



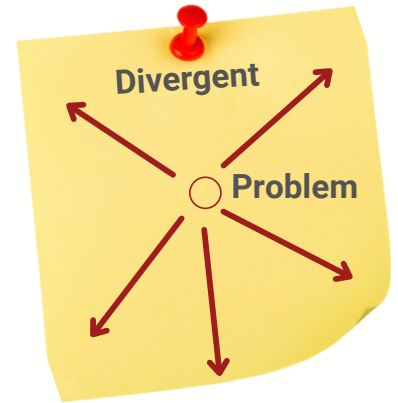
# Designing



Design thinking include both divergent and convergent thinking techniques. Up until know most of the techniques we have used have been divergent.

## Divergent Thinking

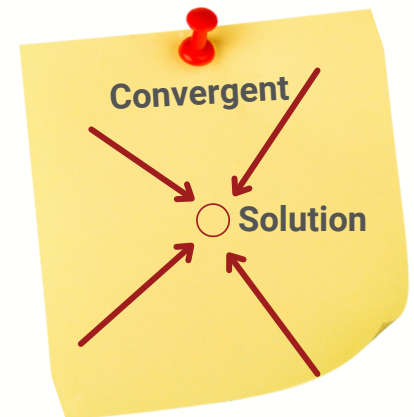
Divergent thinking is the process of generating multiple ideas to maximize the range of possible solutions, applications, examples, etc. It is the initial stage of creative problem solving where learners have the space and freedom to explore out-of-the-box ideas, take risks, push beyond obvious answers, probe deeper, and defy some of the conventional boundaries and constraints of a particular discipline. Typically, divergent thinking involves brainstorming, collecting spontaneous and random associations with a given topic, and increasingly expansive ideation.



In the design phase of the engineering design process, we ask students to use convergent thinking techniques.

## Convergent Thinking

Convergent thinking usually follows divergent thinking. It is a process in which learners critically sift through the collection of possible solutions by considering realistic limitations and feasibility, comparing positive and negative attributes. Divergent thinking unfolds and broadens; convergent thinking narrows down and focuses, filtering the set of creative options to identify and clarify the next step. The challenge during divergent thinking is pushing through the initial blockers, blinders, and biases, and resisting the natural inclinations to turn toward convergent thinking prematurely.



In the design phase of the engineering design process, we ask students to use convergent thinking techniques.

**Activity:** Based on the work of Anne Manning from Harvard Professional Development get students to complete the following exercise which demonstrates the concepts of divergent and convergent thinking to inspire new ways to approach problem-solving.

