FOOTWEAR TECHNOLOGY: INNOVATIVE CONCEPTS

The big brands are in a race to bring the latest footwear innovations to consumers and are discovering new 'concepts' along the way.

Game changers

The big sportswear brands have all launched shoes this year that they claim to be "game-changing", "revolutionary" and "the future of footwear". Nike, adidas, Puma and New Balance are looking to carve out niches and create concepts that did not formerly exist – "the game-changers that successfully fill a need that was there but had not been addressed yet", according to Puma's head of creative and design for footwear, Ray Horacek. He is the brains behind the company's Mobium Elite, released at the beginning of April, which promises "a new way of adaptive running" – the world's first shoe that moves with the foot.

"Aesthetics are an important element on the shelf when a product finally reaches a consumer, but until then the focus of the research, concept, design and construction is about enhanced performance and breaking paradigms," he tells *WSA*. "A designer can't remove aesthetics from the process, it's one of the factors that is considered in every decision, but it's one of the lower priorities during much of the process as we're working through the technology."

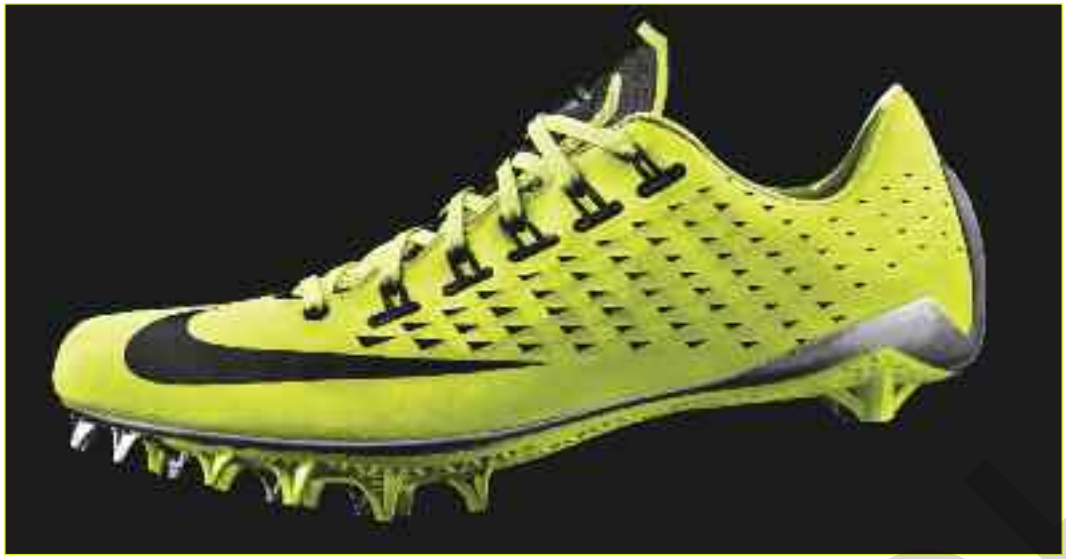
"Even from a conceptual standpoint, we feel the Mobium has a groundbreaking point of view," adds Louis Joseph, global director of strategy and innovation at Puma.

A new dimension

The athletic footwear sector is fairly crowded at the top end, with the top few competing for marketshare and looking to outdo each other in

Among adidas Boost's features is an outsole that reduces wear in key areas.

adidas



Nike's 3D printed football cleat is said to improve "drive stance".
Nike

each sport. Nike claims the lion's share in footwear, with $13.4 billion sales in 2012, according to Transparency Market Research, followed by adidas with $9 billion. Last year, the two went head-to-head with knitted shoes – for Nike the Flyknit and adidas the Primeknit. Both claimed they were world firsts and three years in development – and then launched almost identical concepts within weeks of each other. Nike was the first to call the other's bluff; it launched an injunction against adidas in September, but that was overturned by a German court in October. The case has gone decidedly quiet.

