

What are tools to improve creativity developed by cross-disciplinary scholars?

IDEA GENERATION WITH 77 CARDS: DESIGN HEURISTICS FOR INSPIRING IDEAS

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Background on our project...

Our **objectives** are to explore how designers and engineers use heuristics in generating novel ideas, how these heuristics can be integrated into design and engineering curricula, and how we can assist educators in their integration.

1. The Role of Heuristics in Creative and Innovative Robust Designs: Understanding Both Individual and Team-Based Design

CMMI: 7/2009 – 6/2012

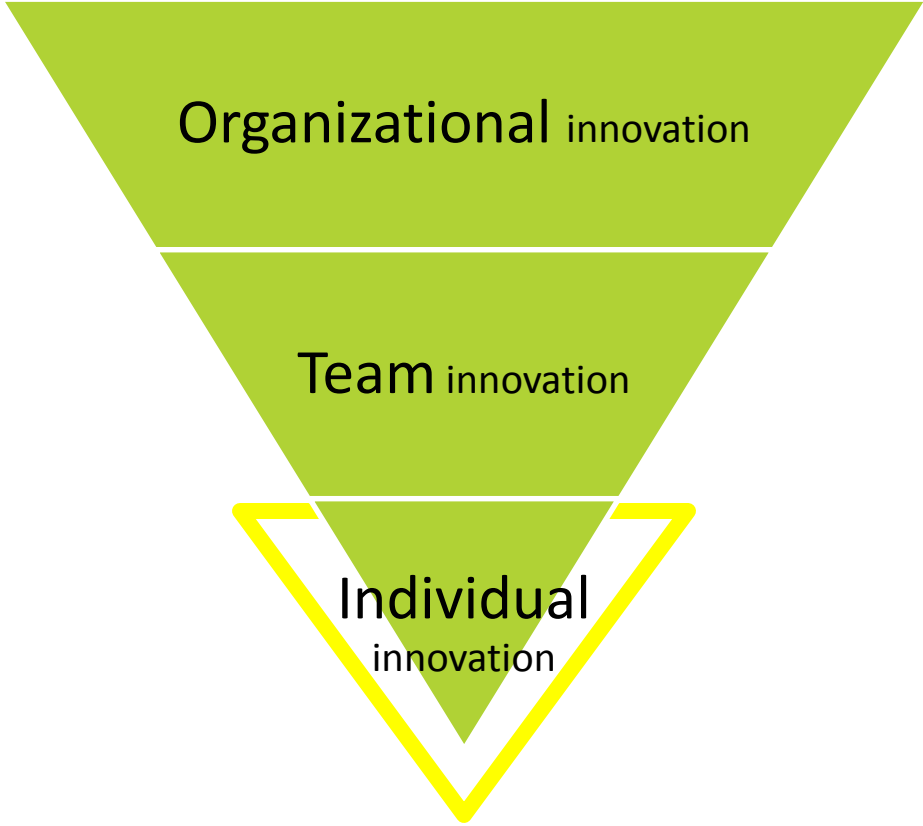
2. Integrating Design Heuristics into Engineering Education as a Pedagogy for Ideation

