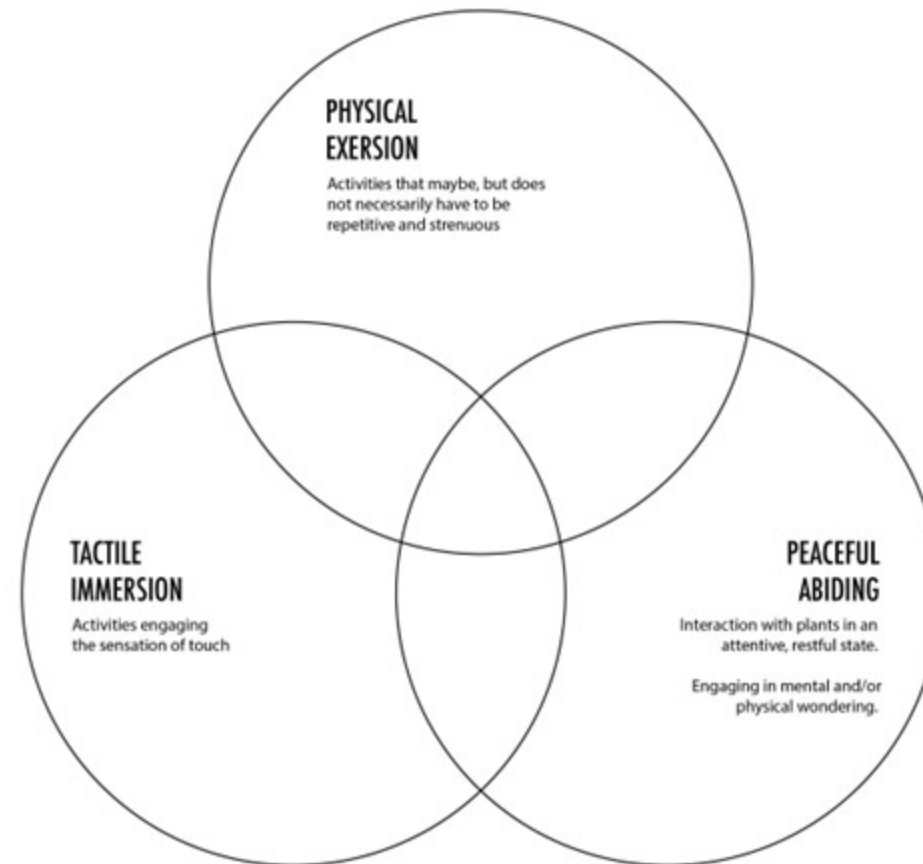


# **PATTERNS :**

**Manifestation of Diverse Biophilic Approach to Design for:**

- 1. People-Plant-Interaction**
- 2. Patterning Air Flow**
- 3. Building an Urban Forest**

# PEOPLE-PLANT INTERACTION



## HEALTH BENEFITS OF PEOPLE-PLANT INTERACTION

**Peaceful Abiding:**  
Sensory engagement with plant environments,  
making plant based foods & products

Immersion in nature provides a gentle distraction to the mind, thereby restoring diminished attention from meeting everyday demands

Phytoncides are antimicrobial volatile organic compounds emitted by plants for defence against decay or herbivores. Ingested through inhalation, phytoncides promotes increase in human natural killer cell activity, which promotes the Release of anti-cancer proteins and also helps reduce stress.

# HEALTH BENEFITS OF PEOPLE-PLANT INTERACTION

**Tactile Stimulation:**  
Examining plant material, Table top gardening

O<sub>2</sub> PHYTO

O<sub>2</sub> PHYTONCIDES

CO<sub>2</sub>

Contact with plant material results in significant reduction of oxygenated haemoglobin in the brain, triggering an unconscious calming effect

Mycobacterium vaccae enters the body via the airways or wounds. In the gut, the good bacterium helps regulate the neurotransmitters that affect an individual's emotional state

Contact soil bacterium mycobacterium vaccae triggers the release of serotonin, a natural antidepressant that strengthens the immunity.



# HEALTH BENEFITS OF PEOPLE-PLANT INTERACTION

**Physical Exertion:**  
Digging, Tilling, Planting, Weeding, Harvesting

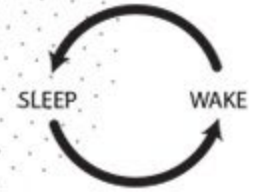
$O_2$ , PHYTONCIDES

$O_2$ , PHYTONCIDES

Physical activity releases endorphins that aids in relieving stress & pain

SUNLIGHT

Stimulates the production of serotonin & melatonin enabling the regulation of The circadian rhythms in the human body



The sun activates the production of nitric oxide on the skin surface. When released into the bloodstream, nitric oxide helps to lower blood pressure & improve heart health

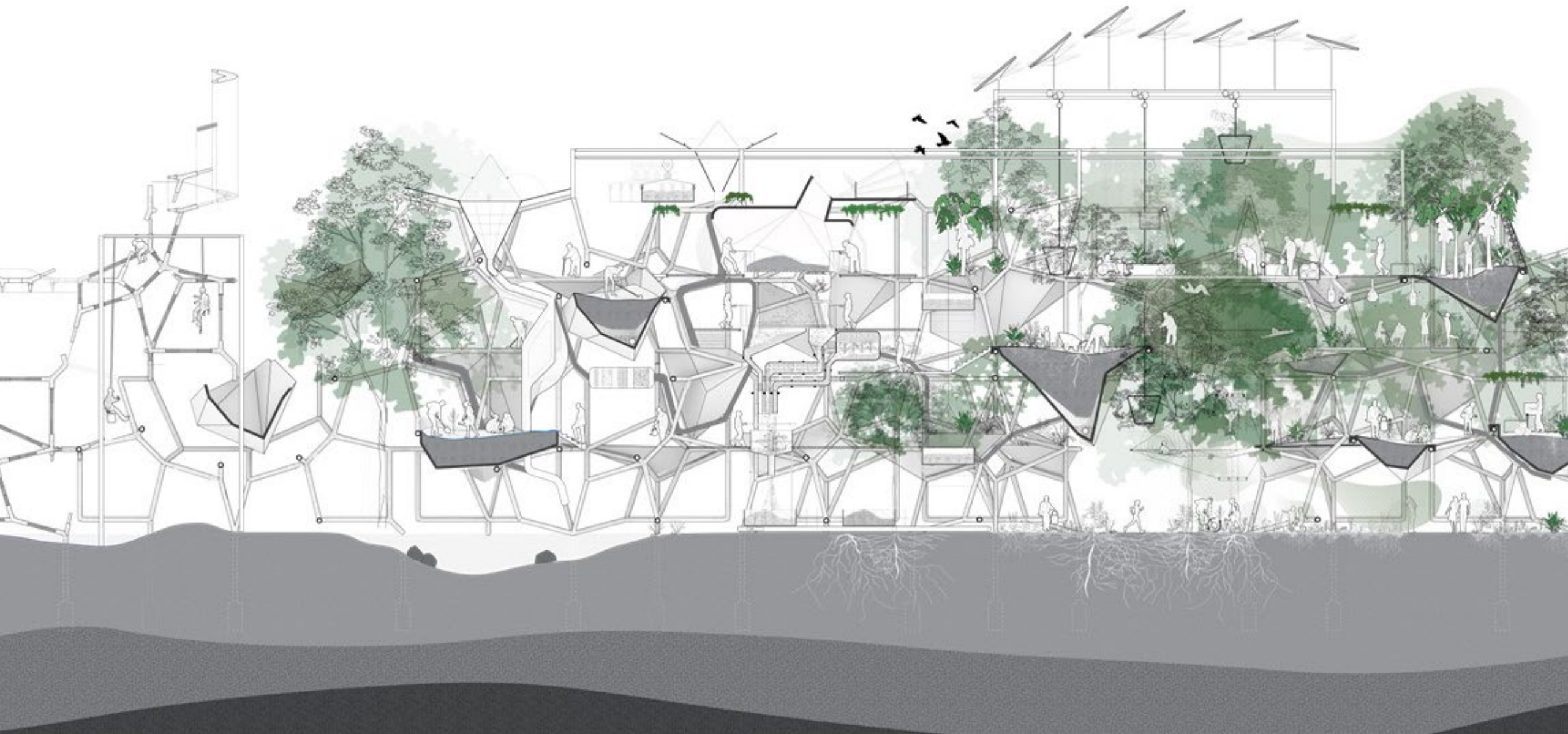
Gardening involves a slew of weightbearing motions: digging holes, pulling weeds, pushing wheelbarrows, etc. These mechanical stresses induces osteoblast activity which help improves bone density

Repetitive ritualistic behaviour is a built-in hardwired system to induce calm

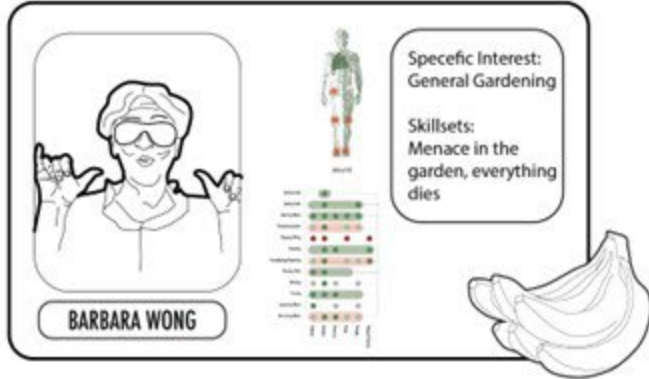








MEETING THE TEAM

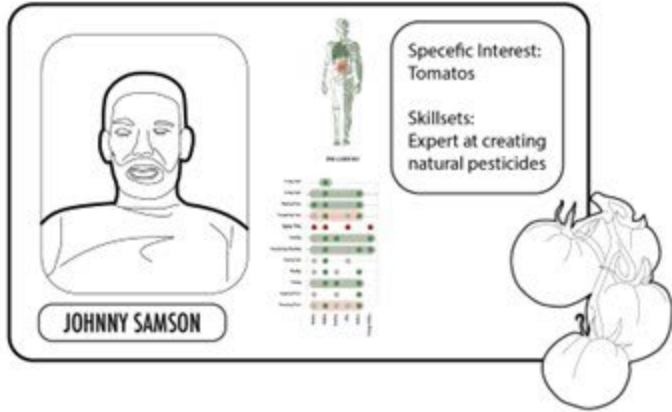


**BARBARA WONG**

Specific Interest: General Gardening

Skillsets: Menace in the garden, everything dies

*(Includes a small human figure with skill indicators and a drawing of a banana)*

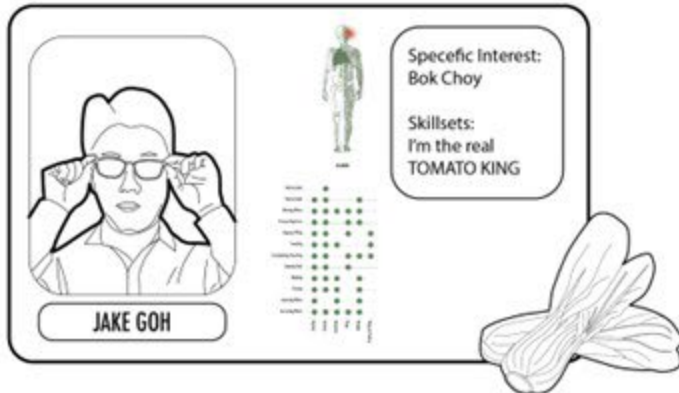


**JOHNNY SAMSON**

Specific Interest: Tomatos

Skillsets: Expert at creating natural pesticides

*(Includes a small human figure with skill indicators and a drawing of tomatoes)*



