

Lighter-weight, better performance, dryness, breathability, fit, shock absorption - just some of the properties hidden in the word 'comfort'.

What about that comfort feeling?

Huge advances have been made in sports technology and performance over the past 30 years. Sprinters can run faster in ever lighter-weight shoes and basketball players jump higher in rebounding soles with added ankle protection. Lighter weight equipment has made extreme sports more accessible to all.

"Women can more easily scale mountains today than 50 years ago with modern lightweight equipment - carrying nylon ropes and wearing lightweight climbing boots," explained Sebastien de Diesbach of Promostyl in a recent trend seminar. These advances in equipment have made it easier to be "out there longer". Not only has endurance been improved, but longer in this context also means that sports men and women carry on their sporting activity later in life - marathon runners over 40 years of age are no longer uncommon. Better performance, however, can also mean greater risk of injury, so manufacturers are also looking at protecting the athlete more as well improving endurance.

Performance improvements created by footwear technology are measured in milliseconds today. Where can sports shoe manufacturers go from here, to create a point of difference in their products? They are already making them lighter and more comfortable. In-built comfort in sports shoes is now no longer an extra - it is becoming a requirement. Single density rubber outsoles on hiking boots are almost 'retro' today.

Fitting

Comfort in terms of footwear is not just a shock absorbing midsole and a removable insock. It is also subjective—it means good fitting shoes. For many years, New Balance has virtually captured a niche market with its wide fitting running shoes, which are also ideal for heavy weight runners. Montrail has been incredibly successful with its roomier trail shoes and boots. And adidas launched custom fitted sports shoes last year. The new Puma technical boots for Formula One



racing drivers feature an ergonomic asymmetric last for more comfort inside a cramped cockpit, with Kevlar on the inside heel area protecting against abrasion, heat and wear from constant gear changing. Ecco's golf shoes have interchangeable PU insoles for extra cushioning even though the shoes have an injected PU midsole as well.

Custom made orthotics based on the individual runner's style are increasingly common in the US. The runner's style is evaluated on a moving belt—not just to evaluate pronation or supination but also heel strike and roll. Shoes to fit the runner's style are then fitted and tested again on the moving belt. The Achillex system, launched last year at ispo by Xybermind GmbH, is now used in German sports retail shops. It uses computer sensors to match a runner's gait to the most suitable shoes in the store. The customer then test runs in the selected shoes to see which suits best, using the same system.

The Receptor RXP from ECCO was worn by Danish tri-athlete Thorbjørn Sindballe, winner of the World Long Distance Triathlon. The Receptor concept is based on the natural movement of the foot, designed in cooperation with Professor Finn Boisen-Møller from the Danish Panum Institute. It has some specific features not just to improve performance but also in the field of comfort, where Ecco was a pioneer decades before entering the performance footwear arena. The '20 degree angle of attack' is the natural attack angle of the heel when the bare foot hits the ground. This natural angle is of great importance to the

Receptor RXP from Ecco where the design is based on the natural movement of the foot. The company uses natural attack angles to improve comfort and reduce the impact on heel strike.

 Ecco

 Reebok



total Receptor concept of replicating the natural motions of the human foot. In order to reduce the force, or shock, generated upon heel strike, a 20 degree angle of attack is required in the heel. The 20 degree angle allows the foot to naturally make contact with the ground with the least amount of shock and comfortably roll into the second step, mid-stance. The unique Plantar Fascia Bridge in the RXP 3000 series is an exact replication of the bare foot in motion. The bridge acts as a dynamic stretching together with the plantar fascia during the gait cycle to provide, according to Ecco, unparalleled support and comfort.

Computers

Computerisation is one way ahead, to improve footwear, and incidentally improve comfort too. The adidas '1' shoe provides intelligent cushioning by automatically and continuously adjusting itself. It senses the cushioning level, using a sensor and a magnet. It then understands whether the cushioning level is too soft or too firm via a small computer. It adapts with a motor-driven cable system to provide the correct cushioning throughout the run.