Not content with being on the back foot, the US giant in February launched what it claims is the world's first 3D printed plate for an American football boot. The plate of the cleat is crafted using selective laser sintering technology (SLS), which uses high-powered lasers to fuse small particles of materials into a three-dimensional shape. SLS allows for the creation of shapes not possible with traditional manufacturing processes, as well as the ability to make design updates within hours instead of months. Nike's designers were able to prototype a plate and traction system within a fraction of the traditional time frame and at a fraction of the weight.

"SLS technology has revolutionised the way we design cleat plates – even beyond football – and gives Nike the ability to create solutions that were not possible within the constraints of traditional manufacturing processes," says Shane Kohatsu, director of Nike Footwear Innovation. The Nike Vapor Laser Talon weighs 5.6oz and is designed for optimal traction on the football turf by helping athletes maintain their "drive stance" longer.

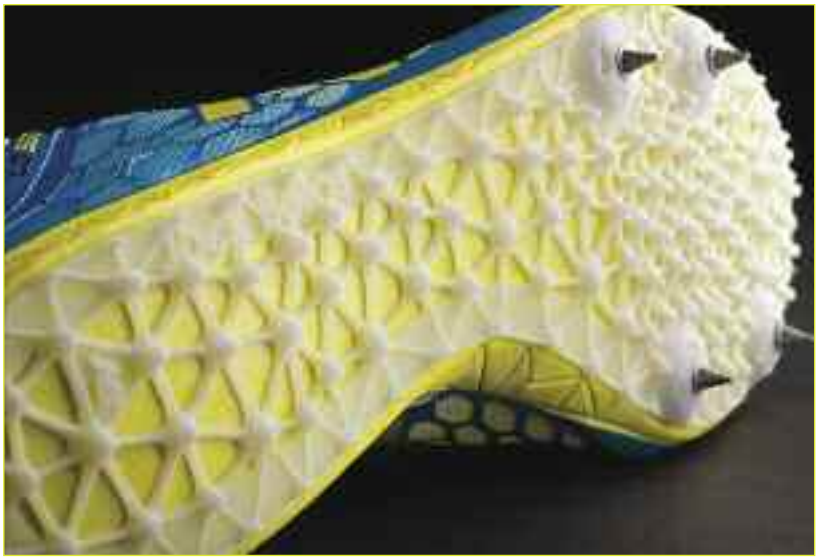
US brand New Balance also tried its hand at 3D printing, developing a process to customise its high-performance spiked shoes for athletes. It uses race-simulation biomechanical data which the company's research lab collects from the runners using a force plate, in-shoe sensors and a motion-capture system. Advanced algorithms are then applied to translate the data into 3D printed spike designs and SLS converts powder materials into solid cross-sections, layer by layer using a laser.

"Utilising our Team New Balance athletes to develop the customisation process was extremely helpful," says Sean Murphy, New Balance's senior manager of innovation and engineering. In January, Jack Bolas, a 1500 metre runner, became the first track athlete to compete in customised 3D printed plates, according to the company.

In addition to printing semi-rigid parts, New Balance is working on softer SLS printed components that mimic the cushioning properties of foam midsoles, which should bring the customisation process to a wider customer base. Its CEO, Robert DeMartini, says: "We believe this is the future of performance footwear and we are excited to bring this to consumers."

Keeping within the running sector, German

New Balance used SLS to create a custom spike for the US athletics team.
New Balance



Footwear sales in millions

Company	Fiscal 2010	Fiscal 2011	Fiscal 2012	Growth rate (2010-2012)
Nike	$10,301	$11,518	$13,426	14.2%
Adidas Group (includes Reebok)	$7,021	$8,132	$9,018	13.3%
Puma	$1,856	$2,006	$2,078	5.8%

Source: Transparency Market Research. New Balance figures not available.

brand adidas introduced "a new way to run" in February with the unveiling of its Energy Boost. Part of a new adidas segment called Energy Running, the shoe features a cushioning technology which provides "the highest energy return in the running industry", according to the company. It partnered with chemical company BASF, which created solid granular material (TPU) that is turned into thousands of small energy capsules which make up the footwear's midsole. "With their unique cell structure, these capsules store and unleash energy more efficiently in every stride. Tests conducted by the adidas innovation team show that the highly durable material found only in Energy Boost products provides the highest energy return in the running industry," said the company in a statement.

