

Video 12-3 Divergent and Convergent Thinking

We have learnt quite a bit about the Design Thinking process as a designer's mode of inquiry from the previous videos. In this lecture video, I will uncover a cognitive appreciation of the design process, and also focus on the holy grail of design – the ideation phase, or act of coming up with new ideas.

First of all, let me introduce 2 terms. **Divergent thinking** and **Convergent thinking**. If you have heard of them before and know something about divergent and convergent thinking, give me a chance to talk you through it. Divergent thinking is a thought process used to generate ideas by exploring many possible solutions. Convergent thinking is the opposite of divergent thinking, where one follows logical steps to arrive at a one “correct” answer. These 2 terms were first coined by the psychologist J.P. Guilford in 1956. Lets compare these 2 thought processes.

Convergent thinking is a type of thinking that focuses on coming up with the single, well-established answer to a problem. Take this simple mathematical problem you might have encountered way back in primary one as an example. What is the solution for 21 plus 4? Twenty-five! If you happen to get this wrong I am very worried for you. And if you gave a different answer from 25 back in primary school, you would have gotten zero marks for this question, and a big red cross.

You would also be very familiar with all the standardized tests and examinations, be it a open ended or multiple-choice questions such as this “O” level physic question on the turning effect of forces, give it a go! There are no error bars to cushion your answer here:

What's your answer? (You may pause the video and give it some thought). Well, if you apply what you have learnt in your secondary school physics class about the turning effect of forces, the correct answer would be 350N. If you got the correct answer good for you! But that is not the point I am trying to bring out. This physics problem, and the arithmetic problem before required a correct answer as a solution. While trying to solve each question, you went through logical steps in your mind, arithmetic for the first question and applying a physics concept for the second one. The thought processes in solving both questions are convergent thinking in principle – You have some facts that you depended upon to find an answer based on the data given.

This type of thinking is certainly necessary and important, especially in decision-making, and it certainly helps one excel in school! Think back to all the subjects you studied in school prior to your university education. Recall the assessment questions during tests and examinations used to evaluate your understanding in those subject areas. Were they mostly based on convergent thinking?

On the other hand, do you remember any questions or tasks that was based on divergent thinking? Ok I'm getting ahead of myself here, let me explain. Divergent thinking is the opposite of convergent thinking. Divergent thinking is the thought process that generates many ideas, or possible solutions based on a single problem or stimulus. Imagine you were tasked with the same question - What is the solution for 21 plus 4? - Now take the perspective of divergent thinking, what might be the

possible solutions? Give yourself some time to work on it, write your answers on a piece of paper. You may pause the video now to give yourself some time.

What are your answers? Let me give you a few:

$$21 + 4 = 25$$

$$21 + 4 = 10 + 15$$

$$21 + 4 = 77 - 52$$

$$21 + 4 = 5 \times 5$$

$$21 + 4 = 489,375 / 3 - 16,310 \times 10$$

$$21 + 4 = 3^9 / 9 - 2,162$$

I am sure by now you realize that the list of answers go on, and there is an infinite number of possible answers. I wonder what might be a school teacher's reaction if any of these answers were given. This is a simple example of divergent thinking, which involves the process of coming up with alternative solutions to a task or problem.

Lets try another exercise. This time, let me introduce the **Alternative Uses Task** developed by J.P. Guilford in 1967, this exercise is used to measure divergent thinking by having you think of as many possible uses for a common item. Grab a piece of paper and write down your answers. Give yourself 3 minutes to complete the task. Il help you keep time. Ready? Here's the task:

List down all the uses for a toothpick.

Time starts now!

Time is up!

