Co-funded by the
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STEM PROJECT TRAINING and STEM & MAKERS FESTIVAL/EXPO. OF THE ERASMUS+ KA2 PROJECT

 # 598367-EPP-1-2018-1-SE-EPPKA2-CBHE-JP

"INTEGRATED APPROACH TO STEM TEACHER TRAINING", STEM

24-28 November 2022

Nevsehir, Turkey

UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH

Design Heuristics for creative ideation

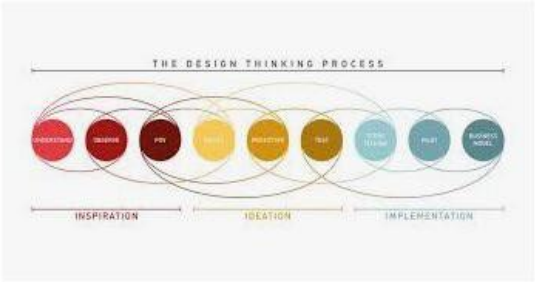
Keelin Leahy

University of Limerick

Ireland

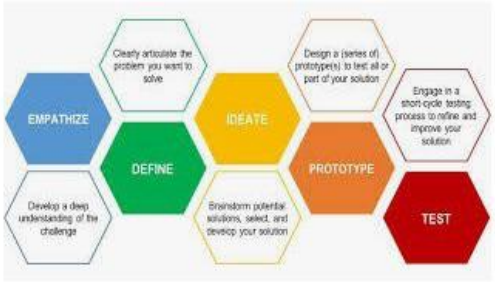
CREATIVITY AND DIVERSITY
DURING THE IDEA GENERATION PHASE
CAN LEAD TO INNOVATION IN STEM

Problem / Project-based context…

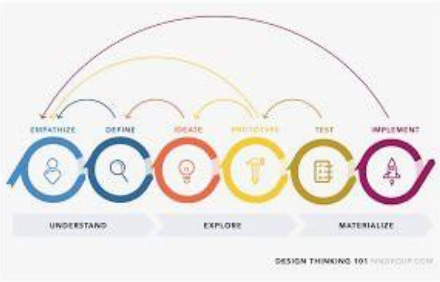


Design Thinking: A Quick Overview ...
interaction-design.org

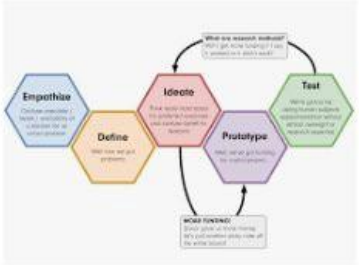
The Design Thinking Move...
medium.com



Design Thinking | Oceanit
oceanit.com



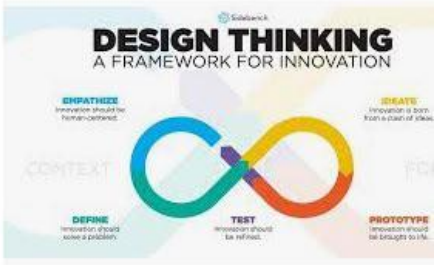
What is Design Thinking? (And What Are ...
medium.com



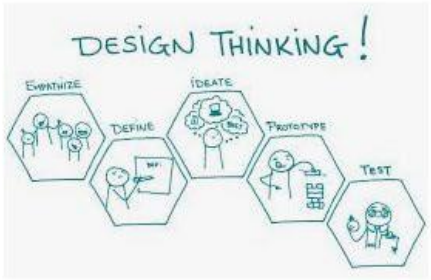
A Response to the Stanford d.school'...
blog.usejournal.com

Design Thinking
citi.illinois.edu

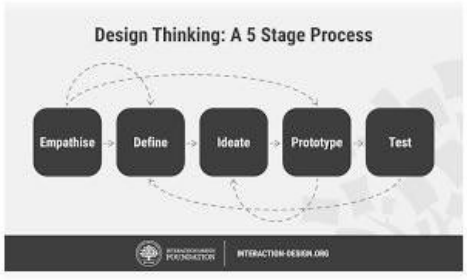
What is Design Thinking? | Interaction ...
interaction-design.org



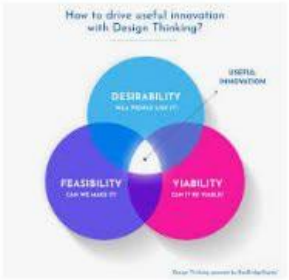
Design Thinking Isn't Just For Your ...
productcoalition.com



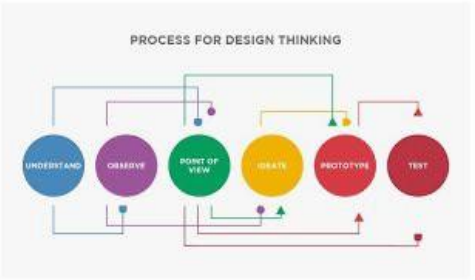
Design Thinking For Software Developers ...
medium.com



5 Stages in the Design Thinking Process ...
interaction-design.org



implement Design Thinking ...
baybridgedigital.com



Design Thinking for Startups – Hacker Noon
hackernoon.com

Design
navigate

Natural Idea Generation

Activity 1

For 10 minutes generate ideas for the following design problem:

Squashed tomato challenge

The problem: In Nepal, many farmers living on the mountainside grow fruit and vegetables, including tomatoes. To earn a living they need to sell these at the local market. The problem is getting to market involves a long, dangerous walk down the mountain side and over a river, at the end of which the tomatoes may well be a bit squashed.

The challenge: To design, [build and test] a way of transporting tomatoes down a mountain

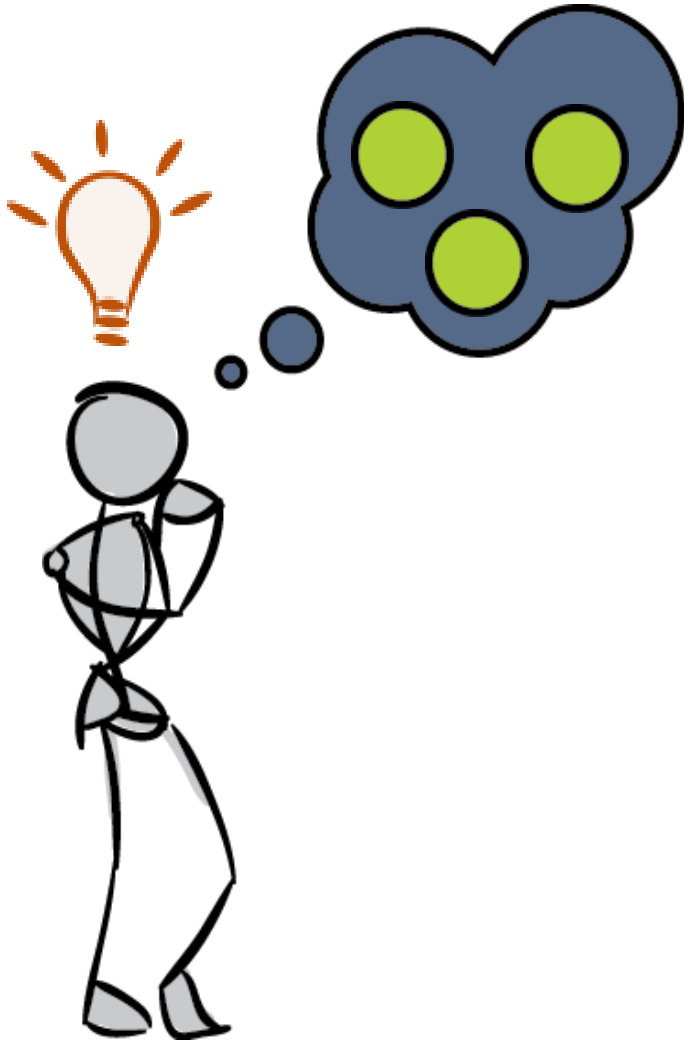
SHARE IDEAS & REFLECT

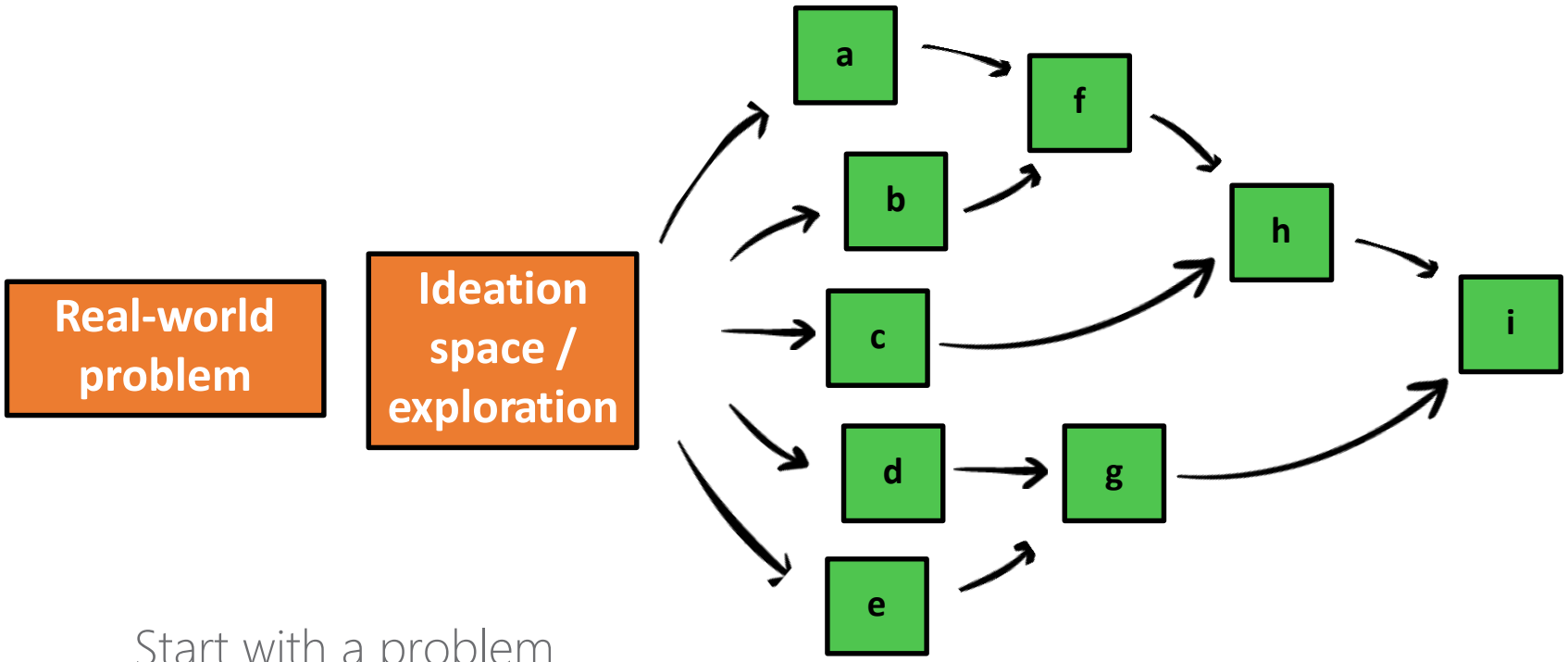
How many ideas did you generate?

