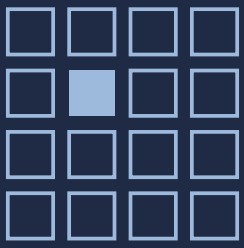
INDUSTRIES OF INDIA

THE SNEAKER

Rubber, Air, Foam



KETINENI RAMARAO

THE SNEAKER

Rubber, Air, Foam

Ketineni Ramarao
Industries of India

A note on the numbers and the sources

Small superscript numbers, for example 13, point to the entry with that number (SN13) in the companion volume, *The Sneaker: Source Companion*. Each entry names a source, says what part of it was read, and lists the claims it supports. Where this book read only an excerpt, or a company describing its own history, the companion says so.

Where two sources disagree, the text says so and does not pick silently. The clearest case is the first Nike Air shoe, dated to 1978 by one source and 1979 by another.

Money is given in the currency and fiscal year the source used. Figures from different companies and different years are not meant to be added together. Forecasts are not used. Several open questions are marked as open in the last chapter, and the book does not fill them with guesses.

Contents

Four things a foot asks of the ground 4

Sap and sulphur 7

Canvas under rubber 11

Two workshops and a court 14

The waffle iron and the gas bag 17

From importer to maker 21

The foam race 24

New bodies, new shoes 30

The shoe becomes a signature 33

What a pair is made of, and how 36

The map of where they are made 39

The companies 44

The carbon in a pair 48

Bottlenecks and dependence 51

What is open 54

CHAPTER 1

Four things a foot asks of the ground

The impact, the grip, the hush and the weight

Start with the foot and not the shoe, because the shoe is only an answer. A foot meets the ground and the ground pushes back. Everything in a sneaker is a decision about how that push is received, passed along, or held off.

Some of the numbers are plain enough to say out loud. The European Patent Office, describing the work of the engineer who put gas cushions into running shoes, notes that on average a runner's foot hits the ground about 1,500 times per mile, and that jogging releases forces more than four times the runner's body weight. In a sport like basketball the same account puts the shock at up to seven times body mass [13]. A pair of shoes is therefore not a fashion object that happens to be athletic. It is a piece of machinery that sits under a body and takes a pounding thousands of times an hour.

The four requests

A sneaker is asked for four things, and they pull against each other.

The first is grip. A sole has to hold on to wet wood, damp grass, polished tile or a hard synthetic track without trapping the foot so firmly that it twists. Too little grip and the wearer slides. Too much and a knee pays for it. The second is cushion. The foot, the shin and the spine all prefer that the first contact with the ground be spread out over time, which is what a soft layer does. The third is support and fit. A shoe that moves on the foot wastes effort and rubs the skin, so the upper has to hold the shape of the foot while letting it flex. The fourth is weight. Every gram is lifted and swung thousands of times a day, and lightness is its own kind of comfort.

There is a fifth request that is not about the foot at all, and it is why the word "sneaker" exists. Customers wanted the shoe to be quiet. The earliest

rubber-soled shoes made almost no noise on a floor, and the name that stuck for them said so: a person wearing them could sneak. The word appears in print by 1887, when the Boston Journal called it the name boys gave to tennis shoes, and an advertising man named Henry Nelson McKinney is credited with using it in 1917 [5, 7]. Before that, prison inmates are said to have used "sneaks" for guards in rubber-soled shoes [5]. The first thing the public noticed about this class of shoe was its silence.

The question nobody had settled

Whether a modern, heavily cushioned shoe is the best answer to those four requests is still argued about. In 2010 a Harvard team led by Daniel Lieberman published a study in the journal Nature comparing runners who had grown up barefoot or in minimal footwear with runners who habitually wore modern running shoes. Their finding was that habitually barefoot runners often landed on the front of the foot, or flat, and sometimes on the heel, while habitually shod runners mostly landed on the heel, a style the raised, cushioned heel of a modern shoe makes easy. On hard surfaces the barefoot runners who landed on the forefoot produced smaller collision forces than shod heel-strikers. The authors explained this as a more pointed foot at landing and a more compliant ankle, which reduces the effective mass of the body that collides with the ground [18].

It would be easy to turn that into a slogan, and plenty of people did. The record is more careful than the slogan. The Nature paper's own conclusion is that forefoot and midfoot landing probably protect the foot and lower leg from some of the impact-related injuries now common among runners; it does not claim that shoes cause every one of them [18]. Later work complicates the picture. A 2012 study of 38 runners of the Daasanach people in Kenya found that most favoured a heel strike, not a forefoot strike. A 2019 prospective study found that people who had been habituated to barefoot running for two months showed higher vertical loading rates than shod runners, which contradicts the injury-prevention argument [19]. And the general encyclopedic summary of

sneakers states that most evidence-based comparisons show no reduction in lower-limb running injuries from prescribing different shoe types for different foot types [5].

This book will not try to settle that argument. What matters for the industry is what the argument reveals: that nobody can say with confidence what the ideal sole is. That uncertainty is the opening in which every company in this story has worked, and it is why, as we will see, the technology on sale has changed so many times in a century.

What a sneaker is, for the rest of this book

For clarity, here is the meaning of the word as it will be used. A sneaker is a shoe designed first for sport or exercise and widely worn for ordinary life, built around a flexible, shock-absorbing, grippy sole under a light upper. The word "athletic shoe" is used as the wider category, and the British "trainer" and "plimsoll" will appear where history requires them [5]. Boots for football and rugby, the cleats and studs, are excluded, as the encyclopedic definition excludes them [5].

The story that follows has four threads. One is material: rubber, then foam, then gas, then engineered plastics. One is business: how a handful of family workshops became multinational companies that do not, for the most part, make their own shoes. One is cultural: how a quiet rubber shoe became a status object. The last is human: the people who stitch, cement and carry these shoes, and the bodies that wear them out.

CHAPTER 2

Sap and sulphur

How a ruined material became a shoe sole

A sole needs a material that grips, springs back and keeps out water. For most of history nothing available did all three. Leather is tough but slippery and soaks through. Wood is rigid. Rubber, the milky sap of tropical trees, did the right things and failed at the wrong moment.

The ball game and the failing sap

The use of natural latex is far older than industry. The earliest archaeological evidence of latex from the Hevea tree comes from the Olmec culture of Mesoamerica, where rubber was used to make balls for the ballgame. The Maya and Aztec peoples later used it for balls as well, for containers, and to waterproof cloth by soaking it in the sap [4]. A material that bounces, sheds water and can be moulded had been in use for a very long time before anyone thought of a shoe sole.

What stood in the way was a flaw of chemistry. Natural rubber of the early nineteenth century, then called India rubber, was a miracle until the weather changed: it melted in summer and cracked in winter [2]. Companies in the United States bet heavily on it in the 1830s and lost. A visitor to one of them, the Roxbury India Rubber Company, was shown shelves of misshapen blobs, goods that had turned to glue [2].

Goodyear's obsession

The visitor was Charles Goodyear, born in 1800 in New Haven and raised in Naugatuck, Connecticut. His father's hardware business had gone bankrupt, and in 1834, at around thirty-three, he began chasing the problem of how to make rubber behave [2]. The Connecticut history project that tells his story describes five years of near-ruin: experiments in rooms he rented and borrowed, in his wife's kitchen and in debtors' prison, using pots, pans and china teacups; toxic mixtures of nitric acid, lime and turpentine kneaded into the rubber; family furniture and even his children's textbooks sold to fund the next test [2].

The breakthrough came in 1839 in Woburn, Massachusetts, where he lived near the rubber factories that had sprung up there. He mixed sulphur into rubber and applied heat. The Guinness World Records entry for the first sneaker summarises the result simply: vulcanization is the process of heating rubber with sulphur, and it produces a stronger, heat-resistant material that Goodyear discovered accidentally [1]. Goodyear still needed several more years to repeat the result reliably and refine it. He established the Naugatuck India-Rubber Company in 1843 and patented the process in 1844 [2].

The patent did not make him rich. He licensed it, showed the process at exhibitions, and spent much of what he earned fighting infringement in American and foreign courts. He died in 1860 at 59, about $200,000 in debt. The tyre company that carries his name was founded in Akron, Ohio, in 1898 and had no connection with him other than the honour [2].

What the patent did was create an industry in the town where he grew up. Many rubber companies in Naugatuck worked under the Goodyear licence over the next century, including the firm that made Keds, and the main street of the town is still called Rubber Avenue [2]. The shoe industry that followed was, in a literal way, built on a patent for baking sulphur into sap.

What vulcanization does

A short explanation, in plain terms, belongs here, because the same idea returns every time this book discusses a foam. Raw natural rubber is a tangle of very long molecular chains that slide past each other when warmed. Heating it with sulphur forms bridges between the chains. With the bridges in place the chains can still stretch, but they spring back and cannot slide away, so the material stops flowing in the heat and stops cracking in the cold. The Guinness summary says exactly this in one line [1]. The DPLA exhibition on Massachusetts shoemaking adds the shoe-specific point: vulcanization uses heat to join rubber to cloth or to other rubber parts, producing a sturdier, more permanent bond [3]. That bond is the secret of the canvas shoe with a rubber sole.

Where the sap comes from

Once rubber could be controlled, demand outran the Amazon. The Hevea brasiliensis tree is native to Brazil, and South America supplied most latex for much of the nineteenth century. No law then prohibited exporting seeds or plants. In 1876 Henry Wickham took about 70,000 seeds from Brazil to Kew Gardens in England; only 2,400 germinated. Seedlings were sent to India, Ceylon (now Sri Lanka), the Dutch East Indies (now Indonesia), Singapore and British Malaya, which became the heart of plantation rubber [4]. The first commercial Hevea plantations in India were established in 1902 at Thattekadu in Kerala [4].