**Step 1:** Stand up, and stretch your arms into the air for about 30 seconds. (Divergent Thinking)

**Step 2:** Bend over and touch your toes for about 30 seconds. (Convergent Thinking)

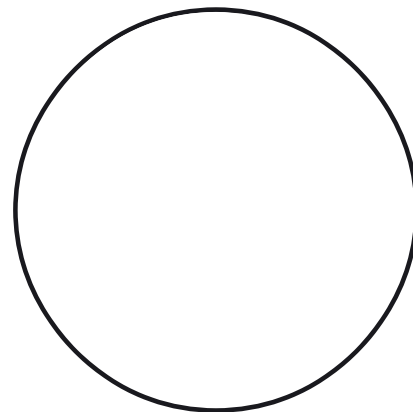
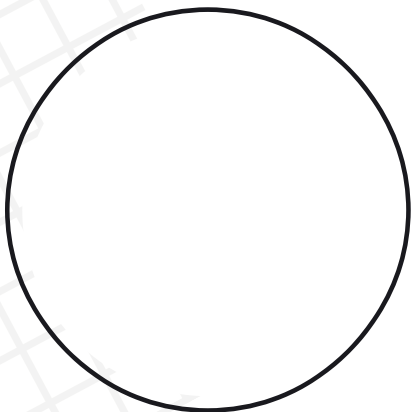
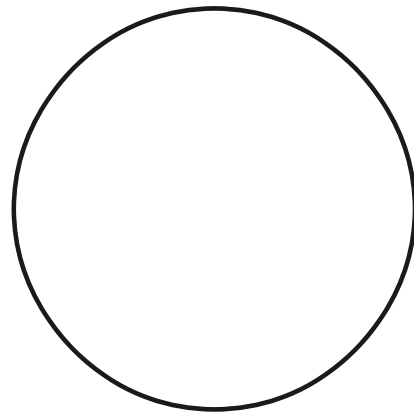
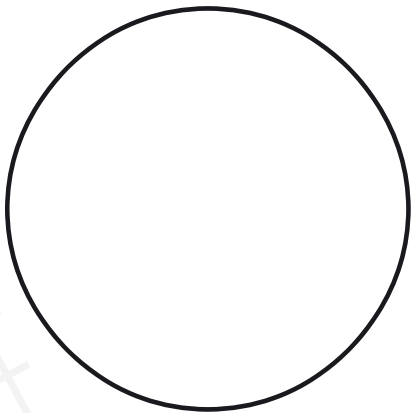
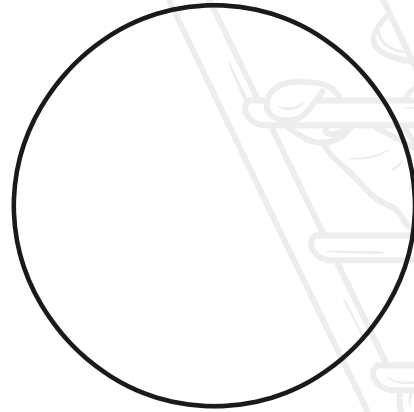
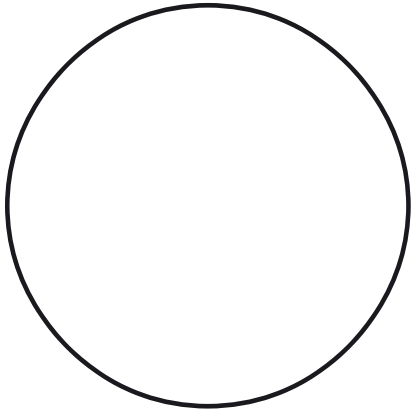
**Discussion:** Think about how you felt when doing each of the exercises.



