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“It’s Gotta be the Shoes”

A Case Study on Shoes, Distance Running, and Technology in Sport

Hannah K. Martin
24 May 2021

Advised by José G. Perillián and Justin J. Harris



A Senior Thesis Submitted to the Faculty of Vassar College in Partial Fulfillment of the Requirements for the Degree of Bachelor of the Arts in Science, Technology & Society

The Map

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Thank you to my parents, who are the reason I started running at all — as much as I hated the idea of joining a sports team in fifth grade, you were right. I did need to go outside and make some friends. Thank you for knowing when to push me, and for knowing when to step back so that I could make running my own. Your love and support at every meet (even when you were halfway across the country), and in every other aspect of my life, means the world to me.

Thank you to all my coaches throughout the years: Michelle Wolfer, Gregg Osborne, Scott Steffen, James McCowan, Ron Stonitsch, and Justin Harris. I am who I am today in large part because of my time on your teams.

Finally, to my teammates, to my housemates (in TH 118 and at Jug End), and to Reed, Caleb, and Sydney — thank you for listening to all my rants about these shoes, and running, and everything else I needed to yell about this year. I have learned and continue to learn so much from you all; thank you for letting me be a part of your lives. Much love, as always.

The Warm Up

Luckily it is still much more reliable to judge from seeing a man run or jump than it is to test his potentialities in a laboratory. If a laboratory forecast were possible there would be hardly any point in an athlete's proving his ability, and he would never experience the satisfaction of struggle and achievement. I hope the frightening day will never come when the scientist can predict with accuracy the limits of an athlete's success.

—Sir Roger Bannister
The First Four Minutes, pg 92

When I finished my first marathon at the end of the 2020 fall semester, it did not show up on my TFRRS¹ profile. There is no official record of my time, or proof that I completed the distance at all, that exists outside of my Strava account, personal training log, and GPS watch data. My marathon could not be considered a *competition* by most definitions. I was the only person running the full 26.2 miles;² a few of my teammates hopped in and out of my run to join me along the way; my coach biked next to us for a little over 20 miles; and he handed me water and energy gels directly from the bike so that we would not have to drop things on the route ahead of time. The route itself was roughly pre-measured, but not marked in any way other than the approximate mile markers installed along the rail trail, which were not specific to my run at all. There was no official starting gun, no marked finish line, and no one to compete against other than myself. My goal was simple: to cover the marathon distance and see what happened.

What happened, as it turns out, was that I bonked. I “hit a wall” — runner’s jargon for what happens when one has pushed one’s body, for any number of reasons, to a point where it all but refuses to continue. On that beautiful late-November Saturday, I was under-fueled and over-stressed. I had rescheduled the marathon several times already due to a COVID-19 quarantine and a location change, which extended my training block further than I had anticipated and left my body slightly past its peak fitness. I began approaching the “wall” halfway through the marathon: much, much sooner than expected. The second half of my run was grueling; at times, I was barely walking. I often muttered to myself angrily, frustrated that

¹ TFRRS stands for Track and Field Results Reporting System, and to many collegiate athletes, it is the all-important record of their achievements. Although much context is left out, this simple, numbers-based website can tell the story of an athlete’s successes, failures, and aspirations, if you know what you’re looking for. My TFRRS profile can be found here, for those curious: https://www.tfrrs.org/athletes/6438999/Vassar/Hannah_Martin.html

² It is possible that others on the Wallkill Valley Rail Trail that Saturday also ran a marathon, but their efforts would have been entirely separate from mine, seeing as I do not even know if they exist.

the day had turned so far south, and in between the mutterings I struggled to keep my eyes open. In what was probably a humorous moment for my friends, I tried to eat an orange around mile 23 and missed my mouth, hitting my face with a slice of it.

As hard as it was to complete, the worst part was, by far, what happened after I finished (fig. 1). In the twelve years since I began running competitively, I have pushed myself to my absolute limit in a particularly devastating way two other times. Once, in my junior year of high school, I very nearly qualified for the state championship cross country meet but collapsed dramatically two hundred meters from the finish line and had to crawl part of the way before I could force myself upright. The other time, in my sophomore year of college, I very nearly qualified for the NCAA national meet before collapsing dramatically three times over the last 400 meters, again having to crawl part of the way to the finish line, this time through rocky mud (I still have the scars on my knees).



Figure 1: The author recovering from her first marathon, 21 Nov 2020. Image courtesy of James McCowan.

Although I did not collapse before the end of the marathon, my body had been fighting itself for so long that when I finally stopped moving, it panicked. I could not control my heart rate, waves of intense pain coursed through my muscles at regular intervals, and it felt as if my brain had short-circuited. At one point, I literally thought I was going to die (I was not — I just could not rationally process what was happening in my body). It took me 40 minutes to begin to feel human again after running for three hours and 39 minutes.

In attempting the relatively simple goal of completing a distance that 1,298,725 people worldwide ran in 2019 (Andersen and Nikolova 2020), I was also exploring my personal limits. How fast could I go? Could I actually finish it? When would I let myself walk? How much pain could I put myself through before it was no longer “worth it”? What would happen if I quit? If I did not? I had pushed my limits in official competitions before — when attempting to qualify for larger races, when people were watching, when a team score was on the line. This marathon was different; the stakes were only as high as I decided they were because, to be honest, it would not matter to anyone else if I finished or not.

* * *

The desire to find existing boundaries and push back on them is nothing new; I certainly do not have a monopoly on limit-pushing. Even toddlers have innate compulsions to see how far away they can wander and to test what will get a reaction from authority figures or not. Sport is a much more organized and complex extension of these dynamics: the players, if they are playing well, are ultimately trying to find out what they are capable of and how they can use the stated and unstated rules to their best advantage.

Runners, in particular, can be fixated on breaking records and finishing faster than those around them, physically and temporally. Because the sport lends itself well to comparable, numerical values, performances are lauded most extensively when a world, national, institutional, or personal record has been beaten. After a race, my family and non-runner friends will often ask me what my time was, closely followed by “and what’s the fastest you’ve ever gone?” They rarely have a concept of what a six-kilometer cross-country race³ entails, or what an average time at that distance is. What they have instead is the innate feeling that faster is better, and that a “good race” is measured in terms of on-paper improvement.

It should come as no surprise that many people carry this instinct; we have been trained to think linearly. Timelines cover the perimeter of our classrooms (at least they did in my schools), marking a steady forward march of “progress” towards bigger and better things. Academics have spent years attempting to predict what the absolute limits to human speed are, to disentangle the inner workings of the biomechanical processes necessary to run fast, and to best engineer and manipulate the conditions, bodies, and technologies required to be better than the runners that came before.

For example, a 2008 study in the *Journal of Experimental Biology* used statistical modeling to analyze how much more improvement is possible in greyhound, horse, and human races. The author found that plateaus in winning times are currently present in greyhound and horse races almost across the board. Humans, on the other hand, have not yet reached a complete plateau. A possible explanation for the plateaued vs. non-plateaued times: greyhounds and horses cannot manipulate their interactions with their environment. Whereas humans can fine-tune

³ For collegiate women, the standard championship cross country race distance is six kilometers, often referred to as the 6k. Men will run either the 8k or the 10k, depending on what NCAA division the school is in. These distances feel largely arbitrary, and have been the subject of many debates on my team, but that is a discussion for another time.

training strategies, develop better fueling methods, and create tools to help them move faster for longer, greyhounds and horses are at the mercy of their handlers and their very selective breeding. The current men and women’s world records in the marathon illustrate our ability to augment and go beyond perceived limits of human performance: both marks have exceeded or are likely to exceed the event’s predicted plateau times. The men’s marathon world record has already improved 116 seconds and 1.56% from its 2008 mark of 2:03:35 to 2:01:39 by Eliud Kipchoge in 2018 (Douglas and Nakamura 2020). Kipchoge’s 2018 record is only 52 seconds and 0.72% slower than the predicted limit of 2:00:47. However, his record-ineligible INEOS 1:59 marathon in October 2019 dipped under both the official record and the predicted limit: Kipchoge ran 1:59:40, 67 seconds and 0.92% faster than 2:00:47. The current women’s marathon world record, 2:14:04, set by Brigid Kosgei in 2019, is 54 seconds and 0.67% faster than the 2:14:58 predicted in the study.

Other researchers, such as Peter Weyand at Southern Methodist University in Texas, have asked the same question — what are the limits of human performance — with an experimental, biomechanical approach. To name just a few studies, Weyand has tested the effects of hypoxic reductions in

aerobic power on sprint speeds (finding that aerobic power has very little effect on “all-out runs

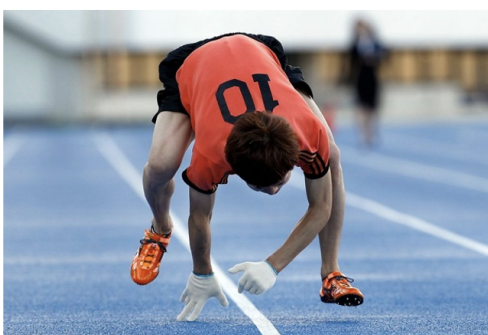


Figure 3: Kenichi Ito, a quadruped runner, during his Guinness World Record-setting 100 meter effort in Tokyo on 15 Nov 2012. Image from AP Photo / Koji Sasahara.

of 60 seconds or less”), developed a new method for predicting maximum high-speed running performances (using a combination of maximum speeds supported by aerobic and anaerobic powers⁴), and has analyzed the mechanical interactions during the stance and swing phase (fig. 2) of a runner’s gait limit speed in order to better train athletes to adopt a more efficient and powerful gait (Weyand 1999; Bundle, Hoyt, and

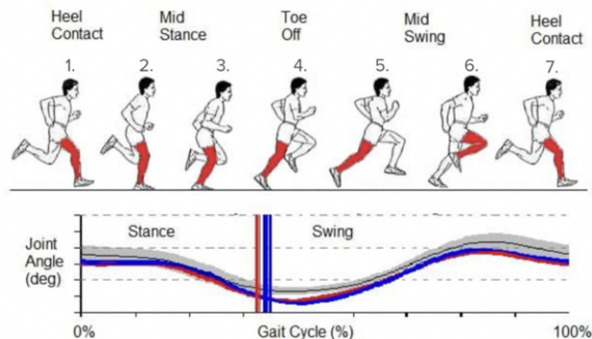


Figure 2: The running gait cycle. Image adapted from Melbourne Sports and Allied Health Clinic.

⁴ Aerobic exercise requires oxygen uptake during the activity, anaerobic does not. Most sprinting events are anaerobic; longer-distance races are aerobic.

Weyand 2003, and Weyand 2010). There has even been a paper published that attempts to predict if or when a human running on four limbs will beat a human running on two legs, and provides hypotheses about possible techniques and successful form strategies (fig. 3) (Kinugasa and Usami 2016).

The accuracy of such studies is less important to this thesis than what the existence of these studies implies. People are interested in who is the fastest, why they are the fastest, and how they can make themselves faster. In short, speed matters.

* * *

Partially because speed and performance matter to people, the primary method used to establish the pinnacles of human abilities — competition and sport — requires a delicate balance of fairness, regulation, and transformation. People want to be able to compare performances and results, which requires that all participants agree to and abide by a standardized set of rules. However, because it is impossible to reach a full consensus about the goals of a competition and the definition of fair play, and because limit-pushing does not fit comfortably into standardized regulations, sports communities argue often over the implementation of their respective rules of engagement. These arguments typically reveal tensions between innovation and tradition and are related to participants' dual desires for a sport to remain the same while also wanting to push back on established limits. Appeals to morality are occasionally made during such conflicts, particularly over technology regulations in sport, calling into question the “true nature” of the sport in its “pure” form.

Relevant to this thesis, shoe technology in competitive running has recently been the source of seemingly endless controversy. The culprit is an innovative combination of a curved carbon-fiber plate sandwiched between thick layers of uber-responsive foam in the midsole of marathon racing shoes, first developed by Nike, which provides an approximately 4% improvement in running economy. This improvement leads to faster times for those runners who are “positive responders” in the shoes. Others, for a variety of reasons, are “low responders” in the new technology, and do not see significant improvements. The shoes were first used secretly in 2016, the early prototypes being disguised as a previous model of Nike's racing shoes, and for several years, Nike's runners were sweeping podiums at major marathon races around the world. Even after other shoe brands began developing and releasing their own versions of the new technology, Nike's product appeared to be on another level.

This innovation was met with strong reactions: very few people in the running community had a middle-of-the-road perspective on them. Some thought the shoes were incredible, a testament to what can happen when we push our human limits and an important step in moving the sport forward. Others were appalled, calling for a total ban on the shoes or at least strong regulations at the elite level. Runners on Twitter, in countless magazine articles, podcasts, and post-race interviews have voiced their own opinions regarding the shoes: whether or not they should be used at all, how they should be regulated, and what they do or do not change about the sport. Meanwhile, the governing body of running sports, World Athletics, was slow to deal with the problem of the shoes. Nike had taken advantage of vague wording in the rulebooks, letting the proverbial cat out of the bag and staying one step ahead of World Athletics, meaning that it would have been almost as problematic to ban the already released shoes entirely as it would have been to allow the new shoe technology to go unregulated. Since 2019, World Athletics has updated their guidelines on what technology is acceptable in competitions; the previously vague mandate that no equipment should “provide any unfair advantage” was rewritten several times (see tables 1-3 in the appendix). At the time of this writing, competition shoes have to be approved before an athlete can wear them, and there is an ever-growing list of which shoes are or are not acceptable.

Because of the proven advantage some runners experience while wearing the carbon plate Pebax-foam shoes, the running community has been forced to grapple with how to regulate “fairness” with respect to new technologies and how to manage the tension between innovation and tradition. Debates about the shoes’ use are especially contentious among elite runners but have been relevant for runners at every level; the shoes reflect broader human concerns about the boundary between what is “natural” or “artificial,” as well as challenge our communal understandings about technology’s place in sport and human performance.

* * *

Seeing as this case study deals primarily with competitive running, I have conceptualized this thesis as a four mile race, including a course map, a warm-up to introduce the general topic and a cool-down to reflect on what has been learned. Each mile of this race represents a chapter, and the course winds back on itself, often needing to return to previous ideas and concepts to connect two stories together. Mile one takes off right into the woods, breaking down the shoes themselves: what makes them different from previous shoes, why people are paying so much

attention to them, and how they came to be. Mile two emerges out of that woods to take a wider view, asking what running is as a sport, what it means to those who participate in it, and why it looks the way it does today. Mile three winds its way through the concepts of fairness and achievement, and provides an introductory-level investigation into the rules about competition-legal footwear and the regulatory body controlling the sport. Mile four loops around again to the context provided in miles two and three, discussing the people most affected by Nike's innovation: professional runners. To do this, the concept of a "professional" must be established, and the aspects of professionalism that are most affected by the shoe technology are explained. The primary goal of this mile is to analyze the rhetoric used by these runners and to establish the three general categories of responses to the shoes. By the time readers reach the finish, they should have a sweeping knowledge of what the shoes physically are and what they mean to the running community, as well as an understanding of why the spectrum of reactions to them is so varied.

* * *

I have a deeply personal connection to running, and as such, I have many preconceived ideas about what the sport means and the values embedded in it. I began writing this thesis because my reaction to watching Eliud Kipchoge run under two hours in the marathon for the first time in human history, while wearing the Nike carbon plate Pebax-foam shoes, was that technology was ruining the sport I love. I thought that the shoes were a step too far, that Nike had pushed running past the pure human endeavor I had always seen it as, and that there was no way those shoes could be good for athletes physically, economically, or philosophically. This thesis is an attempt to lean into that bias, to question it, to investigate those ideas, and to see what holds up, what falls away, and what can be discovered.

By the end, I was convinced that it was not the shoes themselves that were ruining the sport; instead, the problem is that the way the shoes were introduced, regulated, and advertised contradicted public perceptions of the sport's goals and values. Additionally, in the midst of the paradigm shift in shoe technology, those mismatches in the function and presentation of the shoes caused real damage for some members of the running community who were not able to access or benefit from them. This damage exists alongside the new opportunities for growth in the sport catalyzed by the introduction of the shoe technology, making it difficult to reconcile either side of the technological divide.

Mile One: The Shoes

He seemed lost in the American drive for results, which, even at Harvard, turned sport into a machine in which the athlete's individuality was submerged. Jaako [Mikkola] took away my spikes on the morning of the race, grinding them as sharp as needle points. He also rubbed graphite into the soles of the shoes so that none of the cinders would stick. Afterwards I always did this before an important race or record attempt. These precautions may make no difference, but in those last hours before a race I always imagine I must not neglect any assistance, however slight.

—Sir Roger Bannister
The First Four Minutes, pgs 68-69

Breaking Records

On 12 October 2019, Eliud Kipchoge, an unassuming Kenyan marathoner, world-record holder, and sponsored Nike athlete, ran 26.2 miles in 1:59:40.2 in a highly engineered and record-ineligible performance in Vienna, Austria: the “INEOS 1:59 Challenge” (fig. 4). This performance undeniably pushed human abilities to new limits, however, it also ignited an already-simmering debate over a revolutionary technology. This new technology came in the form of the once-humble shoe: a piece of equipment often overlooked and underestimated. Throughout the fall of 2019, chunky neon pink, highlighter green, and stark white shoes produced by Nike captured the attention of runners at all levels because of their performance-augmenting potential. Leading the charge was Eliud Kipchoge, his Nike Alphafly shoes, and the INEOS 1:59 Challenge.



Figure 4: Eliud Kipchoge at the end of the first sub-2-hour marathon during the INEOS 1:59 Challenge in Vienna, 12 Oct 2019. Image from REUTERS / Lisi Niesner.

