

# BUILD IT, BREAK IT

THE ONLY WAY TO DESIGN A WORKING PRODUCT IS BY MAKING PROTOTYPES AND TESTING THEM UNTIL THEY BREAK.

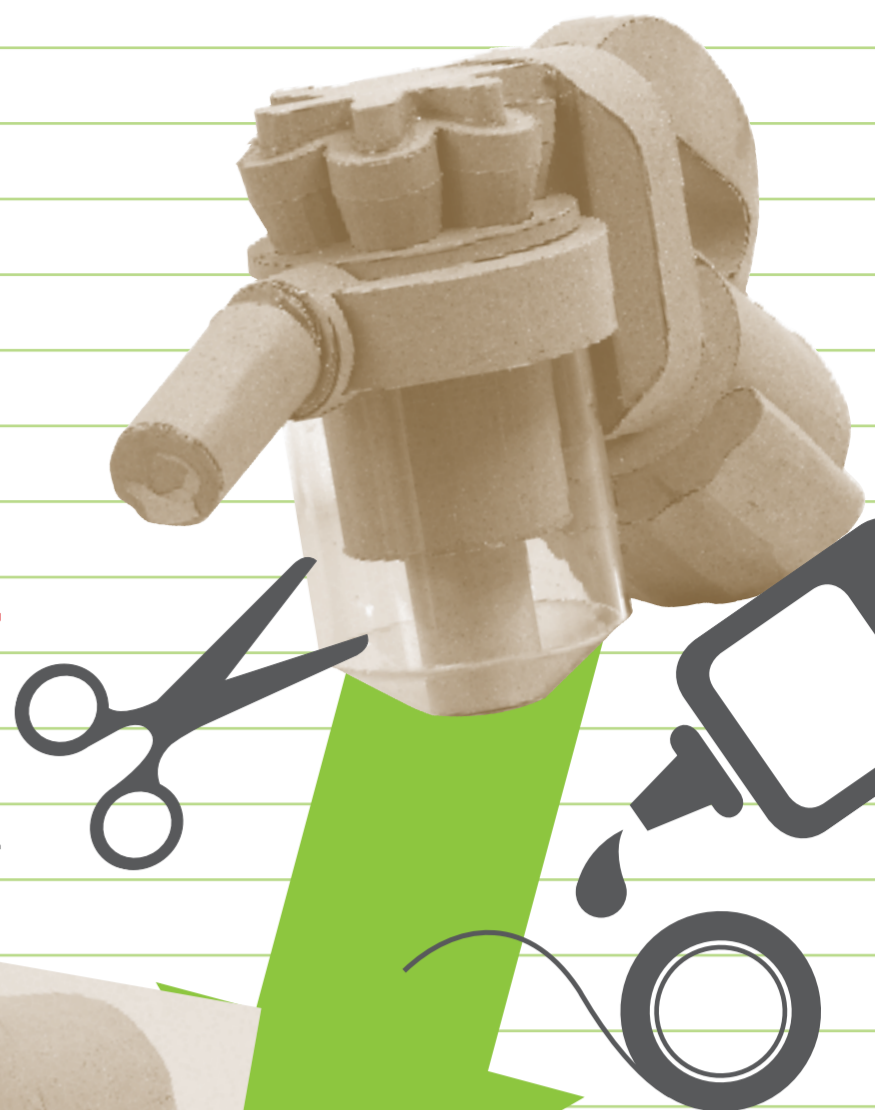
## THE HARD WAY

Engineers spend months prototyping and testing. Over five years, James Dyson built 5,127 prototypes of his first vacuum cleaner, changing one thing every time.