The tree is now pan-tropical. Thailand, Malaysia, Indonesia and Cambodia are among the leading producers of natural rubber [4]. Industrial demand for rubber-like materials began to outpace natural supply by the end of the nineteenth century, which led to the first chemical synthesis of rubber in 1909 [4]. That date is why a modern sneaker sole can be made from a blend of natural and synthetic rubber. The current Nike annual report lists "natural and synthetic rubber" first among the principal materials used in its footwear [24].

The inheritance

Three things from this chapter run through the rest of the book. A sneaker begins as a plant product in a tropical plantation, so a pair of shoes has a farm at one end of its supply chain. The key technical advance, vulcanization, was an accident found by an obsessive amateur and then slowly perfected, a pattern that recurs in later chapters. And the bonding of rubber to cloth is what created the shoe that would be called a plimsoll in Britain and a sneaker in America.

CHAPTER 3

Canvas under rubber

From croquet sandals to the first mass-produced sneaker

With rubber tamed, the next step was small and obvious: put it under canvas. The detail of who did it first is less clear than most histories admit, and this chapter keeps the uncertainty visible.

The earliest claims

The Guinness World Records entry for "first sneakers" runs through the evidence. The creation of mouldable, waterproof soles probably followed soon after the 1839 vulcanization patent, but leisure footwear that anyone would call a sneaker did not reach mass production until some decades later. In the late 1860s, "croquet sandals" became popular in the United States. They took many forms, from a simple rubber overshoe to the product of the Peck & Snyder Sporting Goods company, a rubber-soled, lace-up shoe with a canvas upper that the entry says could be considered the earliest sneaker [1].

In 1876 the New Liverpool Rubber Company in Britain launched rubber-soled shoes with canvas uppers, known as sandshoes and later plimsolls. They were worn for croquet and became popular as beachwear. The entry adds a revealing detail: these early shoes were not made as left and right pairs [1]. The name "plimsoll" is thought to come from the band joining sole to upper, which resembled the Plimsoll line on a ship's hull; sailors may have coined it [1]. Another source puts the origin of the name in the 1870s [5].

The Victorian shoe and the American factory

Plimsolls were worn by Victorian holidaymakers and by sportsmen on tennis and croquet courts for their comfort. Special soles with engraved patterns were developed to improve grip, and orders were placed in bulk for the British Army. Plimsolls were found with the ill-fated Scott Antarctic expedition of 1911 [5]. The SATRA bulletin, a footwear research body, offers a parallel line: the plimsoll of the 1870s was a forerunner of the modern trainer and quickly caught the imagination of sportsmen [7].

In the United States, the DPLA exhibition on the Massachusetts shoe industry describes the first rubber-soled shoes as products of vulcanization manufactured in the late 1800s. One employer it highlights, the Hood Rubber Company of Watertown, Massachusetts, was founded in 1896 and at its peak in the early twentieth century employed over 10,000 people, many of them recent immigrants [3]. That figure is a reminder that early sneakers were an industrial-labour story, not only a leisure one.

The year 1892 is given by one general source as the moment the United States Rubber Company introduced the first rubber-soled shoes in the country, "sparking a surge in demand and production" [5]. Keds was founded in 1916 [37], and the Naugatuck rubber company that made it operated under the Goodyear licence [2]. The first widely recognised American mass brand of canvas-and-rubber shoes therefore arrives about eight decades after Goodyear began his experiments.

Why canvas and rubber won

The canvas-and-rubber shoe solved a problem that leather had not. A leather sole is shaped by a cobbler, stitched, and slowly wears and slips. A vulcanized rubber sole could be moulded in a factory, cemented to a cotton upper, and made quiet, waterproof and cheap. The SATRA bulletin notes the rise of such shoes at the turn of the twentieth century for leisure and outdoor wear [7]; the general summary notes that athletic shoes were increasingly used for leisure by 1900 [5].

Here the shoe split into two paths that run through the book. One path is the mass-market canvas shoe, cheap and uniform. The other is the specialist shoe built for a sport. In 1895 a British company, J.W. Foster and Sons, designed and produced what one account calls the first shoes designed for running, with spikes for traction [5]. A second account dates the start of Joseph William Foster's work to 1895, when he was fourteen and working in a room above his father's sweetshop in Bolton; he founded his business in 1900 and later opened a small factory called Olympic Works [32]. The firm later received a contract to supply shoes for the British team at the 1924 Summer Olympics, whose runners included Harold Abrahams and Eric Liddell [5]. The company is also the ancestor of Reebok, which was set up as its companion company in 1958 [32].

The word and the market

By the First World War the name was settling. The advertising man McKinney's use of "sneaker" in 1917 is the usually cited moment [5, 7], though the Boston Journal had already used it in 1887 [5]. The same source says the market grew after the war, when sports and athletics became a way for people to demonstrate moral fibre and patriotism, and that boys lined up for the shoes endorsed by a basketball player [5]. That is the next chapter's subject.

CHAPTER 4

Two workshops and a court

Converse in Boston, the Dassler brothers in Bavaria

The twentieth-century sneaker was built in two places that never met: a Boston factory that made winter galoshes, and a Bavarian laundry room. Their products met everywhere else.

A galoshes company finds a game

Marquis Mills Converse founded his company in Boston in 1908. Its first products were galoshes and waterproof winter boots, which meant demand fell in warm months. The company's own account, published by Nike (which now owns the brand, a point that readers should keep in mind), says Converse was looking to keep skilled workers busy year-round and turned toward athletic shoes [6].

Basketball had been invented in Springfield, Massachusetts, in 1891, and by the 1910s it was being adopted by regional colleges. In 1917 Converse introduced a "Non-Skid" shoe, which it called the "All-American Basket-Ball Shoe." It was built on the company's existing dress-shoe last, with a two-piece quarter for ankle fit and a patented non-skid sole [6]. The SATRA bulletin calls it the first shoe made specifically for basketball players [7].

The shoe was first marketed to coaches in the area, who gave feedback. They would prefer a darker canvas, because the light tan upper showed scuffs. Converse responded with a dark brown version, trimmed in black along the eyelets, which was branded "All Star" in 1919 [6]. The name of the player who made the shoe famous comes next. Chuck Taylor was a salesman and player-coach for the company's All Star basketball team and was hired by Converse in the early 1920s [6]. The SATRA bulletin says an Indiana player named Chuck Taylor endorsed the shoe five years after 1917, so about 1922 [7].

The two sources agree on the early 1920s, so this book will not put a more exact date on it.

By 1936 Converse equipped the United States men's basketball team with white shoes with red and blue stripes on the foxing tape, a custom version that other teams adopted [6]. The Chuck Taylor All Star was, the company says, worn by basically every top basketball player before 1965, and the low-top version arrived in 1957 and was adopted by skateboarders [6]. The SATRA bulletin describes the shoe as reportedly the best-selling basketball shoe of all time [7]. It is an unusually durable industrial design. The general encyclopedic summary notes that its design has remained largely unchanged [5].

The Dassler laundry

Adolf Dassler, known as Adi, began as a baker's apprentice in 1913, following his father's wishes, though his heart was in sport [8]. After the First World War he began producing his own sports shoes in his mother's wash kitchen in Herzogenaurach, Bavaria [5]. In 1924 he and his brother Rudolf jointly formed the Gebrüder Dassler Schuhfabrik, the Dassler Brothers Shoe Factory [9, 10].

The Dassler company used the Olympics as a showroom. In 1928, at the Amsterdam Games, Adi was determined to have athletes in shoes of his design. In 1929 the brothers formalised a partnership agreement and began registering patents. In 1932, at Los Angeles, more athletes than ever wore Dassler shoes, and Adi attended the shoe technical school in Pirmasens to deepen his knowledge. In 1936, at Berlin, he equipped athletes from many countries; the company's chronicle names the American Jesse Owens, in Dassler spikes, who won four gold medals, among the best known [8]. A second factory opened in 1938 on Würzburger Street, with 118 workers producing 1,000 pairs of shoes, including shoes for eleven different sports [8]. The general summary says the Dasslers were selling 200,000 pairs a year before the Second World War [5].

The brothers split in 1948. The Adidas chronicle describes it as the foreseeable consequence of years of disagreement, with Rudolf accusing Adi of causing his

one-year internment in 1945, which Adi denied and managed to disprove [8]. Rudolf moved to the other side of the Aurach River and founded a firm first called Ruda, then renamed Puma. Adi used his nickname and the first three letters of his surname for Adidas [9]. Wikipedia's company record dates the Adidas name to 18 August 1949 [10].

The two firms shaped the industry in different ways. Puma's early marks include football boots with screw-in studs, the "Super Atom" developed with West Germany's national coach, and boots worn at the first German international match after the war in 1948 [9]. Adidas's marks include the three-stripe warm-up suit of 1967, which in the company's own telling laid the groundwork for sportswear as leisurewear, the boxing shoes worn by Muhammad Ali and Joe Frazier in the "Fight of the Century" in 1971, and the tennis shoe that Stan Smith wore to win Wimbledon in 1972 [8]. Adi Dassler died on 6 September 1978; a few months earlier he had become the first non-American admitted to the National Sporting Goods Industry Hall of Fame [8].