Advertised as an attempt to break “the last barrier in modern athletics” — the two-hour marathon — the tagline for the INEOS 1:59 Challenge was “no human is limited” (INEOS 2019). The event website’s homepage now boasts “HISTORY MADE 01:59:40.2, ELIUD PROVES #NOHUMANISLIMITED” and invites the viewer to relive every moment. Kipchoge was also one of the test subjects in Nike’s 2017 attempt at pushing past the two-hour mark: an event dubbed “Breaking2” in Northern Italy that fell short of the mark by 26 seconds (Nike

2020). Breaking2 was two years in the making and is perhaps best summed up with a quote from two of the sports scientists who directed the project:

For an elite athlete, the margins for improvement are much smaller, there's less room for maneuver, so the big question is, what can we bring? ... We're taking the latest advances in training, the latest advances in technology, the latest advances in shoe design, and what we're saying is, can we add these things together? Can we get a bunch of marginal gains that [make] the impossible, possible?

The architects of the performance used every tool in their toolbox to control the variables that affect performance in a traditional race. Prior to Breaking2, sports scientists spent considerable time hand-picking athletes and testing their oxygen consumption, lactate tolerance, and running economy. At the same time, they were determining the optimal weather conditions, course features (minimal elevation changes, gradual turns, smooth surfaces), equipment, training regimens, and pacing strategies. Breaking2 used three Nike-sponsored East African athletes: Lelisa Desisa, Zersenay Tadese, and Eliud Kipchoge (from Ethiopia, Eritrea, and Kenya, respectively).

It is worth noting that the scientists involved were overwhelmingly White men and most of the pacers and all of the performers were Black; this trend held true in the INEOS 1:59 event as well.⁵ I mention this not to say that it is a negative thing for Black athletes to perform at a high level, or to be chosen for such ambitious projects — the point here is to ask not why most of the athletes are Black, but why most of the scientists are not; or why in most major road races across the United States nearly all the competitors are White, even as Black athletes are successful around the world. What may appear benign at first glance reveals on closer inspection uncomfortable and violent histories of racialized objectification, institutional and interpersonal racism, biopolitics, and accessibility, particularly in sport. Unfortunately, a full analysis of these factors is beyond both the scope of this thesis and my current abilities as a student.

The 2017 Breaking2 event was held early in the morning at the Monza Formula 1 racetrack. There was a crowd, but it appeared to be limited to one stretch of the loop that the athletes repeated and was relatively sparse compared to the crowds at world major marathons. When talking about the event, organizers and athletes referred to it as a “race,” even as they admitted that it would be record ineligible because pacers would be exchanged throughout the

⁵ There are a lot of great articles investigating Whiteness in running, but for a brief introduction and context to this history, I would suggest this Twitter thread from Natalia Mehlman Petrzela, Ph.D.: <https://twitter.com/nataliapetrzela/status/1259081374700625920>

event. The people featured in the National Geographic documentary about Breaking2 constantly reiterated that they were only setting out to prove that a sub-two-hour marathon was “physically possible” and that humans were “not limited” in their potential. This “no human is limited” sentiment clearly evolved into the INEOS 1:59 event’s entire marketing campaign.

Desisa and Tadese fell off the goal pace during the Breaking2 event, but Kipchoge hung on to the pacers and finished in 2:00:25, a non-ratifiable time 2.08% and 152 seconds faster than the official world record up to that point, 2:02:57, set by Dennis Kimetto of Kenya at the 2014 Berlin Marathon (Douglas and Nakamura 2020). Kipchoge went on to set a ratified world record, 2:01:39, a 1.06% and 78 second improvement of Kimetto’s record, at the 2018 Berlin Marathon.

In many ways, Kipchoge was the only person who could have been chosen to make these attempts, and that he had the potential to set the current world record was a given. Kipchoge has been repeatedly described as distance running’s “philosopher king” by the New York Times (Cacciola 2018, Rosen 2020), and is generally considered to be above reproach in terms of his character and doping suspicions. He has a reputation for being nearly monastic in his training, and, as one reporter put it, Kipchoge is “a wealthy man, but he still scrubs the toilet” at the training camp he owns in the Kenyan highlands (Cacciola 2018). His resume of impressive marathon victories — he has won 12 of the 14 official marathons he has ever entered — includes a stunning spread of only seven minutes between the slowest finish and the fastest (fig. 5) (Nike News 2019). When Kipchoge’s slowest time, from his 2016 Rio Olympics gold-medal-winning race, 2:08:44, is thrown out, his 15 next best times (including Breaking2 and INEOS 1:59) have a spread of just over five minutes.⁶ For context, only 6 American men have ever run 2:08:44 or faster (World Athletics 2021, “Senior Outdoor Marathon Men, All Time Top List by Country, United States”), and of the top 4,574 men’s marathon times listed on World Athletics’ all-time list, only 645 men worldwide have done so (World Athletics 2021, “Senior Outdoor Marathon Men, All Time Top List”) — and we are talking here about Kipchoge’s *slowest* time. Kipchoge’s secret sauce of mental fortitude, consistency, and purity have turned him into the beloved leader of distance running.

⁶ To give some context through a very clumsy comparison, I have run 16 six-kilometer races for Vassar: the difference between my best and my worst time is a little under three minutes. The average pace of my best and worst race varied by 30 seconds per kilometer; Kipchoge’s paces (in official races) have varied by only 10 seconds per kilometer. Given that a marathon is over 42 kilometers long, that consistency is incredible.

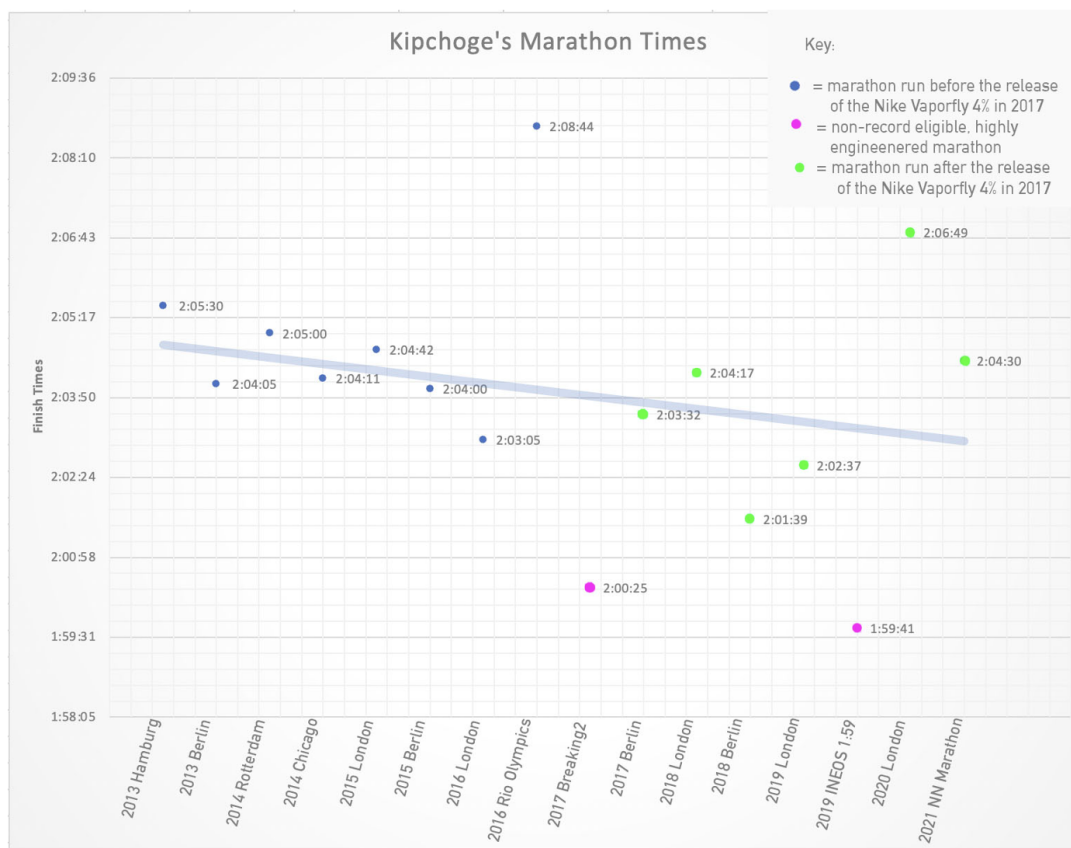


Figure 5: All of Eluid Kipchoge's marathon times (up to May 2021) and linear trendline. Table created by Hannah Martin with data from Kipchoge's World Athletics Athlete Profile and Nike News 2019.

Ahead of the INEOS event in Vienna, Nike released a story on its website calling Kipchoge the “essence of progress” (Nike News 2019). According to Nike, he has “been a consistent partner in Nike’s effort to redefine the marathon shoe,” and has an “insatiable appetite for pushing the limits of potential.” This spirit of innovation served Kipchoge and his entire team well while executing the INEOS event: much like Breaking2, INEOS 1:59 required near-perfect conditions and a complete re-imagining of what a marathon can be.

Vienna was chosen for its mild and predictable weather, its central location (although Europe can only be central if your starting point is already in Europe or the United States) and minimal time zone difference (only two hours) from Kipchoge’s starting point in Kenya, and, importantly, its one long, flat street used in the event, the Prater Hauptallee, with roundabouts on either end. The location also benefited from its position at sea level, its high air quality, and its ability to draw a crowd — one of the “key areas” of improvement identified by Kipchoge and his team from the Breaking2 attempt (INEOS 2019).

INEOS, the event's main sponsor, is a British chemical company that also sponsors an elite cycling team.⁷ They brought in the London Marathon's organizing committee to stage the event, citing the need for a team with "world-class" experience and demonstrated success with large, well-orchestrated events. A team of researchers and sports scientists, some carried over from Breaking2, prepared Kipchoge and fine-tuned the event's performance logistics. Such logistics included 41 hand-picked pacemakers who, in rotating teams, were arranged in a unique outward-facing V pacing formation and laser pacing projected from a lead car (fig. 6 and 7); nearly all these details made the event ineligible for a world record, much like Breaking2. The timing of pacers and their switches had to be impeccable: if any of them tripped Eliud, the entire attempt would likely have been ruined, not to mention the risk of falling off pace and misleading their star into an incorrect rhythm. Kipchoge's fluid and calorie intake was closely monitored and given to him from moving vehicles, unlike the stationary tables provided in traditional marathons.

The performance was not record-eligible because it did not adhere to a variety of rules regarding the number of competitors, the role of pacers, method of liquid intake, and shoe use. Kipchoge was the only runner who started and finished the distance, which goes against World Athletics competitions rule 31.1 requiring at least three athletes to be "bona

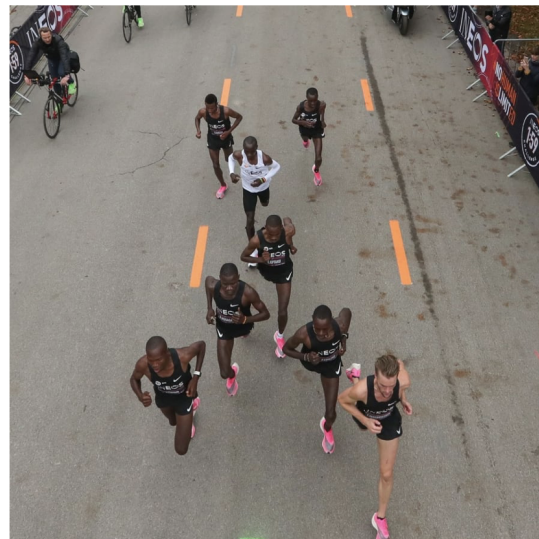


Figure 6: Kipchoge's pacing formation during the INEOS 1:59 Challenge, 12 Oct 2019. Image from <https://www.ineos159challenge.com/performance/formation>.



Figure 7: Kipchoge's pacing formation during the INEOS 1:59 Challenge, displaying the laser projection from a lead car, 12 Oct 2019. Image captured from the video, "Explaining the INEOS 1:59 Challenge Pacemaker Formation," <https://www.youtube.com/watch?v=K1zZgDXfm18>.

⁷ This cycling team, formerly Team Sky, now the INEOS Grenadiers, was recently embroiled in a doping scandal involving one of their coaches — not unlike the situation with the former Nike Oregon Project and now-banned coach Alberto Salazar, discussed in Mile Three. An article about the cycling team doping scandal can be found here: [Macur \(2021\) British Cycling Doctor Ordered Drug in Doping Case, Panel Finds](#)

vide competitors” in any record-eligible individual event (World Athletics Council 2019, see table 1 in the appendix). Pacers were introduced after the official start of the event, breaking technical rule 6.3.1 not allowing “pacing in races by persons not participating in the same race” (World Athletics Council 2020, Technical Rules, see table 2). In regulation events, refreshments for athletes must be placed in marked areas, often on tables, and cannot be “directly in the line of the measured route,” according to technical rule 55.8.5 (see table 2). Additionally, that rule also prohibits any “official or authorized person” from moving “beside an athlete while they are taking refreshment or water.” Kipchoge received fluids and other caloric substances from moving vehicles, which allowed him to continue at the same blistering pace without slowing down to grab a bottle from a table when he needed to refuel.

The most contentious rule that INEOS 1:59 would have broken, had it claimed to be an official record-setting event, is technical rule 5.2 (see table 3). Kipchoge was wearing a pair of prototype Nike Alphaflys, shoes with features that clearly indicate they had been engineered for professional, high-level performances. Technical rule 5.2 regulates what shoes are competition-approved (World Athletics 2020, Technical Rules). The rule at the time of INEOS 1:59 was relatively vague:

Athletes may compete barefoot or with footwear on one or both feet. The purpose of shoes for competition is to give protection and stability to the feet and a firm grip on the ground. Such shoes, however, must not be constructed so as to give athletes any unfair assistance or advantage. Any type of shoe used must be reasonably available to all in the spirit of the universality of athletics.

The question raised by many is did Kipchoge’s shoes provide “any unfair assistance or advantage” — and how does one determine what assistance is unfair? This rule was officially amended in July 2020 (and again in January 2021) — three years after Breaking2 and nine months after the INEOS 1:59 challenge — to include much more specific regulations on what features the shoes can include and what it means for a shoe to be “available to all” (see table 3 and the Mile Three section titled, “Who Makes the Rules, Anyways?”).

The legality of INEOS 1:59 was never in question: no one ever claimed to be going after an official world record, and there are no rules (beyond, possibly, sponsorship contracts) about who can or cannot attempt to run really fast on their own time. INEOS 1:59 was always meant to be an exhibition *performance* rather than a competitive *race*. Races are about more than which

athlete is the fittest or who had the best training in the weeks prior⁸; races are about unpredictability, adhering to previously set rules, and dealing with the given conditions on race day, whether that means bad weather, surprise competitors, or having the bad luck to be caught in a pileup around a tight turn. Exhibition performances are designed to eliminate as much unpredictability as possible. *Performance* implies elegance, entertainment, effort, and a significant lead-up to the big day. While I would argue that races are also performances, the word is more often associated, in the public imagination, with a ballet or an orchestra than with watching a skinny man get really sweaty for (less than) two hours while surrounded by other skinny sweaty men. *Races* are gritty, they are messy, and they can be heartbreaking and breathtaking in the same moment.

In a traditional race, variables like weather, crowd size, pace-setting formations, the fitness of one's competitors, and the consistency of the terrain are not guaranteed. Attempts to control these unpredictable and unreliable factors are also attempts to smooth over the chaos of human nature: despite how much we may want to think we have control over our surroundings and the actions of those around us, it would be naive to believe that is a realistic goal in our daily lives.

A day after INEOS 1:59, Brigid Kosgei⁹ won the Chicago Marathon in two hours, fourteen minutes, and four seconds, a world-record-setting time, and an improvement of 81 seconds and 0.99% over Paula Radcliffe's 2003 London Marathon win in 2:15:25 (fig. 8) (Futterman and Minsberg 2013). Kosgei finished six minutes ahead of the second-place woman, an uncommon gap in elite marathons. Radcliffe's record had stood for sixteen years and was essentially untouched before Kosgei's race in Chicago.

It is difficult to describe how monumental and unprecedented this new record is for raising the standards of women's distance running; the next fastest time after Radcliffe's former record is 2:17:01, run by Mary Keitany in 2017 (Douglas and Nakamura 2020). Kosgei ran 0.99% faster than Radcliffe, who was 1.17% faster than Keitany — making Kosgei's record

⁸ I have been beaten often by athletes who, on paper, should be slower than me, and I have also beaten athletes in races who I had no business being anywhere near in the field. I've battled back and forth with other runners in various races across several years, and who will come out on top is usually anyone's guess. Two examples in particular come to mind, but I digress.

⁹ Kosgei, like Kipchoge, lives and trains in the Kenyan highlands. Her athletic resume is significant as well, but possibly because of poor interviewing tactics (see her 2020 London Marathon pre-race interview with Ruth Chepngetich for plenty of examples of confusing questions and insufficient translations: <https://youtu.be/uSRkhrqWr7c?t=373>) and a lack of publicity around elite female athletes (particularly women of color), she is less well-known.

2.15% faster than her closest contemporary competitor. Only eight women have ever run 2:17 on record-eligible¹⁰ courses, and the majority of those performances came over ten years after the 2003 London Marathon. For comparison, the top ten fastest marathons on record-eligible courses for men have a spread of only one minute and thirty-four seconds (the fastest men's marathon is 1.16% faster than the 10th fastest men's marathon). The top ten women's record-eligible performances are spread out over four minutes and seven seconds (the fastest women's marathon is 2.8% faster than the 10th fastest women's marathon).