DUE: 4/2012 – 3/2014

3. Evidence-based Pedagogy in Engineering Education: Design Heuristics for Concept Generation

DUE: 9/2013 – 8/2016



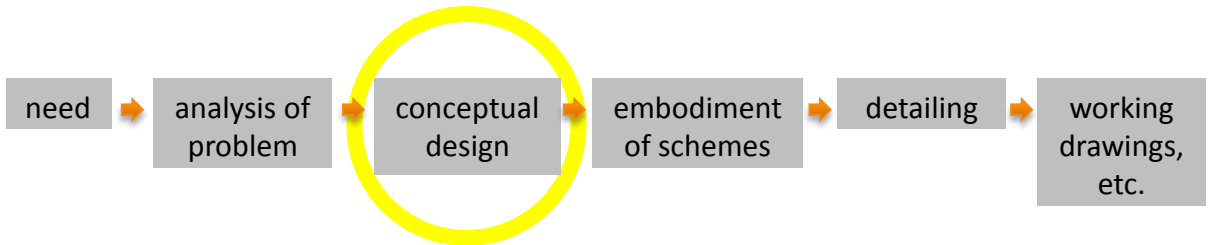


Organizational innovation

Team innovation

Individual
innovation

Product design process



Let's practice conceptual design

Spend 5 minutes generating as many creative ideas as you can and sketching them

Salt & Pepper Design Task

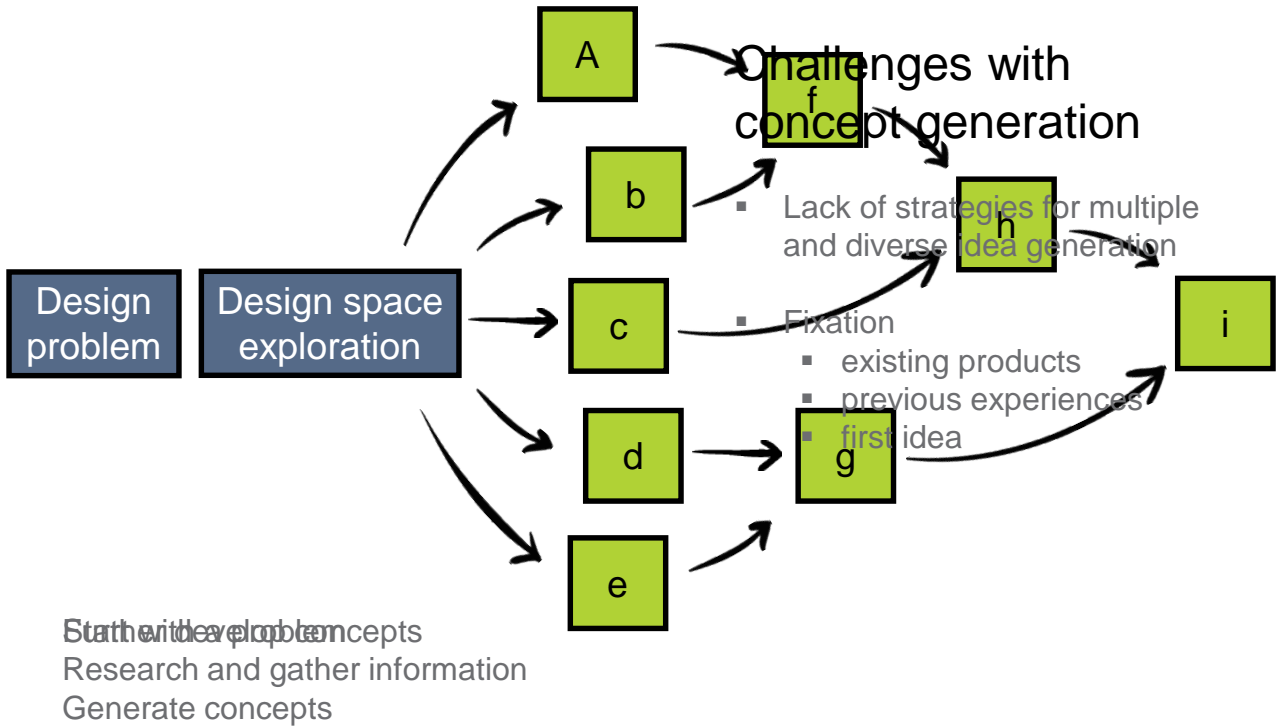
A new restaurant is opening, and it is interested in unique designs. Your task is to design ways to dispense salt & pepper for diners in this restaurant. Focus on new and creative ideas, and generate as many as you can.

Share ideas and reflect

What ideas did you come up with?

How did you generate the concepts?

What challenges did you face in trying to be creative?



Start with a problem
 Research and gather information
 Generate concepts

How do we promote
Successful Idea
generation?