Two shapes of a business

Look at what each company was in its early years. Converse was a factory that took a product it already knew, rubber footwear, and aimed it at a sport. The Dasslers were athletes' cobblers who reached into the athlete's life and asked what was wrong with his shoe. One is an industrial story and the other a craft story, and the business of the late twentieth century fused them. Both relied on the idea that a famous athlete in a shoe sells the shoe. Both would be overtaken, in the 1980s, by a company that began by importing someone else's shoes.

CHAPTER 5

The waffle iron and the gas bag

Two inventions that rebuilt the bottom of the shoe

The shoe that most people wear today was designed around two ideas from the early 1970s and late 1970s. One was a pattern on the bottom, the other a pocket inside the middle. Neither came from a shoe company in the usual sense.

A coach who wrote letters

Bill Bowerman was born in 1911 in Portland, Oregon, was a student athlete at the University of Oregon, coached high school football and track, and fought in the Second World War. He returned to Oregon in 1948, and over a 24-year tenure led the university to four NCAA track titles and coached 16 sub-four-minute milers [11]. In the 1950s he began writing to footwear companies proposing improvements, and none accepted. Frustrated, he learned shoemaking with a local cobbler, took apart existing racing shoes with a band saw to examine their anatomy, and then built his own [11].

A letter he wrote on 8 August 1958 to his student Phil Knight proposed a weight-training plan and a running schedule, and ended with a postscript asking for a pair of shoes Bowerman could remake as racing flats. In 1960 he wrote to a Portland company asking for steel for spikes, remarking that most American shoemakers were not interested in what track coaches thought and that the best shoes then were made by Germans [11]. The shoe industry of the time was still, in his view, closed to people who actually used the shoes.

Knight's route in was commercial. In 1964, after forming a relationship with the Japanese maker Onitsuka, Knight and Bowerman invested 50-50 in a business importing and selling Japanese-made running shoes, based on the belief that cheaper Japanese shoes could perform as well as the German standard. That business was Blue Ribbon Sports, the precursor to Nike [11]. Bowerman travelled

to Tokyo for the 1964 Olympics with his wife, stayed an extra week to meet Onitsuka's founder and an executive, and toured factories to study the cutting and stitching machines [11]. Onitsuka's founder, Kihachiro Onitsuka, had established his company on 1 September 1949; it is the ancestor of the Japanese firm Asics [31].

The waffle iron

In 1971 Bowerman faced a problem on his home track. A hard, slick urethane surface installed at the University of Oregon two years earlier was injuring runners. Spikes dug too deep, and flat shoes did not grip enough. According to the company's own history, he noticed the grid pattern of his wife's waffle iron, a Model 251 that the couple had received as a wedding gift in 1936, and poured liquid urethane into it. The urethane glued the iron shut permanently. He bought secondhand irons and kept experimenting, and the first imprints came out inverted, with concave bumps, which suggested to him how to refine the moulds [12]. By November 1971, members of the Oregon cross-country team wore early versions to win the NCAA title [12]. By the summer of 1972 Bowerman and a colleague, Geoff Hollister, were hand-making a small batch for the US Olympic Trials in Eugene [12].

This is a corporate account, and the tidy story deserves the standard caution about origin myths: the company has a commercial reason to tell it. The detail that holds up is the engineering one. The waffle sole was a response to a measured problem on a specific surface, tested by athletes in actual races, and it was made by moulding a polymer into a grid of raised squares that could grip without digging in.

The man from aerospace

The other invention belongs to Marion Franklin "Frank" Rudy, an American engineer. The European Patent Office, which named him a finalist for its European Inventor Award in 2009, describes him as an aerospace engineer who had been introduced to a process called blow rubber moulding while working at NASA. He used it to make hollow soles and filled the cavities with dense gas sealed in rubber membranes, producing a gas-filled shock-absorbing cushion. In 1979 he patented small gas-filled membranes in the soles of running shoes. Nike marketed them as the "Air" system [13].

The first Nike running shoe with Air was the Tailwind. The EPO dates it to 1979 and says it became famous when the British runner Steve Ovett won an Olympic gold medal in Moscow the following year [13]. Another source dates the Tailwind to 1978 and says Rudy had approached Nike in 1977 [14]. The sources do not agree on whether the year was 1978 or 1979, so the book will say "the late 1970s." Rudy's technology went well beyond one shoe: the EPO credits him as the supplier of patents for numerous follow-ups, including shock-absorbing insoles, gel padding and helium-based cushioning, and it reports that between 1986 and 1993 alone Nike sold more than $2 billion worth of Air-system shoes [13].

Making the air visible

The next step was a design decision, not a chemical one. The Air Force 1 of 1982, designed by Bruce Kilgore, was the first basketball shoe to use Nike's Air technology [15]. The Air Max line, whose first model was released in 1986, made the air pouch visible through the midsole; its concept is credited to Tinker Hatfield, who had begun by designing stores. The line was advertised in 1987 on television with a Beatles song, the first use of a Beatles song in a TV commercial, and Nike adopted the "Just Do It" slogan the following year [14].

Making the cushion visible changed what the shoe was. A cushioning technology had been hidden inside. Now it was displayed on the outside, and

customers could look at a shoe and see what it was selling them. Many later ideas in the industry, from visible gel units to transparent midsoles, follow the same logic: when the sole is the product, show the sole.

What the two inventions share

Both ideas had the same shape. A problem identified in use. A material borrowed from somewhere else, urethane poured into a kitchen tool, or a moulding method learned in aerospace. And a prototype tested on real athletes before it was a product. Neither invention was a breakthrough of pure science, and neither came from the dominant shoe companies of the time.

CHAPTER 6

From importer to maker

A track coach's company learns to design

The company that became Nike spent its first years selling someone else's shoes. This chapter follows the move from importer to designer, because it set the pattern the whole industry followed.

The accidental running shoe

Blue Ribbon Sports was founded on 25 January 1964 by Bill Bowerman and Phil Knight and became Nike, Inc. on 30 May 1971, taking its name from the Greek goddess of victory [40]. For its first years it sold Japanese shoes made by Onitsuka under the Tiger name [11]. The product that changed this arrangement began with an injury.

In spring 1965 an Oregon distance runner, Kenny Moore, who later ran the Olympic marathon, moved wide in an 880-metre race and a teammate's spike gashed his foot. The gash led to a stress fracture. While recovering, Moore trained in the Onitsuka Tiger TG-22, a high-jump shoe that Blue Ribbon Sports had mistakenly sold as a running shoe. His X-ray showed a break across the third metatarsal, and Bowerman asked to see the shoes and ripped them apart. They had spongy cushioning in the heel and forefoot and no arch support. "If you set out to engineer a shoe to bend metatarsals until they snap, you couldn't do much better than this," Bowerman said, according to the company's account [11]. Onitsuka went on to introduce the Bowerman-engineered Tiger Cortez, which an early 1967 catalogue described as designed to be the finest long-distance shoe in the world, with a soft sponge midsole through ball and heel to absorb road shock and a high-density outer sole for wear [11].

The shoe is notable for what it added: a cushioned midsole as a deliberate element, designed by a user, built by a manufacturer on another continent. The

company page that tells the story is Nike's own, and the accident-and-insight structure is typical of corporate history. The mechanical facts, a stress fracture, a shoe without arch support, a redesign with a sponge midsole, are specific enough to be credible, but they come from one side.

The break with Onitsuka

Tension between the two companies grew in 1971, when Onitsuka, according to a reference account, attempted a takeover of Blue Ribbon Sports by proposing an ultimatum that would give the Japanese company 51 percent. In 1972 the relationship ended, and Blue Ribbon Sports prepared its own line. It had already placed, the previous year, its first independent order with two Japanese shoe manufacturers, for 20,000 pairs [40]. The same account dates the "Moon Shoe," named because the waffle tread resembled astronauts' footprints on the Moon, to 1972, and the Waffle Trainer, which it says helped fuel the company's explosive growth, to 1974 [40].

The first independent order matters more than it looks. A brand that had been a distributor became a client of factories. It no longer had to rely on a manufacturer's design for a product it sold; it could specify its own and place the order itself. That is the arrangement the later chapters describe, repeated at a much larger scale.

From shoe to brand

In 1976 Nike hired its first advertising agency, which the next year made the company's first "brand ad," titled "There is no finish line," in which no Nike product was shown. By 1980 the company had a 50 percent share of the US athletic shoe market and went public in December of that year [40]. These claims come from a reference page and should be read as such. They are consistent with the broader history in this book: a company with a design capability, a growing market of runners, and an advertising idea that sold a feeling about running.

The later shift is in who makes the shoes. In its fiscal 2025 annual report Nike says its footwear is made by independent contract manufacturers, in 97 finished-goods factories in 11 countries, as the chapter on the map of production sets out [24].

The pattern

Three things were established in this period that remained constant. A designer close to the athlete identifies a fault. A manufacturer elsewhere builds the answer. And a brand turns the result into a story that outlasts the product. The Dassler brothers, in their own way, had done the first two. Bowerman and Knight added the third at scale, and turned a distributor into a brand.

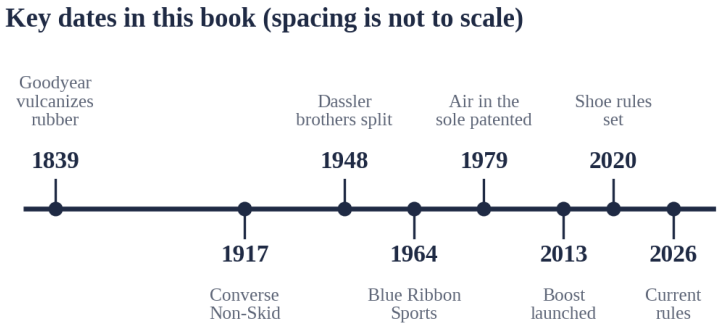


Figure. Key dates from the chapters of this book, evenly spaced for readability. The 1979 date for air in the sole is disputed, as one source gives 1978. Sources: see the chapters named in the text. Original diagram.