How did you generating ideas?

What was easy / difficult in solving this problem?

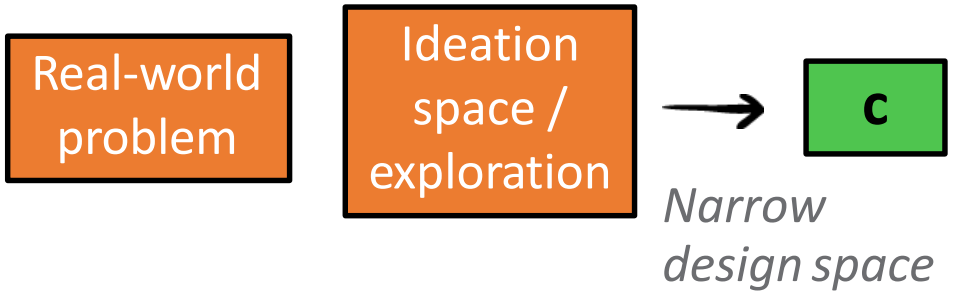
IDEA GENERATION LEADs TO INNOVATION



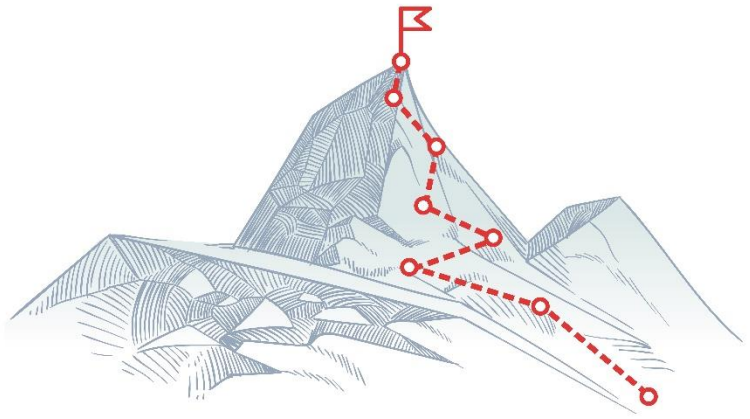


Start with a problem
Research and gather information
Generate ideas
Further develop ideas

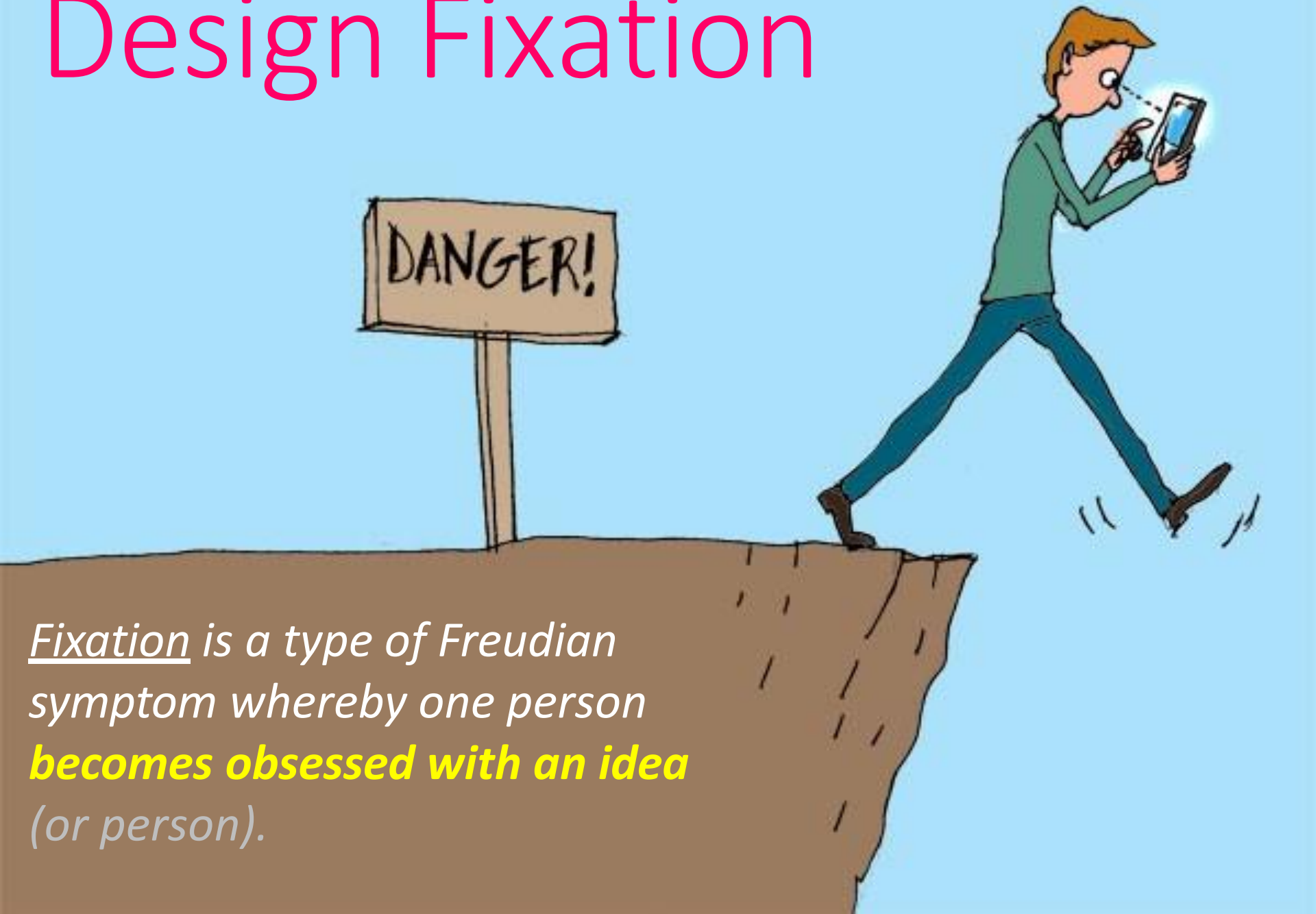
Challenges - Creative Idea Generation



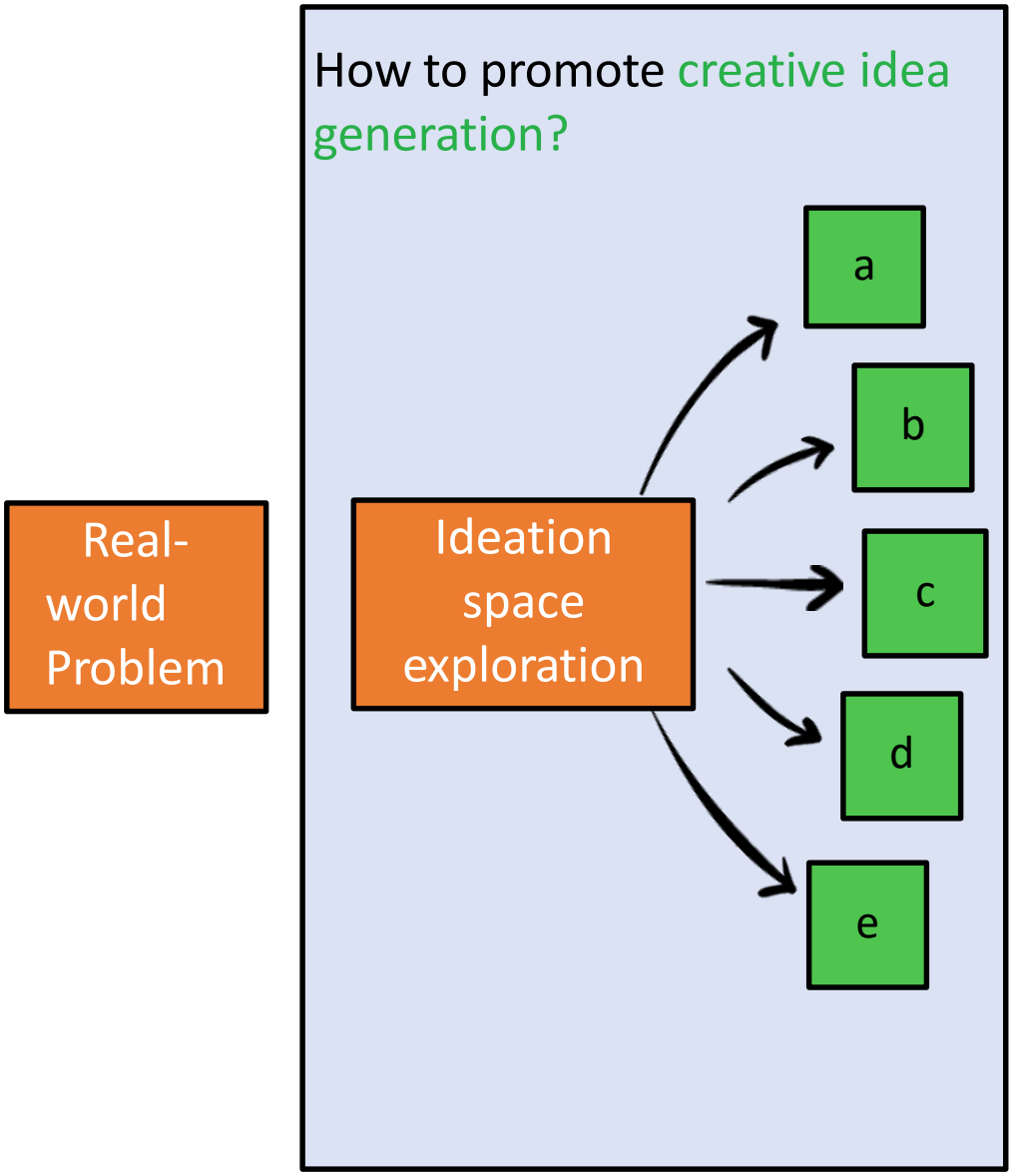
- Lack of strategies for multiple and diverse idea generation
- Fixation
  - existing products
  - previous experiences
  - first idea



Design Fixation



<u>Fixation</u> is a type of Freudian symptom whereby one person ***becomes obsessed with an idea*** *(or person).*



Creative Ideation fostered via:

- Design Heuristics
- SCAMPER
- 16 Squares
- Train of Thought
- Likes / Dislikes
- Ask the right questions
- Brainsketching
- Idea grid
- Random inputs
- Biomimicry