A

b

Many not empirically derived or validated

Can be very general, or very specific

d

e

Existing strategies

- Brainstorming
- Brainwriting
- Lateral Thinking
- TRIZ
- Six Thinking Hats
- **S**TEPNarrow design space
- Analogical Thinking
- Morphological Analysis
- Synectics
- IDEO™ Method Cards
- Whack Pack

Cognitive heuristics

Reasoning processes that do not guarantee the best solution, but often lead to potential solutions by providing a short-cut.

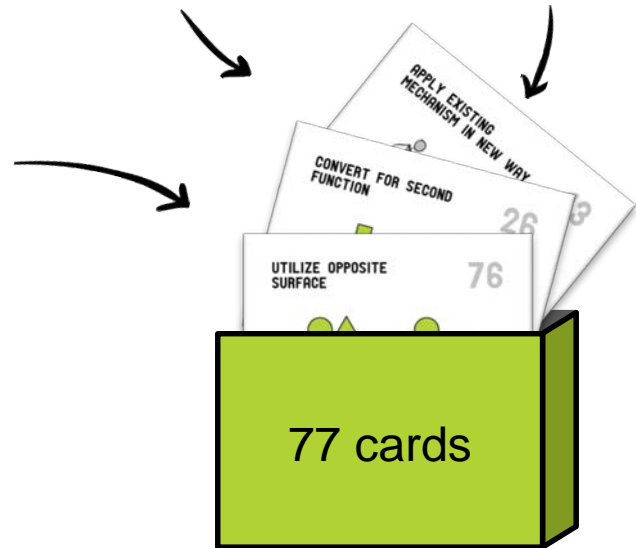
Case Study with a Professional Designer

Award-winning Products

Think-aloud Experiments

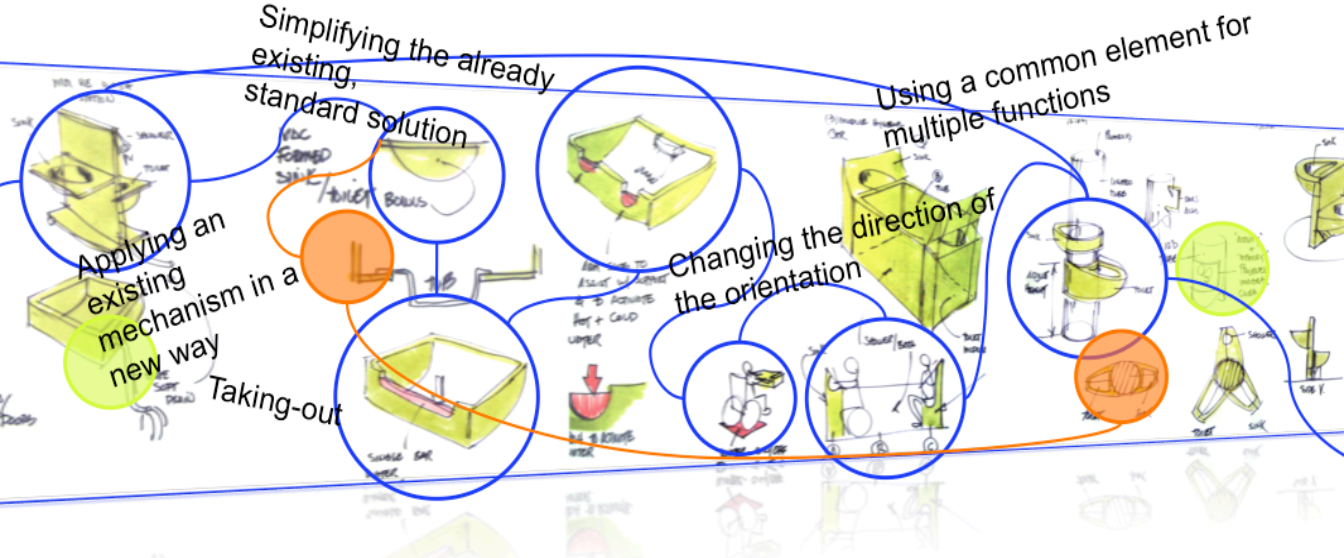
Design Heuristics

Concept modifiers that quickly lead to a potential solution, providing the opportunity for a novel design to occur.























