

James Dyson with an early prototype of his vacuum cleaner © Dyson



JAMES DYSON ON INNOVATION

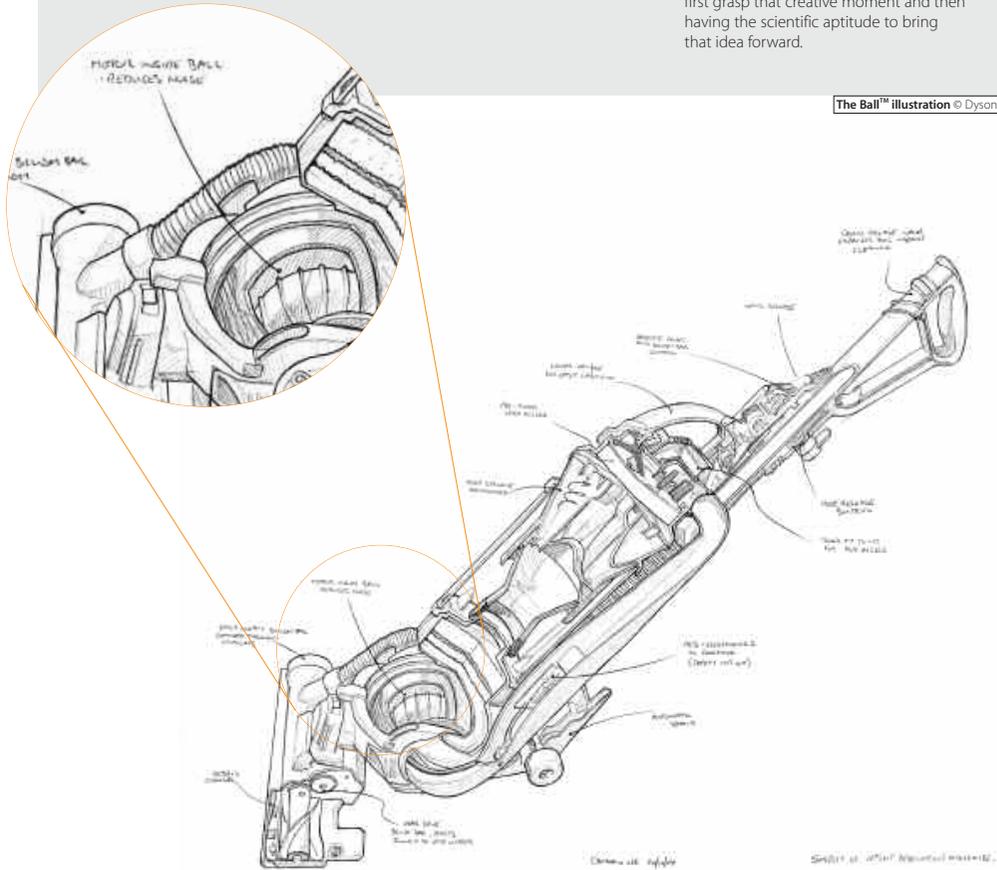
Arguably Britain's best-known design engineer of modern times, James Dyson was recently elected a Fellow of The Royal Academy of Engineering, joining the very highest achievers in UK engineering and technology. In an *Ingenia* exclusive, he poses the question "Engineering and innovation: a stroke of genius or a scientific formula?"

If only it was that simple. I never shrieked 'Eureka!' No doubt it would have felt good, but for me, no such luck: it took years of hard, dogged work. Endless experimentation and many mistakes had to be endured until I found a solution to the problem of clogging vacuum cleaners. Having imagination, faith in an idea's potential and no fear of getting it wrong helped and gave unexpected results. For me, this is engineering, it's innovation. And it's rarely a flash of brilliance.

It's the unlikely juxtaposition of creativity and logic which causes the wooliness and confusion around the term 'innovation'. Everybody wants to be innovative; many companies and ideas are proclaimed to be innovative and no one doubts that innovation is a money spinner. And, thus, we are all looking for the magic formula. Well, here you go: **Creativity + Iterative Development = Innovation.**

Engineers make a living by innovating. Why, you may ask, would one choose the

badge 'engineer' when there are so many more lofty options open to you? Well, it's not as if I am talking to the uninitiated is it? But, please, bear with me. The word 'engineer' and its Latin etymology *in generare*, meaning 'to create', speaks volumes. It's not the terribly serious rote discipline that appearance might suggest. Instead it's about being able to recognise the power of the imagination and the potential of a good idea, and then translate this – through a rigorous and scientific approach – into a tangible object or a clever piece of machinery. This is special: having the ability to first grasp that creative moment and then having the scientific aptitude to bring that idea forward.



The Ball™ illustration © Dyson



James Dyson with other engineers © Dyson

WHAT'S IN A NAME?