CHAPTER 7

The foam race

From soft to springy: what the midsole became

By the 1990s the sole was no longer a slab. It was a designed sandwich with an outsole for grip, a midsole for cushion and a footbed above. Most of the competition since has been inside that middle layer.

The anatomy

An account in the reference book How Products Are Made describes a running shoe in two main parts, the upper that covers the top and sides of the foot and the bottom that touches the ground. The bottom has three layers: the outsole, which provides traction and absorbs shock; the midsole, designed specifically for shock absorption; and the insole inside the shoe. The insole is typically a thin layer of synthetic ethylene vinyl acetate (EVA); the midsole varies by maker and is often polyurethane around another material such as gel or silicone, or a polyurethane foam [22]. A running shoe can have as many as 20 parts [22].

Ethylene vinyl acetate is itself a foam of closed cells. Its properties can be adjusted by processing conditions, and it is cheap, which is why it is used well beyond shoes, in sports padding, helmets, gloves and play mats [34]. The cheapness explains EVA's long reign as a sneaker midsole: it is light, soft, easy to mould in a factory and inexpensive. Its weakness, which the industry has worked around ever since, is that a foam compresses over time and does not give back all the energy it takes.

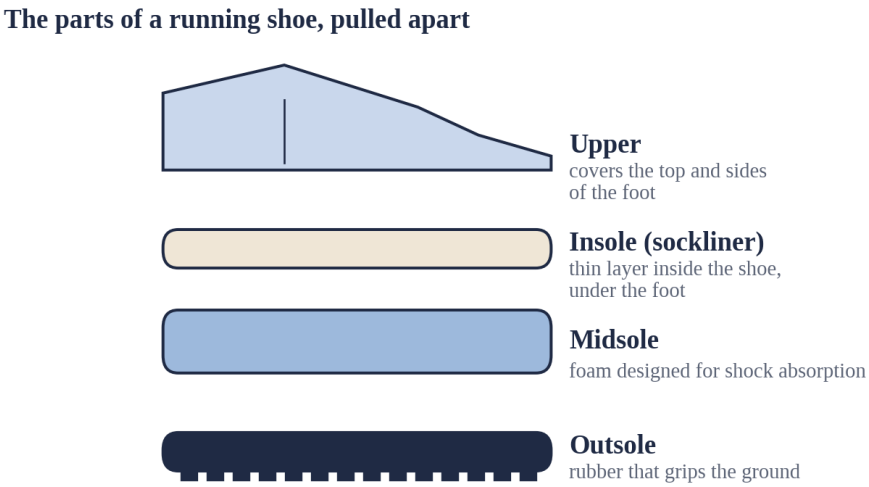


Figure. The parts of a running shoe, following the three-layer bottom described in the reference account: outsole, midsole and insole, under the upper. Original schematic, not to scale.

Boost: pellets of plastic

In 2013 Adidas launched a new cushioning material called Boost. Its own account of the material is candid about the origin. The chemical company BASF showed the material to a few developers, designers and engineers and asked whether they could use it in shoes. An Adidas engineer's first response was that they could not, since the original material was not stable or dense enough to withstand the forces of running. But it had two properties that might change a runner's experience: very soft cushioning and strong energy return. The Adidas innovation team and BASF's scientists spent about three years making it suitable, and the first Boost shoe, the Energy Boost, launched at the end of February 2013 [35].

Boost is built from expanded thermoplastic polyurethane (TPU). BASF, the chemical company, sells that material under the name Infinergy and describes it

as a novel expanded thermoplastic polyurethane, as elastic as rubber but lighter [45]. Trade coverage of its Taiwan plant calls Infinergy a closed-cell elastic foam with low density [46]. The 2017 shoe study discussed below independently confirms the construction of one Boost shoe: its midsole is Boost foam made with TPU [20]. The pattern echoes the Air story: a material developed by a chemical company, adapted by a shoe company through years of testing, and sold on the idea of energy return.

The plate and the foam together

The largest recent change was the combination of two ideas. One was a highly compliant, resilient foam. The other was a stiff plate embedded in the midsole. A 2017 study published in Sports Medicine tested prototype shoes that combined the two [20].

The paper is specific about what was compared. The baseline shoes were the Nike Zoom Streak 6, whose midsole is lightweight EVA foam with a rearfoot Zoom air bag, 23 mm tall at the heel and 15 mm at the forefoot, and the adidas adizero Adios Boost 2, the shoe Dennis Kimetto wore when he set the marathon world record then standing, with Boost TPU foam, 23 mm at the heel and 13 mm at the forefoot. The prototype was Nike's, described as a prototype of the recently released Nike Zoom Vaporfly: a new ZoomX foam made with PEBA (polyether block amide) and an embedded full-length carbon-fibre plate with forefoot curvature. Lead pellets were added to the two lighter shoes to match the 250 grams of the adidas shoe, so that mass could not explain the result [20].

Eighteen runners, tested at 14, 16 and 18 kilometres an hour, took part. The prototype reduced the energetic cost of running in all 18 subjects. Averaged across the three speeds, the energetic cost in the prototype was 4.16 percent lower than in the Nike baseline and 4.01 percent lower than in the adidas shoe, and the percentage improvement did not depend on speed [20]. The prototypes were Nike's and the mechanical tests of the midsoles were run in the Nike Sport Research Lab, as the paper states [20]. The test was therefore of one company's

prototype against two competing shoes, and the reader should weigh that.

What the study shows and what it does not show is worth stating plainly. It shows that, under controlled treadmill conditions, with these runners at these speeds, the new design lowered the oxygen cost of running by about four percent compared with two earlier marathon shoes. It does not show that every runner gains four percent in a race, or that foam, plate and geometry contribute equally.

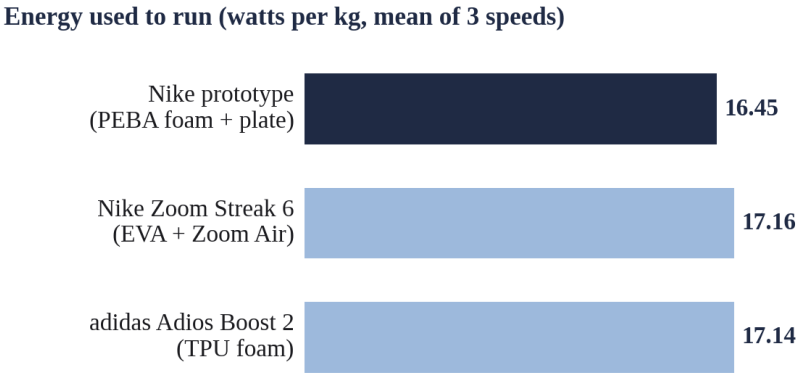


Figure. Energy used to run, from the 2017 Sports Medicine study of three marathon shoes with mass matched [20]. Mean values across three speeds, as reported; the prototype was 4.16 and 4.01 percent lower than the two baselines. Original chart.

Who makes the foam

The PEBA foam in that prototype points to a company most buyers have never heard of. Arkema, the French chemical maker, is the source of Pebax. A running publication that visited its researchers reports that the material dates from the 1980s as a solid plastic, that the real turning point came around 2015 and 2016 when it was turned into a foam, and that the foam now turns up in almost every shoe that is breaking times [44]. The company supplies the raw material, and the brands make the finished foam to their own recipes. The same pattern holds for Boost, where the foam is BASF's [45]. In both cases the brand's famous cushioning is a chemical company's material, adapted.

When the sport pushed back

The track and field governing body, World Athletics, responded. Under rules approved in early 2020 and applying from 30 April 2020 (with an indefinite moratorium on non-compliant shoes from the day of the announcement, 31 January 2020), a shoe had to have been available for purchase by any athlete on the open retail market for four months before use in competition, the sole of a road shoe could be no thicker than 40 millimetres, and a shoe could contain no more than one rigid embedded plate or blade running the full length or part of the length. For spiked shoes the sole limit was 30 millimetres. The stated reason was that independent research indicated the new technology in road and spiked shoes might provide a performance advantage, and that there was sufficient evidence to raise concerns that the integrity of the sport might be threatened [21].

Those 2020 rules have since been replaced. World Athletics says its current athletic shoe regulations were introduced in 2022 [60]. The latest version listed on the governing body's rules page was approved by the Council on 19 March 2026 and took effect on 20 April 2026. Under it, a non-spike shoe may contain no more than one rigid structure; the maximum sole thickness is 40 mm for road running and for track and road race walking, and 20 mm for track events, jumps and the javelin; and shoes must be available for purchase by any athlete

in World Rankings Competitions. The sole rules do not apply to shoes worn in shot put, discus and hammer throws, cross-country races or mountain and trail races [53].

There is something new in this episode. For a century the market had decided what a shoe could be. Now a sports regulator was writing a bill of materials. The rules do not ban foam or plates. They set a ceiling on thickness, a limit on rigid parts, and a requirement that the shoe be sold to everybody. The principle, that technology allowed in competition must be available to all competitors, is a sign that cushioning had become a performance variable worth regulating.