Heuristic extraction from a case study

over 200 concepts



Heuristic extraction from product analysis

1. Add a portability feature to existing solutions	2. Add motion to the product as a playful attribute (push/pull, etc.)	3. Add to existing product	4. Align junctions according to different demographics	5. Adjust junctions by moving the product's parts	6. Align components on the same base or around a center	7. Allow user to reorient	8. Abstract using human features for a approachable	over 400 products	
 <p>This lightweight porcelain helps to make this product easier to lift. Attaching a handle also makes it easy to carry. [1]</p>	 <p>This vacuum is done by a robotic floorvac which cleans rooms by itself throughout the day. [3]</p>	 <p>This walkie-talkie device clips on to a biker's helmet to allow bikers to communicate safely and comfortably while riding. [5]</p>	 <p>This laptop is designed for children living in developing countries. The size, colors, and interface all contribute to the playfulness of the product. [7]</p>	 <p>A sliding hinge attached to the back pushes the screen to the forefront for viewing entertainment media. [9]</p>	 <p>This adjustable shower caddy organizes bathroom products by aligning two shelves on the same base. [11]</p>	 <p>This activity gym converts to a toddler keyboard and chair by flipping 90 degrees. [13]</p>	 <p>This dish soap dispenser is designed to mimic a human body with a head, neck, and body. [15]</p>	 <p>This stool takes the seat from a bicycle and applies it to a bar stool. [17]</p>	 <p>This product functions as a wellness tracker in the form of a wireless device clipped to clothing during exercise. [19]</p>
 <p>This lantern can be used as a table lamp, as well as a light that can be carried to different locations. [2]</p>	 <p>This alarm clock is designed to jump off a table and move. Two wheels on the sides allow it to roll while emitting a siren alarm. [4]</p>	 <p>This product attaches to an existing dining chair to turn it into a high chair for children. Using spring-loaded arms, it can securely hold any dining chair. [6]</p>	 <p>With laces extending to the soles, these shoes respond to the unique movements essential to the urban sport Le Parkour. [8]</p>	 <p>This design features a folding top that flips up or down, allowing the table to be used as room dividers. [10]</p>	 <p>This design allows for six audio devices to be shared at one time. All the components are collected in the center, and the six input jacks are placed around it. [12]</p>	 <p>This product provides three seating options. By turning the chair seat upside down, a baby seat becomes a toddler seat or recliner. [14]</p>	 <p>These shakers hug each other, abstracting human figures. The black and white colors also suggest balance and harmony. [16]</p>	 <p>This desk organizer uses brush bristles to hold pens, pencils, and business cards. [18]</p>	 <p>This vegetable peeler functions as an extension of the hand. It is slipped onto the finger like a ring. [20]</p>

Heuristic extraction from think-aloud experiments

over 250 concepts

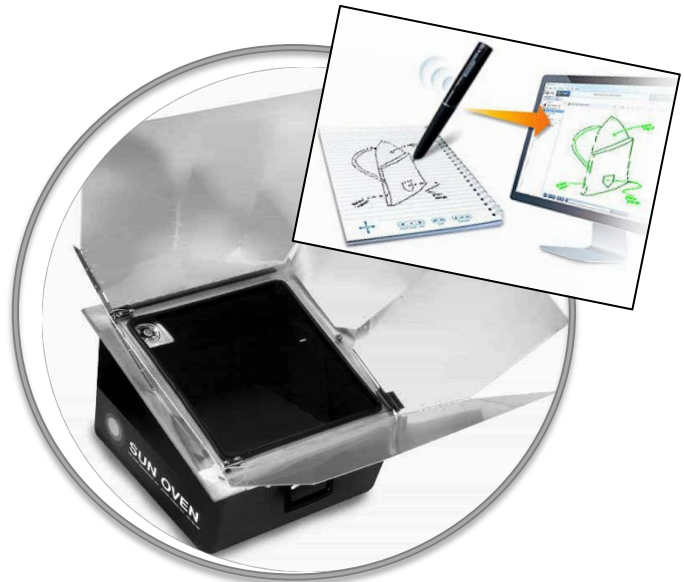
52 diverse participants

Over 50 hours of data (25 min task,
30 min post-interview)

