

# Nature Lab

RHODE ISLAND  
SCHOOL OF DESIGN

## Biophilic Ceiling Installation

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### Materials & Specifications

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Kylie King  
Department of Interior Architecture '18

Peter Lokken  
Furniture Department '18

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# Biophilic Ceiling Installation

## Biophilic Concept

### NATURE-DESIGN RELATIONSHIPS

#### Concept

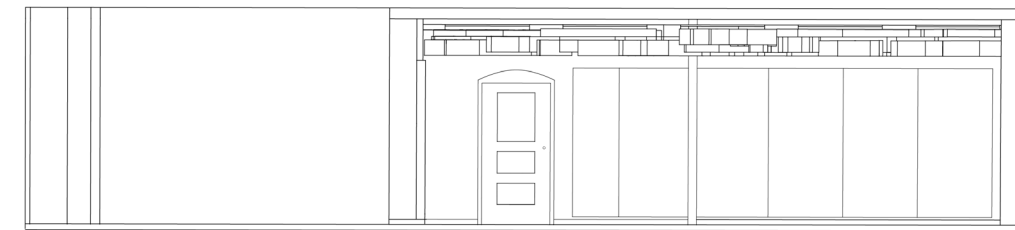
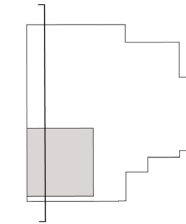
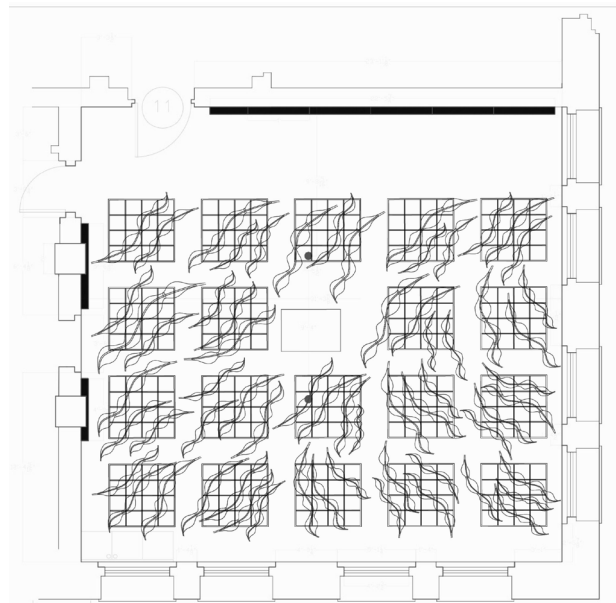
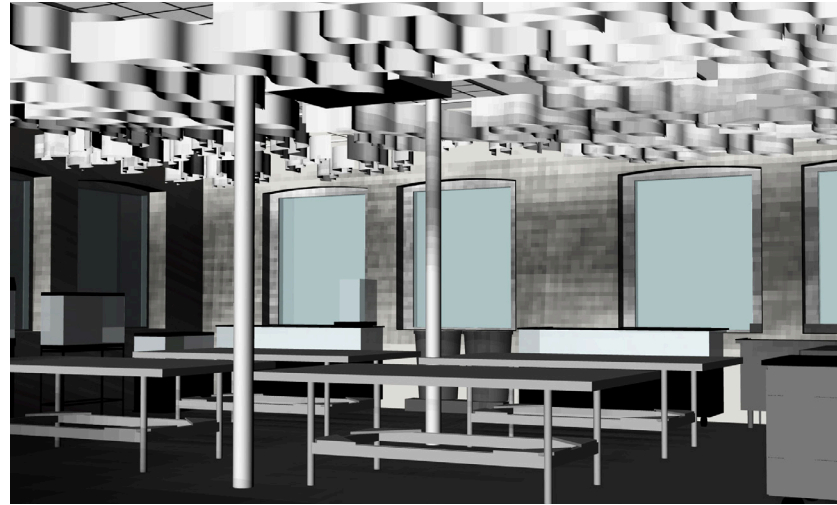
The Nature Lab's Room 11 ceiling intervention is a biophilic lighting installation designed around Biophilic design principals. Biophilic design can be organized into three categories: Nature in the Space, Natural Analogues, and Nature of the Space, all of which provide a framework for understanding and enabling thoughtful incorporation of a rich diversity of strategies into the built environment.