# Convergent Design



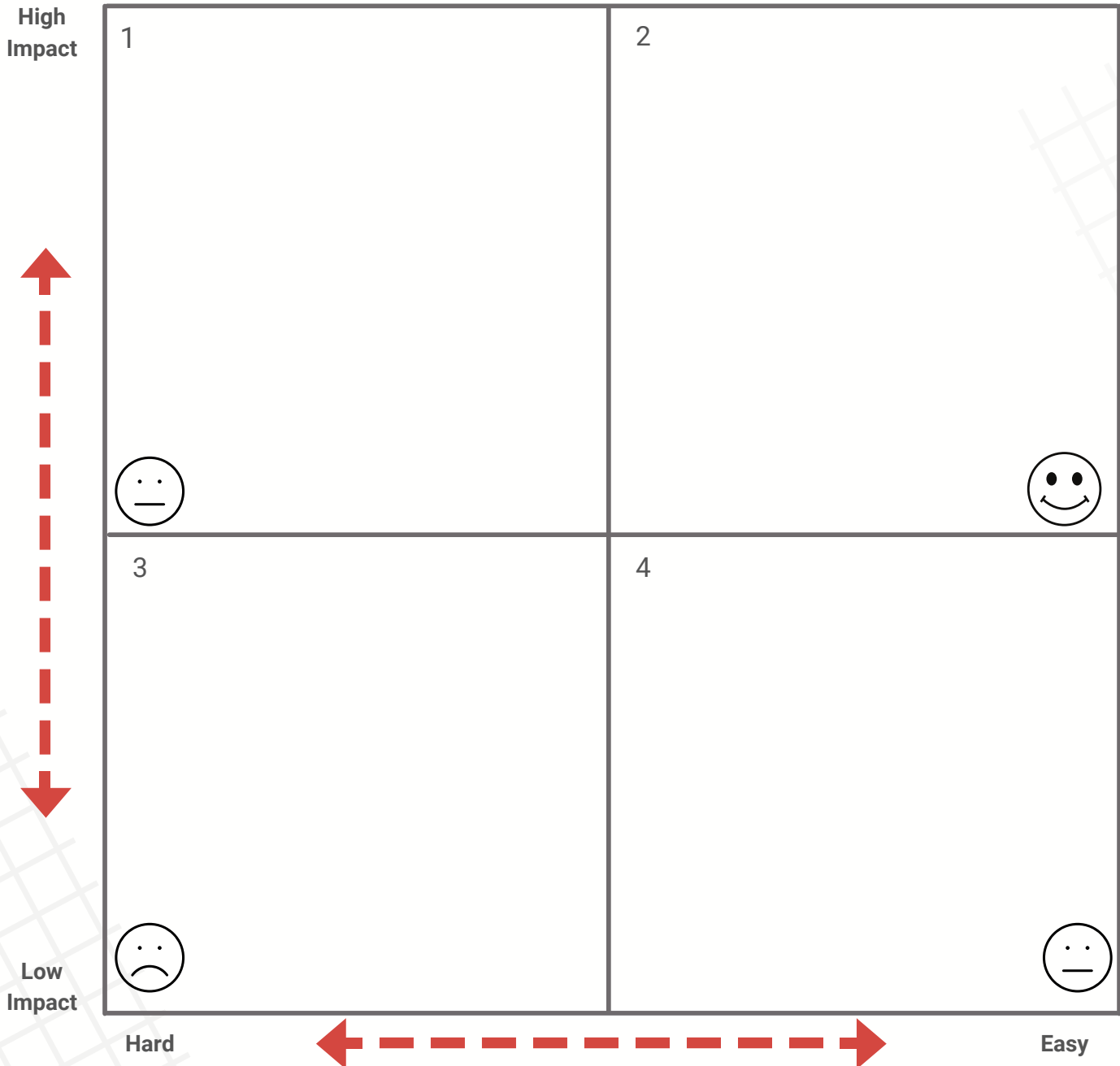
**Convergent Thinking Activity 1:** From the brainstorming activities that you have previously completed in mission 4, select the six best designs. In the circles below make a sketch of the ideas and around the outside make annotations to describe the idea.



# Evaluate



**Evaluate** - Now evaluate your six best ideas further using the impact/effort matrix below. Add all six ideas and connections into one of the four segments.



