the effects of fauna on dune development such as excretion and grazing. Dune-forming – particularly in the Netherlands – is also impacted by human interventions such as forestry plantations, water management measures, and agricultural activity such as grazing and cropping.



What is Oerol?

Oerol is a theatre and culture festival at the island of Terschelling. The name 'Oerol' derives from 'everywhere' in Terschellinger dialect: during the festival the entire Island becomes the natural stage for dance, theatre, street art and music. Oerol has a long tradition of landscape and location art and is one of the major and international centers of development in this field.

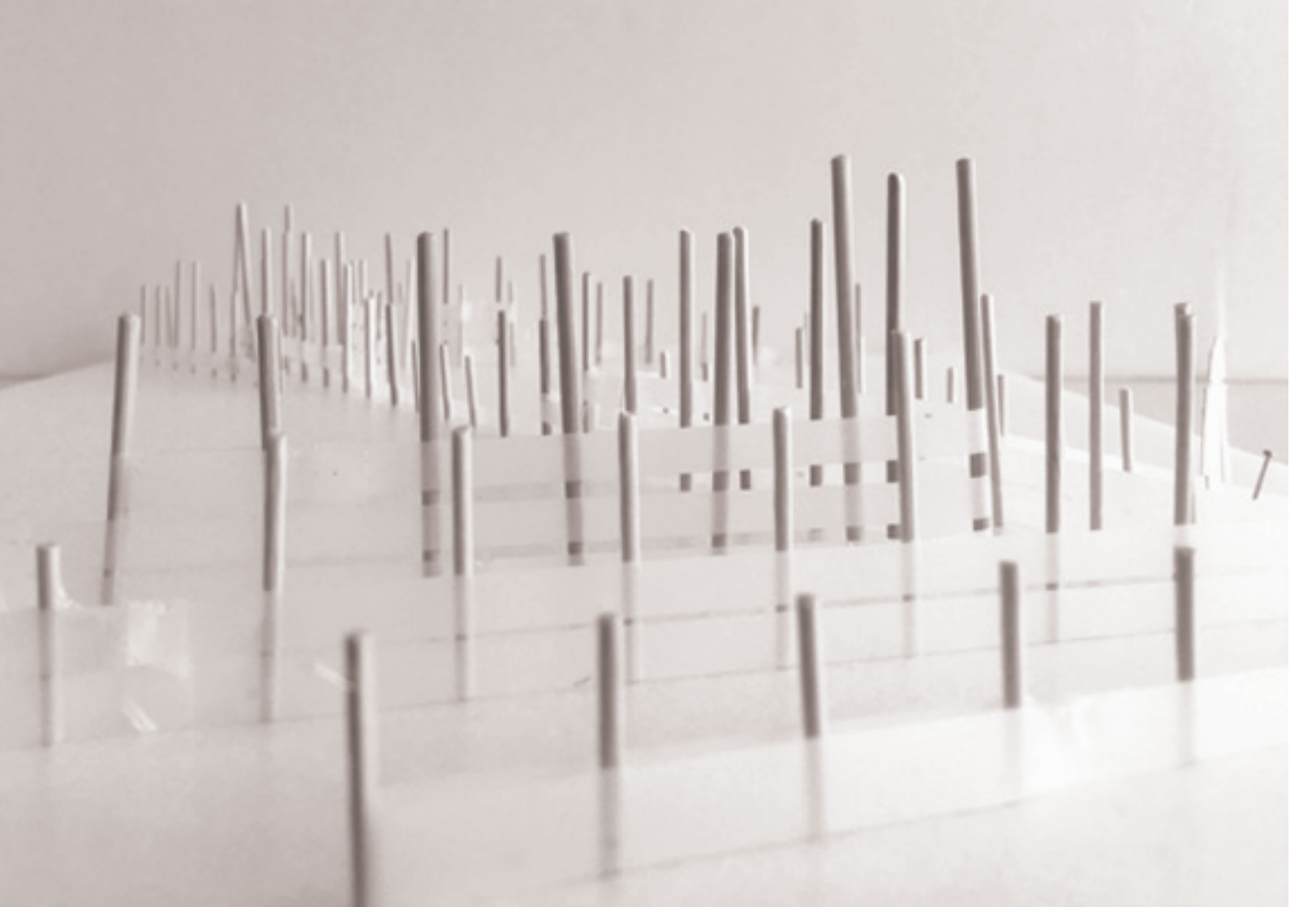
The project was part of the 'expedition program'. The expedition program includes projects of all disciplines which revolve around 'sense of place' and are freely accessible.

THE TEAM

We are a group of fifteen Master students studying at TU Delft from the faculties of Landscape Architecture, Architecture, Urbanism and Industrial Design. We are Dutch, Indian, Italian, Chinese, Austrian and Greek.

We had the unique opportunity to design and build an installation with on site as part of Oerol Festival. But most of all it was a great experience: fun, intense, experimental and inspiring.

We would like to thank all the visitors who came during the Festival and expressed their enthusiasm for our project.



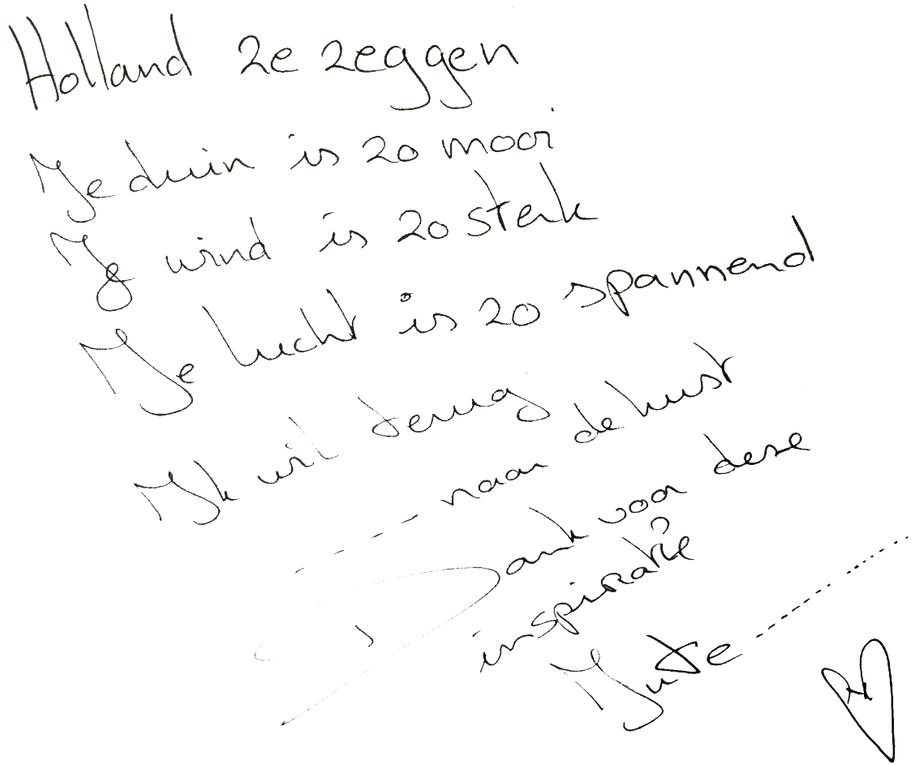
PROCESS

Within the 10 weeks of the course we have designed and built an interactive installation as a part of the Oerol Festival. It has been a very condensed design process including group work, theoretical studies, desk studies, designing, fieldtrip, presentations, testing, construction and curation.

During the first phase three different themes were investigated: technical aspects of dune formation, design aspects of a landscape installation, and the characteristics of the site itself. These themes defined the direction of the project. Within this first phase we split up into four groups. Through prototyping, testing, experiments, brainstorm sessions, desk studies, theoretical studies and site visits each group developed a design concept. Presentations and discussions were held at the end of this phase.

The final design was chosen together - by students, tutors and guests. It stood out due to the way it had integrated the findings of the experiments on dune formation into something impressive and beautiful.

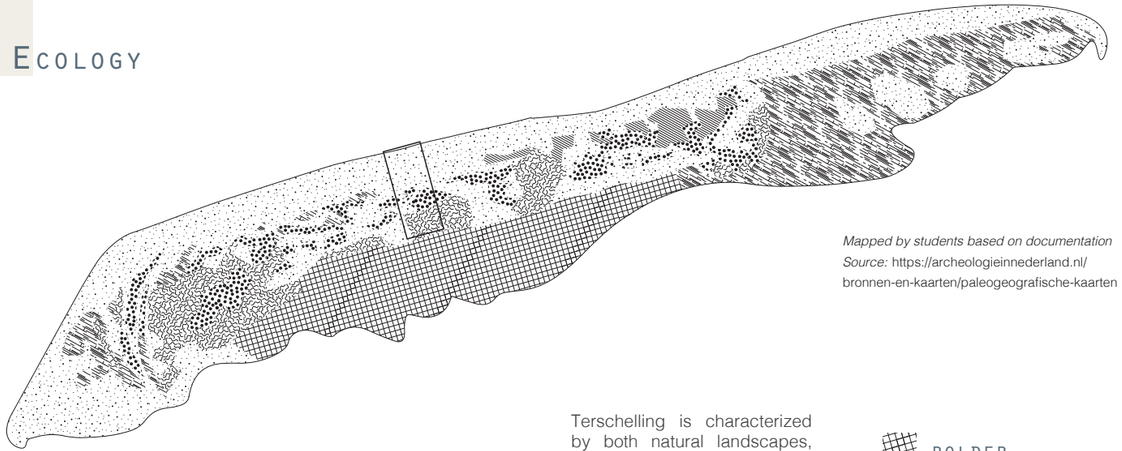
In the last phase, the final concept was elaborated and materialized through testing, drawing and modelling. And finally it was constructed on the site itself within a few days. The final stage of this phase was monitoring and curating the installation.



Facts, narratives, history and scientific knowledge are all enclosed in the landscape and may influence our perception when revealed to us, adding more value and meaning to a landscape.

Therefore, in this stage of the process we analysed the site and the island from the perspective of the four chapters of the dune-building frame: ecological aspects, geomorphological aspects, urban aspects and cultural aspects. The input is developed on the problematique of the climate change and coastal dune systems, in relation to the natural and cultural history of the island. The outcomes from the desk study formed the basis for the fieldwork analysis.

Ecology

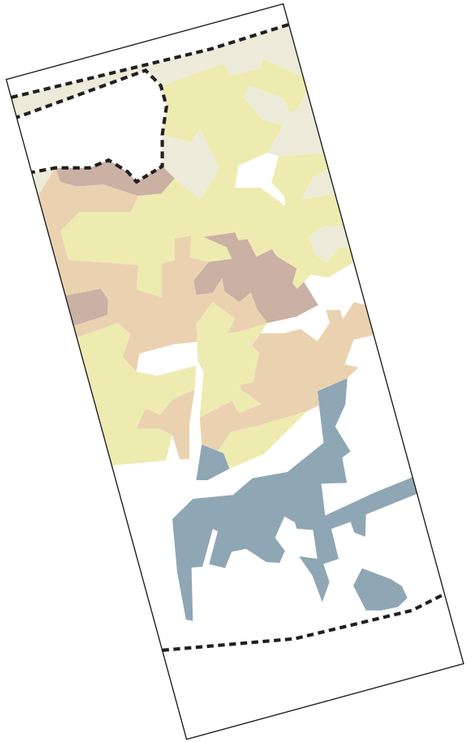


Mapped by students based on documentation
Source: https://archeologieinnederland.nl/bronnen-en-kaarten/paleogeografische-kaarten

Terschelling is characterized by both natural landscapes, such as birch forest and salt marshes in the east, as well as cultivated landscapes, such as the polder landscape and the 'protective' landscapes: planted forest and grass in order to stabilize the dunes.

Terschelling has been identified as an area of great natural value and has therefore been included into the Natura 2000.

POLDER
FOREST
DUNES
MARSHES
HEATHER
FRESH WATER

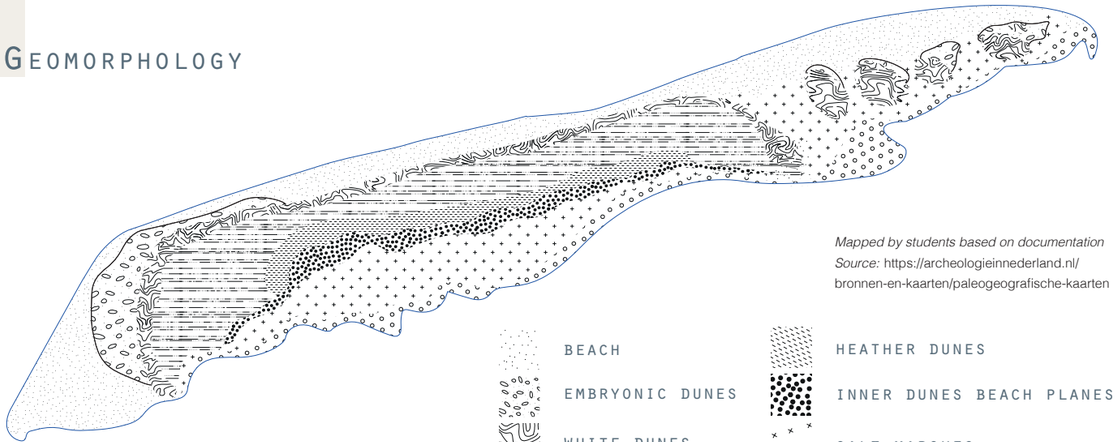


The installation is situated in the dune landscape of Terschelling. This landscape is being characterized by its high dynamics.

Near the seaside, there are the 'white dunes'. These dunes are more recently formed and overgrown by pioneer plants such as Marram grass. Further inland, different other plants have taken over throughout time: the 'grey dunes'. The grey dunes naturally evolve into heather fields.

NATURA 2000 BORDER
WHITE DUNES
GREY DUNES
DUNE HEATHERS
CREEPING WILLOW SHRUBS
DRY DUNE FOREST

GEOMORPHOLOGY



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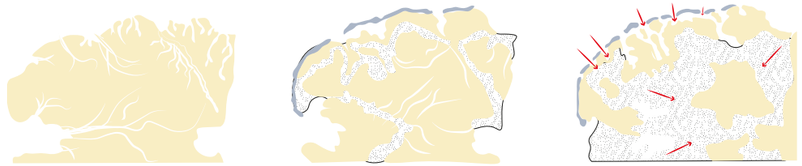
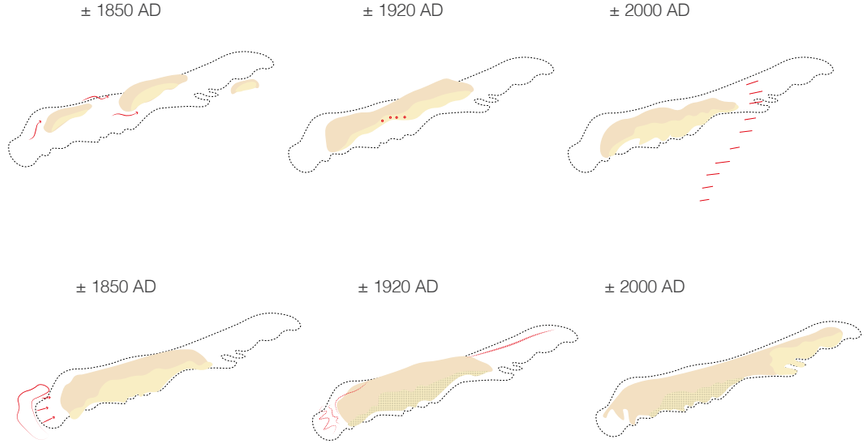
BEACH
EMBRYONIC DUNES
WHITE DUNES
GREY DUNES
HEATHER DUNES
INNER DUNES BEACH PLANES
SALT MARSHES
SALTY PIONEER VEGETATION

EVOLUTION OF NORTH OF THE NETHERLANDS



± 10.000 BC
± 6.000 BC
± 2.000 BC



Due to the dynamic nature of the Wadden Sea, the two islands - Wexalia and De Schelling - merged together and formed what we know today as Terschelling.

This happened somewhere between 100 - 500 AD. Around 800 AD first settlements on mounds were developed on the island. In 1500 AD the Koggediep separated the Boschplaat from the island.

Due to natural processes and the creation of dikes on the east of the island, the Boschplaat and the Noordsvaarder were attached to the island, this happened in the 2nd half of the 20th century. In the same period men started to reclaim the salt marshes, creating polders on the south side of the island. The last image shows the current situation.

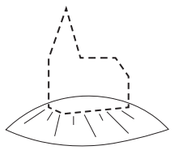
± 100 AD
± 1.000 AD
± 2.000 AD

Mapped by students based on documentation
Source: https://archeologieinnederland.nl/bronnen-en-kaarten/paleogeografische-kaarten

Cultural

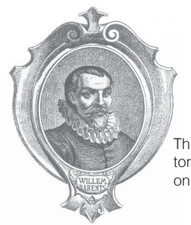
1287

The Saint Lucia-flood washes away the land bridge between the mainland and Terschelling, it is not possible anymore to reach the island without boat.