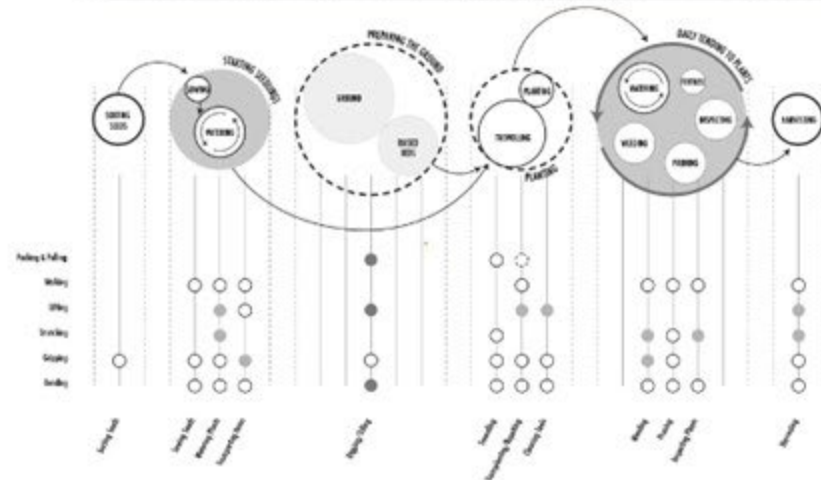
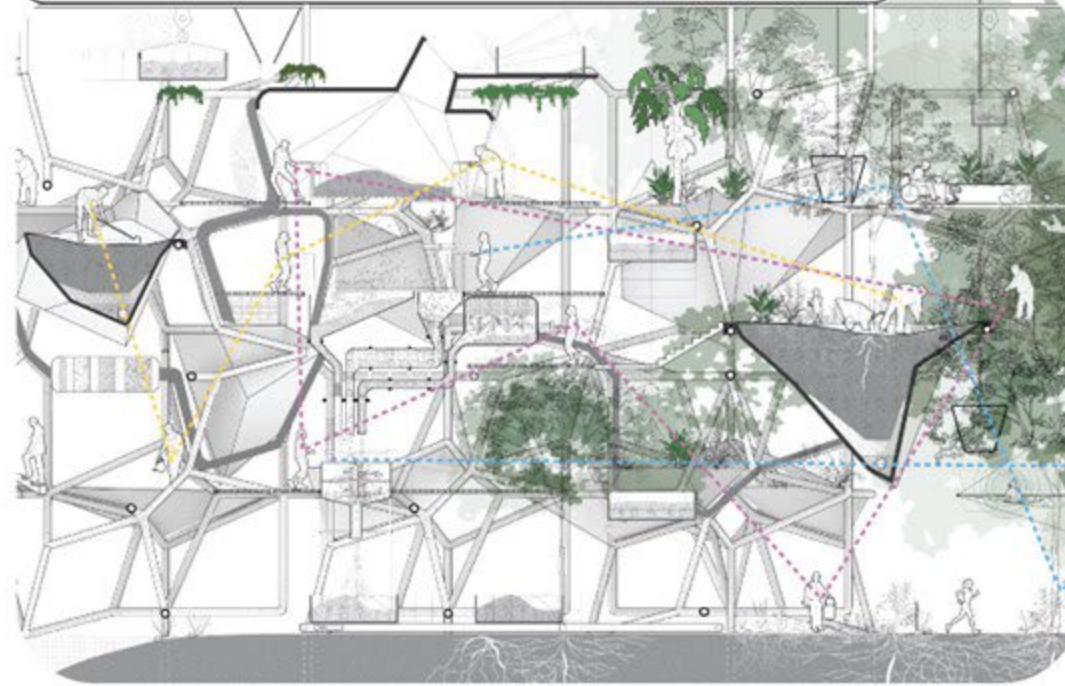
**JAKE GOH**

Specific Interest: Bok Choy

Skillsets: I'm the real TOMATO KING

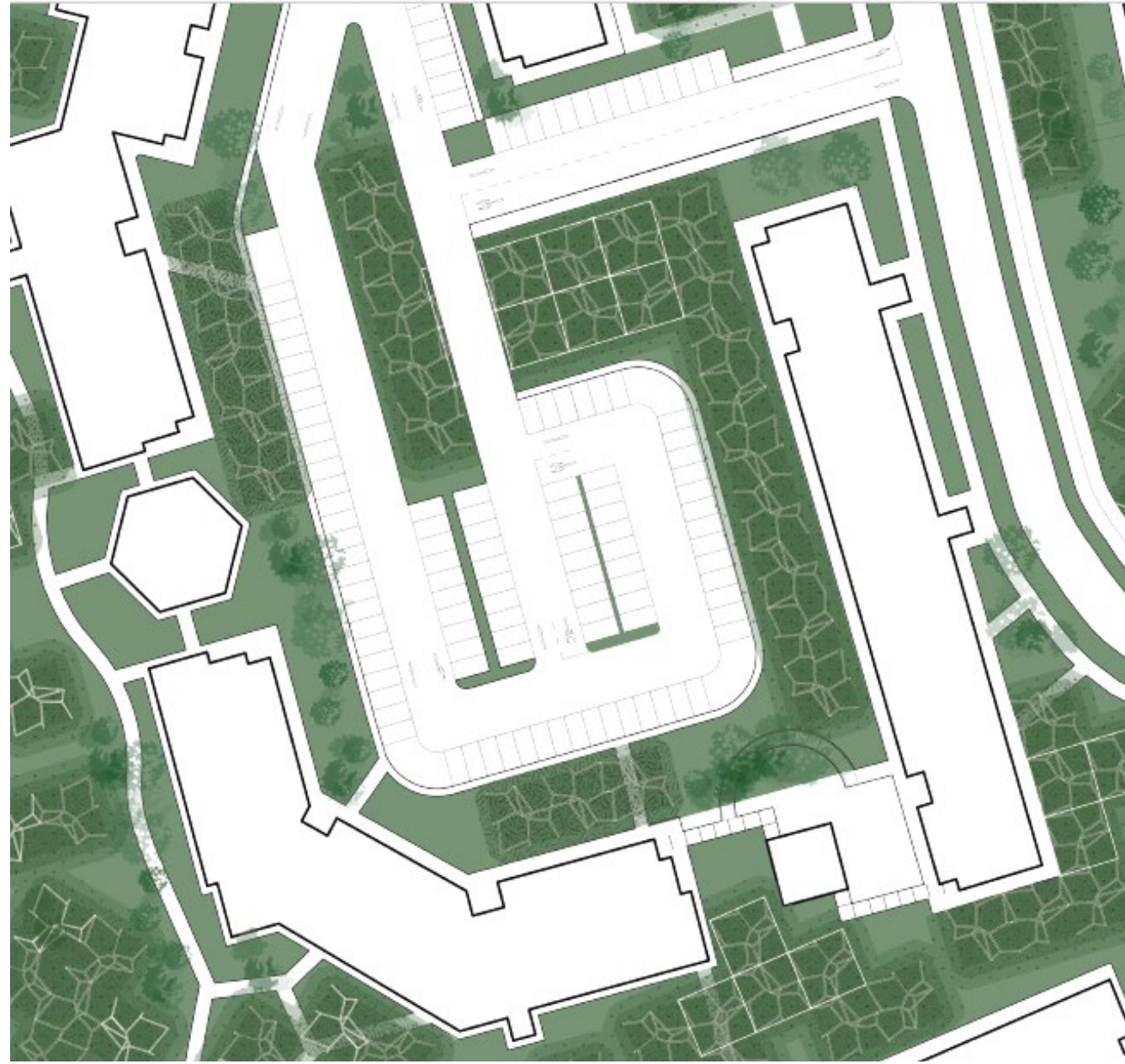
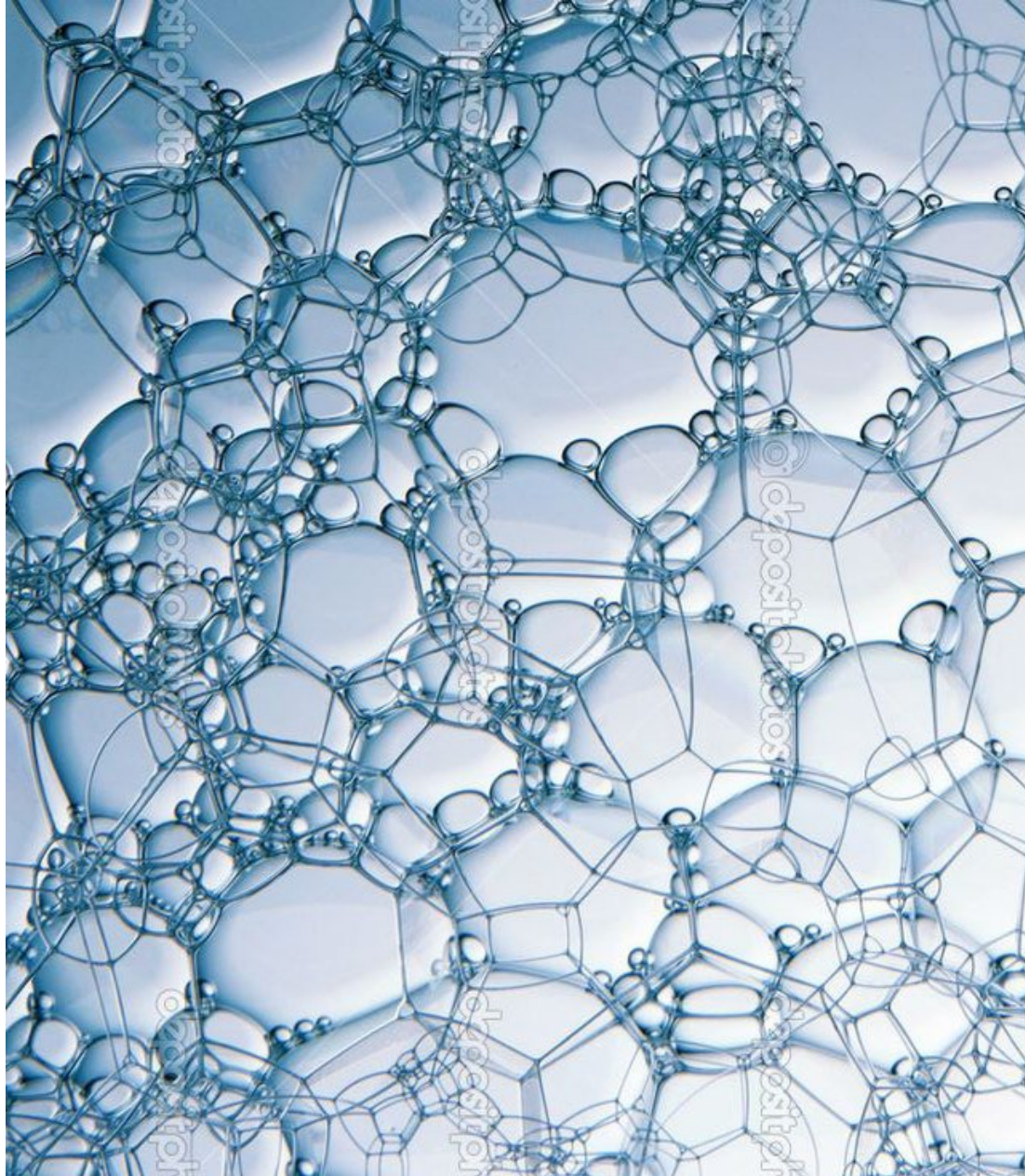
*(Includes a small human figure with skill indicators and a drawing of bok choy)*

The collaboration in this space is also keenly marked by complimentary skillsets, interests and abilities. Individuals take on specific roles in the daily optimization of conditions for plant growth

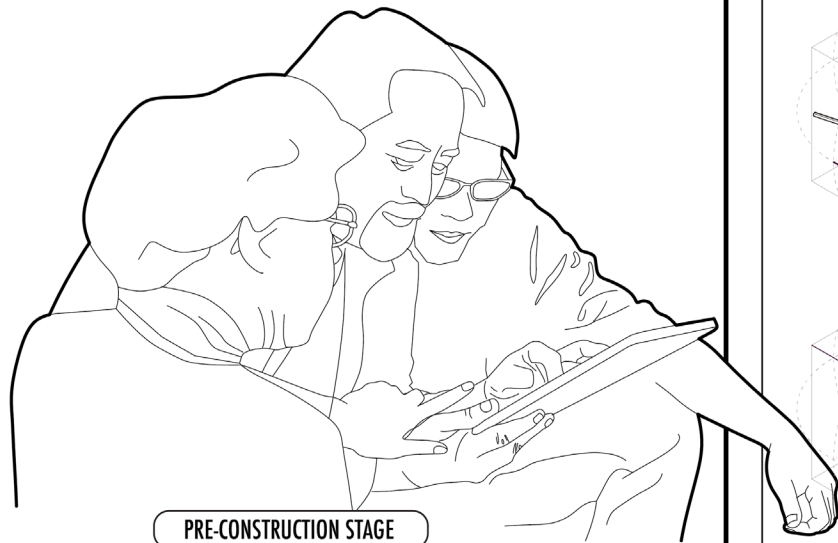


The profile of the team will always be made such that it is always sufficient for the team to be able to create ideal conditions for plant growth





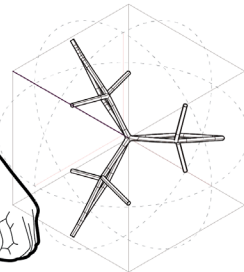
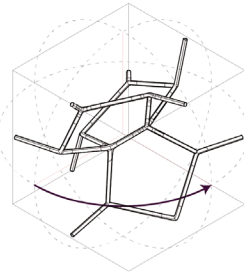
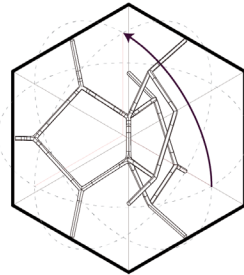




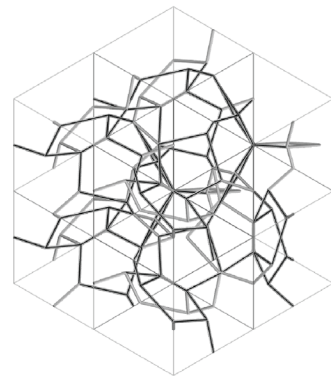
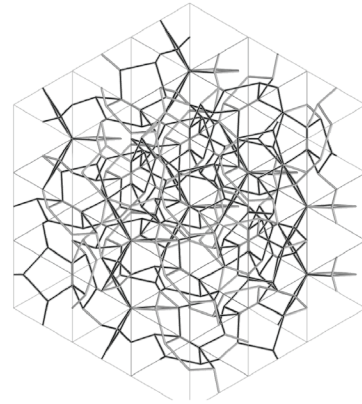
PRE-CONSTRUCTION STAGE

Interested parties come together and pick a location for the structural framework to be erected based on proximity to their home and environmental conditions corresponding to their interests.

