PACE 2010 ANNUAL FORUM

Approaches to Systems Thinking and Emergence in the Creative Design Process

New Methods in Problem Solving

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Seoul Korea, July 21, 2010

Presentation Overview

- Introduction
- Global Issues
- Sustainable Product Development
- Systems Thinking
- Biomimicry
- Emergence
- Collaborative Practices

INTRODUCTION

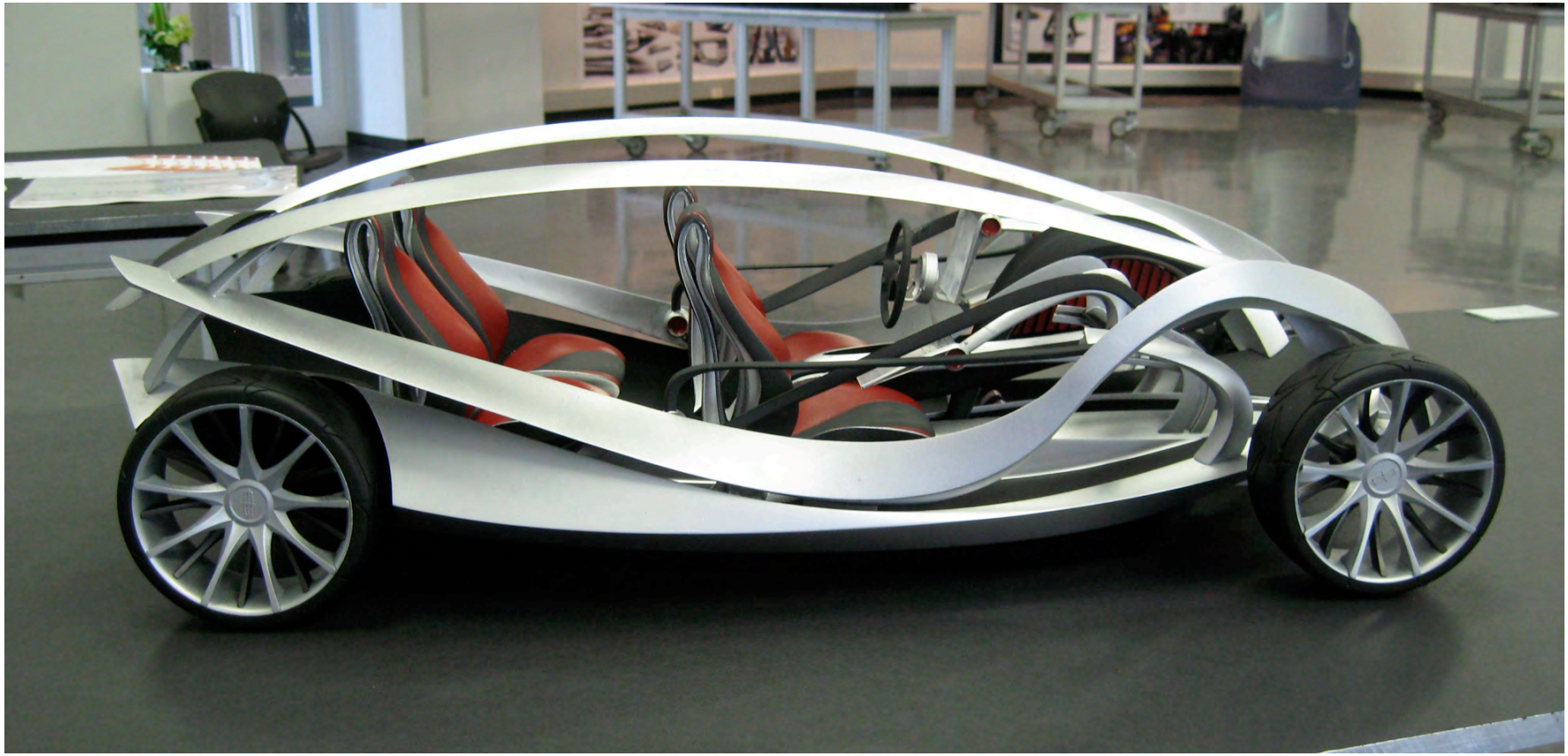
Introduction

- Teaching is a priority
- 10 Years Transportation Design
- 10 Years Industry Experience
- Workshops and Lectures
- Trans TANK

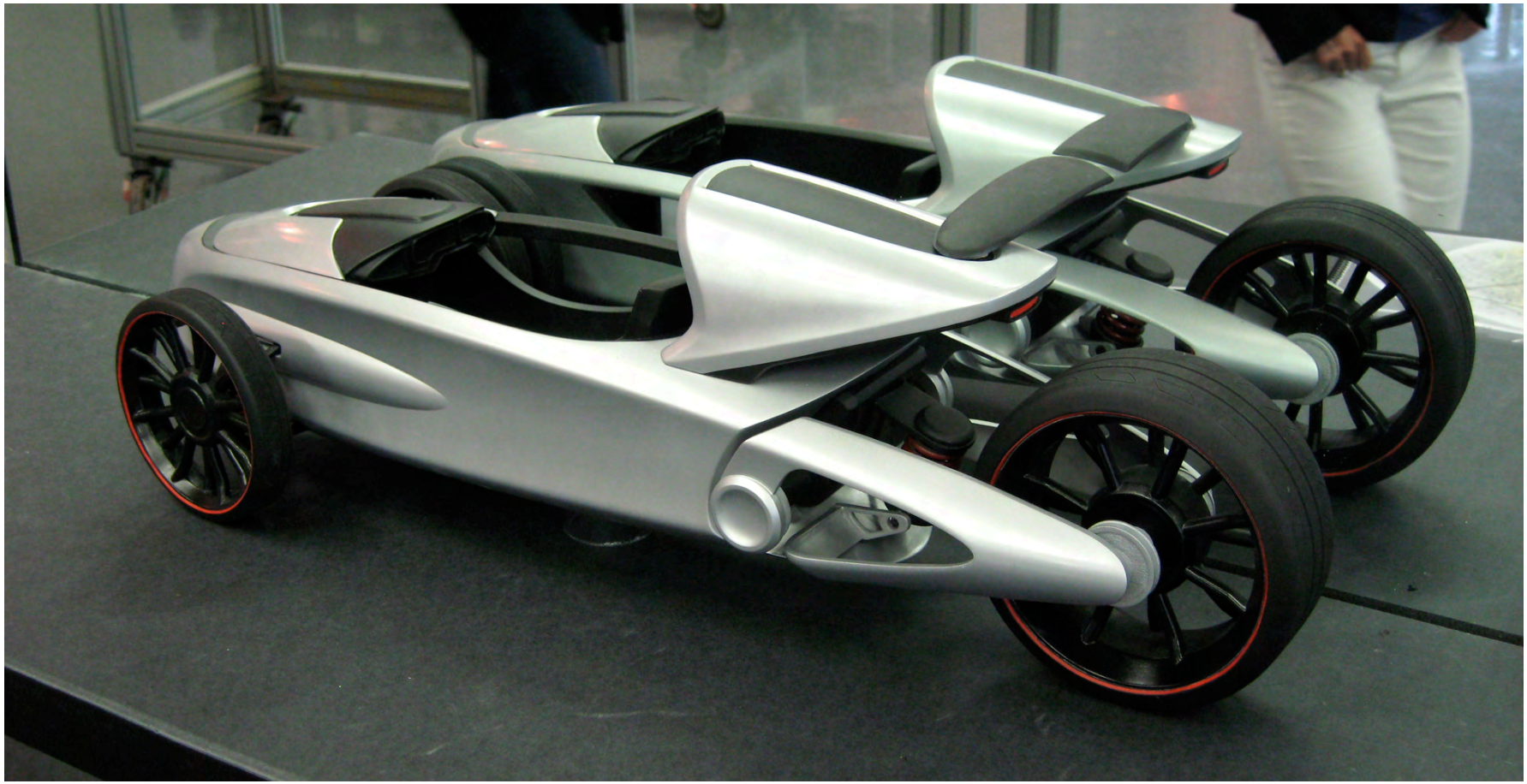
Designer's Role

- Communicate ideas through drawings
- Overall vision or "blue sky" ideas
- Product concept and innovation
- Passion for arrangement of form
- Focus on quality, aesthetics, function, and material
- Intuitive

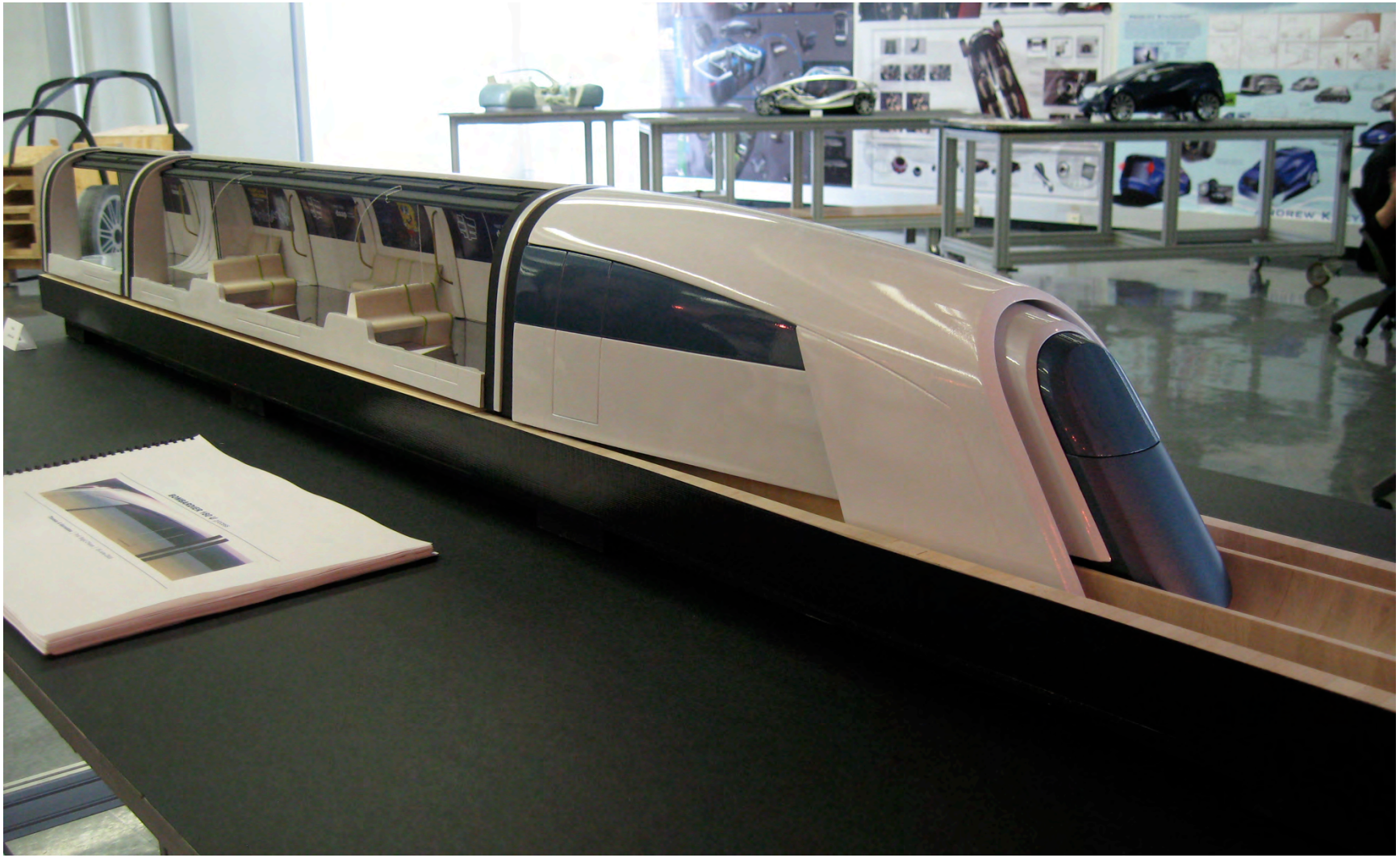
Brian Hillner, UC Gradate 2007



Ryan Wohleber, UC Graduate 2009



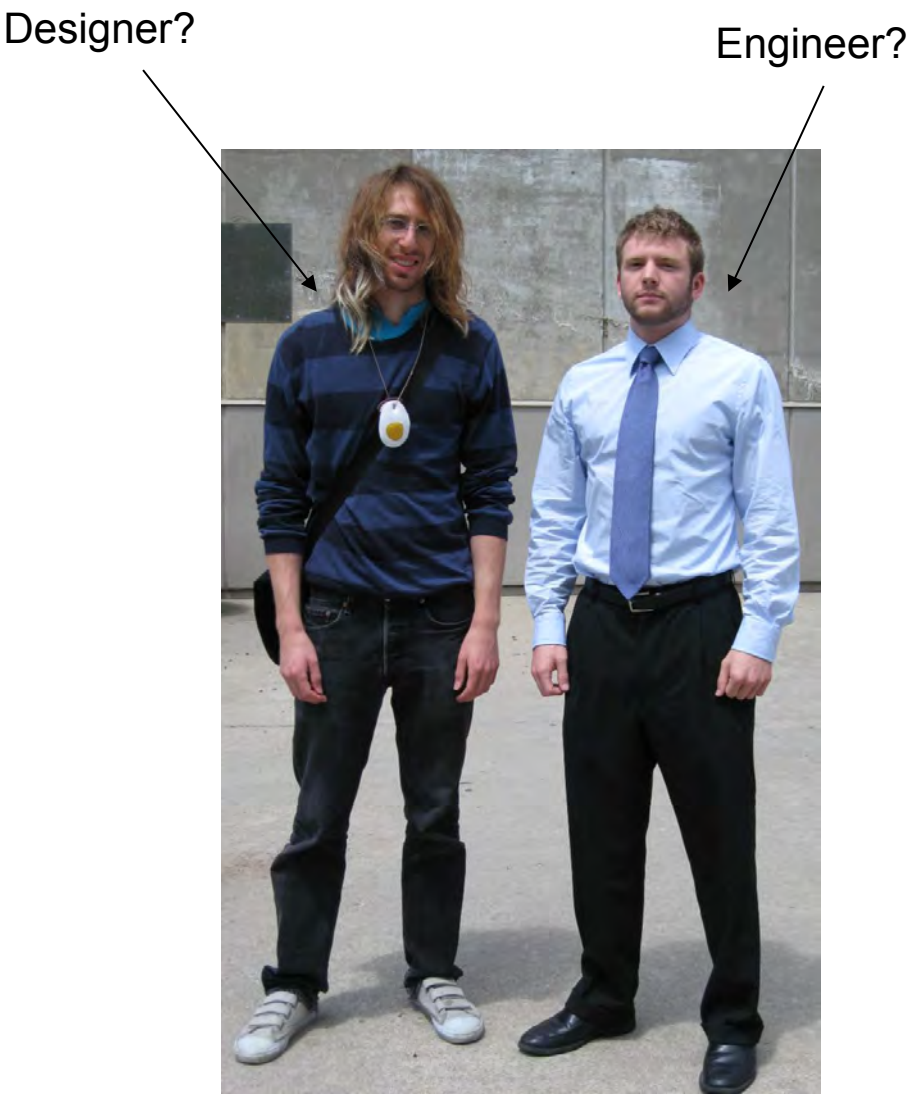
Lucas Yates, UC Graduate 2009



Tom Gernetzke, UC Graduate 2010

Product Development

- Improve the quality of life for others
- Transportation is an opportunity to make huge impacts




GLOBAL ISSUES

Global Issues in Sustainable Product Design

Relating to the Product

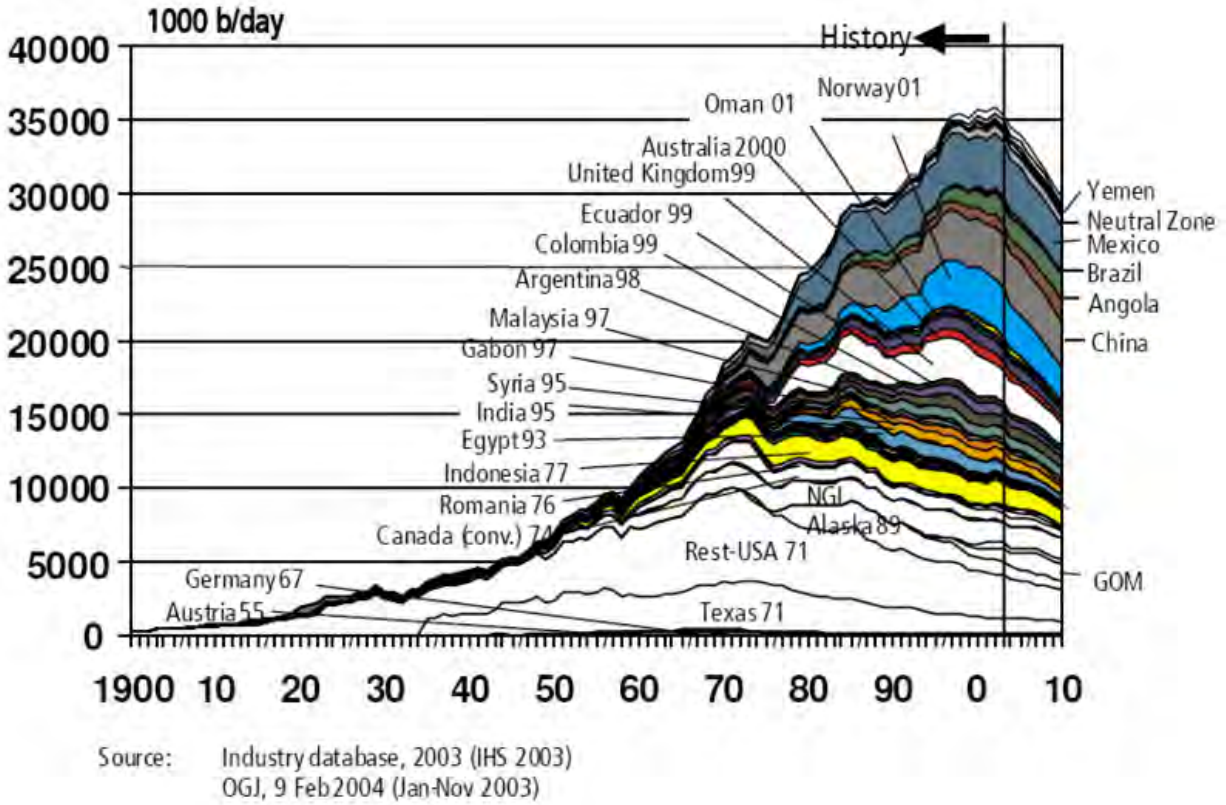
- Recycling
- Design for Disassembly
- Material Product is Made Of
- Experience of Product
- Aesthetics
- Customer
- Efficiency
- Education | Awareness