This biophilic installation falls under the Natural Analogues category. Natural Analogues addresses organic and indirect evocations of nature, and encompasses three patterns of biophilic design:

**Biomorphic Forms & Patterns** — *Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.*

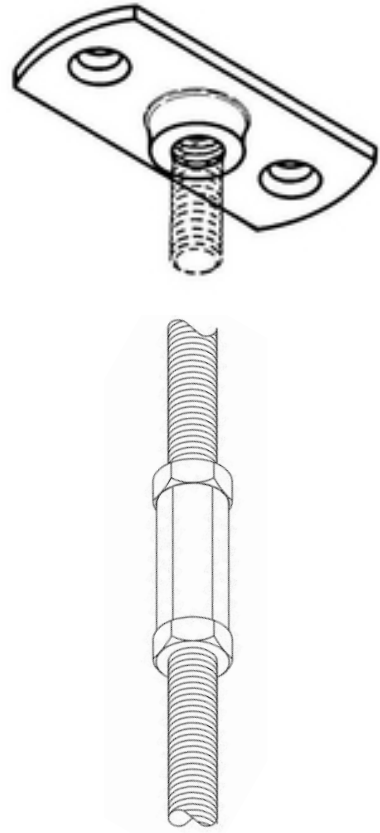
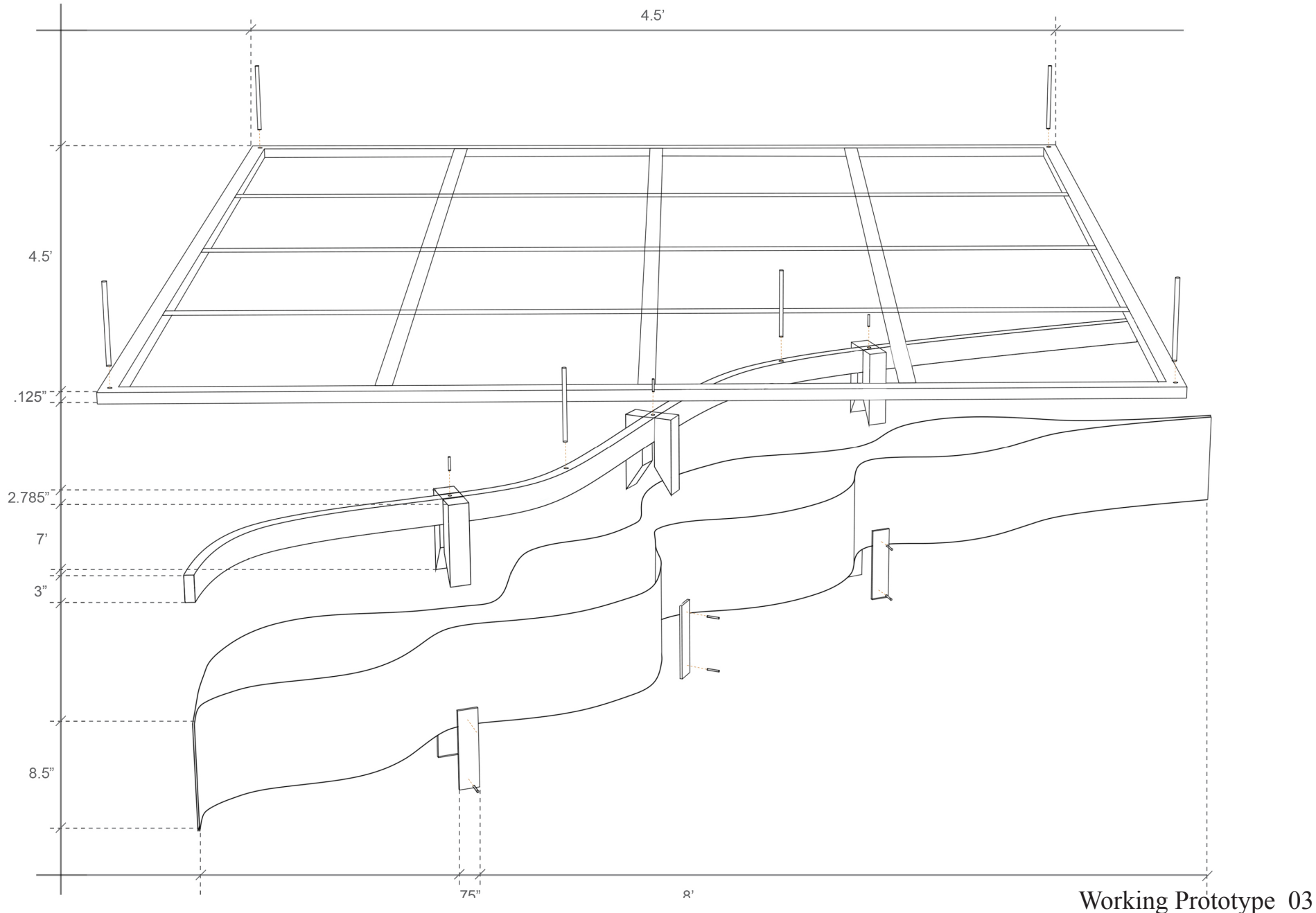
**Material Connection with Nature** — *Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.*