The adidas team tested how the Boost foam reacted in a variety of temperatures compared with standard EVA foam commonly used in most running shoes. It says when taken from +40 to -20°C, Boost foam is three times more temperature resistant than standard EVA material, providing a more consistent run.

"Energy Boost will reset the running industry and pave the way for all future performance footwear," says Eric Liedtke, head of sport performance at adidas.

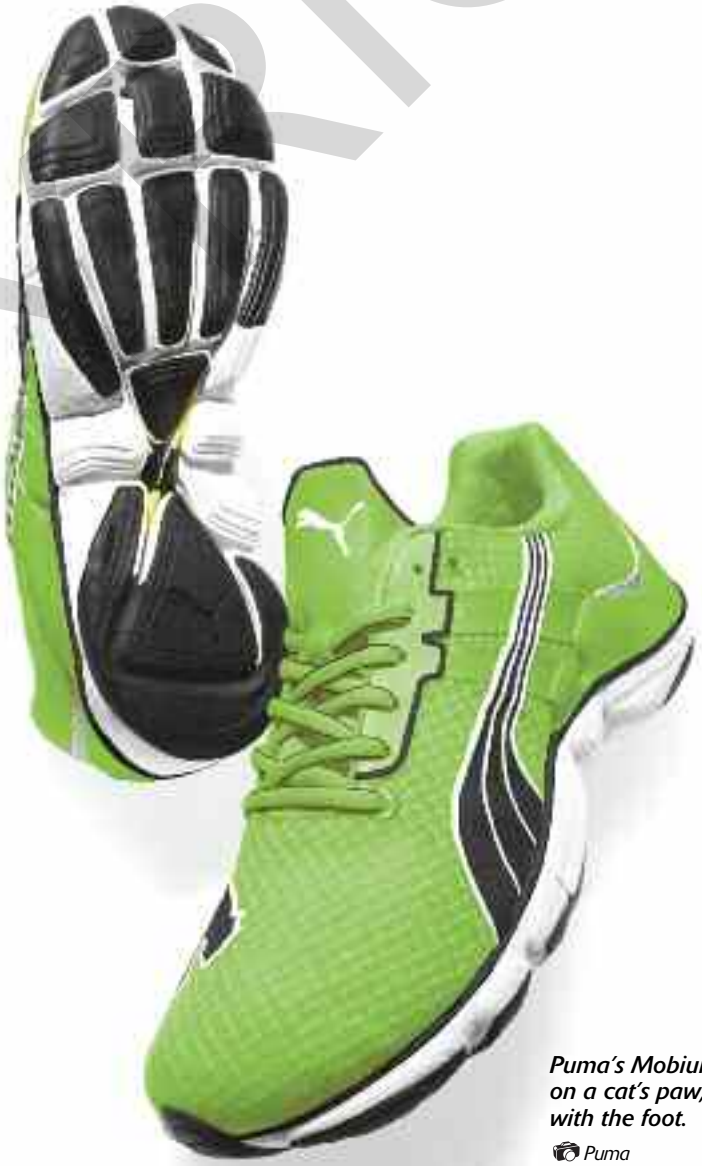
Cat among the pigeons

Not to be outdone, Puma at the beginning of April launched what it says is the first shoe that expands and contracts with the foot. The Mobium Elite started life on the drawing board of Mr Horacek, who took inspiration from a puma, as in the animal. As such, the shoe has 'pads' on the sole, replicating a cat's paw, which expand and contract as the foot moves offering increased cushioning.