Relating to a Wide Range of Issues

- Environment
- Built Local | Global
- Global Trends
- Regulations
- Product Lifecycle Management
- Implications
- Energy Use of All Units
- Global Warming | Climate Change

Global Issues in Oil Production

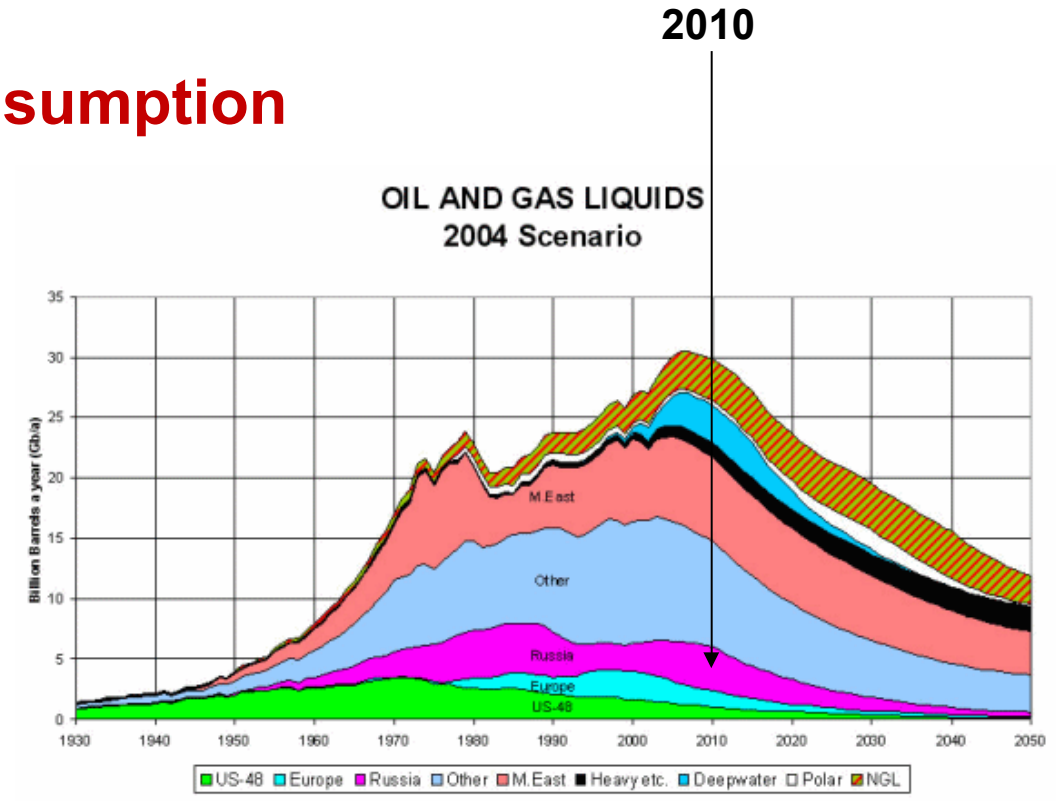
- We are past peak oil
- A global perspective
- Figure shows oil production of countries outside of OPEC and the Former Soviet Union



http://www.energybulletin.net/image/articles/2544/LBST_Countdown_2004-10-12_html_m703e66b2.gif

Global Issues in Oil Consumption

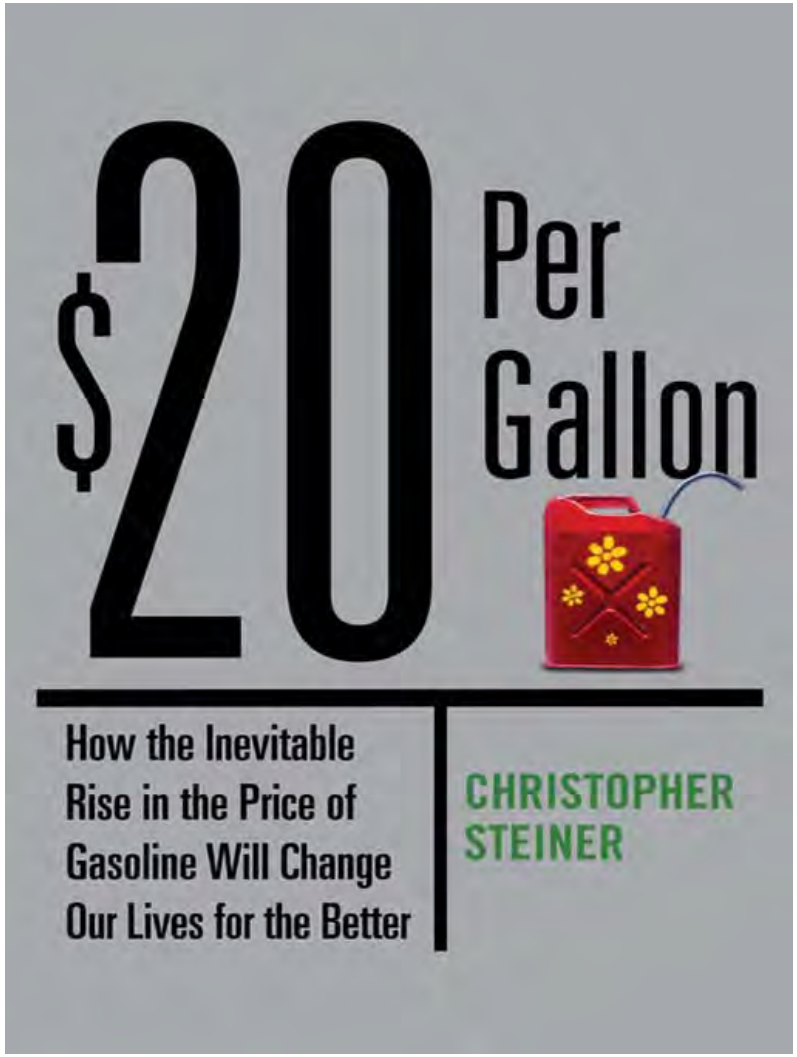
- Total U.S. Oil Reserves 21 billion barrels
- That's all there is
- Total U.S. Daily Consumption 21 million barrels per day (in 2006)



http://www.energybulletin.net/image/articles/2544/LBST_Countdown_2004-10-12_html_m703e66b2.gif

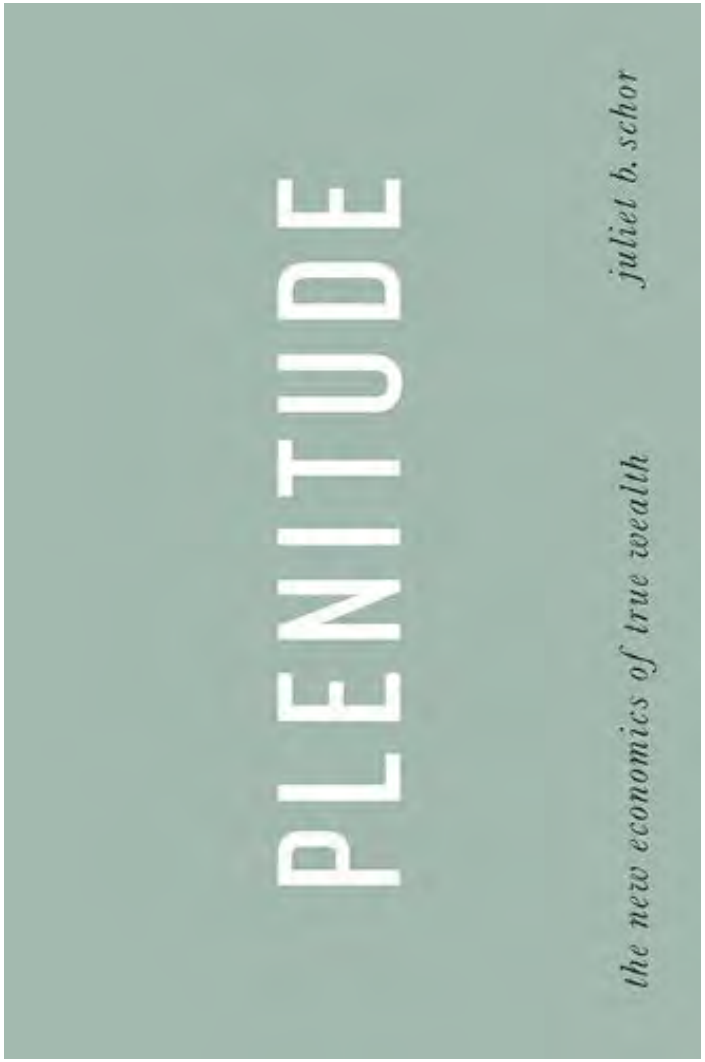
Trends in Oil Production

- $20 Pre Gallon
  By Christopher Steiner



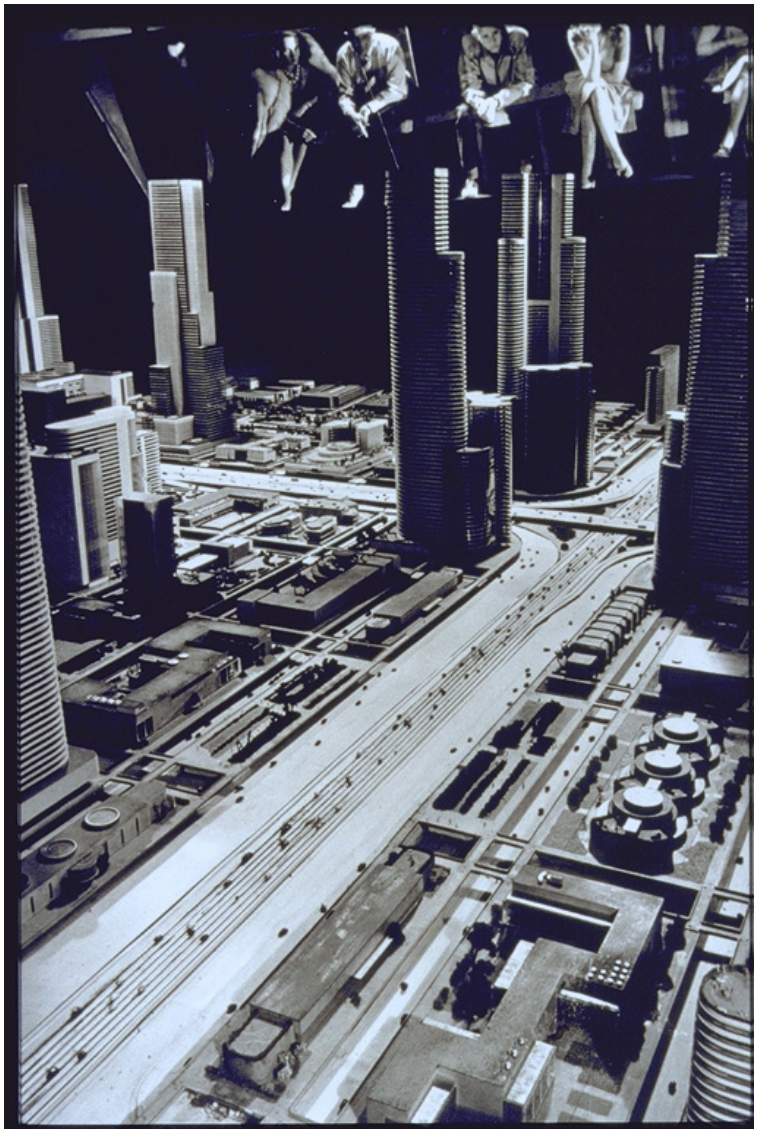
Trends in Lifestyle

- Plentitude
  By Juliet Schor



Future Transportation

- Futurama
- 1939 Worlds Fair Exhibit



http://www.streetsblog.org/wp-content/uploads/2010/03/22/futurama_img_1.png

SUSTAINABLE PRODUCT DEVELOPEMENT

Sustainable Development

- The art of designing physical objects and the built environment to comply with the principles of economic, social, and ecological sustainability.
  - Dictionary Definition

- Development that meets needs of the present without compromising the ability of future generations to meet their own needs. - Brundtland

The Hannover Principles by William McDonough

- Interdependence
- Eliminate the Concept of Waste
- Diversity and Partnership
- Co-Existence
- Relationships
- Responsibility
- Objects of Long-Term Value
- Rely on Natural Energy Flows
- Understand the Limitations of Design

http://graphics8.nytimes.com/images/2007/12/03/arts/Pitts450.jpg

Product Development

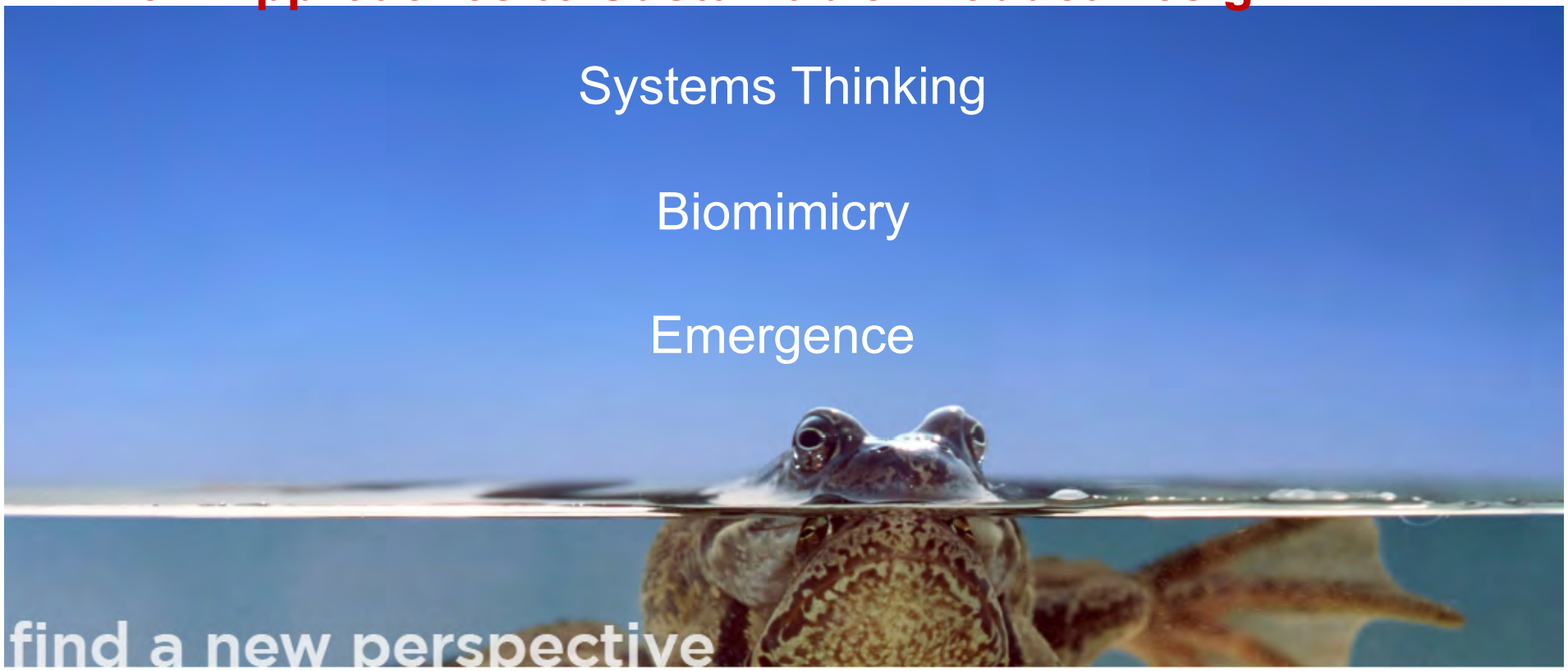
- To achieve excellence in design
- Sustainable product development is part of the fundamental criteria for design excellence.
- 80%of the environmental impact of a product is determined in the design stage - (Thackara, 2005)
- To do things different we need to see things differently

