

# Prompts for Creativity in Design

Hung-Fu (Aaron) Chang, Ph.D.

R. B. Annis School of Engineering

# Creativity

- Creativity
  - Not just about creating new ideas from scratch
  - Also involves redefining existing thoughts and synthesizing previous ideas
- Many studies about using a Large Language Model (LLM) tool to do creative tasks
  - PISA 2022 Creative Thinking assessment (<https://www.oecd.org/en/topics/sub-issues/creative-thinking/pisa-2022-creative-thinking.html>)
  - Based on average creativity performance on above tasks, whether AI is more creative than human is still under debate

# Creativity Measurement

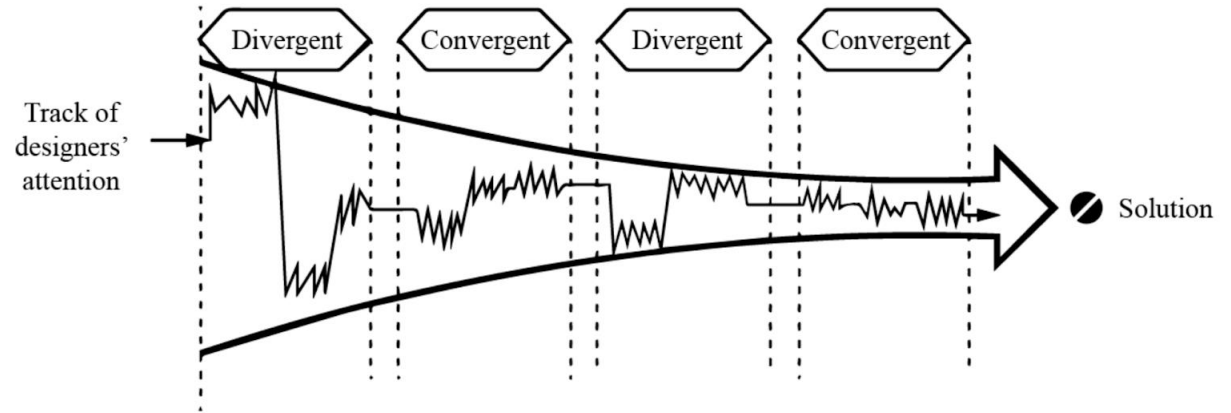
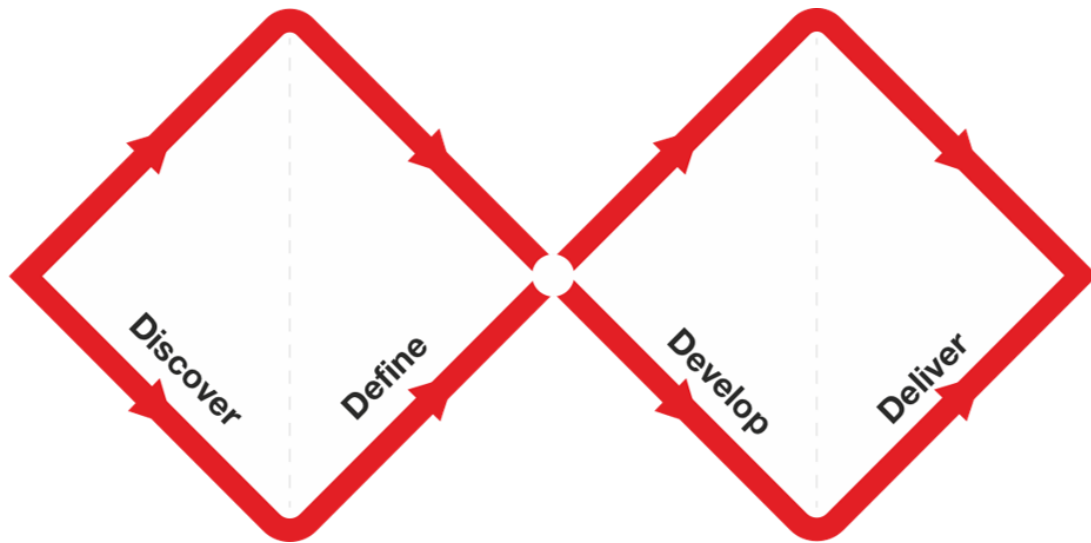
- Torrance Test for assessing creativity

Dimension	Description
<b>Fluency</b>	This refers to the ability to generate a large number of ideas or solutions to a given problem. It measures the quantity of responses, indicating how easily a person can produce multiple ideas.
<b>Flexibility</b>	Flexibility measures the diversity of the ideas generated. It assesses how well an individual can shift their thinking and approach problems from different angles or perspectives. A person with high flexibility can generate ideas across various categories and adapt their thinking to new and diverse contexts.
<b>Originality</b>	Originality evaluates the uniqueness and novelty of the responses. It focuses on how rare or uncommon the ideas are compared to the responses of others.
<b>Elaboration</b>	Elaboration measures the amount of detail and development provided in the ideas. It assesses the ability to expand on ideas, adding depth, intricacy, and complexity.

