manipulation and structured ideation
assignment 5

does it exist already and can you protect it?

novel

patent search  benchmarking

proof of concept  / estimation  costing  pricing

feasible

can you make it and for the right cost?

valuable

do people want it and for how much?
# Assignment 5

## Evaluating Ideas

<table>
<thead>
<tr>
<th>Outline/Timeline Check</th>
<th>1 point if completed on time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Survey</td>
<td>2 = Before starting this assignment, choose the best 3 ideas from your top 10 in assignment 4. These ideas should fit the client needs/scope/challenge and should pass a first order NVF test. Present these three ideas again here. Perform a survey of at least 15 people that represent the user (this can be online) to determine willingness to buy and how much people would pay for each of the 3 best ideas. You are welcome to ask any other questions that would help refine your design. Graphically and textually present the results of your survey data. 0 = No Documentation</td>
</tr>
<tr>
<td>Benchmarking 2x2s and Patent Search</td>
<td>3 = For each of your 3 ideas, benchmark the state of the art with a 2x2 visualization including images of the existing products, prices and key features. Each 2x2 should contain the data from a minimum of 3 existing products. Conduct a preliminary patent search on each of your 3 ideas, describe the most relevant patent and provide a URL link and an image. 0 = No Documentation</td>
</tr>
<tr>
<td>Feasibility Concerns</td>
<td>1 = Describe the greatest concerns and/or unknowns about each of your 3 ideas 0 = No Documentation</td>
</tr>
<tr>
<td>Pugh Chart</td>
<td>1 = Create a visual Pugh Chart which shows your evaluation criteria, a comparison of your three ideas based on your research above, and the idea which you selected to pursue further. 0 = No Documentation</td>
</tr>
<tr>
<td>Sketch Model + Feedback</td>
<td>2 = Present Images of a rough lo-fi sketch model (cardboard, foam core, paper, hacked products) of your selected idea shown in context. Use this sketch model to get feedback from user(s). Document the feedback in text and images. 0 = No Documentation</td>
</tr>
</tbody>
</table>
assignment 5
market survey

Question 1: How many people do you currently share a refrigerator with?

<table>
<thead>
<tr>
<th>Group</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just myself</td>
<td>13.04%</td>
<td>3</td>
</tr>
<tr>
<td>1-2 people</td>
<td>43.48%</td>
<td>10</td>
</tr>
<tr>
<td>3-4 people</td>
<td>39.13%</td>
<td>9</td>
</tr>
<tr>
<td>Over 4</td>
<td>4.35%</td>
<td>1</td>
</tr>
</tbody>
</table>

Q1 Results

Corner bag

- Does not fit to the desk
- Too big
- Hard to reach
- Easy access/convenient
- Looks cool
- It does not keep things organized
- Not necessary/useful
- Do not understand the purpose of product
- Looks cheap

Head-to-Head

I asked one final question that I think is valuable to note here. I asked respondents to list which of the three ideas was most exciting to them ("exciting" being a very intentional word). Here are the results:

- No Shoelaces (25%)
- Shoelaces (27%, 7)
- No Shoelaces (47%, 40)

AVERAGE NUMBER OF SHOES OWNED, PER PERSON:

<table>
<thead>
<tr>
<th>Design</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Shoelaces</td>
<td>15</td>
</tr>
<tr>
<td>Shoelaces</td>
<td>72%</td>
</tr>
</tbody>
</table>

What Percent Of The Time Do You Take Your Shoes Off Without Untying the laces?

- 15
- 72%
assignment 5
benchmarking 2x2
assignment 5
sketch model and feedback

Wall Mounted Organizer

Feedback

Add more slots!!!

Make space for pens.

No more unused slots.
assignment 5
sketch model and feedback

Animal Shaped Laundry Basket

Encourages children to put away dirty clothes by "feeding" them
manipulating ideas
changing a product/idea/process
SCAMPER

substitute
combine
adapt
magnify
modify
put to other use
eliminate
reverse
rearrange