New Approaches to Sustainable Product Design

For innovative, creative, and sustainable solutions

source: http://www.biomimicryguild.com/indexguild.html

New Approaches to Sustainable Product Design



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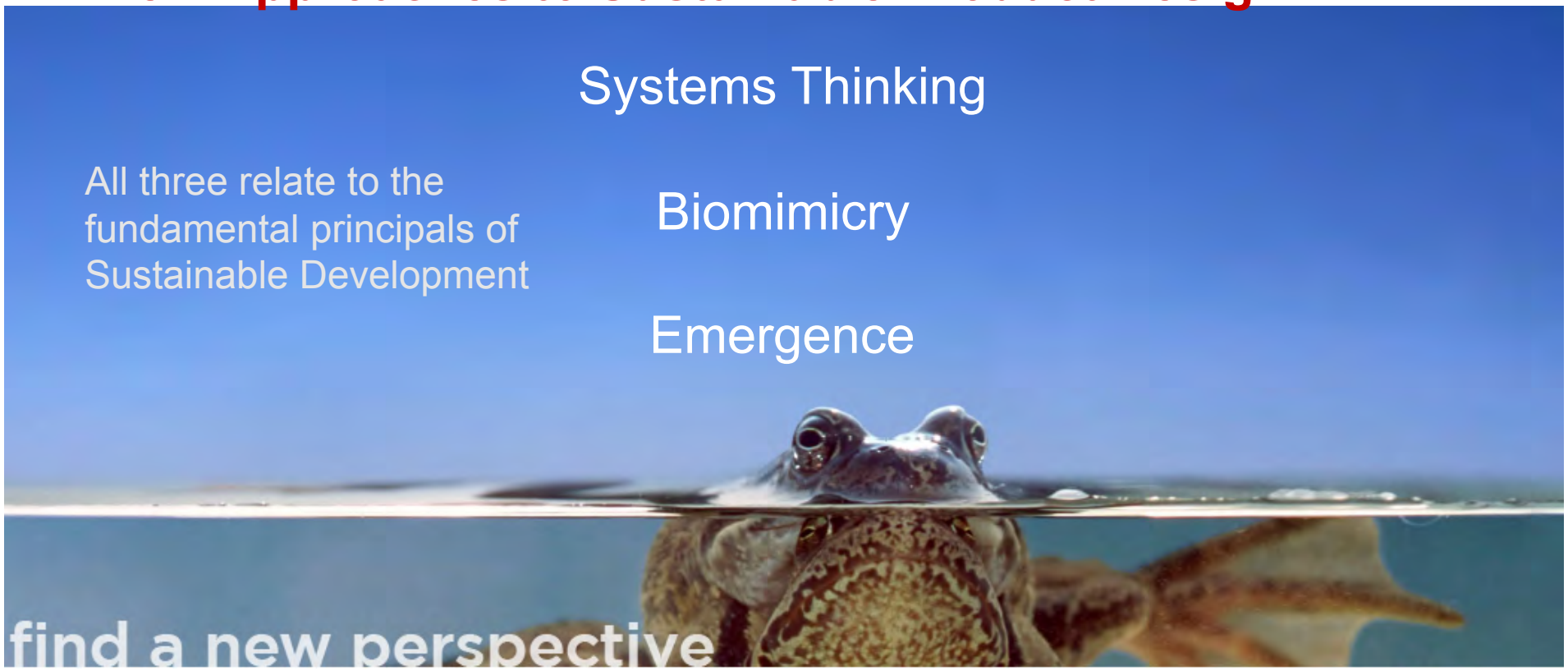
New Approaches to Sustainable Product Design



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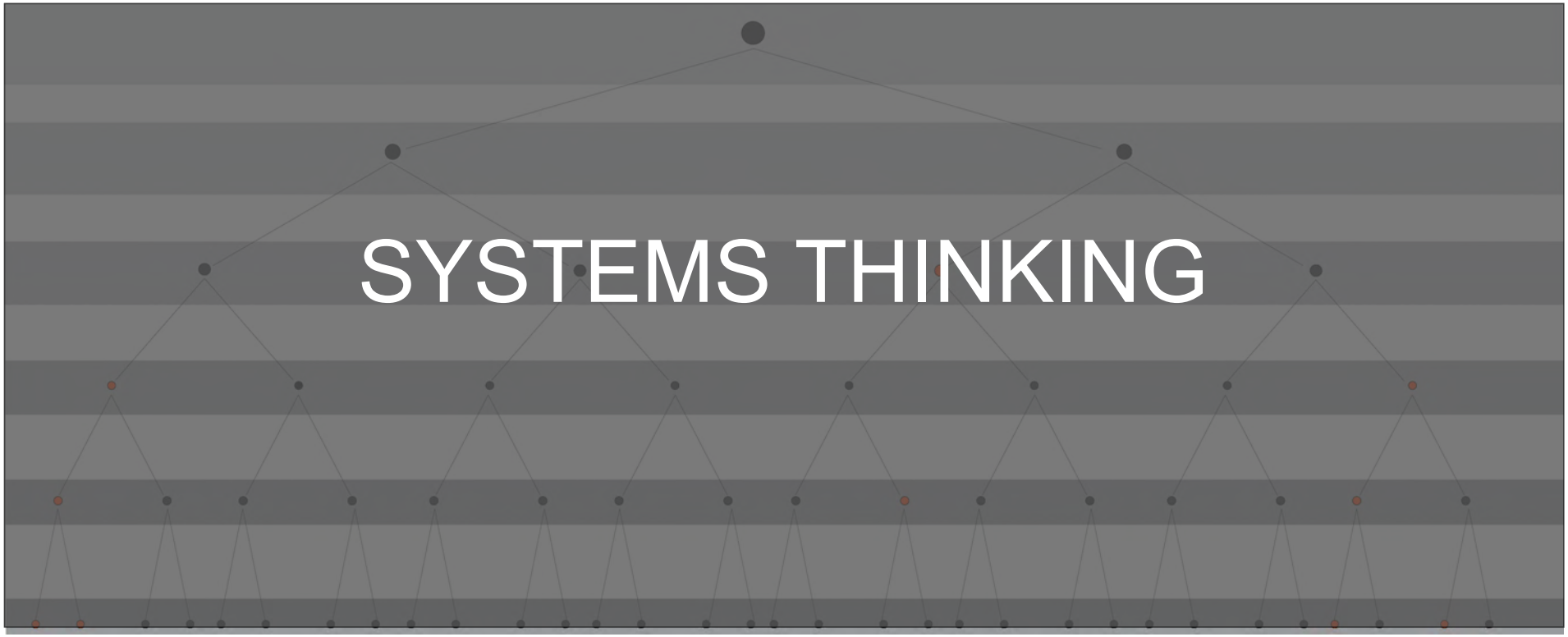
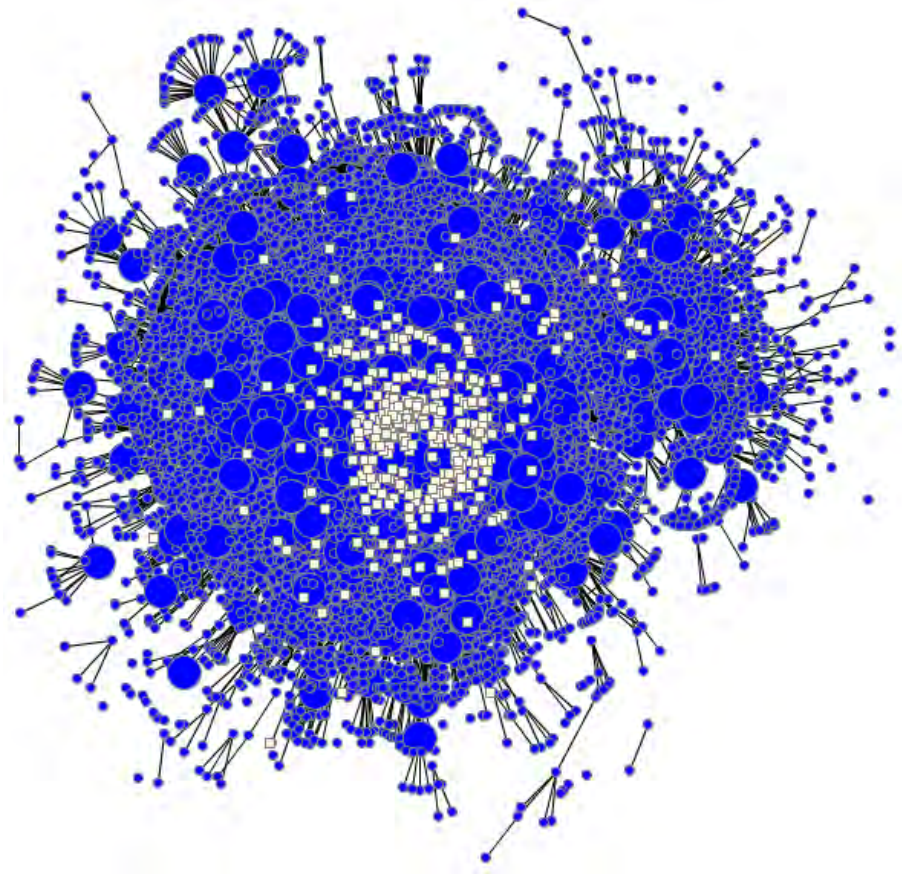

SYSTEMS THINKING

Systems Thinking Definition

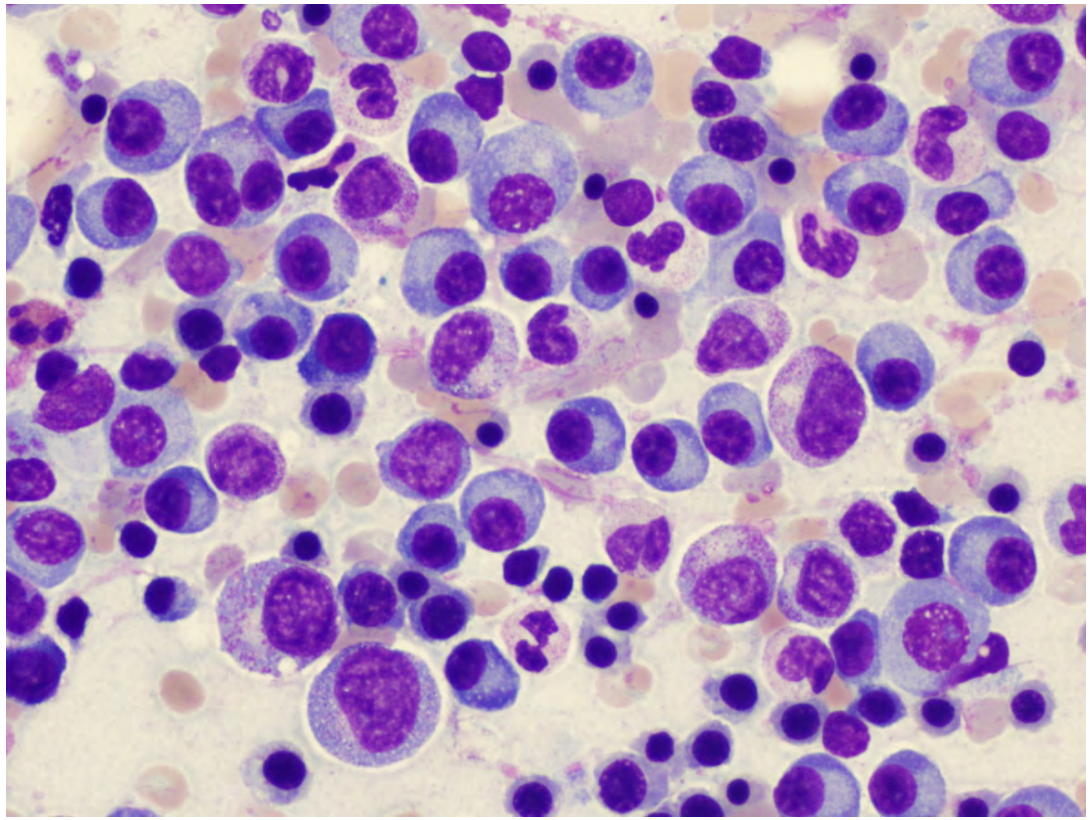
- Originated from engineering
- Holistic approach
- Seeing the system as a whole
- Considers emergent properties that come from the organization
- Boundaries are needed within the design development process



http://datamining.typepad.com/photos/uncategorized/livejournal.png

Systems Thinking

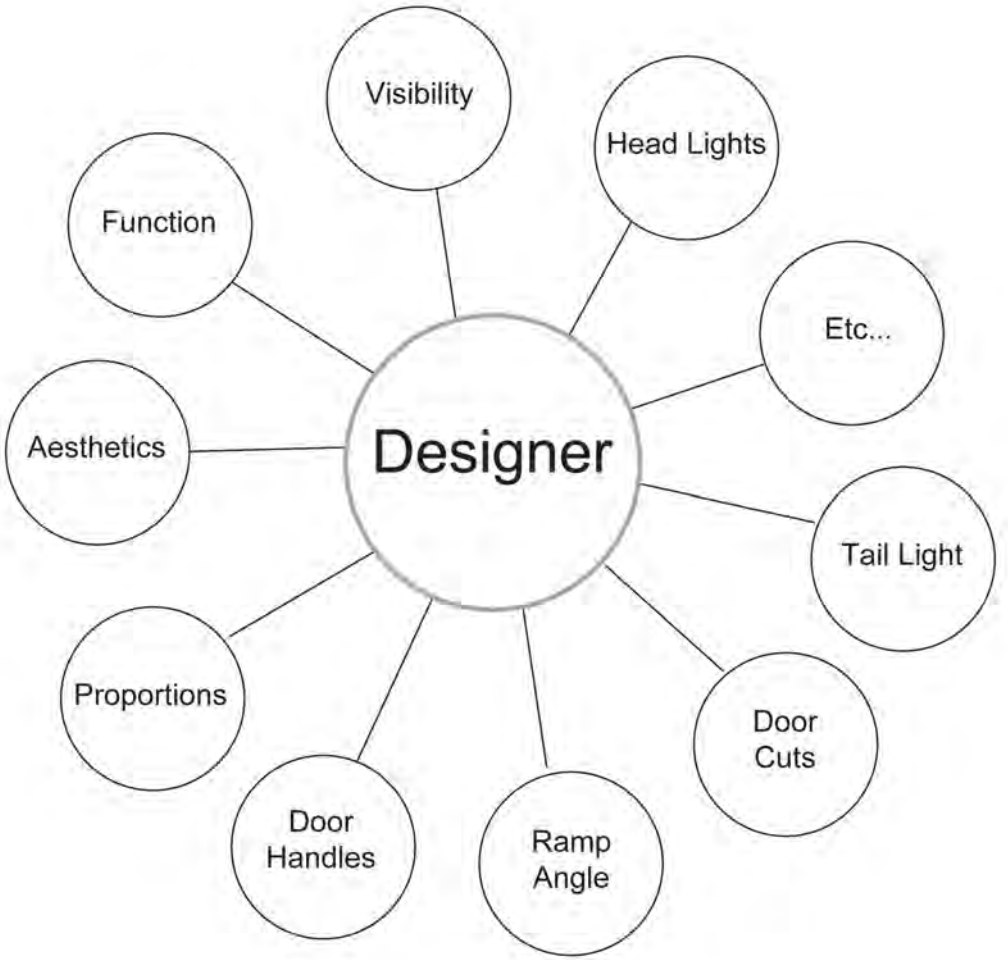
- New development within Industrial Design
- Autumn 2009 systems thinking project began
- Drives innovation
- Elements interacting according to rules
- Structure
- Hierarchy
- Flexibility



http://www.healthsystem.virginia.edu/internet/hematology/HessImages/Plasma-cells-website.jpg