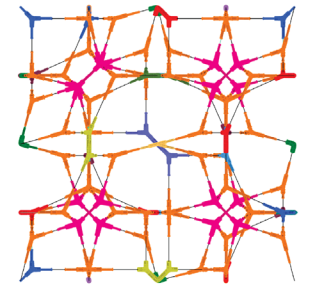
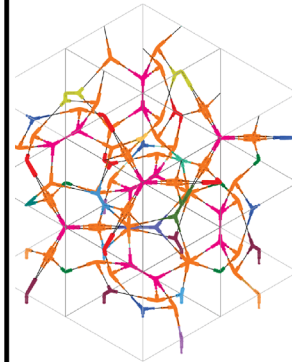
ORIENTATE AND DROP



AGGLOMERATION OF MODULES



SELECTED GEOMETRY



BREAKDOWN OF JOINTS



# PATTERNED FLOW

Panel Discussion:  
Fri, 13 Oct, 6pm - 8pm  
White Room, The URA Centre

Organised by  


Supported by  


Venue by  


Partner  


AUGMENTING AIR MOVEMENT  
IN URBAN ENVIRONMENTS

## BEYOND PERMEABILITY: THE FUTURE OF AIR FLOW DESIGN

Moderators: Kenneth Tracy and Christine Yogiawan (SUTD)

Panellists:  
Szue Hann Tan (Surbana Jurong)  
J. Alstan Jakubiec (SUTD)  
Dion Anadityo (ARUP Singapore)  
Mimi Foreman (ARUP Singapore)  
Vignesh Srinivas Kaushik (DPA)

"What if it was within the architect's power to design the transient environment? To design the way a space feels rather than just how it looks?" Good-bye, Willis Carrier (Michelle Addington, 1997)

This panel discussion will consider how new methods of design could change the look and feel of Singapore's naturally ventilated spaces. BCA's Greenmark guidelines evidence the current interest in air flow design for urban environments in a chapter devoted entirely to natural ventilation; this section highlights a progressive stance towards passive cooling design, stressing the need for simulation and other advanced methods to inform the building design process. Do these subtle, sophisticated tools merely confirm past, rule-of-thumb guidelines for creating permeability, or is there something new? This dialogue aims to provoke speculation and reflection on how the use of sophisticated design tools and new materials might impact the form and experience of the urban environment.

Free by registration on [www.eventbrite.sg/e/beyond-permeability-the-future-of-air-flow-design-panel-discussion-tickets-38319371271](http://www.eventbrite.sg/e/beyond-permeability-the-future-of-air-flow-design-panel-discussion-tickets-38319371271)

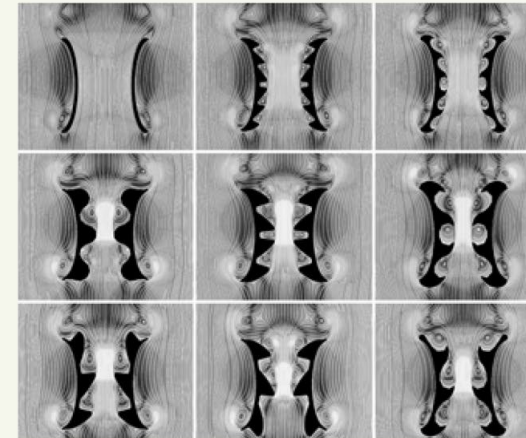
DYNAMIC ASSEMBLIES LAB // SUTD // C. YOGIAMAN

# PATTERNED FLOW

6 - 31  
Oct 2017  
9am - 5pm, Mon - Sat

The URA Centre, 3F City  
Canvas, 45 Maxwell Road,  
S 069118

## AUGMENTING AIR MOVEMENT IN URBAN ENVIRONMENTS



Patterned Flow exhibition highlights current efforts and new tools being added to the discussion of how we shape sustainable cities. Comprised of simulation imagery and experimental models the exhibition peeks into ongoing research utilising physical and digital testing to help design novel building forms and patterns which intensify and/or pattern airflow. A case study of an exterior canopy is used in the project to propose formal and surface texture variations that change local and ambient patterns of air flow. These studies build on physiological experiments which indicate that particular patterns and an increase in air movement generally increase how comfortable people feel in warm environments.

Opening on 6 Oct, 5pm - 7pm

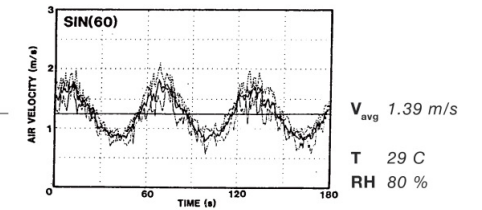
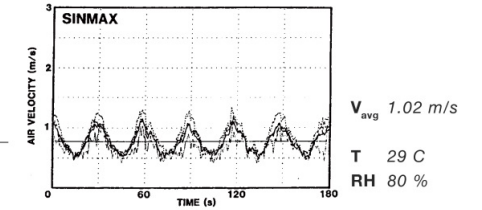
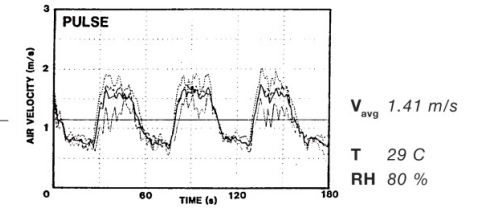
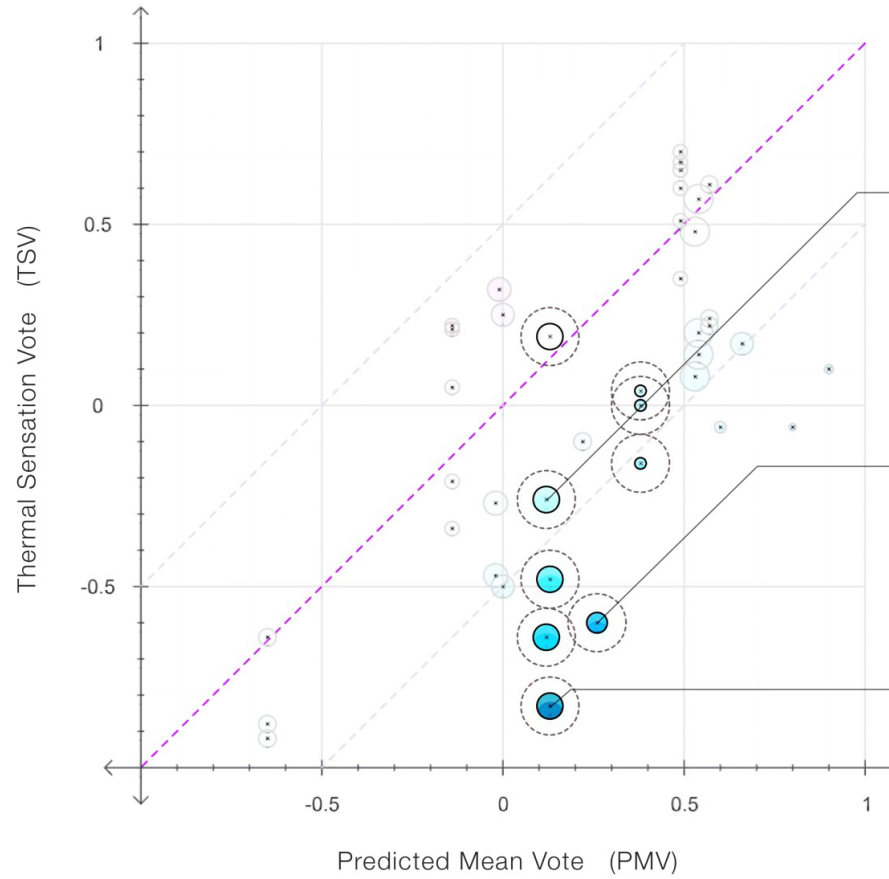
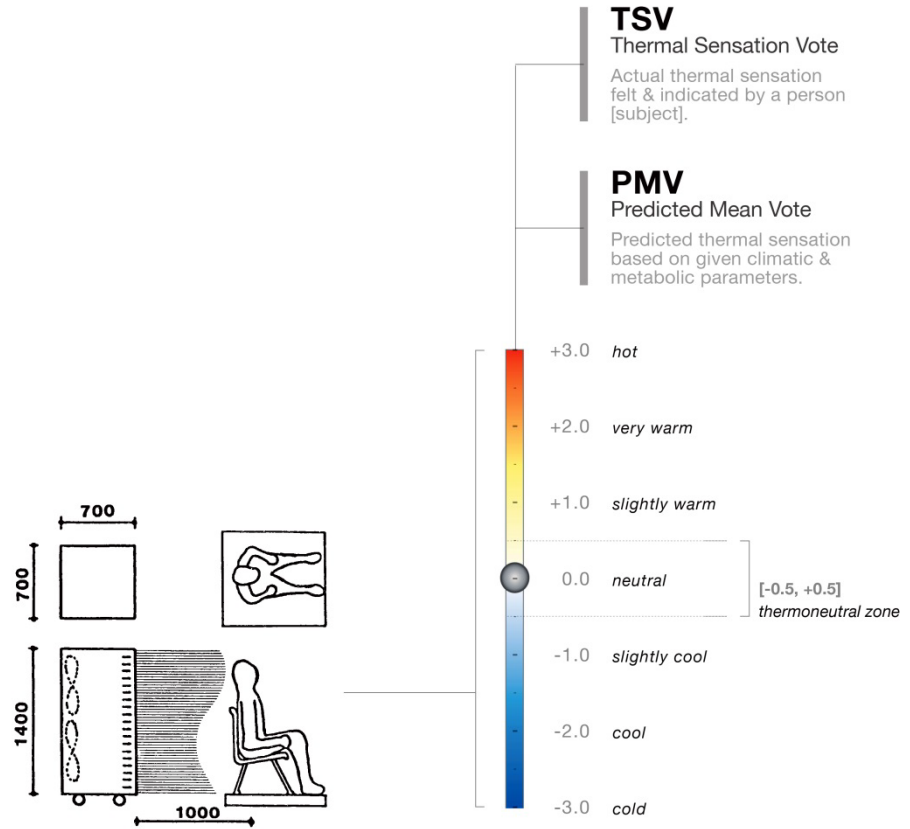
The research collaboration is funded by the SUTD-MIT International Design Centre.  
Collaborators:  
Pablo Valdivia y Alvarado, Assistant Professor Engineering Product Development Pillar  
Kenneth Tracy, Assistant Professor Architecture and Sustainable Design Pillar  
Christine Yogiawan, Assistant Professor Architecture and Sustainable Design Pillar  
Sunil Manohar Dash, IDC researcher in Computational Fluid Mechanics  
Pamela Dychengbeng Chua, IDC researcher in Architecture and Urban Environment

# PATTERNED FLOW

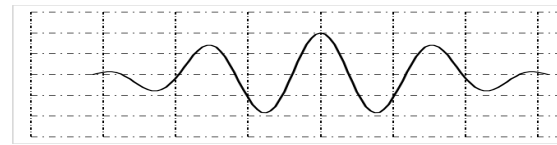
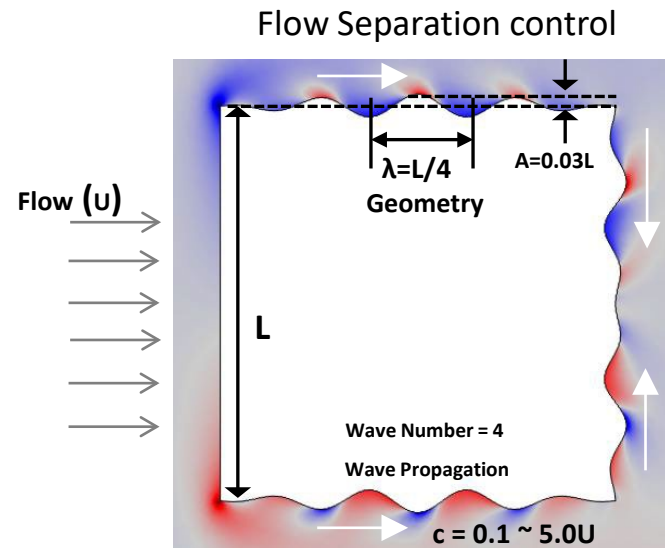
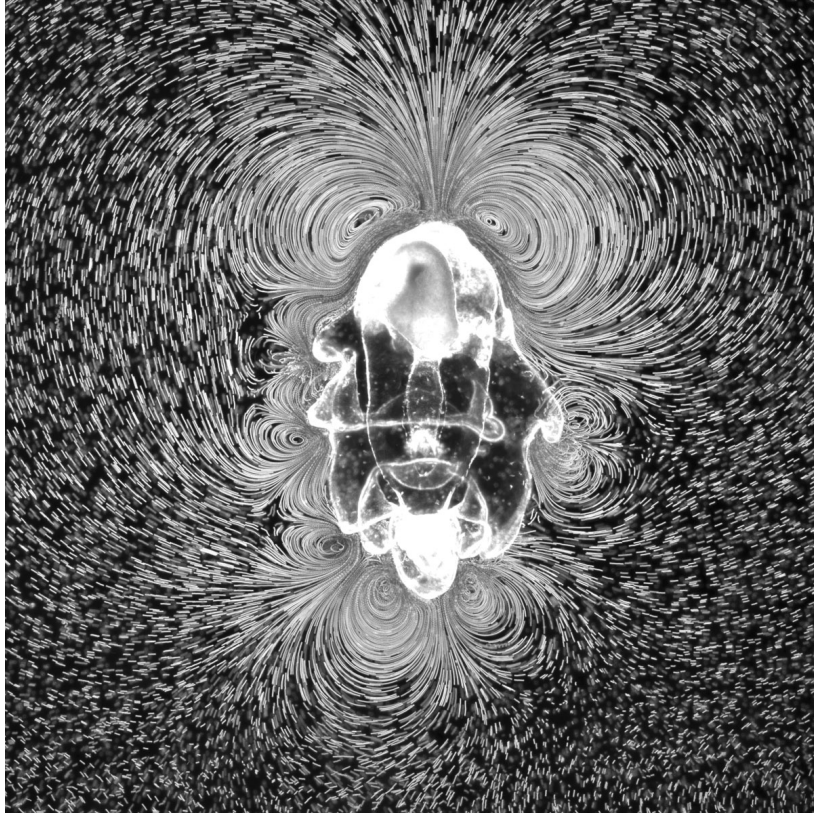
6 - 31  
Oct 2017  
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The URA Centre, 3F City  
Canvas, 45 Maxwell Road,  
S 069118