Bob Eberle, Michael Michalko
substitute

• Can I replace or change any parts?
• Can I replace someone involved?
• Can the rules be changed?
• Can I use other ingredients or materials?
• Can I use other processes or procedures?
• Can I change its shape?
• Can I change its color, roughness, sound or smell?
• What if I change its name?
• Can I substitute one part for another?
• Can I use this idea in a different place?
• Can I change my feelings or attitude towards it?
• Can I change my perspective?
• Can the packaging be changed?
• Can I use a different energy source?
morphological analysis
fritz zwicky, 1967

attribute listing or functional requirements

- holds roll of tape in place
- keeps end of tape accessible
- means of cutting tape
- resists translation
- allows for loading and unloading of tape

desktop tape dispenser
assume “roll of tape” input

not design embodiments
### morphological analysis

#### matrix

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>Design Embodiments (2-6 per row)</th>
</tr>
</thead>
<tbody>
<tr>
<td>holds food</td>
<td><img src="image1" alt="Bowl" /></td>
</tr>
<tr>
<td>conducts heat from stovetop</td>
<td><img src="image2" alt="Steel" /></td>
</tr>
<tr>
<td>means of manipulating pan</td>
<td><img src="image3" alt="Copper" /></td>
</tr>
<tr>
<td></td>
<td><img src="image4" alt="Clay" /></td>
</tr>
<tr>
<td></td>
<td><img src="image5" alt="Glass" /></td>
</tr>
</tbody>
</table>

#### Possible Combinations

Possible combinations = multiplying # in each row
**morphological analysis matrix**

<table>
<thead>
<tr>
<th>functional requirements</th>
<th>design embodiments (2-6 per row)</th>
</tr>
</thead>
<tbody>
<tr>
<td>holds roll of tape in place</td>
<td>![ Magnet ]</td>
</tr>
<tr>
<td>resists translation</td>
<td>![ Anvil ]</td>
</tr>
<tr>
<td>means of cutting tape</td>
<td>![ Razor Blade ]</td>
</tr>
</tbody>
</table>

- Magnet: used for holding roll of tape in place.
- Anvil: used for resisting translation.
- Razor Blade: used for means of cutting tape.
morphological analysis matrix

<table>
<thead>
<tr>
<th>Portioning</th>
<th>Extruded</th>
<th>Creased</th>
<th>Vacuum</th>
<th>驻</th>
<th>Glue</th>
<th>Hand</th>
<th>Cold Rolled - Extrude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaping</td>
<td>Rollers</td>
<td>Roll</td>
<td>Pocket</td>
<td>Stamp (press)</td>
<td>Stamp (roller)</td>
<td>Pouring</td>
<td></td>
</tr>
<tr>
<td>Layering</td>
<td>None</td>
<td>Roll</td>
<td>Sheet</td>
<td>Stamping</td>
<td>Porous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cremping</td>
<td>None</td>
<td>Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting</td>
<td>None</td>
<td>Blade</td>
<td>Die</td>
<td>Heat</td>
<td>Laser</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

For sanitary pad assembly machine
What ideas or parts can be combined?
Can I combine or recombine its parts’ purposes?
Can I combine or merge it with other objects?
What can be combined to maximize the number of uses?
What materials could be combined?
Can I combine different talents to improve it?
**ideal solution elements (ISE)**

<table>
<thead>
<tr>
<th></th>
<th>portable</th>
<th>allows easy (un) loading</th>
<th>easy cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>holds item in place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>easy cutting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>allows easy (un) loading</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

apply features from these products
Heuristic Ideation Technique

**HIT matrix**
edward tauber

Structured “cross products” attribute listing not F.R.s

coffee table

<table>
<thead>
<tr>
<th></th>
<th>table</th>
<th>coffee</th>
<th>legs</th>
<th>surface</th>
<th>wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>collar</td>
<td>table, collar</td>
<td>coffee, collar</td>
<td>legs, collar</td>
<td>surface, collar</td>
<td>wood, collar</td>
</tr>
<tr>
<td>dog</td>
<td>table, dog</td>
<td>coffee, dog</td>
<td>legs, dog</td>
<td>surface, dog</td>
<td>wood, dog</td>
</tr>
<tr>
<td>snap release</td>
<td>table, snap release</td>
<td>coffee, snap release</td>
<td>legs, snap release</td>
<td>surface, snap release</td>
<td>wood, snap release</td>
</tr>
<tr>
<td>colorful</td>
<td>table, colorful</td>
<td>coffee, colorful</td>
<td>legs, colorful</td>
<td>surface, colorful</td>
<td>wood, colorful</td>
</tr>
<tr>
<td>ID tag</td>
<td>table, ID tag</td>
<td>coffee, ID tag</td>
<td>legs, ID tag</td>
<td>surface, ID tag</td>
<td>wood, ID tag</td>
</tr>
</tbody>
</table>
Heuristic Ideation Technique

