Agenda

1) Product Spectrum

2) Project Phase I

3) Finish up "Product Dissection"

4) Function Structure

5) Product Design
   - FAST diagrams
   - Function structure
   - Morphological matrix
(1) Product Spectrum

"Product" refers to a spectrum

<table>
<thead>
<tr>
<th>Value</th>
<th>Category</th>
<th>Low-tech (Physical fitnes)</th>
<th>Example</th>
<th>High-tech (Business productivity software)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>Product</td>
<td>jump rope</td>
<td>Microsoft Excel</td>
<td></td>
</tr>
<tr>
<td>$$</td>
<td>Solution</td>
<td>fitness gym</td>
<td>Microsoft Office</td>
<td></td>
</tr>
<tr>
<td>$$$</td>
<td>Services</td>
<td>personal trainer</td>
<td>Microsoft Office 365 (Cloud)</td>
<td></td>
</tr>
<tr>
<td>$$$$</td>
<td>Experience</td>
<td>health spa</td>
<td>Microsoft Office 365 on a tablet running Windows 10</td>
<td></td>
</tr>
</tbody>
</table>
Project Phase I

To identify a project as "best" we need high-level criteria to narrow down the ideas.

(1) Technical Feasibility

- Can the idea be realized?

Typical goal for a startup: a working prototype in a reasonable amount of time (e.g. 3-4 months) at reasonable cost ($500k - $2m)

(2) Commercialization

Is there a market (customers willing and able to pay for your product)
<table>
<thead>
<tr>
<th>Technical Feasibility</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Microsoft Office</td>
<td>Iphone</td>
</tr>
<tr>
<td>Low</td>
<td>Cure for Ebola</td>
<td>Cure for Cancer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commercialization Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

Place your product ideas into the matrix and select from boxes 1 or 2.

If necessary, combine or alter ideas
Make sure the group likes the idea!
(3) More on Product Dissection

When is product dissection useful?

(1) Understand the relationship between a product's function and form
   (why)  (how)

(2) Identify how a product can fail

(3) Clarify what is new and different about a product

(4) Designing new products
(4) Function Structure

To design a new product (specify its form), we need to determine what the product will do (specify its functions).

Functions → Form; NOT Form → Function

We need an abstract representation of the product that allows us to create a design concept (form) for the product.

**Example:**

```
  Lightbulb
    +--- Create light
    |     +--- Receive energy
    |          +--- Transform energy to light
```

This abstract representation is called the function structure for the product.
(5) Creating a new product
(Product design)

Challenge: design new products using the best possible form for the desired functions.

Approach: Systematically explore the design space that is defined by the product's function structure.

Product Design Process: 9 steps

Step 1: State the overall purpose or objective of the new product.

Example (lightbulb)

Design an energy efficient product that produces light in the home.

Step 2: Dissect existing products that are similar to the desired product.

Example: lecture 3 lightbulb
Step 3: Create a function structure for the new product

1. Remove the realizations ("hows") from the FAST diagram.
2. Review functions ("whys") for any that imply a specific form.
3. Add, remove, and/or modify the subfunctions until the function structure addresses the objectives in Step 1.

Example: energy-efficient lightbulb

```
Create light
```
```
  Store energy
  Receive energy
  Transform energy into light
  Reduce energy consumption
```
Step 4: For each leaf (subfunction) in a function-structure tree, generate several alternatives — "solution-principles" — for realizing the subfunctions.

(Use structured brainstorming!)

Step 5: Organize the sub-functions and solution-principles into a matrix (table).

| F.S.               | SP1        | SP2       | SP3        | SP4        | ...
|--------------------|------------|-----------|------------|------------|------------------------
| Receive energy     | 120V Power Lines | Solar     | Chemical Reaction | Nuclear Power | ...
| Translate energy to light | Filament   | LED       | Bioluminescence | CFL         |...
| Reducing energy consumption | None       | Timer     | Dimmer     | Motion sensor | ...
|                    |            |           |            |             |...
Step 6: Use morphological matrix to generate several alternative design concepts.

Step 7: Write a brief description of how each concept works.

Example: Solar panels on the bulb charge a battery pack located in the socket that powers an LED. Motion sensor turns off the LED when the room is empty.
Step 8: Create a set of criteria to evaluate how well the design concepts satisfy the user needs (design objectives), and compare.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Concept 1</th>
<th>Concept 2</th>
<th>Concept 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical feasibility</td>
<td>5</td>
<td>4</td>
<td>1</td>
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<tr>
<td>Commercial potential</td>
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<td>3-4</td>
<td>4</td>
</tr>
<tr>
<td>Performance</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Price</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Scale: 1 = Poor, 5 = Excellent

Step 9: Select the best design concept, and develop it into a product.