**Complexity & Order** — *Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.*



# Biophilic Ceiling Installation

## Working Prototype



### Armature specifications:

Armature Size	4.5 ft <sup>2</sup>
Number of Units	19 armatures
Material	Hot Rolled Steel
Density	0.29 lbs/cu.in
Pods/Armature	4.0
Per Unit Weight	27.4 lbs
Overall Price	643 \$

Material	Width	Thickness	Linear Feet	Volume (cu.in)	Lbs	Price/LF	Price
Angle Stock	2	0.125	18	54	15.7	\$1.04	\$18.72
Bar Stock	1	0.125	27	40.5	11.7	\$0.56	\$15.12

Spine Length (ave)	5 ft <sup>2</sup>
Material	Poplar
Waste	1.25 ratio
Density	0.0150 lbs/cu.in
Pods/Armature	4.0
Pod Weight (Ave)	3.0 lbs
Per Armature Weight	11.9 lbs
Number of Units	76
Unit Price (ave)	8 \$
Overall Price	588 \$

Material	Length (ft)	Thickness (in)	Width (in)	Qty	Volume (cu.in)	Lbs	Price/BF	Price
Spine	5	0.75	3	135	2.0	\$4.50	\$5.27	
Cleat	1.2	0.75	1	6	63	0.9	\$4.50	\$2.46

# Biophilic Ceiling Installation

## Lighting Schedule & Electrical Specifications



Biophilic prototype (pod)  
Integrated LED lighting



### Electrical Requirements

- Implementation LED string lights
- LED string lights will be 'daisy-chained' to the power limitation of the transformer
- Our working prototype transformer takes in 120V and 1.6amp, and outputs 12V and 3amp
- Employ supplemental lighting to run on a circuit independent of the installation


### Installation:

- We will group them together into clusters and hang each cluster individually in a section from either the ceiling/joists/beams directly.
- Each individual armature will be conveniently detached for ceiling access.

### Specifications:

- # Circuits — 1
- Amps/Circuit — 20
- Efficiency — 0.7
- Total usable amps — 14
- LED strip pull (amps) — 0.22
- # Pods provided for by 1 LED Strip — 1.6
- # LED Strips allowed — 64
- # Pods Provided for (max) — 104
- # Pods in Sculpture (estimate) — 76

### LIGHTING SCHEDULE

TYPE	SOURCE	DESCRIPTION	REMARKS	IMAGE
Pod	LED	16.4ft LED Flexible Light Strip (white)	12V DC, 300 Units SMD 2835 LEDs	
Pod	LED	LED Power Adapter, Transformers	12V DC, 3A Max, 36 Watt Max, UL Listed	
Pod	LED	LED Connector	12V	
Armature	3/8 GALVANIZED PANEL	Mount for 3/8in. threaded rod	3/8IN	
Armature	COUPLING NUTS	Hot Dipped Galvanized A563-A Grade A Steel corrosion resistant fastener	To fit 3/8IN Threaded Rod	
Armature/Pod	WASHER	Zinc-Plated Cut Washer	To fit 3/8IN Threaded Rod	
Armature/Pod	BOLT NUT	A563 Grade A	To fit 3/8IN Threaded Rod	
Armature/Pod	FULL THREADED ROD	Galvanized Threaded Electrical Support Rod	3/8IN	