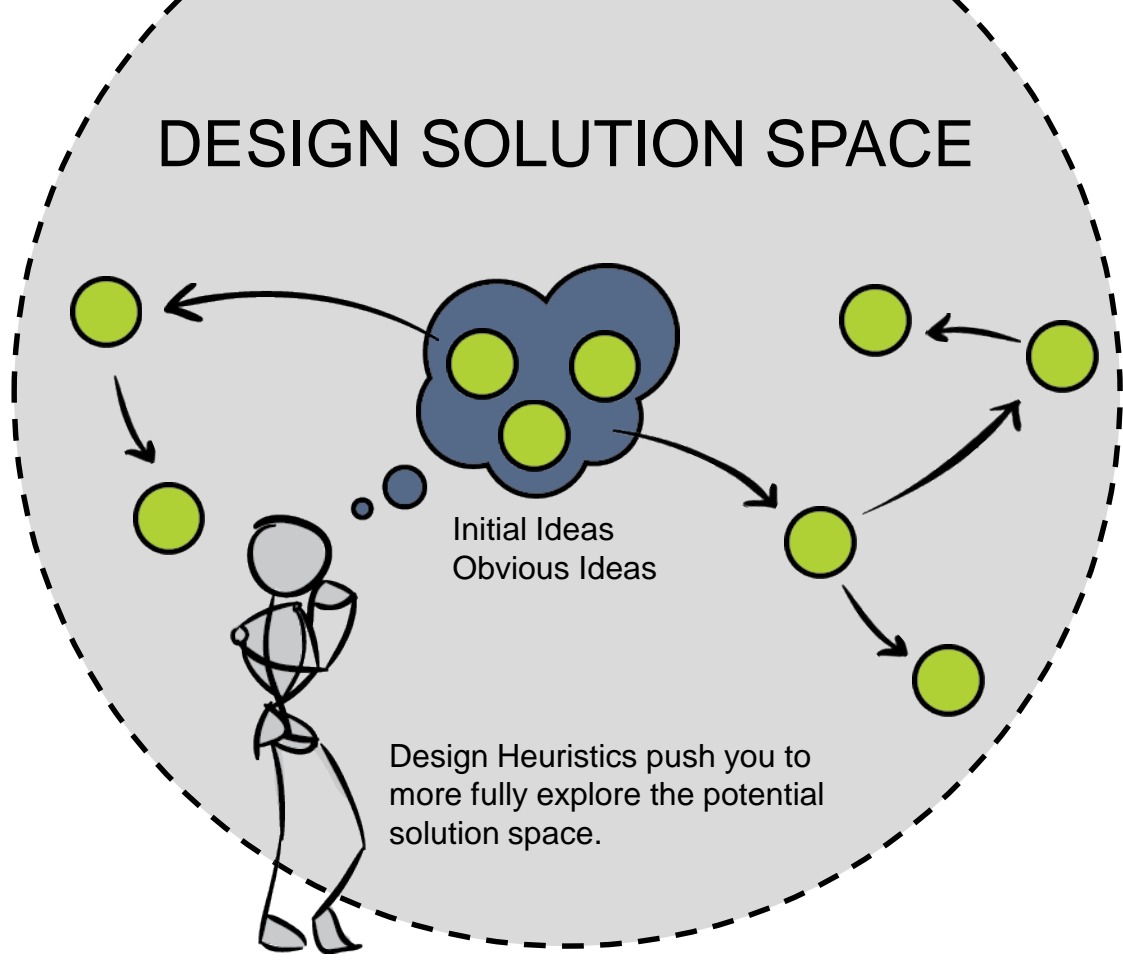
Design task and interview protocol
developed and piloted