**HIT Matrix**
edward tauber

<table>
<thead>
<tr>
<th></th>
<th>action</th>
<th>drama</th>
<th>comedy</th>
<th>horror</th>
<th>cartoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>aliens</td>
<td><img src="image1.png" alt="Poster" /></td>
<td><img src="image2.png" alt="Poster" /></td>
<td><img src="image3.png" alt="Poster" /></td>
<td><img src="image4.png" alt="Poster" /></td>
<td><img src="image5.png" alt="Poster" /></td>
</tr>
<tr>
<td>war</td>
<td><img src="image6.png" alt="Poster" /></td>
<td><img src="image7.png" alt="Poster" /></td>
<td><img src="image8.png" alt="Poster" /></td>
<td><img src="image9.png" alt="Poster" /></td>
<td><img src="image10.png" alt="Poster" /></td>
</tr>
<tr>
<td>dogs</td>
<td><img src="image11.png" alt="Poster" /></td>
<td><img src="image12.png" alt="Poster" /></td>
<td><img src="image13.png" alt="Poster" /></td>
<td><img src="image14.png" alt="Poster" /></td>
<td><img src="image15.png" alt="Poster" /></td>
</tr>
<tr>
<td>super hero</td>
<td><img src="image16.png" alt="Poster" /></td>
<td><img src="image17.png" alt="Poster" /></td>
<td><img src="image18.png" alt="Poster" /></td>
<td><img src="image19.png" alt="Poster" /></td>
<td><img src="image20.png" alt="Poster" /></td>
</tr>
</tbody>
</table>

structured “cross products” or genres and themes

super hero horror? cartoon war? dog action?
adapt

“make it a habit to keep on the lookout for novel and interesting ideas that others have used successfully. Your idea needs to be original only in its adaptation to the problem you are working on” - Thomas Edison

What else is like it?
Is there something similar, but in a different context?
Does the past offer any lessons with similar ideas?
What other ideas does it suggest?
What could I copy, borrow or steal?
Whom could I emulate?
What ideas could I incorporate?
What processes can be adapted?
What different contexts can I put my concept in?
What ideas outside my field can I incorporate?
nature has spent billions of years designing and perfecting systems and processes. - innovator’s toolkit

biodiversity

existence of earth

If a typical mature 70 g (2.5 oz) gecko had every one of its setae in contact with a surface, it would be capable of holding aloft a weight of 133 kg (290 lb)

- Scientific American

bacteria

kingfisher

humans 11:45 pm
biomimicry
structured abstraction - restating problem more generally
progressive revelation in brainstorming or chunking up

- What can you add?
- What can be extended?
- Can it be done faster?
- Can it be used more often?
- What can be magnified or made larger?
- What can be exaggerated or overstated?
- What can be made higher, bigger or stronger?
- Can I increase its frequency?
- What can be duplicated? Can I make multiple copies?
- Can I add extra features or somehow add extra value?
- Can it do more things?
TRIZ (Theory of Inventive Problem Solving)  
genrich altshuller, 1969

more specific to engineering innovation  
based on 40,000 patents  
adaptation!

abstracting the problem into contradictions

how can we design “pop” cans to support heavy loads when stacked?
TRIZ (Theory of Inventive Problem Solving)
abstracting the problem into contradictions

![Diagram of a can opener]

wall needs to be thin but thin walls can’t withstand high pressure
(to hold more liquid, lower cost, lower weight, keep OD handheld)

thin walls need to be improved
to manage undesired issues with pressure

1. Weight of moving object
2. Weight of nonmoving object
3. Length of moving object
4. Length of nonmoving object
5. Area of moving object
6. Area of nonmoving object
7. Volume of moving object
8. Volume of nonmoving object
9. Speed
10. Force
11. Tension, pressure
12. Shape
13. Stability of object
14. Strength
15. Durability of moving object
16. Durability of nonmoving object
17. Temperature
18. Brightness
19. Energy spent by moving object
20. Energy spent by nonmoving object
21. Power
22. Waste of energy
23. Waste of substance
24. Loss of information
25. Waste of time
26. Amount of substance
27. Reliability
28. Accuracy of measurement
29. Accuracy of manufacturing
30. Harmful factors acting on object
31. Harmful side effects
32. Manufacturability
33. Convenience of use
34. Repairability
35. Adaptability
36. Complexity of device
37. Complexity of control
38. Level of automation
39. Productivity