# Brainstorming in Creativity

- Brainstorming is one of many techniques for prompting creativity
- A frequently used techniques
- Unstructured technique used in a group setting
- In engineering
  - Brainstorming is often used in a team to come up with ideas
- AI can help in promoting human creativity in brainstorming

# Divergent and Convergent Phases in Design



Nigel Cross's divergence and convergence model of overall folding

From <https://www.designcouncil.org.uk/our-resources/the-double-diamond/>  
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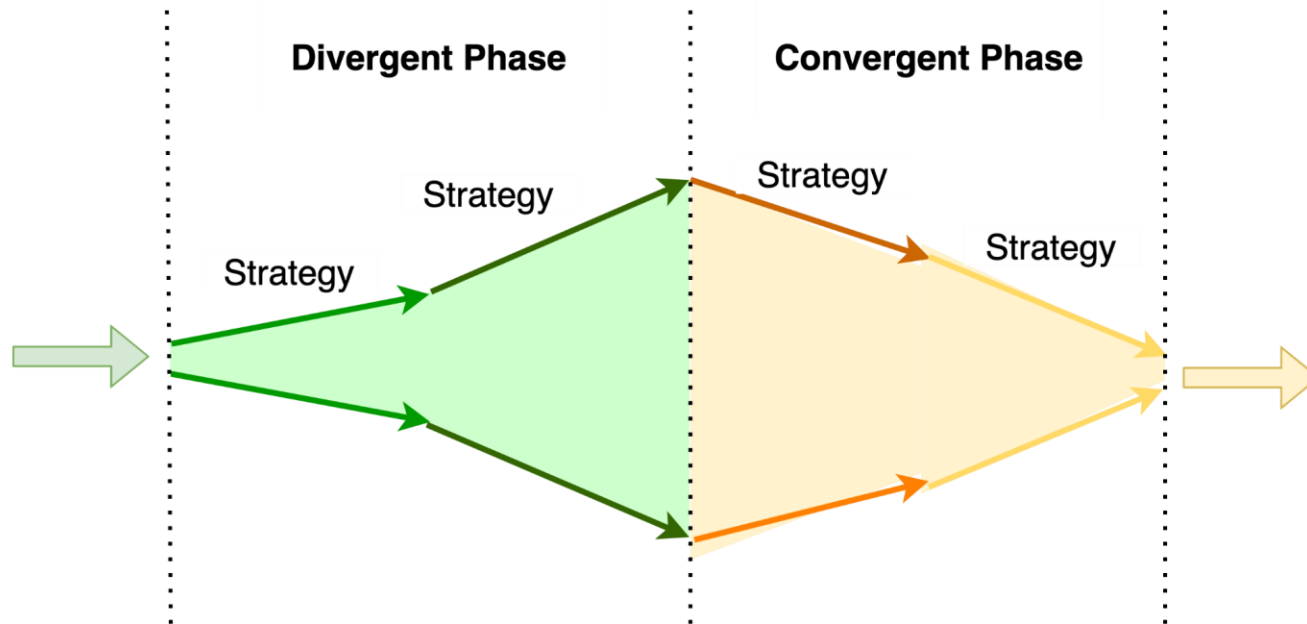
- A visual representation of the design and innovation process
- Brainstorming proved to be an effective approach for

# Goal-Prompt-Strategy Framework

<b>Level 1: Goal</b>	<b>Determining divergent or convergent phase</b>
<b>Level 2: Prompt</b>	<b>Forming a prompt with basic elements</b>
<b>Level 3: Strategy</b>	<b>Selecting strategies for updating a prompt</b>

**Prompts Collection:**

<https://huggingface.co/datasets/fka/awesome-chatgpt-prompts>



# Prompt Template

*{Who (What Role)} under {What Task/What Organization}. {Context} In {What situation or environment} {What is the problem}. {What Scenario} {What do we want to do} {Desired Outcomes}.*

- **Who:** Role, Audience
- **What:** Context, Task, Problem, Scenario, Situation, Constraint, Objective
- **Where:** Location, Environment
- **Output Requirement or Expectation**

# Strategy

<b>Phase</b>	<b>Divergence</b>	<b>Convergence</b>	<b>Both</b>
<b>Strategies</b>	Unconventional Role in Context	Emphasis	Chain-of-Thoughts (Multi-Steps)
	Environment Change	Self-Refinement	Analogy: One-Shot or Few-Shots
	Flipped Interaction		Reflection
	The Alternative Approaches		

# Strategy in a Nutshell (1/4)

- Chain-of-Thoughts (Multi-Steps)
  - Ex:
    - How to build an eighteen-wheel car?
    - (Response)
    - How to modify your solution when the size of the wheel is 20 inches?
- Unconventional Role in Context
  - Ex:
    - [Act as a four-year-old child](#), how would you build a car?
- Flipped Interaction
  - Ex:
    - I would like [you to ask me several questions](#) for designing a car.

