CONTENTS

Research Phase

- Introduction .................................................. 04
- Technical Research ........................................... 08

Design Phase

- Introduction .................................................. 20
- Site Analysis .................................................. 23
- Design 1: De Kampeertent .................................. 32
- Design 2: De Theatertent .................................... 50
- Design 3: Het Klimbos ........................................ 64
- Landschapskunsten en Locatietheater .................... 76
TECHNICAL RESEARCH
INTRODUCTION

Temporary Architecture

- **Altare della Patria** (Giuseppe Sacconi, Rome)
- **Spacebuster** (Raumlabor, New York City)
- **Temple of Juno** (BRC, Burning Man 2012)
INTRODUCTION || Portable Shelters

Clockwise from Left: Traditional Portable Shelters (Renzo Piano), Mongolian Yurt, Hammock Tent, Emergency Shelter (DRASH).
INTRODUCTION || Form-Active Systems

INTRODUCTION || Problem Statement

Clockwise from Left: Nordisk Wind Tunnel Test, Gaudi’s Chain Model (J. Tomlow), Rudimentary Load Testing.
Research Questions:

1. How can computational parametric tools be used for the design and fabrication of small-scale form-active structures?
**Research Questions:**

1. How can computational parametric tools be used for the design and fabrication of small-scale form-active structures?

2. More specifically, what are the strengths and weaknesses of Kangaroo for Grasshopper, a plug-in for Rhinoceros, in the processes of form-finding, selecting materials, and generating cutting patterns?
Research Questions:

1. How can computational parametric tools be used for the design and fabrication of small-scale form-active structures?

2. More specifically, what are the strengths and weaknesses of Kangaroo for Grasshopper, a plug-in for Rhinoceros, in the processes of form-finding, selecting materials, and generating cutting patterns?

3. Which alternative design methods are recommended?
What is Form-Finding?

Kangaroo Script: Form-Finding a canopy.
TECHNICAL RESEARCH || Case Study

Structural Members

Base Geometries: Key Structural Elements for the Case Study.
Analog Model: Scale 1:10.
Comparison Study. Left: Digital Tent Model  Right: Analog Tent Model (Scale 1:10)
Research Conclusions:

• Goal: To promote the creation of more structurally efficient, financially and environmentally economical, and aesthetically beautiful shelters.
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• 3 phases explored in the design process for equilibrium structures:
  1. Form-Finding: Kangaroo was an effective tool.
  3. Cutting Patterns: Possible with Grasshopper + Rhinoceros.
Research Conclusions:

• Goal: To promote the creation of more structurally efficient, financially and environmentally economical, and aesthetically beautiful shelters.

• 3 phases explored in the design process for equilibrium structures:
  1. Form-Finding: Kangaroo was an effective tool.
  3. Cutting Patterns: Possible with Grasshopper + Rhinoceros.

• Next Step: Use these techniques to create portable shelters for different programs (functions), environmental contexts, and scales.
DESIGN PHASE
Design Question:

How can digital parametric tools be used to design various form-active structures customized for the Oerol Festival on the Dutch island Terschelling?
INTRODUCTION || The Oerol Festival

THE NETHERLANDS
Terschelling

INTRODUCTION | The Oerol Festival

Above: Participatory Performances at Oerol.
Duinmeertje van Hee. Terschelling Island (NL).
SITE || Duinmeertje van Hee, Terschelling

Left: 5 Land Types. Right: Duinmeertje van Hee beach.
Duinmeertje van Hee, looking North.
SITE || Duinmeertje van Hee, Terschelling

Above: Duinmeertje van Hee, beach looking East.
SITE || Duinmeertje van Hee, Terschelling

Sketch Model: Early Project Concept.
Sketches: Early Project Concept.
SITE ANALYSIS || Duinmeertje van Hee, Terschelling
Climate: Sun Path

06.2014 Solar Path: Generated with UO's SRML program.
SITE ANALYSIS || Duinmeertje van Hee, Terschelling
Climate: Wind + Temperature

06.2014 Climate: Temperature, wind, and sun conditions.
SITE ANALYSIS || Duinmeertje van Hee, Terschelling
Radial Focus: Floating Stage

Site Axes: Floating Stage as a Radial Focus.
DESIGN 1 || De Kampeertent

The Problem

Left: Flooded Festival Tents. Right: Tent, Concept Sketch.