What it means for everyone else

Most people who buy a running shoe are not racing for a medal. The marathon shoe study applies to well-trained runners at pace. The encyclopedic account notes that most evidence-based comparisons show no reduction in running injuries from prescribing different shoe types to different foot types [5]. The foam race has therefore produced a clearly measurable gain for one group, elite and sub-elite racers, and a murkier picture for the people who buy a shoe for a morning jog. For them, the value of a better midsole is mostly comfort, which is also what the industry has always sold.

CHAPTER 8

New bodies, new shoes

Joggers, aerobics classes and skate parks

A shoe is designed for a body doing something. As the things bodies did changed, the shoe changed with them. Three shifts between the 1960s and the 1980s show how.

Jogging

For most of the early twentieth century, running for fitness was something athletes did in training. A reference account says boxers called it "roadwork," and that in New Zealand in the 1960s or 1970s the word "jogging" replaced it, promoted by the coach Arthur Lydiard, who is credited with popularising the activity. The same account cites a 1963 Eugene newspaper report on the first meeting of a jogging group organised by Bowerman [38]. The sneaker's role changed with it. A shoe had been designed for a specific sport, a track spike or a basketball high-top. Now it was asked to protect ordinary people, many of them not very fit, on roads.

The SATRA bulletin links the shift to a change of name: the word "trainer" is apparently first used in 1968 as a general description of a style of sports footwear made by Gola, and as jogging became popular in the 1960s, shoes designed for the comfort of joggers sold well [7]. The general summary dates the real boom to the 1970s [5]. The New Balance story fits here too: in the 1960s, as the How Products Are Made account has it, the company began studying how running affects the foot and developed an orthopaedic running shoe with a rippled sole and a wedge heel to absorb shock, as joggers became more knowledgeable and began to ask for shoes that prevented injury [22]. Cushioning, as a consumer demand, begins here.

Aerobics and a new customer

In 1982 Reebok introduced the Freestyle, which its reference page calls the first athletic shoe designed for women. The company's sales, the page says, rose from more than $1.5 million in 1981 to $13 million in 1983, and Reebok listed on the New York Stock Exchange in 1985 after becoming officially an American company [32]. The details of how an English firm of runners' cobblers got there are worth stating. Paul Fireman, an American businessman, saw Reebok at a Chicago trade show in 1979 and negotiated the right to license and distribute it in the United States [32]. The company was descended from J.W. Foster and Sons of Bolton, who had made spiked running shoes in the 1890s [32].

Two points arise. One is that women were not a small niche in the sports shoe market. The Freestyle made them a visible segment, with a shoe designed for them and sold through a fitness craze, and the numbers show how quickly the segment grew. The other is the reminder that competitive rivalry in the industry pushed product development. Reebok's Freestyle came when Nike had half the American market, and the company had its own answer [32, 40]. The page states that Reebok expanded into running and basketball in the mid to late 1980s, the largest part of the industry [32].

The skate park

The third shift was from the margin. The Van Doren Rubber Company opened on 16 March 1966 in Anaheim, California. It made shoes and sold them directly to the public. On its first day, twelve customers bought deck shoes, which the page says were similar to Keds but with a thicker sole, priced between $2.49 and $4.99 [39]. In the 1970s the company developed skate shoes, adopting the "Off the Wall" motto in 1976 and releasing styles including the one later called the "Old Skool" [39]. Vans joined VF Corporation in 2004 [39].

Converse's account also notes that skateboarding began in mid-century California as "sidewalk surfing," and that the low-top Chuck Taylor, released in 1957, was already a favourite of the beach boys and adapted to street skating [6].

Those two stories point the same way. The skate shoe was not designed first by a laboratory. A cheap canvas shoe with a thick rubber sole was adopted by a subculture, which found out what it could take, and companies then redesigned it in response.

What these three have in common

Each case begins with a customer doing something that the shoe was not designed for, and each ends with a product designed for exactly that. This habit of following the body has made the sneaker industry expand into every sport and many non-sports. It is also the reason the number of sport shoe models in the United States grew from five in 1970 to 285 in 1998 [5]. Each new use creates a new design problem, and each design problem is a possible product.

CHAPTER 9

The shoe becomes a signature

Jordan, the dunk contest and the habit of collecting

Until the mid-1980s a basketball shoe was something a team wore. After 1985 it was something a person owned. The pivot came from a rookie who did not want to sign with the company that won him.

A reluctant signing

The NBA's own retrospective on Michael Jordan's breakout describes the position in 1984. Jordan had played at North Carolina, which was then a Converse school, and he loved Adidas. After being named college player of the year and starring on the 1984 Olympic team, he was in demand by the shoe companies, and he wanted Adidas. A Nike executive, Howard White, recalled that Converse was then the pre-eminent brand: Magic Johnson, Larry Bird and Isiah Thomas all wore Converse [16].

Nike nonetheless won. The record, on a general reference page, is that Jordan signed a six-year, $2.5 million deal with Nike on 26 October 1984, three times any other deal in the NBA then, plus royalties on products carrying his name, which was considered disruptive. Nike released the Air Jordan line in April 1985 aiming to make $3 million in the first three years. The same page says the line earned $126 million in one year, though that claim is marked there as disputed [17]. The book will cite the figure as reported, not as established.

The banned shoe

The shoe's legend rests on a rule. NBA policy required that shoes be 51 percent white and match those of the rest of the team. The Air Jordan I was designed in the Bulls' red and black with only 23 percent white. The reference page says the NBA fined Jordan $5,000 per game and Nike agreed to pay each fine, which generated both controversy and publicity [17]. The point to take from this is how the product was positioned. A restriction was turned into an advertisement, and the brand's story became defiance of an official rule, even though, in the same account, the company was the one paying the penalty.

The shoes were designed by Peter Moore, Tinker Hatfield and Bruce Kilgore. The "Jumpman" logo came from a photograph taken for Life magazine of Jordan in a ballet-style leap before the 1984 Olympics [17]. Jordan Brand was established as a separate unit in 1997 [17]. In its annual report Nike now says its Jordan Brand designs, distributes and licenses athletic and casual footwear, apparel and accessories, focused on sport performance and streetwear, and reports Jordan sales within Nike's regional segments [24]. A reference page reports Jordan Brand brought in $5.1 billion for Nike in 2022 [17].

From court to street

The Air Jordan was not the only signature product of the age. The Adidas Superstar, originally a basketball shoe, became a hip-hop staple [5]. Adidas, Puma and Nike shoes were important in hip-hop from the 1970s, and Converse and Vans in rock and roll [5]. The SATRA bulletin notes that British punk in the 1970s relied on classic trainers, high and low, and that members of the Ramones wore them [7].

The collecting habit followed. A reference page on sneaker collecting says it came to prominence in New York in the 1980s and traces it to two sources: basketball, specifically Jordan and his line released in 1985, and the growth of hip-hop. The boom in signature basketball shoes supplied the variety a collecting subculture needs, and hip-hop gave the shoes street credibility as

status symbols [33]. The same page notes that sneakers have some of the highest resale multiples of any retail goods, with the most coveted low-production releases sold for more than ten times retail, and that online resale and auction sites grew in the 2010s. Nike launched its SNKRS app in 2015, and some retailers adopted raffle systems [33]. Flight Club, one of the first consignment shops, opened in 2005 [33].

The fashion engine

The late-twentieth-century shoe industry discovered that a design could be sold twice, once to an athlete and once to everyone else. In the 1990s, the general summary says, shoe companies perfected fashion and marketing skills, athlete endorsements grew larger, and sneakers were marketed as a definition of identity and personality, not just athletic aids [5]. The same summary adds that during the 1990s walking shoes for adults used sneaker construction with a traditional look, and that by 2010 these were displacing sales of leather shoes for adults [5].

One statistic in that summary shows the size of the shift in product variety. The number of sport shoe models in the United States rose from five in 1970 to 285 in 1998 and 3,371 in 2012 [5]. That is more than a six-hundred-fold increase in choice in four decades. A figure like this has to be read with care, because it counts models and not sales, but it describes an industry in which novelty itself had become a business.

What the signature changed

A signature shoe turns a technical product into a relationship between a customer and a person. It is why a shoe company needs an athlete, and why it needs to keep new ones coming. It also created the secondary market, in which a limited release is bought for resale, which in turn turns some customers into speculators and some shoes into assets. The industry that began with a quiet rubber shoe for people who wanted to walk without noise now includes people who own pairs they never wear.

CHAPTER 10

What a pair is made of, and how

Cut, stitched, lasted, cemented: a pair in the factory

A sneaker looks like one object. Inside a factory it is dozens of parts, cut from rolls, stitched, glued around a plastic foot-shaped form, and baked into a single shape.

The materials list

Nike's annual report names the principal materials used in its footwear: natural and synthetic rubber, plastic compounds, foam cushioning materials, natural and synthetic leather, nylon, polyester and natural fibre textiles, and the polyurethane films used to make Air-Sole cushioning units [24]. The materials are mostly bought by the shoemakers from what the report calls "Tier 2" suppliers, who provide the principal materials. As of 31 May 2025 Nike had 184 strategic Tier 2 suppliers [24]. Most raw materials are available in the countries where manufacturing takes place [24].

As a general matter of chemistry, and not a claim from any one source here, a sneaker is mostly a petrochemical product with a few exceptions. Synthetic rubber, EVA and TPU foams, polyurethane films and synthetic textiles are all derived from oil and gas feedstocks. Natural rubber and leather are the agricultural exceptions. This explains an economic fact that matters for the carbon chapter later: a shoe's materials and processes sit inside the plastics, textile and chemical industries, and a shoe factory is where those industries are assembled into a product.