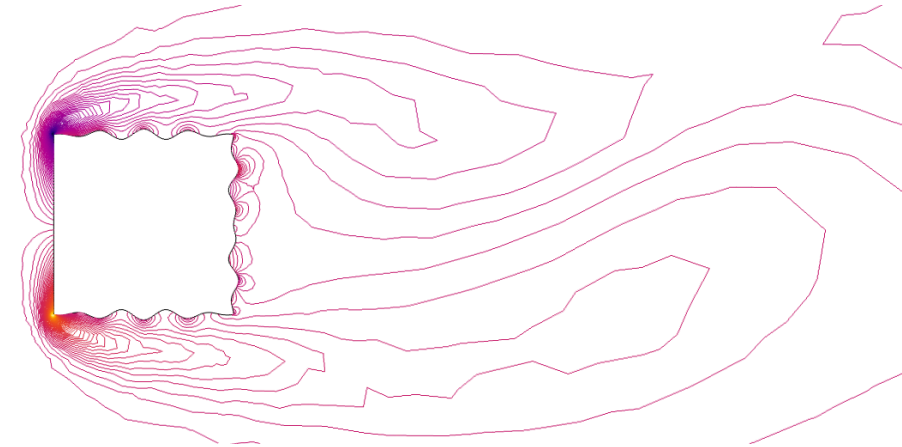




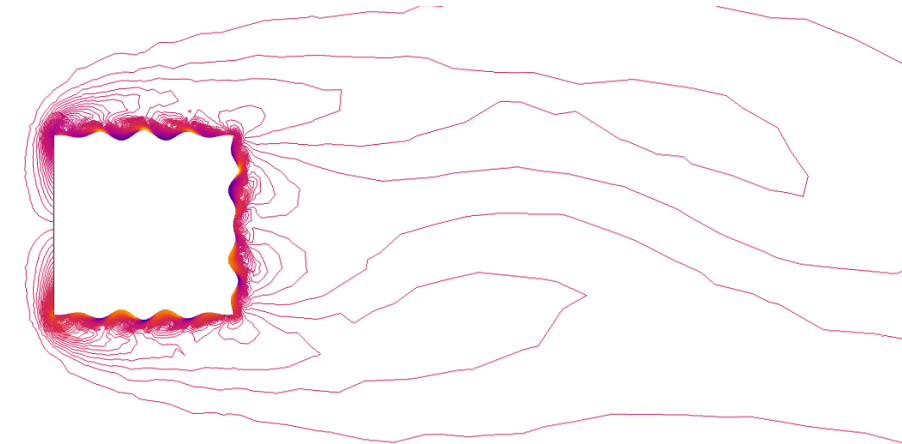




Typical Waveform

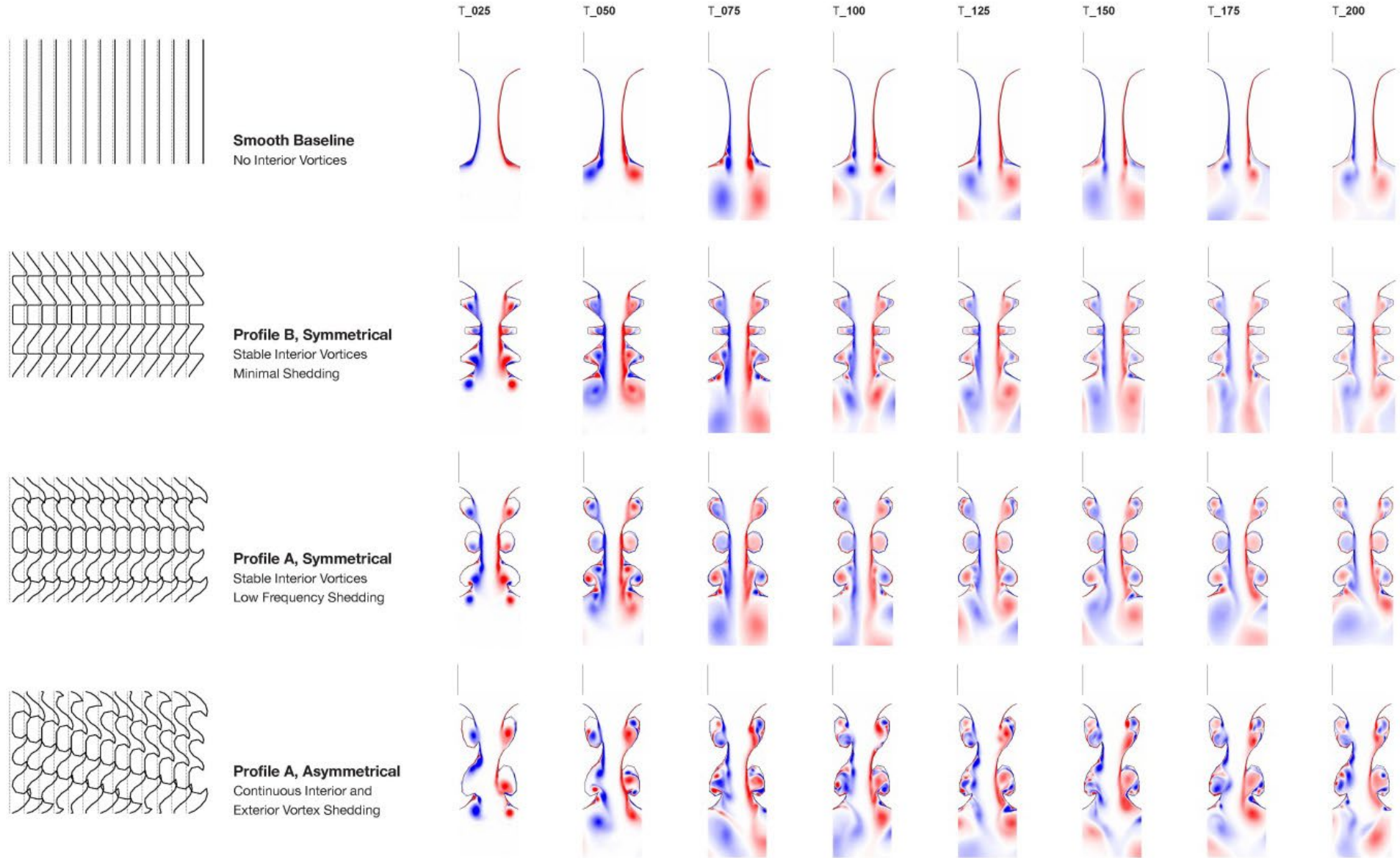


Vorticity field for  $c/U=0.1$

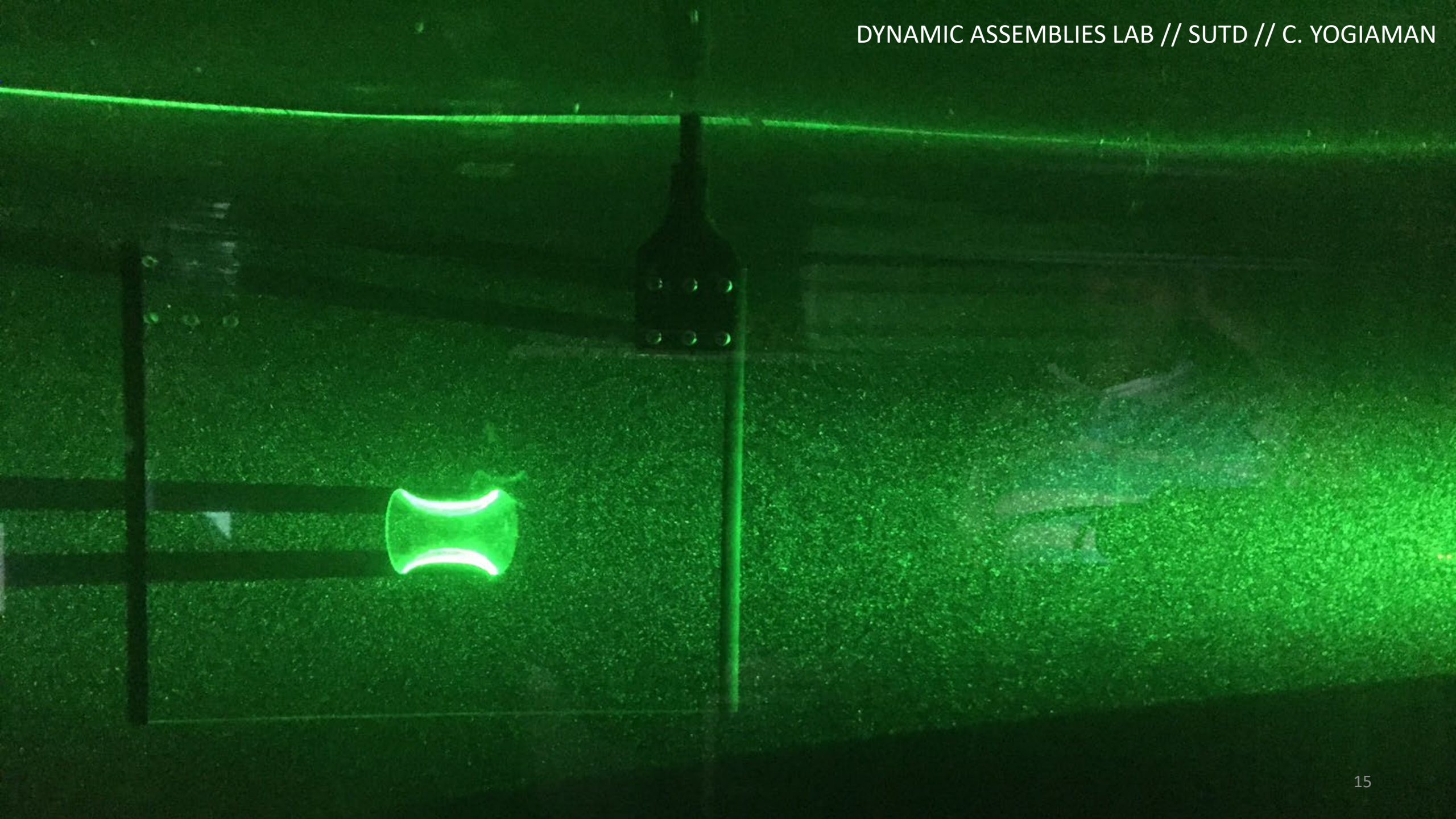


Vorticity field  $c/U=3.0$

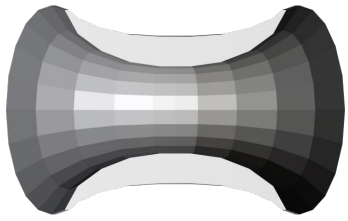
Surface texture exploration





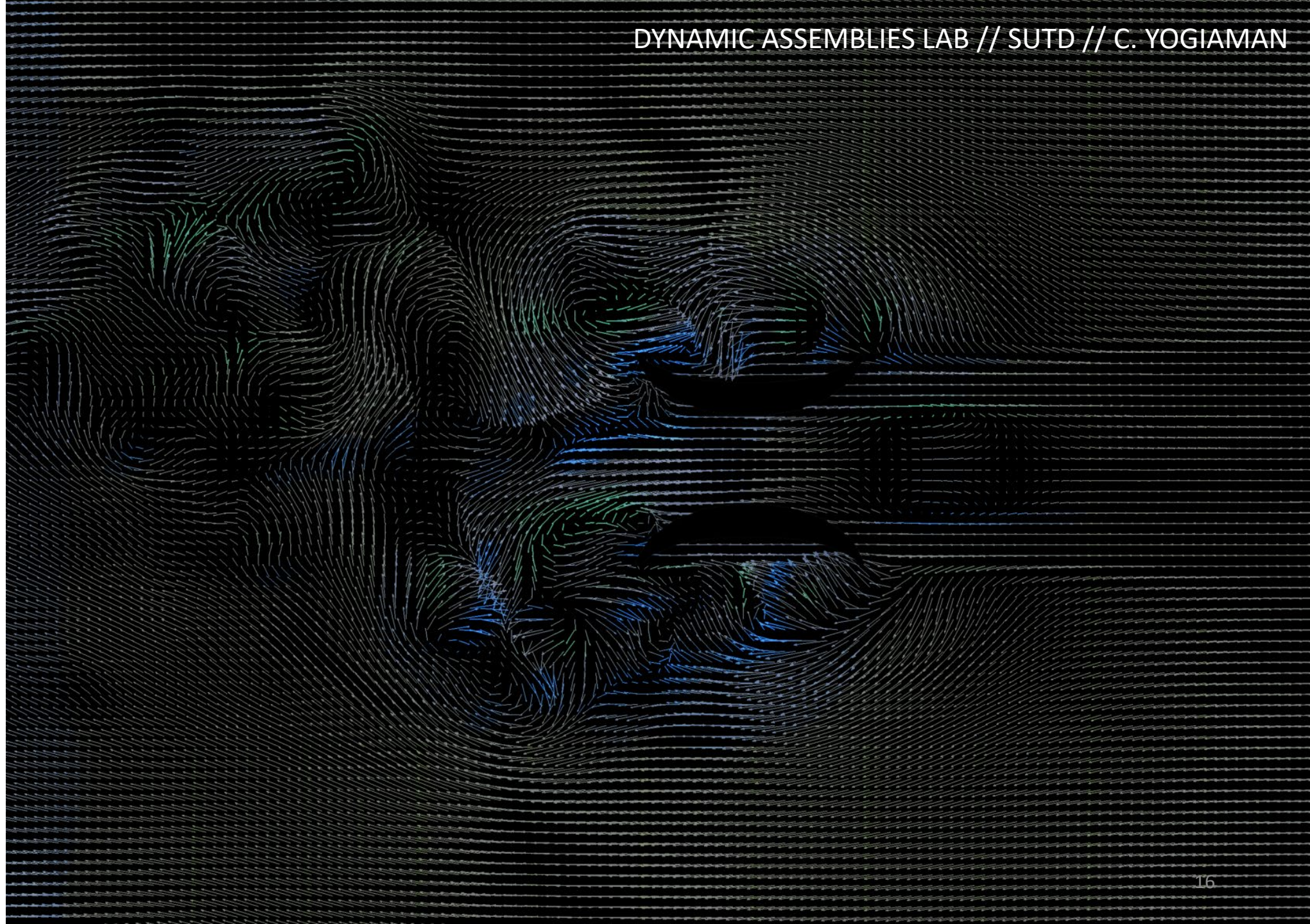