For some, 'engineer' conjures up images of the sooty-faced labourer with welding iron in hand, but I have been proud to call myself an engineer since I realised the scope and excitement of engineering when I first stumbled across the discipline while studying at the RCA in the late 60s. I've been described as an entrepreneur, a designer and an inventor. But there is only one label that sits happily with me – engineer.

My approach to engineering innovation was influenced by Thomas Edison: step-by-step. So, propelled by thoughts of Edison, I stepped onto the first rung of the development ladder in 1979. I ripped off the persistently clogging bag from the offending vacuum cleaner's body, a machine that was supposed to be top notch. To this skeleton I attached a crude cardboard cyclone and had prototype number one.

Encouragingly, it worked better than the one I'd just feverishly dismantled. The air spun so fast in the card cyclone that the centrifugal force created a powerful constant suction. But of course there was more: the fluff and hair separation dilemma. The solution, the shroud, came with prototype number 2,498. The trick was to put the smaller cyclone inside the big one and still maintain the speed as centrifugal force does the work of separating bits. But what material could I use? It couldn't be made from card. Rolled brass became prototype number 3,444. Well, it worked, but polycarbonate plastic later proved to be more durable. I don't want to labour my point, but the fact is that the hard labour was vital to my innovation: it took some 5,127 attempts before I had it. Of course I would hope that the more qualified amongst you may have done it in just 127 steps, but I can honestly say that I learnt

something from each iteration (and not just new swear words).

KEEP THE FAITH

There are hundreds of reasons why so many ideas fail and only one or two succeed. If I had listened to those who could only shed doom and gloom on my idea, then it would have been quashed very early on. As an innovator you must have obdurate faith in your idea. It's about identifying a solution to a problem or a need that people might not know they have in the first place.

Take the recent example of our latest innovation. Stephen Courtney, an engineer from our New Product Development Team was the person who came up with The Ball™ – our latest upright vacuum cleaner. The problem with conventional uprights is

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that they're a bit linear. There's no swerve to them, just a rigid X and Y axis. Can you imagine using a computer without a mouse? It all started with some caster wheels attached to an older machine. From very early on in the development process its manoeuvrability and nippiness were clear, but the magic we were looking for came by replacing the wheel with a ball. It meant the machine was truly steer-able, and able to go round the tightest of bends. A simple enough concept, but it took three years of repeated testing, modifying, and testing again before The Ball™ was ready.

In this time-sensitive, immediate world there needs to be support for potentially good ideas before they are proved successful. Or in other words, a greater understanding of the excruciating Edisonian steps that are required to get to that 'Eureka!' moment (if there is such a thing!).

PROMOTING CREATIVITY

Edison patented more than 1,000 inventions. This was certainly an innovative peak in the

history of inventions and the Golden Age of engineering in the UK was the industrial revolution. Today, the Government has also realised the power of the word innovation. But this runs in tandem with recent surveys that show the UK does not match up to many of its neighbours in the innovation stakes. Britain should have been in the top 10 and it's embarrassing that we weren't. It seems that the Government seeks to maintain the country's competitive edge merely by paying lip-service and promoting quick-fix innovations within companies and industry. It's a good start, but why can't we follow the Japanese model of encouraging innovation within engineering firms too? The Japanese government sets tough, almost impossible tasks and, through R&D, innovations are spawned along the way: a clear example of how mistakes and fearless discovery can go a long way.

Give power and confidence to engineers, put them on the board and give them enough money to research and develop ideas before they get quashed. What we are

making at Dyson now is important, but we are also planning for five years time. Of course many of the ideas will never actually be seen by anyone outside Dyson, but at least we are giving them a fighting start. Innovation needs to be exciting and therefore it must involve risk-taking.

It's all very well and good having a formula, but all good algebra lessons start in the classroom – and not just the maths lesson. The starting point is most certainly at school. Teachers should tap into this creativity by using a simple hands-on approach to encourage uninhibited thinking and instil confidence in pupils to try out ideas. Overly prescriptive curriculums, rigid classroom environments and the constant hurdle of examinations should be over-ridden in order to encourage students to use their imaginations freely. Design and technology classes should be about breaking the rules and learning from mistakes. Experimentation and creativity need to be cultivated from an early age if we are to see true innovations emerging in the future.

BIOGRAPHY – James Dyson CBE FREng

James Dyson studied at the Royal College of Art before producing his first prototype vacuum cleaner in 1983. In 1993, he introduced the Dyson DC01, which has since become the best-selling vacuum cleaner ever. A newly elected Fellow of The Royal Academy of Engineering, James Dyson is also a Fellow of the Chartered Society of Engineers, and has been Chairman of the Design Museum and a member of the Design Council. He has received many awards for his designs and his products have achieved sales of over £3 billion worldwide.