The sequence in a factory

The How Products Are Made account lays out the manufacturing sequence [22]. It begins with rolls of synthetic material and dyed leather. Die machines stamp the shapes out like cookie cutters, with markings to guide assembly. The parts of the upper are stitched or cemented together, and lace holes punched out; at this stage the upper looks like a round hat, with extra material called the lasting margin. The insole is stitched to the sides of the upper, stiffeners are added at the heel and toe, and an insole board is inserted [22].

The upper is then heated and fitted around a last, the plastic mould that gives the shoe its shape. An automatic lasting machine pulls the upper down over the last; a cement nozzle applies adhesive between the upper and insole board, and the machine presses them together. The midsole and outsole, pre-stamped, are layered and cemented to the upper; the bonded sole is reactivated over a heater and the cement cools as the parts join. Finally the shoe is removed from the last, inspected and cleaned of excess cement [22]. The account stresses that shoemaking is labour-intensive and that each phase needs precision [22]. Quality tests developed by SATRA check for poor lasting, incomplete cement bonding and stitching errors [22].

That description is a general account of a conventional running shoe, written a long time ago. Modern factories use more automation, injection-moulded midsoles and knitted uppers. Nike describes its Flyknit as a digitally engineered knitting process, best known for lightweight, formfitting, virtually seamless uppers [36]. The shift from stitched pieces to a knitted whole is a significant change in how the first stage of the process works. This book does not have a first-hand factory visit or a verified manufacturing-yield figure to offer, and it will not make claims about waste reduction that it cannot source.

Where the air is made

One of the details in Nike's report shows how some key components are made close to home. A wholly owned subsidiary, Air Manufacturing Innovation, has facilities near Beaverton, Oregon, in Dong Nai Province in Vietnam, and in St. Charles, Missouri, that make Air components [24]. The shoes themselves are made by independent contractors; the cushioning units that define the brand are produced under the company's own control. It is a clear example of an outsourcing company keeping hold of the one process it considers its core.

Many parts, many industries

The sneaker is a convenient case of the idea behind this series: a single item that is made of many industries. Rubber growers and tappers feed processors; chemical companies make foams and films; textile mills weave and knit; adhesive makers supply the cement; tool and mould makers supply the shapes the factories need for each size and model; machinery makers build lasting and stitching machines; and testing bodies such as SATRA set the standards. The upper alone draws on at least three: textiles, leather or synthetic leather, and the thread and adhesive that hold them together. Behind each of those is another supply chain, none of it visible in a shop window.

What the process reveals

Two features of shoemaking explain much of what follows. First, because shoemaking is labour-intensive, the work goes where skilled labour is available at a cost the market will pay. Second, because the stages are modular, with cutting, stitching, lasting and bonding as separate steps, a factory can be organised as a line of workers, and a company can contract out every stage. Those two facts account for why a firm like Nike employs about 77,800 people worldwide, retail staff included [24], and yet sold 29.5 billion dollars of NIKE Brand footwear in fiscal 2025 [25]. It does not make most of its shoes.

CHAPTER 11

The map of where they are made

Three countries, a few contractors, and a history of wages

If you pick up a pair of Nike or Adidas shoes, the label will most likely name Vietnam, Indonesia or China. That is not a coincidence of the last decade. It is a feature of an industry that decided long ago to design in one place and make in another.

The numbers from the filings

Nike's annual report for fiscal 2025, the year ended 31 May 2025, says that nearly all footwear and apparel is made outside the United States by independent contract manufacturers. At that date contract manufacturers operated 97 finished-goods footwear factories in 11 countries. NIKE Brand footwear was made by 15 contract manufacturers, many of which operate multiple factories. The largest single factory accounted for about 11 percent of total NIKE Brand footwear production. Factories in Vietnam made about 51 percent of NIKE Brand footwear, Indonesia 28 percent and China 17 percent. Four footwear contract manufacturers each accounted for more than 10 percent of production, and together for about 59 percent [24].

Adidas reports that it outsources almost 100 percent of its production to independent manufacturing partners, the vast majority in Asia. In 2024 Vietnam was its largest sourcing country at 27 percent of total volume (26 percent in 2023), followed by Indonesia at 19 percent and China at 16 percent. Overall, 92 percent of 2024 volume was produced in Asia. Its largest factory made about 5 percent of volume [23]. The Adidas report also describes a "local-for-local" approach, in which it has increased production in several markets, naming Greater China, India, Brazil and Argentina, partly to react faster and partly to avoid moving goods between countries in ways that would attract higher tariffs [23].

On the supply side, one manufacturer ranks first by volume. Yue Yuen Industrial (Holdings) describes itself as the world's largest manufacturer of branded sports shoes and casual shoes, and a leading design and production partner for brands including Nike, Adidas, Asics, New Balance and Salomon. Its major shareholder is the Pou Chen Group, and it has facilities in mainland China, Vietnam, Indonesia, Bangladesh, Cambodia, Myanmar and other places [26]. Taken together these numbers show a pyramid: a handful of brands with hundreds of millions of customers, a smaller number of contractors, and a vast workforce below them.

Where the two largest brands source their shoes

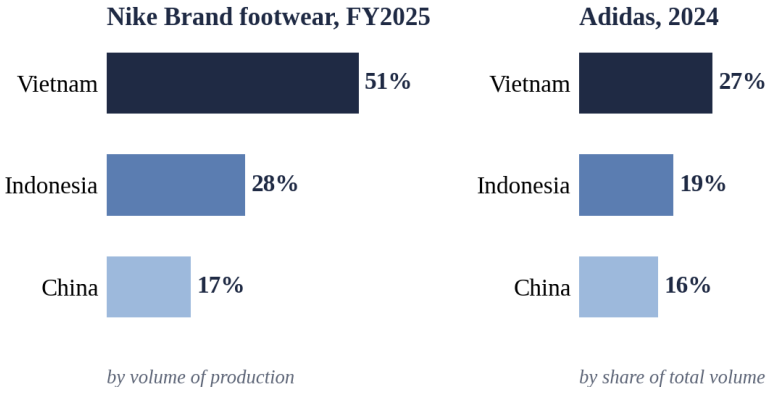


Figure. Top three sourcing countries of Nike Brand footwear in fiscal 2025 [24] and of Adidas in 2024 [23]. Original chart.

How the map got here

The geography has moved more than once. Boston and Naugatuck made rubber shoes in the early twentieth century [2, 3], Herzogenaurach made the Dassler shoes [8], and the first Nike shoes were made in Japan, as Blue Ribbon Sports imported them from Onitsuka. The logic of that first move is in the Bowerman story: Knight bet that less expensive Japanese shoes could perform as well as the German standard [11].

A World Bank study from June 1990 gives the statistics for the decade after. Developing countries, which produced half of the world's footwear in 1983, raised their share to 61.4 percent by 1987. China produced 1.9 billion pairs in 1987, of which 89.5 percent went to its own market, and Indonesia and Portugal almost doubled output. Industrial countries lost share, with the United States falling most. In exports, the study says a shift of high-volume, low-cost production from Korea to Thailand and Indonesia was under way, since those countries offered low wages, few labour problems, political stability and an adaptable work force [50].

Korea's part in this is worth a paragraph. Business of Fashion's 2017 profile of Park Yen-cha says that Busan became the world's sneaker capital in the 1970s and 1980s, and that his firm Taekwang, founded in 1971, was one of the Busan companies that made it so. Taekwang has made Nikes since the late 1980s and, by the article's account, made about 60 million pairs in the previous year, 12 percent of all Nikes sold, with factories in Vietnam, Indonesia and China [49]. Taiwan has a parallel story. Feng Tay Enterprises, founded in Taiwan in 1971, opened a factory in Fujian in 1988, later added Indonesia, Vietnam and India, and in 1992 set up what it calls Nike's first Asia-based shoe manufacturing research and development centre [47]. A 2019 radio report summarised the sequence: shoe manufacturing went from Europe and the United States to Japan and Brazil, then to South Korea and Taiwan, and now mostly to mainland China [51].

The result in 2024 was a larger, more spread-out industry. The World Footwear Yearbook 2025 puts global production at 23.9 billion pairs, up 6.9 percent after a fall in 2023. Asia made 88 percent. China made 13 billion pairs, a little over 54 percent of the world total, India 12.5 percent and Vietnam 6.5 percent [41]. Note how different that is from the brand filings above. Vietnam is first for Nike and Adidas, but third for all footwear, because most of China's and India's output is shoes of many kinds, not branded sports shoes for export. That reading is this book's inference from the two sets of figures, and the yearbook summary

itself does not state it.

Puma shows how broad a brand's supplier base can be. For 2025 its sourcing company bought from 141 independent suppliers in 27 countries, down from 153 in 2024 [42].

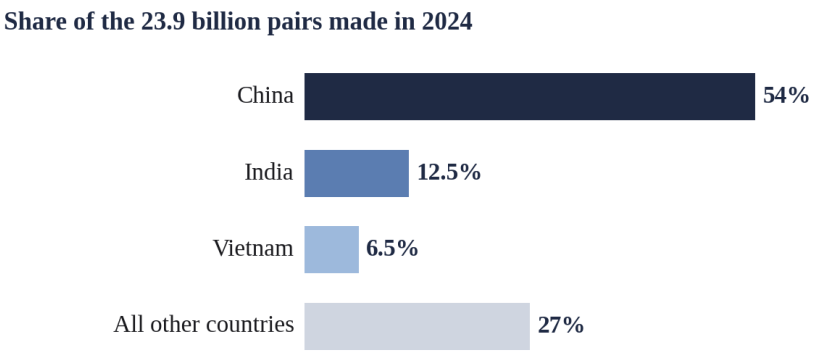


Figure. Share of the 23.9 billion pairs of footwear produced worldwide in 2024 (China is reported as just over 54 percent; the last bar is the remainder by subtraction) [41]. Original chart.