First of all, can you imagine getting this question in an examination? How could one evaluate the possible answers to this question? Well, for the Alternative Uses Task, there are four scoring components, use them to evaluate your answers as much as you can:

- 1 **Originality** – how common is the use (vs. other people's responses). For a toothpick, maybe "a bookmark" could be a common use but "cleaning gaps on my keyboard" or "replacing missing screw on a spectacle hinge" could be more unusual.
- 2 **Fluency** – is the total number of uses.
- 3 **Flexibility** – number of different categories. For these four uses: "a bookmark", "replacing missing screw on a spectacle hinge", "cleaning gaps on my keyboard" and "cleaning gaps and cracks" there are 3 categories, since "cleaning gaps on my keyboard" and "cleaning gaps and cracks" are of the same category.
- 4 **Elaboration** – amount of detail in an answer e.g. "replace missing screw" compared to "quick and temporary replacement of missing screw on a spectacle hinge" has less details.

How do you think you did? How many uses did you come up with? 5? 10? 20? Which of them were particularly interesting or original? Did you have many categories of uses?

Now that you know how good of a divergent thinker you are, let's bring out the design thinking diagram that you are already accustomed to. I'm going to show you how divergent and convergent thinking relates to this process. You already know that this diagram represents the key phases of the design thinking process, where designers go through the cycle of - understanding the issues and users, formulating a well-defined challenge, ideating many possible ways to solve the problem, and prototyping to test the solutions for improvements. Throughout these 4 general phases of design, which you have experienced in the design tutorial, we are actually moving in and out of 2 main modes of thinking – Divergent Thinking and Convergent Thinking.

Let me explain. In the first phase where you were trying to understand the issue you are tackling, interviewing your partner and collecting information, you were listing many options that could have contributed to your problem statement. This is divergent thinking. In the second phase where you made choices based on the data about your partner what was collected to formulate the problem statement, it was convergent thinking.

In the next phase where you generated different ideas that could solve your problem statement, it was divergent thinking. And in the last phase, prototyping and testing helped you select and determine the best solution you have, converging on the final solution.

With this dual thinking approach in the design thinking process, both divergent and convergent thinking is important in a design and creative process. Coming up with lots of interesting ideas is insufficient if we fail to use logical and evaluative thinking to critique and narrow ideas to ones best suited for given situations or a set criteria. Vice versa, being very good at decision-making is futile if there are no quality alternatives to choose from.

In the design process, it is important to be aware of which phase you are operating in, and your mindset should be guided by the dominant thought process. This is crucial especially if we are operating in the divergent thinking zone, where logic and judgment are deterrents of divergent thinking. While ideating, give yourself, and others (if there are more people involved) mental space to be free to come up with ideas however unexpected, crazy or obscure the ideas are. Only after you have given yourself the room to ideate, go through the ideas and start making sense of them. A crazy idea can sometimes become a catalyst leading to an innovative breakthrough.

There's a particularly interesting piece of study about the ideation process I will like to point out. You might have heard of the term **brainstorm**, used to describe a group based creative technique for generating lots of new ideas about a particular subject in a very short time, where criticism of the suggested ideas coming much later. This technique is often used in education and in the industry, often seen as a magical 1-2 hour moment where the most creative ideas and solutions are produced. You probably would have participated in such a session yourself, either in school or with a project team, where a group of people come together, most of the time with many colourful post its, jotting down and sharing as many ideas as they can within fixed duration. Well, here's the interesting news: brainstorming is one of the least successful methods for developing good and creative solutions. Keith Sawyer, a psychologist at the

University of Washington, summarized what science knows about brainstorming as follows:

Decades of research have consistently shown that brainstorming in a group produces fewer ideas than if the same number of people had thought up their own ideas individually, before sharing them collectively.

Even the quality of ideas resulting from group brainstorming were worse than ideas generated by other methods.

In 2003, Charlan Nemeth, a psychology professor at the University of California did a study showing that a “debate approach” to brainstorming was more effective than the classic approach to brainstorming, where solutions generated in a group needed to be criticized and discussed for maximum effect.

So it certainly seems that divergent thinking and convergent thinking are not effective when each thought process exists independently. But when they are put to work together, such as in a design thinking process, it becomes a powerful tool. Also, don't underestimate the creative abilities of an individual. We will talk more about this in the next video.