Many not empirically derived or validated

Too general, or too specific

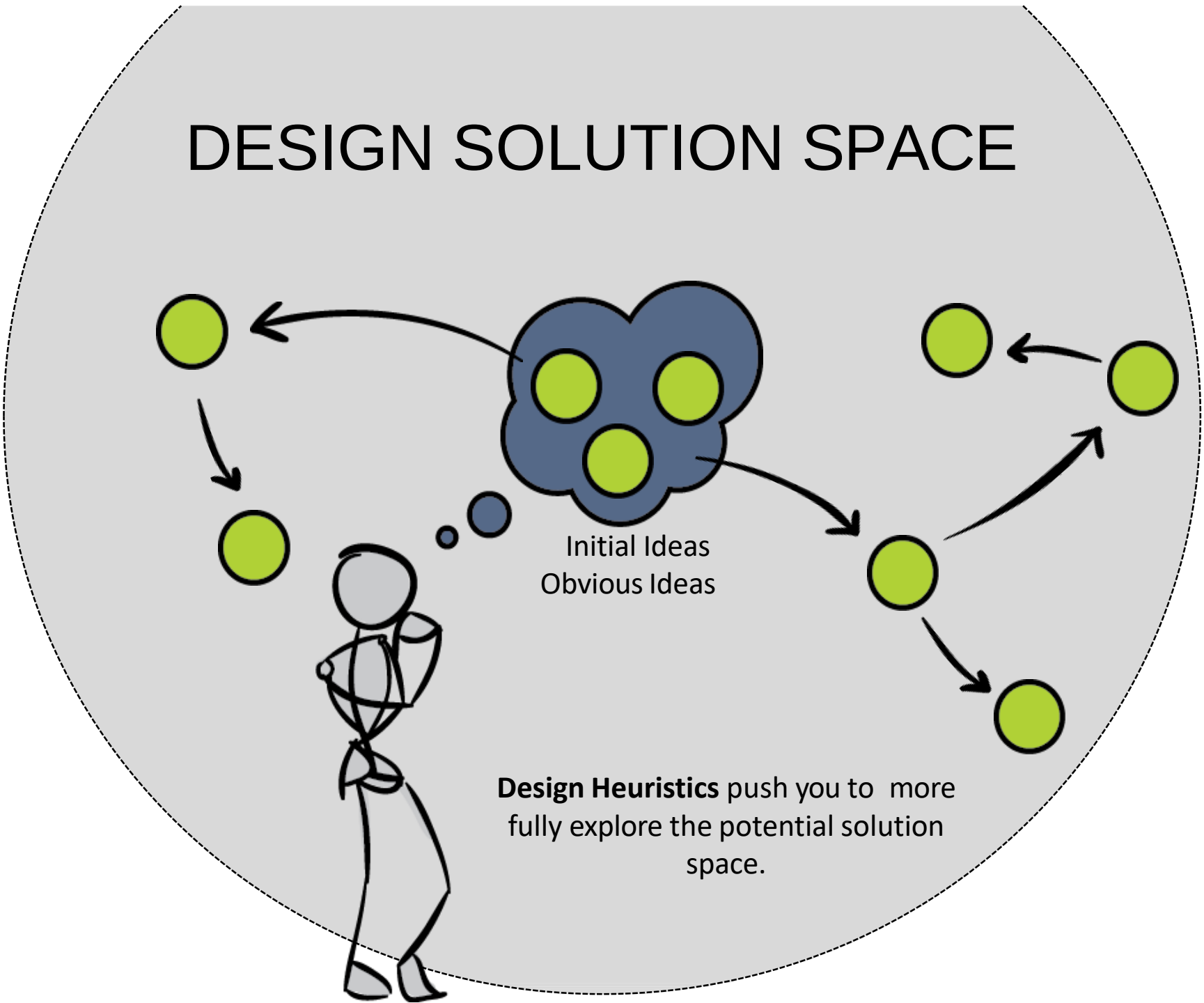
Cognitive heuristics

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

Design heuristics

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

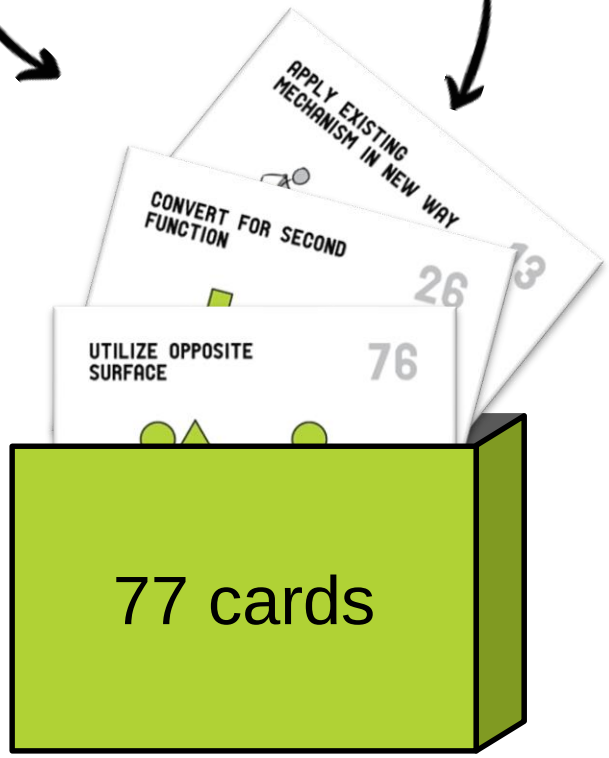
DESIGN SOLUTION SPACE



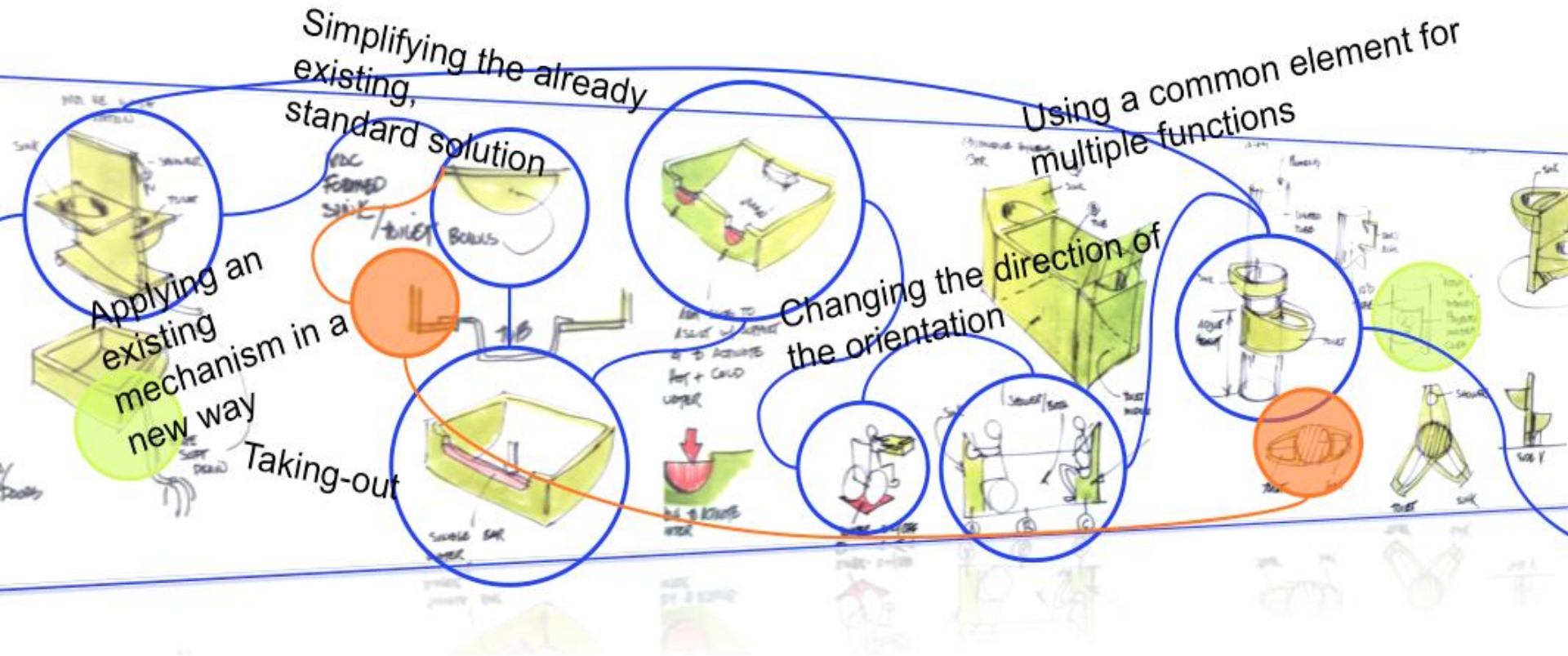
Award-winning Products

Think-aloud Design Task

Professional Designer



Heuristic Extraction from a Case Study



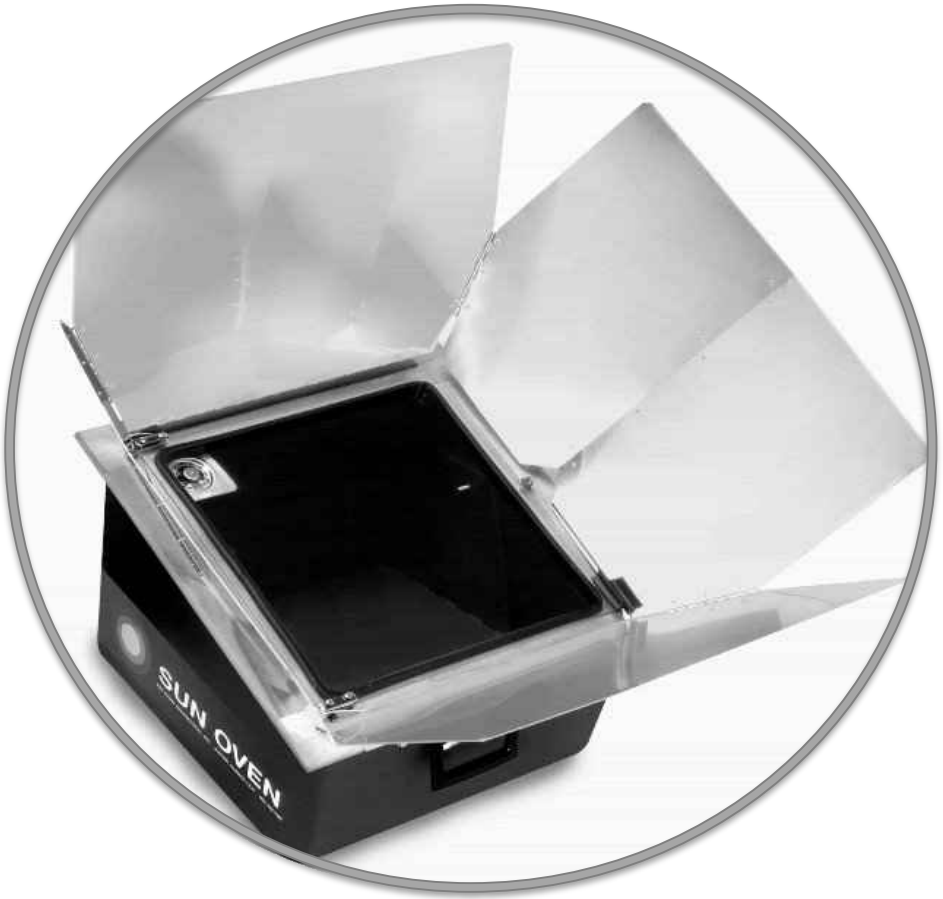
Product Analysis

DESIGN HEURISTICS									
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. Adjust functions according to different demographics*	*5. Adjust functions by moving the product's parts*	*6. Align components on the same base or around a center*	*7. Allow user to reorient*	*8. Animate product using human features for an approachable look*	*9. Apply an existing mechanism in a new way*	*10. Attach the product to the user*
Lightweight porcelain helps to make this product easier to lift. Attaching a handle also makes it easy to carry. **[1]**	This vacuum us done by a robotic floorvac which cleans rooms by itself throughout the day. **[3]**	This walkie-talkie device clips on to a biker's helmet to allow bikers to communicate safely and comfortably while riding. **[5]**	This laptop is designed for children living in developing countries. The size, colors, and interface all contribute to the playfulness of the product. **[7]**	A sliding hinge attached to the back pushes the screen to the forefront for viewing entertainment media. **[9]**	This adjustable shower caddy organizes bathroom products by aligning two shelves on the same base. **[11]**	This activity gym converts to a toddler keyboard and chair by flipping 90 degrees. **[13]**	This dish soap dispenser is designed to mimic a human body with a head, neck, and body. **[15]**	This stool takes the seat from a bicycle and applies it to a bar stool. **[17]**	This product functions as a wellness tracker in the form of a wireless device clipped to clothing during exercise. **[19]**
This lantern can be used as a table lamp, as well as a light that can be carried to different locations. **[2]**	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]**	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]**	With laces extending to the soles, these shoes respond to the unique movements essential to the urban sport Le Parkour. **[8]**	This design features a folding top that flips up or down, allowing the table to be used as room dividers. **[10]**	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]**	This product provides three seating options. By turning the chair seat upside down, a baby seat becomes a toddler seat or recliner. **[14]**	These shakers hug each other, abstracting human figures. The black and white colors also suggest balance and harmony. **[16]**	This desk organizer uses brush bristles to hold pens, pencils, and business cards. **[18]**	This vegetable peeler functions as an extension of the hand. It is slipped onto the finger like a ring. **[20]**

