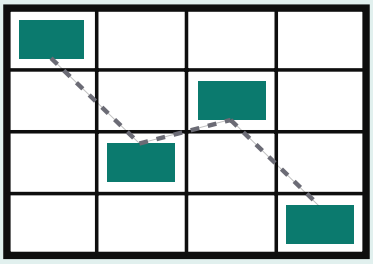
Method

# Morphological analysis

A method that breaks a problem down into its dimensions, lists the options for each and explores the possible combinations in a table.



In Spanish
*Análisis morfológico*

Origin
Zwicky (1969)

Output
A table of parts and options, and the most promising combinations

## What it's for

It helps find solutions nobody would think of at first, because it goes through every combination in an orderly way.

## Key elements

### Parts and options
Each part of the problem (a parameter) is decided separately and has its own options (values). The table that crosses them is called a morphological box, or Zwicky box.

### All the options
For each part, list the alternatives, including the odd ones.

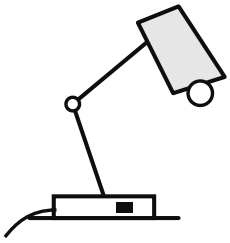
### Combinations multiply fast
Each combination, one option per part, is a configuration. Five parts with five options each already give 3,125.

### Combinations that fit
Compare the options in pairs and cross out those that can't go together (cross-consistency assessment). That leaves only a few to study.

## An example

A team is designing a reading lamp for a small home.

### The first idea




Cord, base, switch and bulb. It's the lamp almost everyone pictures first. **A single combination.**

### The morphological box

| Power | Mount | Control | Light |
|---|---|---|---|
| Cord | Base | Switch | Bulb |
| **Battery** | Clamp | Touch | **LED strip** |
| Solar | **Magnet** | **Twist** | Panel |
| USB | Hanging | Sensor | Globe |

The first idea · A new combination

**4 × 4 × 4 × 4 = 256 combinations**

Four parts with four options give 256 combinations. One of them is a battery LED strip that attaches with a magnet and turns on with a twist. **A combination nobody had thought of.**

The table doesn't invent the idea: it makes you look at combinations that habit skips.

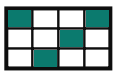
## How it's done

1 

**Name the parts** of the problem, in columns.

2 

**Fill in the options** for each part, in rows.

3 

**Combine them** by choosing one option per column, and assess the best.

## Applications in design

### ✓ When to use it

When a product has several parts that can each be solved in many ways.

### ✗ Avoid

Using so many parts and options that the combinations become impossible to review.

### Don't fall for it

The table generates ideas, it doesn't choose them; you still need to test them.

## 34,560 → 480

### What the research says

Extended producer responsibility strategies, before and after crossing out those that couldn't go together, in a study for the Swedish Ministry of the Environment (Ritchey, 2011).

● ○ ○ **Single study.** It is a case reported by its author, not an experiment. Very few studies compare its ideas with those of other techniques.

## Connections

Used by

- Industrial design
- Illustration

Related to

- Sketching
- Brainstorming
- Scenario planning
- SCAMPER

## Authors and works

| | | |
|---|---|---|
| 1969 | **Fritz Zwicky** | The Caltech astrophysicist used it to explore solutions to technical problems, such as propulsion, and explained it in his book. |
| 1998 | **Tom Ritchey** | Explained the Zwicky box and how to discard impossible combinations by comparing the options in pairs; in his account, 99% or more usually drop out. |
| 2011 | **Tom Ritchey** | From the Swedish Morphological Society, he gathered more than a hundred client projects over some fifteen years, with models of scenarios, strategies and organizations. |
| 2013 | **John S. Gero, Hao Jiang and Christopher B. Williams** | Observed eleven student teams using brainstorming, morphological analysis and TRIZ. The more structured the technique, the more attention they paid to the problem (goals and requirements), especially at the start. |
| 2021 | **Nigel Cross** | His handbook of engineering design methods, first published in 1989, teaches it as the morphological chart for generating alternatives. |

### Sources

**Original sources**


- Zwicky, F. (1969). Discovery, invention, research through the morphological approach. Macmillan.
- Ritchey, T. (2011). Wicked problems – social messes: Decision support modelling with morphological analysis. Springer. View source (https://link.springer.com/978-3-642-19652-2)

- Gero, J. S., Jiang, H., & Williams, C. B. (2013). Design cognition differences when using unstructured, partially structured, and structured concept generation creativity techniques. International Journal of Design Creativity and Innovation, 1(4), 196–214. View source (https://doi.org/10.1080/21650349.2013.801760)


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- Ritchey, T. (1998). Fritz Zwicky, "Morphologie" and policy analysis. Ponencia en la 16th EURO Conference on Operational Analysis, Bruselas. View source (https://ia600207.us.archive.org/27/items/ritchey_swemorph_Gma/gma.pdf)


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- Cross, N. (2021). Engineering design methods: Strategies for product design (5th ed.). Wiley. (Obra original publicada en 1989). View source (https://www.wiley-vch.de/en/areas-interest/engineering/engineering-design-methods-978-1-119-72437-7)


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