

MORPHOLOGICAL CHART

When can the method be used?

The Morphological Chart is usually applied at the beginning of the idea generation phase after some ideas have been sketched. A function analysis is used as a starting point to break down the overall product function into sub-functions – see Function Analysis. Often a number of solutions to these sub-functions are already known, while others still need to be generated. The morphological method results in a matrix of sub-functions and solutions, also referred to as parameters and components. Functions are abstract and solutions are concrete but do not need to have a definitive shape or size yet. The matrix enables you to describe possible principal solutions by combining solutions for each sub-function.

How to use the method?

The starting points of a Morphological Chart are a well-defined main function of the product and a function analysis of the product; the product should be described in terms of its function and sub-functions. The sub-functions describe the characteristics that a product normally has to have in order to serve its overall function. For example, a teapot has the following sub-functions: containing tea (container), filling water (opening in the top), pouring tea (spout) and operating teapot (handle).

The description of a function always contains a verb and an object. In a Morphological Chart, functions and sub-functions are independent and have no reference to material features. Through careful selection and combination of a set of solutions, a 'principal solution' is formed. Generating solutions is thus a process of systematically combining solutions.

The Morphological Chart helps you to generate principal solutions in an analytical and systematic way. It is based on the deconstruction of the overall function of a product into sub-functions.

Possible procedure

STEP 1

Formulate the main function of the product.

STEP 2

Identify all the functions and sub-functions that are needed in the solution.

STEP 3

Construct a matrix with these sub-functions as rows. For the design of a pedal kart this could be, for example: put kart into motion / stop kart / control direction / support the driver's body.

STEP 4

Fill the rows with solutions for a particular parameter. Solutions can be found by analysing similar products or by thinking up new principles for these sub-functions. For example: stopping a pedal kart can be done with disc brakes / cantilever brakes / brake on the tires / feet on tires / feet on the ground / stick in the ground / parachute / and probably more. Use evaluation strategies to limit the number of principal solutions.

STEP 5

Create 'principal solutions' by combining one solution per row for each sub-function.

STEP 6

Carefully analyse and evaluate all solutions with regard to the design requirements and choose at least three principal solutions.

STEP 7

Sketch possible ideas for the whole product based on each principal solution.

STEP 8

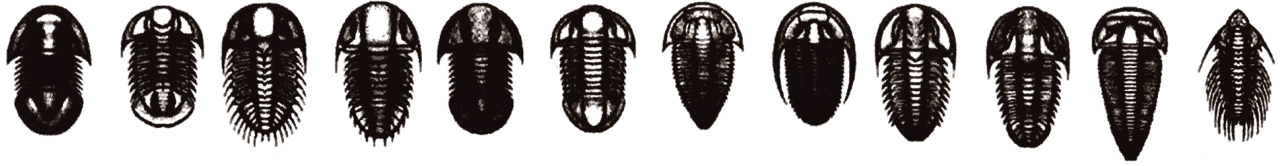
Further detail a selection of the ideas into design proposals.

Limitations of the method

- The Morphological Method is not suitable for all design problems. It is best suited to design problems in the field of engineering design, but with some imagination it can also be applied to form-related design problems.

Tips & Concerns

- The possible combinations for solutions increase fast; a 10 x 10 matrix yields 10,000,000,000 solutions. In order to limit the number of options, analyse the rows critically and group the solutions before making the combinations.
- For the analysis of the rows you can rank the solutions per sub-function in order of first and second preference, using the design requirements.
- Group the sub-functions in groups of decreasing importance. As a first step, only evaluate the most important sub-function group. After you have chosen one or more combinations of solutions, only these are involved in the evaluation. When a combination of solutions has yielded a principal solution, be sure to draw all the solutions or components when developing the solution principle into an idea or design proposal.
- Challenge yourself by making counterintuitive combinations of solutions.



Morphology originates from the biological study of animals and their functional body parts.
 Below: example of a morphological chart for a pedal kart.

	SOLUTIONS	1	2	3	4	5	6
SUB FUNCTIONS	Support kart	4 wheels A	4 wheels B	3 wheels A	3 wheels B	3 wheels C	
	Put kart into motion	Direct drive	Chain drive	Belt drive	Drive shaft	Crankshaft	
	Stop kart	Disk brakes	Rim brakes	Brakes on tire	Brake with feet	Parachute	Anchor
	Control direction	Central axis	Ackermann				
	Support driver's body	Saddle	Chair	Plank	Cloth		

principal solution 1
 > starting point for ideation

principal solution 2
 > starting point for ideation

principal solution 3
 > starting point for ideation