Think Aloud Experiment: Grand Challenges Design Task

Engineering students and practitioners

Varying experience levels



DESIGN PROBLEM

DESIGN A SOLAR POWERED COOKING DEVICE

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.

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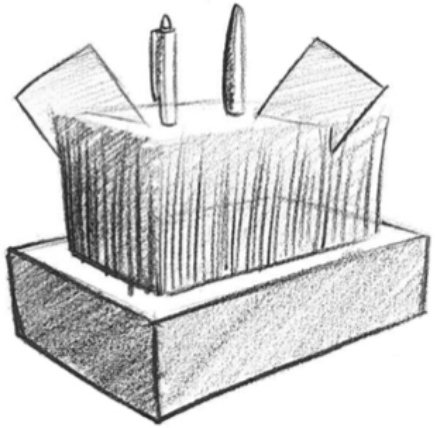
APPLY EXISTING MECHANISM IN NEW WAY

13



PRATONZOLO

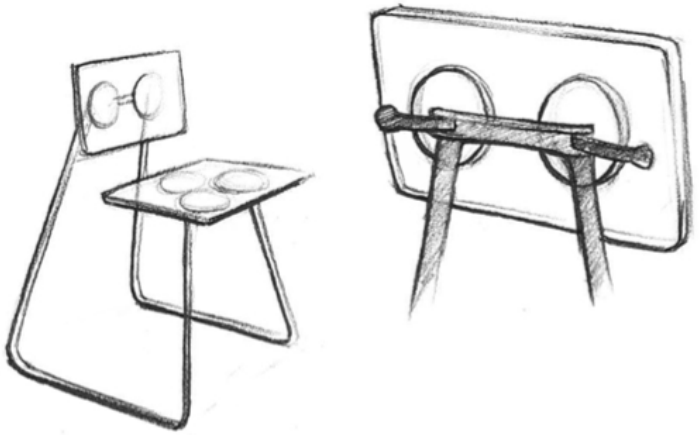
Max Battaglia

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

WANTUZ

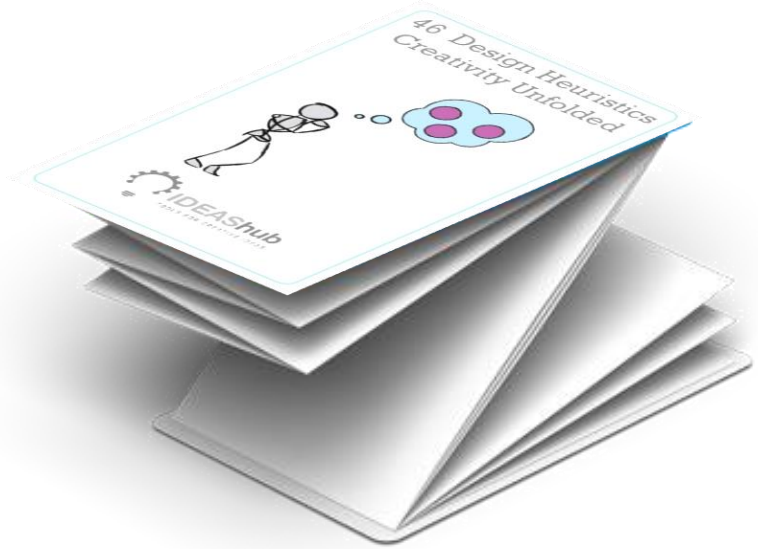
Reha Erdogan

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.



IDEAShub

TOOLS FOR CREATIVE IDEAS



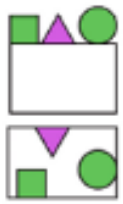
46 Design Heuristics: Creativity Unfolded

IDEAShub
TOOLS FOR CREATIVE IDEAS

CC BY NC ND

46 Design Heuristics: Creativity Unfolded

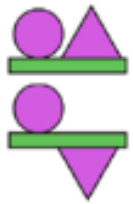
UTILISE INNER SPACE



Make use of the inside of the design.

DH29

UTILISE OPPOSITE SURFACE



Make use of another side/surface of the design.

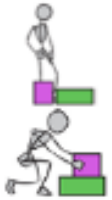
DH30

ADJUST FUNCTIONS FOR SPECIFIC USERS

Change the design based on the needs of the user.

DH6

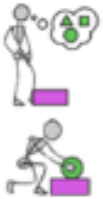
ALLOW USER TO ASSEMBLE



Allow the user put the design together.

DH8

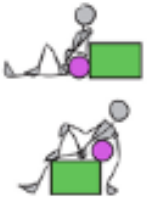
ALLOW USER TO CUSTOMISE



Let the user personalise part of the design.

DH9

ALLOW USER TO REARRANGE



Let the user move/ rearrangge parts of the design.

DH19

ATTACH PRODUCT TO USER

Join the user and the design.

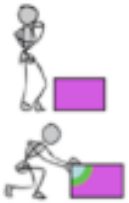
DH15

INCORPORATE USER INPUT

Include the user's wants and wishes.

DH40

PROVIDE SENSORY FEEDBACK



Allow the design to guide the user by giving feedback.

DH26

APPLY EXISTING MECHANISM IN A NEW WAY

Use an existing design in a new way.

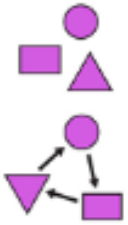
DH13

CONVERT FOR SECOND FUNCTION

Change the design so it has more than one use.

DH24

CREATE SYSTEM



Develop a set of designs that work together.

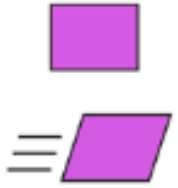
DH20

SEPARATE FUNCTIONS

Divide the use(s) of the design.

DH39

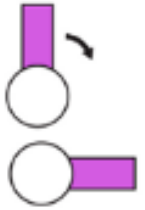
ADD MOTION



Make the design move in some way.

DH3

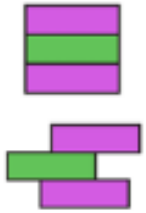
ROTATE



Move part of the design around another part.

DH37

SLIDE



Move one part across another part.

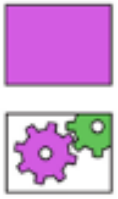
DH61

CONVERT 2-D MATERIAL INTO A 3-D OBJECT

Change the design so it could be made from a flat surface.

DH35

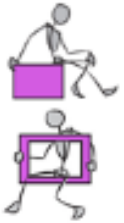
EXPOSE INTERIOR



Show the inside of the design.

DH33

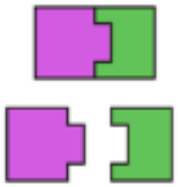
HOLLOW OUT



Remove the inside of the design's parts.

DH27

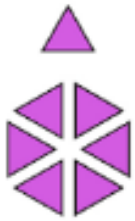
MAKE COMPONENTS ATTACHABLE/DETACHABLE



Join or take apart the design.

DH42

MIRROR/ARRAY



Start or continue a pattern.

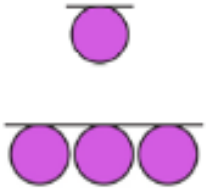
DH47

OFFER OPTIONAL COMPONENTS

Add choice of parts.

DH49

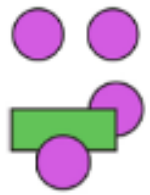
REPEAT



Copy a part of the design.

DH54

USE COMMON BASE TO HOLD COMPONENTS



Add a base that support other parts.

