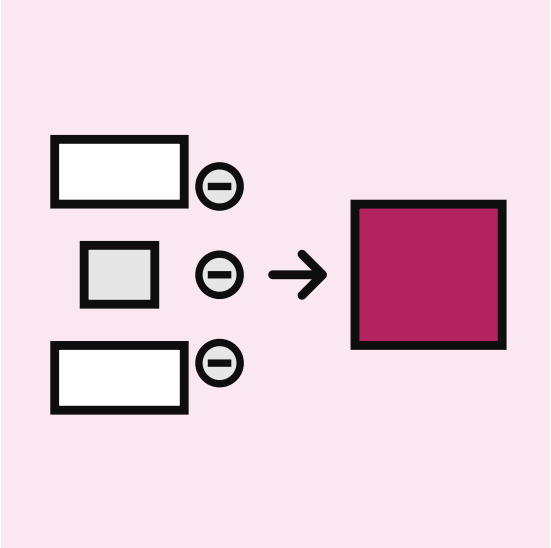
Model

Design for manufacture and assembly

Method for designing products with fewer parts that are easy to make and assemble, assessing each part with criteria and estimated times before production.



In Spanish
Diseño para fabricación y ensamblaje

Origin
Boothroyd (from 1977) and Dewhurst; Boothroyd, Dewhurst and Knight (1994)

What problem it addresses

Almost all of a product's cost is decided while designing it, and changing it later is expensive. Industrial design takes from it the habit of asking, part by part, whether it is really needed.

Components

Assembly first
The product's structure is simplified before each part is detailed.

Every part must be justified
It stays separate only if it moves relative to the others, needs a different material, or the rest could not be assembled or taken apart without it.

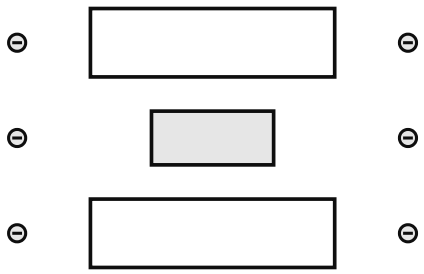
It is measured
Assembly time is estimated and compared with an ideal of about 3 seconds per necessary part.

Manufacturing next
With the structure simplified, the most suitable material and process is chosen for each part.

An example

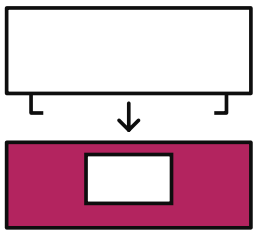
An illustrative example: the housing of a small appliance.

Initial design



Two halves, a separate bracket and six screws. **Assembling it takes many steps and a screwdriver.**

Redesign



The bracket is molded into one half and the two halves snap together. **Two parts and no screws.**

The appliance does the same thing; what changes is how much it costs and how long it takes to assemble.

How it works

1

Each part is listed and its assembly cost is estimated;

2

you ask whether it must be separate, using the three criteria;

3

and you merge or remove any part that meets none of them.

Applications in design

Use it like this

Review the parts list piece by piece, together with engineering, from the first sketches and not at the end.

Avoid

Merging parts at any cost. A single very complex part can cost more to make than two simple ones.

Don't fall for it

Fewer parts must not mean a product that can't be repaired: think about how it comes apart too.

−85%

Before

After

What the research says

Fewer parts in the NCR 2760 point-of-sale terminal after it was redesigned with this method; assembly time fell by 75% (Boothroyd, 1994).

Connections

Used in

- Circular design
- Color, material and finish (CMF) design
- Furniture design

Related to

- Desirability, feasibility, viability

Authors and works

1977	**Geoffrey Boothroyd**	Began, at the University of Massachusetts and with National Science Foundation funding, a method to estimate assembly time and reduce parts.
	Geoffrey Boothroyd and Peter Dewhurst (1980s)	Turned the method into computer software and spread it through industry.
1994	**Geoffrey Boothroyd, Peter Dewhurst and Winston Knight**	Brought the full method, assembly and manufacturing, together in the book Product Design for Manufacture and Assembly.

Sources

Original sources

- Boothroyd, G. (1994). Product design for manufacture and assembly. Computer-Aided Design, 26(7), 505–520.
- Boothroyd, G., Dewhurst, P., & Knight, W. (1994). Product design for manufacture and assembly. Marcel Dekker.

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