# Strategy in a Nutshell (2/4)

- Analogy
  - One-Shot
    - Ex:
      - Given using wind to drive a motor, design a car without using gasoline
  - Few-Shots
    - Ex:
      - Given using wind to drive a motor and solar power to drive a motor, design a car without using gasoline
- Environment Change
  - Ex:
    - How to design a car that runs on a muddy and rocky road?

# Strategy in a Nutshell (3/4)

- Emphasis

- Ex:

- How to build a car?
    - (Response)
    - Are you sure X in your answer?

- Reflection

- Ex:

- How do you build a car with tools X and Y?
    - (Response)
    - Explain the reasons and assumptions of your answer?

# Strategy in a Nutshell (4/4)

- The Alternative Approach
  - Ex:
    - Given the conventional approach that uses gasoline to drive a car, **list all the possible alternative ways to drive a car**
- Self-Refinement
  - Ex:
    - How to increase software robustness?
    - (Response)
    - From your suggestion X, **evaluate it yourself, suggest a better version of your solution**

# Test on GPS Framework



**Design Task:**  
Design a car that can fly.

# Creativity Measurement

- Torrance Test for assessing creativity

Dimension	Evaluation Method
<b>Fluency</b>	Number of Ideas
<b>Flexibility</b>	Number of idea groups or categories
<b>Originality</b>	Rating from 0 – 10 0: No uniqueness 10: Most original Average rating of all the generated ideas
<b>Elaboration</b>	Rating from 0 – 10 0: No details, depth, or complexity 10: Most details, depth, or complexity Average rating of all generated ideas

# Test on GPS Framework: $P_0$ vs $P_1$

## $P_0$ : Direct Prompt (without framework)

What are possible solutions to design a car that can fly?

## $P_1$ : Prompt with framework's template only:

Imagine you are an engineer, you were asked to design a car that can fly. The goal is to save people's commuting time and improve the traffic. Specifically, this car is designed for school teachers. We would like you to generate as many ideas as possible. What are possible solutions to this problem?

### Who:

Role: Imagine you are an engineer

Audience: Specifically, this car is designed for school teachers.

### What:

Context: You were asked to design a car that can fly.

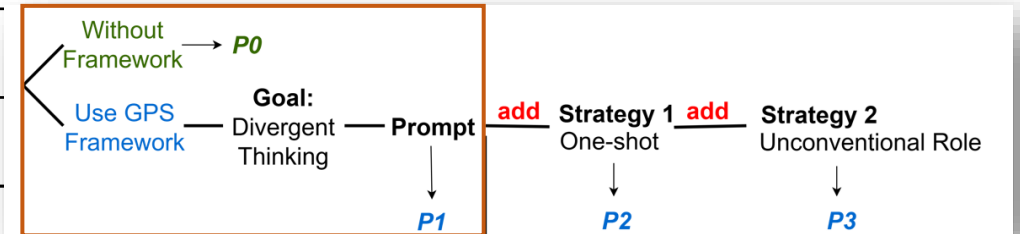
Objective: The goal is to save people's commuting time and improve the traffic.

### Output Requirement:

We would like you to generate as many ideas as possible.

### Additional Information:

What are possible solutions to this problem?



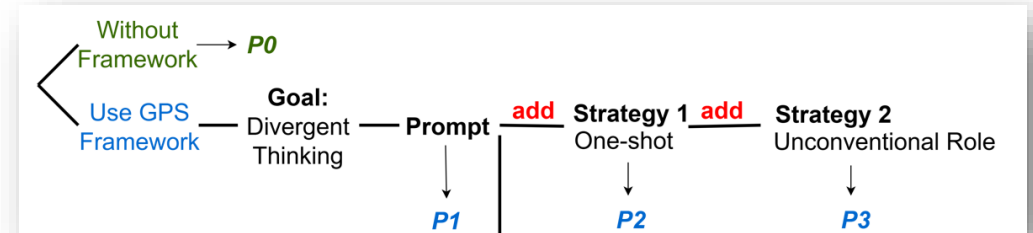
# Highlights of the ChatGPT Responses: *Po*