DH58

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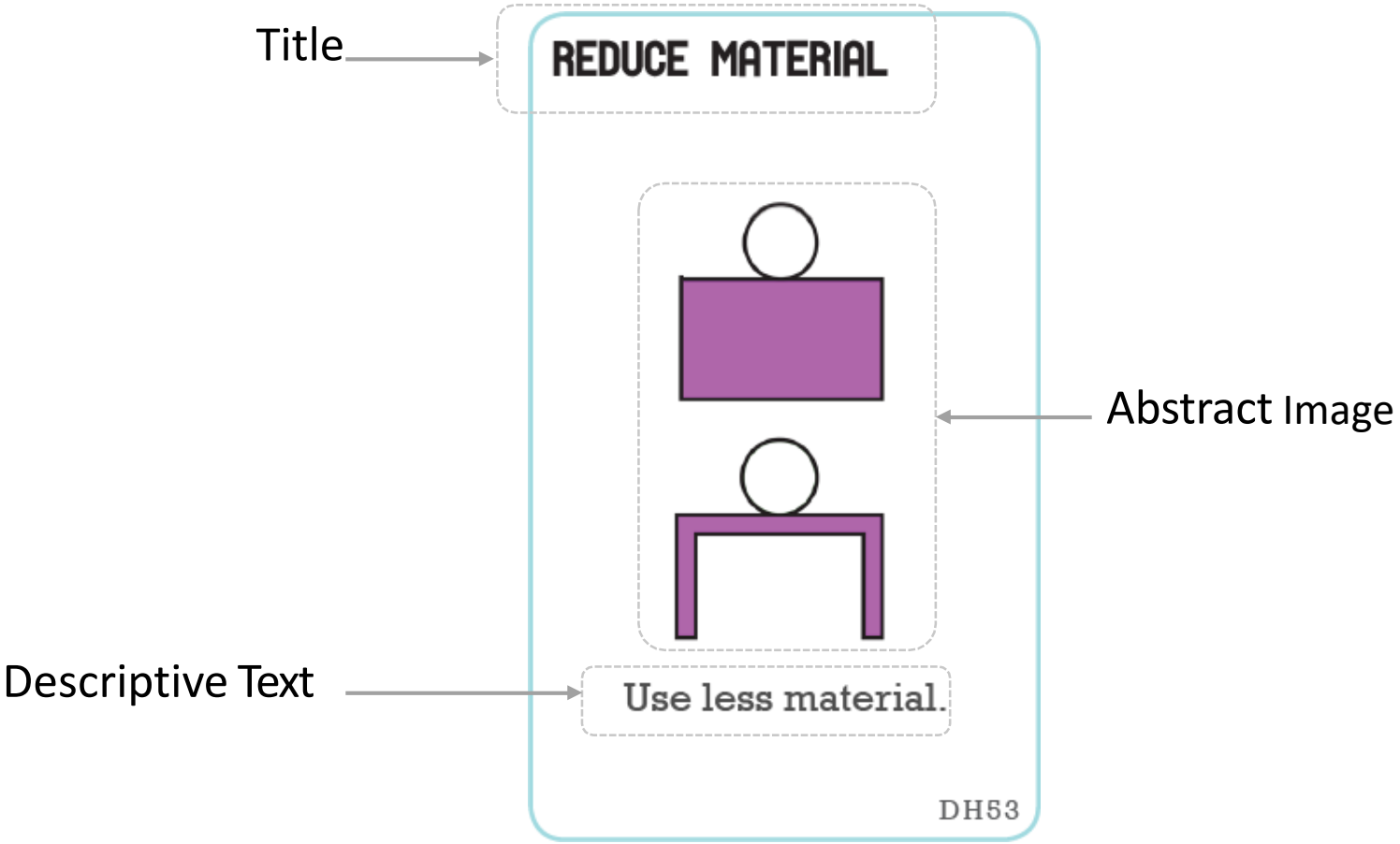
Example of one Design Heuristic



IDEASHub
TOOLS FOR CREATIVE IDEAS
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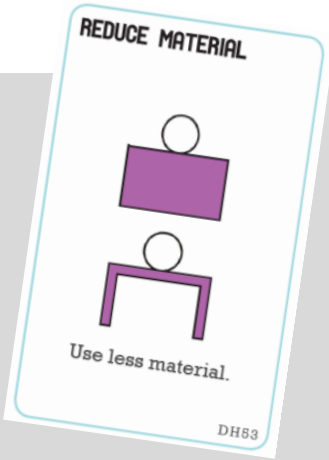
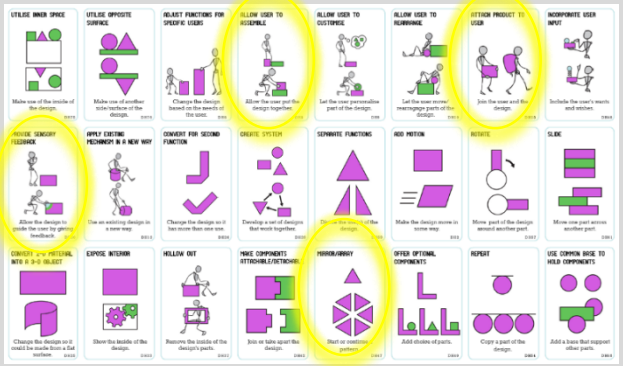
Ways to use the Design Heuristics

There are no rules!

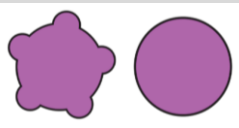


Use one card to generate many ideas.



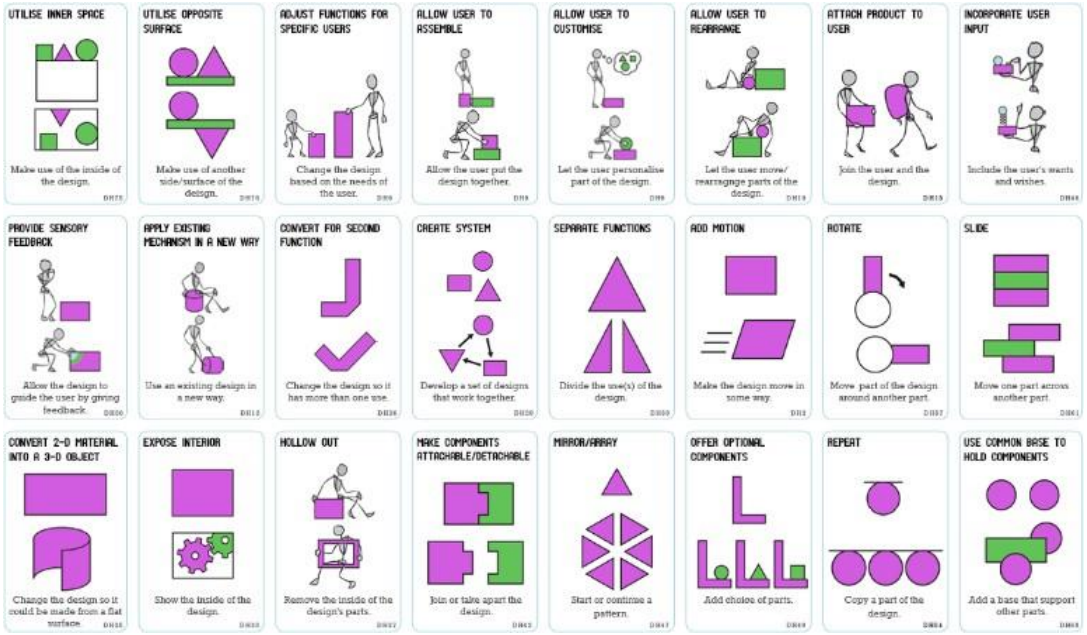
Use many cards to generate one idea.

Use any feature of a card; title, image, or descriptive text.



IDEAShub
TOOLS FOR CREATIVE IDEAS

46 Design Heuristics: Creativity Unfolded



Guidelines for use:

Use any aspect of the handout, such as:

- Heuristic title
- Images
- Description

- To generate or inspire an idea
- Transform an idea by applying a design heuristic to an existing idea
- Develop part of an idea by applying a design heuristic to a part of an idea

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Best Practices for Idea Generation

BEST PRACTICES:

1. First concept generation session; Capture what is in your head!

2. Start with a subset of cards; Or one card

3. Work individually (at first); Your voice and ideas are important

4. Encourage doodles, sketches, drawings; Communication is key

5. Creativity, Diversity, and Quantity!

6. Generative → Transformative; Start with what you know, and transform from there!

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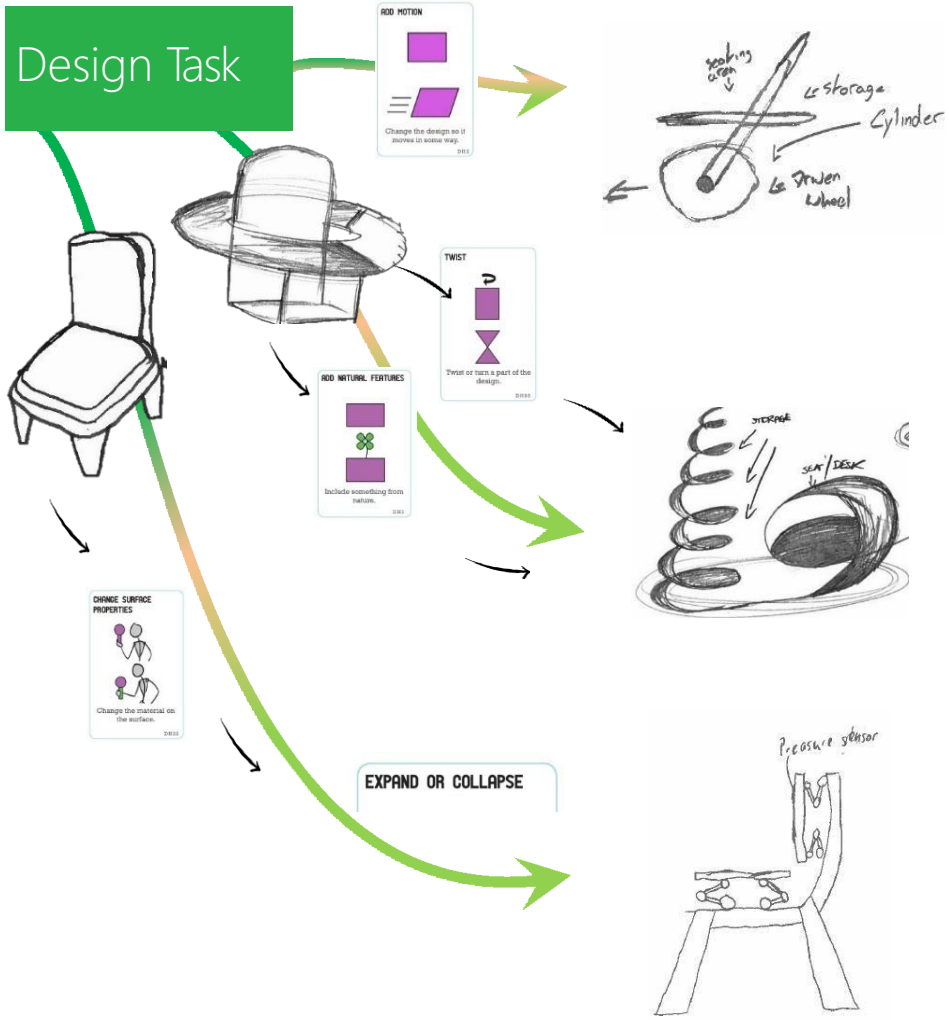
Design Heuristics evolving ideas



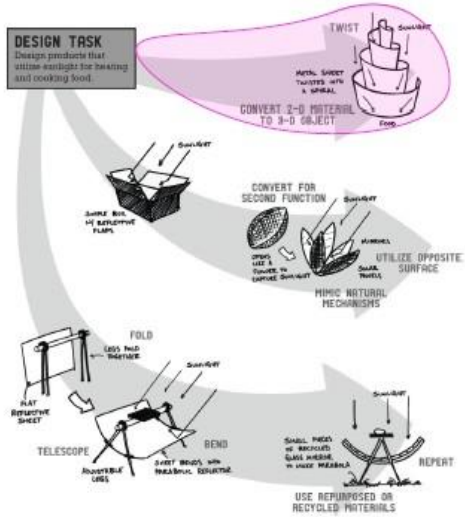
46 Design Heuristics tool can support creativity in the context of:

- Generate a new idea.
- Develop an existing idea
- Develop part of an existing idea.