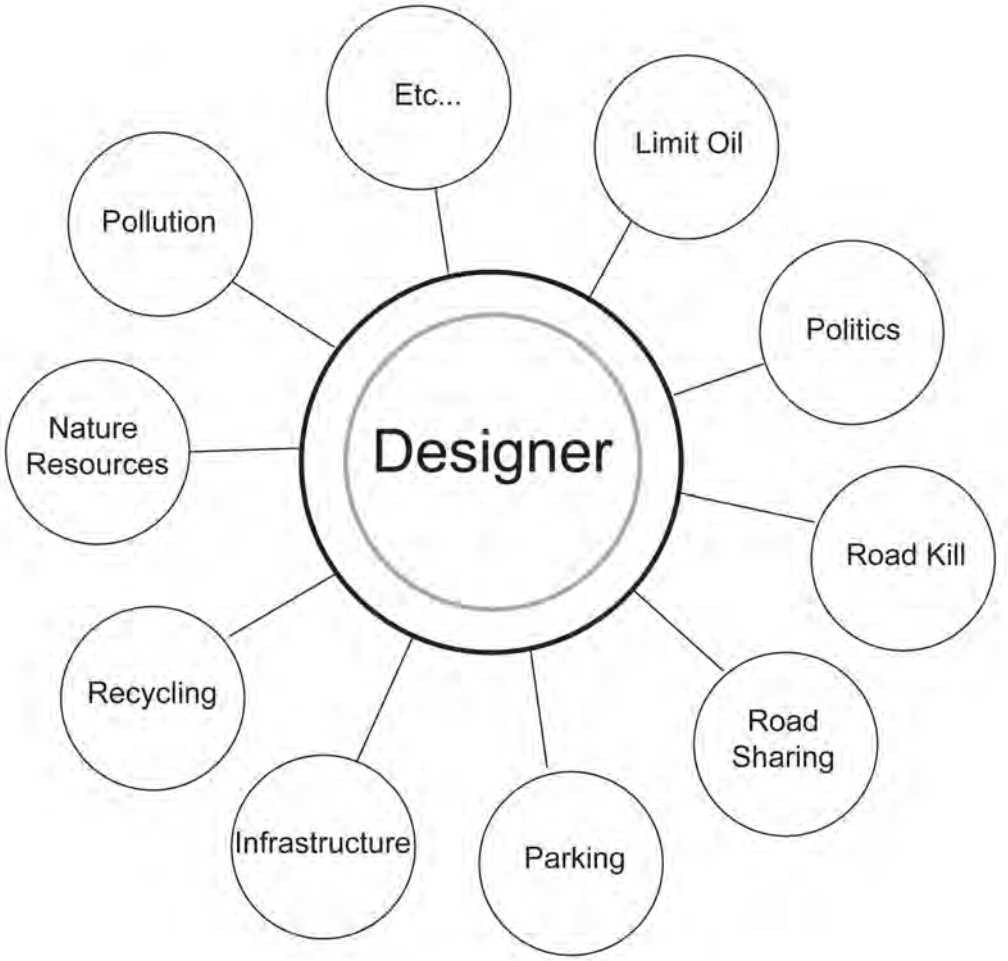
Systems Thinking

- Relating to the product



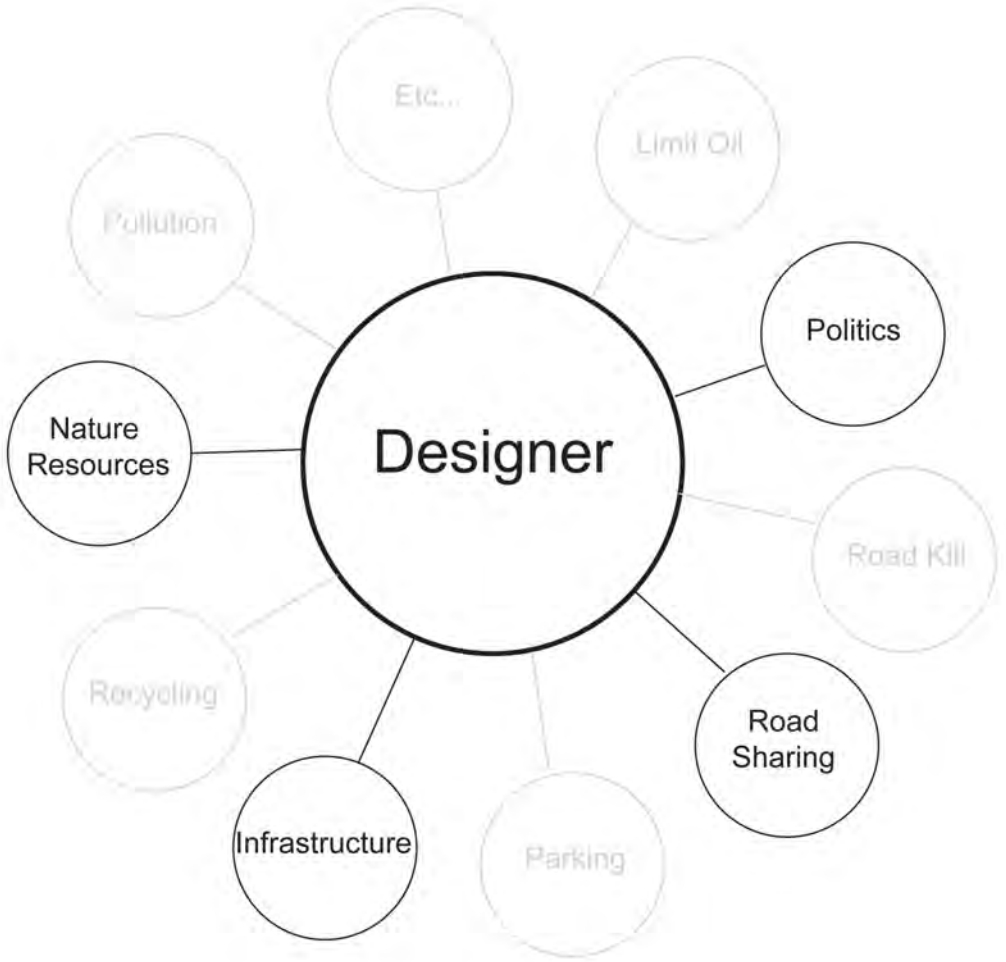
Systems Thinking

- Thinking outside of the product bubble
- Relate to broader issues



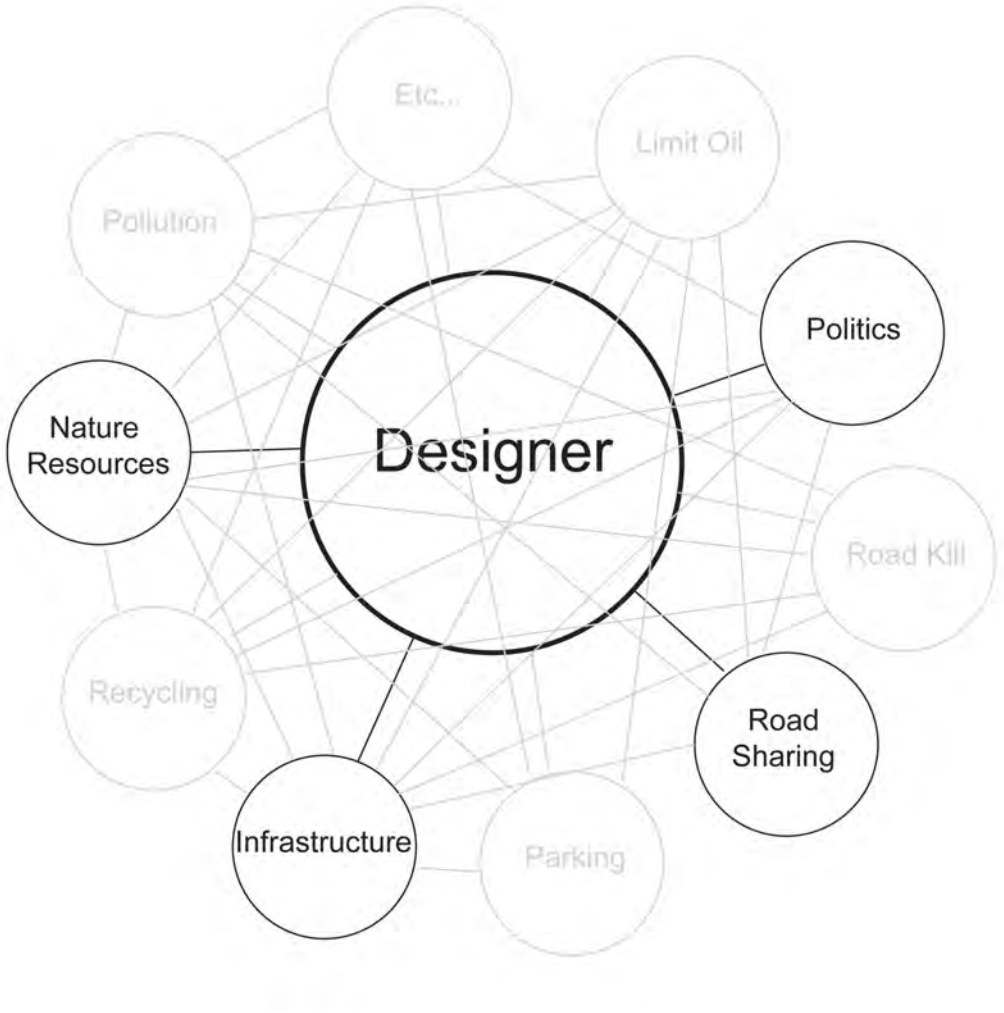
Systems Thinking

- Thinking outside of the product bubble
- Focus on specifics



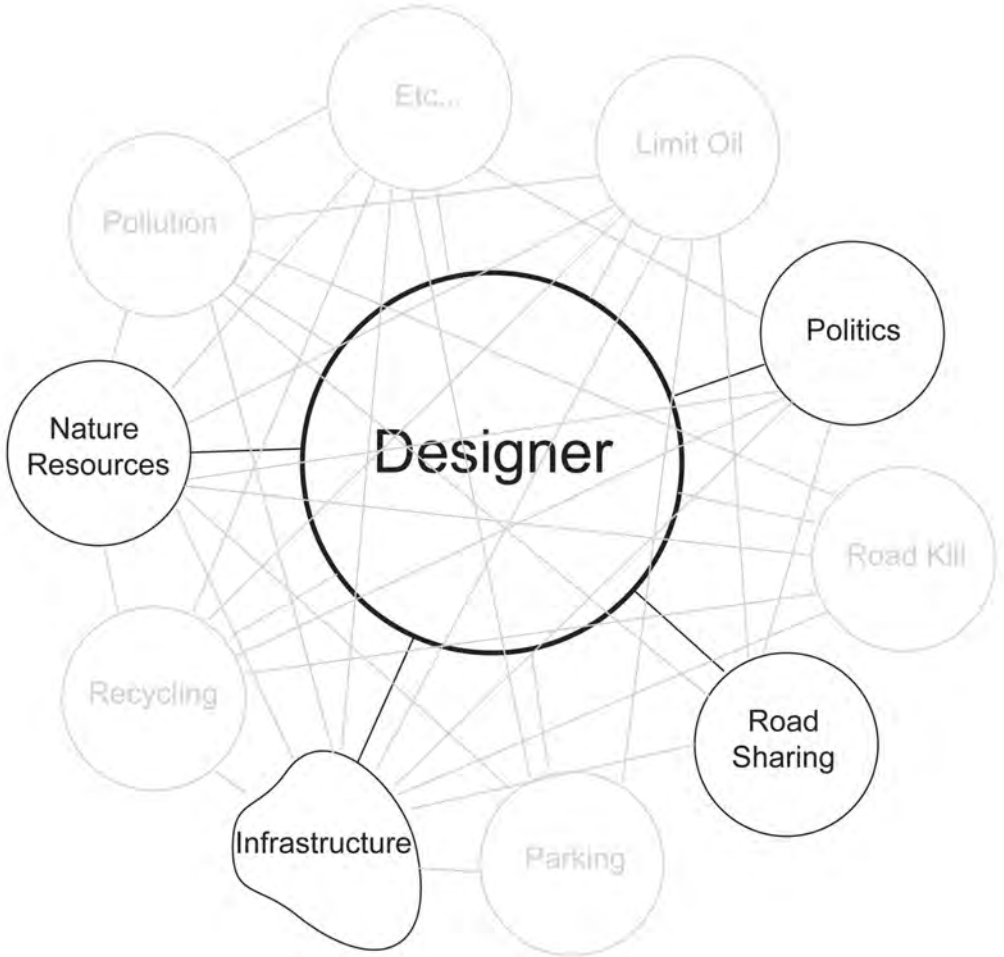
Systems Thinking

- Thinking outside of the product bubble
- Focus on specifics
- While relating to or thinking of the others as a whole



Systems Thinking

- Thinking outside of the product bubble
- Focus on specifics
- While relating to or thinking of the others as a whole
- Elements of the whole may change



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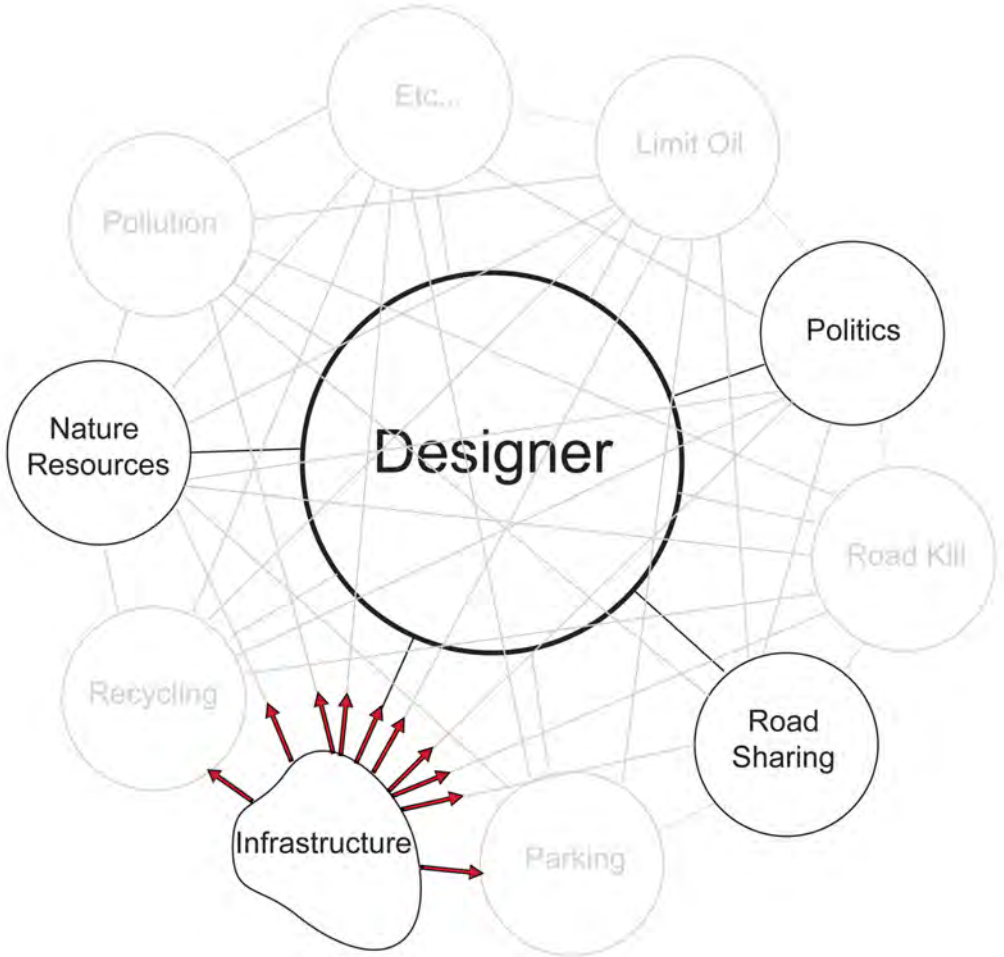
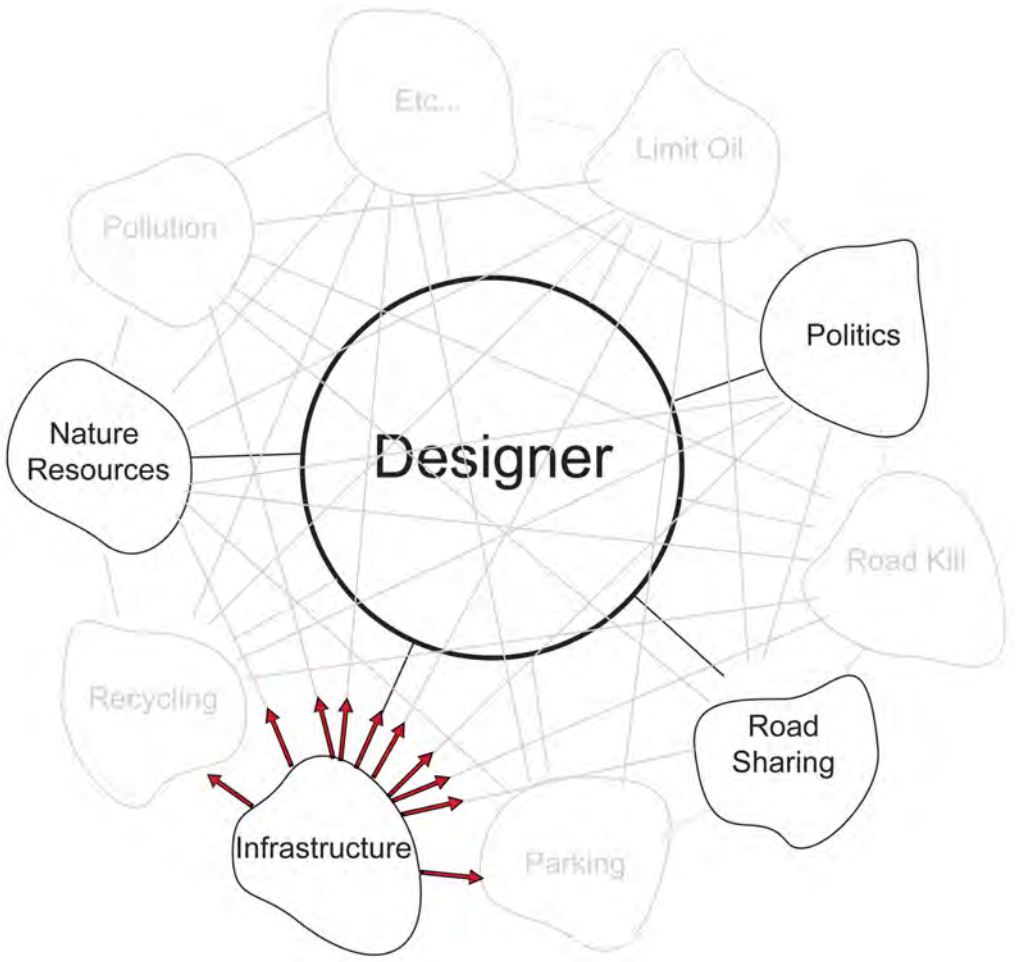


