Advanced Energy Vehicle (AEV)

Lab 01: Creative Design Thinking*

*Directly from the EEIC Multidisciplinary Capstone Program
Introduction

- **Create**
  - To produce or bring about by a course of action, to bring into existence something new, to produce through imaginative skill

- **Creativity**
  - The ability to bring into fruition one’s original, imaginative and/or expressive ideas and concepts to serve new purposes and/or fulfill a need.

Ref: Merriam-Webster’s Collegiate Dictionary, 10th edition.
Who is CREATIVE?

Creativity in everyone

• personal
• social
• cultural

Knowledge ➔ Creativity

Engineers use their creativity to generate useful ideas and solve problems.
Conceptualization of Creativity

- Generating a *useful* idea

Problem ➔ Product vs. Technology ➔ Product

- Communicating the idea
  - Words,
  - Pictures,
  - Construction
  - Making the concept aesthetically appealing

Image: from OSU industrial design
Ways to Becoming More Creative

- Learn creative thinking techniques
- Keep a daily journal/notebook
- Indulge in relaxation activities
- Maintain other interests
- Read
- Ask questions
- Exchange ideas
Obstacles to Creativity

- Fear of criticism
- Lack of confidence
- Negative stress
- Hectic environment
- Rigid rules and barriers
- Conflicting goals and objectives
- Routine tasks

Image: from OSU industrial design
Techniques to Generate Ideas/Solutions

- Notebook
- Brainstorm
- Attribute Listing
- Drawing
- Construction
- Research and Lateral Thinking
- Assumption Smashing
- Fail Fast
Technique 1 - The Notebook

- Keep notes on product goals
- Sketches
- Notes
Technique 2 - Brainstorming

- Rules of brainstorming
  - Free flow
  - Random ideas
  - Leap-frog
  - Piggy-back
  - Divergent thinking
  - Convergent thinking
  - Non-critical

Images: from OSU industrial design
## Technique 3- Attribute Listing

**Classification Table:**

<table>
<thead>
<tr>
<th>Crust</th>
<th>Vegetables</th>
<th>Meat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand tossed</td>
<td>Onions</td>
<td>Pepperoni</td>
</tr>
<tr>
<td>Pan</td>
<td>Peppers</td>
<td>Ham</td>
</tr>
<tr>
<td>Wheat</td>
<td>Olives</td>
<td>Sausage</td>
</tr>
<tr>
<td></td>
<td>Mushrooms</td>
<td>Bacon</td>
</tr>
</tbody>
</table>

**Classification Tree:**

```
  Veggies
    /   \
   /     \
  Toppings Meats
    /   \   /
   /     \  /
  Olives Mushrooms Pepperoni
        /   \    /
       /     \  /
      /       \/
     /         /
    Onions    Ham Bacon
```
Technique 4- Drawing

- Doodling- freeform drawing
- Storyboarding
- Mind Mapping
Storyboarding

Farm
- Product Description
- Product Range
- Prices
- Delivery

Product Description
- Seat Options
  - We offer top of the line vinyl in all of our tracker seats.
  - Bucket seats can be ordered for an additional fee.
  - Bench seats are available with seat belts.

Product Range
- Small
- Medium
- Large
Technique 5 - Construction

Given a variety of shapes and sizes these techniques allow for quick rearranging:

- Popsicle Sticks
- Construction Paper
- Foam Models

Image: from Plains Art Museum
Technique 6- Research

- Web Search
- Patents
- Solutions to similar problems in unrelated areas
A vine cutter for cutting entangled vines of potato plants in front of a potato harvester so that the vines do not become entangled and accumulated upon a front portion of the potato harvester. The inventive device includes a frame having a pair of upper members and a pair of opposing lower members, a first disc journaling to the frame, a second disc journaling to the frame below the first disc and having a ground engaging rim attached coaxially, and a motor mechanically connected to the first and second discs. The first disc and the second disc are vertically oriented, and a portion of the discs overlap and are juxtaposed to one another. The pair of discs preferably include a plurality of notches projecting into their respective outer perimeters. The discs rotate at a differential to one another from 1.2 to 2.5 depending upon the type of vines being cut. The ground engaging ring attached to the second disc determines the depth of penetration by the second disc into the ground. The discs preferably rotate opposite of one another with a lower portion of the second disc rotating with the movement of the frame with respect to the ground surface.

16 Claims, 2 Drawing Sheets
Technique 7-
Assumption Smashing

Consider what happens to the design of a product or system if each of the assumptions are dropped one at a time.

Fewer Limitations  ➔  More Creativity

Keep Success Criteria at High Level
Technique 8 - Fail Fast

- Trying many ideas
- Free of limitations
- Recognize other opportunities
- Recognize failures early
Creativity in Invention
Summary

“To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science.”

Albert Einstein