Using Design Heuristics

To generate or initiate ideas…

Idea Initiation



Idea Initiation

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- It can be difficult to generate ideas from the 'top of our heads'.
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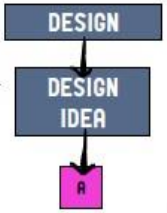
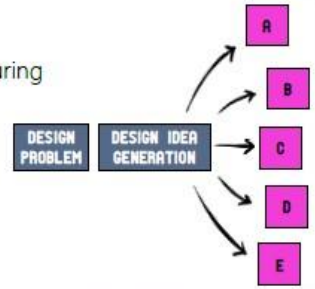


Think like a designer with Design Heuristics

Design Heuristics are idea modifiers, which:

- Offer an exciting means of generating a initial ideas during the idea generation process.
- Help us when we cannot think of initial ideas.
- Prompt us when we are stuck for ideas.



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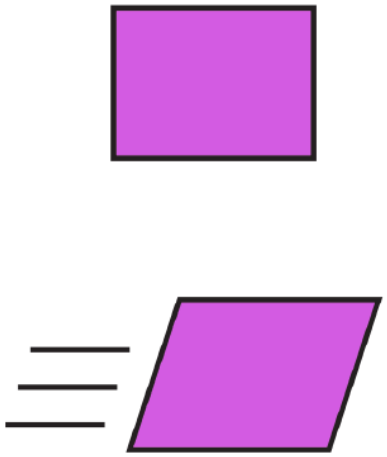
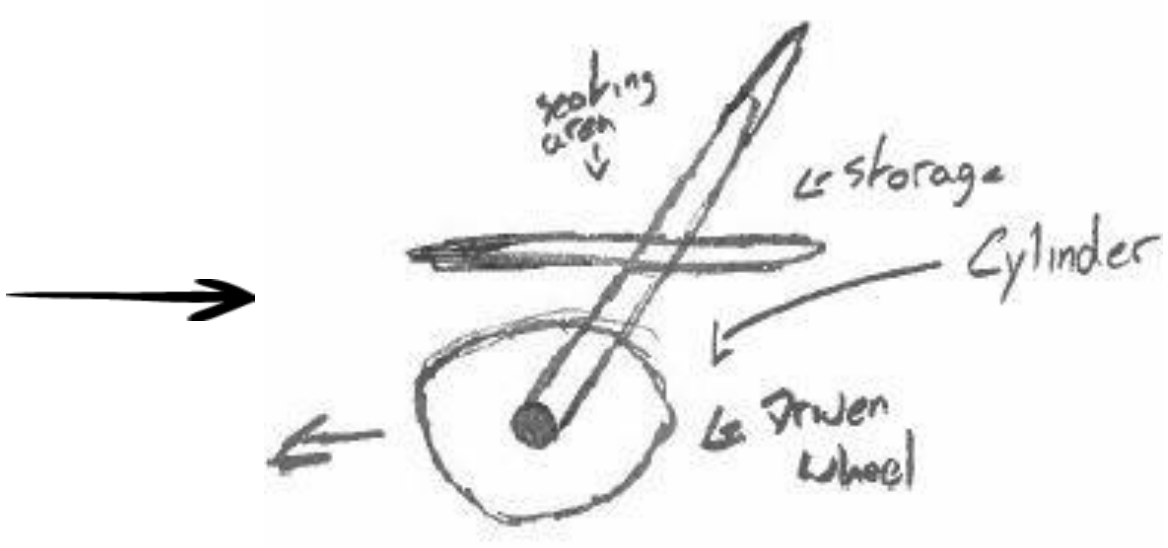
Design Heuristics initiating an idea

ADD MOTION



Change the design so it moves in some way.

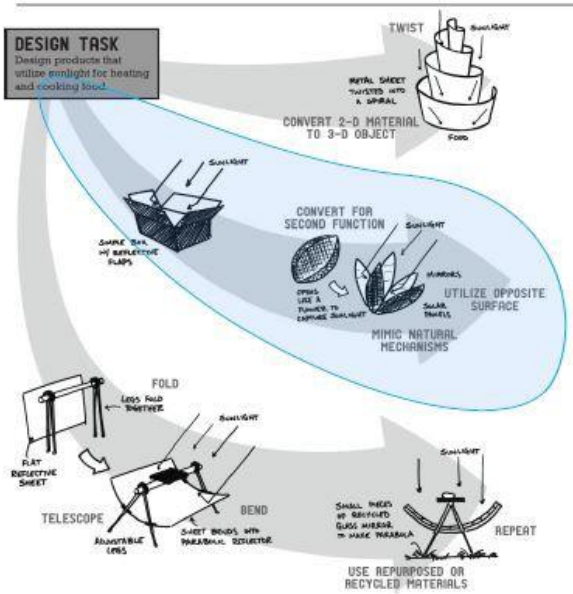
DH2



Using Design Heuristics

To transform ideas…

Idea Transformation



Idea Transformation

Idea transformation means to modify or alter ideas or existing solutions.

Transformations:

- It is very difficult to design from scratch, or from nothing.
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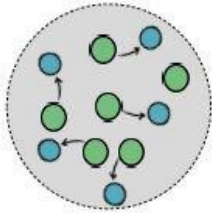
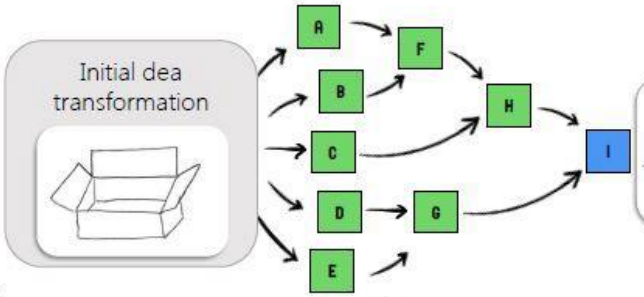
- Transform ideas by pushing your thinking a little further



Generate multiple ideas through transformations

Use Design Heuristics to push our ideas further



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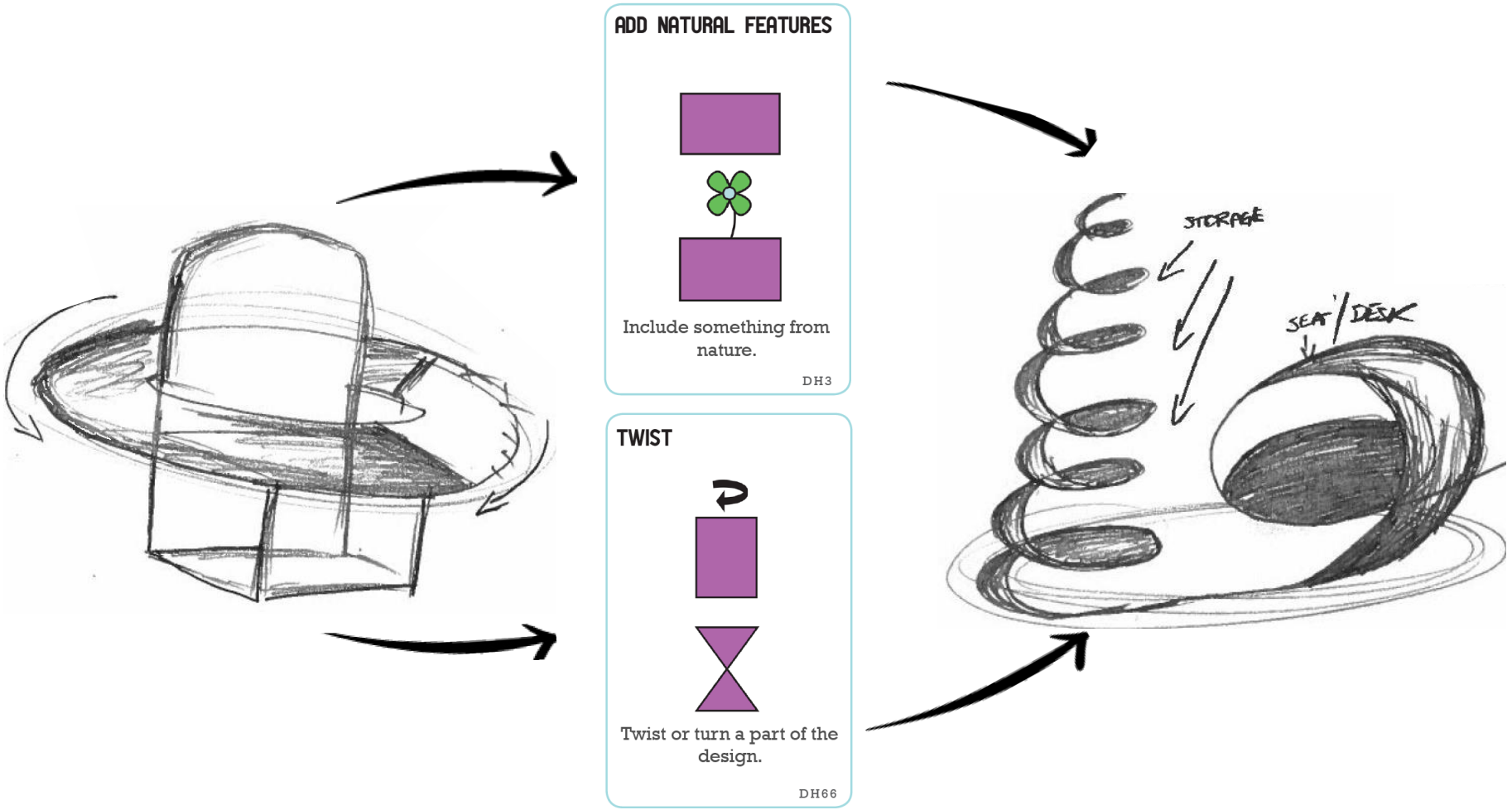
Design Heuristic transforming an idea



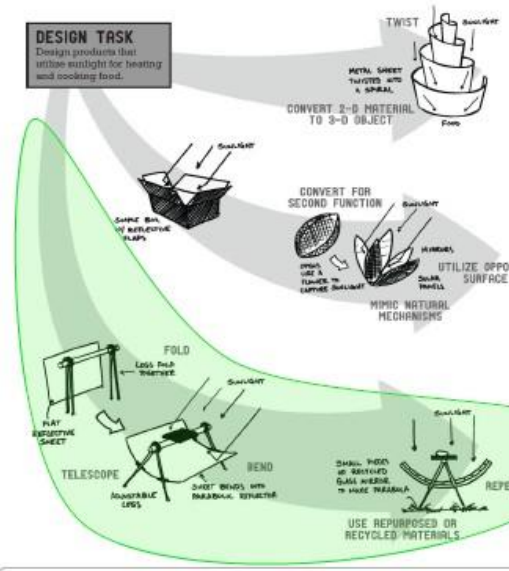
Using Design Heuristics

To develop subcomponents

- Decomposition

- Recomposition

Subcomponent Design



Subcomponent Design

Subcomponent design can be used to modify individual components of pre-existing whole products. This would enable designers to improve individual component(s) of a design.