850

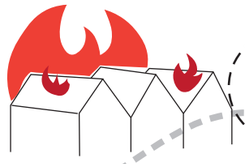
The old church of Midsland is dated back to 850, thus it was the oldest buildings on the island. Today the church, which was built on a mount does not exist anymore, but the graveyard around it is still located there.



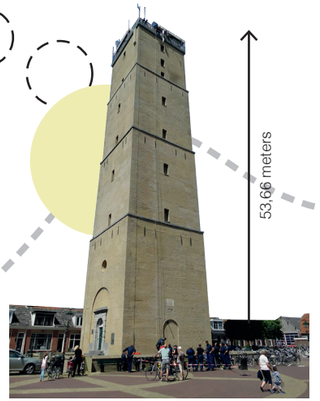
The famous cartographer, navigator and explorer was born in 1550 on Terschelling.

1666

English war. A big fire destroys almost everything on the island.



The East India Company creates a base on Terschelling, which brings trade and wealth to the island



1593

The Brandaris is constructed. Since then it has the function as a lighttower.

1845

cranberry spots

The large cranberry (*Vaccinium macrocarpa*) is introduced to Terschelling from North America. A legend says that a barrel full with cranberries fell of a ship and landed on the island.

Read bin de wolken ,
Blaue is de lucht,
Geel bin de helmen ,
Griën is et ges,
Wyt is et sân,
Dat bin de kleuren fan Schylgerlân .

1970s

The tourism takes over at Terschelling. Agriculture as major economic driver of the island decreases.

A traditional dress of Terschelling which is usually worn on Sunderum, a communal celebration every year on 6th of December.

2009

The waddensea area becomes UNESCO world heritage. Terschelling's economy is based mainly on tourism through nature conservation and secondarly on agriculture.

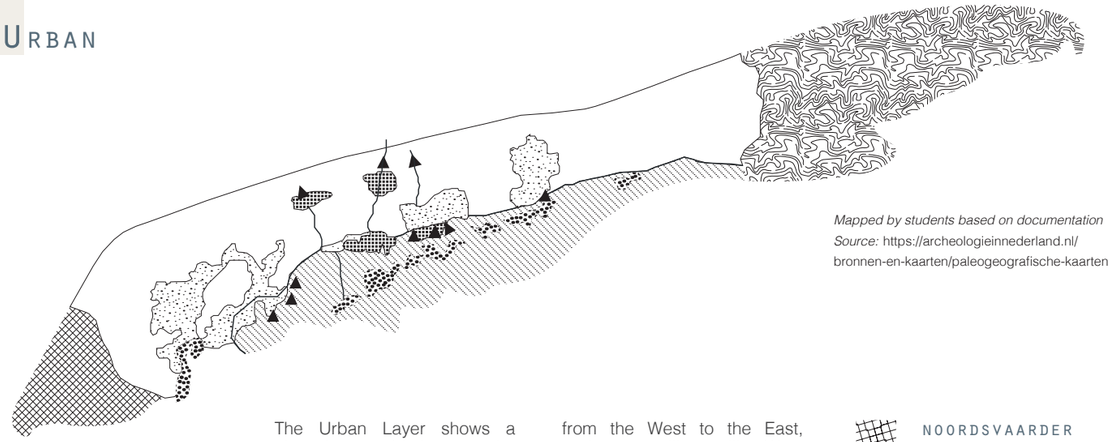
1940-45

Terschelling is, like the rest of the Netherland, occupied by Germany. Many bunkers are erected and the island is included to the Atlantic Wall.

1981

First OEROL festival takes place on Terschelling.

URBAN



Mapped by students based on documentation
Source: https://archeologieinnederland.nl/bronnen-en-kaarten/paleogeografische-kaarten

The Urban Layer shows a clear demarcation between the agricultural Polder landscape and the Dune landscape with settlements. The older, major towns of West Terschelling, Midsland, Formerum, Hoorn show a radial settlement pattern - similar to the Terp settlements. They are predominantly characterized by a mix of campsites and concrete houses, hotels, churches and cemeteries. A linear road cuts across the center of the island from the West to the East, and newer villages like West aan Zee and Midsland aan Zee are located on roads perpendicular to the main road. The access road to these villages terminates into a beach pavilion. Forests were grown along the polder boundary, to restrict the growth of the dunes, allowing the dunes to grow higher along the coast.
Brandaris Lighthouse in West Terschelling was constructed in 1954, and is the oldest lighthouse in the Netherlands.

NOORDSVAARDER

BOSCHPLAAT

MANMADE FOREST

OLD VILLAGES

POLDER

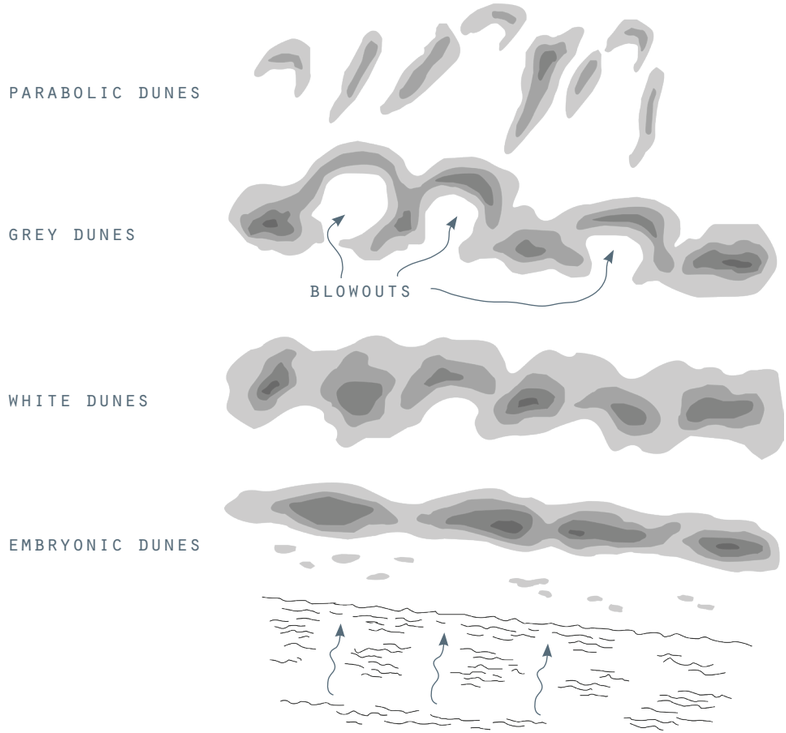
URBAN EXPANSION AFTER 1950

PERMANENT CAMPSITES

Dune formation

The plan shows typical sand dunes with low embryonic dunes near the shoreline and much taller mature dunes several hundred metres back from the shore. As you follow the plan from the beach, the dunes get older and the vegetation changes, gradually covering more and more of the bare sand.

Blowouts are mostly created when the wind erodes patches of bare sand on stabilized vegetative dunes. The depression usually starts from a higher part of stabilized dunes. When plant growth on sandy or loose soil is eliminated for any reason wind can blow the sand away causing a depression on the ground. Sometimes the exposed land may quickly be re-vegetated before the blowout can expand.



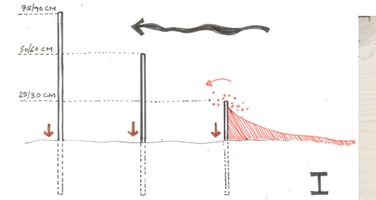
Mapped by students based on documentation of Sand dunes
Source: Sand Dunes Handbook, TCV, UK.

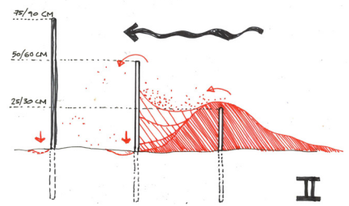
Sand motor experiments

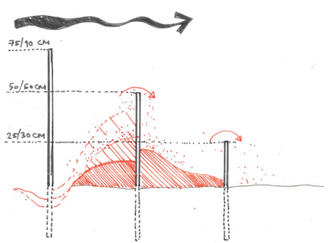
During the first week of the project we experimented in groups on the use of materials in combination with sand and how the natural process evolve around 'man made' objects placed on the beach. We wanted to discover how certain materials would speed up sand erosion and accretion processes and how we could influence this.

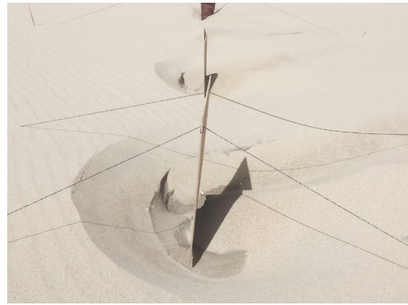
After a lot of experimentations the choice was made to use hessian in different settings. Hessian has a porous structure which is ideal in tempering windspeed to accrete sand. In the following two days we left the installation on the beach to see the natural process. Due to strong winds, the hessian indeed accreted a lot of sand and even formed small dunes already. In between the hessian, and on places that the hessian was not properly attached, erosion indicative of the wind direction was visible.

The experiments were useful for further development. Because of the success of the first experiments on the Sand Motor, a lot of different fences/ angles/shapes where tested out. Unfortunately there was not much wind in the weeks we experimented but the patterns the wind made around the objects and the accretion that occurred in specific angles was very interesting. We started to experiment with fences that were (partly) covered with hessian and placed them in angles to see if the accretion and erosion would develop.
We came up with the idea of combining accretion experiments with architectural design.

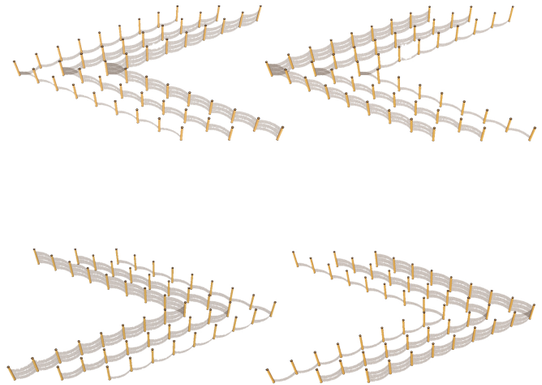




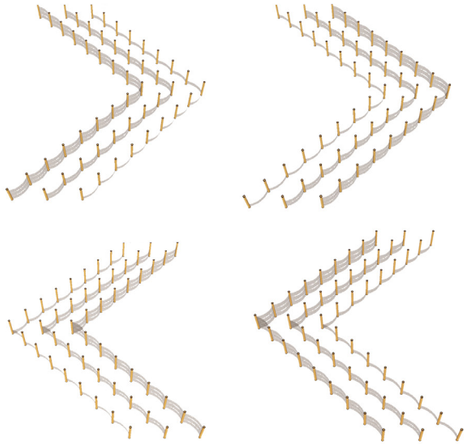




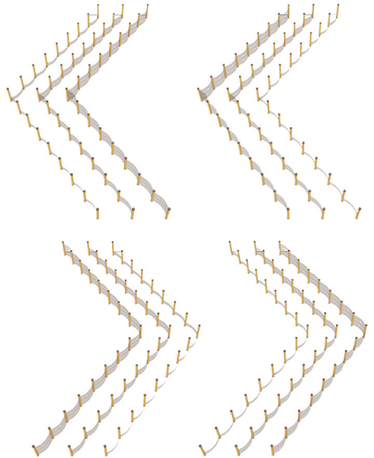
PROTOTYPES



ACUTE ANGLE



RIGHT ANGLE

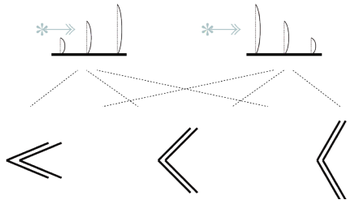


OBTUSE ANGLE

The prototypes were developed keeping in mind the changing wind direction.

Hence, height of poles + hessian panels above ground level is 0.35M, 0.5M, 0.85M, in a rhythmic ascending as well as descending order.

The acute angles accelerate wind, and help sand accrete behind it in the form of long sand transport dunes. The right and the obtuse angles act as wind catchers, slowing down the windspeed, and hence enabling sand accretion. The various permuations and combinations of the Hessian panels combined with their permeable nature, brings about a variety of dune patterns.



FRAMING THE LANDSCAPE

Through a series of frames -highlighting different chararteristics of the dune landscape- visitors are guided through the landscape and made aware of the process and the different stages of dune formation. A garden typology and mirrors are used to enhance the visitors experience. The patterns of movement of the public, refering to the human impact on dune development , become visible overtime within the installation .

TRACKS 'N TRACES

Tracks 'n Traces is an interactive route from the beach towards the dunes. Whitin this design the final installation is being made by the public over time. Through placing sticks -representing vegetation- and a chosen route, guided by using points of attraction on a superimposed grid, visitors create a pattern in the landscape. Being able to look-back on the created pattern towards the end of their route, visitors are made aware of natural processes and the antropogene layer.

DUNE DNA

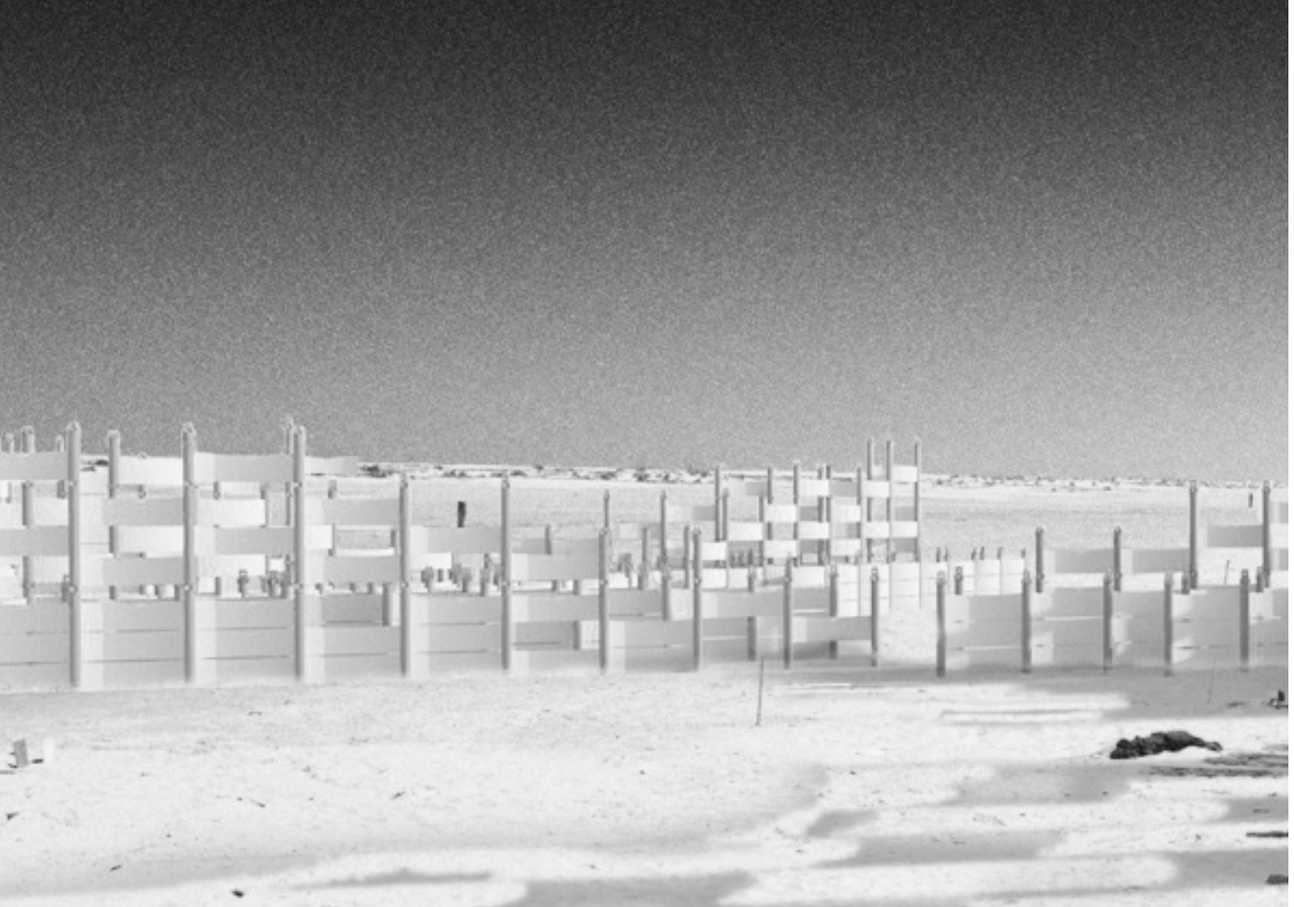
Dune DNA is an artificial, transparent dune. Dune DNA aims to create an alternative experience and reading of the site: an 'inside the dune' experience. The installation is designed to acrete sand and collect water. Due to its transparency it makes the sand accretion visual, revealing the site dynamics. The accreted sand and water creates patterns of light, reflections and transparancies, enhancing this alternative experience. Dune DNA investigates a new type of dune architecture.