Design Problem

Design a solar powered cooking
device

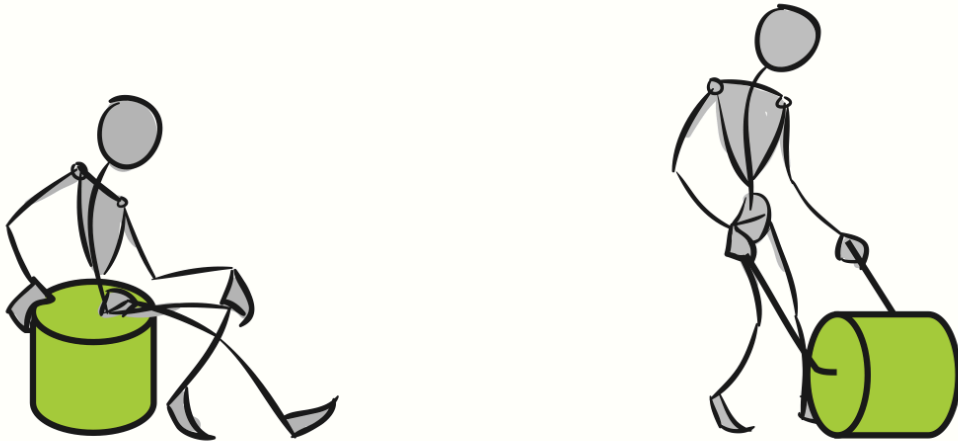


DESIGN SOLUTION SPACE



APPLY EXISTING MECHANISM IN NEW WAY

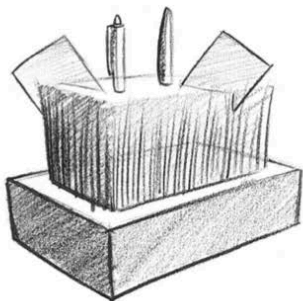
13



Consider whether existing products or their components can fulfill the desired function. This can facilitate reuse of existing products, make the design process more efficient, and expand the pool of options.

APPLY EXISTING MECHANISM IN NEW WAY

13



PRATONZOLO

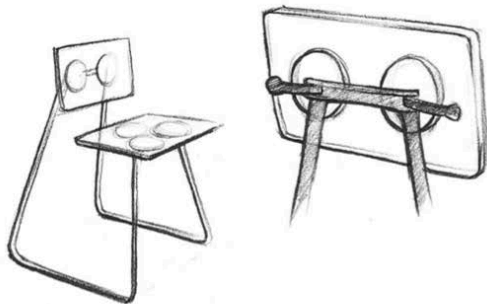
Max Battaglia

This desk organizer uses brush bristles to hold pens, pencils, and business cards.

WANTUZ

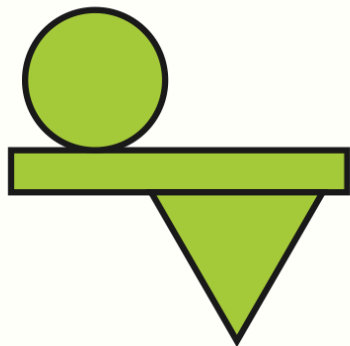
Reha Erdogan

Hand vacuum cups are used to transport large sheets of glass. Here, they are used to hold the seat and back of this chair in place.



UTILIZE OPPOSITE SURFACE

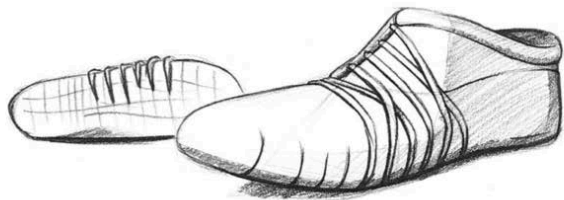
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Create a distinction between exterior and interior, front and back, or bottom and top. Make use of both surfaces for complimentary or different functions. This can increase efficiency in the use of surfaces and materials, or facilitate a new way to achieve a function.

UTILIZE OPPOSITE SURFACE

76



980 TATOU

Annika Luber

The laces wrap around the bottom of this shoe and connect with the sole.

FARALLON CHAIR

fuseproject

The back side of this chair has a pocket for storage.



Practice with Design Heuristics

Use the 5 Design Heuristic Cards provided to you
Spend 5 minutes using the cards to help generate ideas

Salt & Pepper Design Task

A new restaurant is opening, and it is interested in unique designs. Your task is to design ways to dispense salt & pepper for diners in this restaurant. Focus on new and creative ideas, and generate as many as you can.