**Typology:** Tent

**Function:** Overnight Shelter

**Location:** K001 Camp, Terschelling

**Scale:** 27500 cm²
Early designs. **Left:** Tent Design, Plan View. **Right:** Elevation View.
DESIGN 1 || De Kampeertent

Early Designs

DESIGN 1 || De Kampeertent
Early Designs

Left: Communal Tent, Plan.  Right: Elevation.
Revised Concept: Private Tents with shared Community Space.
Revised Concept: De Kampeertent, with public + private zones.
DESIGN 1 || De Kampeertent
Structure + Materials

DESIGN 1  ||  De Kampeertent

Structure

Left: Mesh Height.  Middle: Mesh Gradient.  Right: Mesh Curvature.
DESIGN 1 || De Kampeertent

Structure

**Top Left:** Membrane Pre-Stress.  **Top Middle:** Cable Tension.  **Top Right:** Reactions at Fixed Points.

**Bottom:** High Wind Simulation. **Bottom Right:** Displaced Shape in High Winds.
DESIGN 1 || De Kampeertent
Final Design

Above: De Kampeertent, Plan.
Above: De Kampeertent, Section.
DESIGN 1 || De Kampeertent

Final Design

Above: De Kampeertent, Section.
Early Detail Sketches. **Left:** Fabric Pocket with Cable.  **Right:** Edge Cable with Clamps.
Early Detail Sketches. Left: Eye Cable. Right: Cable Loop.
DETAIL 1

De Kampeertent

Detail A

Detail: Tree Compression Ring.
DESIGN 1  ||  De Kampeertent
Details B, C

Left: Hypar Sail Unit.  Right: Cable Hooks and Ground Connection.
Above: Climate and Air Flows.
Cutting Patterns: Panels to be cut from flat fabric, pre-nesting.
DESIGN 2 || De Theatertent

The Problem

Left: Problem: Cold, Rain, Wind. Right: Solution: Sun/Rain Canopy.
DESIGN 2 || De Theatertent

Early Designs

DESIGN 2 || De Theatertent
Transformation Concept

Left: Day Configuration. Right: Night Configuration.
DESIGN 2 || De Theatertent
Structure + Materials

DESIGN 2 || De Theatertent
Structure

Left: Mesh Height. Middle: Mesh Gradient. Right: Mesh Curvature.
Sun Simulations: Over a 12-hour time period in June.
DESIGN 2 || De Theatertent

Final Design

Above: De Theatertent, Plan.
Above: De Theatertent, Section.

DESIGN 2 || De Theatertent
Final Design
Above: De Theatertent, Section.
DESIGN 2 || De Theatertent

Early Details

Left: Adjustable Valley Cable. Right: Clamped Corner Plate with Adjustable Cables.
DESIGN 2 || De Theatertent

Early Details

*Left:* Bale Ring.  *Right:* Butterfly Cable Loop.
DESIGN 2 || De Theatertent

Detail D

**Detail:** Top Ring with Tension Cables and Masts.
**DESIGN 2 || De Theatertent**

**Detail E**

*Detail:* Ground Plate Anchor with Steel Stakes
De Theatertent: Climate and Air Flows.
Cutting Patterns: Panels to be cut from flat fabric, pre-nesting.
DESIGN 2 || De Theatertent

Portability

Mobile Design: All structural parts are estimated to fit into 1-2 standard EU trucks.
DESIGN 3 || Het Klimbos

The Problem

**Left:** Problem: Protected Duinmeertje Hee Forest.  
**Right:** Solution: Minimally Invasive Installation.
Early Design: Interactive Installation.
Early Design. **Left:** Installation, Front Elevation.  **Right:** Side Elevation.
Early Design: Installation, Side Elevation.
Early Design: Interactive Installation.
DESIGN 3 || Het Klimbos
Final Design

Above: Het Klimbos, Plan.
DESIGN 3 || Het Klimbos

Final Design

Above: Het Klimbos, Section.
DESIGN 3 || Het Klimbos

Final Design

Above: Het Klimbos, Section.
Early Details. Left: Cap Connection. Right: Tree Connection.
DESIGN 3 || Het Klimbos

Detail F

Detail: Tree Connection for Lightweight Catenary.
Detail: Adjustable Cable Connection with Tree.
**Mobile Design:** All structural parts are estimated to fit into 1-2 standard EU trucks.
Landschapskunsten en Locatietheater: Site Plan.
Landschapskunsten En Locatietheater
Landschapskunsten En Locatietheater
Landschapskunsten en Locatietheater
Landschapskunsten En Locatietheater