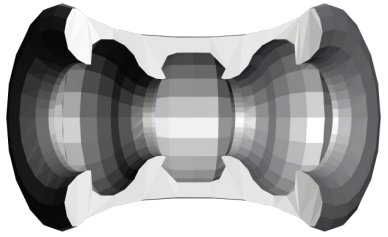


Smooth\_Baseline

**No interior Vortex**

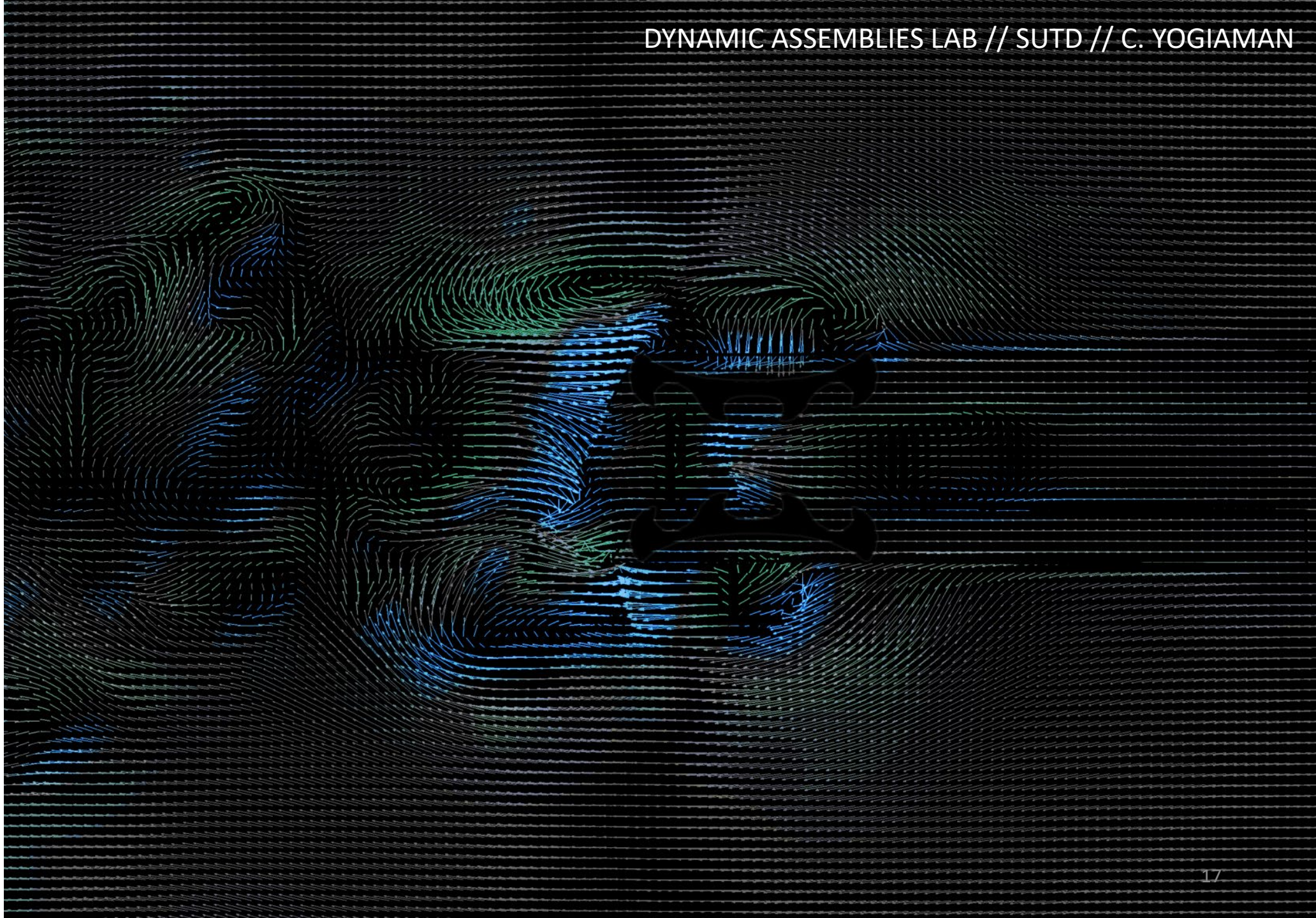




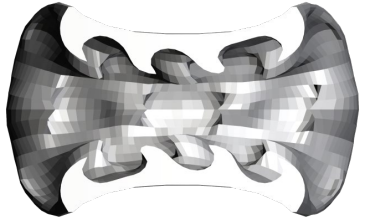


Profile A\_ Size L/4\_Linear  
Symmetrical Placement\_Ridges

**Three symmetric interior  
vortices observed**

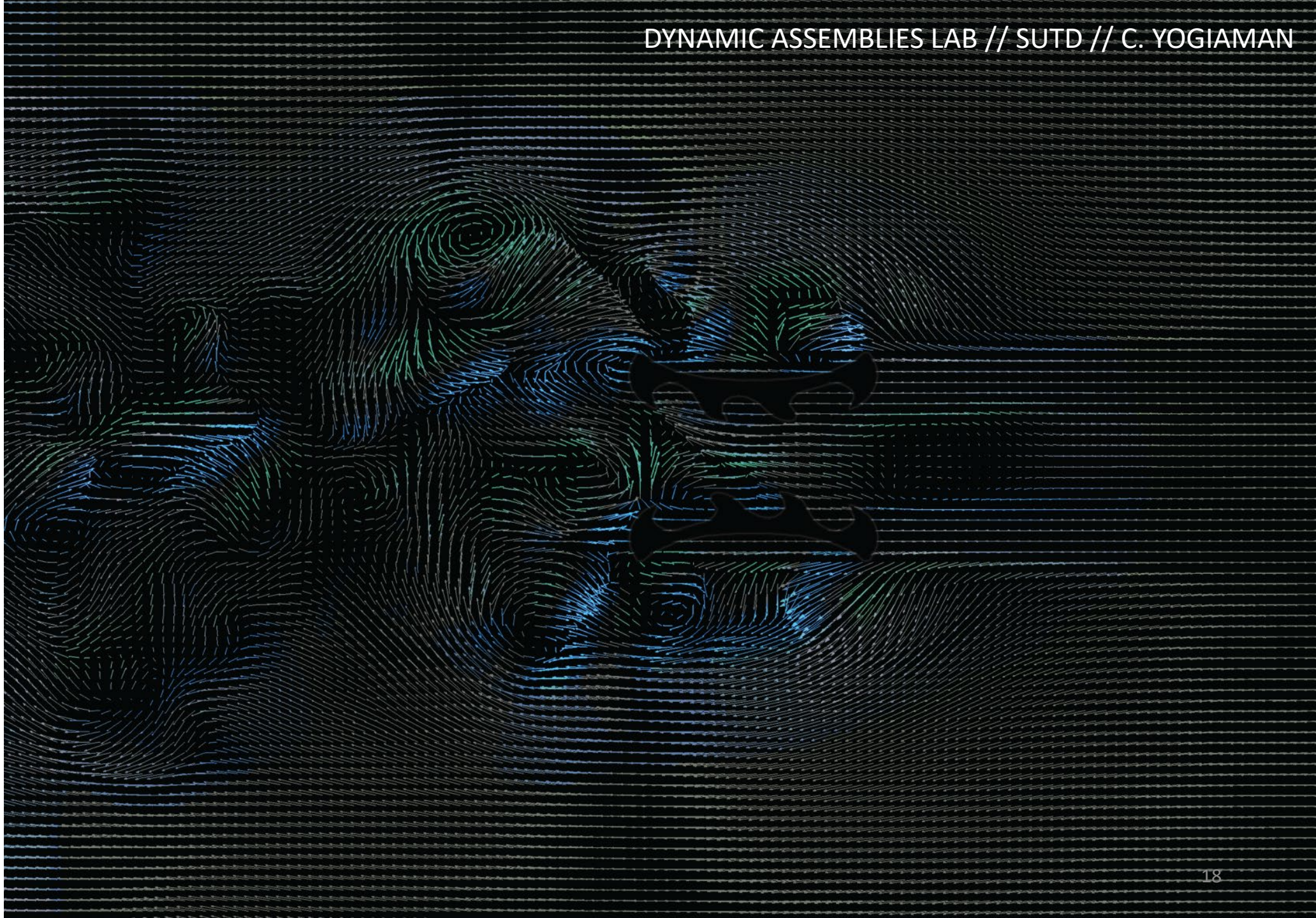




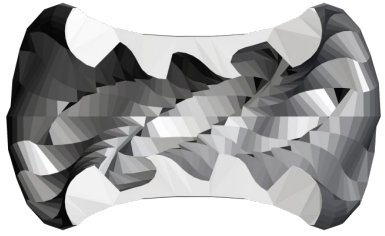


Profile A\_ Size L/4\_ Staggered  