Kosgei's mark is arguably more impressive than Kipchoge's: she dropped the world-record time by a larger margin, and she ran in a standard race following World Athletic regulations. Despite that, the INEOS event overshadowed her performance. Kosgei, in describing her victory, also put herself second to Kipchoge: "I kept saying, 'Tomorrow is my day... I wanted to be the second Kipchoge — the Kipchoge for women. I focused on that'" (Futterman and Minsberg 2019). The media, when reporting Kosgei's record-setting race, was sure to reference Kipchoge's mark set the day before. Often, she was mentioned as a mere footnote in the stories on INEOS 1:59. Even here, I have spent only two paragraphs detailing Kosgei's achievements. This could be read as a clear example of sexism in sport (a result of a widespread lack of knowledge about women's marathon history, or simple dismissal of the record's merit because, as a woman, Kosgei benefitted from male pacers), a side effect of INEOS' need to recoup on their significant monetary investment by attracting media attention, or, more likely, both.



Figure 8: Brigid Kosgei posing by her new world record time after winning the Chicago Marathon, 13 Oct 2019. Image from REUTERS / M. Segar.

Interestingly, Kosgei had initially planned to run in the market-available version of the Nike Vaporflys. After seeing Kipchoge's performance in Vienna, she switched to the then-unreleased Nike ZoomX Vaporfly NEXT%^s (Futterman and Minsberg 2019), which have one carbon-fiber plate, no air pockets, and a slightly lower midsole height (the height of the foam under a runner's foot) than the shoes worn by Kipchoge, but which still included improvements to key features in the market-available Vaporflys (figs. 9-12). Her choice of shoes was deliberate: she was going for the record, and she was trying to set herself up as well as she could to do so.

Both Kosgei and Kipchoge's records (legal or otherwise) appear to be breaks from tradition, if one views running as a sport without the need for tools and technology. However, the reality is that even though one could go for a run entirely naked — without any material on or in one's body that was not produced by that body — and the activity would be recognizable as running, competitive running as a sport uses technology regularly, and it has for a long time. Especially if one considers techniques as tools, the ways in which runners have trained for races or just for general fitness has evolved greatly over time (more on that later in this thesis). In this case, both Kosgei and Kipchoge were utilizing footwear with proven benefits that had not been fully integrated into the community of elite running; they used pacers in unconventional or “unnatural” ways (the inverted-V formation during INEOS 1:59, Kosgei's use of male pacers to break a female record); and they benefited from years of research and developments in training techniques, nutritional strategies, and race tactics. It is no accident that these two athletes were the ones to break such significant records. Runners have blurred the lines between natural and artificial for a long time (for example, track races are no longer run on naturally occurring surfaces, but the races run on synthetic tracks are still considered “purely human” efforts), but these two athletes in particular pushed previously set human limits while working hand-in-hand with technology in a strikingly clear way. For some in the running community, the technology they used — specifically their footwear — was too much, too fast.



Figure 9: The Nike ZoomX Vaporfly NEXT% in hot pink. Image from Nike Running, <https://www.nike.com/running/vaporfly>.



Figure 11: Eluid Kipchoge and pacers during the INEOS 1:59 Challenge, 12 Oct 2019. Kipchoge is wearing a prototype of the Nike Air Zoom Alphafly NEXT%, and his pacers are wearing the Nike ZoomX Vaporfly NEXT%. Image from Robert Szaniszlo/NurPhoto/Getty.



Figure 10: Kosgei on her way to a world record in the Chicago Marathon, while wearing the Nike ZoomX Vaporfly NEXT%, 13 Oct 2019. Image from Strout 2019.



Figure 12: The Nike Air Zoom Alphafly NEXT% in white. Image from Nike Running, <https://www.nike.com/running/alphafly>.

Design Details

Nike's carbon plate shoes have a nearly undisputed effect on running performance; many runners wearing the shoes experience significant improvements in running economy (Hunter et al 2019). It is generally believed that three main physiological measures affect running performance: VO_{2max} , running economy, and lactate threshold (Borgen 2018). Lactate threshold has a relatively complicated calculation and is mostly irrelevant to a discussion on the impact of running shoes on performance. VO_{2max} is an athlete's maximum rate of energy expenditure, and most studies agree that elite athletes have a high VO_{2max} , although this measure does not change much throughout an athlete's career, and an understanding of its relationship to race performance is incomplete. Most relevant to this case, the rate of an athlete's oxygen consumption at a given velocity, in relation to their VO_{2max} , is known as running economy (RE), and can also be expressed as metabolic rate (Hoogkamer et al, 2016).

Improvement in RE and a lower metabolic cost allows an athlete to increase their velocity without taking in more oxygen or using more energy. Runners with a low RE value are more efficient (Borgen 2018): think of this like fuel economy in a car. The same amount of gas will power a Prius for a longer trip than it would for a large pickup truck because the Prius uses the fuel more efficiently. If a Prius were a runner, it would have a low RE. The pickup, on the other hand, is more powerful than the Prius, but it is inefficient: the truck has a greater engine capacity, translated as VO_{2max} for runners, but it is less efficient and has fewer miles per gallon. Thus, a pickup would have a high RE and a high VO_{2max} . Like in cars, in elite athletes, there is a moderate positive correlation between VO_{2max} and running economy: on average, athletes with high VO_{2max} have higher RE.¹¹ One explanation, which appears consistent with the proposed mechanisms of the shoes, is that “greater lower limb mass will result in higher VO_{2max} but also poorer RE” (Borgen 2018, 5).

Scientific studies outside of Nike’s labs (although with Nike-associated authors) have shown that the carbon plate shoes specifically provide an advantage in terms of running economy and improved finish times. One study, which compared the Nike prototype carbon plate shoes to the top two industry-standard marathon racing flats, matched shoe mass and found that “the new shoes reduced the energetic cost of running in all 18 subjects tested” (Hoogkamer, Kipp, and Kram 2018, 1009). Running economy for those wearing the prototypes was improved by an average of 4%, regardless of the runner’s velocity.

Importantly, athletes do not all experience the same metabolic improvements while wearing the shoes. What may provide me with a 4% advantage in running economy may only lend you a 2% improvement. There is not a 1:1 relationship between the theoretical benefit to running economy a runner might get from the shoes and what their actual response to the shoes is. As with any training regimen or pre-race go-to meal, there is not one shoe design, magic workout, or oatmeal flavor that will suit everyone in exactly the same way.

A follow-up study from many of those same authors attempted to establish the specific time improvements associated with improved running economy. While the improvement in running economy does not change based on a runner’s speed, the time advantage they receive does differ depending on how fast they are running. For someone who typically runs a 4:30:00

¹¹ However, studies that demonstrate this may suffer from selection bias: studies of RE and VO_{2max} most often recruit elite athletes only, and may provide an incomplete explanation for these processes. This is explored thoroughly in Borgen 2018.

marathon, a 1% improvement in running economy can be expected to confer a 1.17% improvement (or four minutes and seven seconds) in race time, resulting in a new finish time of 4:26:53, (Kipp, Kram, and Hoogkamer 2019). However, an elite marathoner who would run a 2:03:00 can expect to see only a 0.65% improvement (or 47 seconds) in their finishing time with the same 1% improvement in running economy, resulting in a 2:02:13 marathon.

This may seem trivial, but consider the progression of Eliud Kipchoge's marathon times. In the 2015 Berlin marathon, before the introduction of Nike's carbon plate prototypes, Kipchoge ran 2:04:00 (Kipp, Kram, and Hoogkamer 2019). If we assume that Kipchoge experiences a 3% improvement in running economy while wearing the carbon plate shoes (potentially a conservative estimate, considering the laboratory studies), then we would expect him to improve his time by 1.97%, three minutes and 31 seconds, in the shoes, finishing instead in 2:01:36. Recall that the current world record, set by Kipchoge in the 2018 Berlin marathon, is 2:01:39 — almost exactly what would be predicted from the study's calculations.

Regardless of the physiological processes involved, Nike's carbon plate shoes have helped a significant number of people run faster. A thorough (and visually impressive) but non-scientific¹² article from the New York Times analyzed the Strava¹³ data of thousands of marathon runners and found those who ran in Nike's carbon plate shoes, the Zoom Vaporfly 4% or ZoomX Vaporfly Next%, “ran 4 to 5 percent faster than a runner wearing an average shoe, and 2 to 3 percent faster than runners in the next-fastest shoe” (Quealy and Katz 2019). The next fastest shoes were the Nike Streak and Adidas Adizeros (marathon shoes from the pre-Vaporfly/Alphafly era), followed by the HOKA Carbon X and Nike Zoom Fly. This study included results from 577,000 marathons and just under 500,000 half marathons in dozens of countries between April 2014 and December 2019. To provide a sense of scale, there were approximately 1.3 million marathon finishers globally in 2018, with the majority of participants coming from the United States, the United Kingdom, and Germany (Andersen and Nikolova

¹² Non-scientific in the sense that the authors were analyzing existing data, rather than setting up a controlled experiment. Because of the nature of the data they analyzed, there are potentially confounding variables and factors influencing the results that cannot be explained or filtered out.

¹³ Strava is a popular social media, activity-tracking app particularly beloved by runners and cyclists. Athletes can upload GPS data, post photos, add detailed descriptions of an activity, race results, equipment use, and can connect with friends and teammates to follow each other's activities. Many runners will use the app to track the mileage run in their shoes, which involves uploading what make and model they are using. If you were to look up my own Strava account, you could fairly easily see that I switch shoe models often and have recently been rotating through three pairs at once. You would also get a relatively comprehensive look into my training habits, and lots of examples of what I would consider to be funny captions. Think of it like Facebook for runners and cyclists.

2020). By using information from the popular activity-tracking app Strava, the study's authors were able to compare race times run in various shoe models, comparing results for individual runners across time, and runners of similar ability racing in different types of shoes in the same race.

The shoes themselves have three key differences in design from traditional running shoes: a carbon-fiber plate embedded in the midsole, a Pebax foam midsole, and a greater midsole height (Burns and Tam 2020). Runners are notorious for their jargon, and a brief digression here to explain what these terms mean is necessary. Running shoes have three main sections (fig. 13): the upper,

the midsole, and the outsole

(Furrer 2019). The upper

composes most of what is seen when looking straight

down at a shoe. Uppers

include the fabric that physically holds the foot in place, which can feature an

overlay, often made of

reflective materials, to provide

extra structure and design to

the fabric. Many brands are foregoing the overlay and engineering the upper fabric to drop

weight from the shoe in an effort to make them faster. The tongue, which sits directly underneath

the laces, is often connected to the sides of the shoe to keep debris out. Some uppers have

incorporated the tongue into the fabric seamlessly, giving the shoe more of a sock-like fit. Toe

boxes are often discussed when talking about shoe uppers as well, and this refers to the space at

the front of the shoe where the toes sit. Wide toe boxes give toes room to splay out and grip the

insole of the shoe when pushing off the ground. The insole is the removable section inside of the

shoe and can be customized to provide extra arch support.

The section of white or grey foam underneath the foot is known as the midsole. When people reference the “cushioning” in their shoes, they are really describing the midsole. This foam layer does the bulk of the shoe's energetic work, and is usually made up of some

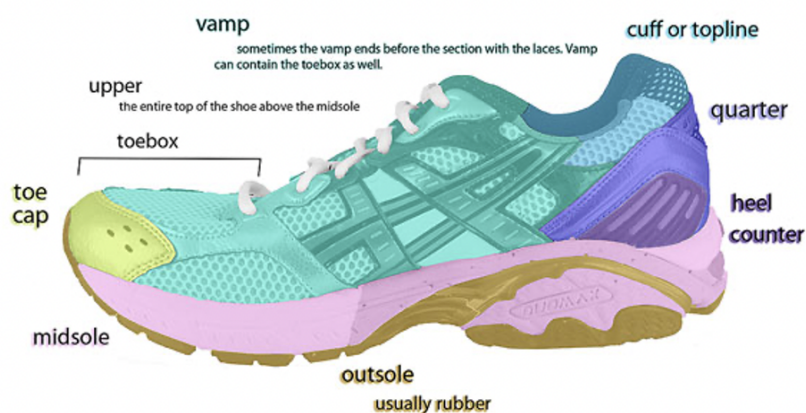


Figure 13: Diagram of a "traditional" running shoe. Image from Clopper 2012.

combination of ethylene vinyl acetate (EVA), polyurethane (PU), thermoplastic polyurethane (TPU), or, more recently, Pebax foams (Furrer 2019). The midsole design is what angles the foot forward and puts it into a more efficient mechanical position. The manipulation of this angle alters the heel to toe drop, also known as heel lift or offset. The difference in height between the heel and the forefoot is typically 8mm to 10mm, but can be as low as 0mm to 4mm. This lower drop is a more “natural” foot position, but can put some extra strain on the tendons and muscles of the lower leg. For reference, standing barefoot is the same as having a shoe with a 0mm drop, and high heels are typically around three inches tall, which is equivalent to a 76.2mm drop in running shoe language. The total height of this foam section is known as the midsole height (sometimes referred to as stack height).

EVA is the standard foam used in most “traditional” running shoes. Its low production cost, flexibility, and soft feel have made it the preferred foam since the 1970s (Furrer 2019). However, it compresses significantly as an athlete runs more miles on it, and it can become rigid in cold temperatures. PU is bouncier and more durable than EVA, but is approximately 50% heavier. Because it is more dense and adds extra weight to the shoe, it is rarely used. TPU is an upgraded version of PU: this foam is the result of heating and reforming PU, often into beads that are then fused together, to create a more durable, flexible, and bouncier foam than EVA. It is still heavier than EVA but less dense than the original PU. Pebax foam is the kind used in Nike’s fastest models, explained in more detail below. This foam is approximately 20% lighter than TPU, and retains its flexibility and energy return much better even in cold temperatures.

Finally, the outsole is the rubber layer of the shoe that actually makes contact with the ground. The outsole is made of blown (more flexible) or solid rubber (more durable), sometimes with a footbridge or shank inserted (Furrer 2019). Blown rubber is often used under the forefoot, but solid rubber would be used there to provide a more stable landing. The footbridge, or shank, when included, is located between the heel and forefoot. These footbridges are made of harder plastic, which reduces twisting and stabilizes the shoe. Depending on the purpose of the shoe, outsoles can be more or less intense and incorporate more features such as rock plates (between the outsole and midsole, to prevent rocks from stabbing through the softer foam and irritating the foot), beveled heels (to reduce impact on the heel), lugs (to provide better grip on rough terrain, like mud, snow, sand, etc), or decoupled heels (a split in the outsole that absorbs forces from

landing). From the upper to the outsole, each piece of technology and design choice affects the price.

Typically, running shoes retail for \$80 to \$120, although this price has increased in recent years as the engineering of shoes has become more technical and difficult to produce. Depending on the “bells and whistles” a runner wants,¹⁴ their everyday training shoes, often known as “trainers”, could be \$160. I can usually expect to spend around \$250 when purchasing two pairs of shoes that will last for three to four months total, given that I run 40-50 miles a week and can run approximately 300-400 miles in one pair before they break down and begin to cause muscle and joint pains.

As of May 2021,¹⁵ there are two primary models of marathon racing shoes from Nike with carbon-fiber plates and Pebax foam: the Vaporfly (fig. 14) and the Alphafly (figs. 15 and 16).¹⁶ The Vaporflys, which retail for \$250 USD but are frequently sold out and unavailable for online purchase, feature a full-length carbon-fiber plate that Nike describes as providing “a propulsive sensation to help you push the pace” (Nike 2021, “Nike ZoomX Vaporfly Next%”). The Vaporfly midsole is “made for speed” and consists of “ZoomX” Pebax foam. The Alphaflys retail for slightly more, \$275 USD, and are equally as difficult to purchase as the Vaporflys. In addition to a full-length carbon-fiber plate (the thickness of which is scaled for the size of each shoe), the Alphafly features extra ZoomX foam for a taller midsole, and two “streamlined Zoom Air pods.” These air pods are meant to “deliver even more energy return than just the ZoomX foam that is in the Vaporfly NEXT%” (Nike 2021, “Nike Air Zoom Alphafly NEXT%”). Nike describes the Alphafly as “the next generation of fast” and emphasizes that this racing shoe is meant to “shatter records and PRs, whether you’re looking to finish a marathon in two, three, four, or five hours.”

¹⁴ For example, do you need heavy lugs in the sole to grip technical trails? Are you looking for a super-cushy, marshmallow-soft ride, like HOKAs? Do you like no-tie laces? Are you a fan of special-edition prints of your go-to model? How picky are you about stability features?

¹⁵ A history of the models prior to this date can be found here: [Howes \(2021\) The Evolution of Nike's Zoom Series](#). The minutiae of which models contained which features at which times, while fascinating, is outside the scope of this thesis. What is important instead is an understanding of the primary features and their deviations from “traditional” shoes.

¹⁶ The full names of these shoes are “Nike ZoomX Vaporfly Next%” and “Nike Air Zoom Alphafly NEXT%”, for the sake of brevity and to reflect the way the running community in general refers to them, I have reduced their names to Vaporfly and Alphafly here.



Figure 14: Diagram of the Nike ZoomX Vaporfly NEXT%, with the carbon-fiber plate displayed. Image from Nike Running, <https://www.nike.com/running/vaporfly>.