THE CHOICE

In order to finalize the first phase of the process one of the four design concepts was chosen. To come to a group decision a presentation day was organized. During this day each group presented their design concept. The presentations were followed up by questions and a discussion between the students, tutors and guests. Afterwards everyone present voted by ranking their top-three projects.

The 'winning' design was SANDS OF TIME. It stood out due to the way it had integrated the results of the technical experiments on dune formation into an impressive and beautiful installation.

SANDS OF TIME investigates the building with nature concept. It is a prototype sand catching installation. At the same time it refers to the merging of two Islands - into what we now know as the island Terschelling - roughly 2000 years ago.



Inspired by the idea of building with nature to tackle the problem of sea level rise, the project aimed to develop a prototype accreting sand to strenghten the coastal barrier. Out of the four proposals, the most promising experiment involved modification of the old technique of fencing and translating it to an architectural installation. The selected design was further modified in two weeks to fit well with the existing landscape.

The site initially assigned by Oerol for the installation was relocated and the design was altered accordingly. The new location included the bare embryonic dune zone and a blow-out.

Fifteen students were further divided into smaller task teams – management, logistics, assembling, testing, media & communication and curation. The structure radiates a strong personal character as everything was hand-made.

The teams also worked on budgeting, finding sponsors, preparing working drawings, ordering material, coordinating with the festival organisers and transporting everything to the site. On-site these teams amalgamated into one and carried on the construction process which ranged from setting out the plan to digging holes for poles and tying the panels. During the ten days of the festival, the dynamic nature of the coastal landscape was carefully analysed.

19-6-2018

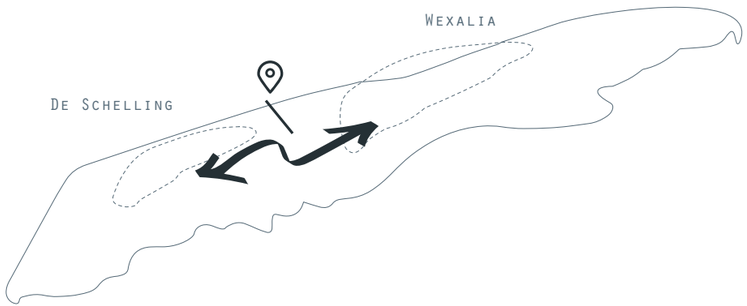
Dear Gap the Border!

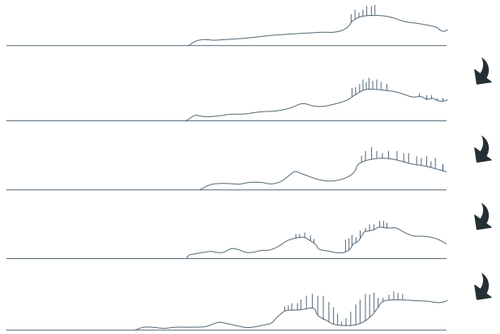
Thank you for your inspiration,
creativity & dedication to make
such a beautiful project:
It's a true symbiosis of art & science,
and inspiring to a lot of people
(including me :)
You can be proud! and don't
forget your 'live' contributions...
in the story you will bring the message
alive! Keep up the good work
& see you in Delft,
best Janneke

Introduction

Coastal areas are in great danger due to increasing sea-level rise. Natural landscapes and continuous human interventions in these areas prevent the low lands from flooding.

The Wadden islands have been the barrier forces for the north Netherlands for hundreds of years but due to the rising sea level they are under great pressure. The project derives its concept from the idea of building with nature which is supported by the morphological history of the site. The project combines prototypes for research with landart in an integral way.





The design is located on the area where the two islands merged: encouraging a dialogue between man and nature, it tries to Gap the Border. It recreates different stages of early dune formation, speeding up the process through an artificial structure.

The structure is based on the concept of sand accretion: catching and holding different sizes of sand particles which result in dune formation. It functions as a big sand-catching machine by using fences to simulate the vegetation and speed up succession in urban areas.

With the sequence of fences, at different angles and distances, we investigate and measure the process of sand accretion and erosion further. Aeolis - Gap the Border helps us to understand the concept of Building with Nature to preserve sandy shores, like Terschelling, from the consequences of sea-level rise.

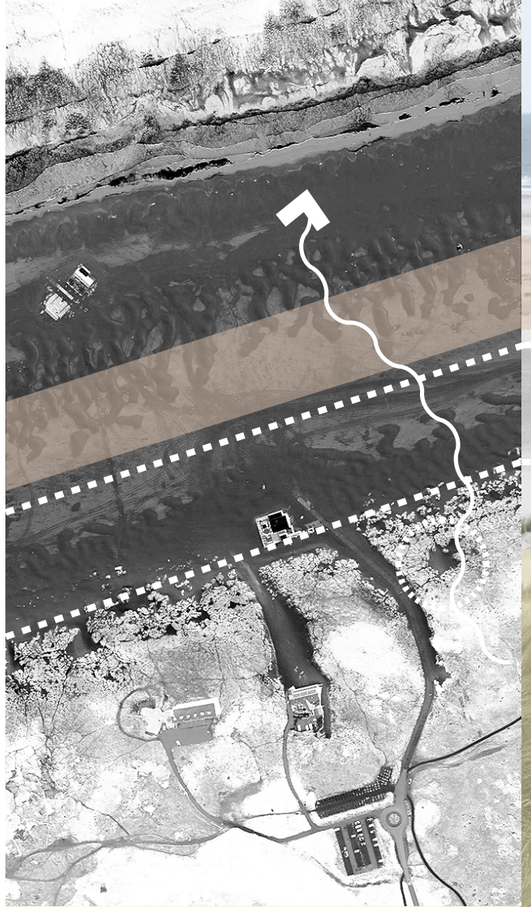
The installation aims to give insights into cultivation of the dynamic coastal landscape from the past to the future. Our goal is to create a dialogue between natural processes and human interventions, using the border as a catalyst to interfere with the landscape.

SITE DIAGNOSIS

The site is framed between the two dynamic natural elements: the sea and the dunes.

The design acts as bridge in the transition zone. The area towards the sea lies in the major sand transfer zone and the area closer to the dunes lies in the wet zone. The process of dune formation is from slow to moderate in the wet zone.

As sand transport is largely influenced by the prevailing wind conditions, the structure is aligned perpendicular to the dominant western winds on the island.



A typical dune landscape along the coast consists of different zones; starting with the berm on the sea side, the embryonic dunes, fore dunes and grey dunes. An important characteristic of the site is the presence of embryonic dunes.

In the process of dune formation, blow outs form an important part which are a result of the winds blowing from inland eroding the dune area with less vegetation.

Therefore, the journey through the installation starts from the fore dune area along the blow out and into the transition zone.

PROJECT'S GOALS

The main goal of the project is to find an architectonic solution using semi-permeable material in order to accrete sand and accelerate the process of dune formation. The installation is expected to serve two distinct yet inter-dependent perspectives: landscape and research. Firstly, it should act as an informative landscape installation and secondly, it investigates conditions for dune formation as a pilot for scientific research.

LANDSCAPE: From this perspective the installation should be able to express the ideas of memory, history, garden and place. It is also expected to gauge the impact of human intervention on the existing landscape:

- express the landscape qualities of the island
- imbibe the ideas of memory – the cultural and historical aspects of the island
- harmonize with the existing landscape identity of the site/ place and building with nature
- create awareness about the sea-level rise and coastal defences
- inform/educate visitor on importance of dune formation/ maintenance for preservation of the Dutch coast
- justify the aspects associated with the notion of a garden:
  - generator of forces and transmitter of forces in terms of the movement patterns
  - create spatial division and spatial addition in terms of the architectonic qualities
- provide a great opportunity for the visitors to get acquainted with the historical & geomorphological developments of the island of Terschelling and the Wadden in general

SCIENTIFIC : The project is a pilot to investigate sedimentation on a larger scale and to experiment with variable parameters like materiality, density, form and heights:

- Investigating the use of fences made of semi-permeable material to accrete sand.
- Investigating on the use of angled fencing to influence dune formation.
- Investigating about staged dune building using a sequence of fences (varying height and distances).
- Producing leads for further research on dune formation in the built environment to reinforce sandy coasts.

RESEARCH QUESTIONS

The main research question for the installation is - 'WHAT IS THE EFFECT OF SEMI PERMEABLE MATERIAL ON THE BEACH FOR SAND ACCRETION? WHAT IS ITS INFLUENCE ON DUNE FORMATION PROCESS?.

This is further influenced by various factors which also form an important part of the research - hence the following research sub-questions:

1. What is the effect of applying semi permeable obstructions with different build up heights?

2. How to build a bridge between the embryonic dunes and the foredunes using 'building with nature' principle?

HYPOTHESIS AND METHOD

Based on the previous experiments at the Zandmotor in The Hague, the design is formulated on various parameters such as the opacity of the material, height of the panels, openings and layers. Basic angles – acute, obtuse, right – are used in order to direct and/or accrete the sand, acting as a dune builder.

The outcome expected after a period of ten days is to accrete creeping, saltating and suspended sand by lower panels, creating new small dunes. The angles are also expected to direct the sand transfer process and help in creating new dune ridges and valleys.The experiment is dominated by three major factors – wind speed and direction, angles and openings.

Firstly, various angles are strategically placed to tackle the dominant west wind but are also capable to accrete and react in the case of non-dominant wind directions. The acute angles are assumed as the accelerator and the right and obtuse as collectors/ accretors.

Secondly, the semi permeable hessian panels allow the coarse particles to accrete and reduce windflow to create further accretion behind the panel.

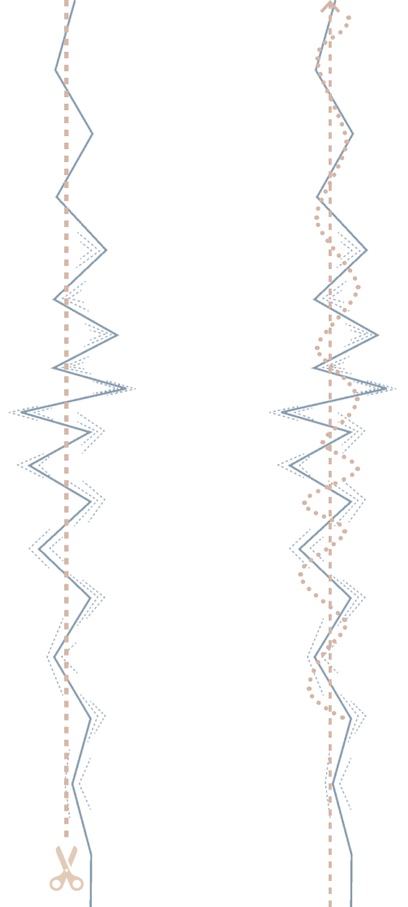
Although the various openings were initially designed to strengthen the architectural experience and/or mimick the obstacle of beach buildings; after construction they turned out to be valuable either to accelerate sand for transport or to create a lee side to accrete sand within the installation. Also, during the experiment a few openings were manipulated to test the variations in accreted and eroded sand.

BEFORE

AFTER

EVOLUTION INTO THE INSTALLATION

This poetic land art transforms into an architectural and scientific experiential space.
In the further chapters, one can see the process of transmutation from a conceptual design to details and the on-site construction process. The design evolves and bolsters itself by the ideas of memory, landscape and space.



CONTEXT AND MORPHOLOGICAL STORY

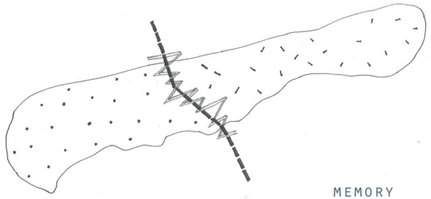
As aforementioned, the island of Terschelling is an amalgamation of two islands with distinct cultural characteristics. The site is culturally and morphologically strengthened by the idea of memory.

Therefore, a central axis is added to the initial design which cuts through the structure. This central axis or the 'gap' is a metaphorical division between the two islands and highlights the historical process. The two sides along the axis act as two islands and the accreted / drifted sand aims to merge these two parts.

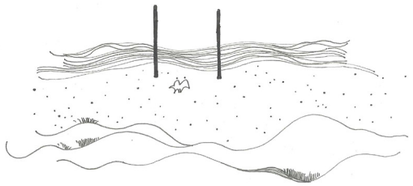
ARCHITECTURAL CHARACTER

A frame or window is created from the dunes through the structure focussing towards the sea and vice versa. To dramatize the journey through the structure, 4m and 6m poles are used along the central axis.

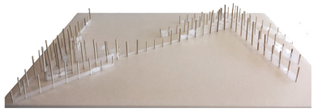
The hessian panels (semi-transparent material) along the route streamline the vision of the visitor. These panels also abstain the user to look out of the triangular spaces created within the installation. The architectonic spaces within the structure acts as small enclosed gardens with the dynamic sand patterns.



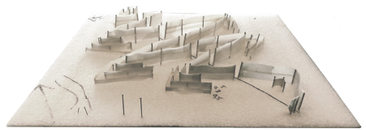
MEMORY
BORDER OF THE PAST



LANDSCAPE
ROUTE TO THE OCEAN

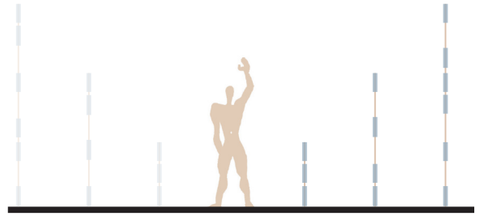


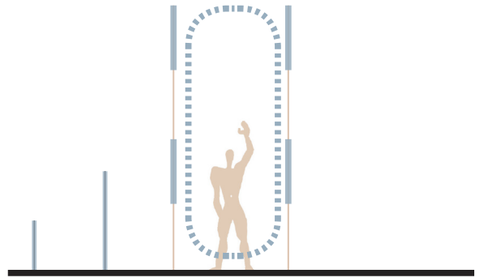
ORIGINAL MODEL



MODIFIED MODEL

SPACE
SHELTER FOR MAN





USER EXPERIENCE AND EFFECT OF HEIGHTS

To enhance the architectural robustness of the structure and improve the spatial experience, two major developments have been done

INCREASING THE HEIGHT:

The initial design had poles varying from 1 – 3 M whereas in the final design has poles of length 0.4 – 4 M. This provides a good variability to compare the human and sand scale.

The higher poles are deliberately placed along the central axis to create a dramatic and imposing walkway.

COMPRESSING THE OVERALL FORM:

The length of the structure is reduced from 270 M to 170 M. The compact structure provides more well defined intimate spaces which enable a more personal dialogue between the structure, sand and human.

Final design

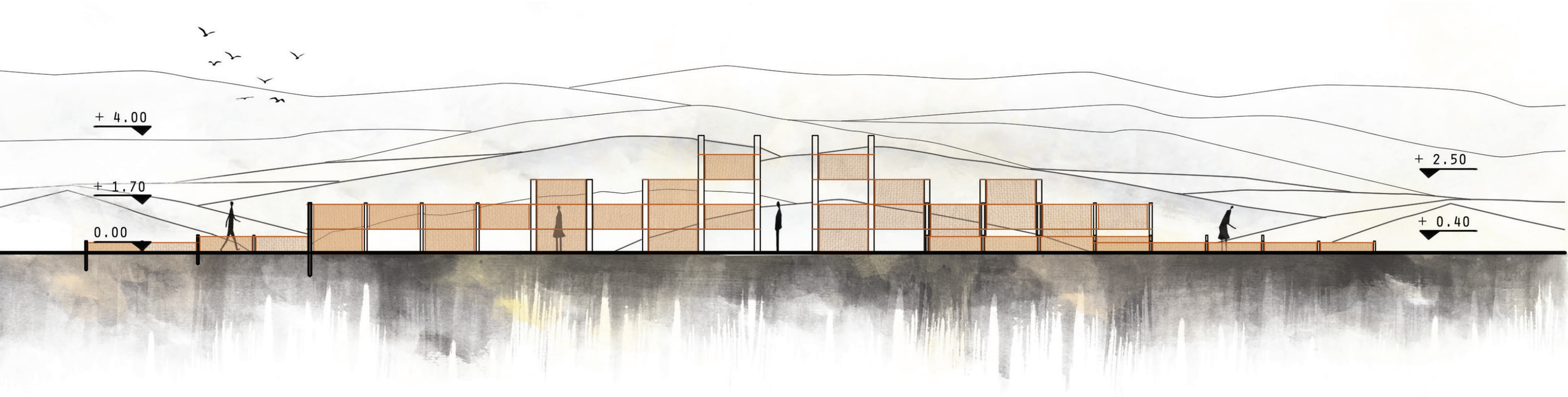
Building with nature and coastal processes as erosion and sedimentation have been the backbone of this project.