It works like a human reflex nerve. The nerve is a magnetic sensing system, where the sensor sits just below the runner's heel and the magnet is placed at the bottom of the midsole. On each impact, this sensor measures the distance from top to bottom of the midsole (accurate to 0.1 mm) gauging the compression and therefore the amount of cushioning being used. About 1,000 readings per second are taken and relayed to the shoe's brain. Underneath the arch is the shoe's brain, a microprocessor capable of making five million calculations per second.

Software written specifically for the shoe compares the compression messages received



'Intelligent cushioning' is the phrase applied by adidas to its '1' running shoe. Impact sensing technology adjusts the firmness of the underfoot structure.



from the sensor to a preset zone and understands whether the shoe is too soft or too firm. Once it has determined the cushioning level, if appropriate, it sends a command to the shoe's muscle to make a change. A motor-driven cable system is the shoe's muscle. The motor, housed in the mid foot, receives the 'brain's' instructions and adapts by turning a screw, which lengthens or shortens a cable. This cable is secured to the walls of a plastic cushioning element. When the cable is shortened, the cushioning element is tensed and compresses very little. When the cable is longer, it allows the cushioning element to compress further, making the shoe's ride softer. A small battery, which is replaceable and lasts for 100 hours of running (the normal life of a running shoe), provides the motor's power. The changes are gradual and happen automatically, so all the runner notices is that the shoe feels right during an entire run.

Shock absorbing soles and insoles

When Viking wanted to make a new full grain leather hunting boot, it went to a specialist – an enthusiastic end user – a keen Swedish huntsman. The resulting boot has been designed to fit end user requirements, in a specialist market. And, with enthusiasts, all day comfort is important when out hunting elk in Scandinavia from a very early daybreak. Most of the company's high grade Italian boots are made on Vibram soles, but the Italian made products were too hard for all day use on uneven stony and rocky terrain. Vibram was unwilling to reduce Shore hardness as it could mean sacrificing wear properties. So Viking went about designing its own 'Ultimate Grip Concept' outsole with a much softer Shore of only 60 as against traditional 80 hardness. The separate midsole is also in premoulded PU for insulation and shock absorption, and there is an additional EVA heel cushion inside. When designing its own sole, the company also went ahead and designed an uncompromisingly Scandinavian last for all day use. It is wider in the joint area than classic Italian lasts and has a much



The Hyper Outsole of Ecco's Hyper Terrain sandal mimics the technology of the footbed in providing channels for water and mud to be dispersed. Semi-opaque windows grant a through-view for the curious.



roomier toe box. Wearers can wriggle their toes inside on a cold morning, so that they don't go to sleep.

The adidas Ground Control System, used in the outdoor performance footwear, distinguishes vertical from horizontal cushioning. It is designed to improve stability and reduce stress on knees and ankles. All cushioning systems provide shock reduction, better pressure distribution, and improved impact protection. However, it is the first time that a cushioning system addresses specifically horizontal cushioning – meaning the forces that are caused by the movement from the front to the back and to the side during a foot strike. Eighty per cent of all runners land with a force in the heel area that equals a multiple of their body weight. The horizontal forces occurring in this area are equivalent to up to 0.5 times their body weight. The Ground Control System is an independent unit placed in the heel area that can deform to all sides, has rotational freedom, and adapts to the ground. The unit consists of two thin, radiused, layered plates: the top plate cradles the heel of the athlete and does not move, whereas the precisely fitted bottom plate can move with the outsole in any direction. The two plates are held together by an elastic material for the road version, the adiStar Control, and by four multi-directional springs for the off-road shoe, the adiStar Trail. This construction allows the bottom plate to move in a controlled manner and to gradually cushion the horizontal forces of landing. Adidas says that independent research showed that the its Ground Control System reduces the rate of pronation by an average of 15% and the critical forces on the knees by a significant 30% on average.