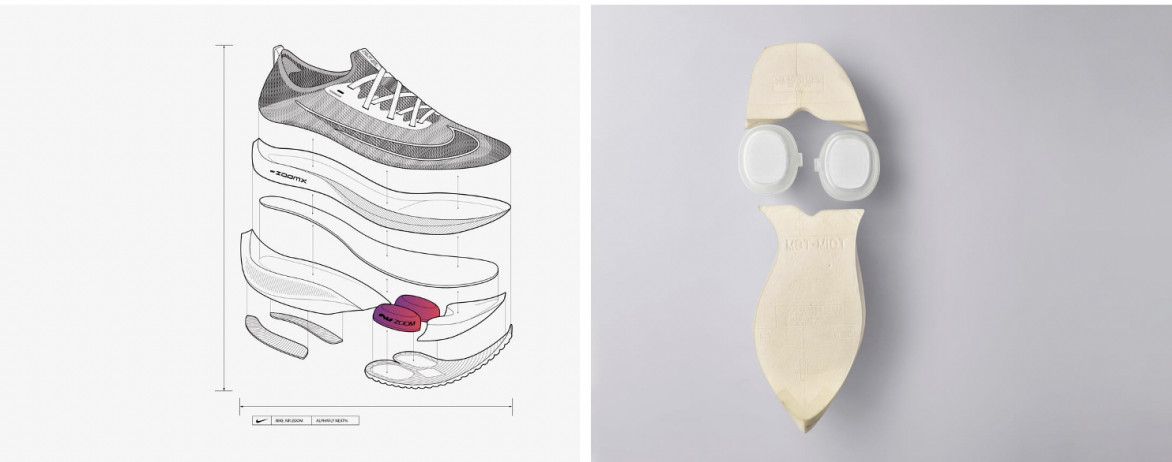


Figure 15: Diagram of the Nike Air Zoom Alphafly NEXT%, with the Pebax foam midsole and Air Zoom pods displayed. Image from Nike Running, <https://www.nike.com/running/alphafly>.



Figure 16: Diagram of the Nike Air Zoom Alphafly NEXT%, with the carbon fiber plate displayed. Image from Nike Running, <https://www.nike.com/running/alphafly>.

Because all of the racing models feature a full-length carbon-fiber plate, and because the line is constantly evolving in both name and materials, I will refer to this line of shoes as Nike's carbon plate shoe line, while acknowledging that it is not only the carbon plate that impacts the function of the shoes. Other shoe brands have also developed their own racing shoes with Pebax foam and carbon-fiber plates or rods, and unless otherwise specified as Nike's shoes, these models are also included when I, or those I am quoting, use the term "carbon plate shoes" throughout this thesis.

The design elements cannot be separated to disentangle the specific advantages each provides, but the Pebax foam midsole could be the primary mechanism for improving running economy. This foam is much less dense than traditional materials, which means more cushioning can be added to the midsole without increasing the weight of the shoe (Burns and Tam 2020). Adding shoe mass has been shown to degrade running economy with a proportional relationship to increased times in 3000m time-trial performances; therefore, reducing shoe mass would lead to a decrease in times (Hoogkamer et al 2016, 2180). Reducing shoe mass while also increasing cushioning is key: the additional cushioning aids the runner in absorbing and returning energy, removing some of the burden from the muscles and tendons in the legs (Hunter et al 2019, 2371).

This cushioning and added height also increases the "effective leg length of the runner" which reduces the cost of transport (Burns and Tam 2020). Essentially, the added height creates a longer leg and foot, sending the runner further into the air and increasing the distance covered with each stride (Hunter et al 2019, 2371). This is backed up by a 2018 University of Colorado study which found that, compared to the top two "traditional" marathon racing shoes (Nike Zoom Streak and Adidas Boost), runners wearing the Nike carbon plate prototypes had a slower step frequency and took longer steps (Hoogkamer, Kipp, and Kram 2019, 1015). Simply put, fewer but longer steps are more efficient. If an athlete takes fewer steps to cover the same distance (which requires their steps to be longer), they have not used as much energy.

That being said, the foam alone is not enough; the carbon plate adds important structure to the shoe. Without anything stabilizing the midsole, running on the Pebax foam would be like sinking into an unstable marshmallow. The plate allows the runner to consistently rebound and take advantage of the super-responsive foam that surrounds the plate. It also reduces functional strain on the big toe at push-off, but that energy has to go somewhere further up the line. Because of this, the geometry of the plate is imperative. When Darren Stephanyshyn at the University of

Calgary first began experimenting with carbon plates during a collaboration with Adidas in the late 1990s and early 2000s (Francis 2019), the curve of the plates was such that any gains made in reducing strain at the big toe inhibited ankle function and was ultimately detrimental to the athlete (Hutchinson 2018). The current plates have a deep curve at the ball of the foot, which helps to both reduce strain on the big toe and redistribute the energy so it does not harm the ankle (Hutchinson 2018; Hoogkamer, Kipp, and Kram 2019). Nike is not known to skimp on the details, and the company was careful to put a patent on the exact curve of the plates used. Without the innovation of the deep forefoot curve in the carbon-fiber plate, the shoes on the market today would likely not exist, or would be less effective and therefore less controversial.

The Race to Build a Better Shoe

The race to build a better running shoe has existed for as long as competitive running has been a profitable market. Controversy over the effectiveness and legality of new performance-focused shoes is nothing new either: on September 12, 1968 during the United States Olympic Track Trials at Echo Summit in Lake Tahoe, two Puma athletes, John Carlos and Tommie Smith, raced in Puma's new "brush spikes" (McKnight 2019). These spikes featured "tiny, steel piranha teeth aligned like brush bristles under the ball of [the] feet," rather than the traditional eight (maximum) metal spikes attached to the bottom of track shoes (figs. 17 and 18). Carlos ran the first sub-20 second 200 meter race (19.7s) in history wearing the spikes, but that mark did not count as an official world record because of his footwear. It might not have drawn any negative attention, either, if the same spikes worn by Carlos had not also been worn by Vince Matthews and Lee Evans two weeks prior when they took turns breaking each other's 400 meter records. The spikes were officially banned from competition on September 28, two weeks before the opening ceremonies of the 1968 Olympics — presumably because Horst Dassler, the founder of Puma's rival Adidas and the estranged brother of Puma's founder, Rudi Dassler, bribed and/or blackmailed the IAAF, the governing body of track and field at that time. Although the brush spike design was struck down, that out-of-the-box design "opened the door to creative thinking about the future in track spikes," as Nike designer Nelson Farris described in a Sports Illustrated article (McKnight 2019). Then, as now, shoe companies hold a large amount of power over the sport, and competition between companies over their products is as intense as the races those products are meant to influence.

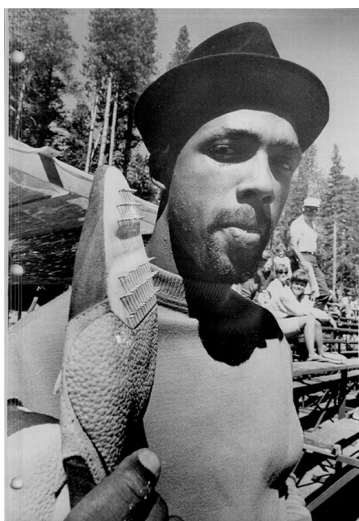


Figure 17: John Carlos posing with the controversial Puma "brush shoes" on 13 August 1968, during the Olympic Trials at Echo Summit in South Lake Tahoe. Image from Wright 2015, courtesy of the City of South Lake Tahoe.



Figure 18: The Puma "brush shoes." Image from McKnight 2019, Kohjiro Kinno.

The exact designers and design process for any Nike shoe is shrouded in secrecy: anyone who sees their design lab or shoe history museum¹⁷ is held to a non-disclosure agreement. Very little is publicly known about how the carbon plate shoes came to be, other than Nike's promotional materials, which focus on Kipchoge's influence on the design, along with the elegance of the shoe itself. That being said, design elements of the carbon plate shoes can be traced back to large, maximalist cushioning shoes in the 1980s, and a carbon plate was featured in the Adidas Adistar shoes in the early 2000s (Francis 2019). However, I would argue that the development of Nike's extra-cushy carbon plate line also evolves from the barefoot running trend of the mid-2000s.

Chris McDougall's 2009 book, *Born to Run*, which describes the Mexican Rarámuri¹⁸ tribe's long, barefoot hunts,¹⁹ is often credited with inspiring many people to shuck off their traditional running shoes to run in the grass barefoot, or to purchase minimalist shoes. As

¹⁷ Yes, this exists. According to my track coaches, who have been inside, it looks just like a regular warehouse and bears almost no indication of its affiliation to Nike from the outside. They were unable to provide me with details of what they saw, but suggested that the walls hold all kinds of shoe models, with little placards explaining the development and success of each design, including inspirations for it. Unfortunately, that is about the only thing they were legally allowed to tell me.

¹⁸ The Rarámuri are frequently called the Tarahumara; however this is a name that comes from the conquistadors, so I will refer to them here as the Rarámuri.

¹⁹ Reports from Rarámuri consultants in a 2020 paper by Liebermann estimate that these hunts were "usually four to six hours' or as short as 'two or three hours.' Given typical running speeds... the maximum length of these hunts [is estimated to be] between 12 and 36 kilometers" (Liebermann et al 2020, 361).

discussed in the previous section, traditional running shoes incorporate a layer of foam to cushion a runner's landing and provide some energy return to each footstrike and a heel drop of 8 to 10mm, meant to reduce strain on the lower leg muscles and better position the foot for pushing off the ground. In contrast, these minimalist shoes are meant to mimic barefoot running mechanics, but with a product that can be sold for a profit (and, admittedly, also protects a runner's foot from debris). Minimalist shoes have scant cushioning, often with a negligible or zero-millimeter drop from heel to toe, and on the extreme end, go as far as separating each toe to create a glove effect for a runner's foot (the Vibram 5-fingers, for example²⁰). Entire brands were born out of this movement, the most significant being Altra, a current sponsor of former Nike athlete and elite marathoner Kara Goucher.

Lighter shoes, as demonstrated in Hoogkamer's 2016 study, can benefit an athlete's performance: reducing the energy needed to produce a stride by reducing the weight carried by the foot improves running economy. However, as the race distance increases, the lack of cushioning (theoretically) puts more stress on the leg muscles and makes recovery from hard efforts more difficult. Longtime elite marathoner, former Nike athlete, and current Nike coach Shalane Flanagan, among others, experienced these drawbacks personally and brought this complaint to Nike around 2014 (Zaccardi 2019). By the 2016 US Olympic Marathon Trials, Flanagan and her teammate Amy Hastings-Cragg were outfitted with an early, disguised version of the Vaporflys. These prototypes included a carbon-fiber plate but were significantly less advanced than the versions on the market only four years later. Flanagan, quoted in a 2019 NBC Sports article, has said that "Even within my training, I felt I was able to recover quicker because there was not as much muscle breakdown, fiber breakdown, because the load of the landing was softened" (Zaccardi 2019).

Studies proving or disproving the impact of shoe type on running-related injuries are scarce, and generally do not have a large enough sample size to draw full conclusions. As the authors of a 2018 editorial in the *British Journal of Sports Medicine* describe, "In light of the lack of evidence supporting traditional shoe prescription [matching shoe features to foot morphology], we must be careful not to view alternative shoe paradigms as suddenly more

²⁰ For a brief background into the evolution of the 5-Fingers and a deep dive into the legal battle over advertising that followed, see: Joshua T. Calo, "Deceptive Advertising or Evolving Science: How Barefoot Running Demonstrates Novel Strategies for Defending False Advertising Lawsuits under State Deceptive Trade Practices Acts," *Jeffrey S. Moorad Sports Law Journal* 22, no. 2 (2015): 529-592.

effective” (Napier and Willy 2018, 1552). Still, there are studies that suggest additional cushioning could shield runners from the full force of their footstrike, which is typically one and a half to five times their body weight on each leg. For example, one study in the Journal of the American Podiatric Medical Association from researchers at the University of Wisconsin found that cushioned insoles significantly decreased the “the mean vertical ground reaction force peak impact (6.8%; $P = .004$; Cohen’s $d = 0.29$) compared with the shoe-only condition” (O’Leary, Vorpahl, and Heiderscheit 2008, 38). Additionally, the knee flexion angle did not change between the cushioned insole or regular shoe conditions, which indicated that the reduction in shock to the leg was not due to altered knee biomechanics. Such studies, taken together with the anecdotal descriptions of leg soreness after hard efforts in varying shoe models indicate that it is not unreasonable to believe that these carbon plate shoes could, in fact, improve recovery after long races and reduce strain on an athlete’s musculoskeletal system.

This pendulum swing towards super tall midsoles with lots of foam for maximal cushioning, away from the minimalist boom, was first reflected in the rapid rise in popularity of HOKA ONE ONE’s shoes (fig. 19). HOKA’s maximalist shoes were inspired by the large tires



Figure 19: An early model of Hoka's "clown shoes." Image from Megroz 2013.

of mountain bikes and oversized skis; when they were initially launched to the public in 2010, people “thought they looked like clown shoes” (Megroz 2013). At the time of HOKA’s launch, minimalist shoes accounted for a third of the market. HOKA was bought by Deckers Outdoor Corporation in 2012. Between 2012 and 2013,²¹ sales of HOKA merchandise spiked by 400%. In that same period, minimalist shoes fell to only 15% of the overall market.

HOKA’s shoes are characterized by a lightweight, cushy foam that pads a thick sole and forms a “rocker.” This rocker is meant to propel the runner by rolling the foot forwards through

²¹ I first saw HOKAs at my local running specialty store in 2013, when I joined my dad to look for a pair of shoes that he could use while getting back into running after breaking his lower leg bones a year before. I thought they looked ridiculous and laughed when I saw them on display. My dad ended up buying a pair because they were the only ones that did not irritate the plates near his ankle, and did not jar his lower leg as much as the other brands’ models.

its curved sole design, which rather than forming a flat line of contact when resting on the ground, bends upwards at both the heel and the forefoot to create a rocking-chair-esque shape. Additionally, HOKA's soles are designed to provide protection from rocky trails and hard footfalls because the sheer thickness of the midsole, sometimes combined with rock plates and lugs, prevents debris from penetrating through the shoe and being detected by an athlete's foot. They were designed with ultrarunners (people who frequent 50 kilometer, 50 mile, or 100 mile races, much longer than 26.2 miles, the length of a conventional marathon) in mind, and were quickly adopted by that community before the "clown shoes" spread to other runners. This maximalist design did not sprint to the front of finish lines on the roads in the same way as the Nike carbon plate shoes. It did, nevertheless, catalyze the development of more creative designs from other brands who responded to HOKA's surprising success by expanding their thinking beyond traditional models.

Another piece of the carbon plate shoe history involves a small company in El Paso, Texas that sparked controversy when they released a spring-loaded competition shoe. Spira Footwear was founded in 2001, and in 2005 their WaveSpring technology was banned from major competitions by USA Track & Field and the International Association of Athletics Federations, now known as World Athletics (Banks 2017). The WaveSpring technology included springs in the heel and forefoot, meant to give more energy back to the runner than a plain midsole and was also intended to improve recovery (fig. 20). By 2007, through a technicality, Spira's shoes were allowed in major competitions again, and the winner of that year's Boston Marathon's men's Master's "Over 40" division was wearing Spira shoes. The company's spring-loaded shoes provided a 1% improvement in running economy in at least one study and were an early indicator that a performance-focused shoe could also be well-cushioned while incorporating a rigid midsole structure with rebounding features



Figure 20: Diagram of the Spira WaveSpring technology, with midsole, plates, and springs exposed. Image from Ryan 2014.

(Riess 2014). Despite this controversy and innovation, the production of Spira models ended in 2016.²²

Short of forcing Nike employees to break NDAs, it is impossible to know for sure what specific technological history inspired the development of Nike's carbon plate line. Still, Shalane Flanagan's request for more cushioned racing shoes and Nike's well-researched, high-tech response seems almost predictable when placed in this context of these maximalist, spring-loaded developments. In the time since Flanagan and Hastings-Cragg first wore prototypes in 2016, Nike's carbon plate shoes have taken the running world by storm.



Figure 21: Carbon plate racing shoe models organized by year of release. Table created by Hannah Martin with data and images from Metzler 2019; Brooks Sports, Inc. 2020; Dengate 2020; Law 2020; Mazzuchi 2020; Singh 2020; Nike 2021; and Runners Lab 2021.

Other versions of the lightweight, high-response, carbon-fiber plated shoes began appearing almost as soon as Nike's carbon plate shoes hit the pavement in 2017. The flood of

²² One has to wonder what, if anything, could have become of Spira if they had held a wider influence on running culture and the marketing budget to promote their shoes in the same aggressive and brilliant way as Nike does.

copycat shoes to the running market in the years following Nike's first iteration of the carbon plate design demonstrates an attempt from other companies to level the playing field (fig. 21). These shoe mimics were created in an effort to boost the other companies sales and ensure that their athletes were not left behind (if not for the sake of upholding "fairness"). HOKA was the first brand to produce a response to the Vaporflys, releasing the Carbon Rocket (\$160) in 2018 (Metzler 2019). The following year, Nike released a new version of the Vaporfly 4%, the ZoomX Vaporfly NEXT%, and Hoka improved on their carbon plate line by adding the Carbon X (\$180) to their collection. The Carbon Xs were worn by Jim Wallmsley during his 50-mile American-record-setting race in 2019, and more than their Carbon Rocket predecessors, were a close competitor to the Vaporflys early on. Nearly every major shoe brand had managed to replicate the Nike carbon-plate-Pebax-foam "supershoes," with various degrees of success, by the end of 2020. That year, Adidas released the Adizero Adios Pro (\$200) (Law 2020); Asics's first carbon plate model was the Metaracer (\$200) (Singh 2020); Brooks finally released their model, the Hyperion Elite (\$250) first worn by Des Linden in her inspiring 2018 Boston Marathon victory (Brooks Sports, Inc. 2020); New Balance had the Fuel Cell TC (\$199.99) (Dengate 2020); and Saucony had the Endorphin Pro (\$200) (Mazzuchi 2020). The COVID-19 pandemic interrupted normal development and release schedules, but Asics still put out the MetaSpeed Sky in early 2021 (\$250) ("Asics MetaSpeed Sky," 2021).