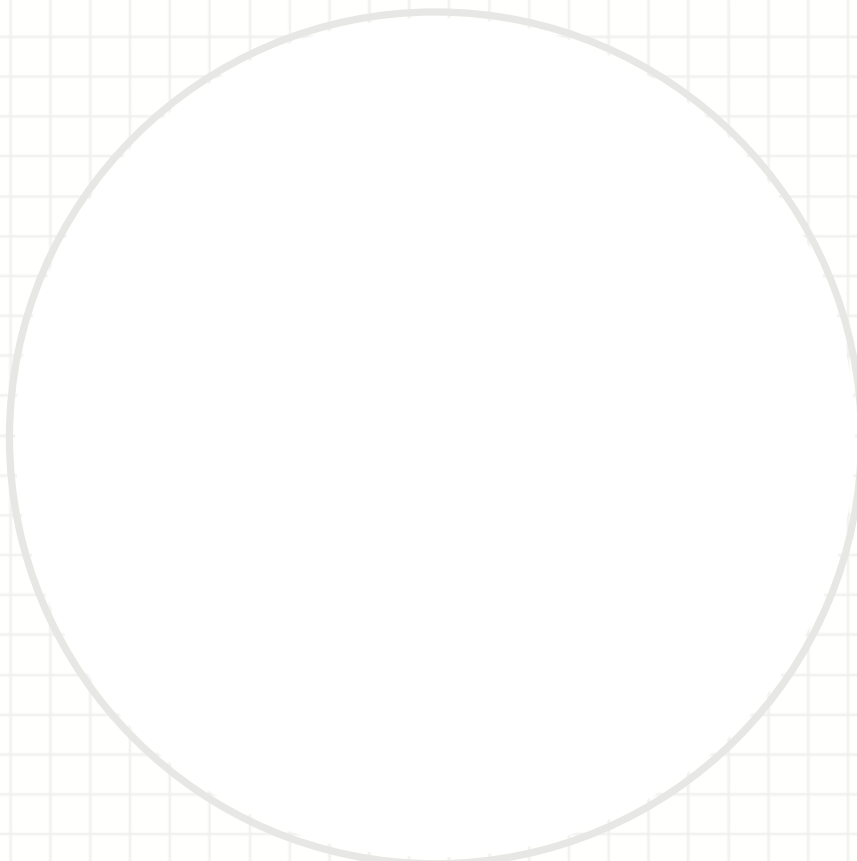
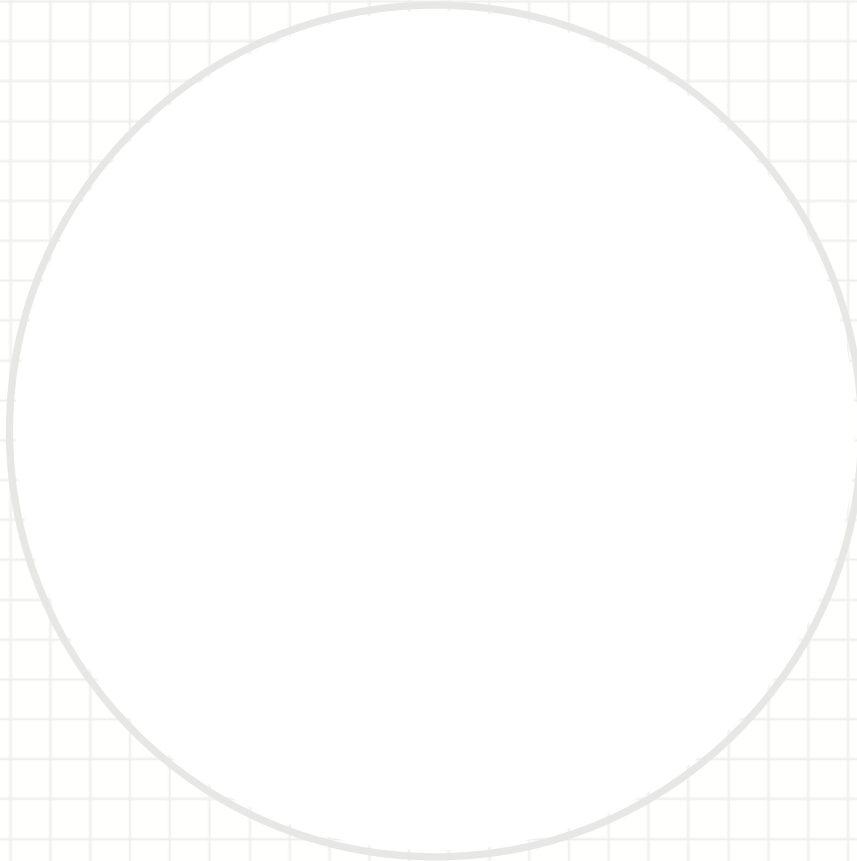
**What is an Impact Effort Matrix?**

An impact effort matrix is a decision-making tool that assists people to manage their time more efficiently. Each potential idea, strategy or project is assessed based on the level of effort required and the potential impact or benefits they will have.