The design evolved from the idea of developing innovative and sustainable strategies to enhance dune formation to curtail sea – level rise. The installation acknowledges the natural process, thereby feeding the embryonic and fore dune landscape.

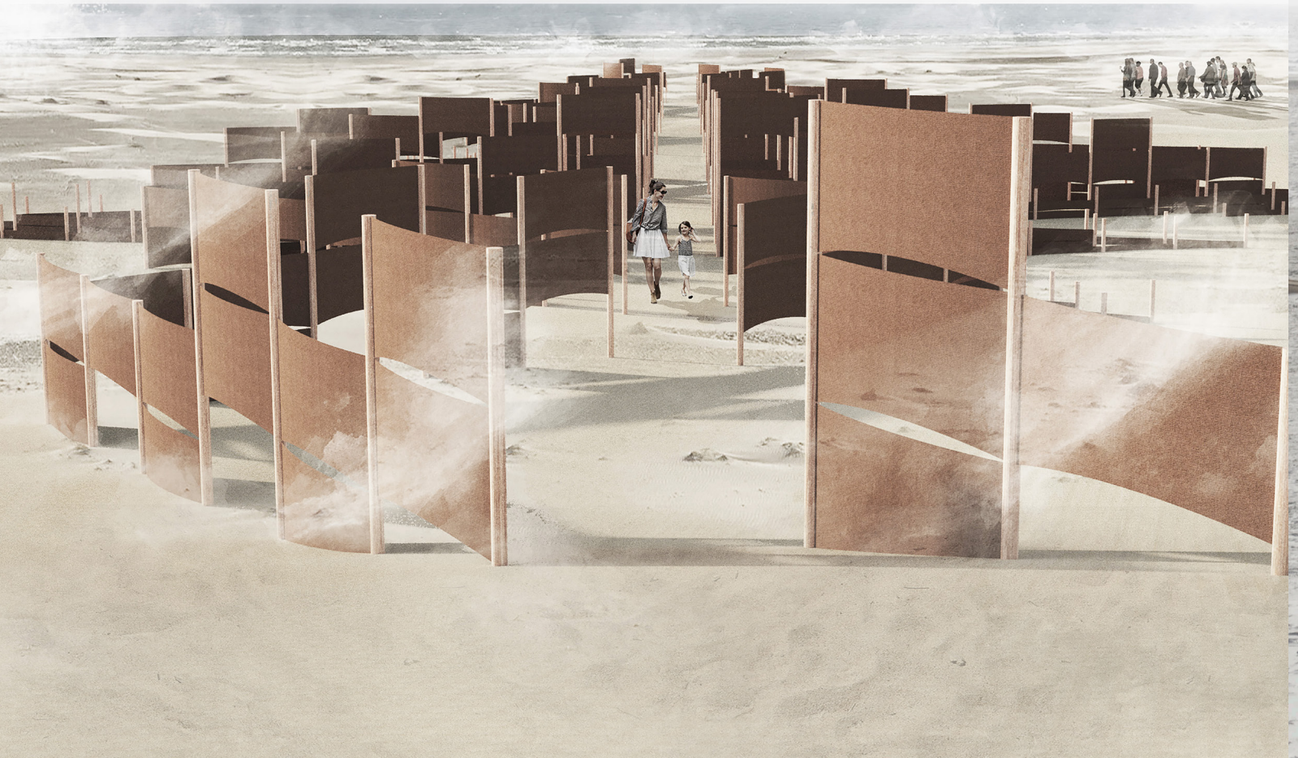

BUILDING WITH NATURE
N


MASTERPLAN
N
5
20
0
10
40

LONGITUDINAL SECTION


+ 4.00
+ 1.70
0.00
+ 2.50
+ 0.40

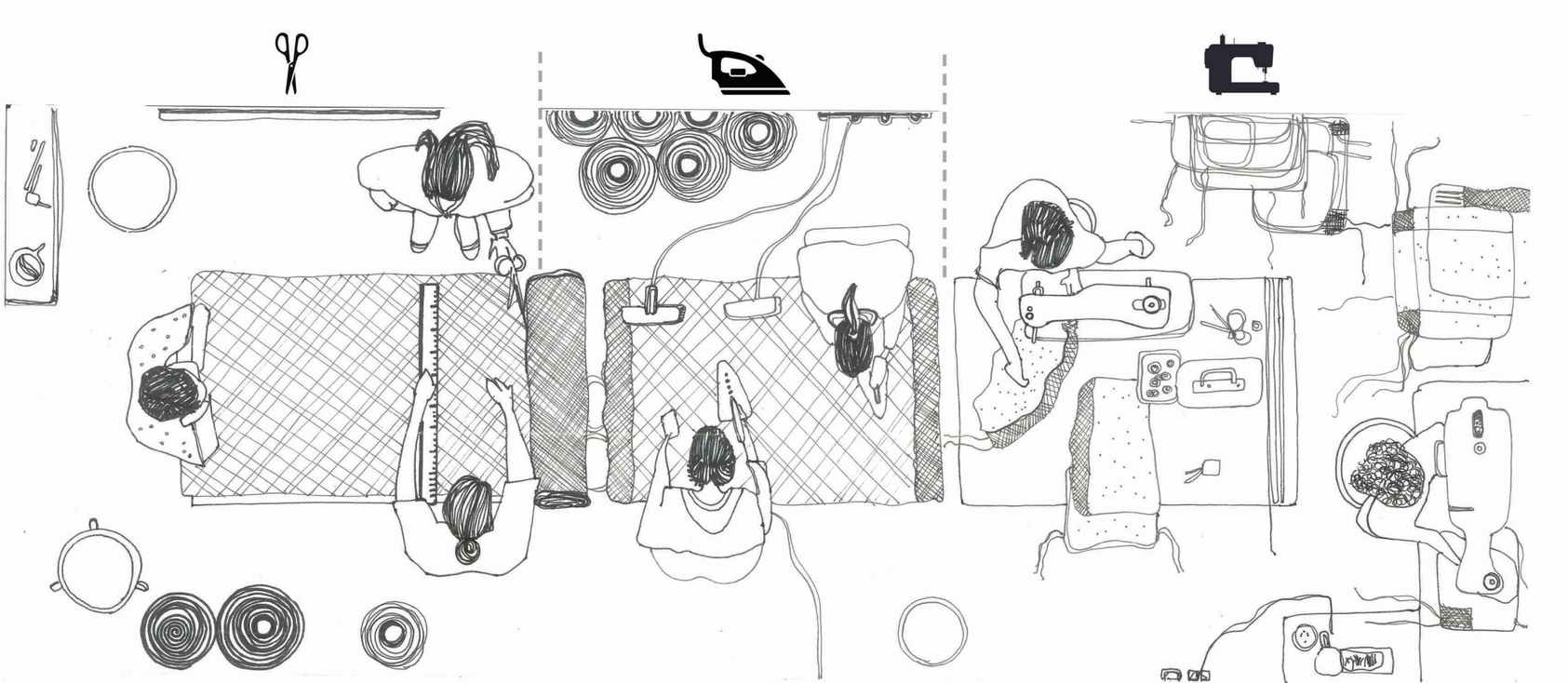
IMPRESSION



ACTUAL SITE PHOTO

The construction process was divided into two major phases.

The first phase was manufacturing of hessian panels of various sizes and the second phase was on-site fabrication and building. The building with nature idea is supported by using a biodegradable material - hessian (jute). The colour picked for the hessian is kept very natural and neutral so as to blend the structure with the surroundings. As the installation is completely hand-made, the rawness is clearly visible in every panel.

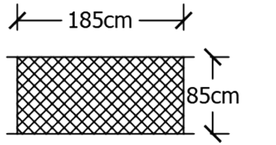


"CUTTING, FOLDING, IRONING AND SEWING,

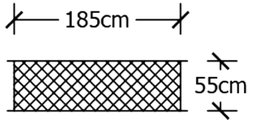
THAT IS ALL WE DID WITH LAUGH.

HAPPY STUDENTS ARE PRODUCTIVE WORKERS.

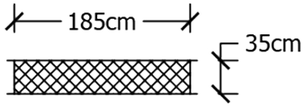
COME TO OUR SWEATSHOP WITH YOUR SMILE."



×156

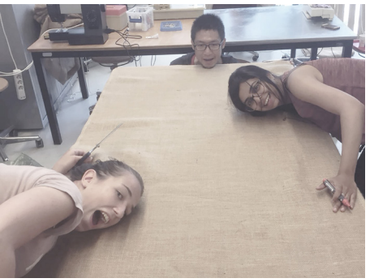


×77

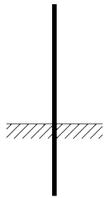


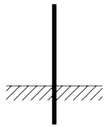
×57

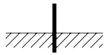
=290

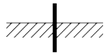


SIZE & QUANTITY OF THE POLES



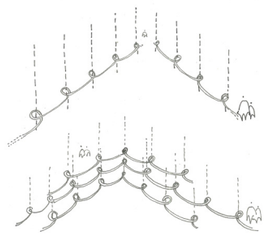




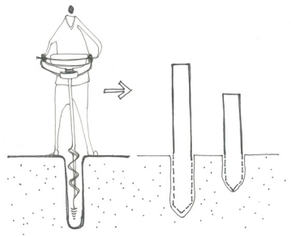


L/Φ	6.0м/12см	4.0м/10см	2.5м/7см	1.0м/6см	1.0м/6см
	×6	×48	×104	×81	×65
					=306

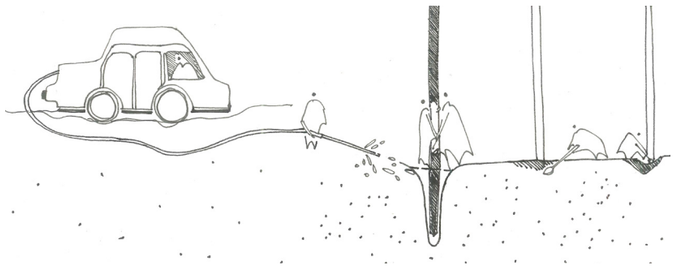
On-site construction was carefully planned with first the lining out and marking of all the points for the poles. The high poles (6m and 4 m) were then placed with the help of a contractor's water lance. Lower poles were placed using engine-powered soil drills. The hessian panels were also installed in two stages – first the lower panels to initiate the sand accretion process and then the higher panels which attributed architectonic qualities to the structure.



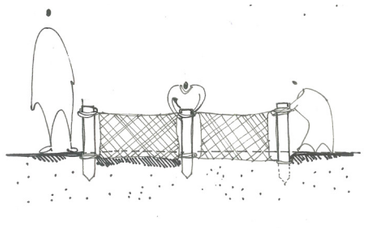
SETTING OUT



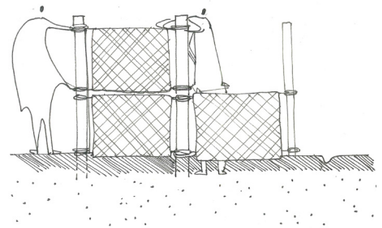
BURROWING MACHINES



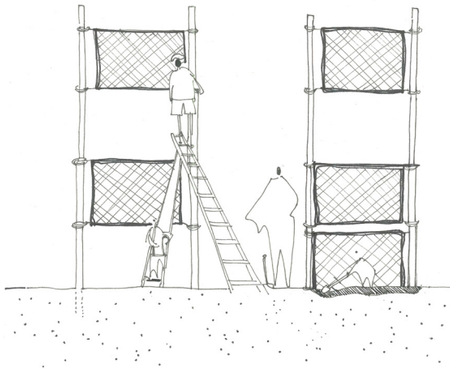
WATER LANCE



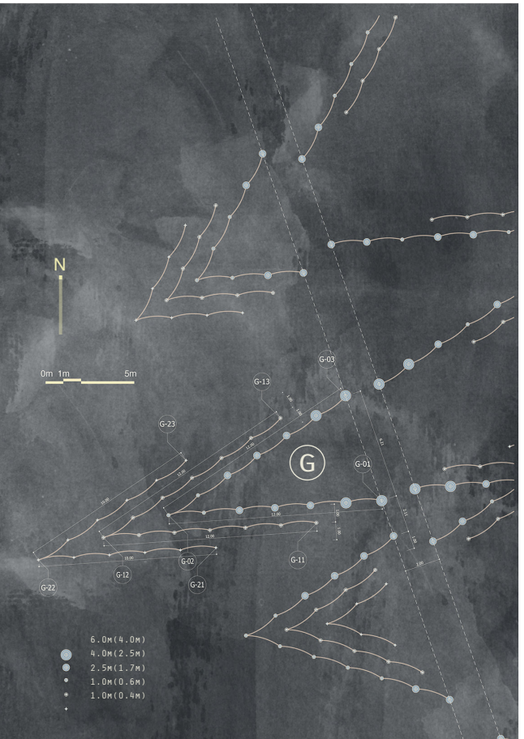
SMALL

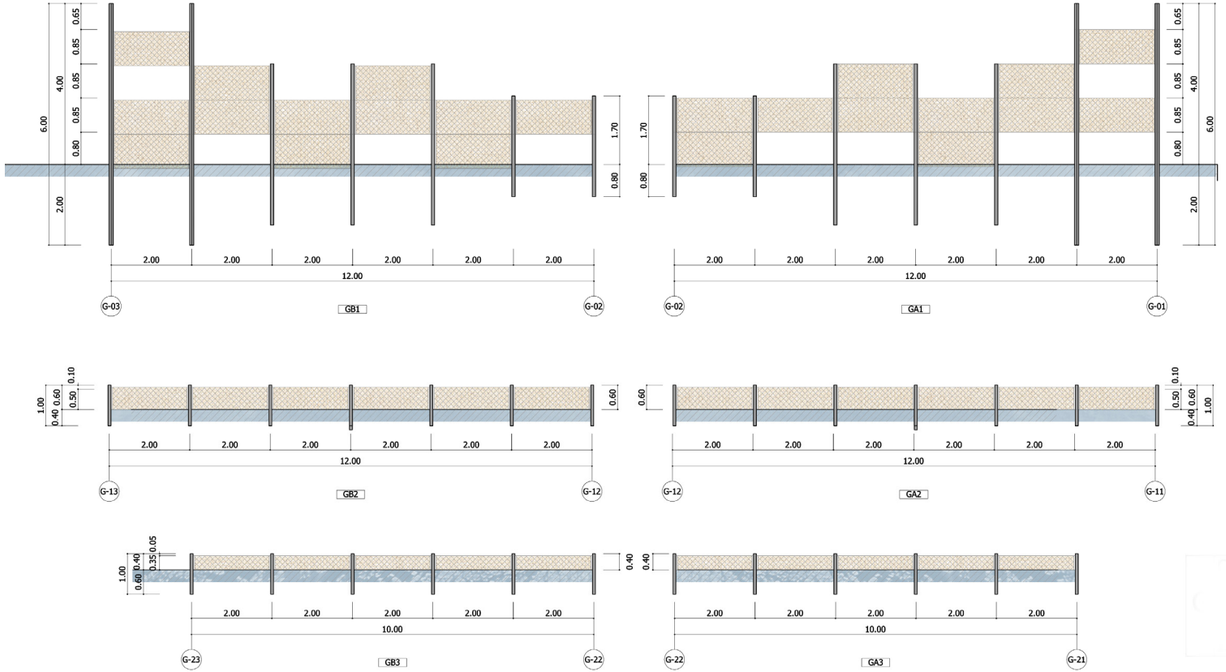


MEDIUM



LARGE HESSIAN PANELS


N
0m 1m 5m
G
G-03
G-13
G-23
G-01
G-02
G-12
G-22
G-21
G-11
6.0M(4.0M)
4.0M(2.5M)
2.5M(1.7M)
1.0M(0.6M)
1.0M(0.4M)


6.00
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12.00
G-03
G-02
GB1
G-02
G-01
GA1
1.00
0.40
0.60
0.50
0.10
0.60
G-13
G-12
GB2
G-12
G-11
GA2
0.40
0.35
0.05
2.00 2.00 2.00 2.00 2.00
10.00
G-23
GB3
G-22
G-21
GA3

Timeline

THE CREATION

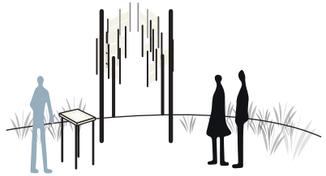
THE FESTIVAL

THE DEMOLITION

Storyline

Welcome to
Aeolis:
Gap the Border

Continue your way through
the dunes to read and learn
about our project



Overview Aeolis:
Gap the Border

Measuring points in
the installation

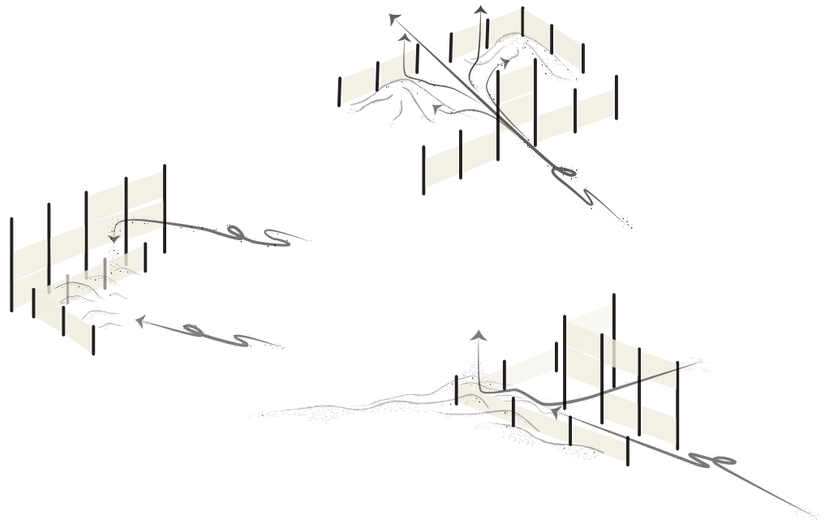
Exploring the rest of
the installation and
the results

Write your review in
our guestbook

The wind speed will increase where there are gaps in the installation. Underneath the high panels erosion will occur. Within the installation sand will accrete on the right and the left side.