Understanding the technical specifications and various iterations of the carbon plate shoes does not tell the full story. Digging into a theoretical lineage of this particular shoe design does not do so either. Nor do Kipchoge and Kosgei's records reflect the entire impact of this paradigm shift. These are important aspects of the "shoe wars," as it is occasionally referred to in the press, but more context and analysis is needed. What has been the reaction from the running community? Why does an improvement in one's running economy through shoes have the potential to be so upsetting? What aspects of the sport of long distance running allow for shoes to be disruptive? How does one define what is fair? Who gets to do this boundary work? Is there a difference between what is fair and what is legal? Who is affected by the new technology, and in what way? Crucial to this case study is the question of what it means that the action of running is both an organized, individualized sport *and* an activity that does not require another person in order for the action to be completed in the same way as the organized sport (this category also includes swimming, and in a more technologically-dependent way, cycling).

That these particular shoes stirred up controversy is no coincidence: the originals were produced by Nike, a mega-company whose impact on the sport of running cannot be overstated, (whether you want to talk about monetary and cultural contributions or public scandals); the shoes were first worn by superstar runners, sponsored by Nike because that company can afford to pay for ambitious projects and cream of the crop athletes; and the timing of their release lines up with the most important races on a runners calendar (the Olympic Marathon trials in 2016 and the lead-up to 2020, various World Marathon Majors, etc). All artifacts (e.g., technologies, tools, objects, not just what could be found in a museum) have a politics baked into them, and the next three miles/chapters unpack the culture, systems, and sociotechnical imaginaries powering the politics behind these shoes.

Mile Two: The Soul of a Sport

When the broad sweep of life is viewed, sport, though instinctive, physical and ephemeral, illustrates a universal truth that most of us find effort and struggle deeply satisfying, harnessing almost primeval instincts to fight, to survive. It gives us all a challenge, a sense of purpose and freedom of choice.

—Sir Roger Bannister
The First Four Minutes, pg viii

On Running, Moving, and Sport

To grasp the full force of the paradigm shift initiated by Nike’s carbon plate shoes, it is necessary to take a few steps back and understand what it means to move, to run, and what it means that tools have been introduced into that movement. A primary truth of being human is that our movement is limited. We cannot fly on our own, and no matter how hard we try, there are some directions to which our bodies simply will not bend without breaking (picture torn ACLs, or athletes’ leg bones snapped in half during game play²³). Within these limitations, however, is a nearly infinite number of possibilities: where will we move, when, with whom, for how long, how fast will we (or can we) go, for what purpose, and with what tools? Asking these questions of movements, and the sports that come from them, is what makes people care about them.

In sport, movements have been given purpose through agreed-upon rules and objectives. The institutions of sport are frequently criticized and analyzed for their economics and their political uses, and rightly so in many cases. However, these criticisms often lead to the dismissal of sports as “only a game” (Gumbrecht 2006). Missing from such criticisms is the pure enjoyment that can come from movement and from the intense moments of sport — and it is difficult to write critically and analytically about a sport without losing sight of this emotional, and very much human, side of it. There does not always, however, have to be an agenda behind our movements; sometimes the goal of a movement is simply to move, to enjoy the movement, and to admire the capabilities of the human body.²⁴

Running, stripped down to its most basic meaning, is simply moving. When someone runs, they are moving their body through space, propelling themselves forward at any number of

²³ Isaiah Canaan in 2018, for example: <https://www.youtube.com/watch?v=JYFZ1H6JpX4>

²⁴ This desire to move just for the sake of moving is, I think, something that a lot of people can relate to on a deeper level after enduring the ongoing COVID-19 pandemic which has forced the world to face month after month of isolation and disruption of routines.

speeds for any number of reasons. This movement is both primal and personal: human evolution and physiology is optimized for running, and our bipedal posture and striding gait is part of what distinguishes us from other mammals (Carrier et al 1984, 483). While early humans may have needed to run primarily to hunt, humans today run because it helps keep them healthy (Pedisic et al 2020), for the rush of “feel-good” endorphins and/or endocannabinoids released during activity (Boecker et al 2008, and Seibers et al 2021), and as the foundational movement needed to participate in almost every other sport. Little kids instinctively know how to run — they seldom need to be taught, and their form is often much better than that of adults. People move, and run, to expand their abilities, to push their physical bodies, gently or otherwise, to see what they are capable of. Running can be used as a social vehicle, as a way to spend time with friends and family outside. Or it can be deeply meditative, giving one time and space to tune the rest of the world out in order to listen to one’s body and thoughts in an intimate way.

These movements and desires are innate and natural, but the process of performing those movements almost always plays with a perceived boundary between natural and artificial. Our limited physical capabilities are often augmented by the tools (such as shoes) that we create to help us move more easily or in new ways through space. When these new technologies are introduced, decisions have to be made along the way regarding the continued validity of those activities. Technology does not always benefit performance, nor does it always make movements more efficient; this is part of what Langdon Winner urges us to understand when he encourages critical analysis of new technologies.

In a 2007 article, Dutch philosophy professors Ivo van Hilvoorde, Rein Vos, and Guido de Wert acknowledged that “technology is supposed to make life easier and more comfortable, which is generally not the goal in sport” (175). This conflict between the two very human views of technology — that technology is good because it is supposed to make life easier, but also that we should not always want life to be made easier — drives debates over the use of tools and technology in sport (which is, at the most basic level, just organized movements). The Dutch philosophers suggest that a fruitful approach to discussing new technologies in sport is to ask “if the athletes are still playing the same game, and whether or not there are equal opportunities and an equal distribution of means for playing the game” (173). The remainder of this chapter will explore the ways in which the game of running has been described, in an effort to complicate the

category of “the game of running,” as well as making an attempt to determine what is or is not an equal distribution of means for playing.

A Modern History of Running

The origins of the sports that we recognize today as running, road racing, cross country, and track (sometimes referred to together as “athletics”) can, conceivably, be found in New Zealand; Eugene, Oregon; and in post-war concerns over American sedentary lifestyles. In the 1950s, Arthur Lydiard, a runner in New Zealand, began developing a training plan for himself after joining the Lynndale Athletic Club (Whatman 2020). His training plan was centered around building a strong base of fitness to build upon through gradual increases in run lengths, then introducing workouts and strength work (such as hill repeats) into regular training. Lydiard became a successful marathoner himself and eventually attracted other athletes into his own training group. He famously coached an all-star New Zealand team at the 1960 Rome Olympics that included three medal winners: Peter Snell (800m, gold), Murray Halberg (5000m, gold), and Barry Magee (marathon, bronze). While coaching elite athletes, Lydiard also started the “Auckland Joggers Club” with fellow former athlete Colin Kay (Lathan 2015, 108). The goal of this joggers club had been to “foster a community where men of all ages could run together to develop their physical fitness” (108). The club met weekly for runs on One Tree Hill, was well-attended, and was not focused on training for any competitions.

Lydiard was not using an entirely novel training strategy: Arthur Newton, an ultra-distance²⁵ runner in the 1920s, won the Comrades Marathon in South Africa (a 90 kilometer, or 56 mile, race) several times while training using a progressive-increase philosophy similar to what Lydiard used decades later (Burfoot 2007). However, Newton’s method did not capture the same kind of attention that Lydiard did. The Kiwi was prominent in running circles around the world, sometimes infamously, and in 1963 the University of Oregon coach, shoe maker, and future Nike founder Bill Bowerman took his team on a tour of New Zealand. The trip was ostensibly for the Oregon team to race world-class athletes but principally for Bowerman to meet Lydiard (Latham 2015, 105).

²⁵ An “ultrarunner” or “ultra-distance athlete” is generally considered to be anyone who completes a distance further than 26.2 miles, the length of a traditional marathon. There is some debate over this, however, and a few ultra-enthusiasts would argue that a race does not become an ultra-marathon until it is longer than 40 miles — personally, I think anything above 26.2 goes but I am, admittedly, not part of the ultra-running community.

Meanwhile, rates of hypertension, heart attacks, diabetes, and other chronic illnesses among Americans had been rising throughout the post-WWII years, and many Americans were searching for solutions. Exercise outside of productive work was rare, and jobs were becoming more and more desk-oriented. In 1961, Seymour Lieberman, a former Loyola University track athlete and a sitting member of the governing board of the US Track and Field Federation at the time, published a pamphlet on “rhythmical jogging,” a form of exercise where one trots back and forth across a room or hallway to increase one’s heart rate (fig. 22). The idea was that this simple exercise would help alleviate the consequences of the chronic lifestyle diseases sweeping across the country, and Lieberman had asked Bowerman to endorse this program. Bowerman, however, was focused on Lydiard’s jogging clubs.

During his trip to New Zealand, Bowerman had seen firsthand how consistent running could keep people fit; on his first day with Lydiard, Bowerman was dropped from the slowest jogging group, and a 74-year-old man slowed down to help the 51-year-old coach finish the run (Latham 2015, 108). He then developed his own training regimen, styled after the programs Lydiard had written for his elite and amateur athletes, and began running. When he returned from New Zealand, Bowerman started his own jogging club back in Eugene. It took off quickly, even though it began in the middle of winter, and, as Bowerman described, “it got completely out of hand. I told people to go home until I could work out some programs” (110). On the first day, two hundred people showed up. By the third day, there were nearly 1,500 people gathering at the University of Oregon’s track.

Although he had already written “The Jogger’s Manual,” a short pamphlet promoting

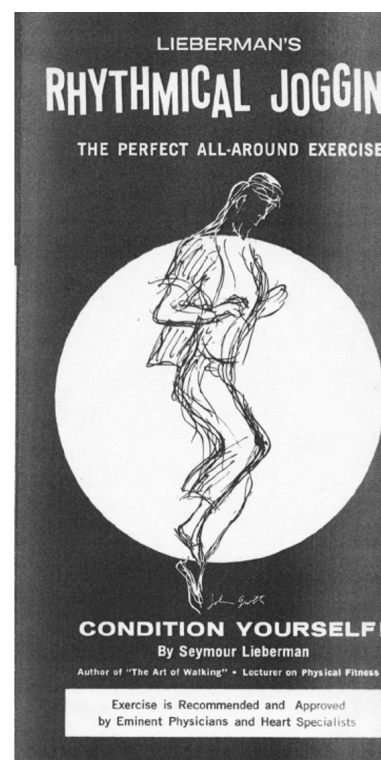


Figure 22: The cover of Seymour Lieberman's "Rhythmical Jogging: The Perfect All-Around Exercise" pamphlet, published in 1961. Image from Latham 2015.

Patience + Work = Improvement

Check off each day's jogging, and this chart will be a reminder to keep your workout schedule, as well as yourself, in good shape. Check it daily.

✓	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week
Mon.						
Tues.						
Wed.						
Thurs.						
Fri.						
Sat.						
Sun.						

Figure 23: Table from Bowerman's "Joggers Manual" demonstrating a basic training plan. Image from Latham 2015, courtesy of the University of Oregon Special Collection and University Archives.

jogging in 1963 (fig. 23), Bowerman wanted to be sure that running was actually healthy and good for people's hearts, particularly for those who had previously been predominantly sedentary. He connected with Waldo Harris, a cardiologist in Eugene, to explore those ideas (Latham 2015, 112). At the time, the concern for sedentary adults was not that they were exercising too little, but that they would exercise too much and over-exert themselves (111). Harris and Bowerman generated a series of controlled conditioning trials to test Bowerman's Lydiard-esque training regimens, beginning in the spring of 1965. The goal of these studies was not to undo the sedentary lifestyles of their subjects; they were not intending to encourage more people to bike to work, rather than drive, or to spend less time at their desks. Instead, by supporting the use of daily exercise to manage the side effects of a sedentary life, they helped to solidify such lifestyles in the American psyche. The studies were largely successful, and Bowerman wrote another pamphlet, this time with a more detailed approach to training: "The Runner's Manual."

Bowerman's pamphlets, the studies with Harris, and the Eugene jogging clubs launched a "jogging boom" in the following years for a few key reasons. They taught joggers to train themselves, how to deal with common problems (stretches for tight or sore muscles, strengthening exercises for minor aches and pains, etc), and how to "interact with their environment as runners" (Latham 2015, 115). Running is not often seen as a particularly complicated skill, but it is still a specific way of moving one's body that requires practice; Bowerman and Lydiard helped encourage the practice required to hone this corporeal skill.

Bowerman's adaptation of Lydiard's jogging clubs, his later innovation of waffle-soled training shoes, and the creation of Blue Ribbon Sports with co-founder Phil Knight in 1964, which became Nike in 1971, were a few of the first small seeds of the sociotechnical imaginary of running. A "sociotechnical imaginary" is a "collectively held, institutionally stabilized, and publicly performed [vision] of [a] desirable [future], animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff and Kim 2015, 4). When a group of people hold a collective belief about what their society is, that vision is what the society becomes, and these collective beliefs are made possible partially by the technology and science they employ. The desirable future and shared understandings in the sociotechnical imaginary of running (explored further in the next

section as well) are wrapped up in the history of the sport and presently controlled (in large part) by shoe and apparel companies, Nike now being chief among them.

Of course, Bill Bowerman and Arthur Lydiard did not invent running. Even among their contemporaries, they were not the only ones encouraging the fledgling sport. For example, Ted Corbitt, the first president of the New York Road Runners Club and the first African American to run in an Olympic marathon, did a lot of (often unsung) heavy lifting in terms of establishing running as a standardized sport throughout the 1960s and 70s (New York Road Runners 2020). New Zealand and the United States were not the first countries to take up running as a common practice either.

Prior to the running boom of the mid-twentieth century, running was, and continues to be, important to Japanese and some Native American cultures.²⁶ Japan's running boom came a few decades before the US, beginning in the 40s and 50s, and the country has consistently produced successful marathoners on world stages (Fritz Huber 2018). Ekidens, a long-distance relay race, are the equivalent of the Super Bowl in Japan. Many companies sponsor professional level teams that compete within the country, a system which is able to support more elite athletes (who typically also work for the companies as regular employees) than other corporate sponsorship systems. Running for the Rarámuri tribe in Chihuahua, Mexico, along with other Native American peoples, has long been an important part of spiritual and social life (Lieberman et al 2020). As mentioned before, the Rarámuri were made famous recently by Christopher McDougal's 2009 book, *Born to Run*, which idolized the tribe's use of running in persistence hunting and their long-distance races.²⁷ Their races are not competitive in the same way that Western-style races are; the rarajípare (the men's event) and ariwete (the women's event) races are more community-based, and incorporate teams that must run while also kicking wooden balls or flinging hoops with wooden poles. For the Rarámuri, running is not done to "get in shape," but instead to build community and engage with their traditions (368).

Despite running's more diverse history, its current image is largely whitewashed, eurocentric, and focused on male athletes. Progress has been slow moving for inclusivity and

²⁶ For the sake of brevity, I'm naming just a few; there are others.

²⁷ Like other accounts of the Rarámuri before it, *Born to Run* invoked the "fallacy of the athletic savage" in assuming that the tribe was predisposed to higher pain tolerances because of their "primitive" lifestyle and genetics (Lieberman et al 2020, 357).

equity among non-white and female participants.²⁸ Recall the brief discussion in Mile One of Brigid Kosgei’s world-record-setting marathon in 2019 and the lack of attention on her impressive feat in the shadow of Kipchoge’s sub-two-hour record-ineligible performance; this sport is not immune to the problems that plague the rest of society.

Culture in Finite and Infinite Games

During the jogging boom of the 1970s, following the importation of Lydiard’s training philosophy by Bowerman, George Sheehan, a cardiologist from New Jersey, wrote a newspaper column on running. His writing was prolific and profound, and bits and pieces of it continue to be influential today. In 1978, Simon and Schuster published his book, called *Running and Being: The Total Experience*, which lays out an introspective philosophy of running. The chapters, with simple names like “Discovering” or “Excelling,” are full of proverbs about this physical activity which was simultaneously an individual endeavor and a growing team sport. In the “Discovering” chapter, Sheehan describes what being a runner means for him, and in doing so, begins to establish what a *runner* is in the public imagination:

I am a runner. Years ago that statement would have meant little more to me than an accidental choice of sport... Now I know better... Because in being a runner, in moving through pain and fatigue and suffering, in imposing stress upon stress, in eliminating all but the necessities of life, he is fulfilling himself and becoming the person he is... And though he’s on the run, he’s in no hurry. *Concerned at times with tenths of a second, he actually responds to the season, moving through cycle and cycle, toward less and less until body and mind and soul fuse, and all is one* (Sheehan 1978, 34-35, emphasis added).