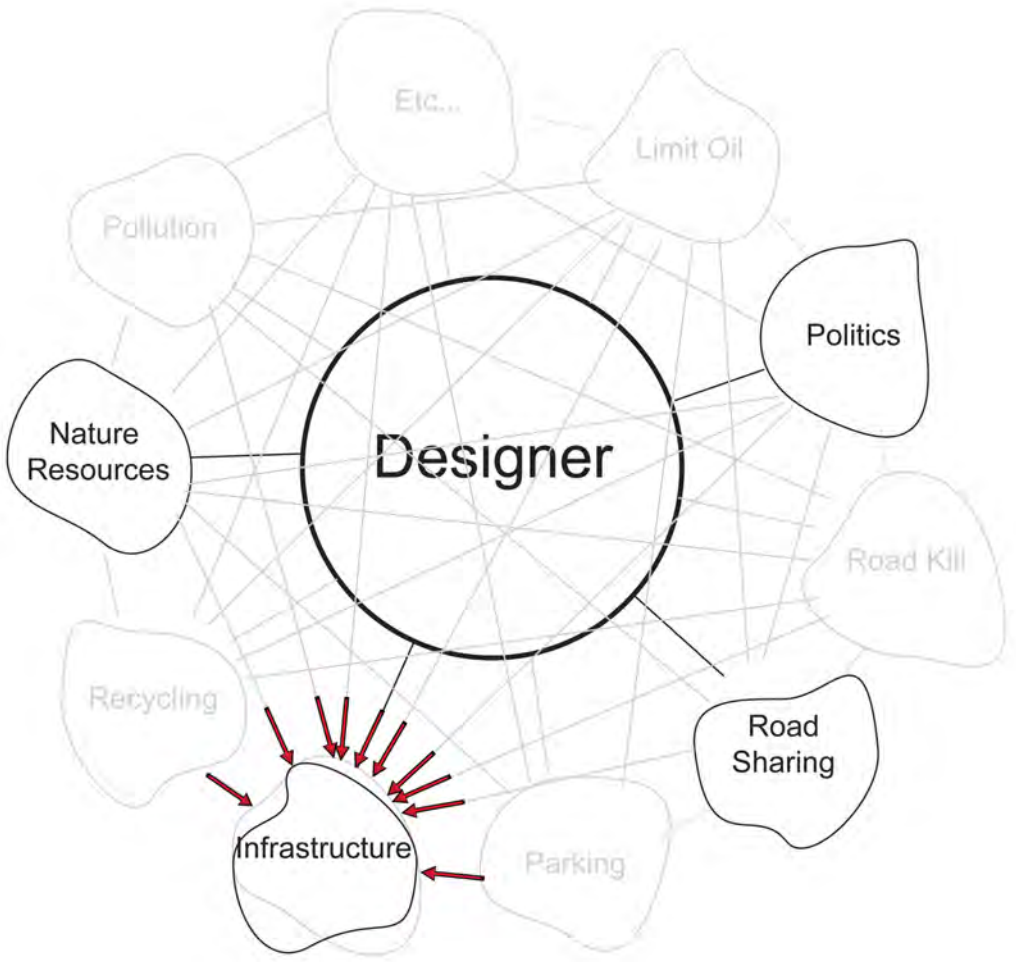
Systems Thinking

- Thinking outside of the product bubble
- Focus on specifics
- While relating to or thinking of the others as a whole
- Elements of the whole may change
- Changing elements influence the whole



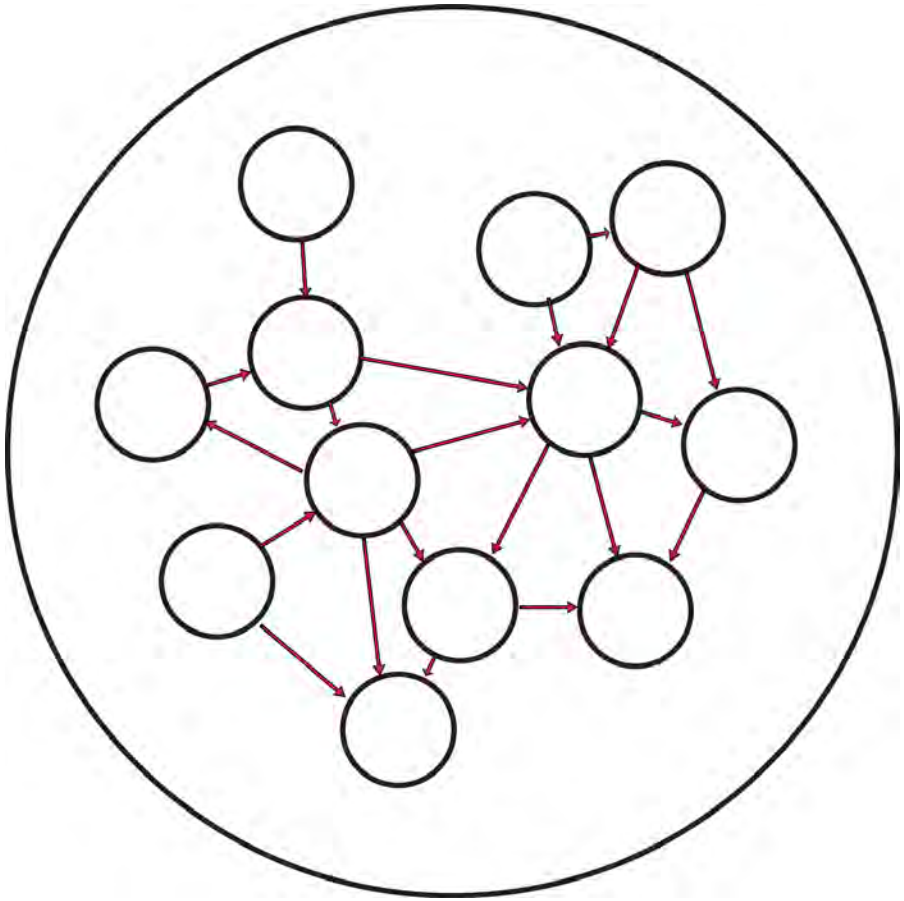
Systems Thinking

- Thinking outside of the product bubble
- Focus on specifics
- While relating to or thinking of the others as a whole
- Elements of the whole may change
- Changing elements influence the whole
- Elements may need rethinking



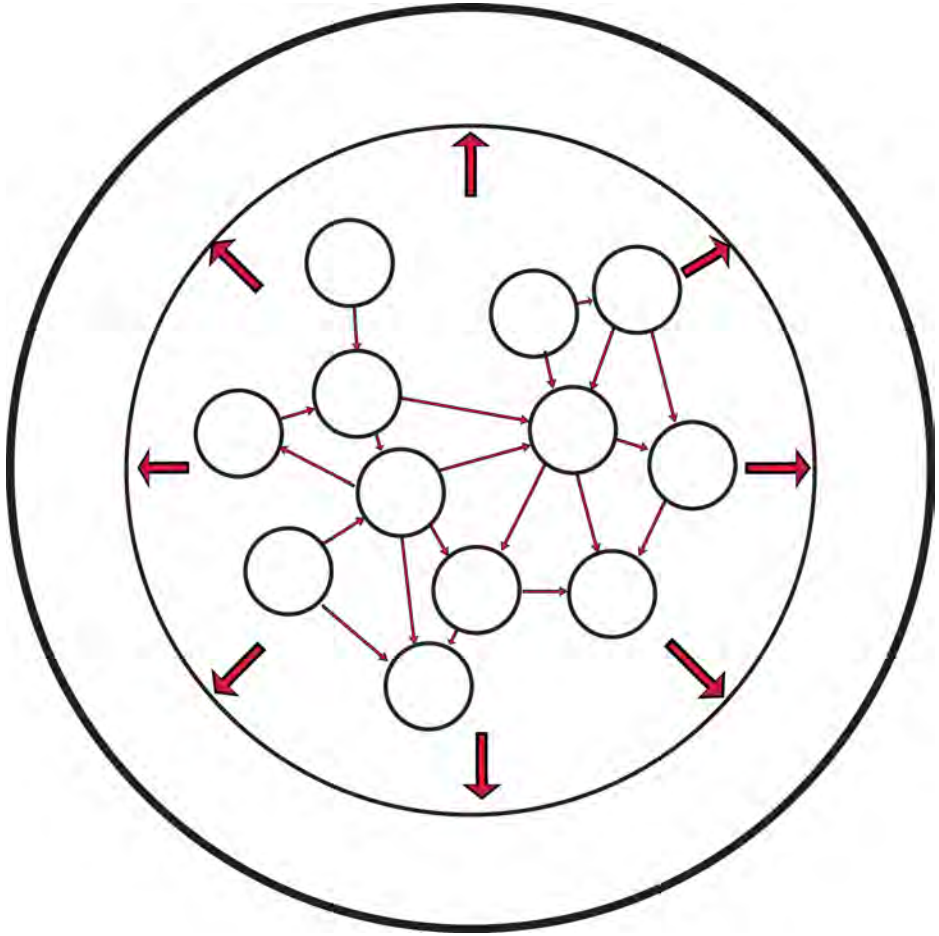
Systems Thinking

- Look at the system separate from other influences



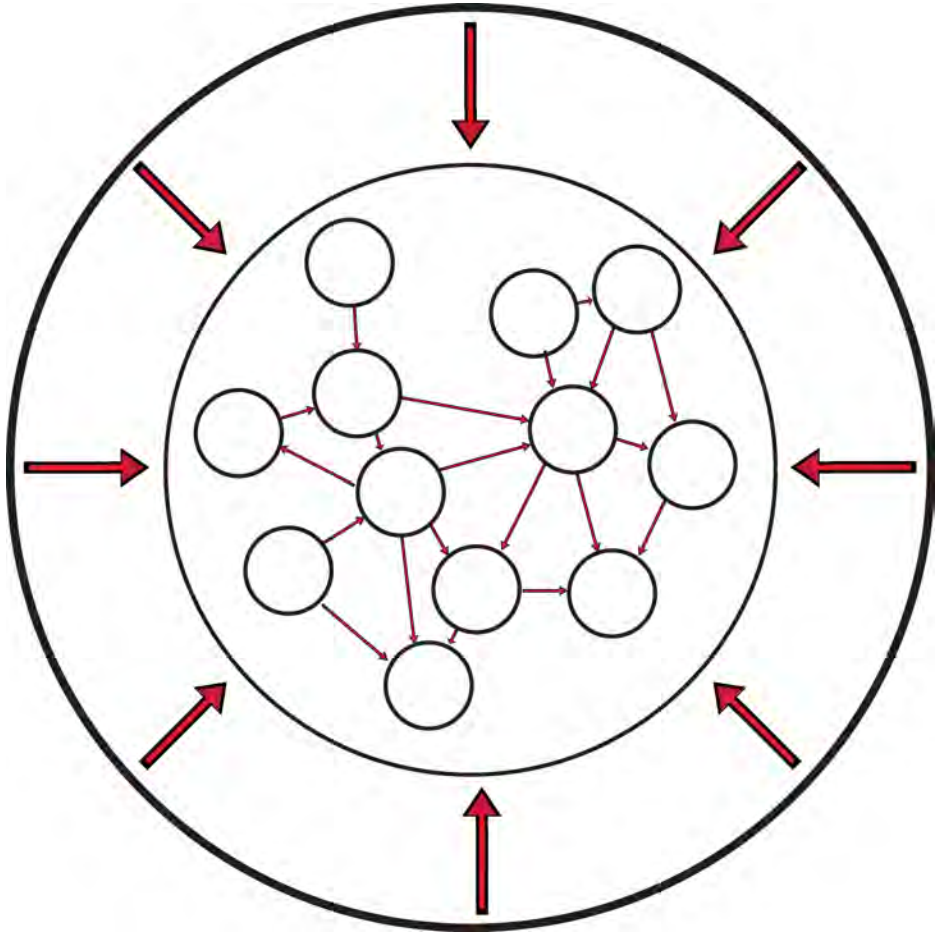
Systems Thinking

- Look at the system separate from other influences
- Look at the system as it affects the outside environment



Systems Thinking

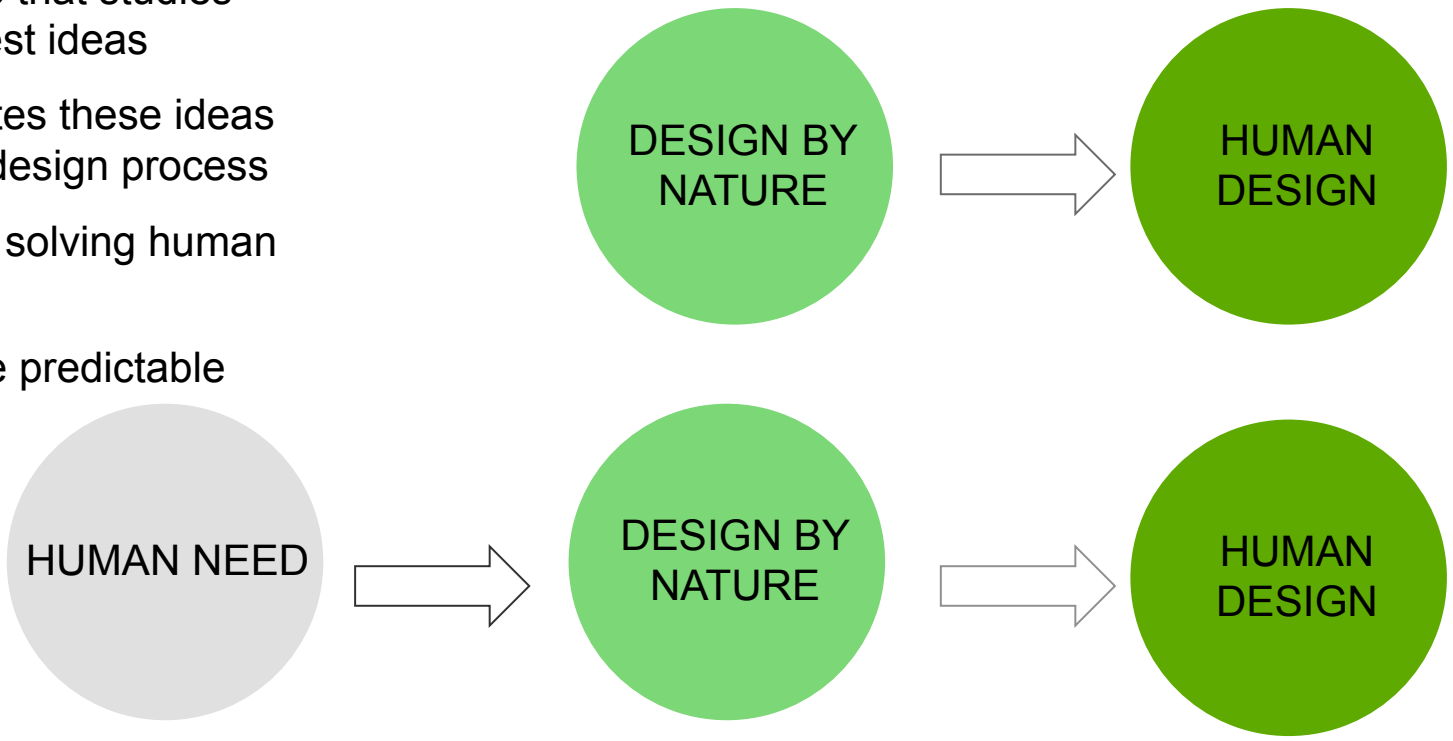
- Look at the system separate from other influences
- Look at the system as it affects the outside environment
- Look at outside environments and how it affects they system



BIOMIMICRY

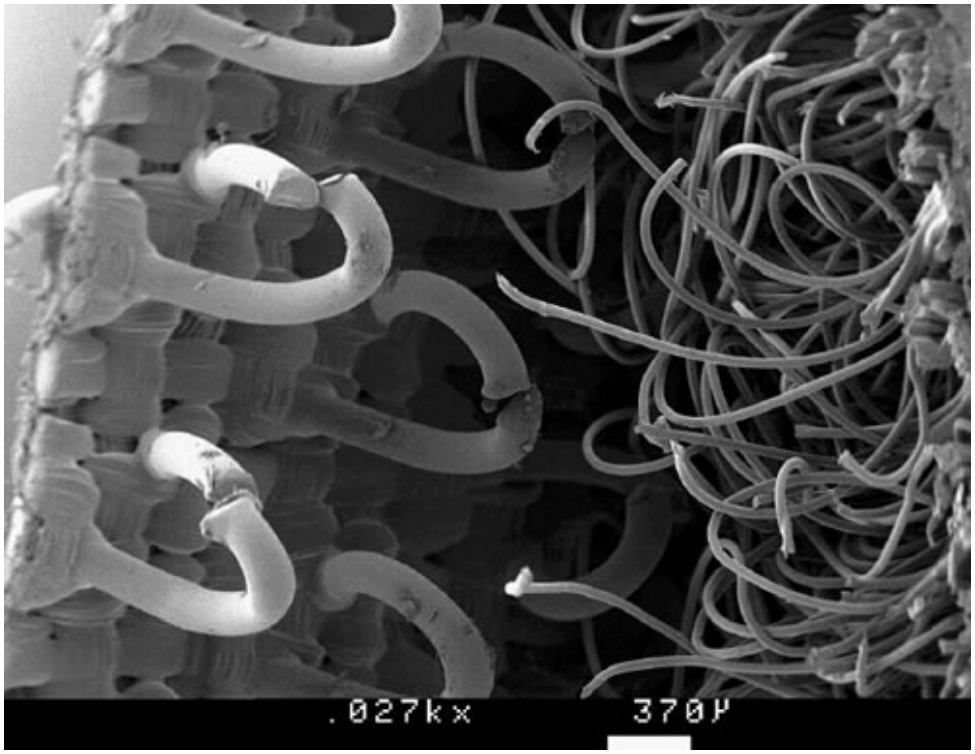
Biomimicry

- A discipline that studies nature's best ideas
- Then imitates these ideas within the design process
- Process of solving human problems
- Results are predictable