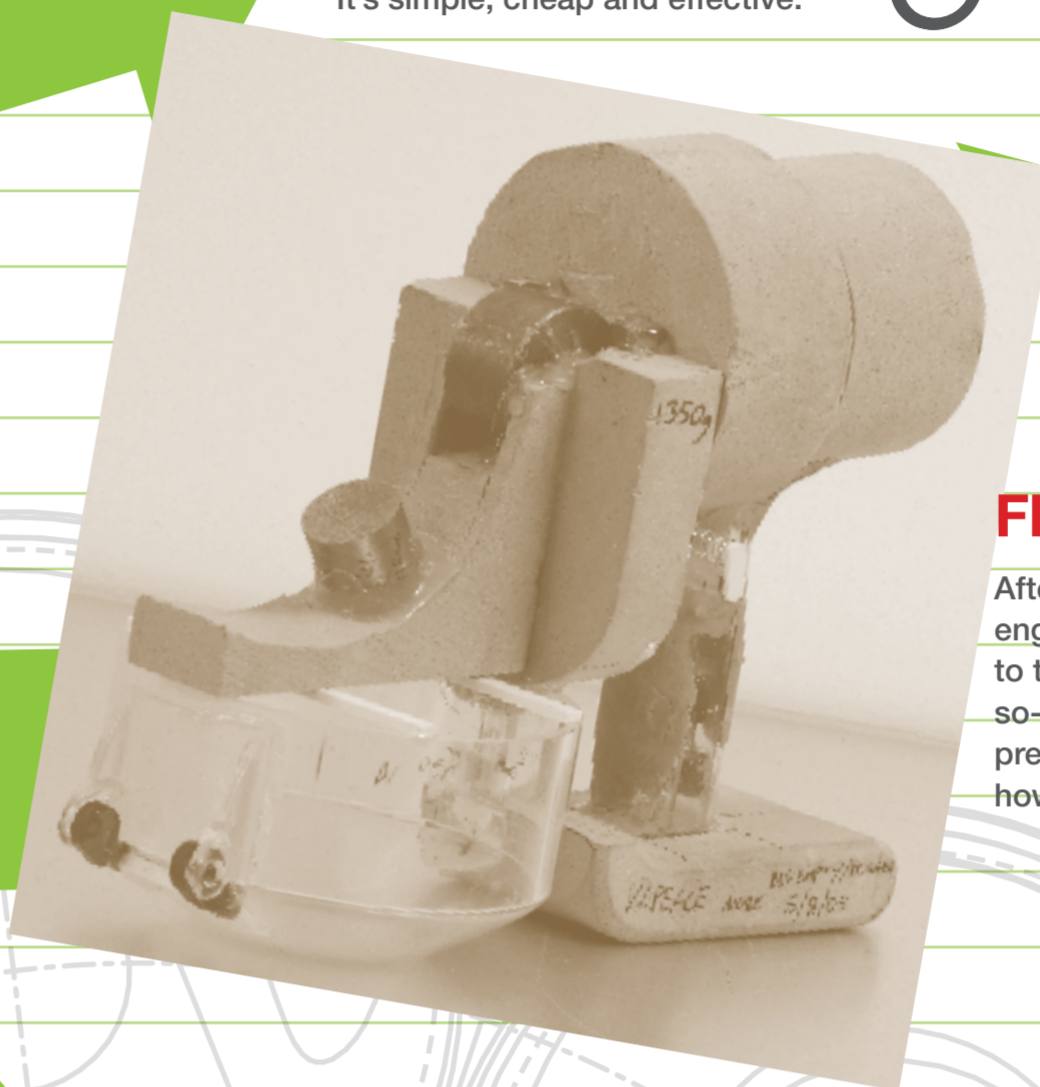
## CUT, STICK, FAIL

Concorde started out as a cardboard aeroplane. Today Dyson engineers still make initial models out of cardboard. It's simple, cheap and effective.



## FRANKENSTEIN RIGS

After cardboard modeling, design engineers make weighted prototypes to test how they handle and feel. These so-called 'Frankenstein rigs' are not pretty, but they're invaluable for testing how a product will feel when it's made.



## COMPUTER AIDED DESIGN

Similar to the graphics in computer games, CAD creates detailed computerised images of products. This allows designers to see how a product might look and work as well as doing some virtual testing.

But there's no substitute for the real thing. Rapid Prototyping (RP) allows engineers to physically test machines. Drop a kettle into a bread-slicer and you'll get hundreds of cross-sections. RP virtually slices CAD models, making thousands of cross-sections which are then printed on top of each other in plastic or metal.

## THE PROTOTYPES

At Dyson, a prototype SLS vacuum cleaner can cost up to \$16,000. Sounds expensive, but the ability to test something and know that it works is worth the cost. RP also helps teams like Williams F1 design faster cars as they perfect their designs millimeter by millimeter.

## SELECTIVE LASER SINTERING (SLS) - THE LUCKY DIP

SLS uses lasers to melt thin cross-sections 0.015mm thick (that's 1/16th the thickness of this poster) into metal or nylon powder on top of each other.

As the layers build up, the surrounding powder gets deeper, and the engineers face what they call a 'lucky dip' to get their prototype out at the end of the process.



## REPRAP

The University of Bath has made a 3D printer called the RepRap (Replicating Rapid Prototyper) that can make copies of itself for only \$800 instead of the original's \$48,000. In a few years, every school, home and office could own one (or many).

## DOWNLOADING DESIGNS

Rapid Prototyping could change the world. One day, your new MP3 player could be downloaded and printed instantly in your own home.