Later, on page 119, he writes, “Every time I put on my running clothes, I am born again.” In Sheehan’s version of running, you need very little, and the goal is to reach a kind of nirvana, to accept yourself as you are while also wanting more from yourself. Similarly, Alexi Pappas, an Olympic runner, author, and actor wrote in her memoir: “Truthfully, running has always been a way for me to matter, which has been the most essential mandate in my life... Performing as a

²⁸ For example, women could not run a marathon in the Olympics until 1984, and although Frances Hayward had successfully finished the Comrades Marathon (a 90km/56mi race) in 1923, it was not until 43 years later that Roberta Gibb became the first woman to finish the Boston Marathon in 1966 (Burfoot 2007). The prevailing belief for a long period was that women’s uteruses would prolapse if they ran distances longer than 800 meters. And one needs only to look at the starting line photos of major races today to notice the lack of non-white bodies in a space that advertises itself as accessible and open. There are a lot of great activists working to change this though, one of the most notable (in my opinion) being Alison Désir. You can find her website here: <http://alisonmdesir.com/>

runner, or as an actor, or any kind of performance, is a way to matter” (Pappas 2021, 9:13:20). Running thus becomes a vessel for finding meaning in life and in desirable, “pure,” pursuits.²⁹

A quick Google image search of “running quotes” pulls up hundreds of pithy sayings overlaid on dramatic photos of runners and nature scenes. This is something I did often as a young runner in middle school and early high school, and I dedicated a whole Pinterest board to these images. One, attributed to Kara Goucher, reads “Running allows me to set my mind free. Nothing seems impossible. Nothing is unattainable” (fig. 24). Another, not attributed to an author but featuring a watermark from @Running_Junkie, declares “Running is life; with the volume up” (fig. 25). Similar sayings can be seen at any development-level cross country or track meet;

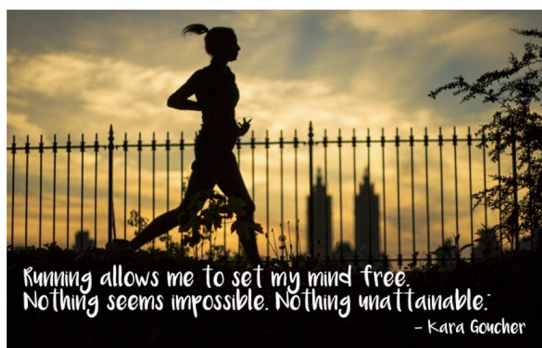


Figure 24: Silhouette of a woman running with a quote from Kara Goucher. Image from Paxton 2021.

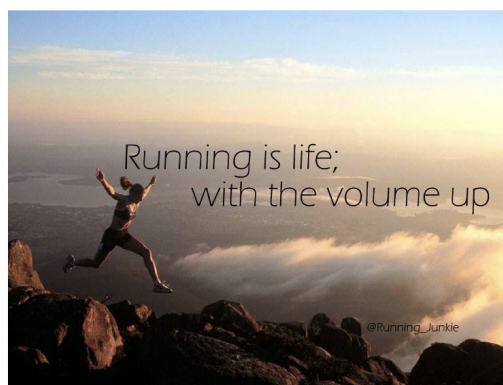


Figure 25: Photo of a woman running in the mountains with an unattributed quote. Image from "Runner Things #984" 2012.

teams will often put “motivational quotes” on the back of that season’s warmup shirt to inspire team cohesion and to reinforce the team’s goals and values. At various points in my middle and high school career, the back of my team’s shirts said “breathe, every breath is a stride,” “we burn down limits,” “act now,” “be intentional,” and a Bible verse about “running the good race.” In college as well, the back of my team shirts have boldly declared values like “aspire,” “stronger every day,” “suffer well,” and “in it together.” Culture is a difficult thing to define, and these quotes, or Sheehan’s book, are clearly a poor substitute for a full ethnography or the lived experience of being a runner, but they demonstrate some of the stated values of running: personal fulfillment, growth, and possibility.

The “soul” of a sport is defined both by the people participating in it, and by other actors with a vested interest in it (i.e., companies, regulatory bodies, the tools used to do the sport).

²⁹ One could say that this way of practicing running does religious work: it provides a space for connection and community, as well as providing individual practitioners with an activity through which to find ultimate meaning, to ask and attempt to answer larger questions about human existence (e.g., what is my place in the world? What am I meant to be doing? What feels satisfying to me and why?).

Important here is a discussion of what a teammate of mine once referred to as little-r running and capital-R Running: running as an activity and as a hobby; and Running as a career, as a professional sport, and as a business. Put another way, running exists as a *finite* and as an *infinite* game. This concept was developed by James P. Carse, a professor at NYU prior to his death in September 2020, and his philosophy is relevant in several capacities: both in helping to understand a bit better why some in the sport are so opposed to the technology changes, and in discussing what aspects of the sport change because of those developments.

Carse's 1986 book, *Finite and Infinite Games*, begins with simple this-or-that comparisons, seemingly only describing games, but eventually evolving into longer, more complex discussions on storytellers, politicians, historians, and society at large. Part one opens by stating, "There are at least two kinds of games. One could be called finite, the other infinite. A finite game is played for the purpose of winning, an infinite game for the purpose of continuing to play" (Carse 1986, 3). Races and competitions are finite: there is a clear ending, and winners are decided through established and agreed upon rules (this would be capital-R running, in my teammate's framework). But *running* does not end when the race does; it continues on as an infinite game (little-r running). Rules of finite games cannot change during the course of play, but the rules of infinite games have to change in order for the game to continue (9). As Carse puts it, "finite players play within boundaries, infinite players play with boundaries" (10).

To play within boundaries, finite players have to "hide their future moves" and "everything about their appearance must be concealing" (Carse 1986, 18). Infinite players, on the other hand, "play in complete openness" and expect surprises and transformative changes to the game; otherwise, the game would have to reach an endpoint (18-19). Within the finite game of a single race, or a competitive season, athletes have to ignore the effect of new technology: footwear, in the case of this thesis. They have to compete as if nothing had changed, and as if they were exactly the same as they were before they accessed the new technology. Otherwise, they would be admitting that they were no longer playing the same game in the same way. However, in the infinite game of running as a larger sport, the shoes and technology are hugely important, and cannot be concealed as such in order to continue the evolution of the game: the players have to be able to say, 'look, these things have increased human potential, and isn't it so exciting to see old records fall?' These developments are critical to the continuation of the game

(think back to made-up playground games as a kid — after a while, new rules needed to be introduced or the game got boring, and your players moved on).

Finite players are concerned with *titles* that have to be earned, whereas infinite players have only their *names*, which are given and imply an “open future” (Carse 1986, 26). Titles, according to Carse, are based “in an unrepeatable past” (27). They are concerned with power, which is “determined by the amount of resistance I can displace *within given spatial and temporal limits*... The establishment of the limits makes it possible to know how powerful I am *in relation to others*” (28, emphasis original). Units of comparison within a competition are paramount: otherwise, there is no way to allocate a title. Within a finite game, the shoe technology altered the limits of those units of comparison. The goalposts moved, in a way. Finishing times meant something new; a 2:09 men’s marathon was suddenly less impressive because more people were doing it. Because the shoes are helping some people run faster, everyone else needs to be faster, too. Obtaining a title requires a different amount of power than it did before. Looking at the same technology from the viewpoint of an infinite game, however, it appears to do little to alter the ultimate goal of being able to play the game.

It could be said, then, that professional athletes are playing finite games. They are competing for titles, and trying to accrue more power than their opponents. Those finite games are still wrapped up in the larger, infinite game of running, but the changes necessary for that infinite game to continue have real consequences on the outcomes of any given finite game. Although it is confusing and often convoluted, following those threads is important — especially once one begins attempting to balance the regulation of fairness in finite games while simultaneously promoting the progress of the infinite game.

Advertising Imaginaries

To continue with our finite and infinite games analogy, allow me to focus on how one specific concept of finite and infinite games is presented to us. As described previously, the denial of change in a finite game does not leave much room for cavorting with the rules and familiar aspects of the game, as is necessary for the continuation of an infinite game. Technology is an integral part of this experimentation, which can be seen in the example of carbon plate running shoes. Infinite games, then, support the creation and re-creation of sociotechnical imaginaries, which in turn influence the ways that individual finite games are experienced, all

while those same finite games might appear to be threatened by the experimentation and changing rules necessary for the infinite game.

Within these imaginaries, what is seen often is what becomes familiar, and what is familiar becomes defined as normal. Social conceptions shape the ways we respond to irregularities and changes: the sharper our definitions of objects or behaviors are, the more likely we are to “find the corresponding anomalies abominable” (Stout 1983, 8). This cloudy, subjective notion of normality also shapes our ideas of fairness: as will be discussed further in Mile Three, sports philosophy professor Sigmund Loland’s definition establishes fairness as “an individual obligation that arises as a result of voluntary engagement in rule-governed practices” and as “certain structural characteristics of a particular situation of choice between moral principles” (Loland 2009, 161). Depending on the structures or morals one has previously adapted to through repeated exposures, one’s obligation to the rules and boundaries around fair or unfair practices will shift. In this case, there is a preconceived notion of what running shoes are supposed to be and do for an athlete. This notion is supported by corporate interests, the cultural history of the sport, and athletes at every level — but particularly those on the professional stage who serve as role models for amateur athletes.

One of the major ways technology is made familiar to us is through advertising. Advertising plays a huge role in “shaping the meaning which a social group gives to an object” (Pinch and Bijiker 1984), and creating the sociotechnical imaginary of professional running that (the) shoes exist in. In their campaigns, Nike often highlights the role of their product in an athlete’s performance, rarely shying away from boldly announcing that their product will be the one to improve your abilities, and if you do not have it, you will be left behind. In doing so, they are working on the very pro-technology, cyborg-like end of the spectrum of human feeling towards technology. However, in a brilliant series of Air Jordan commercials in the mid to late 1980s, Nike worked both sides of the human-technology scale at once.

In one of these Air Jordan commercials, Spike Lee’s character from the movie *She’s Gotta Have It*, Mars Blackmon, pesters basketball star Michael Jordan about what makes Jordan such a good player.³⁰ Blackmon/Lee, playing the role of Nike, believes Jordan is a good player because of his shoes. Nike wants to sell the shoes, and sell the idea of the shoes, by linking Jordan’s performance to the equipment he uses (fig. 26). Undeniably, Jordan was a good player

³⁰ Watch the commercial here: <https://www.youtube.com/watch?v=fkY7W6kCRY4>

prior to the Air Jordans, which is why he got the franchise deal in the first place. Nike knows this, and they also know that people want to believe that human ability is not predetermined by the technology they use — this idea produces a moral discomfort in sport, which focuses on corporeal abilities. The rest of society though, and the audience for this commercial, want to believe that tools can make them better *and* that their achievements are a product of their human ability alone. So, throughout Blackmon/Lee’s pestering of Jordan, Blackmon/Lee insists that Jordan is great because of his shoes, Jordan continually denies this, and the ad concludes with a disclaimer that Jordan’s views are not necessarily the views of Nike.

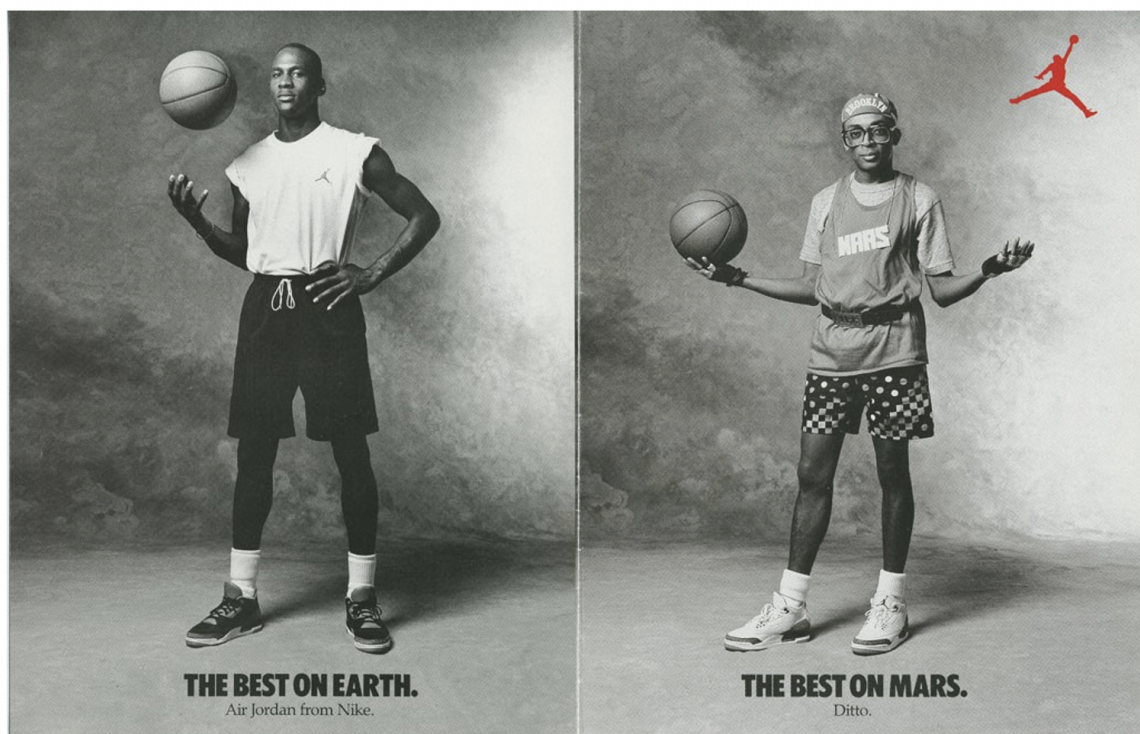


Figure 26: Advertisement for Nike’s Air Jordans featuring Michael Jordan and Spike Lee (as Mars Blackmon). Image from Warnett 2016.

Nike brought back Blackmon/Lee’s insistence that “it’s gotta be the shoes” in a 2018 “Shoe Therapy” commercial with Olympian and early carbon plate shoe adopter Shalane Flanagan.³¹ In this commercial, Flanagan is in a therapist’s office wearing her Vaporfly 4% shoes. She recounts a dream in which her carbon plate shoes were stolen the night before the 2017 New York City Marathon — but, as her therapist points out, in reality her shoes were never stolen, and on the morning of the race, Flanagan woke up as normal, put the shoes on, and won

³¹ Watch the commercial here: <https://www.youtube.com/watch?v=yA0kJ7yhII8>

the marathon.³² Flanagan corrects this narrative, saying “no — we won” and points to the shoes. The therapist then suggests that Flanagan take the shoes off, and Flanagan becomes flustered, asking why she would ever want to do that when she likes to do everything fast. The session is interrupted by another sneaker addict, who is carrying his Nikes close to his chest in a baby björn, and then we see that the waiting room is full of people obsessing over their Nikes — cleaning them with toothbrushes, protecting soccer cleats with bubble wrap, and walking around with several boxes of precious shoes. The commercial ends with Blackmon/Lee’s famous quote in all-caps black box letters standing in bold contrast to the plain white background: “it’s gotta be the shoes.”

The 2018 commercial, unlike the original Air Jordan iteration, is taking a slightly less nuanced stance about the place of shoe technology in conceptions of an athlete’s abilities (fig. 27). Here, Nike is presenting shoes as integral parts of an athlete — Flanagan, presumably, never takes them off. The shoes have become a part of her. Even the peripheral characters, in literally keeping their shoes close to their chest and earnestly caring for them, are embracing their footwear in an intimate way. Viewers are not meant



Figure 27: Nike advertisement for the Vaporfly 4%. Image captured from "Nike TV Commercial, 'Shoe Therapy It's Gotta Be the Shoes' Ft Shalane Flanagan," <https://www.youtube.com/watch?v=yA0kJ7yhI18>.

to assume that these people would hesitate to use a new innovation in technology, rather, that they would stay up all night in line to get their hands on it. Meanwhile, these characters are being presented in the context of a therapist’s office. Given that mental health and therapy have not historically been openly or positively accepted among the commercial’s target audience (Americans), it would also be safe to assume that Nike is not presenting these characters as examples of emotionally stable, “normal” people.

³² The video of her finish captures Flanagan’s joyful “f*** yeah!” and fist pump as she became the first American woman to win the NYC Marathon since 1977, in what is possibly one of my favorite moments in women’s running history: <https://www.youtube.com/watch?v=zo63CWP0YgE>

Viewers are left with an image of shoe-obsessed athletes, in therapy, who have a lifestyle that both uplifts various kinds of shoes as key parts of their identities but who also see that same perspective as something that should be tempered. Again, Nike is walking a fine line between wanting its audience to buy shoes, to believe that their products are necessary for athletic success, and also not wanting that goal to be so obvious that it could be easily critiqued and turned against the achievements of its own athletes. Viewers are supposed to buy into both of Nike's products: effective footwear *and* talented athletes. The company purposefully blurs the line between natural and artificial here, adopting what may seem to be an unlikely application of Harraway's cyborgs, "fabricated hybrids of machine and organism" (Harraway 2006, 118). These shoes, and Nike's advertisements, also challenge essentialisms, another major theme of Harraway. Read critically, both force the viewer to reconsider what they believe to be integral to athletic endeavors (is running *really* about pure motivations, personal growth, and limitless potential? Or is it also about technology and access to resources? Is the purpose of shoes *only* to protect one's feet? Or is it also to augment one's restricted physical ability?). As a major funder and influential member of the regulatory bodies of the sport, Nike is comfortably able to take such risks and to re-shape running — their version of the sport ultimately is not one that can be ignored.

This dynamic is playing out beyond Nike's carefully crafted commercials as well. Individual athletes want to downplay the advantages of the shoes and focus on the effort that they put into their training and into the performances they gave, rather than admitting that those improvements and achievements could have been a result of a slab of foam with a plate in the middle of it strapped to their feet (Ingle 2021). In a sport that focuses heavily on individual performances, this tension between technological and human achievement is not easily balanced.

Mile Three: The Regulations

Do records have any real importance? I sometimes think that we would be better off without stopwatches so that no one would know how fast or slow a race was run. The important thing would be the struggle of one man against another for supremacy. Yet the time taken is important as a yardstick with which to assess the merit of the performance after the heat of the battle has died down.