39 Problem Parameters
(force, speed, brightness, length, time, etc)
TRIZ (Theory of Inventive Problem Solving)

contradiction matrix
39x39 problem parameters

undesired effect - X axis
feature to improve - Y axis
TRIZ

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Taking out</td>
<td>16. Partial or excessive actions</td>
<td>29. Pneumatics and hydraulics</td>
</tr>
<tr>
<td>3. Local Quality</td>
<td>17. Another dimension</td>
<td>30. Flexible shells and thin films</td>
</tr>
<tr>
<td>&quot;Nested doll&quot;</td>
<td>21. Skipping</td>
<td>34. Discarding and recovering</td>
</tr>
<tr>
<td>8. Anti-weight</td>
<td>22. &quot;Blessing in disguise&quot;</td>
<td>35. Parameter changes</td>
</tr>
<tr>
<td>Preliminary anti-action</td>
<td>23. Feedback</td>
<td>36. Phase transitions</td>
</tr>
<tr>
<td>Preliminary action</td>
<td>24. &quot;Intermediary&quot;</td>
<td>37. Thermal expansion</td>
</tr>
<tr>
<td>Beforehand cushioning</td>
<td>25. Self-service</td>
<td>38. Strong oxidants</td>
</tr>
<tr>
<td>The other way around</td>
<td>27. Cheap short-living</td>
<td>40. Composite material films</td>
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</table>

1. Segmentation

Divide an object into independent parts.
- Replace mainframe computer by personal computers.
- Replace a large truck by a truck and trailer.
- Use a work breakdown structure for a large project.

Make an object easy to disassemble.
- Modular furniture
- Quick disconnect joints in plumbing

Increase the degree of fragmentation or segmentation.
- Replace solid shades with Venetian blinds.
- Use powdered welding metal instead of foil or rod to get better penetration of the joint.

elaboration on these in web references
40 Innovative Principles

14. Spheroidality - Curvature
Instead of using rectilinear parts, surfaces, or forms, use curvilinear ones; move from flat surfaces to spherical ones; from parts shaped as a cube (parallelepiped) to ball-shaped structures.
- Use arches and domes for strength in architecture.
- Use rollers, balls, spirals, domes.
- Spiral gear (Nautilus) produces continuous resistance for weight lifting.
- Ball point and roller point pens for smooth ink distribution.

Go from linear to rotary motion, use centrifugal forces.
- Produce linear motion of the cursor on the computer screen using a mouse or a trackball.
- Replace wringing clothes to remove water with spinning clothes in a washing machine.
- Use spherical casters instead of cylindrical wheels to move furniture.

from triz40.com
**40 Innovative Principles**

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<tr>
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<td>27. Cheap short-living</td>
<td>40. Composite material films</td>
</tr>
</tbody>
</table>

35. **Parameter changes**

- **Change an object’s physical state** *(e.g. to a gas, liquid, or solid.)*
  - Freeze the liquid centers of filled candies, then dip in melted chocolate, instead of handling the messy, gooey, hot liquid.
  - Transport oxygen or nitrogen or petroleum gas as a liquid, instead of a gas, to reduce volume.

- **Change the concentration or consistency.**
  - Liquid hand soap is concentrated and more viscous than bar soap at the point of use, making it easier to dispense in the correct amount and more sanitary when shared by several people.

- **Change the degree of flexibility.**
  - Use adjustable dampers to reduce the noise of parts falling into a container by restricting the motion of the walls of the container.
  - Vulcanize rubber to change its flexibility and durability.

- **Change the temperature.**
  - Raise the temperature above the Curie point to change a ferromagnetic substance to a paramagnetic substance.
  - Raise the temperature of food to cook it. (Changes taste, aroma, texture, chemical properties, etc.)
  - Lower the temperature of medical specimens to preserve them for later analysis.

from triz40.com
TRIZ

want a portable tape dispenser that doesn’t require two hands

feature to improve?
undesired effect?

“convenience of use” needs to be improved to manage issues with weight

2. weight of non moving object vs. 33. convenience of use

6 - universality (multiple functions, eliminate need for other parts)
13 - the other way round (invert action, movable parts, upside down)
1 - segmentation (divide object, ease to disassemble, fragment more)
25- self-service (make an object serve itself)
put to other use ➡
reverse adaptation

- What else can it be used for?
- Can it be used by people other than those it was originally intended for?
- How would a child use it? An older person?
- How would people with different disabilities use it?
- Are there new ways to use it in its current shape or form?
- Are there other possible uses if it’s modified?
- If I knew nothing about it, would I figure out the purpose of this idea?
- Can I use this idea in other markets or industries?
- What else can it be made from?
eliminate

functional analysis

• How can I simplify it?
• What parts can be removed without altering its function?
• What's non-essential or unnecessary?
• Can the rules be eliminated?
• What if I made it smaller?
• What feature can I understate or omit?
• Should I split it into different parts?
• Can I compact or make it smaller?
• What if it had less of something?