Lotto's top-level soccer boot, the Vento Evolution, is designed for professionals who spend a lot of time wearing their boots. The upper is in water-repellent leather, with film X-Grip on the surface. The special anatomic pull-out insole with Shock-Absorber insert in the heel zone maximises the cushioning capacity. In this model, the Biomechanical Foot Control—the insole that improves weight distribution on the sole and gives controlled flexibility, anatomical support and torsional elasticity—is visible on all of the medial part; the result is a lighter boot that favours foot torsion during direction changes. The Adapto dual-density quarter stiffener cushions the heel anatomically, providing a dual adaptation and support action. The Adapto system is a counter sheet in dual-density SBS which wraps around the heel thereby offering both adaptation and support. It has a black section, rigid in the lateral area, and a red section, which is flexible. It helps prevent the repeated micro traumas that can cause tendon inflammation. The Puntoflex is a special technical transverse sole insert in the metatarsal area that allows the foot to flex naturally.

Lotto's Optika soccer boot has a water-repellent microfibre upper (lighter weight than leather) with EVA lining and X-Grip inserts. Like many other

soccer boots, these have asymmetric lacing which helps to eliminate the pressure points in the instep zone while, at the same time, enlarging the ball-contact area.

One important feature of Lotto's tennis shoes, being worn by sponsored players in the ATP and WTA 2005 tour, is the internal lining in polystatic carbon. This is made from anti-static carbon fibre to reduce static electricity build-up and enhance blood circulation, reducing cramp while speeding up perspiration evaporation. Uppers, which have side air vents, are in nylon mesh and Top microfibre, a new, highly-breathable and resistant microfibre. The removable anatomic insole, which is made of EVA for better cushioning, has vents to reduce the build-up of heat and humidity. The Adapto system is again used in Lotto's tennis shoes to help prevent the repeated micro traumas that can cause tendonitis.

Lotto's patented BFC (Biomechanical Foot Control) system in the midsole, in EVA and made of anatomic thermoplastic, has been further strengthened to provide even more support and stability to the foot, as well as controlled elasticity and flexibility. The Enerturn cushioning system—an insert in dual-density elastic material—has been integrated along all of the sole from front to heel and cushions impact stresses while returning the energy generated by the player during thrust.

Moisture control adds to comfort

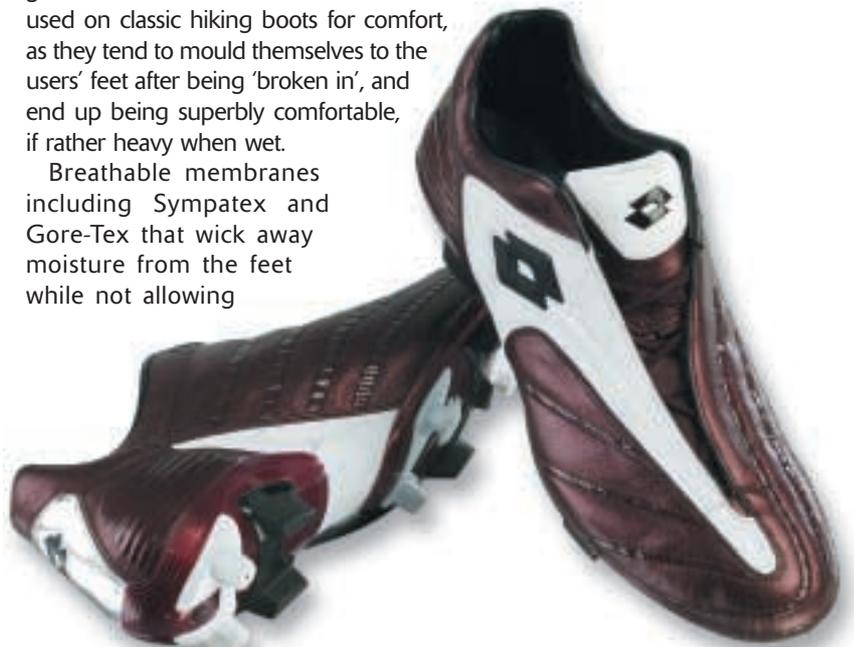
Keeping feet warm and dry or cool and dry has been taken for granted as vital for active footwear. Cambrelle was one of the early companies to convince both buyers and consumers that synthetic linings could be better than natural and animal products in the field of moisture control. For uppers, leather still has a strong place, however.