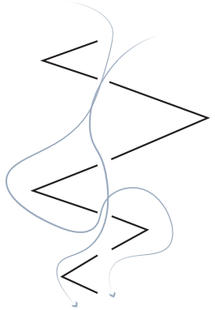
When low panels are placed in an angle and higher panels are placed in a row behind, sand will accrete in the low corner. Then, due to accretion, a small dune is formed. Sand will be blown over and eventually sand will also accrete between the two rows.

In reverse, a combination between the angled fencing and the use of windspeed will form dunes in both the front and back of the fences.

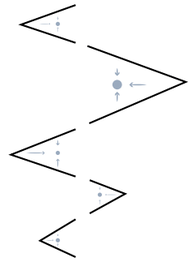


Reflection

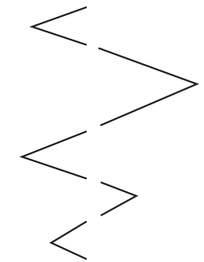
The project was successful in creating an interactive garden in the dune/beach landscape. The notion of the landscape is enriched by the enclosed garden principles. The history, memory, garden and place are an important part of the installation. For the history and memory part we searched into the history of the island. Combined with the site analysis this created a sense of place. We aimed to have an enclosed feeling while inside the installation we created and also the idea that you walk in an interactive garden. Combined this resulted in enclosed garden. The object aimed to be a generator of forces, a transmitter of forces, a spatial divider and a spatial addition to the landscape.



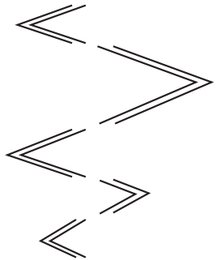
Transmitter of forces
– Undefined path with
a defined destination.



Spatial division
- Giving more power
to ''in between''



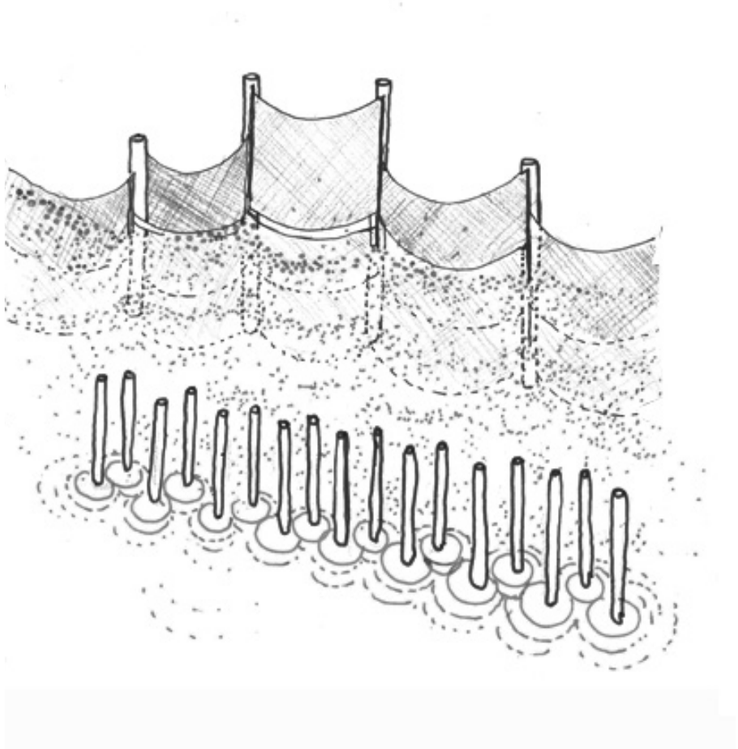
Generator of forces
– Defining a space or
Framing a space



Spatial addition
– Creating or
expading the
landscape

Besides the story of the dune creation we also wanted to make an architectonic object. The open axis combined with the zigzagging pattern functioned as an interactive walkway. The two poles in the end functioned as the goal and end of the installation while the panels and poles acted as an undefined path to the defined destination. Most of the people walked the line. We didn't took into account the fact that the dune also would appear into the general axis, and after the stormy days when the dune formation was very high in the general axis and the corners. The undefined route became more defined as the dune creation process evolved. The enclosed corners were often used for photos. So people liked the in between places of the structure. It gave an isolated feel, and made visitors curious about what was next.

The organic look of the used materials made it fit the installation's surroundings, as was also emphasized by the visitor's comments.



FINDINGS

Aeolis Gap the Border intends to research about the use of the semi-transparant hessian on the beach of Terschelling as a means for sand accretion and transportation. This research was done during the build-up of the installation and during the 10 day period of the Oerol festival. The research consisted of document the weather conditions, measuring the height of sand during the festival, and capturing the processes through film, pictures and sketches.

The results of the research are collected and organised in this chapter to show the main findings.

EEN CONCEPTUEEL KUNSTWERK, MOOIE (FIJNE) KLEUREN. HELEMAAL NIET ERG ALS DIT OP MEER PLEKKEN IN DE DUINEN ZOU STAAN ♡.

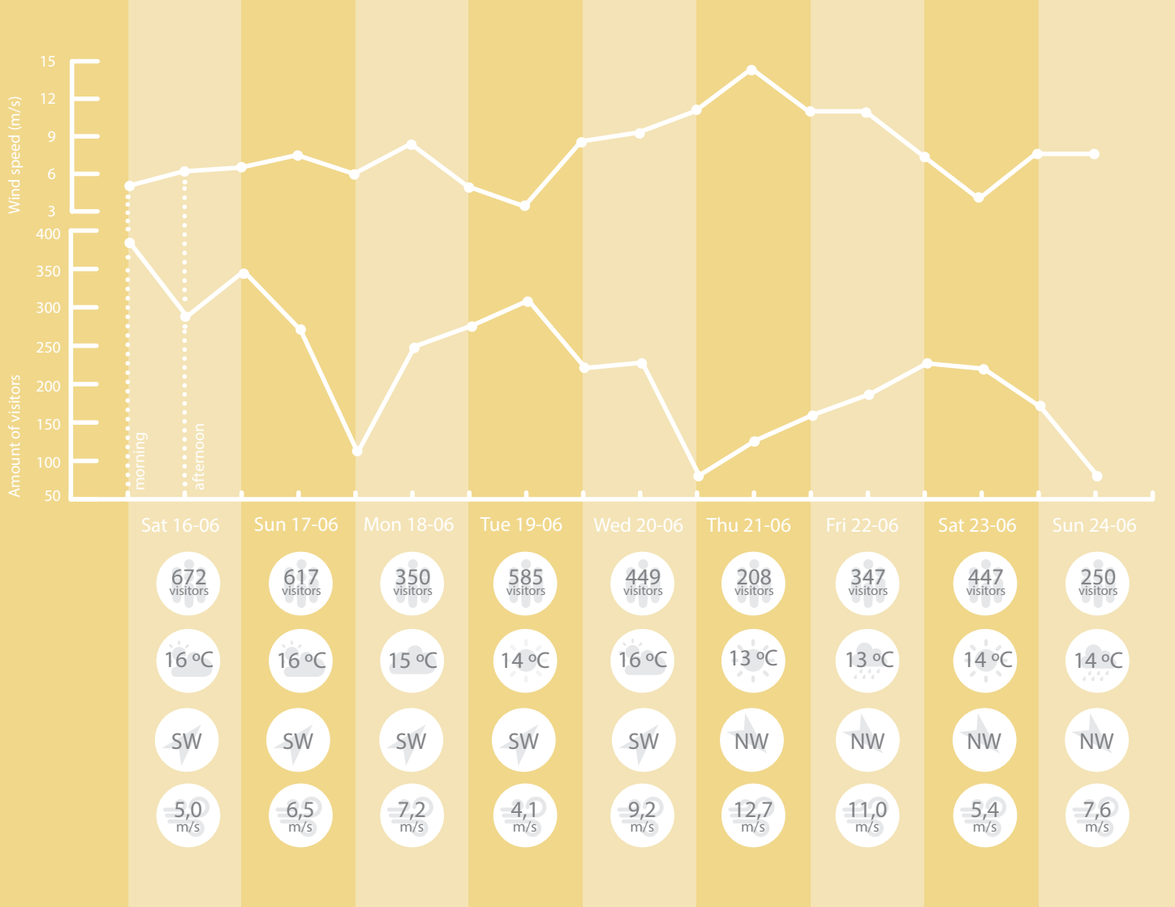
Interacting conditions

The two graphs illustrate the wind speed and the amount of visitors during the festival between 11 and 17 o'clock.

As shown in the chart, the number of visitors had reached its peak during the first weekend due to good weather conditions and low wind speed. On Sunday (17th June) evening, the majority of visitors left the island and on Monday morning new tourists came to Terschelling. Therefore, we see a lower footfall at the installation from 11 until 14 o'clock with only 111 visitors. Whereas the count almost doubled in the afternoon.

On Tuesday and Wednesday the amount of visitors remained almost similar but it considerably lowered on Thursday due to the drop in temperature and high wind speed.

On the last day the number of visitors dropped again because of the end of Oerol Festival.



Measurement

Within the installation, five measurement points were appointed based on first expectation with a west to southwest wind. The points addressed the different acute, right and obtuse corners of the installation. Focus was on the effect of the shallow (M1) and long (M3) funnels, the effect of the southwest oriented corners versus the northwest production (M2 & M4) of which M4 had a blowhole setup, and the effects of the installation on the parallel sandbank movement in the transportzone (M5).

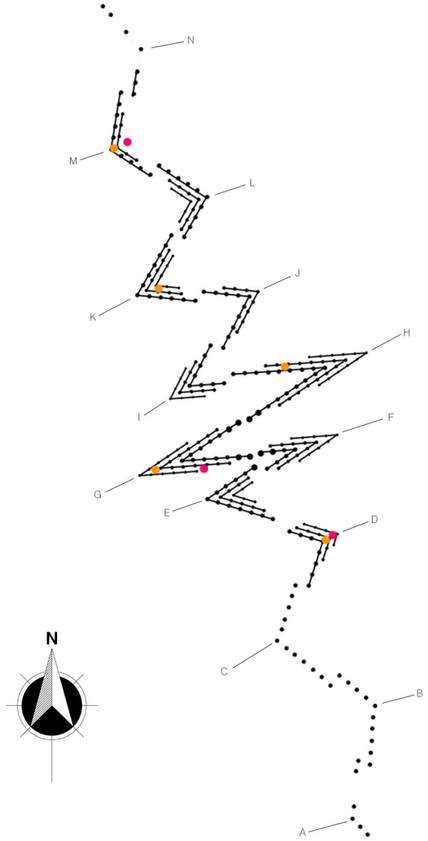
Measurements were recorded in two phases. Based on the outcome after five days, the locations of the measurement points 1, 2 and 5 were adjusted. The adjustments were made with the new wind directions (W/NW) in mind.

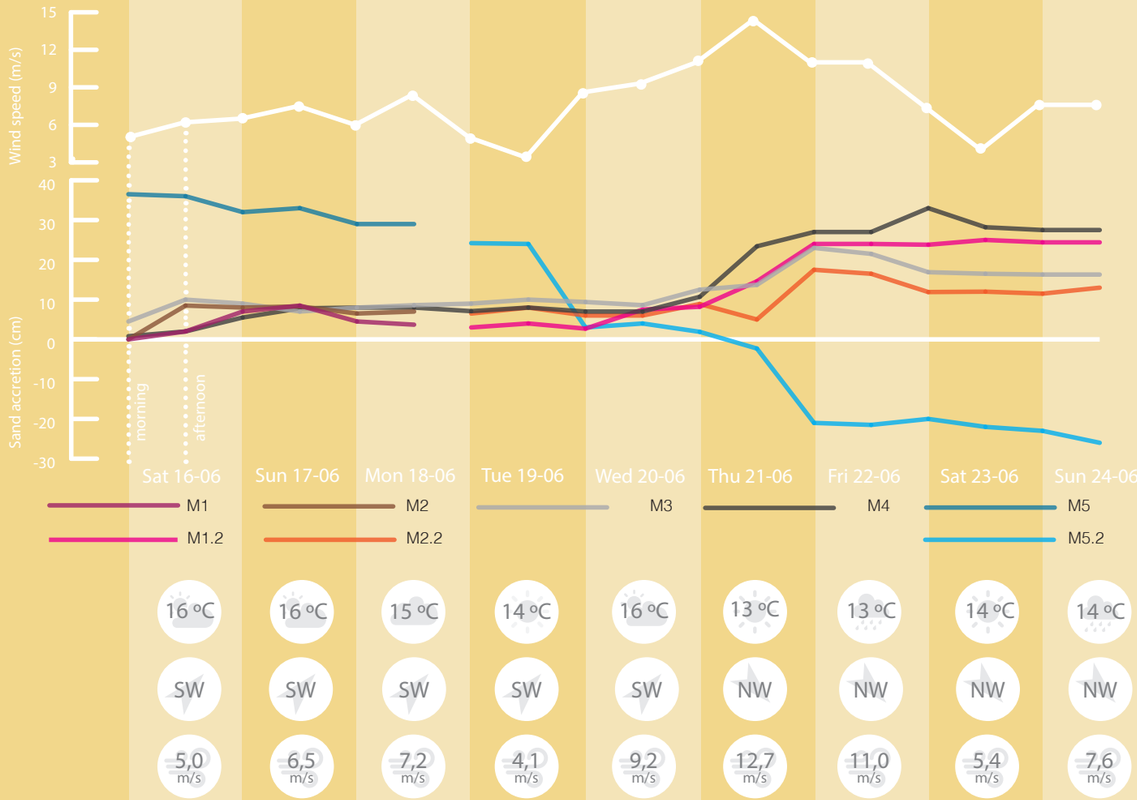
>M1: A maximum level of sand accretion had been reached. Therefore, the configuration of panels was adjusted and the measurement point was placed in the corners closest to the east.
>M2: In the acute corner, sand transport alongside the panels was dominant over sand accretion.Therefore, results in height were limited. The point was placed further into the core of the installation where accretion was expected to become more dominant in the second phase.
>M5: It became clear that the sandbank still moved eastward but stagnated and increased in height. As the front of the panel reached zero on wet soil, the development of the inner dune became more interesting. Therefore, the point was placed in the core of the sand dune in the second phase.

The graph shows the sand accretion of the five measurement points during the Oerol festival (M1 - M5), in combination with the measurements of the weather conditions. In the sand accretion graph, Points M1 - M4 show an increase in sand accretion due to increased wind speed. Measurement point M5 shows a decrease due to the increased wind speed. M5 was the only measurement point located on an sandbank at the start of the project. This dune moved eastward due to the wind, leaving the measurement point clear of sand.

Wind speed was however not the only factor important to the difference in measurements. It is also visible that the wind direction changed from SW to NW between 20-6 and 21-6, resulting in suspended sand transportation inland instead of along the beach.

Detailed graphs on the following pages show the measurements of amounts of sedimentation on three different moments during the day; 11:00 - 14:00 - 17:00. An overview of the installation is shown to the right, in which the different corners (A - N) and measuring points (yellow and pink dots) are shown in relation to the direction of the installation.