Subcomponent design

- Design by parts or components is a method which comes from engineering.
- It allows you to think of a product or idea in terms of the use of its many parts or components.

Subcomponent design can involve two main activities:

Decomposition is the process of breaking something apart into smaller parts.

Recomposition is the process of putting the redesigned parts back together into one designed product.

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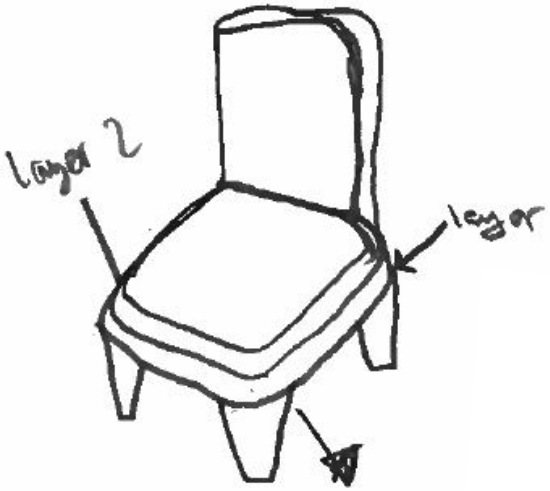
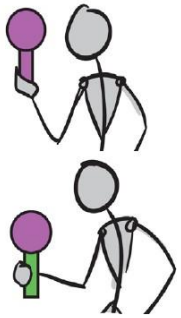
Design Heuristics developing parts of ideas



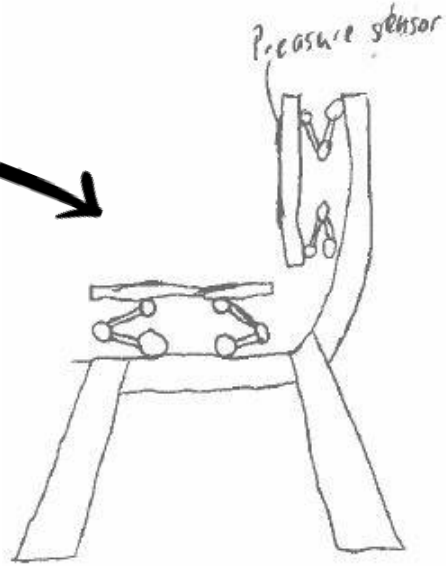
CHANGE SURFACE PROPERTIES



Change the material on the surface.

DH22

EXPAND OR COLLAPSE



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Design Heuristics
Familiarisation

IDEAShub
TOOLS FOR CREATIVE IDEAS

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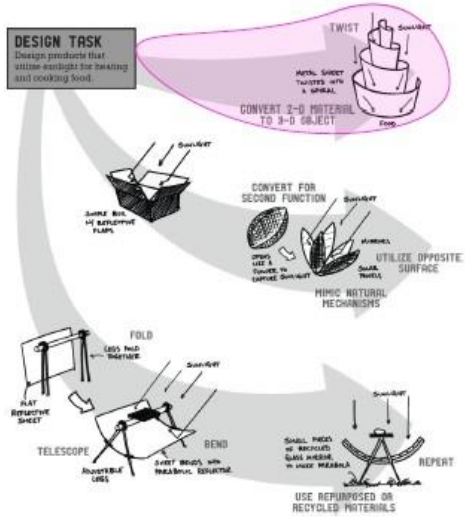
Using Design Heuristics

To generate or initiate ideas…

Idea Initiation



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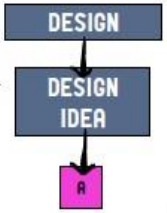

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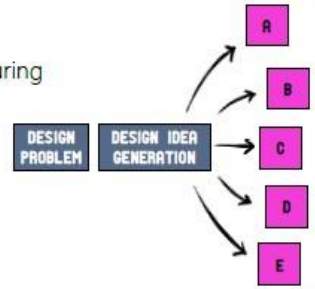

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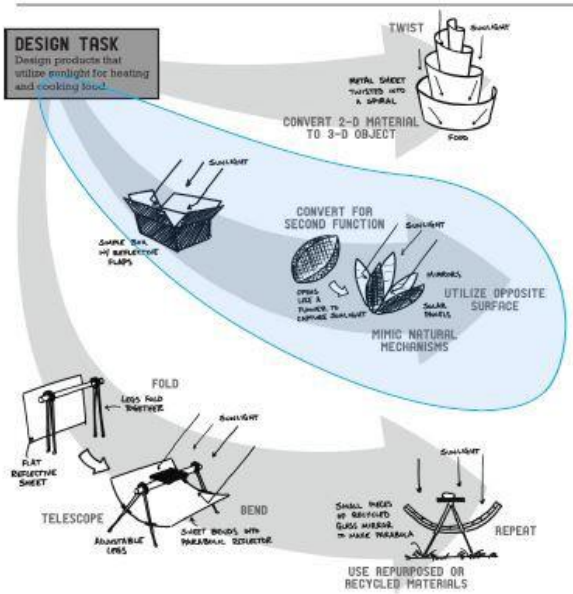
Using Design Heuristics

To transform ideas…

Idea Transformation



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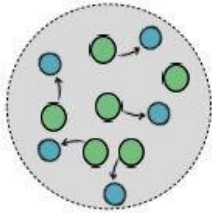

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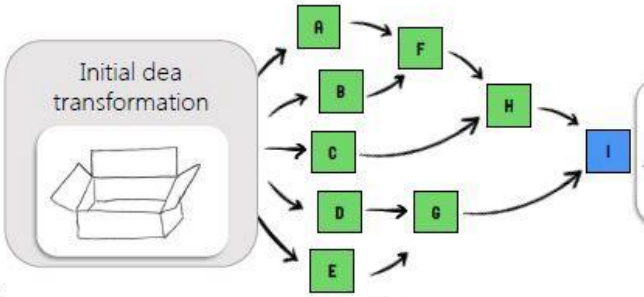

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Using Design Heuristics for Idea Generation

Activity 2

Spend 10 minutes generating ideas for the following design problem using the 46 Design Heuristic tool.

Squashed tomato challenge

The problem: In Nepal, many farmers living on the mountainside grow fruit and vegetables, including tomatoes. To earn a living they need to sell these at the local market. The problem is getting to market involves a long, dangerous walk down the mountain side and over a river, at the end of which the tomatoes may well be a bit squashed.

The challenge: To design, [build and test] a way of transporting tomatoes down a mountain

SHARE IDEAS & REFLECT

How many ideas did you generate?

How did use Design Heuristics to generate ideas?

What was easy / difficult in solving this problem?

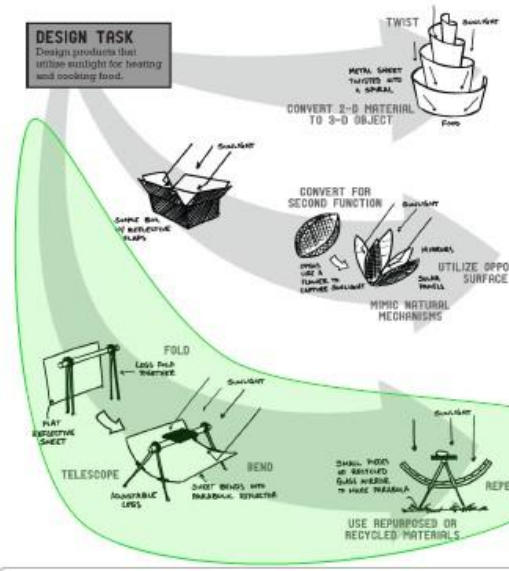
Using Design Heuristics

To develop subcomponents

- Decomposition

- Recomposition

Subcomponent Design



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Understanding Subcomponent Design

Lesson 7: Subcomponent Design

Activity 4 – Superhero redesign

Design a superhero using subcomponent design. Using the Design Heuristics, design the decomposed individual components of your favourite superhero. Then use Recomposition to generate numerous superheros.

Subcomponent: Outfit

Subcomponent: Superpower

Subcomponent: Footwear

Subcomponent: _____

Recomposition: Using the decomposed ideas for the various parts of a superhero, recombine various parts to generate numerous superheros.

Has your superhero changed since Lesson 5? _____

If so, explain how: _____

How did the Design Heuristics support you? _____

_____

Using Design Heuristics

Activity 3

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Resources

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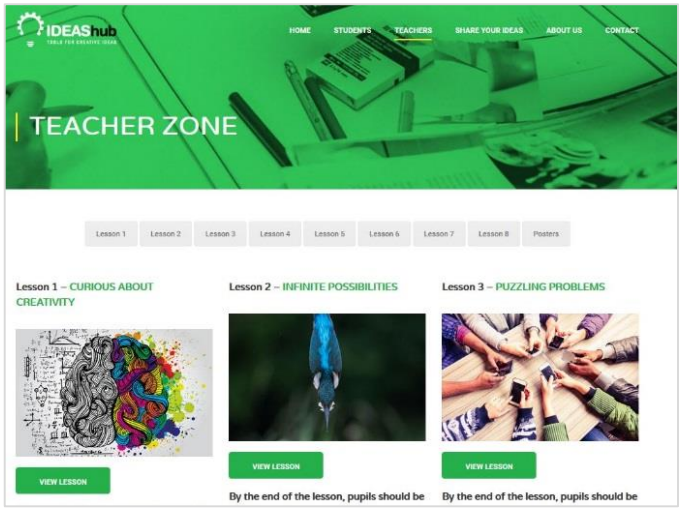
IDEAS hub is an educational programme, aimed at Primary and Post-Primary school teachers, and pupils, aged between 5-17 years.

IDEAS hub informs teachers and educates pupils on idea generation for enhancing creativity and innovation.

