

A Test of Responsibility

It's one thing to design a market winner – another to make it long-lasting, recyclable and energy efficient too. Is digital prototyping the answer? Mike Lucas of Autodesk presents the case...

Our consumer society is undergoing a major shift. The throwaway culture is nearing its sell-by date.

This is causing many manufacturers to stop and think. For the past decade they've been meeting demand for constant innovation – the next must-have pair of trainers, the latest MP3 player – with the goal of being first to market with new ideas and designs.

But now the urgent need to preserve resources and to avoid even more mountains of waste is breaking old patterns. Consumers are becoming more responsible – and sustainability is fast becoming a critical buying factor.

Many manufacturers are ready, willing and able to change tack. But first there are some difficult questions to answer. Not least, what is really meant by a sustainable product? Is it all to do with what it is made from? Or the total energy consumed in the creation, use, maintenance, transportation and disposal or recycling of a product?

The clothing manufacturer Patagonia discovered that a cotton shirt consumes three times more petroleum in its manufacture and lifetime care than one made of synthetic fibres, thanks to fertilisers and other factors. For a product to contain more than just a token of green-ness means looking at design, the product itself and production holistically.

Patagonia solved the problem by converting to 100 per cent organic cotton, but this example demonstrates the need for accurate, reliable information at all stages of a product lifecycle – plus a way of testing the impact of different materials and alternative designs.

Until recently, too much experimentation at the design stage would have been costly and may even have led to the loss of market share. However, the growing inclusion of digital prototyping capability in mainstream and affordable software applications such as Autodesk Inventor, is providing a way for almost all manufacturers not just to visualise their products before they are made, but to actually simulate and analyse their performance too.

This opens up a whole new world where key decisions about a product can be taken far earlier in the life of the product, even at the concept stage using a model on screen rather than real prototypes. Obviously this gives far greater flexibility for trying out ideas and optimising designs.

So, is this the key to more thoughtful and sustainable design? It can certainly help in a complete range of ways. For example:

Reduction of waste and associated costs

The latest software enables integrated 3D design and stress analysis, allowing design teams to evaluate all options, avoiding the stop-start process of scrapping a physical prototype and beginning all over again, with all the unnecessary waste involved. Also, users can try downsizing certain parts, and so use less material. Automated bills of materials which are updated every time an adjustment is made helps to reduce waste by eliminating over-ordering.

Use of alternative materials

Digital prototyping tools use integrated simulation to record how the product will behave in certain circumstances. Because all changes automatically ripple through the entire design and documentation, “what-if” scenarios are easy and fast to assess. Designers, therefore can “try out” using different materials on screen at an early stage of the design process and measure their behaviour. In turn, key decisions about the materials for the product and components can be made before investment in further work or components.

Improved energy efficiency

Manufacturers can also reduce a product’s overall energy footprint with the help of such simulations. Motors can be right-sized to minimise lifetime energy use and packaging can be reworked to use fewer materials and allow more items to be shipped in the same amount of space, reducing the fuel needed for shipment.

Design for longer life, recycling and recovery

Digital prototypes can be used to calculate eventual point of failure and design the product so that this is in a serviceable area, so prolonging its life. A smart operation may even use this information to help work out what spares will be needed for the product throughout its lifetime.

Because the data produced is always totally updated and accurate, when stored in a safe, but accessible data management system it can be re-visited for disassembly or recycling.

Because testing is all done in-house as an integral part of the design workflow, there are no delays while the digital model is sent back and forth, there is no need for data to be recreated and users can be flexible in their testing, responding quickly to their results. Automatic monitoring of key rules and parameters such as length, distance, angles, diameters, volume and mass ensures any changes remain within design limits.

These are just examples of what can be achieved with digital prototyping – opportunities for improvement are limited only by the imagination of the designer.

But what is clear is that digital prototyping gives designers the power to be highly creative and inventive about using resources wisely and designing smarter longer-lasting products. And to have plenty of flashes of inspiration (energy efficient, of course) for themselves.