—Sir Roger Bannister
The First Four Minutes, pg 142

Threats to Achievement

In late September and early October 2019, two weeks before the INEOS 1:59 Challenge, I spent more time than I would like to admit sitting in Vassar’s library, streaming the World Championship track meet in Doha, Qatar, when I should have been writing papers. That meet was particularly captivating, not only because it was the World Championships, or because the stadium was nearly empty of fans despite the exciting elite races happening inside, or because it was so hot in Doha that the track had to be air conditioned to keep the athletes safe, but also

because Sifan Hassan (fig. 28) was

running incredibly fast. On

October 5, the Nike-sponsored

athlete won the 1500 meters in

3:51.95, a World Championship record (World Athletics 2021, 1500

Metres Women Final), and 1.88

seconds behind the world record,

set in 2015 by Genzebe Dibaba

(World Athletics 2021, 1500

Metres). Only seven days earlier,

on September 28, she had won the

10,000 meters (10k) in 30:17.62 (World Athletics 2021, 10,000 Metres Women Final). Her 10k

result was the world-leading time up to that point in the season, and although it is a full minute

slower than the world record, 29:17.45, set by Almaz Ayana in 2016 (World Athletics 2021,

10,000 Metres), it was an incredible effort, especially given the hot conditions. Her final 1500m

of that 10k race was run in a mere 3:59 — fast enough to beat the 10th place finisher in the



Figure 28: Sifan Hassan at the 2019 World Championships in Doha. Image from Alexander Hassenstein/Getty Images for IAAF.

1500m championship race, and she ran that time after having already raced over five miles (World Athletics 2021, 1500 Metres Women Final).

That is not even to mention the fact that a 1500m and 10k double is more or less unheard of in professional track and field: Hassan is the first athlete — male or female — to do so at any World Championship (Thompson 2019 and Dutch 2019). Winning both events at a World Championship is almost oxymoronic; it means that Hassan excels in both speed and stamina, which exist at opposite ends of a spectrum. Typically, athletes will specialize in middle-distance events (800m and 1500m), and won't venture much further out than those races, or vice-versa for longer-distance races (5k to marathon) and sprints. Training for middle-distance events is much different than training for longer track races, especially the 10k. Middle-distance training is often more speed-based, focusing on power and strength, whereas longer-distance training is more endurance-based, focusing on maintaining a strong pace for an extended period of time. Being able to pull off world-class times in both categories is a huge achievement, and Hassan's races did not go unnoticed.³³

In addition to the attention on her unprecedented results in Doha, Hassan, a woman born in Ethiopia, competing for the Netherlands, while based in the United States and training with Nike, was also dogged that week by news regarding her coach, Alberto Salazar, a former American record holder and Nike athlete himself. Salazar (who had also coached Kara Goucher and Shalane Flanagan in the past) was present for Hassan's 10k race, but not for her final 1500m race a week later. The night of the 10k final, September 28, Salazar had been handed a four-year ban from coaching by the United States Anti-Doping Agency (USADA) (Longman and Hart 2019). The ban meant that Salazar was no longer allowed to have any contact with his athletes, and could not be at their meets to watch them compete. Although Nike is emphatic that the ban is not because Salazar provided drugs to his athletes, and therefore they should not be criticized,³⁴ the ban came down because Salazar had been "trafficking in testosterone, tampering with the doping control process and administering improper infusions of L-carnitine, a naturally occurring substance that converts fat into energy," and is on the World Anti-Doping Agency's (WADA) banned substances list (Longman and Hart 2019). For her part, Hassan gave an "impassioned

³³ [LetsRun \(2019a\) Not A Typo: Sifan Hassan Wins 10,000 World Title With A 3:59 Final 1500](#), [Shryack \(2019\) Sifan Hassan Sets 1500m Championship Record In Wake Of Salazar Ban](#), [Rahel \(2019\) IAAF World athletics Championships Doha 2019: Sifan Hassen Wins Women's 10,000 m](#)

³⁴ It is true that his athletes have not been suspended or banned because of doping violations, at least at the time of this writing.

defense” against doubts over her status as a clean athlete during the championships, noting that she has been at the top of her game, running elite times, since she was only twenty-one years old in 2014 (LetsRun 2019b).³⁵

Adding to the scrutiny of Hassan’s achievements were her shoes: Nike had begun moving its innovative carbon plate-pebax-foam-combo technology to the track. In 2019, this move was relatively subtle. The road shoes were still holding the majority of the running world’s attention,³⁶ and there were few widely-known details about the spikes, beyond what could be observed and deduced through photos at races. If the photos of her spikes at the 2019 championships are compared to what is on the market today (figs. 29 and 30), it looks as if she was racing in an early version of the Nike Air Zoom Victory spikes released in the summer of 2020 (Nike News 2020, Ingle 2020). This may or may not have been legal: the World Athletics regulations are constantly shifting, as will be seen later in this chapter, and previous iterations of the rulebooks are not



Figure 29: Close-up of fig. 28 showing Hassan's racing spikes, which may have been prototypes of Nike's Air Zoom Victory spikes, in the 2019 World Championships in Doha. Image from Alexander Hassenstein/Getty Images for IAAF.



Figure 30: The bottom of Nike's Air Zoom Victory spikes. Image from Nike News 2020.

publicly available, making research on the legality of past equipment use incredibly difficult. At the time, little was said about her footwear, but a slew of fast races in early 2021, largely run in

³⁵ The video of her interview can be seen here: https://youtu.be/w2ryB_hNphM

³⁶ Several months after the 2019 World Championships, the world shut down due to the COVID-19 pandemic, and the controversial shoes and spikes took a backseat to more pressing issues. In early 2021, however, as professional racing has adapted to the necessary safety precautions of the ongoing pandemic, the spikes have re-entered the debate: more on that later.

the Air Zoom Victories or the Dragonflies, another plated spike with Pebax-foam, has reignited the debate over shoes and brought the focus to the track.

Accusations of unfair competition color the results. Guilt by association might not hold water in a legal setting, but the court of public opinion is another matter. As I watched Hassan's races, I could not help but wonder if what I was watching was real. Had she and Salazar used banned substances in her training? Was it actually possible for someone to run that fast in both a 1500m and 10,000m race just days apart, without "artificial" help — either from the shoes or from doping? I had several back-and-forth arguments with my teammates about how we felt watching Hassan's races. I said that it was hard to be too excited about the races when it seemed likely that in a few years, the results would be thrown out for doping violations, or if the shoes were retroactively banned (a sentiment shared by others in the running community). Conversely, a few of my teammates thought I was too cynical, that Hassan's performances were inspiring, and who she was coached by or what shoes she was wearing should not matter.

In philosopher and political scientist Mika La Vaque-Manty's "Political Theory of Doping," he establishes achievement as "understood both procedurally and as independent of the process" (La Vaque-Manty 2009, 173). It is related not only to effort but also to "talent, elegance, beauty, strength, [and] speed" (174). An achievement is both the fact that something notable was completed and the ways in which that notable thing was accomplished. When professional athletes (such as Sara Hall or Kara Goucher — more on Goucher in Mile Four) refer to the shoe technology as "mechanical doping," (fig. 31) they are adapting familiar feelings about shortcuts, doping, and achievement to the time decreases seen in races run while wearing the shoes (Komen 2020). The way people, myself included, talked about Hassan's Doha performances is not unlike the way the shoes are talked about: is it cheating? Is it



Figure 31: Sara Hall's 16 Nov 2020 tweet about a sign seen in Flagstaff, Arizona, opposing "mechanical doping." Image captured from Hall's Twitter account: <https://twitter.com/SaraHall3/status/1328484486355374081>

still an achievement if one was helped by technology or drugs? Are shoes “unnatural” (either the carbon plate ones, or shoes in general)? What is the line between fair and unfair advantages? Until we know more, what can we make of the performances that may or may not be tainted?

If a professional athlete has “doped,” (i.e., used banned substances such as L-carnitine, or used illegal techniques like strategic blood transfusions to maximize red blood cell counts and oxygen uptake), many people would agree that the person has taken a shortcut. They used techniques or chemicals seen as “unnatural” in an attempt to improve their fitness, and by extension, their performances and ultimately their financial gains. There is an ever-growing list of banned substances, and people like Alberto Salazar are constantly trying to push the boundaries of what is legal. Such shortcuts, in La Vaque-Manty’s words, make “the outcome something other than an achievement” (173). Doping makes us uncomfortable because it involves altering the human body’s natural chemistry, muscle composition, or other functions in a way that, for one reason or another, has been deemed unnatural. The results of doping are sometimes indistinguishable from what is considered natural: take, for instance, the difference between blood doping and altitude training camps.

Blood doping, either through the use of erythropoietin (EPO), synthetic oxygen carriers, or blood transfusions, is banned by the WADA. EPO promotes the production of more red blood cells; synthetic oxygen carriers “are purified proteins or chemicals having the ability to carry oxygen”; and blood transfusions can involve either extracting an athlete’s own blood when it has higher levels of red blood cells and freezing it for later use (i.e. to be given back to an athlete before a big competition), or doing the same thing with someone else’s blood (WADA 2021). All three methods improve the body’s ability to transport oxygen to an athlete’s muscles during exercise, which increases their stamina and performance. Altitude training camps are frequently incorporated into elite endurance runners’ training cycles; during these camps, an athlete spends several weeks at a higher than normal altitude in order to increase their red blood cell count, a process that occurs naturally to compensate for the lower oxygen levels in the atmosphere at high altitudes. These training camps are not banned, but they achieve the same ends as the banned blood doping techniques: an increase in red blood cells.

Blood doping is seen as a shortcut, as the wrong way to go about reaching the same result, because it involves little effort on the part of the athlete. The treatment (infusions of EPO, synthetic oxygen carriers, or a transfusion of boosted blood) is *applied to* the athlete, rather than

being *executed by* them. Training at altitude, however, is difficult — it is objectively harder to complete the same workout when you are unable to get as much oxygen to your muscles as normal — and an athlete must *do* the difficult thing for several weeks in order to reap the temporary rewards of a higher red blood cell count.

There is a logical argument for equating the carbon plate shoes with doping. Without the shoes, an athlete would have to *do* many targeted workouts to increase their running economy. With the shoes, however, an increase in running economy is achieved by simply *putting on* the shoes; nothing else about the athlete has changed, except for what is on their feet. The key difference — whether you are comparing blood doping to altitude training or wearing the shoes to not wearing the shoes — is that one method of improving an athlete’s performance is *inactive* and the other is *active*. That being said, an equally important difference between blood doping and wearing a pair of shoes is that the former *physically alters* an athlete’s body, it changes their blood chemistry and internal functions. The latter, however, does not make any permanent changes — it alters the way that body *moves* and how it interacts with its environment, rather than what it is made of.

Defining Fairness

The crux of the debate over the Nike carbon plate shoes rests on the “fairness” of their use and the meaning of both implicit and explicit regulations. The term “fairness” is a slippery one, frequently mixed up with equality, equity, and personal moral beliefs. Moreover, given the fundamental differences between finite and infinite games, it follows that there would also be differences in what constitutes “fair” in each type of game. What is fair in a finite game is what will allow the game to come to a reasonable conclusion while ensuring one competitor does not have an unreasonable advantage over another. Infinite games are fair when they are allowed to evolve, and when the players are allowed to continue playing (without unreasonable outside interference).

Sports are fundamentally dependent on differences in skill, meaning that calling for *equality* would be irrational; if everyone had the same skills and the same training and the exact same tools, sports would a) not be fun to watch and b) likely never come to any satisfying resolution in competitions. *Fairness*, on the other hand, calls for *equity of opportunity* and the elimination of beneficial circumstances to some athletes but not others for unearned reasons. It

would not be *fair*, for example, if one child were granted a spot on the school's basketball team over another child of the same skill level simply because the first child could afford to compete on a travel team in the summer, while the other child had to babysit their siblings during their parents' workdays. The two children do not have equal *opportunities* to play, although they may have equal skills. Stretching this logic out to the topic at hand, if one athlete is able to, say, make an Olympic marathon team because they had access to better shoes through their sponsor, and another athlete is left at home despite having the same skills, that might not be considered a fair competition. Why should the second athlete be punished for not getting the right shoes? A major problem with comparing skill and opportunity, however, is that both are difficult to quantify and prove — is it possible to determine if the two Olympic hopefuls in our example actually have the same skills? Would the first athlete still beat the second without the shoes? Real-life competitions cannot be replicated with variables isolated in order to separate correlations from causations, and every claim of “fair” or “unfair” is, ultimately, a judgement call.

There is no neat way to define fairness without context. Sigmund Loland, a professor of sports philosophy and sport and ethics at the Norwegian School of Sport Sciences, offers six “overlapping moral accounts of fairness” based on a literature review in his contribution to the 2009 book, *Performance-Enhancing Technologies in Sports: Ethical, Moral, and Scientific Issues*; in his summary, fairness is:

- 1) not disadvantaging others,
- 2) being unbiased, impartial, or neutral in our treatment of others,
- 3) sharing burdens or benefits equally, or maintaining a proper proportion between benefit and contribution,
- 4) treating equal or similar cases equally or similarly,
- 5) adhering to the rules, and,
- 6) treating others with the concern and respect they deserve (Loland 2009, 161).

Loland goes on to define fairness in his own terms as “an individual obligation that arises as a result of voluntary engagement in rule-governed practices” and “certain structural characteristics of a particular situation of choice between moral principles” (161). Fairness outside of sports focuses on treating others well and not taking advantage of each other. For little kids, things are fair when they are equal. As adults and as athletes, we know it is more complicated than that, and what is equal is not necessarily fair.

This leads Loland to the “Fair Opportunity Principle” (FOP) for sport, in which some inequalities, but not all, are seen as “essential” and should be eliminated as much as possible

(Loland 2009, 163). This principle is already seen in the standardization of external competition conditions: take, for example, professional sports arenas, rules about wind-aided times (in short sprints, races run in excessive tailwinds are record ineligible and results appear with caveats next to the times), and seed positions to match competitors against each other (separate heats of the same race distance are often organized by the competitors' previous results; "fast heats" and "slow heats" help give athletes the best chance of running in a race where they are evenly matched to their opponents, thus having an opportunity to be competitive rather than being lapped or having no one around to push them). If everyone is playing on the same size fields, measured the same way, made with the same materials, and the weather conditions are the same for all competitors on the same day, then it can be assumed that any differences in the quality of their performances are based on differences in skill. Weather conditions and field composition are *irrelevant inequalities* within competitions because those factors are the same for everyone at a given time (comparisons of results and skill across time is another story). The *relevant inequalities* of a sport vary based on what skills are valued and are what make competitions interesting.

According to Loland, such relevant inequalities do not include equipment or technology. This is not to say that equipment and technology have no bearing on performance; this position instead reinforces the idea that equipment and technology is a central factor in sports, something that many "purists" might want to downplay. He believes that, based on FOP, "equipment and technology should be identical for all competitors, or at least standardized as far as possible, and all competitors should be given equal access" (168). He and many others recognize that differences in "economic strength" and financial resources can "significantly affect performance," and to remedy this reality, the chance for someone to buy their way into better performance should be eliminated as much as possible. In most organized, professional sports, this strategy of mitigating technological advantages by ensuring all competitors have access to the same equipment would be easy, relatively speaking. There are clear, defined rosters and team management systems that could theoretically distribute uniform equipment to everyone in a league. Professional running, as we will see later in Mile Four, is not as cut and dry. There is much more room for elite amateurs to compete against professional runners, and simply supplying all "professional" runners with the same technology is nearly impossible: no one can

agree on who counts as a professional, and even if they could, that information is hidden under layers of non-disclosure agreements.

Loland also advocates for the open sharing of performance-enhancing knowledge because it still takes skill to apply that knowledge for useful results (Loland 2009, 168). It is slightly more difficult to apply this open sharing ideology to technology, although Loland still asserts that “the key procedure here is standardization of, or at least equal access to and free choice between, various kinds of equipment” (170). For him, this almost-radical stance is justified because of the huge potential for financial and social payoffs for athletes who perform well (172). He points to a need for athletes and teams to “control key aspects of their performance” (171), which should, in theory, produce fair competitions once all the irrelevant inequalities have been accounted for.

In response to Loland’s essay about the Fair Opportunity Principle (FOP), Thomas H. Murray, the president and CEO of The Hastings Center,³⁷ wrote about a concern that the FOP would lead to genetic hierarchies. For Murray, “fairness requires diminishing the impact of these factors we believe should not affect the outcome. We still need to decide which factors should count” (Murray 2009, 228). His concern is that FOP could be taken too far, that eventually even natural talents will be seen as relevant inequalities needing to be accounted for.³⁸ In this hypothetical, people are separated by their genetic predispositions rather than by skill. Murray asks “should differences in natural talents be the sort of difference-making factors that ought to be permitted under FOP in sport?” (225), which is, in many ways, the central question in any debate around fairness in sport. He holds on to a belief that sports are “relentlessly meritocratic” (231), and that they allow us to “pursue flourishing” through “embracing our physical embodiment and perfecting our talents” (236). His philosophy of sport then, is more focused on

³⁷ From The Hastings Center website: “The Hastings Center addresses social and ethical issues in healthcare, science, and technology. Through our projects and publications, The Hastings Center shapes ideas that influence key opinion leaders, including health policy-makers, regulators, health care professionals, lawyers, legislators, and judges.” <https://www.thehastingscenter.org/who-we-are/our-mission/>

³⁸ In some ways, this is already happening. See the South African Olympian Caster Semenya’s case, an ongoing battle over the definition of “woman” and acceptable testosterone levels that could fill several theses’ worth of discussion. An introduction can be found here: [Longman \(2016\) Understanding the Controversy over Caster Semenya](#) and a recent update here: [Ingle \(2020\) Caster Semenya's Olympic hopes fade as runner loses testosterone rules appeal](#). Or take former University of Montana athlete Juniper Eastwood’s fight against anti-trans legislation in the United States, for example (for the record, she is not the only trans athlete in this fight, there are many other brave young people doing the same): [Welsch \(2021\) While Fighting HB 112, Transgender Former UM Runner Juniper Eastwood Finds Clarity On Trails](#)

the personal fulfillment of goals and the sense of accomplishment that comes from striving towards something greater than what one was before.