Asymmetrical Placement\_ Bumps

**Multiple small interior  
vortex shedding observed**

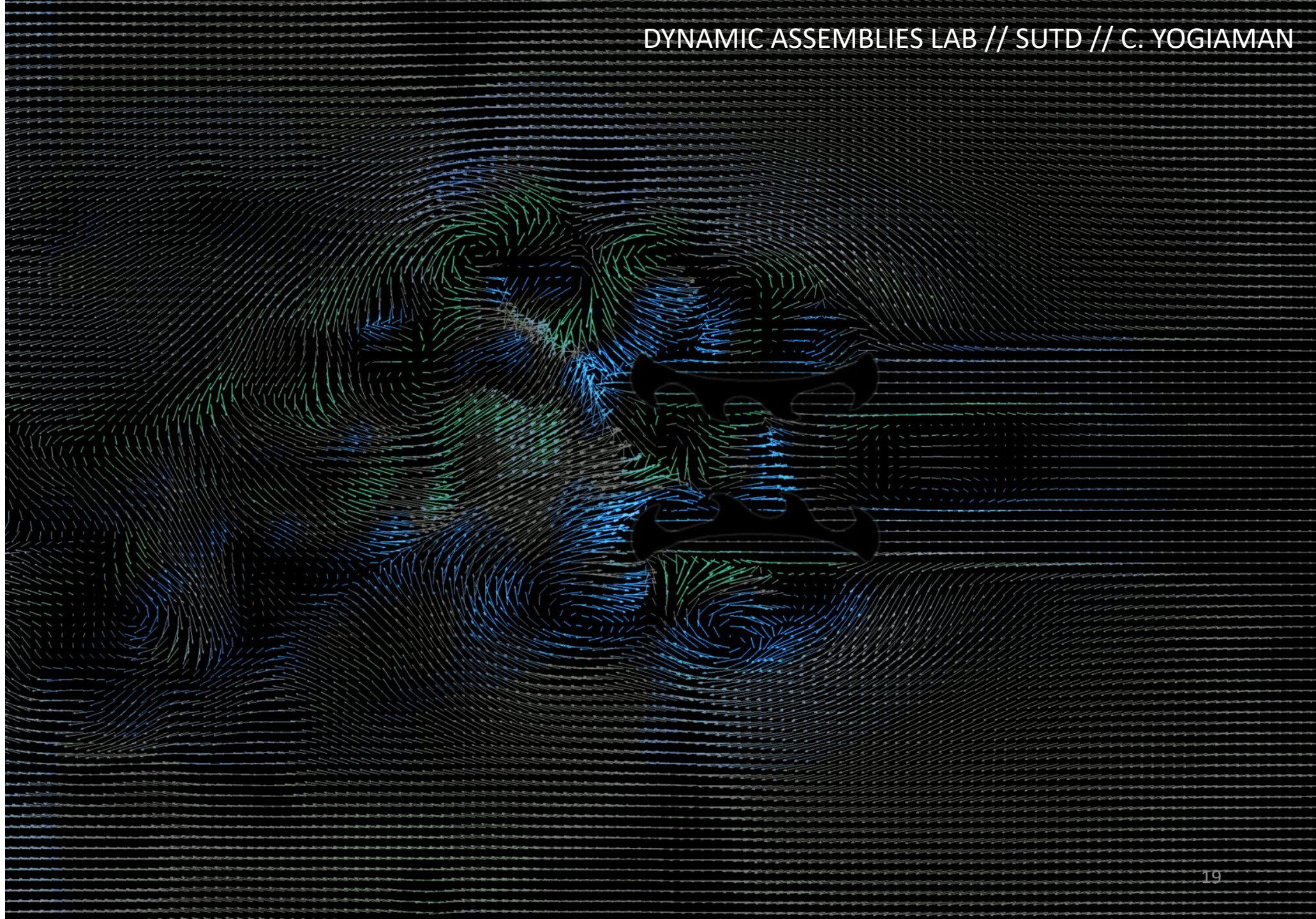




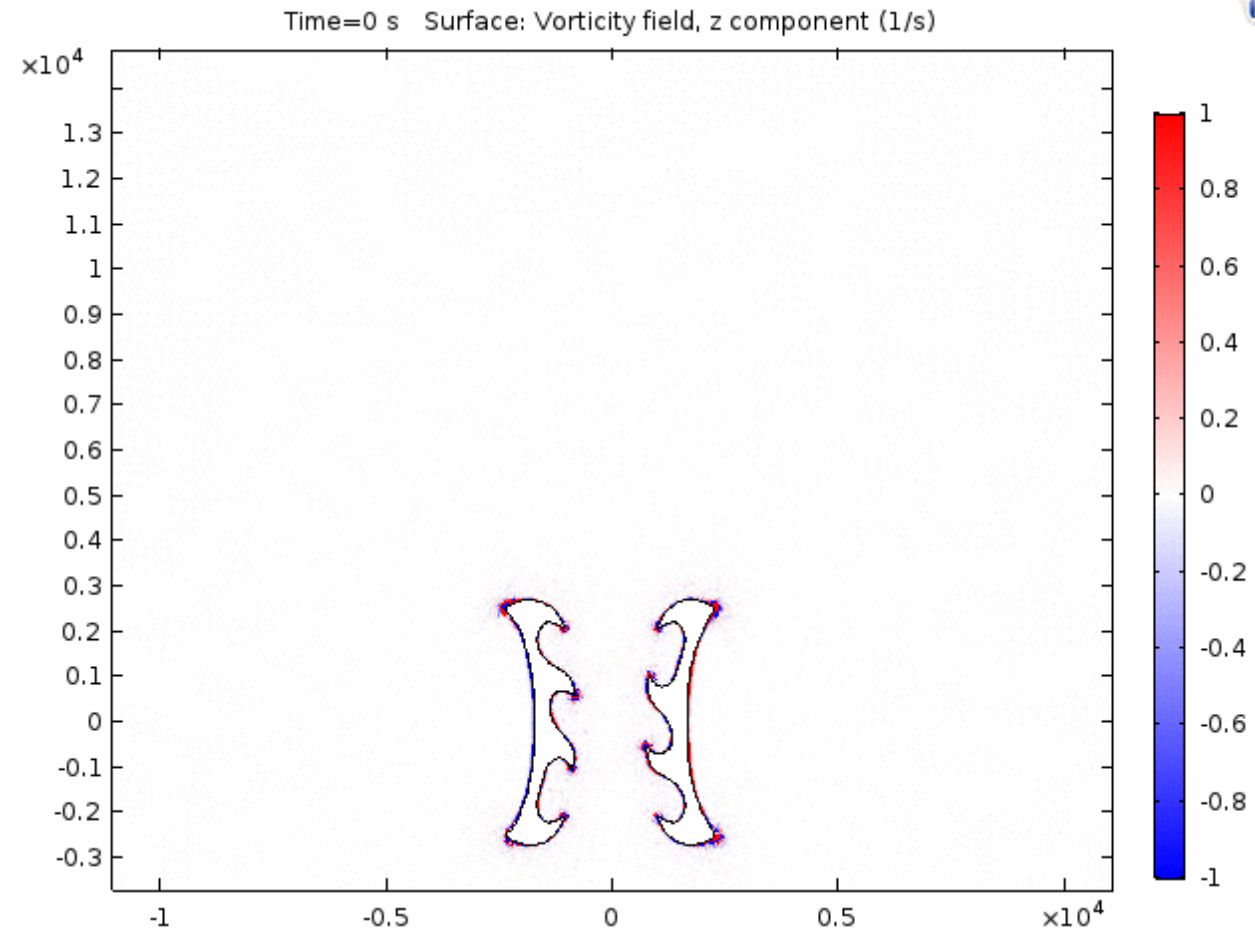
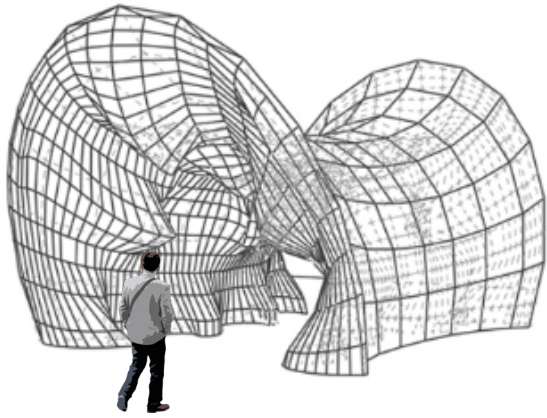


Profile A\_ Size L/4\_Linear  
Asymmetrical Placement\_Ridges

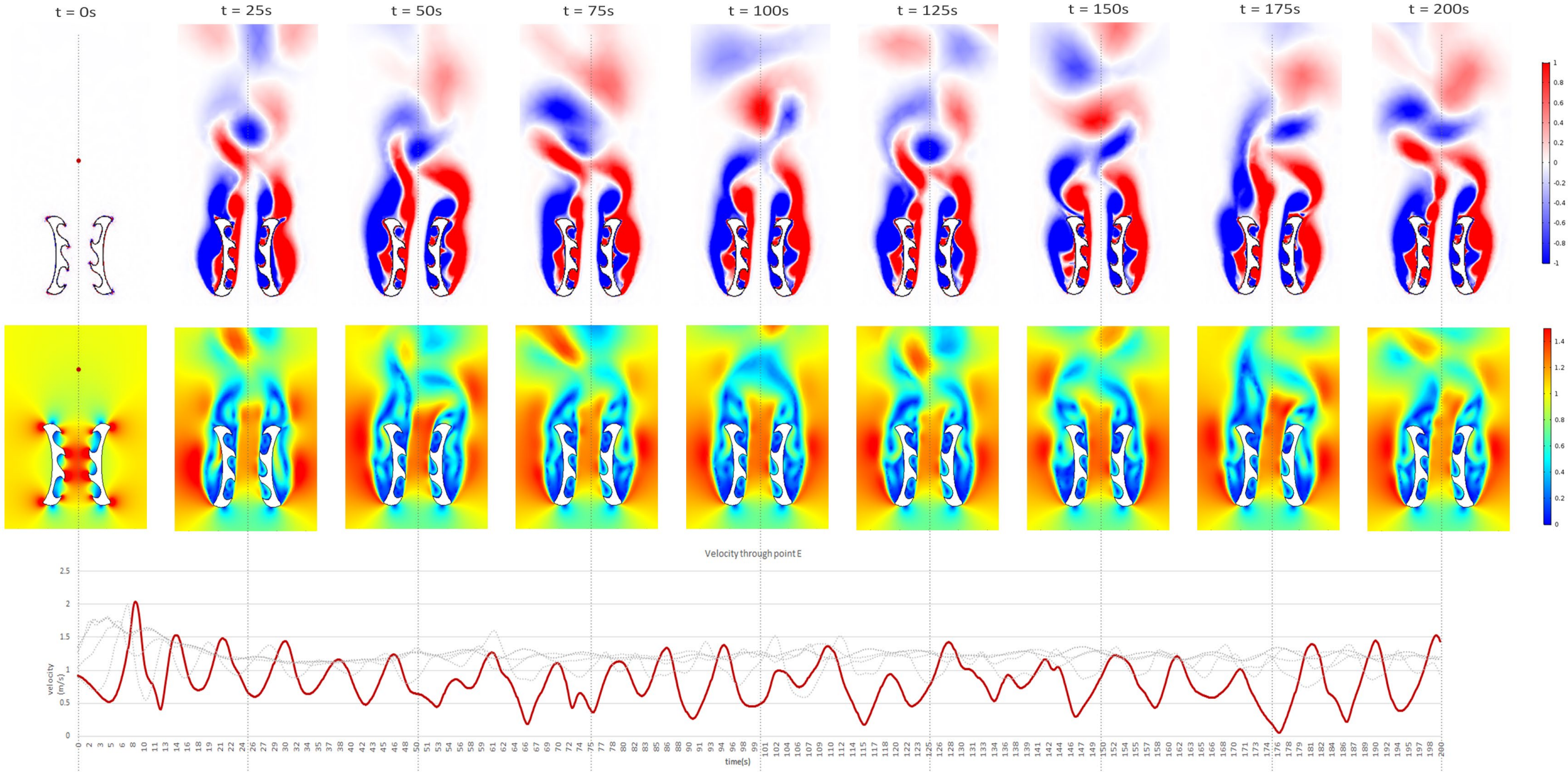
**Asymmetric interior vortex  
shedding observed**