- Designing a car that can fly involves overcoming several technical challenges. Here are some possible solutions to address these challenges:
- **1. Dual-Mode Capability:**
  - Develop a vehicle with the ability to transition seamlessly between driving on roads and flying in the air.
  - Integrate retractable wings, tail, and other aerodynamic surfaces to enable flight.
- **2. Propulsion Systems:**
  - Use a combination of electric motors and jet engines for propulsion.
  - Electric motors can provide efficient ground propulsion, while jet engines offer the necessary power for flight.
- **3. Flight Controls:**
  - Implement advanced avionics systems, including GPS navigation, autopilot, and collision avoidance.
  - Ensure intuitive controls for both driving and flying modes, possibly with automated transition systems.
- **4. Structural Design:**
  - Design a lightweight yet durable structure to minimize weight and improve fuel efficiency.
  - Utilize composite materials and advanced manufacturing techniques to achieve the desired strength-to-weight ratio.
- **5. Safety Features:**
  - Incorporate safety mechanisms such as parachute systems for emergency landings and collision avoidance sensors for obstacle detection.

# Highlights of the ChatGPT Responses: *P1*

- More items generated: totally 12 items
  - New ideas, such as
    - Hybrid Power System
    - Vertical Take-Off and Landing (VTOL) Technology
    - Autonomous Flight Systems
    - ...etc.
- More categories generated

# Test on GPS Framework: *P2*



## ***P2: Prompt with framework (P1 + one-shot) (Phase: Divergence)***

Imagine you are an engineer, you were asked to design a car that can fly. The goal is to save people's commuting time and improve the traffic. Specifically, this car is designed for school teachers. We would like you to generate as many ideas as possible. You can generate ideas such as using magnetic power to make the car hover in the air. What are other possible solutions to this problem?

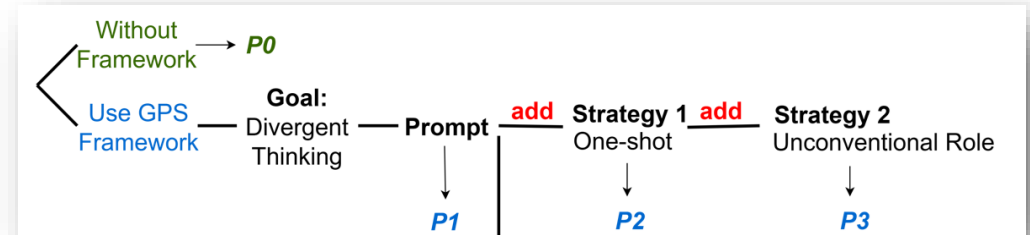
### **One-shot:**

You can generate ideas such as using magnetic power to make the car hover in the air

# Highlights of the ChatGPT Responses: *P2*

- More items generated: totally 16 items
  - New ideas, such as
    - Tilt-Rotor Mechanism
    - Lightweight Composite Materials
    - Noise Reduction Technology
    - ...etc.
  - Some of them are original
    - Tilt-Rotor Mechanism
- More categories generated

# Test on GPS Framework: $P_3$



## ***P3: Prompt with framework (P2 + Unconventional Role) (Phase: Divergence)***

Imagine you are an eight-year-old child, you were asked to design a car that can fly. The goal is to save people's commuting time and improve the traffic. Specifically, this car is designed for school teachers. We would like you to generate as many ideas as possible. You can generate ideas such as using magnetic power to make the car hover in the air. What are other possible solutions to this problem?

### **Unconventional Role:**

Imagine you are an eight year old child

**(Role change:** replace an engineer with an eight-year-old child)

# Highlights of the ChatGPT Responses: *P3*

- More items generated: totally 20 items
  - New ideas, such as
    - Solar Power
    - Balloon Lift
    - Hover Pads
    - ...etc.
  - Many of them are very original
    - Magnetic Tracks
    - Balloon Lift
    - Rocket Boosters
- More categories generated

# Quick Summary

- In the divergent phase
  - Fluent: number of ideas increases
  - Flexibility: number of idea categories increases
- Unconventional Role strategy
  - Bring original ideas
- As we use AI to help us on brainstorming, we expect to “think outside of the box”

# Fun Facts

- Be specific and direct
  - No need to be polite
  - Ex: solving the problem...., directly provide the answer, without showing how to derive the answer
- LLM training data collection time
  - Ask on 4/14/2025
  - ChatGPT: My training data is up-to-date until April 2023, which means that any new information or developments after that date are not included in my responses.
- Training on the fly?

# Reference

- Hung-Fu Chang, Tong Li, A framework for collaborating a Large Language Model tool in brainstorming for triggering creative thoughts, *Thinking Skills and Creativity*, Volume 56, 2025.  
<https://doi.org/10.1016/j.tsc.2025.101755>.
  - (<https://www.sciencedirect.com/science/article/pii/S1871187125000045>)