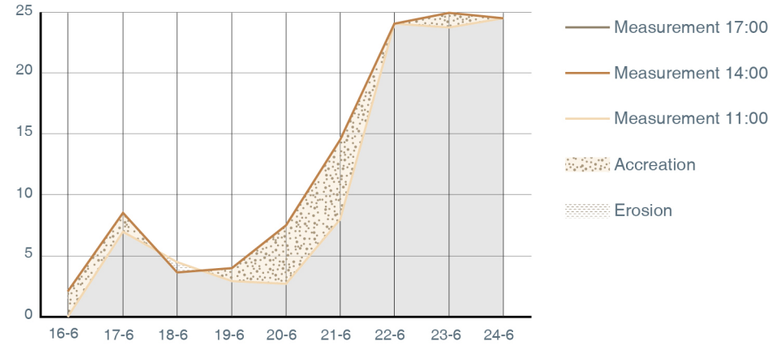


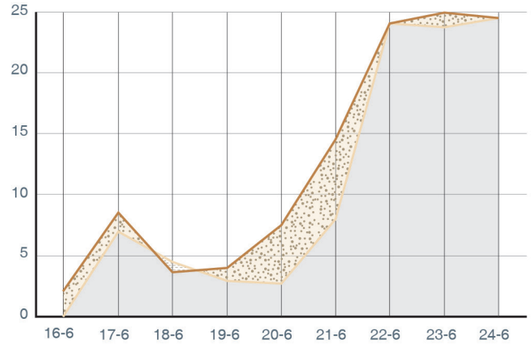
Measurement point 1

Phase 1: SW-period

Phase 2: NW-period

Measurement point 1 was located in corner D, a right angle in the installation. During days of SW wind, the sand drift was blocked by the inner panels of the installation. However, strong winds from NW made the panels in this corner act as a funnel for sand accretion. This effect can clearly be seen in the graph, which shows the height of the sand accretion. After the strong winds, the accretion level stabilized.





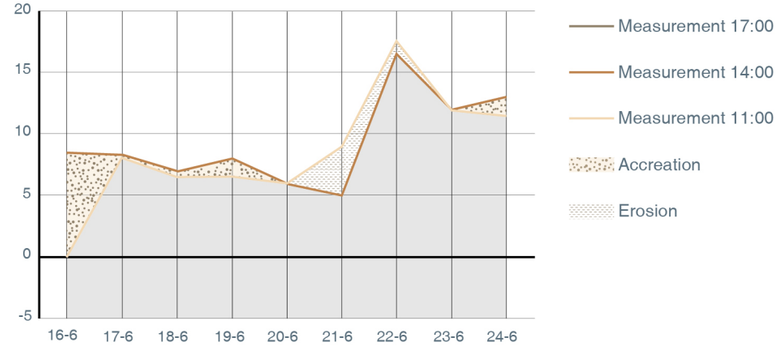
Measurement point 2

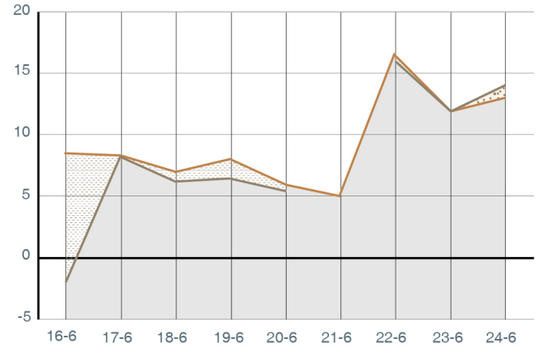
Phase 1: SW-period

Phase 2: NW-period

The hessian panels at measurement point 2 acted as a guiding structure for the sand in the first days with SW winds. The sand was guided along the outer edge towards the inside of the installation.

With the changing of the winds to NW, the panels acted as barriers, catching the transported sand. The graph shows that aftter the strong winds had passed, the accretion level dropped, indicating a further transportation of the sand.



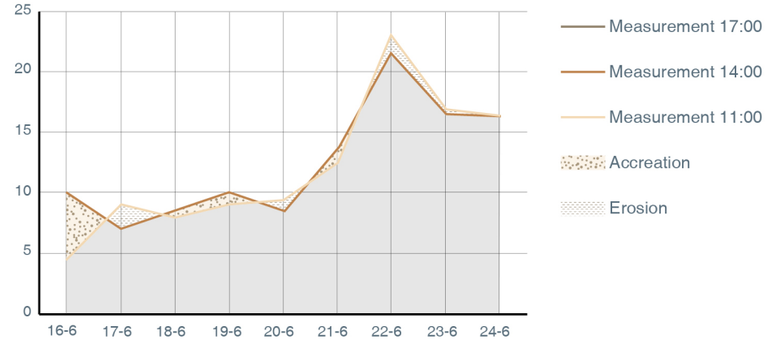


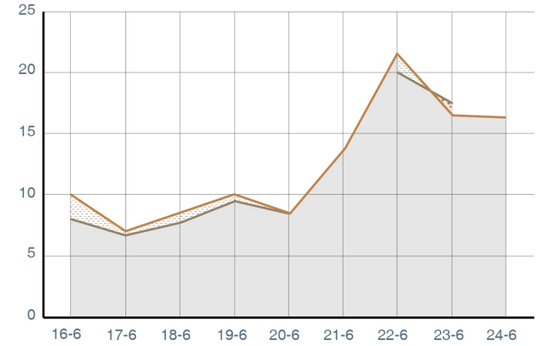
Measurement point 3

Phase 1: SW-period

Phase 2: NW-period

Measurement point 3 is located in a sharp angle in the installation. Unlike point 1, this point is located halfway from the central axis to the corner. The first four days, the level of accretion varied between 5 and 10 cm. The strong NW wind caused an increase in accretion. However, since the measuring point was not in the corner, the NW winds caused the sand to be transported further into the corner, decreasing the accretion level.

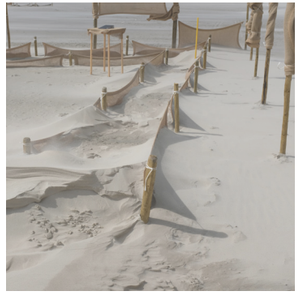




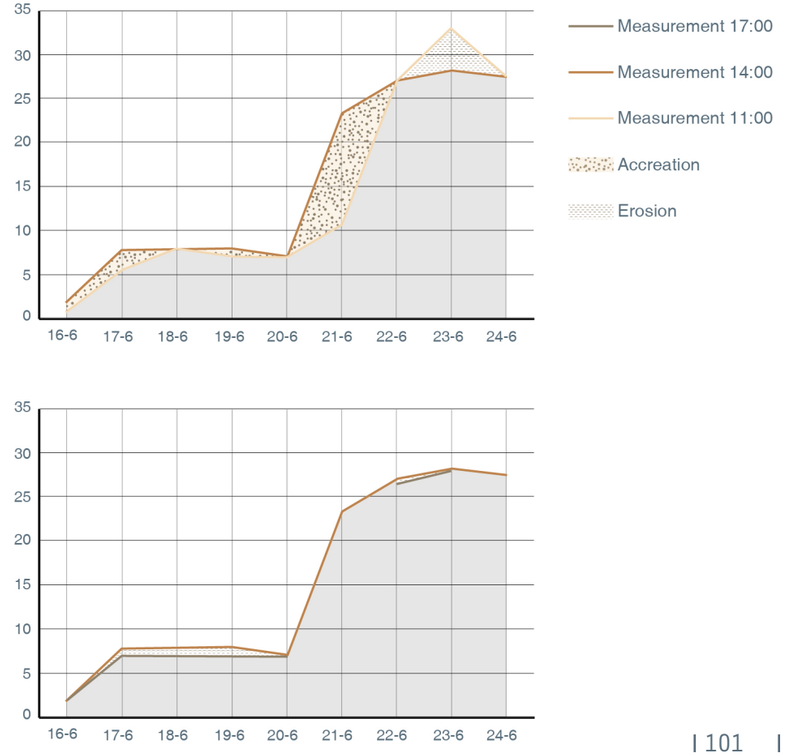
Measurement point 4

Phase 1: SW-period

Phase 2: NW-period



Measurement point 4 was located on the leeward side of the row of medium hessian panels. To the outside, the wind was accelerated under the higher hessian panels, causing acceleration of sand particles under these panels. These particles accreted on the leeward side of the medium panels, since the wind slowed down here. Further transportation was blocked due to the lower hessian panels.

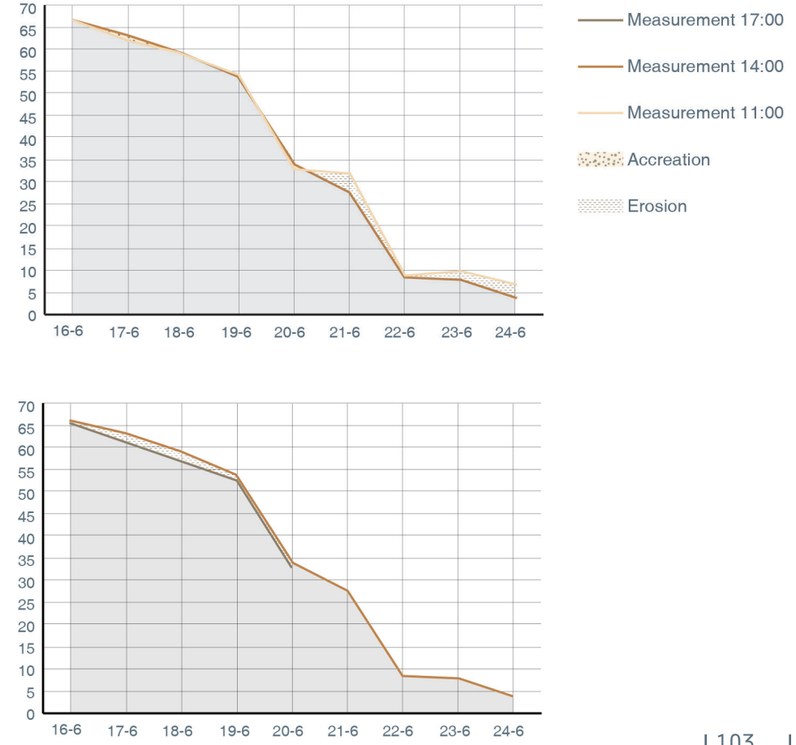


Measurement point 5

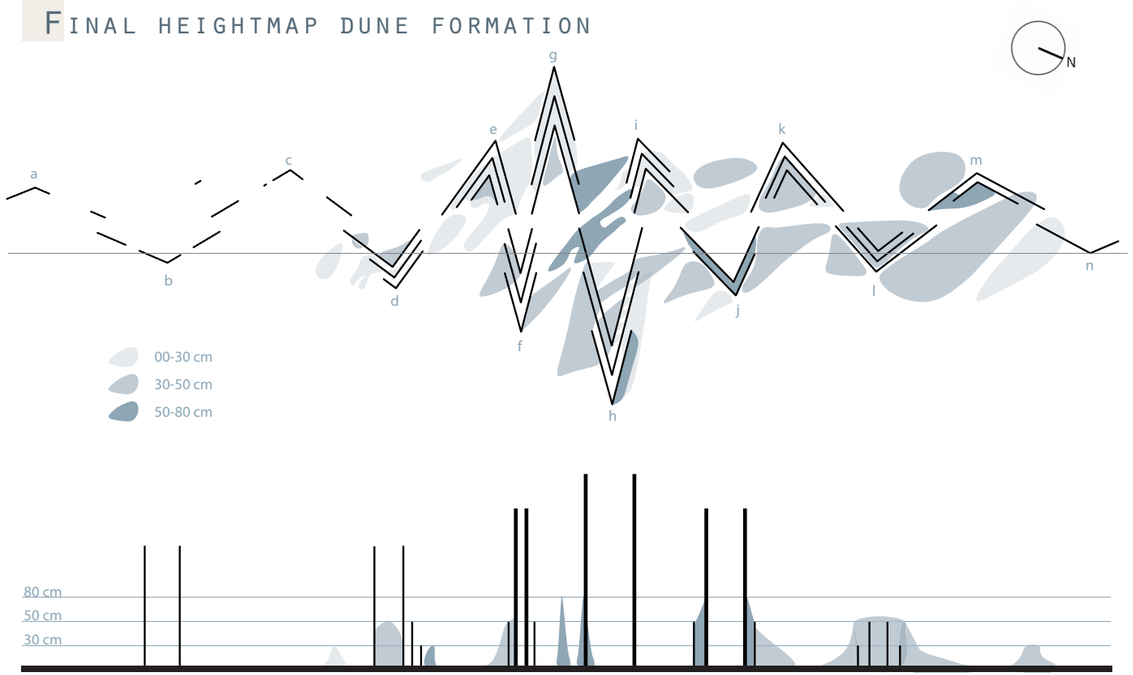
Phase 1: SW-period

Phase 2: NW-period

Measurement point 5 was located on a sand bank. Both the SW and NW winds caused the sand bank to move away from the measurement point. The graph shows that the sand level is decreasing over time. When this sandbank was fully inside the installation, it seemed to stay in place and grow in height. This can be explained by the placement of the hessian panels on the outside. A row hanging on approximately 1 metre height slowed the wind at that height, and caused wind acceleration and sand drift below it.



Final heightmap dune formation



The general height map shows the outcomes of sand accretion after the festival (measured on June 24th). Sand formations reached heights up to 50-80cm. The map shows a clear northwest direction, the dominant winddirection of the final days.

Based on these findings it is assumable that the dominant source of sand seems to be the seaward transportzone. During the first phase of measuring the foredunes were appointed as the main source due to the southwest winddirection. This shows the value of the fencing in angles as a way to prevent sand transportation from the foredunes towards the sea.

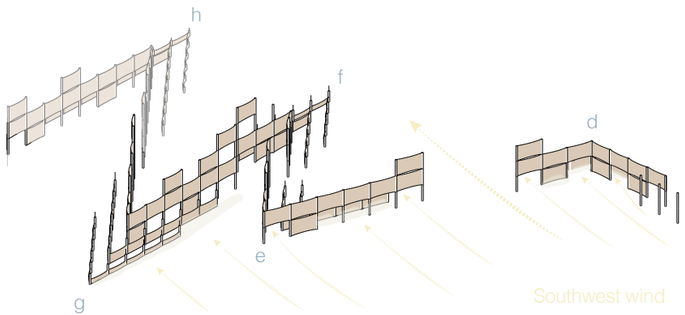
Based on the configuration of the panels, the different heights can be explained. Due to the complexity of the configuration, several spots were selected to be elborated on in this report.

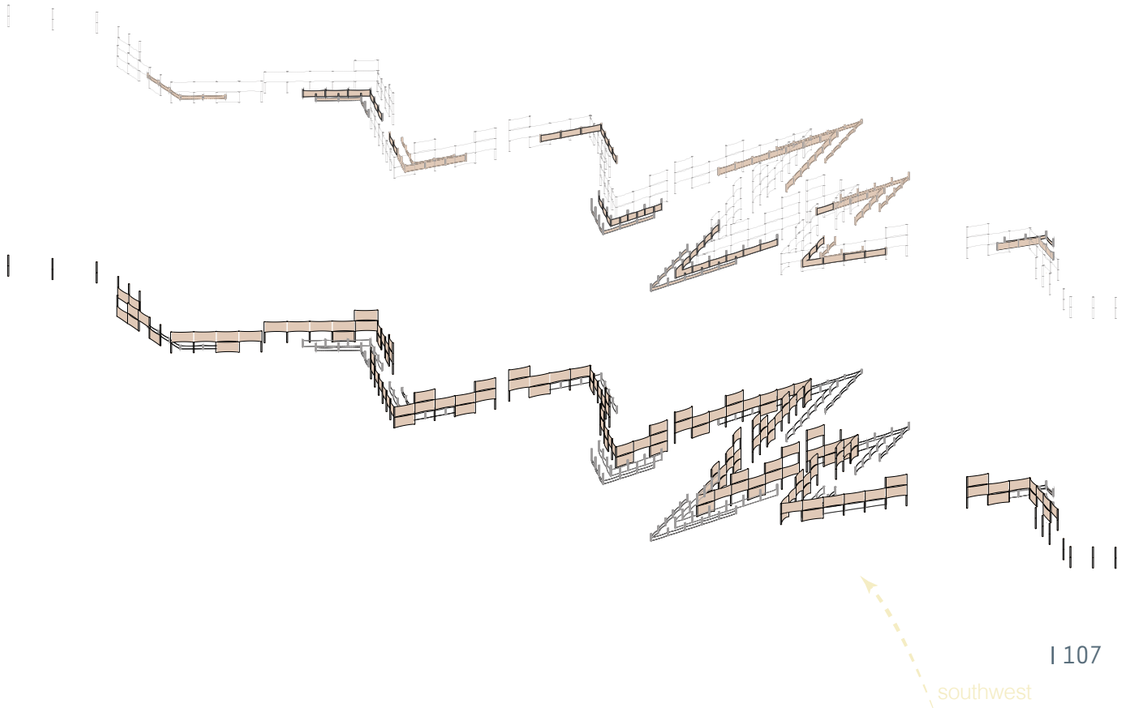
Configuration

The configuration of the corners of the installation was based on continuous, staged lower panels with building heights of 300mm and 500mm, and an adjustable range of higher panels rising up to 4m. Expected was that the lower panels were filled at first by creeping sand. Due to strong winds during the build-up period, the lower panels were placed two days before the higher panels. It already showed accreting sand mainly from the southwest.