Biomimicry

- One of the first examples of Biomimicry is Velcro
- Charles de Metral
- 1941



http://www.neatorama.com/2008/06/06/how-velcro-was-invented/

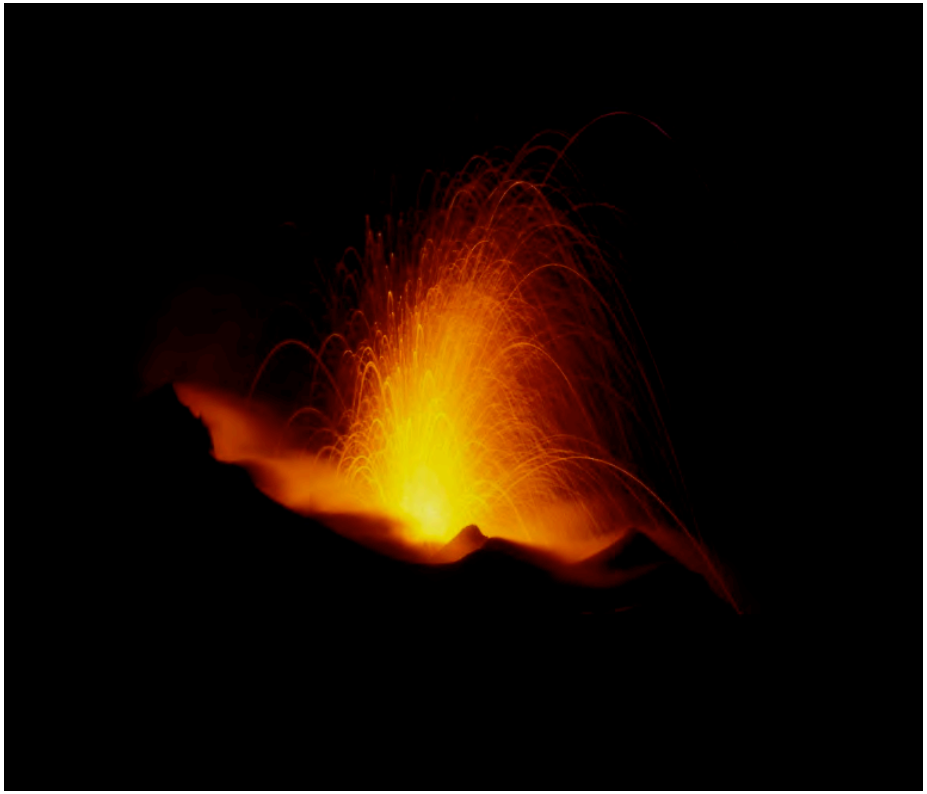
Biomimicry

- Pax Technologies
- Took the calla lily's shape as inspiration for a water mixer
- The shape is designed to assist with the mixing of liquid
- Uses a fraction of the traditional energy requirements

EMERGENCE

Emergence

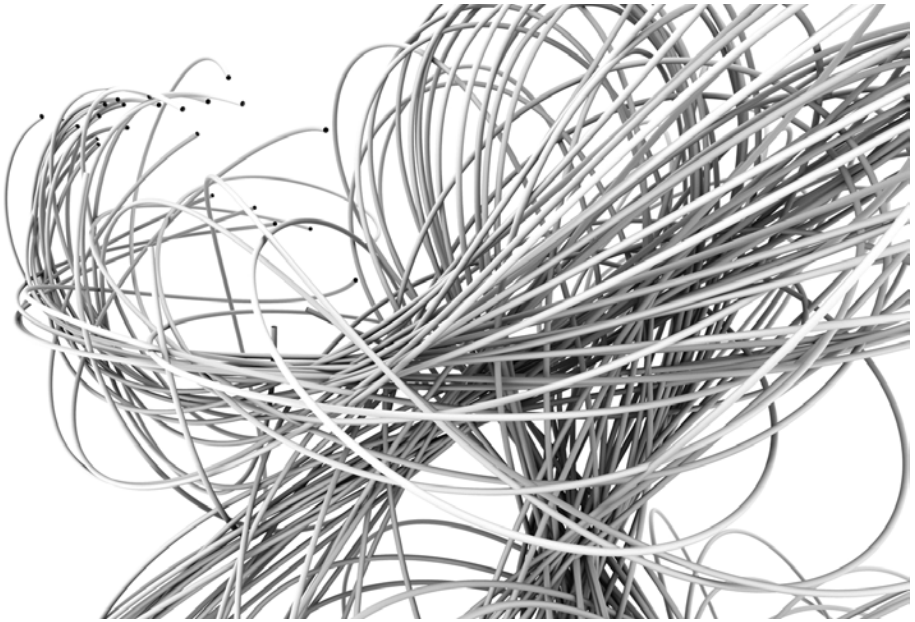
- Marie Jaspart focused on emergence for her thesis
- Emergence is “the arising of the phenomenon in a process”
  - Dessalles, Ferber, Phan, 2006
- Emergent phenomena are unexpected phenomena that are observable at global level when elements of a lower level are interacting.
  -Jaspart, 2010



The eruption of a volcano is an example of emergence.

Emergence

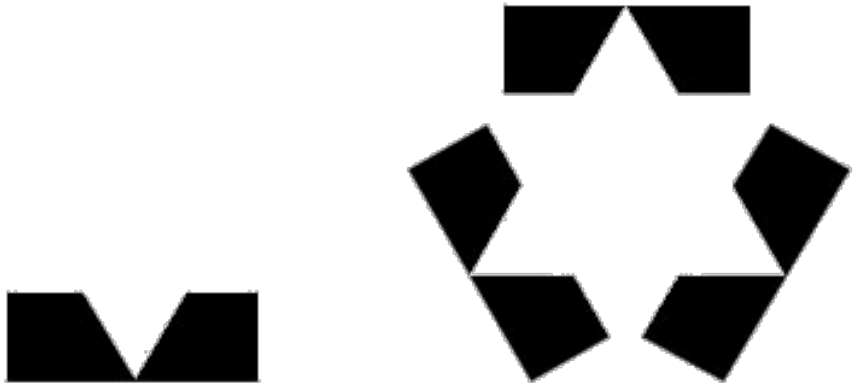
- Emergent phenomena are:
  - Ambiguous (Opportunities for novelty)
  - Unexpected
  - Growth comes from interactions in a complex system (Internet)
- In design, emergence is a perceptual and conceptual process. Oxman, 2002
- Exist in multiple fields, most recently architecture



http://www.syedrezaali.com/blog/?tag=mel

Emergence

- Emergence brings innovation to the design process. This leads to adaptable design systems that intelligently interact and evolve with their environment
- A new form emerges from the combination of this form
- By combining simple elements together you get a new unexpected shape



Gero, 2006

Emergence

- Emergence has been identified in natural systems
- Natural systems are perfect models for Emergence
- Emergence can come from outside natural systems

http://www.paulinewoolley.co.uk/gfx/gallery/emergence/emergence_a.jpg

Emergence

- In emergence we must study the entire system
- Studying one ants is relevant, but studying the global behavior of an ant colony is gives the observer a better perspective
  Stevens, 2002
- Ant Scout is an idea inspired by studying an ant and the colony

http://australianmuseum.net.au/Uploads/Images/10228/OP065_Leaf-cutter%20ants%20at%20w.jpg

Emergence and Biomimicry

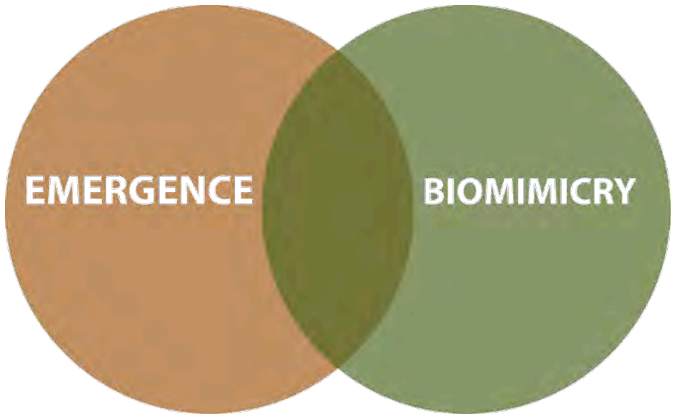
- Systems thinking is an approach

Emergence

Unexpected Results

Emerges from interaction

It does not necessarily refer to nature



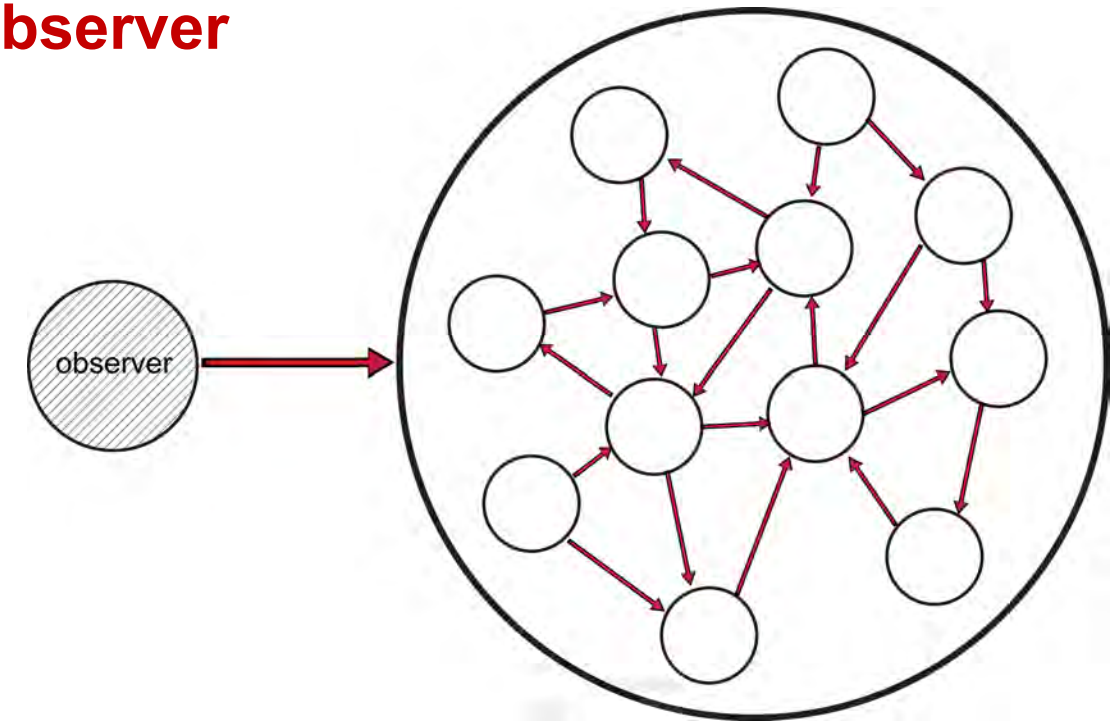
Biomimicry

Expected results

Reproduces or mimics the natural concepts

Emergence and the Observer

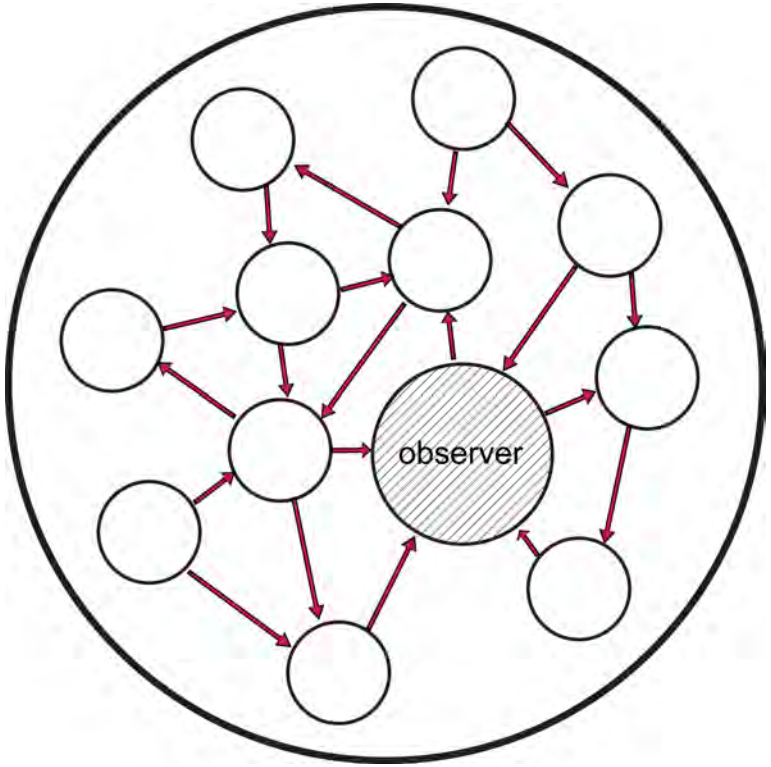
- Notions of the observer and the resulting emergence
- Example of the observer outside of the system
- Weak emergence
- More difficult to adapt ideas to a product



Dessalles, Ferber, & Phan, 2007

Emergence and the Observer

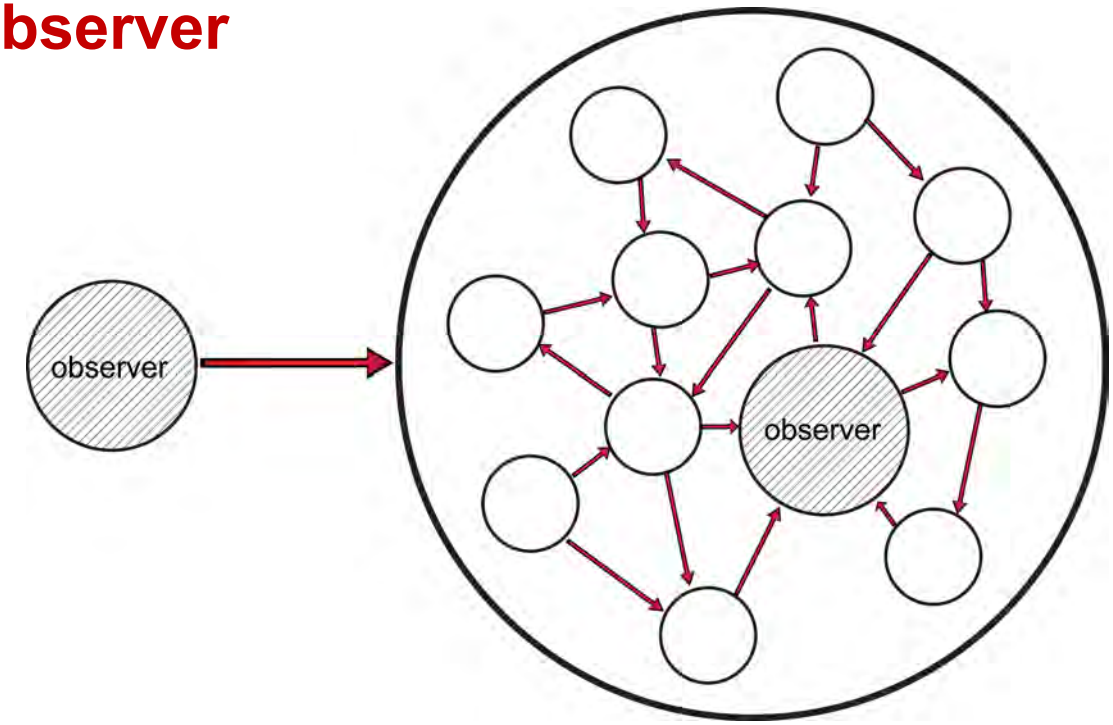
- Notions of the observer and the resulting emergence
- Example of the observer inside of the system
- In this senario the observer must stay objective and not interfere
- Strong emergence
- Somewhat easy to adapt ideas to a product