The wage question

The same arrangement drew a long public argument. In May 1998 Nike's chairman and chief executive, Philip Knight, gave a speech at the National Press Club in Washington after years of criticism of low pay and poor conditions in contract factories. He promised to raise the minimum age for new factory workers to 18 for shoe factories and 16 for others, to tighten air-quality controls to match US standards, and to allow outsiders from labour and human rights groups to join the independent auditors that inspect factories [27].

Knight said in the speech that "the Nike product has become synonymous with slave wages, forced overtime and arbitrary abuse" [27]. The New York Times report notes that his pledges did not include higher wages, which critics said were less than $2 a day in China and Vietnam and less than $1 a day in Indonesia, while Nike cited a report it had commissioned showing that its

Indonesian and Vietnamese factories paid at least the legal minimum wage [27]. These figures are the claims of critics and of the company in 1998, given as reported. They are not current wages, and this book does not have a verified current wage dataset for the countries involved.

What concentration means

The numbers from the filings point to an industry with two risks. One is geographic: a single country, Vietnam, accounts for more than half of one company's footwear and more than a quarter of another's. The other is organisational: four contractors make about three-fifths of Nike's footwear [24]. Neither is a prediction of disruption. Both are structural facts that explain why Adidas describes avoiding transfers that trigger tariffs [23], and why companies keep investing in sourcing from several countries.

There is also a human fact beneath the arithmetic. A pair of shoes is labour-intensive, so the people doing the work are very likely the largest group in the industry, though this book has no sourced count of factory workers. For comparison, Nike lists about 77,800 employees worldwide including retail [24], while its footwear is made in 97 factories by contractors. The people who make the sneakers are not on the brand's payroll, which is why the argument of the 1990s was partly about who is responsible for them.

CHAPTER 12

The companies

Who sells, who owns the name, and who makes the shoe

The industry has two layers that are easy to confuse. Brands design, market and sell. Manufacturers make. This chapter looks at the first layer, with the second covered in the last.

The two giants

Nike describes itself in its annual report as the largest seller of athletic footwear and apparel in the world [24]. For fiscal 2025 its total revenues were $46,309 million, down 10 percent from $51,362 million the year before, and NIKE Brand footwear revenue was $29,510 million against $33,427 million [25]. The fall was large, and it matters as a reminder that a dominant brand can lose sales quickly when fashion and product cycles move. This book does not attempt to explain the decline.

Adidas reported net sales of €23,683 million for 2024, up 11 percent in euros and 12 percent at constant currency, and its operating profit rose by more than €1 billion to €1,337 million [43]. Wholesale remained its largest channel, at 60 percent of net sales [43]. The two companies are not the same size, but both have the same structure: they design and sell, and others make.

The older names

Puma, the other Dassler company, reported sales of €8,817 million for 2024, up 4.4 percent at constant currency [42]. Its report lists the main footwear inputs as polyurethane, ethyl vinyl acetate, natural and synthetic rubber and leather [42].

Asics, founded by Kihachiro Onitsuka in 1949 and headquartered in Kobe, makes athletic and lifestyle footwear and is known for running shoes; Performance Running is its largest category [31]. For 2024 it reported net sales of

678.5 billion yen, up 18.9 percent on a comparable basis [58]. Reebok, the descendant of J.W. Foster and Sons, is now part of Authentic Brands Group since 2022, and the reference page says it generates about $5 billion in annual retail sales [32]. Converse is owned by Nike, as Nike's own history page makes clear [6]. Keds was founded in 1916 [37]. New Balance began, in the account of running shoes in this book's sources, with research in the 1960s into how running affects the foot, which led to an orthopedic running shoe with a rippled sole and wedge heel [22]. These names are a sample, not a ranking.

The new challengers

The most interesting recent movement is among younger brands. Deckers, whose brands include UGG and HOKA, reported for its fiscal year 2025 that net sales rose 16.3 percent to $4.986 billion, and that HOKA net sales rose 23.6 percent to $2.233 billion from $1.807 billion [28]. On, the Swiss company, reported net sales of CHF 2.32 billion in 2024, up 29 percent, with Asia its fastest-growing region [30], and said in its 2025 results that annual net sales surpassed CHF 3.0 billion for the first time, up 30.0 percent [29]. Skechers, founded in 1992 by Robert Greenberg, announced record 2024 sales of $8.97 billion [56]. Its annual report says it owns no factories and that its products are made by independent contract manufacturers located primarily in Asia, with China and Vietnam named as the main sourcing countries [57].

These figures show that the last decade's growth was not only in lifestyle fashion but also in running, a market where Nike's margin was challenged by brands that sold a specific idea of cushioning or a specific community. The numbers come from the companies' own releases, except where noted as reference-page summaries, and they cover different fiscal years and currencies. They should not be added together or compared directly without conversion.

Manufacturers

The layer below the brands includes the contract makers named in the previous chapter. Yue Yuen is the largest by volume [26]. Nike says that four contractors made about 59 percent of its footwear, without naming them in the part of the report this book read [24]. Other makers can be named from their own pages and from press profiles.

Feng Tay Enterprises, a Taiwanese company founded in 1971, describes itself as a long-standing manufacturing partner of Nike, with about 130,000 to 140,000 employees, factories in China, Indonesia, Vietnam and India, and capabilities that include moulds and soles [47]. Taekwang, founded in the same year in Busan, makes Nikes in Vietnam, Indonesia and China [49].

Below the shoe factories are the firms that make the parts. Vibram, founded in 1937 in Italy by Vitale Bramani after he designed the Carrarmato rubber sole, is based in Albizzate, makes more than 40 million soles a year and has operations in the United States, China, Japan, Brazil and Italy [48]. Arkema supplies the polyether block amide polymer sold as Pebax [44]. BASF supplies expanded thermoplastic polyurethane as Infinergy, and in 2018 began producing it at a plant it operates in Changhua County, Taiwan [45, 46]. Both are chemical companies. Their names rarely appear on the shoe box, though their materials are central to the shoe's cushioning.

This list is a sample of firms with a published account, not a ranking of the industry. No source this book read gave a complete census of component makers, and the number of small specialist firms, which make laces, eyelets, adhesives and knitted uppers, is not known to it.

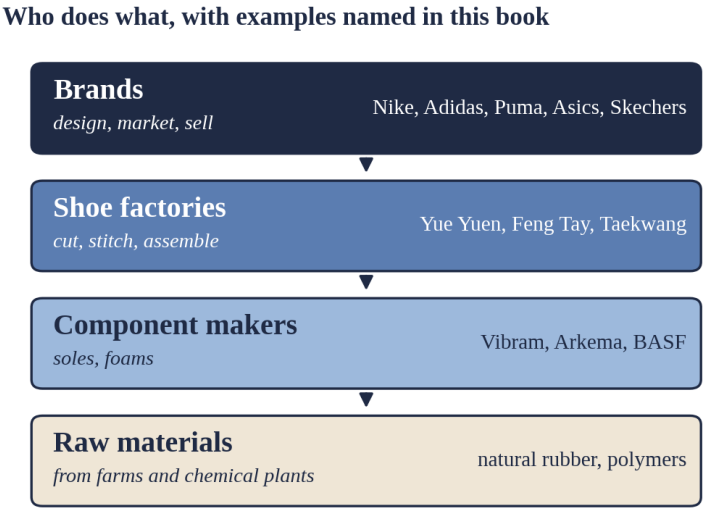


Figure. The layers of the industry, with examples named in this book [47, 48, 44, 45, 49, 26]. Original diagram.

What the list shows

Four patterns stand out. The brands are old: Converse was founded in 1908, Puma and Adidas in 1948 and 1949, Asics in 1949. The ownership is international: a German brand, a Japanese company, a Swiss challenger whose fastest-growing region is Asia, American brands made mostly in Asia. The most valuable assets are names and designs, not factories. And the brands rise and fall with product cycles, which is why a company with $46 billion in revenue can drop ten percent in a year.

CHAPTER 13

The carbon in a pair

Where the weight of a shoe actually sits

A shoe weighs a few hundred grams. The emissions associated with it weigh much more, and most of them occur before the shoe is boxed.

The study that measured it

In 2013 a team led by Lynette Cheah, with Elsa Olivetti and colleagues, published a life-cycle assessment of athletic footwear in the Journal of Cleaner Production. Its abstract reports that a typical pair of synthetic running shoes generated 14 kilograms of carbon dioxide equivalent, with a standard deviation of 2.7 kilograms. Materials processing accounted for about 29 percent of the impact and manufacturing for about 68 percent. The abstract adds that a single shoe can contain 65 discrete parts and require 360 processing steps, and that company estimates from Puma and Timberland ranged from 18 to 41 kilograms per pair [52]. MIT Technology Review, reporting on the work, also described more than 360 steps and 65 parts [59].