Due to the complexity of the configuration a timeframe of five days was chosen in which the configuration including higher panels was tested.

The outcome after the first five days was discussed on site. An interesting development in acute corner G was that due to sand transport alongside the panels, sand accretion to the second row of panels was limited. In between corner E and D the panels were perpendicular to the wind direction causing sand accretion.





ADJUSTMENTS CONFIGURATION

Based on the results of the first five days, and with the expectation that the wind direction would change from SW to NW, the configuration of some panels was adjusted to enhance more sand accretion (blue).

In addition a selection of higher panels was removed during the storm (June 21st and 22nd) to prevent damage to the installation (yellow).

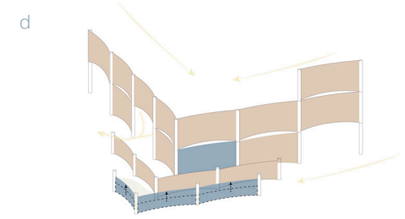
d: The sand accretion in this corner had reached a maximum after five days. A panel was added in the corner to improve accretion from the SW to NW direction. In addition the lower panels were heightened from 300mm to 500mm.

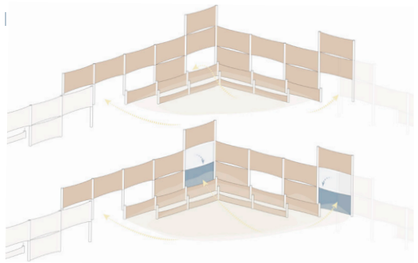
l: Panels were shifted from middle level to ground level to prevent erosion on the groundlevel caused by tunneling. This allowed more accretion in the corners.

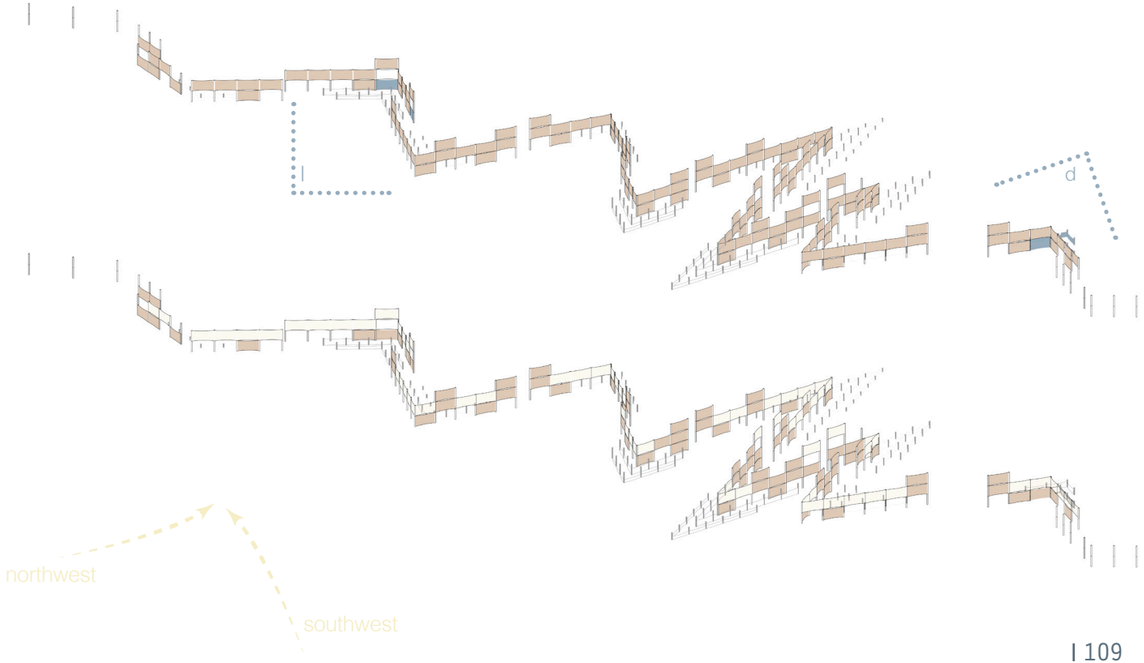
removed during storm

panels up

added or adjusted







Comparison

Based on the outcome a comparison was made between a southwest oriented side of panels (point G) and a northwest oriented side (point K).

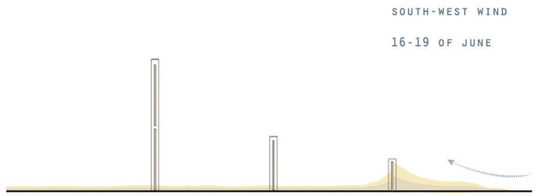
Point G

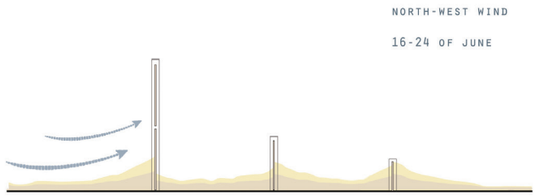
Due to the moderate west to southwest wind, creep and saltation were the main forms of transport on the beach during the first five days. This resulted in a moderate amount of sand accretion in the lower (and middle) panels. Due to the acute angle towards the wind direction, sand was also transported alongside the panels causing a sand tail and limiting the amount of sand towards the middle row of panels.

Point K

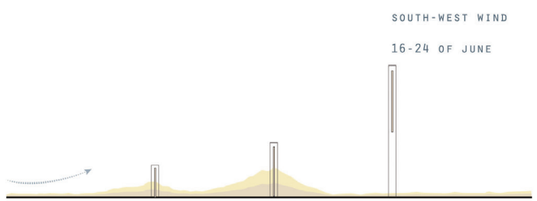
During the last five days, high windspeeds from the northwest direction caused suspended sand transport. This transport was substantially more than the south west production through creep and saltation. The configuration of elevated higher panels in combination with lower panels caused a blowhole effect with the northwestwind. This created a sand tail and caused build-up of sand in the lower panels.

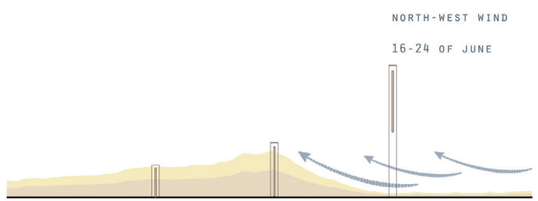
Point G

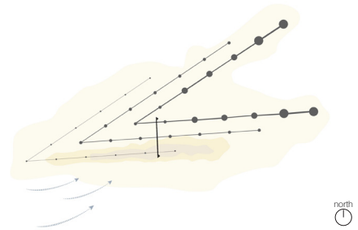


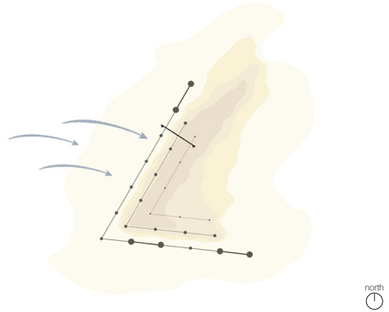


Point K







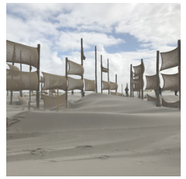


Particular findings

22/06

The obtuse corners fill up with sand due to sand banks that naturally move over the beach. These banks get caught in the installation and thus become the main supply of sand.

22/06



The NW wind caused small dunes to arise in between fences where the wind speed drops. These conditions made both smaller and bigger particles drop and caused small dunes to form in the span of only one day.

22/06

Tails of sand are accreted by different openings in the installation that act as a blowhole. Together, the NW wind and the positioning of fences stimulate the process of tail formation.

22/06

Erosion takes place due to the higher positioned fencing, creating a blowhole effect. Sand particles of different sizes can be transported by the wind because of the acceleration of the wind in between and under the panels.

24/06

Erosion also takes places because of human movement trough the installation. Sand particles are being loosened and the wind is able to carry this along, stimulating the sedimentation proces.

Conclusion

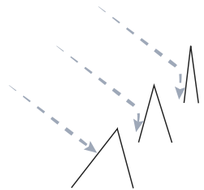
The main question addressed for this research was:

WHAT IS THE EFFECT OF SEMI PERMEABLE MATERIAL ON THE BEACH FOR SAND ACCRETION? WHAT IS ITS INFLUENCE ON DUNE FORMATION PROCESS?

The use of Hessian half open fences have brought positive effects for accreting and/or transporting sand. The design of the installation included the use of stepped fences and various angles to respond to ongoing sedimentation and changing wind directions. The complex configuration of the installation made it difficult to analyse the cause of the resulting patterns. However, it did give an indication of the phenomena that might occur in sedimentation processes through an architectural intervention. These leads are recorded and will be used for further research.

WHAT IS THE EFFECT OF APPLYING SEMI PERMEABLE OBSTRUCTIONS IN DIFFERENT ANGLES?

The different angles show the ability of the panels to transport, accelerate, guide or accrete depending upon the wind direction faced by them. When the panels are perpendicular to the direction of the wind, more sand can be accreted. When the wind direction hits the panels at a certain angle (acute/ obtuse) then the panels act as guidelines for sand transport. When angles meet the installation acts as a funnel although accretion starts more locally first (and might be transported into the funnel later).



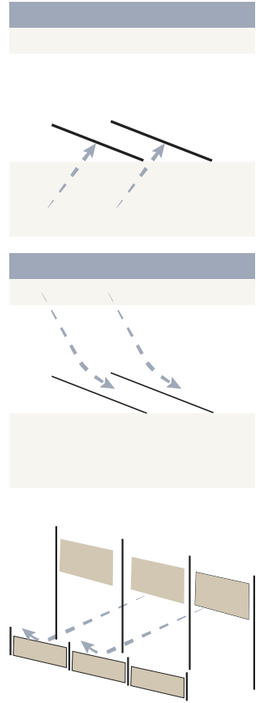
WHAT IS THE EFFECT OF APPLYING SEMI PERMEABLE OBSTRUCTIONS WITH DIFFERENT BUILD UP HEIGHTS?

Based on the initial design, it was noted that sand accretion could take place with panels that build up in height. To a certain extent the build up of panels seems to contribute to the build up of sand due to the fact that the lower panels could function as a ramp. Secondly, the second row of panels creates leeward conditions in the in-between zone.

However, the comparison between point G and K shows that a reverse build up in heights is also capable of accreting sand. In that case, the configuration of higher panels with lower openings in combination with lower rows of panels leads to the functioning of these openings as vertical blowholes. Due to these blowholes, sand transport is increased causing large sandtails. However, the use of the build up in heights is questionable as the combination of different rows of panels seems to create leeward conditions that stabilize the sedimentation.

HOW TO BUILD A BRIDGE BETWEEN THE EMBRYONIC DUNES AND THE FOREDUNES USING 'BUILDING WITH NATURE' PRINCIPLE?

In order to create a 'bridge' it was found that the installation needs to meet with two conditions. First of all the installation needs to be able to prevent sand transport towards the sea caused by the dominant southwest wind direction. Secondly, the installation needs to be able to guide and accrete the sand coming from the west to northwest direction towards the foredunes. In that sense, the shape of the installation did not fully meet these requirements and could be improved to gain better results.



During the field observations it was noted that the installation could be used as a ‘bridge’. This raised the question: where does the sand need to go? Can it be used to speed up accretion for the front dunes, or maybe to strengthen the inner dunes?

While the earlier methods focussed mainly on nourishing the front dunes, it is equally important to nourish the inner dunes as well, especially on the Islands.

With the intensive use of the coastline due to tourism and beach infrastructure the embryonic and foredunes get eroded and steeper. Recent studies show that the foredunes are damaged and eroded by storm, causing steep angles that limit the sand transport. The nourishment for inner dunes mainly depends on these angles and the transportation is hindered because of these steep angles.

This also highlights the value of sequential design, that is not approached as a fixed image but as a sequence of processes influencing each other. Hence, the structure could be adapted to develop a flexible foredune front to meet the functions on the beach. This system can also be used to further regulate and fix the second or inner dunes by creating aerodynamic edges or slopes.

The ‘bridge zone’ developed could also act a major sand bank to collect sand at the wet zone and transfer it to the back dunes. The current design does allow the sand to blow from fore dunes back to the sea. Hence, deeper understanding of the placement of the angles needs to be done. Therefore, further investigation needs to be done as how to use the design in a more effective way.

After completing our part of the research we would like to give an additional recommendation on how to proceed on a possible further research which is based upon our findings.

VERTICAL BLOWHOLES

We came across this interesting phenomenon when doing fieldwork. The unforeseen positive influence they had on accreting sand and helping the movement of sand asks for more research. Moreover, the position of the blowholes and the size will affect the outcome. As several variables were included in one design this makes it difficult to elaborate on them separately.

BUILDING WITH NATURE

Specifically in this type of installation, further research can be done on resulting nourishment of both the front dunes and the inner dunes. The performance of the installation was limited to the period of the festival. It would be interesting to look at the performance on a longer period of time and monitor the speed and size, depending on both wind speed and wind direction.

The initial idea was to speed up the processes of sand accretion to reach a level in which vegetation could take over the process. One could think about inserting plant seeds into the hessian which can provide a monitored and controllable situation.

REFLECTION

Public response

During the 10 Oerol days we had a total 'official' visitors count of 3925.

The installation was open from 11:00 till 17:00 during which visitors could experience the installation, ask questions to the students and 'help' us monitoring the installation. They also could leave a comment in the guestbook.

The main reactions were very positive and the most heard comments were:

'An interesting project, a shame it is broken down so soon' and 'Art and science come together'

An informative route through the dunes that leads the visitor onto the beach where they can literally see the sand accretion happening in the installation gave the visitor a real expedition experience.

The route leading through the dunes was exciting as that is normally forbidden in the Netherlands.

People were respectful, enthusiastic, positive and surprised by our project.

"Ship of sand"
(anonymous)

Publications

ALGEMEEN DAGBLAD

https://www.ad.nl/delft/tu-studenten-op-oerol-met-installatie-gap-the-border~ac6fc2b1/

DELFTSE POST

https://www.delftsepost.nl/nieuws/algemeen/442944/installatie-van-de-tu-delft-op-oerol-festival-2018-

DELFT OP ZONDAG

https://www.delftopzondag.nl/nieuws/algemeen/87770/groep-master-studenten-tu-delft-op-oerol-festival

DELTA

https://www.delta.tudelft.nl/article/ben-je-op-oerol-ga-bij-deze-tu-studenten-langs

DE ARCHITECT

https://www.dearchitect.nl/

architectuur/blog/2018/06/zoektocht-naar-alternatieven-theaterfestival-oerol-op-terschelling-101192653?vakmedianet-approve-cookies=1&_ga=2.139189620.613157544.1530179989-436297130.1530179989

POLIS

https://www.instagram.com/p/BjdLP7uFSGs/?hl=en&taken-by=polistudelft

BK CITY

https:// www.instagram.com/p/BkK_O0elmYA/?hl=en&taken-by=bkcity.tudelft

Team reflections

Landscape Architecture ON Site has been an exceptional course in many ways. The project is about combining landscape architecture, art, architecture, and science. Whilst designing and building Aeolis- Gap the Border-, there have been unpredictable, exciting, and nerve breaking moments. Here we will reflect upon our process and our methods.

During these 10 weeks, we went through all phases of any design process together. The experience of designing and building an installation is of great value to all of us: it was the first time we had the opportunity to realize our own design. First of all, because it gave us more insights on all the aspects of a design project, included the more practical aspects such as testing and prototyping and logistics. Secondly, to gain experience in designing for a public (the visitors of Oerol). But also, to get more familiar with practice: including the external factors and external parties which influence the design outcome.

Working together and Management

The team worked incredibly well together, everyone's input was of great value to the project. We managed to finish everything within a very limited timeframe due to manageable tasks, a shared ambition, and great flexibility.

In the first phase of the process the groups functioned very well, there have been many effective discussion and brainstorm sessions. The most difficult moment in our process came after the presentation day. It was unclear how to move forward and we tried to solve everything all together, at once. After a group discussion we managed to get everyone on the same page again and within smaller groups we proceeded with the design.

After a vote, smaller groups were formed. Even though everyone had joined two groups of interests, the groups changed 'naturally' over time. Some groups asked for extra help, whilst others naturally picked up tasks from different groups. This worked because everyone was motivated and there was good communication.

We arrived well prepared on-site, included a work plan, materials, and tools. Even though we were well prepared we had underestimated the energy it took to construct something in windy and rainy weather.

Landscape research methods

The literature studies have been a great source of inspiration for the 4 design concepts, presented in week 5. Due to an organized morning of short presentations, a cross-over of information was made possible. (The readings on Land-Art and Garden clearly resonate within the final design.)