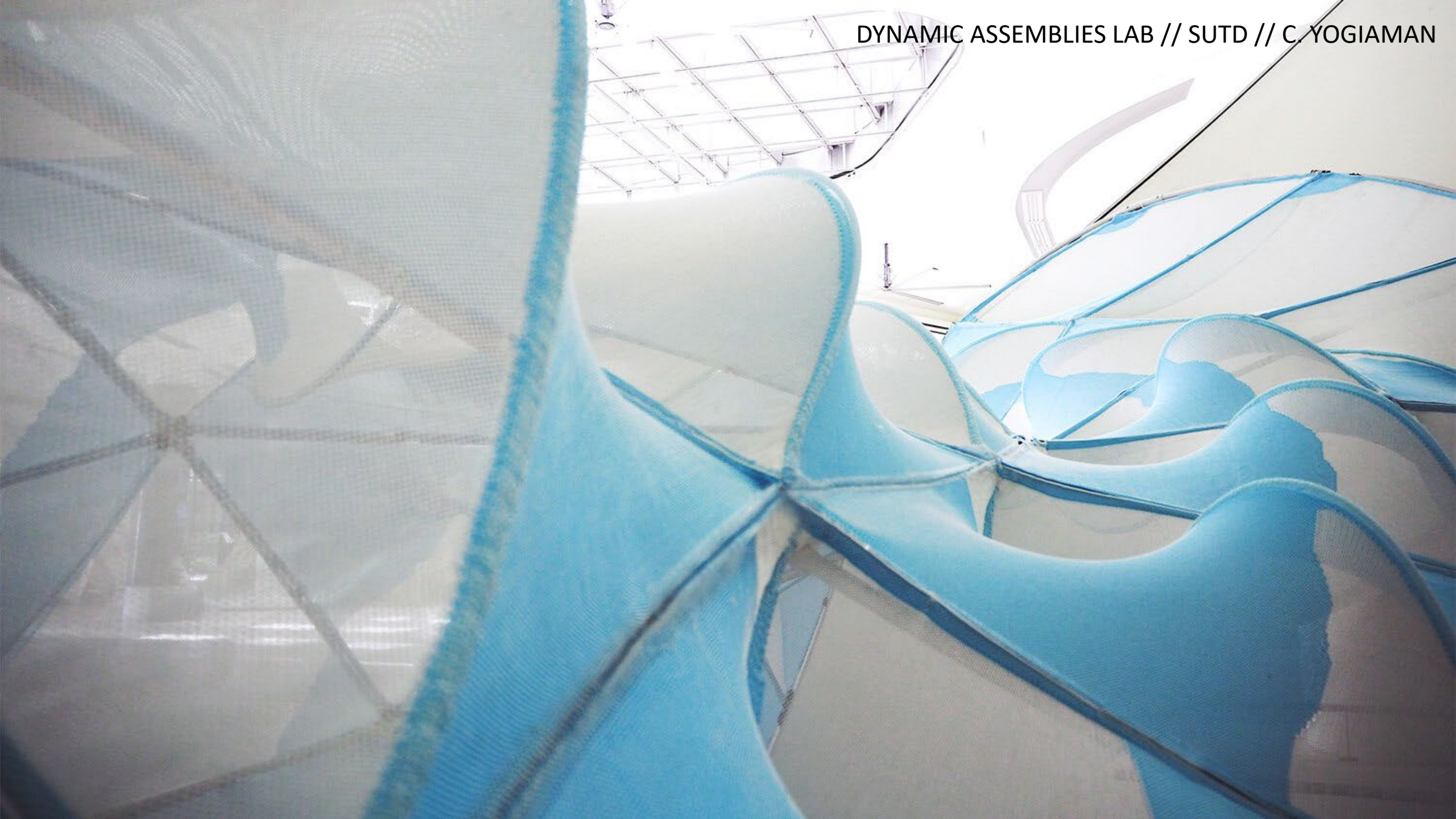














DOVER FOREST

ALEXANDRA WOODLAND

BUKIT MERAH SCRUBLAND

MAJU FOREST

SUNGEI PANG SUA WOODLAND

KRANJI SCRUBLAND

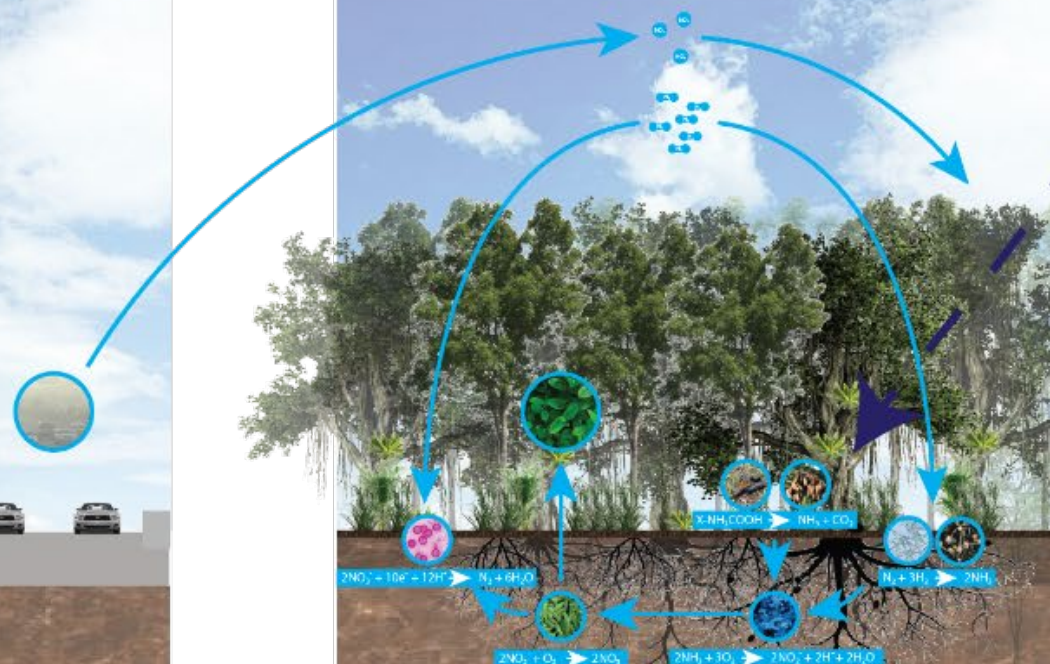
CLEMENTI FOREST

SPOTTISWOODE WOODLAND

.....



## ECOLOGICAL SERVICES THE NITROGEN CYCLE



**CITY**

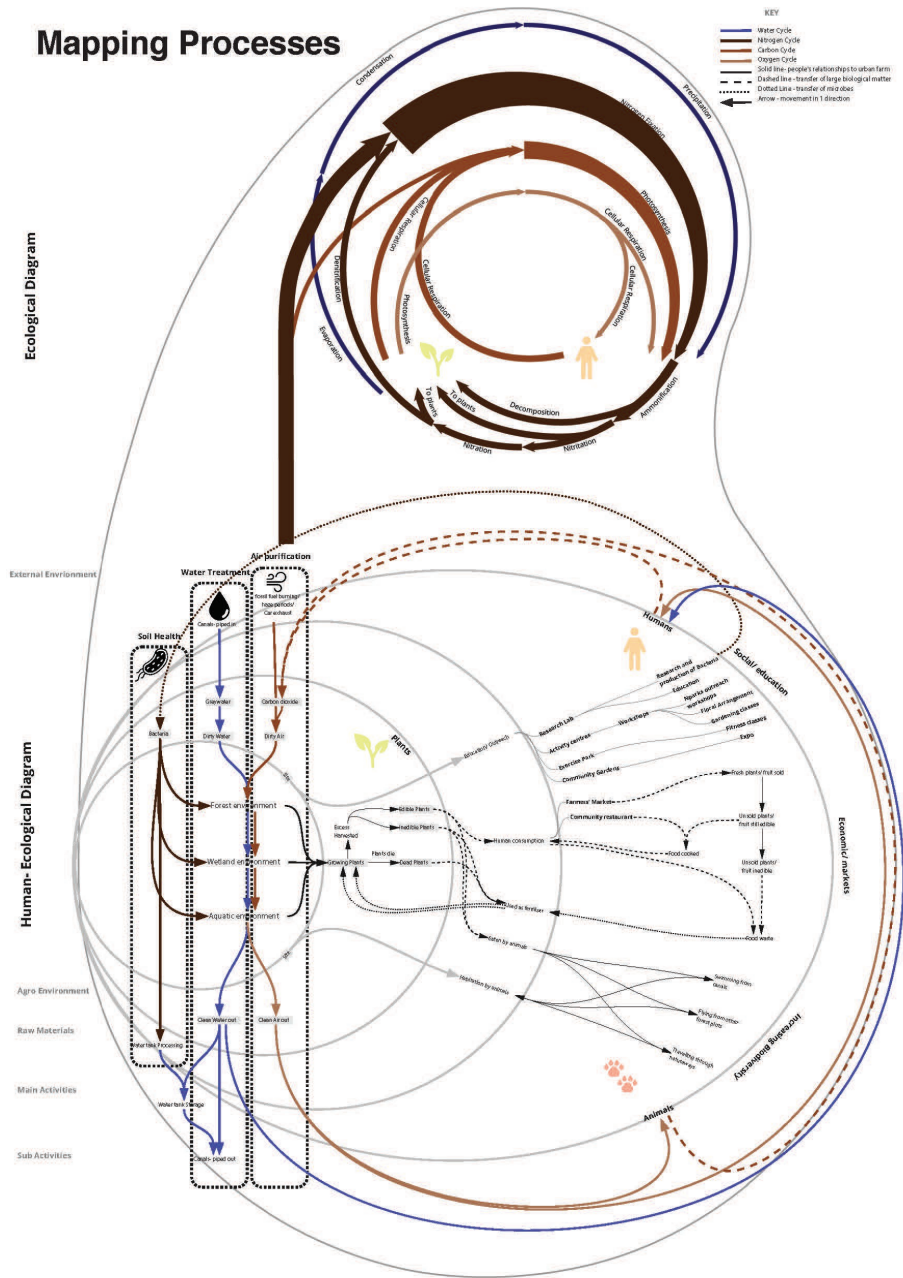
**FOREST**

**WATER BODIES**



**HUMAN ECOLOGICAL DIAGRAM**

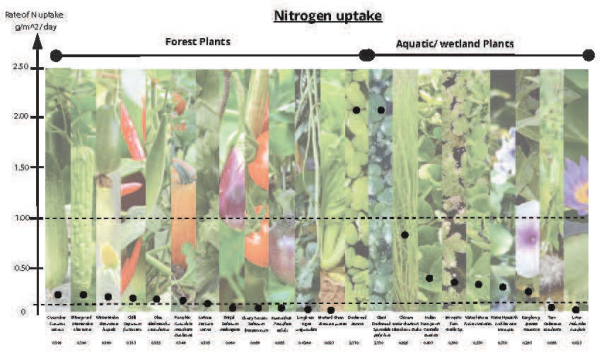
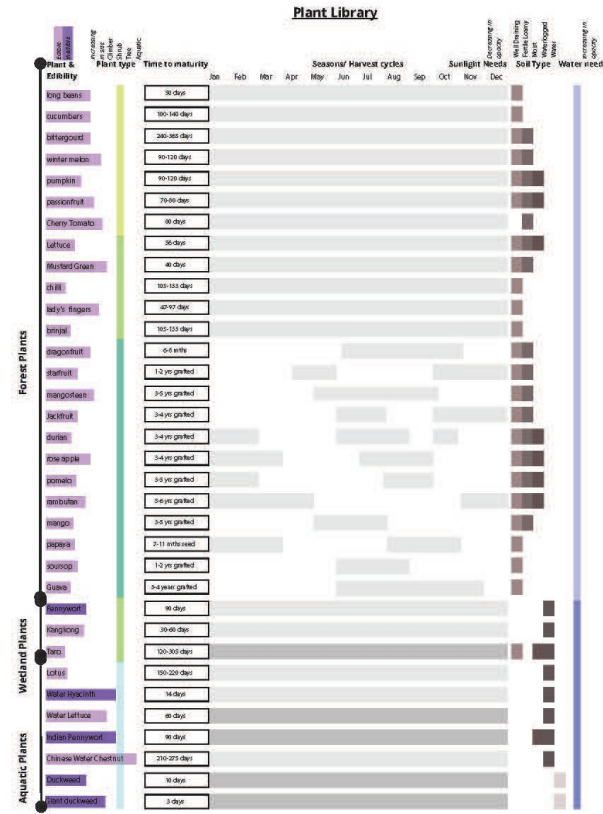
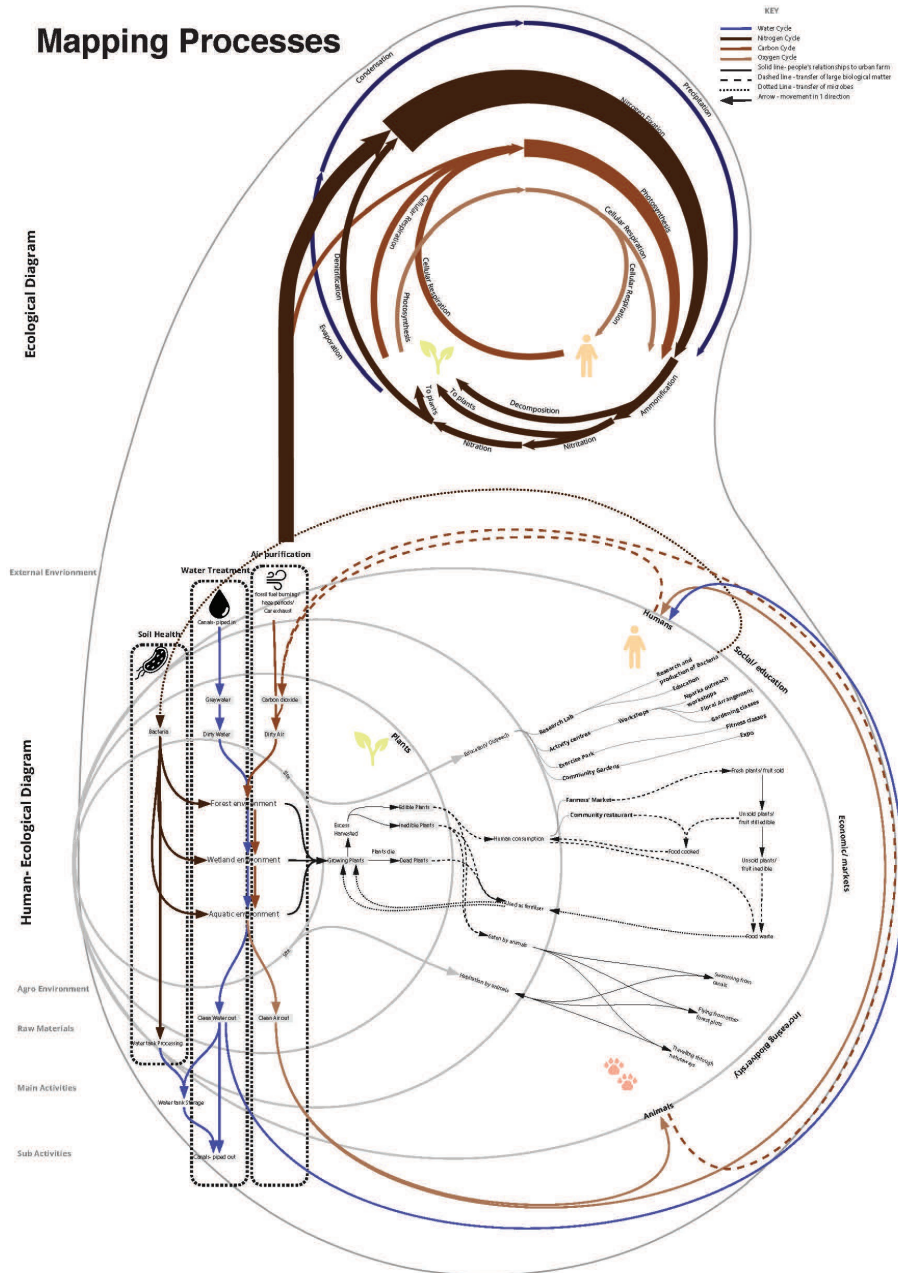
**Mapping Processes**