Share ideas and reflect

Can you share some of your solutions based on the Design Heuristics you used?

How did the Design Heuristic cards impact your approach to generating ideas?

How did you feel about your ability in generating creative ideas comparing both ideation sessions?

Implementation studies

How do Design Heuristics impact idea generation approaches and design outcomes?

- Diversity
- Creativity
- Quantity
- Practicality
- Elaboration

Participants

- Middle and high school students
- Pre-engineering students
- Engineering Undergraduates
- Design Undergraduates
- Engineering Graduates
- Engineering Practitioners

Contexts

- In-class design tasks
- Controlled design tasks
- Longitudinal projects
- Professional settings
- New product lines
- Existing product lines

Design Heuristics across disciplines

Design Heuristics were empirically derived from tangible products and designers generation processes

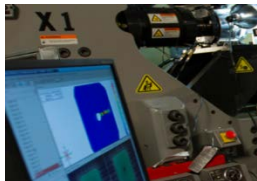


What about **other disciplines**?
How can design heuristics be used **across contexts**?

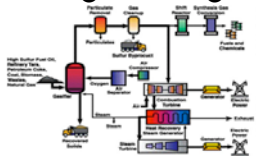
Mechanical Engineering



Aerospace Engineering



Chemical Engineering



Electrical Engineering



Biomedical Engineering



Civil,
Environmental and
Sustainable
Engineering



Student Feedback

After using Design Heuristics in the classroom, here are things that students say:

“The heuristic cards **provided a lot of options and directions** to develop solutions. The concepts presented led to new ideas. The examples helped me visualize and better understand the concepts.”

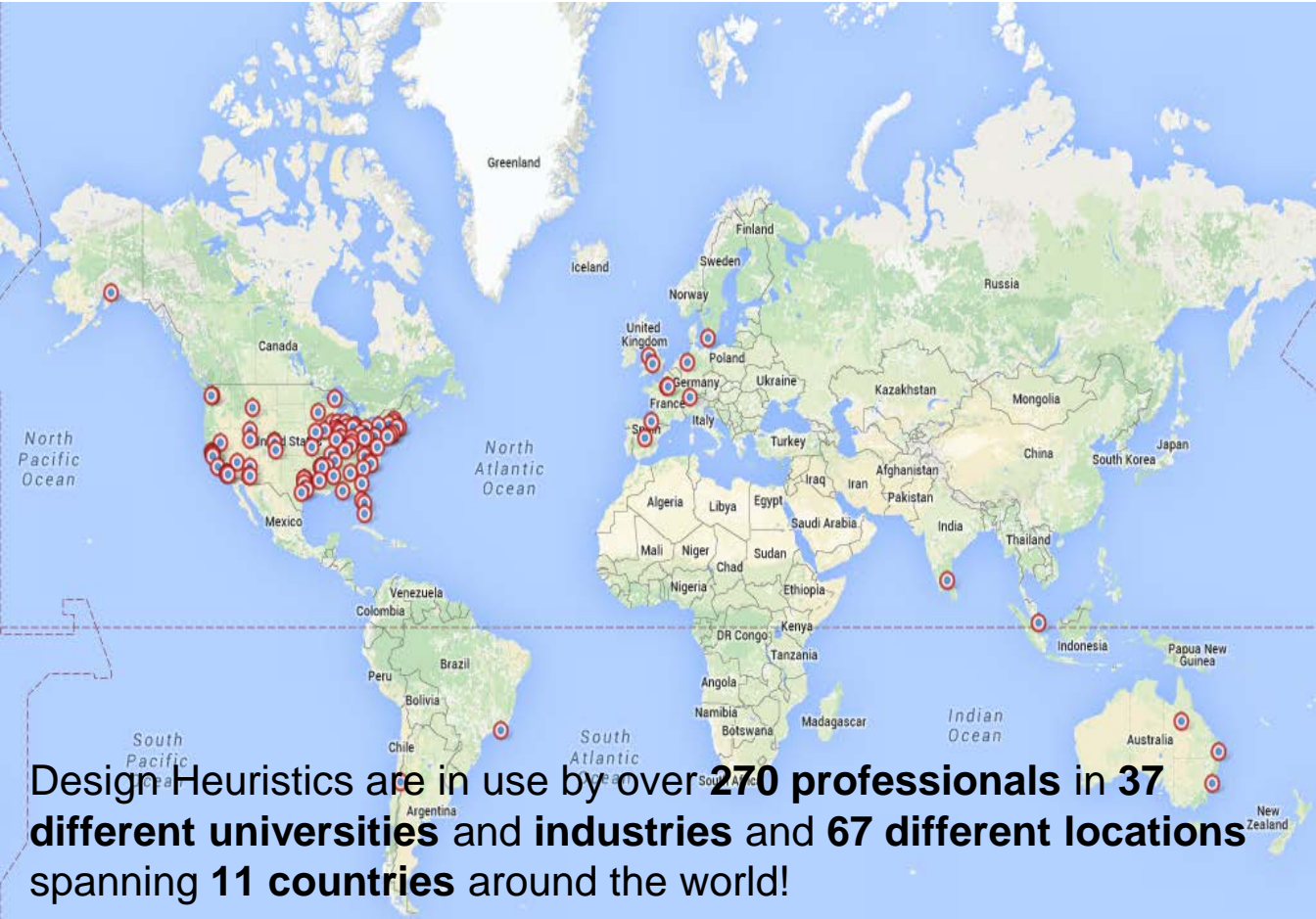
“Design heuristics really helped a lot. **I thought of features that I did not even think could be taken into consideration before.**”