The desk analysis allowed us to diverge. The research method we used to determine our findings was the 'layered analysis'. By combining layers, we gained many new insights on Terschelling and the site. The analysis was successful: findings formed a great source of inspiration for the final design.

approach

The approach to the project was very experimental, a big part of our design decisions derived from 'trial and error'. The many experiments which were carried out allowed us to combine, test and evaluate different themes from different disciplines at the same time. On a critical note: this also meant that we made lots of assumptions and left certain aspects implicit.

Integrating these disciplines have been challenging and a great point of discussion throughout the entire process: sometimes our different goals were conflicting. Yet precisely this combination is what visitors valued the most about the installation: not only being able to achieve results through quick prototyping but also being able to translate these results into something experiential.

Build process and external parties

By choosing the project 'Sands of Time' we took a risk. The design was ambitious, both in scale, time and construction, and also because it was situated in a protective area. For us, it became a challenge: make something big and impressive, in a limited timeframe and with a limited budget.

On top of this, the project almost got canceled by the forester. Up to the Friday prior to our departure to Terschelling we were held in uncertainty. Despite this we had to continue our work. Looking back, it could not have been avoided within this limited timeframe. Rather than a setback, we approached it as a challenge: to be as convincing as possible. It forced us to be flexible, investigate the objectives and communicate strategically.

the Students

Gap the border:
design experiment as incubator for nature based solutions

On Site – Reflection
Janneke van Bergen - researcher for ShoreScape and guest tutor On Site 2018

How to speed up dune formation to strengthen our sandy coast in answer to sea level rise? This challenge was given to an international group of On Site students early april 2018. In 10 weeks time they took a journey to coastal dynamics, sand transportation and last but not least, sedimentation through design. This resulted in a large sand catching installation on the beach of Formerum, Terschelling during the Oerol festival in june 2018. This article looks back on the sequence of steps that led to this intervention, not only to harvest sediment, but also valuable lessons for future nature based design.

Background: sediment in answer to sea level rise

Coastal zones globally are faced with the effects of climate change. The rising sea level increases erosion on sedimentary coastal systems, and puts the academic world to new challenges, especially for low lying countries as the Netherlands. Here new insights for coastal protection have led to a change in policy; since the 1990's the Netherlands have shifted from hard coastal defences (such as sea walls) to a more system based approach of sand nourishments. Currently, the Netherlands is nourishing 12 Mm3/year, that can increase to 66 Mm3/year in 2100, depending on sea level rise. New techniques for large scale nourishments are now being investigated, but this little is known how these nourishments affect dune formation and its interaction with the built environment. Therefore the NWO-funded research programme 'Shorescape' started in 2017, to investigate and model dune formation in urban environments, and give way for new forms of urban 'building with nature'. This research is executed by the University of Delft (urbanism/landscape architecture) and the University of Twente.

In 2018 the research topic of the ShoreScape was combined with the On Site education project to create a mutual gain: for the research to test initial concepts, fieldwork and monitoring; for the landscape architecture students to learn from and contribute to science.

Learning by doing: field experiments

The initial start of the journey was on a rainy day on the sand engine, a pilot for large scale nourishment south of The Hague, the Netherlands. This first workshop was planned to introduce the students to the features of sand transportation, dune formation and traditional dune building techniques such as fencing. Afterwards the students made first design interventions either to accrete or accelerate sediment by the use of obstacles, screens and funnels. With an abundance of sand at site, wind speed and direction were important keys to success. Windspeed was determining the type of transport (such as sand'creep'), while the wind direction and type of obstacle determined how and where sand was accreted. Half open hessian fences turned out most successful in accretion and were taken into the design process.

Think like sand: system based design

Next step was to transfer the first insights on dune formation, sand transport and accretion into design. Most student designs managed to address the different stages of dune formation, (f.e. by museumizing it) but only few designed an intervention perceptive to sediment accretion and addressing changing wind conditions. The chosen design was based on the technique of fencing addressing BwN on three scales:

1- **Regional:** the design acts as a symbolic 'stitch' on the border between the two former isles of Terschelling. Sea level rise around 1500 AC tore the island apart, but merged again through natural processes stimulated by human intervention. The project not only reflects on this history of building with nature (BwN), but also puts it back on the future agenda: re-employing traditional BwN-techniques such as fencing combined with high tech monitoring to address the challenge of sea level rise.

2- **Local:** On the beach of Formerum the installation connects the foredunes to the seaward sediment transport zone, a valuable source of sand. Normally the dominant windforce on Terschelling results in a parallel sediment transport along the beach, separating embryonal dunegrowth from the fore dunes. The installation could be a first step to guide the sediment back to the fore dunes, bridging the gap between sediment source and dune formation.

3- **Architectural:** The installation is formed by a row of hessian fences between wooden poles; the low ones accreting sand, the high fences mimicking coastal buildings, such as beach pavilions. Within the installation different fencing-typologies were used: steep or low angles, funnelling or wedging, stepped fences and vertical blowholes. In the middle aisle the effects of manmade erosion were made visible. Although the whole installation was perceptive for sediment transport, the varied angles and stepped fences were first efforts to anticipate to an ever changing, evolving system and move from static to dynamic design.

Performance: the unexpected finds of art & science

The complex configuration made it hard to predict how sediment would respond to this setup. The first week the installation performed under mild to strong SSW-wind conditions (creep and saltation transport), resulting in accretion in the facing angles, and an unexpected increased parallel transport between the fences. Another unexpected find were the positive effects of lower openings in the high fences. These openings functioned as vertical 'blowholes', increasing transport and creating long sand'tails' behind them.
By the end of the festival the wind direction changed to strong NW-wind (13 m/s or more), resulting in large landward transport. This (suspension) transport was harvested on the lee side of the higher fences; where the reduced windspeed dropped sand in large quantities, resulting in heaps of sand of 1m or more. At this time, some of the low fences were already filled up. Some of them were altered in height in order to stimulate further sedimentation. In total the installation included around 300 poles and fences over a length of 170m. In 10 days it more than doubled the amount of accretion compared to its natural surroundings.

Reflection: lessons learned for BwN design in urban sedimentary coasts

Ten days of Oerol have shown that it is indeed possible to accrete a substantial amount of sediment through architectural design. The used technique of fencing is meaningful for the harvest of sediment in urban coastal areas, where vegetation is not an option. The architectural features of the prototype showed successful ways for the manipulation of sand transport, from acceleration to guidance to accretion. The collaboration with On Site as a pressure cooker and Oerol as laboratory of art & science have been fruitful: rapid prototyping has increased insights and unveiled solutions that would have taken a long time if only based on scientific evidence. The collaboration with Oerol gave way to art to enter the scene and create unexpected outcomes valuable for research.

These are all valuable leads to be explored further in the ShoreScape research, and see how they can be translated to operational mechanisms for sand transport and new urban typologies. They also raised new questions to take research to the next level:
First of all the performance of sediment based interventions in time: how will an installation function over al longer period? And does this imply that part of the design has to become dynamic in order to increase its harvest in changing conditions? The understanding and manipulation of dynamic systems is in fact one of the front lines of current academic research: from dune formation to dynamic traffic systems to the behaviour of cancer cells. It will not only need insights into system behaviour and dependencies, but also proactive and sequential thinking in order to design.
Secondly, the employment of these sand mechanisms needs a clear goal of where the sand ultimately needs to go. Is it needed to speed up embryonal dune growth, accretion of the fore dunes or to feed the inner dunes? This will have an impact on the type of design intervention. The appointment of sediment is part of a societal discussion that already started during Oerol. Policy goals are scattered and contradicting, leaving an important role for research and design to communicate and overcome these differences.
And last but not least: how will sediment catching installations function within an urban context? Will they be able to incorporate more urban functions that can help the BwN process? With our coasts eroding we are forced to accommodate more functions in less space, the so called coastal squeeze. Here design has another role to play: to match technical needs (science and engineering) with the daily functions and experience of the coastal zone. This is one of the greatest values of design, it being able to gap the border and investigate and incorporate a larger set of parameters into one creative solution, preceding science, to learn how to protect our coasts in a sustainable way.

Laboratory Oerol: Designerly Ways of Knowing in the TU Delft Landscape Architecture elective project On Site, 2018

Reflection: Design

Dr. René van der Velde – Course co-ordinator Oerol_On Site 2018

introduction

Discussion on the synergies between scientific and artistic endeavour is a recurring topic in academia, but has gathered a new momentum since the turn of the millennium in response to among other things the urgency of global challenges such as climate change. The incapacity of nations and their various political systems to adequately address problems such as global warming has revived a discussion on the development of new synergies between science and art that might breach this inertia. A first and rudimentary line of thinking has been the communication of scientific findings to the general public by way of artistic 'pieces' such as installations, (theatrical) performances and visual art works. Art praxis has also engaged with scientific findings to deepen its societal relevance and as inspiration for new creative work. In turn, certain areas of science acknowledge that modes of art praxis generate results which are not achievable by their own, accepted research methodologies. These reflections suggest that an engagement with art praxis may prove fruitful for academic enquiry. Aside from some incidental experiments however, a more fundamental and structural synergy between the realms of science and art has to date not emerged. Synergies have been hampered by reservations about the compromising of scientific integrity on the one hand, and artistic creativity and autonomy on the other, but have also been hampered by the fundamental differences between both realms. By extension, viable methodologies to bring both realms together, which might uphold disciplinary independence and integrity, have to date been lacking.

Design, Engineering, Landscape Architecture and the Oerol Festival

Design and design thinking has been mooted as an area which might offer a way forward in this debate. The role of spatial design disciplines forms a small but critical chapter in this discussion. Within the discourse, reflections on the particularity of (architectural/ planning) design methodology as compared to engineering methodology have emerged. A potential complement to this discussion are approaches from the discipline of landscape architecture. Landscape architecture distinguishes itself from other spatial design disciplines by the critical role of site and context in the design process (Braae & Diedrich, 2015). Other distinctions include a working through various scales of design, the development of narratives, and the attention to phenomenology and experience (Van der Velde, 2018). The differing perspectives of (landscape) architecture and planning as compared to engineering forms part of a discussion at a University level about design methodology for problematique at the confluence of spatial design and (civil) engineering, such as infrastructure design. To this end, the chair of landscape architecture has received structural funding from the Delta Infrastructures and Mobility Initiative (DIMI) in 2012, 2016 and 2018 to participate in the Oerol Festival on the island of Terschelling in the Netherlands. Oerol has a long tradition of landscape and location art and is one of the major international centres of development in this field. With the island as a source of inspiration and stage for the broad programming the Oerol festival has a leading artistic profile, focussing on culture, nature and experimentation. Each year, Oerol selects some twenty innovative projects that fit within this focus for the 'expedition' programme. The expedition programme includes projects from all disciplines and mixed forms, such as short presentations, performances, objects, theatrical films and/ or visual installations which the public can visit. These projects are freely accessible to visitors of the festival.

TU Delft On-Site elective 2018

This frame sets the scene for a discussion of one of the projects realised for the Oerol festival in June 2018, by a group of lecturers and researchers from the section landscape architecture at the TU Delft, together with master students from the faculties of architecture and industrial design. The elective course 'Landscape Architecture On Site' involves the realization of a design-and-build project in a landscape setting, exploring the role of the designer in situated, interactive projects.

What makes this project fertile for a discussion on the synergy of science and art and the more development of design methodologies for problematique at the confluence of spatial design and (civil)

engineering, is that it engages with an NWo funded research project entitled ‘Shorescape’ run by researchers from the Delft University of Technology and the University of Twente. This project addresses the problematique of sea-level rise caused by climate change by calling for the study, conceptualization and trialling of ways to foster wind-blown sand transport on the one hand and sand accretion/harvesting in lieu of strengthening the dune system as flood-barrier infrastructure. Specific to this project is the focus on the role of built environment features on landward sand dynamics (with an associated attention to the cultural-historical, recreational and ecological futures of dune landscapes). These built environment features range from large seaside towns and resorts to beach pavilions and subsidiary recreational infrastructures such as roads, paths and hardscapes, furniture, walls and fences. All these elements influence the aeolian (wind-driven) sediment transport towards the dunes, but at the moment little is known about the interaction between wind-driven sediment transport, built environment features and long-term dune development. To this end, Delft (group landscape architecture) and Twente (group coastal morphology) have joined forces to investigate and contribute to knowledge in this area. As such, the project was envisaged to incorporate a number of field trialling components for Shorescape, which might inform later fieldwork trials. It was also envisaged to represent and communicate aspects of the research problematique to the general public. Of interest for discussing the approaches and outcomes of design (for and in relation to science) is the splitting of the project into two parts: a ‘scientific’ installation examining the effect of built form on sand transport run by the University of Twente, and a ‘design’ installation engaging with sand accretion/harvesting run by the Delft University of Technology (PhD researchers, teachers and elective course students). The UT project can thus be seen as a ‘control’ installation. Research questions include:

- How did the TUD outcome differ from the control experiment as an spatial installation?
- what alternative insights did it generate for the scientific goals of the Shorescapes project?
- what processes were used to develop the scheme?
- how does this process input to the discussion on design vs. engineering?
- What conclusions can be drawn from this work in regard to the synergy of science and art?

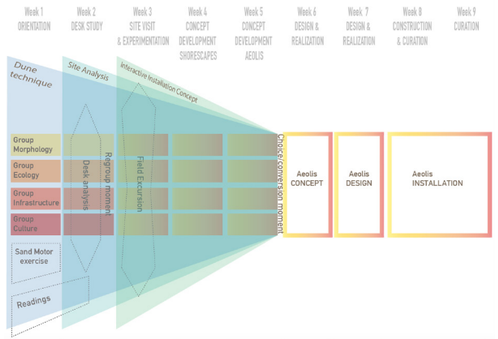


Figure 1. Didactic structure Oerol On-Site elective 2018

PROCESS & RESULTS

Delft University of Technology Installation

The Delft project ‘was structured into an initial 5 week period including orientation, desk study, literature study, site visitation and concept development, followed by a second 5-week period including design elaboration construction and project management (Fig. 1).

The orientation phase included a workshop to introduce students to dune formation in which students made built rudimentary prototypes to play with accretion or erosion/transport of sand. Hessian screens were used successfully in accretion and were taken into the design process. A second part of the orientation phase was literature study on the topics of Garden, Place, Land Art, and Curation. In the desk study phase student teams analysed the development of the island landscape(s) as a series of four interacting layers: abiotic aspects such as geology, wind and water and their effects on the geomorphology and topography of the island; biotic-ecological aspects; cultural aspects such as agricultural and forestry practices and measures; and urban-tourism aspects such as infrastructure, settlements, holiday houses, beach shacks and recreation infrastructures. Input was also generated in this stage on the problematique of climate change and coastal dune systems in relation to the natural and cultural history of the island. The outcomes of these four chapters were collated in a 4-part ‘framing document’ that

formed the basis for fieldwork analysis to be carried out in the next phase. At this stage the groups were re-shuffled into four new groups (design teams), each with an expert on one of the four chapters. These groups then brainstormed first ideas and prepared a prototype installation to be installed on site during the field trip.

During a field excursion, students explored a transect of the island including the site location, followed by an individual interpretation of the site using cartography, collages, photographs, drawings, paintings, animation, film and text. First concepts were then tested in trial installations, in which each of the installations is 'enacted' using the rest of the student group.

Results from these various steps were then synthesized into a project brief. Four concepts were developed presented at the end of this stage, and a winner chosen for further development.

Gap the Border

The chosen concept entitled 'Gap the Border' starts as a symbolic representation of the stitching together of the two former islands De Schelling and Wexalia into Terschelling at the end of the middle ages; the waterway between the islands being located on the same place as the project. The stitch is 'woven' as a route from the foredunes to the ocean, and includes at the same time a gap down the centre which forms a route for festival visitors to move through the installation and symbolically walk the historic divide between the two islands. The height and extent of the installation forms an architectonic space in which the visitor can 'enter' and exit, and creating a particular kinaesthetic spatial experience. In terms of materials, the installation is constructed of hessian panels strung at different heights between wooden poles, conjuring up images of sails of bygone ships in the passage. As a sand accretion installation, the hessian panels were laid out in different angles to funnel or capture sand. The installation also connects the foredunes to the seaward sediment transport zone, setting up a movement of sand from this zone to the dunes which usually wouldn't happen as the dominant winds on Terschelling results in a parallel sediment transport along the beach.

DISCUSSION / CONCLUSIONS

In terms of discussion of design vs engineering (from the perspective of landscape architecture), there has been a critical impact of site and island context on the design concept. Site readings - particularly the morphological development of the island over a long period - has inputted to the development of an historically-informed scheme. The scale of the installation is also derivative of its context, and the intention to create a form which has the scale of the island and its dune system. The stitching concept moreover, also offered the opportunity to test the effect of different angles of hessian panelling on sand movement and accretion.

In relation to the broader discussion of the synergy of science and art, the project can be seen as an example of 'designerly ways of knowing' which breach both realms. These include the incorporation of characteristics of the site and its (island) context, and the spatial and experiential aspects of a landscape installation.

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FRIENDS OF GAP THE BORDER

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