# Biophilic Ceiling Installation

## Material Considerations

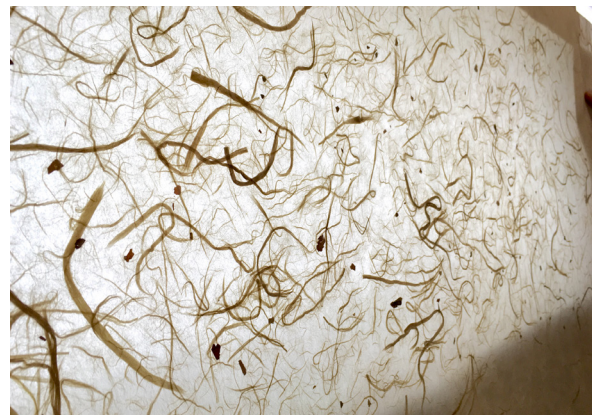
### ORGANOID TECHNOLOGIES

- WILDSPITZE
- organically harvested Alpine hay (slightly fregrant)
- solves acoustic concerns in room 11
- standard flame-retardant phenolic resin (not inflammable B s1 d0 according to EN 13501-1)
- backings: AURO self-adhesive, fleece, transparent
- this material supports an afforestation project in San Rafael de Pocosol in Costa Rica



### HAND-MADE PAPER

- paper making is an active field at RISD
- produceed with invasive species inclusions, tying into the narrative of biophilic design
- handmade paper may include implementation of 1/32" hard-backed substrate (e.g. cellulose acetate) for protection and reinforcement
- volume of material will be low as it pertains to the ceiling coverage (upwards of 80% coverage)



## Materials Specification

### Total Cost Kozo paper

Average Pod depth	8.50 inches
Average pod length	8.00 feet
Ceiling Coverage	90%
Individual Pod coverage	12 sqft
Room size	990 sqft
# pods	74
Surface area of light face/pod	10.7 sqft
Total linear feet of light face	1188 Lft

### Total Cost Organoid Wildspitz

Average Pod depth	8.50 inches
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### Iteration 1

Number of pod units	74.25
Pod Units / cluster	8
Number of clusters	9.3

<b>Material 1</b>	<b>Kozo Paper (2 sided pods)</b>
Cost / sqft	0.45 \$
Surface area of light face/pod	21.3 SqFt
Total Surface Area of light face	1584 SqFt
Total Material Cost	158.4 sqMeter \$

<b>Material 2</b>	<b>cellulose acetate</b>
Cost / sqft	1.6 \$
Total Material Cost	\$

<b>Material 3</b>	<b>Hardwood (Spine + Vertebrae)</b>
Cost / bdf	5.0 \$
Area / unit	2.5 BdFt
Total Area	185.625 BdFt
Total Material Cost	\$

<b>Material 4</b>	<b>LED Strips</b>
Items / section	1
Total	74.25
Cost / item	15 \$
Total Material Cost	\$

<b>Material 5</b>	<b>LED Transformer boxes</b>
Items / section	0.125
Total	9.28125
Cost / item	15 \$
Total Material Cost	\$

Total Weight of unit	lbs
Total weight of section	lbs

### Iteration 2

Number of pod units	74
Pod Units / cluster	8
Number of clusters	9.3

<b>Material 1</b>	<b>Organoid</b>
Cost / sqft	7 \$
Surface area of light face/pod	10.6666667 SqFt
Total Surface Area of light face	792 SqFt
Total Material Cost	79.2 sqMeter \$

<b>Material 2</b>	<b>petg (0.03)</b>
Cost / Lft	0.7 \$
Total Material Cost	\$

<b>Material 3</b>	<b>Hardwood (Spine + Vertebrae)</b>
Cost / bdf	5.0 \$
Area / unit	2.5 BdFt
Total Area	185.625 BdFt
Total Material Cost	\$

<b>Material 4</b>	<b>LED Strips</b>
Items / section	1
Total	74.25
Cost / item	15 \$
Total Material Cost	\$

<b>Material 5</b>	<b>LED Transformer boxes</b>
Items / section	0.125
Total	9.28125
Cost / item	15 \$
Total Material Cost	\$

Total Weight of unit	lbs
Total weight of section	lbs

### Iteration 3

Number of pod units	74
Pod Units / cluster	8
Number of clusters	9.3

<b>Material 1</b>	<b>Kozo Paper (1 sided pods)</b>
Cost / sqft	0.45 \$
Surface area of light face/pod	10.6666667 SqFt
Total Surface Area of light face	792 SqFt
Total Material Cost	79.2 sqMeter \$

<b>Material 2</b>	<b>cellulose acetate</b>
Cost / lf	1.6 \$
Total Material Cost	\$

<b>Material 3</b>	<b>Hardwood (Spine + Vertebrae)</b>
Cost / bdf	5.0 \$
Area / unit	2.5 BdFt
Total Area	185.625 BdFt
Total Material Cost	\$

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