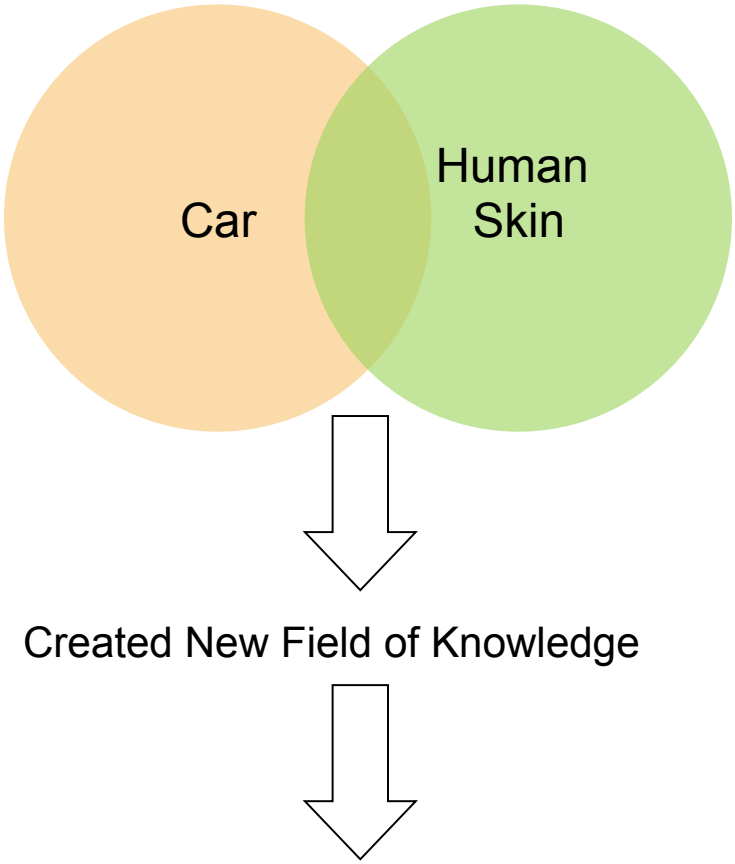


Dessalles, Ferber, & Phan, 2007

Emergence and the Observer

- Example of the observer inside and outside of the system for very close observation
- In this senario the collaborating observers have the best results
- Strongest emergence
- Easiest to adapt ideas to a product




Car
Human
Skin
Created New Field of Knowledge
Infinite Possibilities Where New Elements are Interacting
New Form and Behavior

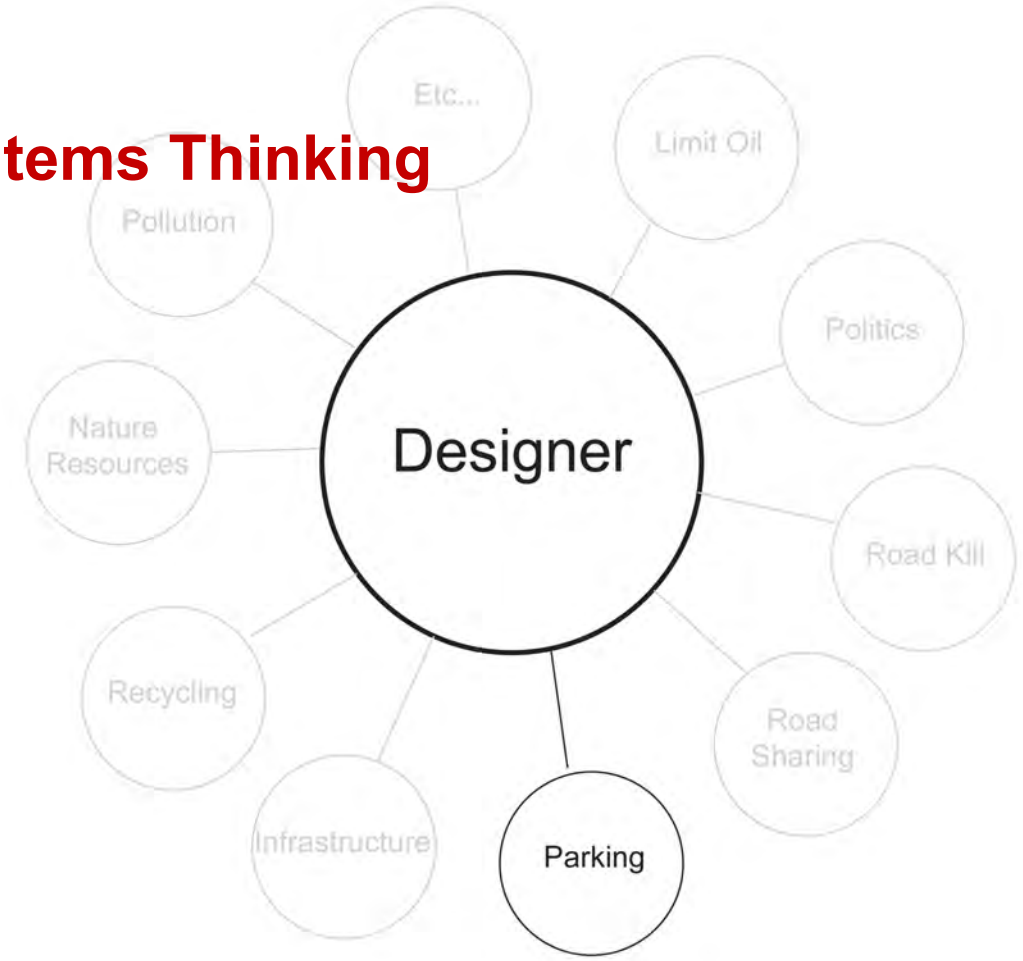
Emergence Product Examples

- BMW Gina car design inspired by human skin
- A flexible shape
- Developed a unique fabric structure
- Can be assembled in a few hours
- Light weight
- Emergent form and behavior


PACE PROJECT

Emergence and Systems Thinking

- Focusing on parking as it relates to vehicle design



Emergence

- Parking lots for churches
- Artist Travis Shaffer

http://travisshaffer.com/project/eleven-mega-churches/

Emergence

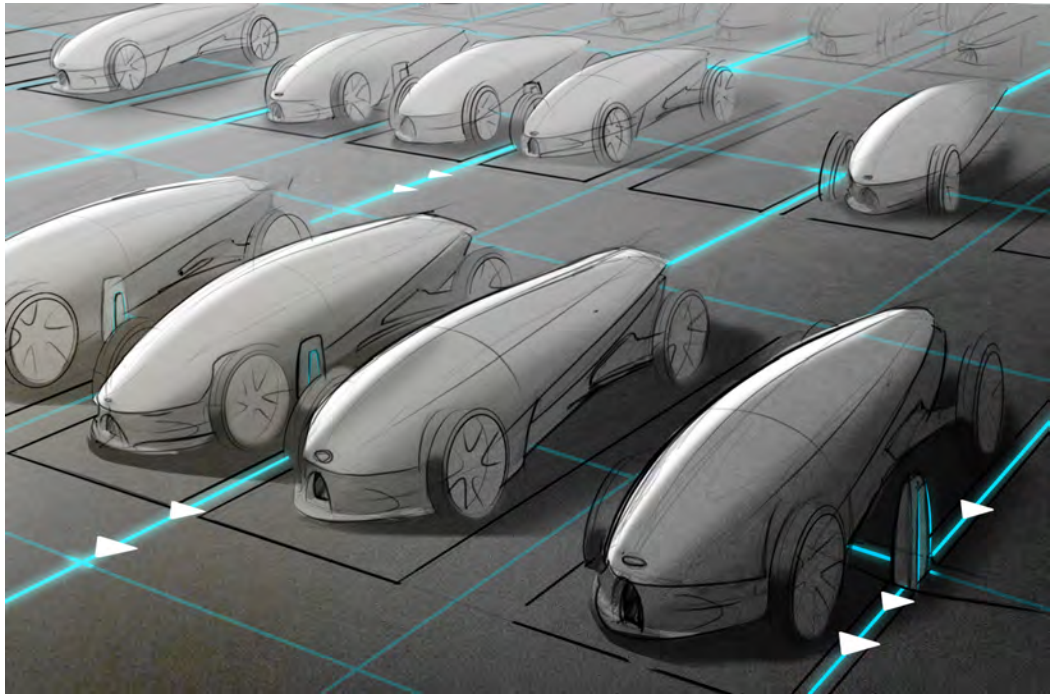
- Walmart Parking Lots
- Artist Travis Shaffer
- When considering parking lots and vehicle design infinite possibilities appear