"Since no one has made a shoe that expands and contracts with your foot in this way or one with a high-tension band in the outsole, we were in completely uncharted territory during most of the design and development process," he explains. "At one stage [head of research and insights] Christian Harig and I spent almost two full weeks on the floor of the factory in Vietnam just to get the basic construction working."

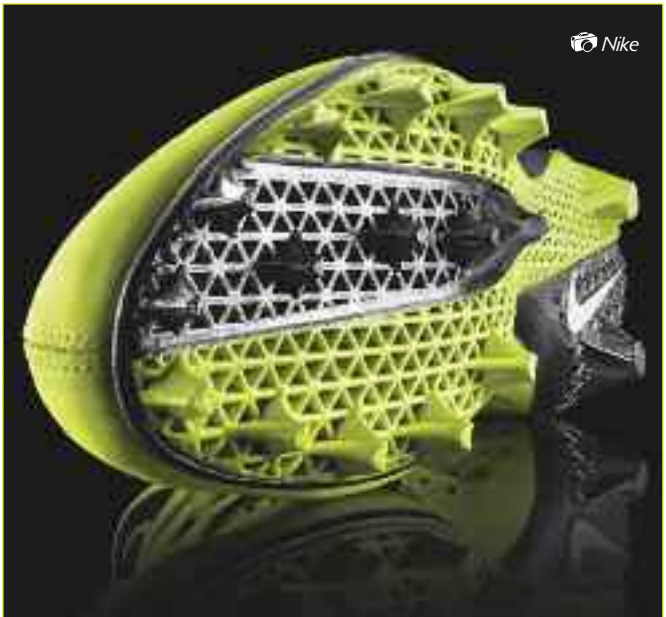
The mobium band wraps around the outsole in a figure of eight and is said to enhance natural spring by working like the tendons in the foot. The 'windlass chassis' sculpted arch creates a platform for the foot in movement, helping the foot transition through the full running gait and the design encourages runners to land on their mid-foot, rather than a hard heel strike, which means less "braking action".

Mr Horacek says his inspiration comes from nature or emerging technologies and approaches. "The best ideas are always the



Puma's Mobium, based on a cat's paw, moves with the foot.

Puma



Precision engineering: what is SLS?

There are a number of ways brands are making use of 3D printing, or additive manufacturing, choosing from a range of 'inks' including thermoplastics, polylactic acid or polycarbonate, or metallic powders or clays. All additive processes use the same basic principle of melting and fusing fine powder layers, which are cooled and set, sometimes using chemicals, and then finished.

The Nike and New Balance designers use SLS, a process that cures powder in very fine layers, directed by a computer-guided mirror. When used with nylon, the inert nitrogen environment stops the nylon oxidising when it is heated by a laser beam. The temperature inside the chamber is maintained at 170°C, just below the melting point of the polymer powder, so as soon as the laser makes contact with the surface particles they are instantly fused by the 12°C rise in temperature.

ones you happen upon by accident. So I try to always research into areas in which I am not an expert in the hopes of discovering something new that can help us advance performance footwear."

He says that for every new technology on the shelf, there are at least 10 other shoes at various stages that didn't make it through the process, and the number of sketches and ideas would usually number well into the hundreds.

He adds that it's important to keep up with what rival companies are doing in terms of performance and lifestyle just as it is to monitor emerging innovations in all major industries. "With other brands, though, it's as much of a reference for what not to focus your time on … especially when your goal is to come up with something truly groundbreaking," he explains.

Mary Taylor, Puma's global head of footwear, adds: "We are driven to look at performance through a different lens, to break with convention through true innovation. Mobium is the result of this and we feel strongly it will be a game-changer."

With the game changing so often, customers would be forgiven for losing track of the rules. But, with so much money ploughed into research and development, the latest generation of athletic footwear should result in a win-win situation for both consumers and the brands.