Water resistant leathers such as Pittards WR100 are used in many deck shoes and in nubuck versions on Merrell's outdoor shoes. Waxy full grain leathers and reversed suedes are still used on classic hiking boots for comfort, as they tend to mould themselves to the users' feet after being 'broken in', and end up being superbly comfortable, if rather heavy when wet.

Breathable membranes including Sympatex and Gore-Tex that wick away moisture from the feet while not allowing

The pinnacle of Lotto's soccer boot development – the Vento Evolution is designed for the professional game where players wear their footwear for long periods. The anatomic insole features a shock absorbing insert in the heel zone.

 Lotto



droplets of water ingress have been around long enough to have total market acceptance. They do have the less well recognised problem, however, that the bootie construction does not 'give' as much as normal leather boots. They look better longer as they tend to spring back to shape and not deform as much as traditional hiking boots. They keep out the water but are not as forgiving as the old fashioned leather upper, leather lined boots. Softer, lighter materials and the use of more mesh helps, as do the newer laminated constructions. Nike's very lightweight trail boots with Gore-Tex XCR have an exo-skeleton instead of hard reinforced parts, which helps deal with this. They are as popular for inner city wear as out in the wild.

Montrail's Stratos XCR has Gore-Tex on the outside of footwear. With its seam-sealed, waterproof breathable 'jacket' as the outermost layer, the Stratos XCR shields the whole shoe and the foot inside from any kind of weather or trail conditions. Inside, a form-fitting internal bootie maximises comfort and breathability. Montrail, in partnership with WL Gore, developed the first shoe – the Susitna XCR – that featured Gore-Tex on the exterior of the shoe. Montrail's concept, using Gores's waterproof/breathable fabric and patent-pending EXO construction, prevents water from penetrating even the first layer of the shoe. Traditionally, the Gore-Tex laminate in footwear is sandwiched between the shoe or boot's layers. The Stratos XCR design and construction improves breathability to a level greater than Montrail's other Gore-Tex or Gore-Tex XCR footwear. Several factors appear to influence this result. The exterior shell fabric, which itself is highly breathable, has a greater surface area than the laminate used in traditional multi-layered Gore-Tex footwear construction. Also, the Stratos XCR's inner bootie promotes breathability from the foot outward.

Currently some shoe designers are looking at moisture management from a different perspective. As with the difference between wet suits and dry suits, the same is happening in footwear. Teva sandals were a revolution in water sports when they were introduced as they allowed



Lotto's ATP tennis shoes feature polystatic carbon linings, the full Adapto system and BFC (Biomechanical Foot Control).

 Lotto

feet and footwear to get wet during strenuous activities such as river rafting. Now shoe/sandal hybrids are considered more practical for activities in streams and rivers where there are stones and rocks. And they are a good alternative for mid-level all day sailing when it is too warm for rubber boots. Water is fine if it comes into footwear as long as it flows out again—just as it can in Salomon's water sports shoe-sandals and Helly Hansen's new dinghy sailing boots.

Ecco's new sandal, the Hyper Terrain, is inspired by the draining system in small sailing boats. Since water and sand get into a sandal, the company created a vent in the centre of the footbed and outsole along with channels moulded into the footbed that moves water to the vent for ease of drainage. The vent has a shutter-like design to stop small stones and objects coming through the mesh and hurting the foot. The shuttering design looks just like the closable drainage system in the hull of a small sail boat.

Sebago's new sailing sandals have bulbous protective rubber toes, open heel counters with sling back for comfort and breathability and reinforced vamps for hanging over the edge while sailing close to the wind. An added comfort factor is a removable insock which has a soft knitted cotton tricort mix covering which absorbs sweat, and water—and can be pulled off at the end of the day to dry or be replaced. 

(left) Viking developed its own sole unit to improve the grip on its hunting boot.

(right) Merrell's combination of upper materials includes Pittard's WR100 leathers.

 Viking / Merrell