http://travisshaffer.com/project/fourty-one-walmart-supercenters/

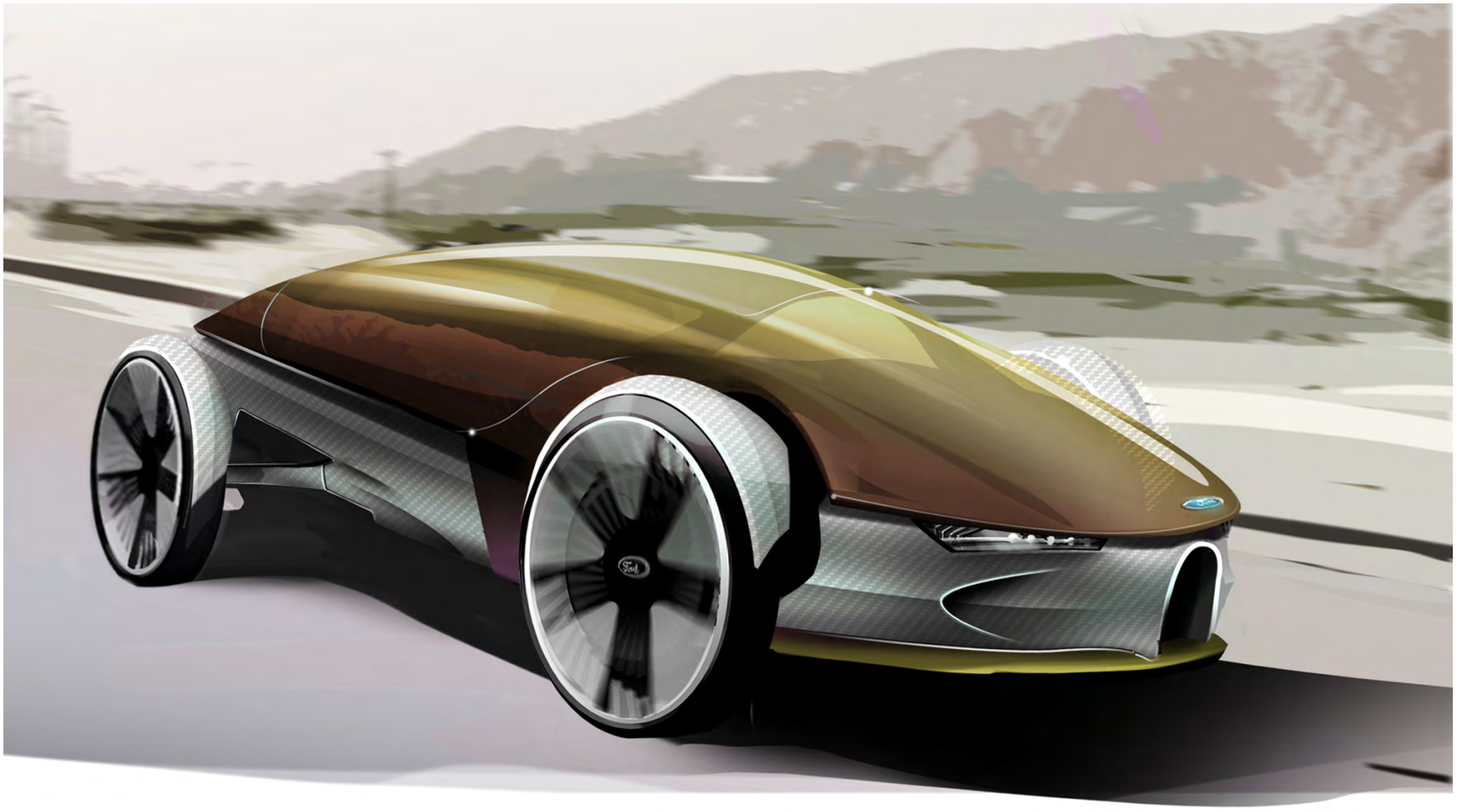
Emergence

- Image of of parking as it relates to land use in the city

Reinventing the Automobile



Greg Martin, Junior 2010



Greg Martin, Junior 2010

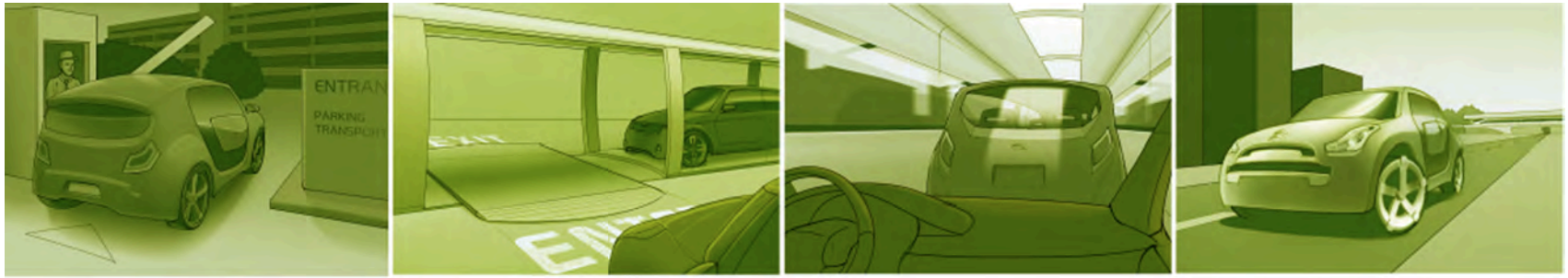
Systems Thinking

- Focusing on trains and education

Peter Tabeling, Junior 2010

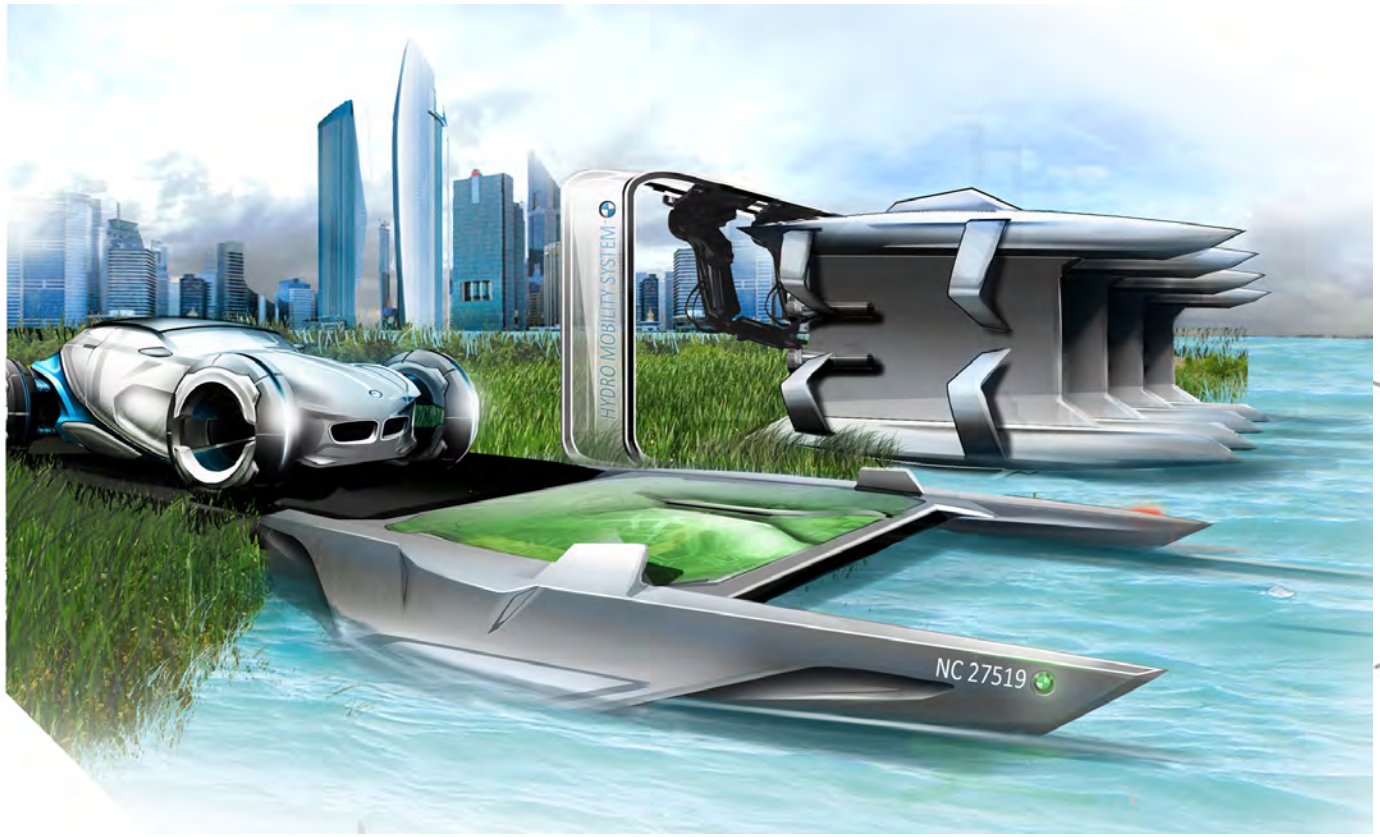
Person

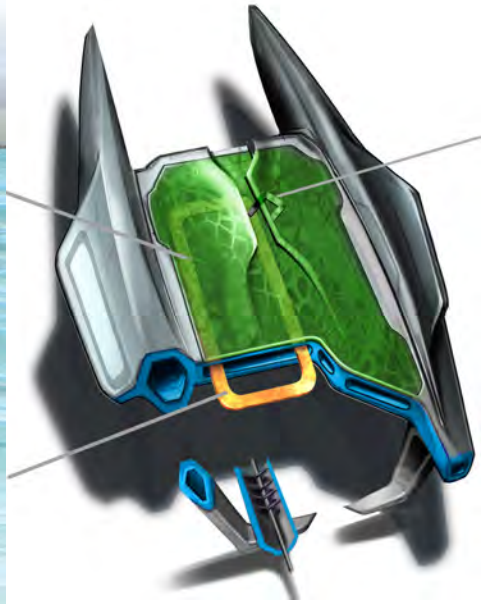
Car



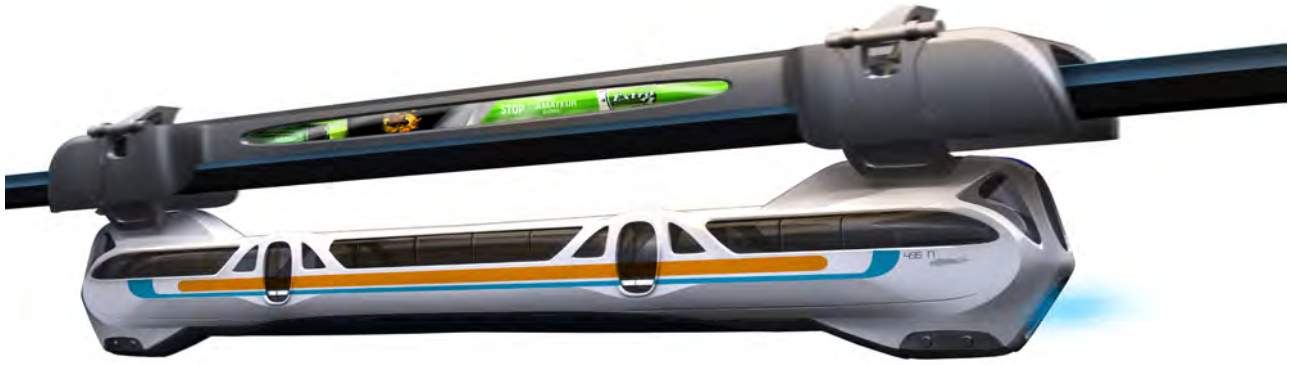
Cargo

Peter Tabeling, Junior 2010

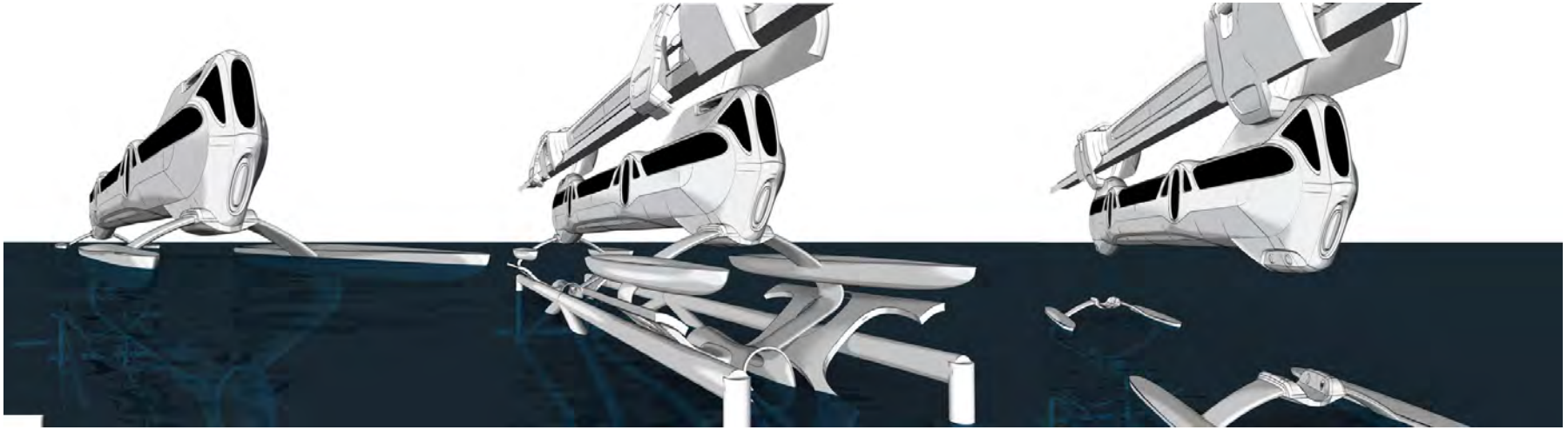




Drew Browder, Junior 2010

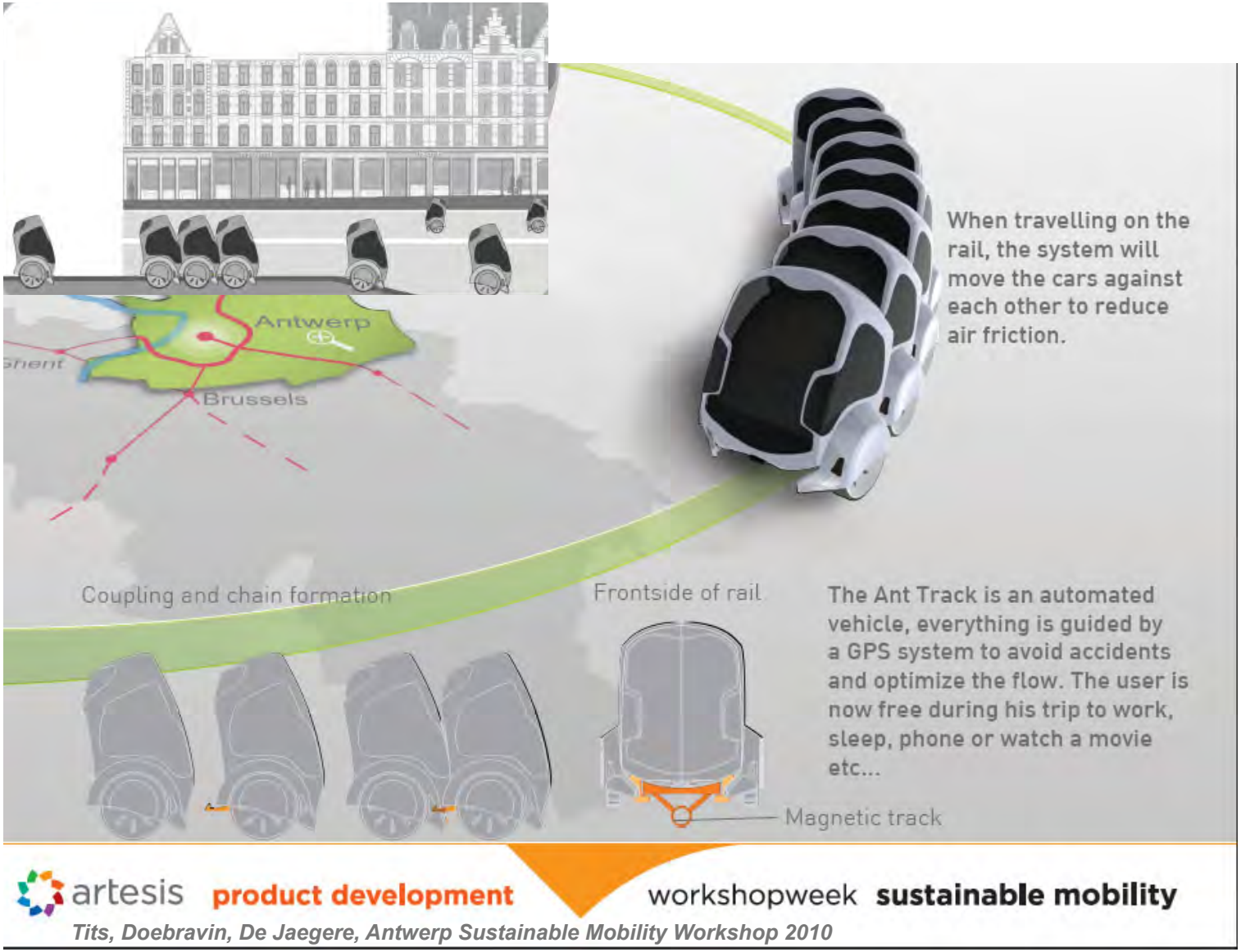


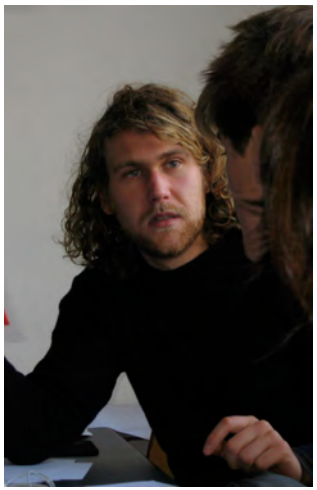
James Robbins, Junior 2010

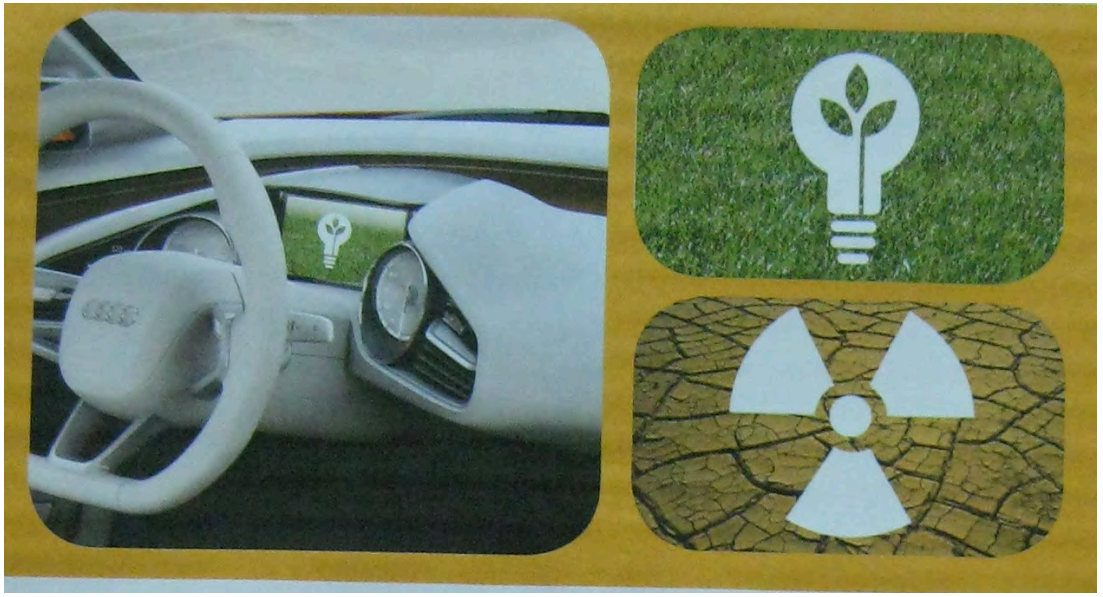


James Robbins, Junior 2010

Antwerp Sustainable Mobility Workshop


Antwerp
Brussels
When travelling on the rail, the system will move the cars against each other to reduce air friction.
Coupling and chain formation
Frontside of rail
The Ant Track is an automated vehicle, everything is guided by a GPS system to avoid accidents and optimize the flow. The user is now free during his trip to work, sleep, phone or watch a movie etc...
Magnetic track
artesis product development workshopweek sustainable mobility
Tits, Doebravin, De Jaegere, Antwerp Sustainable Mobility Workshop 2010






COLLABORATION

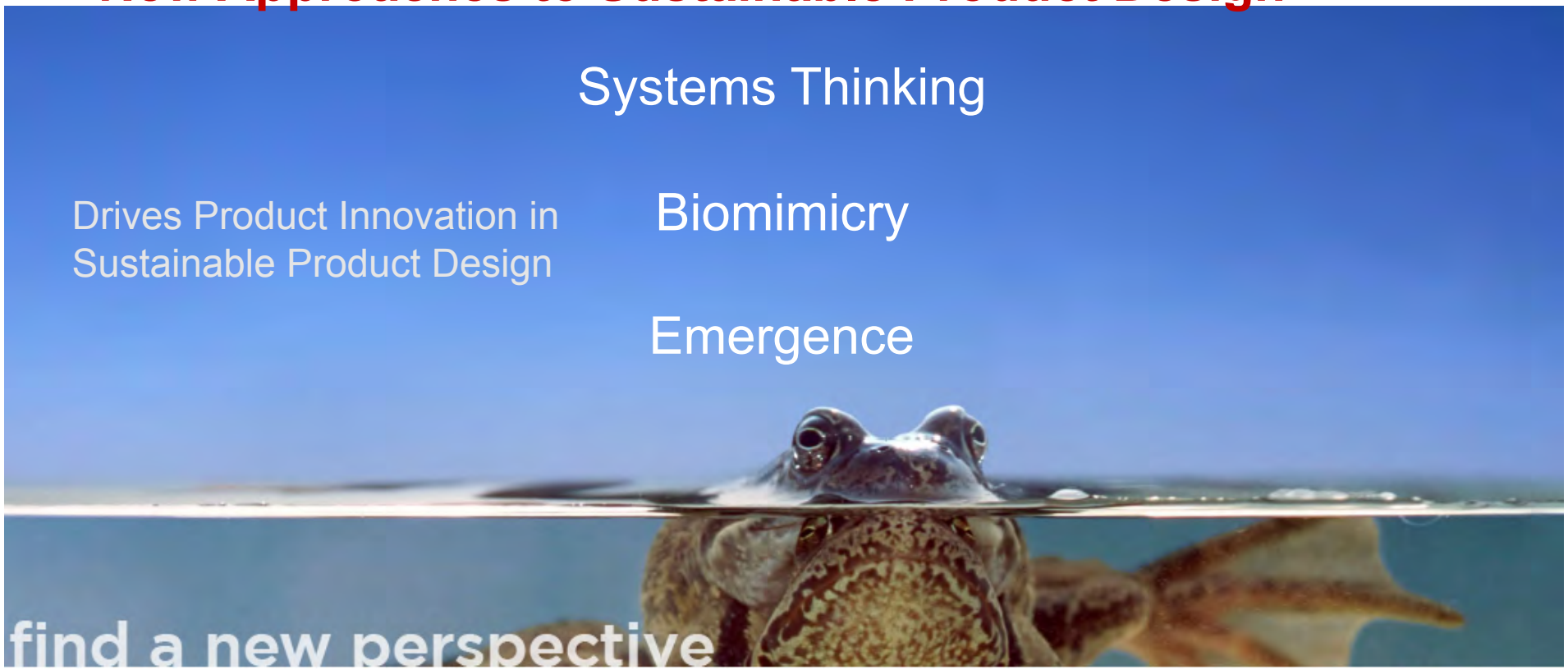
Collaboration

- Solutions for future challenges
- Innovative sustainable products
- Different disciplines
- Engineering and Industrial Design


Gregory Martin
Prudent
Resourceful
Independent
DUO


POLARIS
The Way Out.
HZERO 2020
EMERGENCY TERRAIN VEHICLE
BOUNDLESS
RECOVERY
EXTREME TERRAIN
RAPID
PROJECT STATEMENT
POLARIS HZERO
TRACTION
REAR SUSPENSION
FRONT WHEELS
TUBULAR FRAME
EXIT

New Approaches to Sustainable Product Design



source: http://www.biomimicryguild.com/indexguild.html

Thank You

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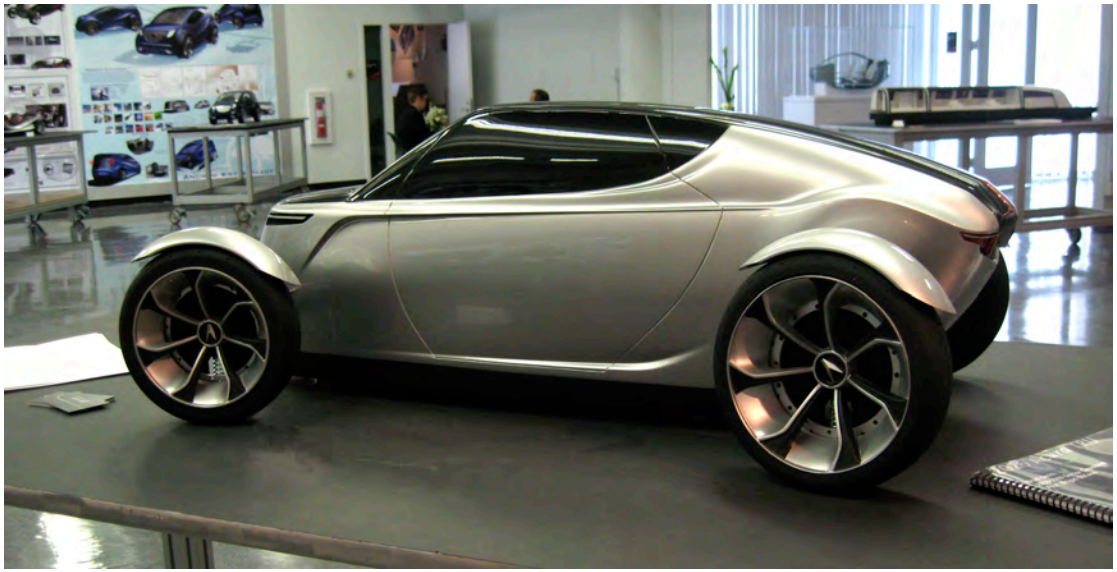
brigid.okane@uc.edu



Brad Smith, UC Graduate 2009

Bibliography and Acknowledgements

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Systems Thinking, Managing Chaos and Complexity, A platform for Designing Architecture, Second Edition, by Jamshid Gharajedahi, (2006) Elsevier Inc.

Travis Shaffer, Artist, http://travisshaffer.com/

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