# Convergent Design



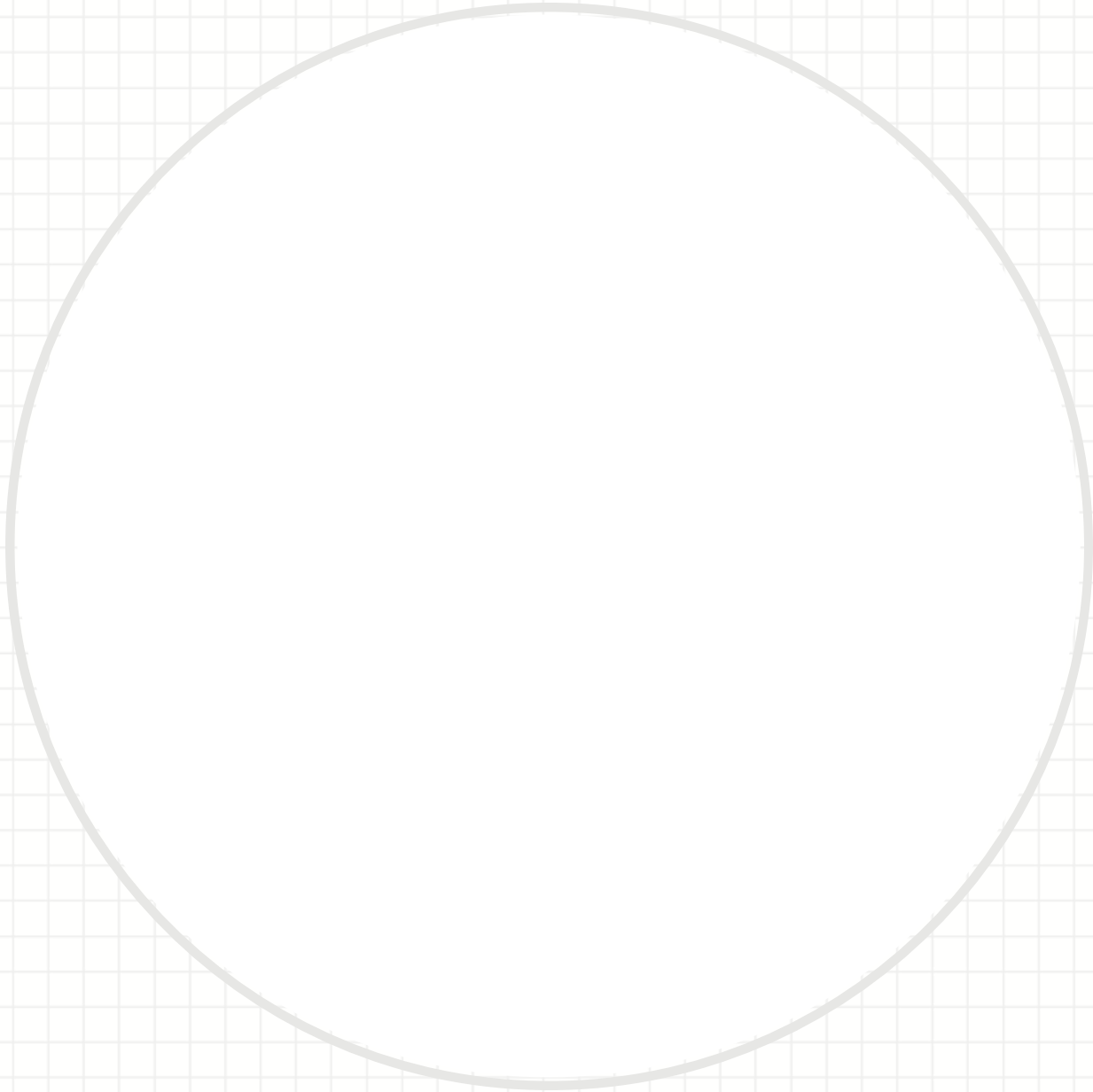
**Convergent Thinking Activity 2:** In the circles below, combine the best aspects of your top six designs to produce two new combined design solutions. These should have aspects of two or more ideas. Use the space around the circles to annotate your ideas or make detail sketches.



# Final Design Idea



**Convergent Thinking Activity 3:** Finally, select one the final design solution that you wish to prototype. Ideally, it will combine some of the successful features of the two previous combined design ideas. Sketch your idea in the space provided and use the space around the out side to annotate and provide detail sketches.



In the space provided, tell us why you think this one is the best design.