“If a thing can be done adequately by means of one, it is superfluous to do it by means of several; for we observe that nature does not employ two instruments [if] one suffices.” - Thomas Aquinas
design for manufacture - part reduction
reasons you need multiple parts...

Must the part move relative to all other parts?

Must the part be a different material from the other parts?

Must the part be different to allow for (dis)assembly/access?
reverse/rearrange

• What other arrangement might be better? Changing Layout?
• Can I interchange components?
• Are there other patterns, layouts or sequences I can use?
• Can I transpose cause and effect?
• Can I change pace or change the schedule of delivery?
• Can I transpose positives and negatives?
• Should I turn it around? Up instead of down? Down instead of up?
• What if I consider it backwards? Inside out?
• What if I try doing the exact opposite of what I originally intended?
reverse/rearrange

- What other arrangement might be better? Changing Layout?
- Can I interchange components?
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- What if I consider it backwards? Inside out?
- What if I try doing the exact opposite of what I originally intended?
next lecture

techniques for visually presenting concepts
The first part of this assignment is to *manipulate and improve your current idea* using some of the tools discussed in lecture.

1- With your selected idea use the SCAMPER prompt questions (substitute, combine, adapt, magnify/minify, put to other use, eliminate, reverse/rearrange) to generate ideas for improvements or changes to your product concept. For each letter of SCAMPER, list as many variations/improvements on your idea as you can (at least 7 per letter). For each letter, select the best concept and make a higher quality drawing (full page, title). Scan these 7 sketches and present both the lists of ideas and the sketches in your blog.

2- With TRIZ, use your problem statement or a variation of it. Convert it into a contradiction. Determine the problem parameters, the key innovative principles related to it, and then make a list of five new ideas that come from this process. Sketch the best idea in your notebook (full page, title) and scan it.

Using your best version of your idea after this session (which could be the original idea), create **two slides** that can be used to pitch your idea to the client. **One slide should focus on the problem/market/state of the art/user** and **one should focus on your solution**. These slides should be thematically unified and feel as if they are part of the same presentation. They should neatly and clearly summarize your work without being overly detailed or text heavy. You can use any means to create these slides, however the final submission will be two pages of **PDF that are 11”x8.5” landscape orientation that can be printed**. Solution slide should focus on your final idea and can feature hand drawings, renderings, photographs, photoshopped images, etc. Images of these two slides should appear in your blog post and you should physically bring in copies that can be drawn on.

**TITLE with refinement**
### Outline/Timeline Check
1 point if completed on time

**SCAMPER**
3 - With your selected idea use the SCAMPER prompt questions (substitute, combine, adapt, magnify/minify, put to other use, eliminate, reverse/rearrange) to generate ideas for improvements or changes to your product concept. For each letter of SCAMPER, list at many variations/improvements on your idea as you can (at least 7 per letter). For each letter, select the best concept and make a higher quality drawing (full page, title). Scan these 7 sketches and present both the lists of ideas and the sketches in your blog.

0 = No Ideas lists or sketches

**TRIZ**
2 = With TRIZ, use your problem statement or a variation of it. Convert it into a contradiction. Determine the problem parameters, the key innovative principles related to it, and then make a list of five new ideas that come from this process. Describe your process, sketch the best idea in your notebook (full page, title), and scan it.

0 = No Ideas/process

**Presentation Material**
3 = Using your best version of your idea after this session (which could be the original idea), create two slides that can be used to pitch your idea to the client. One slide should focus on the problem/market/state of the art/user and one should focus on your solution. These slides should be thematically unified and feel as if they are part of the same presentation. They should neatly and clearly summarize your work without being overly detailed or text heavy. You can use any means to create these slides, however the final submission will be two pages of PDF that are 11”x8.5” landscape orientation that can be printed. Solution slide should focus on your final idea and can feature hand drawings, renderings, photographs, photoshopped images, etc. Images of these two slides should appear in your blog post and you should physically bring in copies that can be drawn on.

0 = No presentation material

### Instructor Scores on Presentation Material Quality and Clarity
1 point
any questions?