IDEAS hub – www.ideashub.eu

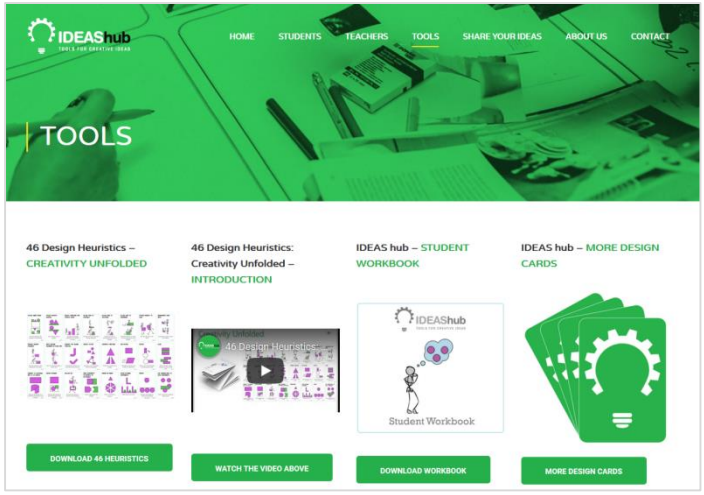
Teacher Zone



Teachers can access all resource material, including:

- Lesson plans
- Activity sheets
- Presentations
- Posters

Tools



Teachers can access Tools from the website:

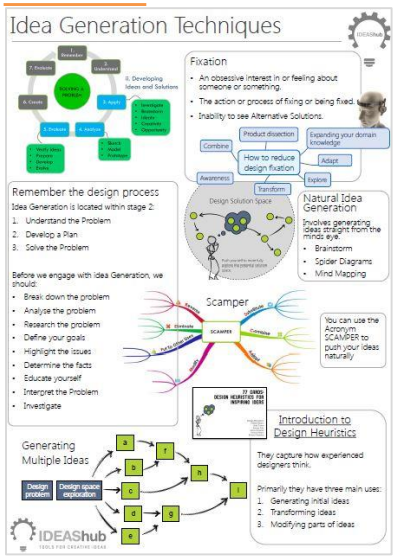
- The 46 Design Heuristics: Creativity Unfolded
- Explanation Video for students
- Student Activity Workbook
- Access to even more tools.

All content is free to download and 100% adaptable.

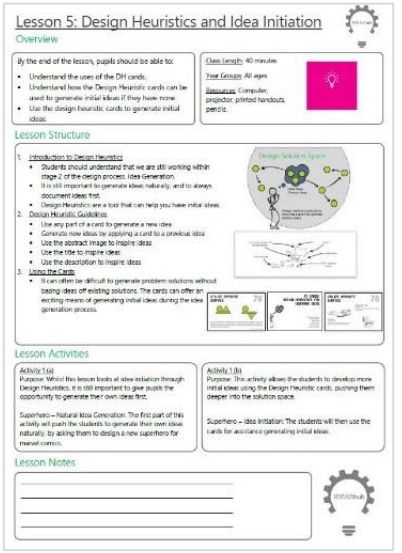
IDEAS hub - Resources

Activities

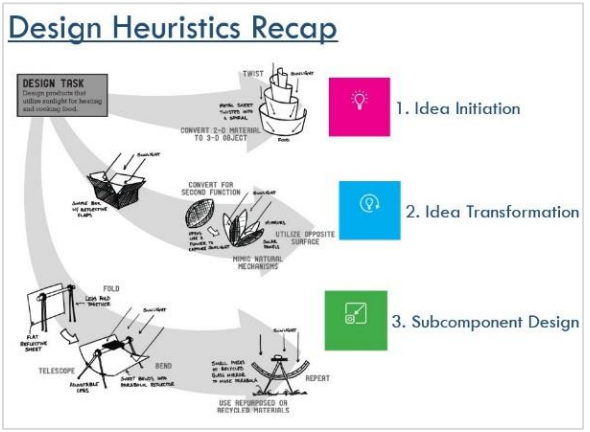
Posters



Lesson Plans



Presentations



What do the lessons address?

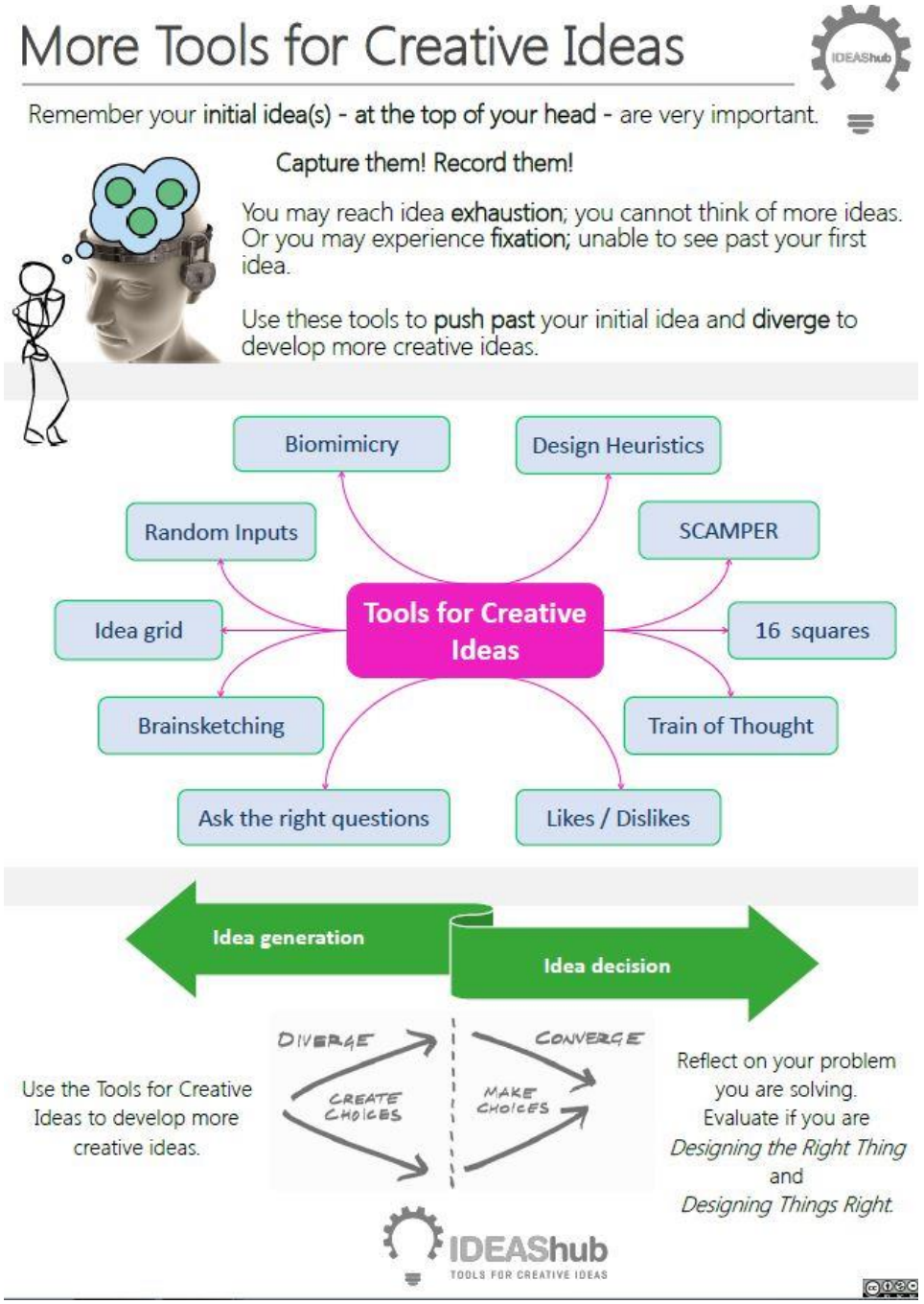
1. Understanding Creativity
2. Understanding the role of Design and Designers
3. Understanding what a problem is and how to solve a problem
4. Idea Generation – How to generate ideas
5. Introduction to Design Heuristics – Idea Initiation
6. Idea Transformation
7. Subcomponent Design
8. More tools for Creative Idea Generation

How can the resources be used in education?

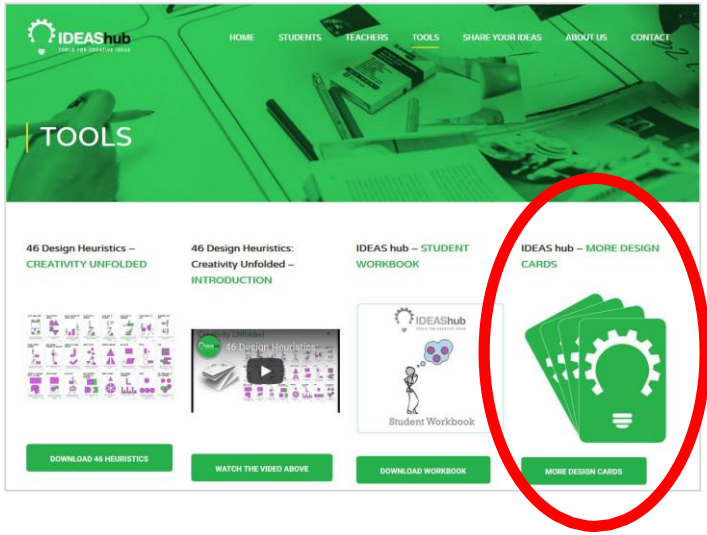
Poster 5

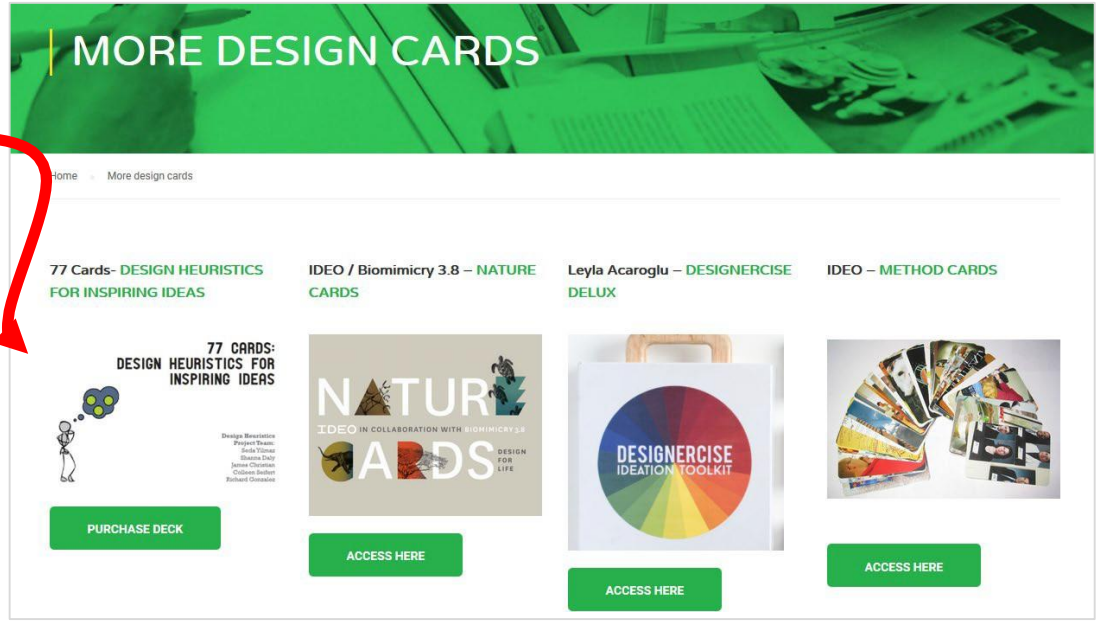
More Tools

This poster links to Lesson 8. There is a bank of tools that will help students to further develop their ideas.



www.IDEAShub.eu – More Tools





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THANK YOU

QUESTIONS or COMMENTS?

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