HUMAN ECOLOGICAL DIAGRAM

Mapping Processes



Existing Forest/Trees



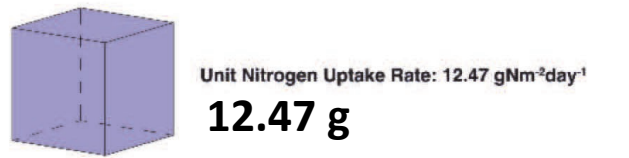
Shrubs



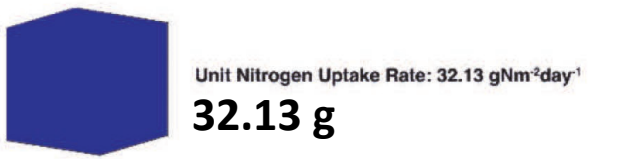
Climbers



Wetland Plants



Aquatic Plants





























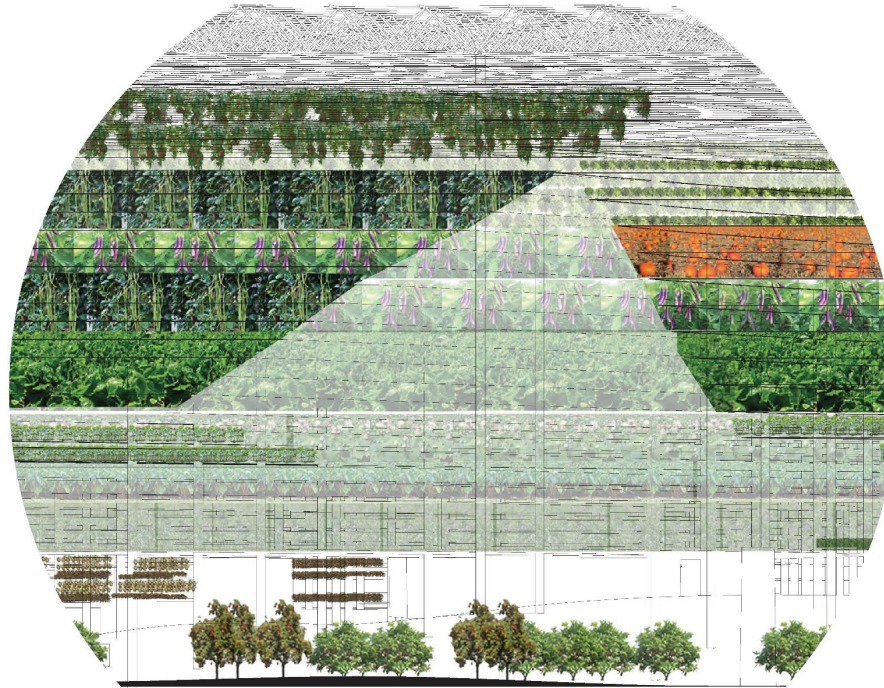
HUMAN ECOLOGICAL DIAGRAM



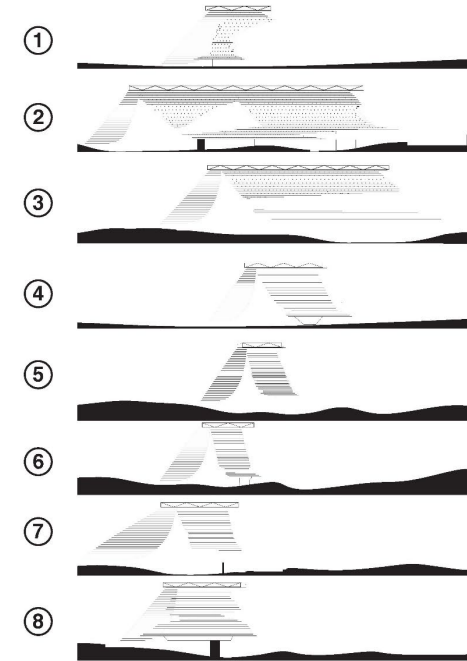


Enlarged Section

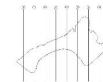
- (A) Terrestrial Plant Block**  
 Nitrogen Uptake Rate:  $0.429 \text{ gNm}^{-2}\text{day}^{-1}$   
 Plant Species:  
        
*Cucurbita melongena* *Solanum melongena* *Passiflora edulis* *Vigna unguiculata* *Solanum lycopersicum* *Lactuca sativa* *Brassica juncea*
- (B) Aquatic Plant Block**  
 Nitrogen Uptake Rate:  $20.2 \text{ gNm}^{-2}\text{day}^{-1}$   
 Plant Species:  
        
*Ceratella asiatica* *Lemna sp.* *Eleocharis dulcis* *Eichhornia crassipes* *Isona aquatica* *Colocasia esculenta* *Nelumbo nucifera*
- (C) Leguminous Plant Block**  
 Nitrogen Uptake Rate:  $14.17 \text{ gNm}^{-2}\text{day}^{-1}$   
 Plant Species:  
    
*Arachis hypogaea* *Glycine max* *Medicago sativa*
- (D) Tree Block**  
 Nitrogen Uptake Rate:  $0.028 \text{ gNm}^{-2}\text{day}^{-1}$   
 Plant Species:  
        
*Palium guajava* *Artocarpus heterophyllus* *Nephelium lappaceum* *Mangifera indica* *Carica papaya* *Citrus grandis* *Durio zibethinus*



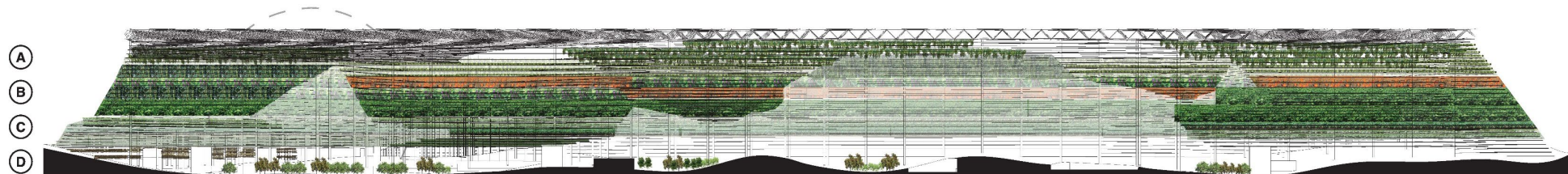
Sectional Variation  
Every 100 m



1:4000



Section













# Ecological Mapping

## Alexandra Woodland, Singapore

1914  
Rifle range constructed  
Hospital present

1938  
Hospital established as Alexandra hospital

1943  
Rail line constructed

1945  
Rifle range converted to oil rig  
Alexandra hospital is expanded

1952  
Major Wang Jeeat is built

1953  
Oil Rig demolished  
Bungalows on site constructed

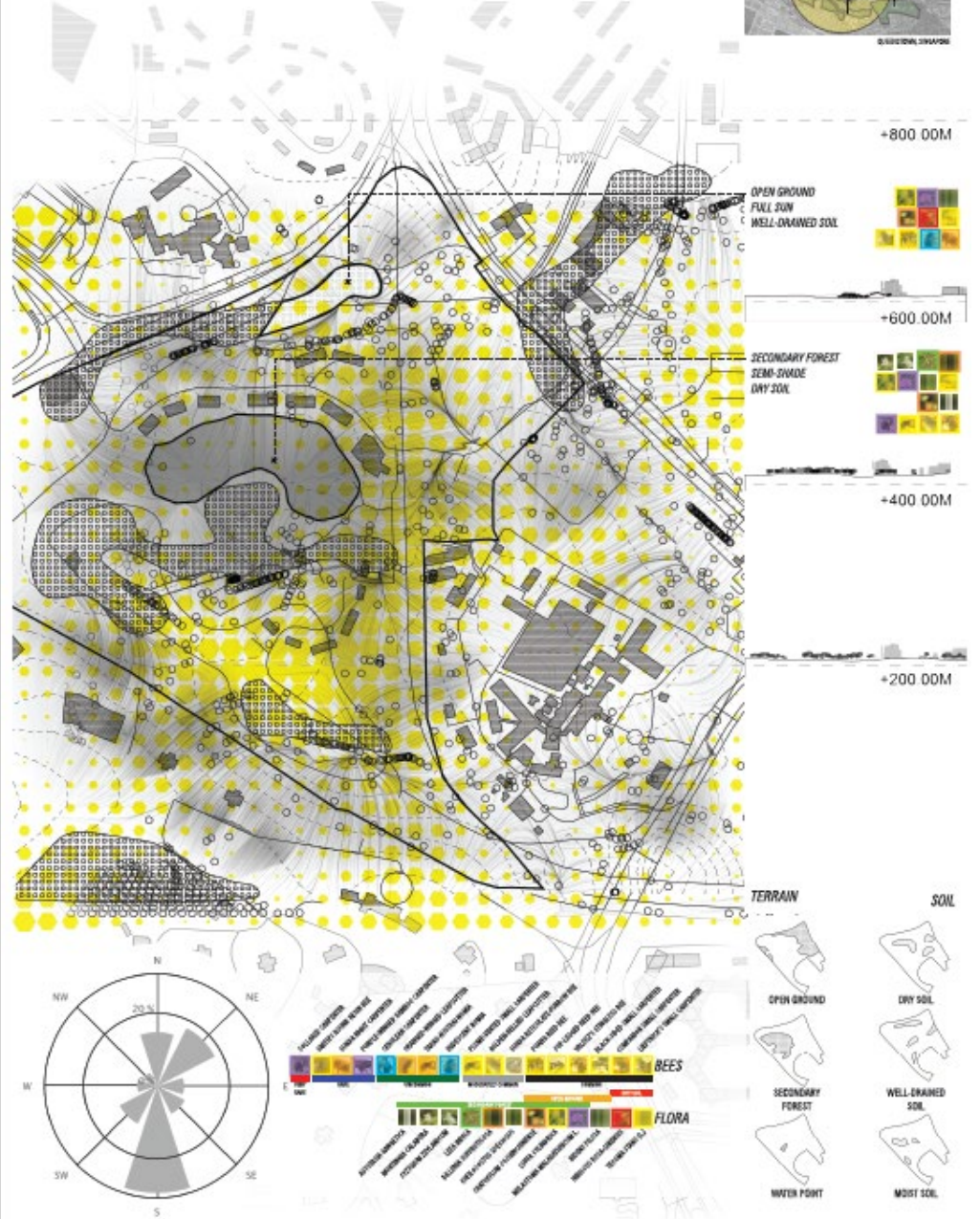
1975  
Residential buildings constructed at NE of site  
Green land converted to minor cultivation areas



- Legend**
- Tree
  - Shrub
  - Childcare Centre
  - Residential
  - Other Buildings
  - Contours of time
  - Water flow
  - Access routes
  - Building boundary
  - Access points

# STUDIO URBAN FOREST // SUTD // C. YOGIAMAN

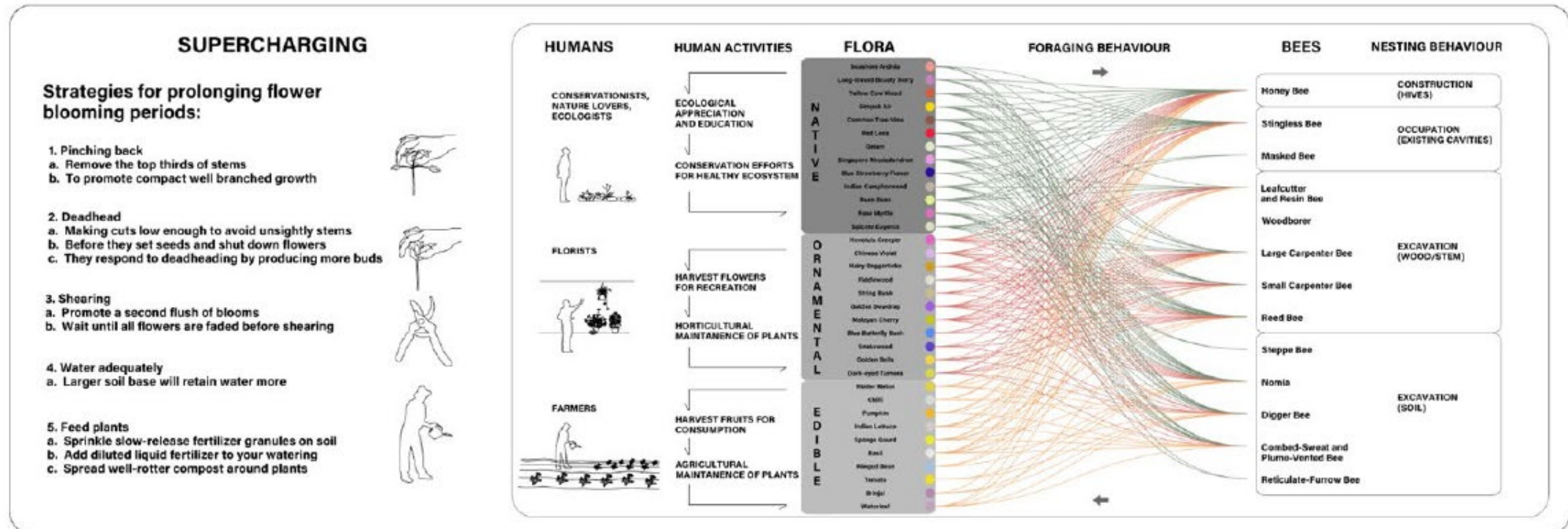
ALEXANDRA WOODLANDS, SINGAPORE  
1.2891288°, 103.7990427°





Family	Apidae								Halictidae					Megachilidae				Colletidae
Common Name	Cloak-and-Dagger Bee	Digger Bee	Honey Bee	Large Carpenter Bee	Small Carpenter Bee	Nomad Bee	Reed Bee	Stingless Bee	Blood Bee	Combed-Sweat and Plume-Vented Bee	Nomia	Reticulate-Furrow Bee	Steppe Bee	Chili-Tail Bee	Leafcutter and Resin Bee	Sharptail Bee	Woodborer	Masked Bee
Size																		
Social Behaviour		Solitary		Subsocial	Solitary		Solitary			Solitary	Solitary	Solitary	Solitary		Solitary		Solitary	Solitary
			Eusocial		Subsocial		Subsocial			Subsocial								
Nesting	Cuckoo		Construction		Excavation		Excavation		Cuckoo					Cuckoo		Cuckoo		
				Excavation	Excavation		Excavation	Occupation		Excavation	Excavation	Excavation	Excavation		Occupation		Excavation	Occupation

### Human Ecology Diagram





**PATTERNS :**

**Manifestation of Diverse Biophilic Approach to Design for:**

**YOUR PROJECT!**



# YOUR PROJECT!

What PATTERNS are manifested  
from **Form-Material logics...**

What PATTERNS are manifested  
from **Human-Ecological Interactions...**

**(HINT: Elements-Attributes-14 Urban Patterns)**