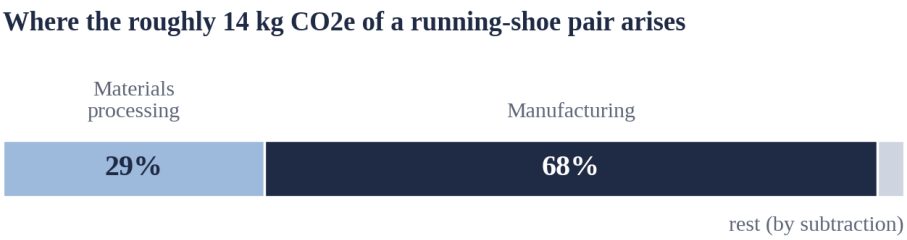


Figure. Division of the carbon footprint of a typical pair of running shoes, as reported in the 2013 study; the small remainder is the difference from 100 percent [52]. Original chart.

Two cautions come with these numbers. The study measured shoes of the early 2010s, and the authors' own scope should be read in the paper. And the range from other companies, 18 to 41 kilograms, shows that different methods and different shoes give very different answers.

Why manufacturing dominates

A sneaker has no energy use phase. Unlike a car or a refrigerator, it consumes nothing while worn, so the impact sits upstream: in making foams, rubber, textiles and films, in heating and moulding them, and in the factory's energy supply. Adidas's annual report says that greenhouse gas emissions from manufacturing are a major contributor to its carbon emissions [23]. This book did not read the section of that report in which the company sets its reduction targets.

Two things follow. As a matter of general reasoning, not a sourced finding, a shoe's footprint should depend on the electricity and heat used where it is made, so the same shoe made in two countries may differ. And the brand that designs the shoe does not control the factory's energy, which is another reason the contract structure of the previous chapters matters for sustainability as much as for labour.

Material choices

The materials list in Nike's report gives a sense of what is being decided. Natural and synthetic rubber, plastic compounds, foams, leather, nylon, polyester [24]. Each has an impact. Leather and natural rubber involve agricultural land; synthetics involve fossil feedstocks. Foams such as EVA and TPU are hard to recycle because they are bonded to other materials, a point that follows from the construction methods earlier in this book: a cemented sole is permanently glued to its upper [22]. That statement is an engineering inference, not a measured recycling rate, and this book does not have a source for how many shoes are recycled.

A last point of caution about marketing. Companies describe lighter or knitted designs as lower in waste. Nike calls its Flyknit a digitally engineered knitting process [36]. Whether a specific design reduces total emissions depends on the whole life cycle, not on one stage, and this book has not located an independently verified life-cycle figure for any specific knitted shoe.

The honest summary

What the sources support is narrow but useful. The carbon in a pair of running shoes is mostly in manufacturing. That is probably still true of newer shoes, but the evidence this book reviewed is a 2013 paper, and the foams, plates and uppers of 2025 are different from those of 2012. Anyone who wants to quantify a modern shoe's footprint would need a new life-cycle study of a current design.

CHAPTER 14

Bottlenecks and dependence

What limits the industry, and how far we lean on it

Every industry has a point where it is thin. For sneakers the thin points are not scarce metals or rare crops. They are places, firms and people.

The constraints that show in the filings

Four limits can be read from the sources already cited.

The first is concentration of production. Vietnam makes about half of Nike's footwear [24] and more than a quarter of Adidas's volume [23]. A single Nike factory accounts for about 11 percent of its footwear, and four contractors for about 59 percent [24]. A shock to a country, a port or a contractor would reach shelves quickly.

The second is trade policy. Adidas states that it monitors the political and regulatory environment and avoids transferring goods between countries that would trigger increased trade tariffs, and has increased local-for-local production in Greater China, India, Brazil and Argentina [23]. The exposure is explicit in the company's own language.

The third is materials. Nike's report says that from time to time certain materials used in its products experience periods of high demand, shortages and price volatility, and that in fiscal 2025 its contract manufacturers were able to source enough [24]. The sentence is brief, and it is the standard disclosure, but it describes a dependency: the foams, rubbers and textiles come from chemical and farming industries with their own cycles. Natural rubber comes from plantation trees in tropical countries. Cirad, the French agricultural research centre, said in 2025 that about 80 percent of it comes from family farms, and that 14.6 million tonnes were produced in 2024, with Thailand at 34 percent, Indonesia 14 percent and Ivory Coast 12 percent. China took 45.8 percent of

consumption and India 9.2 percent [54]. Rubber is also one of the commodities named by the European Union's deforestation regulation. Under the Commission's page, large and medium operators must comply from 30 December 2026 and micro and small operators from 30 June 2027 [55].

The fourth is labour. Shoemaking, as the manufacturing account stresses, is labour-intensive [22], so the industry depends on workforces in a small number of countries, and the 1990s argument over wages and conditions shows that this dependence carries a reputational risk [27].

The regulatory edge

A constraint of a different kind appeared in 2020 when World Athletics limited sole thickness to 40 millimetres for road shoes and one rigid plate, and required that shoes be available on the open market [21]. Those rules have since been replaced. The version effective from 20 April 2026 keeps the 40 millimetre ceiling for road running and one rigid structure in non-spike shoes, and sets 20 millimetres for track events, jumps and the javelin [53]. A governing body can limit the thickness of the product, and in a sport where the shoe is performance equipment, that sets a ceiling on one kind of technical competition. It does not touch the vast majority of shoes, which are not worn in elite competition.

How much humans depend on the sneaker

The question of dependence is harder to answer with numbers than the earlier questions. The best production figure found is the World Footwear Yearbook's 23.9 billion pairs made in 2024, with Asia accounting for 55.5 percent of consumption [41]. Beyond that, the sources show where the shoe sits in daily life.

It is the default footwear for exercise, which is why the categories of running, basketball, tennis and training each have their own design [5]. It has displaced other footwear: the general summary says that adult walking shoes using sneaker construction were by 2010 displacing leather shoe sales, as sneakers had done for children after the 1950s [5]. It shapes culture, as the chapter on

collecting shows [33]. And it is a medical object, in a limited way. The sources are clear that cushioning can reduce impact, and equally clear that the evidence that prescribing different shoes to different feet reduces injury is weak [5, 18, 19].

There is a bluntly physical form of dependence too. People walk and run on hard surfaces that did not exist for most of human history: pavement, tarmac, polyurethane tracks, indoor floors. The Nature paper's point, that for most of human evolution runners were barefoot or in minimal footwear [18], is also a statement about how recent the dependence is. The modern running shoe was not invented until the 1970s, in the paper's words [18]. Whatever the final judgment on cushioning, a large part of the world now moves on a manufactured surface in a manufactured shoe.

Uses outside the shoe

The sneaker industry feeds, and draws on, other industries. It draws on rubber growers, chemical companies, textile mills and adhesive makers, as shown in the chapter on materials. It feeds the sports media economy through athlete endorsement, a business Jordan and Nike showed at scale [16, 17]. It feeds retail and, through online resale platforms, a secondary market [33]. And it has fed material science: the same blow-moulding method that Rudy learned in aerospace was applied to a shoe [13], and a foam first shown by a chemical company to shoe designers as a curiosity became a midsole [35].

Research for this book did not find a sourced figure for the economic size of these linked industries, and none is offered.

CHAPTER 15

What is open

Questions the sources raise and do not answer

This book stays within what its sources support, so this last chapter does not predict. It lists questions that the evidence leaves open, since a good map of an industry marks where its edges are.

Will the rules or the market set the shoe?

World Athletics set limits on sole thickness and plates in 2020 and replaced that rulebook in 2022; the version effective from 20 April 2026 still allows one rigid structure and a 40 mm road-shoe sole [21, 53]. The limits apply to elite competition. The broader market has no such limit. If the next foam or plate offers a gain, the rule book and the shop shelf may diverge, with one kind of shoe for competition and another for everyone else. The record so far shows both kinds of change: rules changing in response to technology, and technology changing to fit rules.

Where will shoes be made?

The filings describe concentration in Vietnam, Indonesia and China, and the Adidas report describes local-for-local production in Greater China, India, Brazil and Argentina [23, 24]. Both statements are about the present. Whether production spreads more widely, or concentrates further, depends on tariffs, wages and automation, and none of the sources read here forecast it. The evidence of the last century is that the industry moves its factories when the economics change: from Massachusetts and Connecticut to Japan, and then to Southeast Asia, with the timing of each move left for a later study [2, 3, 11].

How much of a shoe's story is the shoe?

Nike's 1998 confession that its name had become synonymous with poor conditions [27] and the Air Jordan's rule-breaking fame [17] belong to the same observation. The product is partly a story told about the product. The research question is how much of what customers pay for is the foam and how much is the name. This book has no sourced answer.

What does a shoe cost the world?

The 2013 life-cycle study found that most of a running shoe's carbon impact came from manufacturing [52]. A current study of a current design, with its foams and plates, would be a useful piece of research. So would a count of how many shoes are repaired, resold or recycled, which this book was unable to find.

Does cushioning help?

The Nature paper suggests that barefoot-style landing can lower impact forces [18]. The Sports Medicine paper shows that a particular combination of foam and plate lowers the energy cost of running for trained runners by about four percent [20]. The encyclopedic summary reports no clear injury benefit from matching shoe type to foot type [5]. These three results do not contradict each other, but they do not form a single answer to the question the first chapter asked. A shoe may make a runner faster, may feel better, and may or may not protect the body in the long run. The studies measure different things.

A closing note

The sneaker began as a silent shoe for people who did not want to be heard on a floor. It became a technical object, a signature and an asset. At every step the pattern was the same: a problem seen in use, a material taken from somewhere else, an athlete to prove it, and a factory to make it at scale. It is probably a fair summary of how a modern industry is built. Most of the interesting open questions are still at the bottom of the shoe.