“The cards made me think **outside the basic characteristics** that I would have incorporated into my designs. The examples on the back were great, and I loved the general diagrams on the front side because it ensured that **I was not fixated** on the examples.”

Discussion

How might the design heuristics impact **mood**, **cognition**, **decision making** and **team dynamics**?

How might **mood**, **cognition**, **decision making** and **team dynamics** impact using idea generation tools, such as design heuristics?



Incorporating Design Heuristics into engineering and design courses

Design Heuristics Lesson Plans

Lesson 1

Idea Initiation

Lesson 2

Idea Transformation
and Development

Lesson 3

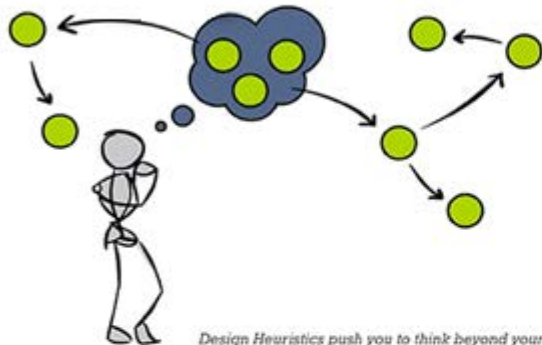
Subcomponent
Design (Functional
Decomposition and
Recombination)

Individual / Solo

Teaming

DESIGN HEURISTICS

STRATEGIES TO INSPIRE IDEAS



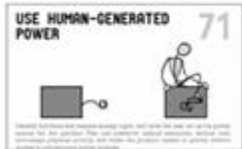
Design Heuristics push you to think beyond your initial ideas

Designers want to create many, varied concepts to choose among. Design Heuristics provide **77 specific strategies** to help you generate novel designs that are different from each other, leading to innovative concepts.

www.designheuristics.com

Lesson PowerPoints, Idea sheets,
Research articles, Sample cards

the Cards



Each card includes a description of the heuristic, an abstract image depicting the application of the heuristic, and two sketches that show how the heuristic is evident in consumer products.

WATCH the VIDEO



Design Heuristics are easy to use with just a little instruction. Download this podcast for a short video covering the "why" and how of using Design Heuristics to generate ideas.

MEET our TEAM



Our team consists of researchers from diverse disciplines, including Industrial Design, Engineering, and Psychology.

THANK YOU!

www.DesignHeuristics.com

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