

Personalised insoles using 3D printing

3D printing is opening up new possibilities for shoe design and manufacture as revealed by Sergio Dulio in the July/August 2014 issue of *World Footwear*. It is also a process where advances are being made at a rapid rate as more experience is gained and an ever wider range of materials are explored so that new applications will be constantly developed. Some will succeed and some will fail, such is the nature of progress.

A very clever one that has all the appearances of succeeding has been developed by RS Print, a new joint venture set up last year by 3D printing services provider Materialise and an existing long-term partner, specialist foot scanning technology provider RSscan International. The two Belgian companies have brought their knowledge and expertise together to create customised insole inserts for athletes that can help to enhance their existing performance or bring them back to previous levels of performance after injury.

Take the example of UK runner Paula Radcliffe, holder of the women's marathon world record. On a mild autumn morning last year, she did something she had not done for over two years and completed a 10 kilometres competitive race. She finished third, but winning the 2014 Worcester Road Race was far from her main objective on the day; she is on the comeback trail. One of the great home hopes for a medal at the London 2012 Olympics, she was forced to withdraw after a persistent injury problem in her left foot returned and, having reached her late 30s and not confident she could regain full fitness, she decided to end her career.

RS Print is helping her to make a comeback through the use of its personalised 'dynamic' insoles that match the feet and running style of the individual. The improvements she has experienced plus a desire to make the London Marathon in 2015 her swansong, have combined to convince her to start competing again. The company is now so sure of the positive effect that its insoles can have that it is making them much more widely available to athletes in all sports and of all levels of ability; not just world record holders.

HIGH FREQUENCY MEASUREMENT

The scanning method is the one RSscan International has been using for some time, whereby pressure sensors are inserted into a plate or floor and, by inviting an athlete to run or walk over the surface, the system creates a 'high-frequency measurement of the dynamic movement of the feet'. The plate can be covered with wood, plastic, tarmac, synthetic grass or any other surface to get as close as possible to imitating competition conditions. This makes it a great deal easier to analyse the gait of any runner.

The business model is to set up testing facilities like this in the shops RSscan International runs in three locations in

Paula Radcliffe racing in the 2011 Berlin Marathon, part of her preparation for the 2012 Olympic Games in London that ended in tears. After more than two years, she is now making a comeback, thanks in part to new-generation insoles from RS Print.

CREDIT: RAMON SMITS / WIKIPEDIA



Belgium, at its headquarters near Beringen, in Antwerp and in Ghent. Members of the public can come in, have their gait analysed and have staff in the shops recommend shoes that will best fit and work for their particular needs. The shop in Antwerp has a facility called the ProLab, in which elite athletes can receive dedicated help with particular foot and footwear challenges. This, in fact, was how the company came into contact with Paula Radcliffe. Around 200 elite athletes from all parts of the world avail themselves of the services on offer at the Antwerp facility every year and prominent athletic footwear brands are frequently instrumental in pointing their sponsored athletes in the direction of the RSscan International ProLab in times of injury; the Belgian company has paid many of the brands back by supplying important, detailed product development information.

The company began talking to Materialise about developing a 3D printing project for insoles as far back as 2008, but it was only in 2014 that they set up RS Print together. CEO Dennis Vandebussche says that the market is now ready for products of this type and 3D printing techniques have now also become mature enough for serious production to be viable. The inserts have two parts; the first is the 3D-printed section which comes out as a thin, lightweight, hard plastic polyamide after sintering through the Materialise 3D printing system in powder form. The second is a top layer, which is typically in polyurethane or EVA and is there for comfort. These are then bonded together to complete the insole.

PERSONALISATION GOES FURTHER

Although dynamic analysis of a runner's gait is not new, Dennis Vandebussche says that what is new and is happening for the first time, is that all the information from the scans is being used in a very controlled way to make an 'intelligent' insole. The information built up about a particular person and a particular foot can be linked to the digital design of each 3D-printed insole, putting all the information the scans have made available inside the insole. Each insole is therefore completely personalised to a far greater degree than has ever been achieved before.



Pressure sensors in the floor can help build up high-frequency measurement of the dynamic movement of an athlete's feet.

CREDIT: RSSCAN INTERNATIONAL

The way we bring our feet into contact with the ground can clearly say a great deal about us, provided you know how to analyse the data. Officer candidates for the UK army provided RS Print with an interesting case study for its business idea. Young people selected as potential officers have to undergo an intensive period of physical training and RS Print carried out gait analysis on one group before the training programme began.

It used the information to put the candidates into three groups: high risk of dropping out before the end owing to physical problems, medium risk and low risk. The pre-assessment was confirmed by the fall-out rates in the three groups. A follow-up study, providing some of the people in the high- and medium-risk groups with personalised insoles to use during the physical training resulted in a 65% improvement in drop-out rates.

RS Print will continue to focus on feet and one idea to have emerged recently from the work it has done so far is that it will also be able to analyse fully what happens when a cyclist rides a bike in a race. And, by mimicking what is going on on the bike, the company will be able to develop cycling-specific insoles. It is

also interested in developing products for sports such as tennis and badminton, which are characterised by very short movements and often on very aggressive surfaces. It wants to be able to make a difference to athletes at the top of such sports by providing them with special, targeted, personalised support in a very thin insole.

RS Print's direct customers are retailers rather than individual athletes, with the RSscan International shops in Belgium being the most obvious examples. Other retail groups in Belgium and the Netherlands have now also begun to use the technology and the company hopes to expand into other countries during the course of 2015. "What we want now is to help those retailers upgrade," says Mr. Vandebussche, "to allow them to order insoles for their clients from RS Print. They are using the scanning technology to help their customers choose shoes already and they will be able to use the same technology to order personalised insoles too with a delivery time of just two weeks." 

RS Print insoles are in two parts, a top layer for comfort and, the clever part, a thin, lightweight 3D-printed layer underneath.

CREDIT: RS PRINT