In his deep-dive on the political theory of doping, La Vaque-Manty notes that fairness could be considered a “constitutive norm” of sports.³⁹ This was not always the case. As he describes, “it emerged with recognizably modern forms of sport in the eighteenth century as a way of facilitating gambling but also as a reflection of the moral value of equal chance” (La Vaque-Manty 2009, 169). This focus on fairness was accentuated during the American Progressivism and Muscular Christianity era in the early 1900s, when sports were used as one of the movement’s ways to remedy America’s “moral issue” (Morgan 2006). Sports were seen as dedicated to “the ideal of fair play” and many Americans believed that adopting sports’ “team spirit” ethos into the larger society would ameliorate the effects of market capitalism and “cure the atomistic ills of an overly commercialized society” (2). Today, though, many American spectators, along with spectators from the rest of the world, largely regard sports as entertainment, as a thing to be consumed. Despite the best wishes of Progressivists, professional sports are businesses.

Because professional sports exist to make money, athletes and teams are always looking for ways to gain an edge over their competitors, to make the game more marketable, and to control the narratives told about them. William Morgan, a professor of sport humanities at Ohio State University in Columbus and former president of the International Association for the Philosophy of Sport, describes this “excessive individualistic bent” in his 2006 book, *Why Sports Morally Matter*:

For whatever market-averse motivational pull sports might have had on participants and spectators has largely been laid low by the market... just about everybody is (or is encouraged to be) on the take, whether it be to land a lucrative endorsement deal or to secure whatever profitable end to which sports can be fitted. The result is that sports are treated more so as a means than ends... Indeed, the idea that professional sports could be ends in themselves comes off either as wishful thinking or as a willful distortion. (Morgan 2006, 26)

Even though, as Morgan astutely points out, sport is more often merely a means rather than an end in itself, there is still a sense in running that intrinsic motivation makes for a more

³⁹ Constitutive norms are ideas or practices without which an activity or system cannot exist. For example, a constitutive norm of school is learning; in the COVID-19 pandemic, with many schools moved to online instruction, it could be questioned whether “school” is still happening because many students are unable to learn effectively in that context.

sustainable and desirable career than one fueled by an extrinsic motivation to compete. Countless articles have been written about professional runners’ “whys” — what keeps them going, why they have managed to be successful, and why they continue trying to make a living in a sport with, relatively speaking, very little money to go around.⁴⁰

This rhetoric highlights another essential tension between the infinite game of running as a sport in general and the finite games of professional running which exist within it. Audiences are taught to expect that professional runners will be “above” the goals of finite games (titles and power), that they will be focused instead on the more idealistic motivations of the infinite game (“love of the sport” or self-actualization). In reality, both things are true at once; professional runners can be and are motivated by both titles and their love of the sport. As a result, rules of finite games occasionally have to accommodate the needs of the infinite game — in this case, the regulations of equipment use have to allow for new innovations while maintaining the balance of power within specific competitions.

Who Makes the Rules, Anyways?

World Athletics (WA) is the global governing body of athletics — the catch-all term for sports involving running, sprinting, field events, or race walking. It is made up of a Congress of member federations (most countries have their own athletics governing body), a Council, and an Executive Board, as well as specific Commissions composed of current or former athletes and industry professionals. According to WA’s website, the Congress is the “highest authority of World Athletics and the sport of athletics worldwide,” although it is technically the Council which conducts the specific duties of governing the sport: the most relevant to this topic being writing and amending rules and regulations along with appointing Commissions and Working Groups to address specific issues within the sport. Changes to these rules and regulations are published publicly, although previous versions of the rulebooks are not archived and cannot be accessed unless one has saved a copy prior to the release of the current iteration. To their credit, WA typically indicates which sections of the rules have been amended, but such tracking only

⁴⁰ A very, very brief list of such articles, only about a handful of American runners: [Crouse \(2020\) The Runner Sara Hall's 2020 Breakthrough](#), [Roll \(2018\) How Des Linden Won Boston: Lessons on Big Goals, Showing Up & Loving The Work](#), [Joyce \(2020\) How Kara Goucher Stood Up to Running's Goliath](#), [Fritz Huber \(2019\) Running Legend Shalane Flanagan Is Retiring](#), [Munson \(2020\) 3-Time Olympian Galen Rupp Shares How He Stayed Motivated to Train in 2020](#), [Woods \(2020\) Noah Droddy: From nowhere to the fastest Indiana marathon runner ever](#).

goes back to the version immediately preceding the most recent rule change. This archival dearth makes a critical analysis of the development of rules difficult at best, and impossible at worst.

Since late 2019, the time when I began tracking the WA competition and technical rule changes related to Nike's carbon plate shoes, there have been three major amendments and changes to technical rule 5.2 (also seen in table 3). On 1 November 2019, the rule stated, in full:

Athletes may compete barefoot or with footwear on one or both feet. The purpose of shoes for competition is to give protection and stability to the feet and a firm grip on the ground. They must not give athletes any unfair assistance or advantage. Any type of shoe must be reasonably available to all in the spirit of the universality of athletics.

Note (i): Adapting a shoe to suit the characteristic of a particular athlete's foot is permitted if made in accordance with the general principles of these Rules.

Note (ii): Where evidence is provided to World Athletics that a type of shoe being used in competition does not comply with the Rules or the spirit of them, it may refer the shoe for study and if there is non-compliance may prohibit such shoes from being used in competition.

The carbon plate shoes do, technically, "give protection and stability to the feet and a firm grip on the ground." They do, also, provide "assistance or advantage," and were, for a period of time, not "reasonably available to all." The issues at stake for many people involved in the shoe controversy are whether that assistance or advantage was "unfair"; if the "universality of athletics" is a useful concept that actually exists; and if the availability clause was violated by Nike in a more egregious way than any other company which provides its professional athletes with prototype equipment.

On 31 January 2020, following public discussion about the legality of Nike's carbon plate shoes brought on by performances like Kipchoge's INEOS 1:59 Challenge, Kosgei's world record, and a proliferation of fast times among elite athletes across the board, the rule was expanded to specify what exactly "reasonably available to all in the spirit of the universality of athletics" meant. This amendment banned prototype shoes, common among elites, and defined a "reasonably available" shoe as one that had been "available for purchase by any athlete on the open retail market (i.e. either in store or online) for at least four months prior to that competition." An "indefinite moratorium" was placed on any shoe thicker than 40mm (note that the midsole of Nike's Alphaflys measure in at just around 39mm) and on any shoe with more than one rigid, embedded plate (a plate may be in more than one part, however, it cannot be on

more than one plane, and the pieces may not be stacked on top of each other). Additionally, it required athletes, or their representatives, to submit to WA the specifications of any new shoe they are proposing to wear and the timeline of its availability. Finally, this amendment was accompanied by the announcement that WA's "Assistance Review Group" recommended that "further research be undertaken to establish the true impact of this technology" and called for the establishment of a working group to oversee this research, which was to include shoe manufacturers along with "biomechanics specialists and other qualified experts."

A 28 July 2020 amendment further complicated this definition, introduced a "transition period" for prototype shoes (which of course included its own set of stipulations), added clarifying information regarding when and how the specifications of a proposed shoe could be sent to WA for approval, and included new midsole height limits on track spikes as well as road shoes (the limit for the latter remains at 40mm). Perhaps most interestingly, the 28 July amendment also introduced an "Athletic Shoe Availability Scheme" in Note (ii) (a) of rule 5.2:

(a) Any new shoe (road or spike shoe) introduced after 31 January 2020 that, as at 28 July 2020 has already been confirmed by World Athletics as meeting the requirements of Rule 5.13 may be used in International Competitions immediately ('the Approved Shoe'). As from 28 July 2020, the Approved Shoe must also be made available prior to an International Competition for distribution to any uncontracted (i.e. not contracted to a manufacturer) elite athlete ('the Athletic Shoe Availability Scheme'). The Working Group on Athletic Shoes will develop and finalise the process (including timelines), criteria (i.e. if the athlete is given a place to attend a World Athletics Series Event or Olympic Games (known as an 'unqualified athlete' and 'universality place' respectively), numbers of pairs of shoes required (including brand model, sizes etc.), method of distribution and resources (including costs) required for administration of the Athletic Shoe Availability Scheme.

At the time of this writing, no such Availability Scheme has been made public. Furthermore, as I will describe further in Mile Four, the Working Group on Athletic Shoes faces an uphill battle in determining who would qualify for such a program: "professional" or "elite" are difficult terms to nail down among runners.

WA explained the purpose of these changes in a press release accompanying the 28 July amendments:

The purpose of these amendments is to maintain the current technology status quo until the Olympic Games in Tokyo across all events until a newly formed Working Group on Athletic Shoes, which includes representatives from shoe manufacturers and the World Federation of the Sporting Goods Industry (WFSGI), have had the opportunity to set the

parameters for achieving the right balance between innovation, competitive advantage and universality and availability.

The shoe manufacturers, evidently, did not entirely agree that the amendment as it stood in July actually achieved “the right balance between innovation, competitive advantage and universality and availability.” On 6 December 2020, WA announced yet another amendment to technical rule 5.2: prototypes were again legal for use in official competitions, but only for a “12 month ‘development’ period” and would still have to meet the approval of WA’s previously stated shoe specifications. In the press release accompanying this amendment, WA disclosed that the change was approved “following requests by all major shoe manufacturers and the industry body that represents them, the World Federation of the Sports Goods Industry (‘WFSGI’).”

Clearly, shoe manufacturers hold a significant amount of power over WA and the regulations regarding the equipment they produce. Even a cursory look at the structure of the Working Group on Athletic Shoes reveals that there is one representative from the WFSGI (president and CEO Robbert de Kock) and six representatives from major shoe manufacturers (Adidas, Spencer Nel; Asics, Ryan Montgomery; Brooks, Carson Caprara Sr; New Balance, Tom Carleo; Nike, Chris Cook; Puma, Johan Adamsson), two of whom (Adamsson and Montgomery) are also members of the WFSGI Committee on International Sports Organizations (CISO). Joining them in the working group are one representative from the World Athletics Council, one from the Athlete Commission, three representatives from each of the three “work streams” (Certification and Control, Science and Medicine, Development and Manufacturing), and the WA CEO Sebastian Coe.

It feels important here to note that WA publishes biographies of all Council and Executive Board members, the vast majority of whom are former elite, professional athletes, but leaves out any prior associations to brands or coaches. The current president of WA is a prime example of this. Sebastian Coe is a former world record holder from Britain who was sponsored by Nike and was a paid Nike brand ambassador until 2015, despite serving as a Council member from 2003-2007 and as the vice president of the Council from 2007-2015 prior to his election as president. In 2017, Nike even named a building after Coe as part of their campus expansion; none of this information is part of Coe’s extensive WA biography.

It would be difficult to ask these governing bodies to be entirely objective and free from all possible conflicts of interest: I am not so naive as to think that this could even be possible.

Instead, this analysis merely points out that such connections, potential biases, and prior relationships have been obfuscated and, accurately or not, this would lead one to believe that those relationships are playing a role in governing decisions. I understand why people are upset by the vague, endlessly shifting rules — it is frustrating to see the goalposts constantly moved and to feel like your sport is rapidly changing in order to benefit a few large companies that make fast shoes.

But why does it matter that it is shoe companies making (or at least heavily influencing) the rules? Technology always has someone's politics baked into it, and trying to make an apolitical decision about its use is paradoxical. At some point, someone is going to make a rule, and they will be influenced by their own motivations and prior knowledge. Shoe manufacturers, unquestionably, are motivated by money. When these companies are making the rules, they will make them in such a way as to benefit themselves and to protect their products. Given how much of a cornerstone these companies are to the organized sport of running (Nike is an official sponsor and major funder of USATF, Asics is a primary partner of WA, New Balance hosts huge national competitions for high school runners, to list a few examples), is it such a bad thing for them to have an influence on the sport at a high level? They may not be primarily interested in preserving “the best interests of the sport,” but how can one define what those interests are in the first place? Are rules that favor new, disruptive technology still a net negative if they have the potential to encourage more money and investment into the sport?

Mile Four: The Athletes

Does this primitive joy remain when I put on shoes with three-quarter-inch steel spikes and run round a circular cinder track, only to come back to the starting point? What is it like to have the excitement of competitive struggle grafted on the natural freedom found in movement — to champion the cause of club or country and to have their honour, as well as your own, at stake?

—Sir Roger Bannister
The First Four Minutes, pg 3

A Brief Re-Orientation

In the previous three miles/chapters, I have guided the reader through technical explanations and analysis of the carbon plate shoe technology and its development; we have explored the history of running as a sport in an attempt to understand the social context in which the shoes emerged, including an examination of running's stated values and the finite and infinite games existing simultaneously within the sport; and I have scratched at the surface of the dynamics behind the regulations and regulatory bodies that control the sport while offering a rudimentary philosophy of fairness. Throughout all of this, we have heard very little from the people most directly affected by the shoes: the athletes themselves.⁴¹

While runners at all levels are impacted by the shoes and have a right to opinions about them, the visibility of professional athletes puts them in a unique position to influence the larger culture of the sport. As an amateur or recreational athlete, the carbon plate shoes may affect what kind of goals I am setting or how satisfied I may feel with any given race result, but the shoes do not affect my livelihood, and I have a significantly smaller platform on which to talk about them. Professional athletes and their coaches, on the other hand, are impacted in very real ways by this new technology, and I would like to focus our attention on their reactions to the shoes.

Over the course of this mile/chapter, I will discuss the reactions of five professionals: Kara Goucher, Pete Julian, Craig Engels, Mason Ferlic, and Des Linden. Each of these individuals are representative of three general philosophies about the shoe technology which are seen throughout the running community: that the shoes were ruining the sport and should be banned (Kara Goucher); that the shoes were certainly impressive but were introduced in such a way that accentuated existing issues within running and more careful thought should be taken

⁴¹ The appendix also contains a link to a document with archived tweets discussing the shoes that I have come across over the last two years — if you have time, those tweets provide a good sense of the discourse that emerged on the internet about this particular technology change.

regarding their use (Mason Ferlic and Des Linden); and that the shoes are outstanding and should be allowed to be used freely without much oversight (Pete Julian and Craig Engels). Each runner or coach discussed here exists within their own network of people, ideas, and technologies. They bring their biases, motivations, and past experiences with them to the starting line as well as to the press box. The categories that I have placed them in fall along a less clearly defined spectrum but are still useful in understanding and analyzing the impact of the shoe technology. By siphoning the responses of these stakeholders into distinct categories, we are better able to visualize and comprehend the dynamics and relationships between various actors in the running community.

Professionalism

To help provide context on what being a professional runner entails, and why the carbon plate shoes have been disruptive to that ecosystem, the definition of a “professional” has to be established. In general, a professional is considered to be anyone “participating for gain or livelihood in an activity or field of endeavor often engaged in by amateurs.”⁴² Translating this specifically to sports, a professional would be anyone making money through their participation in a competition.

For most major sports, it is easy to quantify how many professional athletes there are; the rosters are published online and athletes are easily identified, even if the details of their contracts and salaries are confidential. For example, for major leagues in the United States, I was able to find that there are 3,320 active players in the National Football League directory, 749 on the Major League Soccer 2021 rosters, 158 in the National Women’s Soccer League, 509 in the National Basketball League, 149 in the Women’s National Basketball League, 770 in the National Hockey League, 186 in the National Women’s Hockey League, and there were 882 players on the Major League Baseball rosters in 2019.

Professional running, however, has no centralized roster. World Athletics does not keep a list of athletes who are under contracts from brands, and while some countries do have a national program, occasionally with financial support, that identifies that country’s elite athletes (some of

⁴² *Merriam-Webster Dictionary* (2021), s.v. “Professional”
<https://www.merriam-webster.com/dictionary/professional>

whom may also have corporate sponsorships), the United States does not. Great Britain, for example, supports 117 athletes in their national program (British Athletics 2020).⁴³

In the United States especially, professional running can be amorphous. Professionals can primarily earn money through sponsorships, but specific details about sponsor contracts are very secretive. However, top finishes at races are also sometimes rewarded with prize purses (the amount varies depending on how well-funded a race is, and if the performance included a course/venue, national, or world record time). This means that there could be, and are, runners who make money through races without necessarily having a sponsor.⁴⁴ For athletes who have the support of a brand (usually a shoe or clothing brand, but increasingly diverse companies are investing in runners, such as Goodr sunglasses or Blue Land cleaning products), performing well can increase an athlete's value in sponsorship negotiations, and contracts might include bonuses for especially successful races (Strout 2021, Lorge Butler 2021). Furthermore, because running competitions are races, where individuals are competing against other individuals in discrete events rather than in a playoff-game bracket system, athletes do not need to be attached to a team in order to train or compete at a high level.

There are some professional “teams,” but it is often more accurate to call such cohorts “training groups,” because many professional competitions are not team scored, especially the road races. Some of these training groups are made up of athletes sponsored by a variety of brands, such as the group informally known as “Team Boss,” led by Olympic steeplechaser and 2017 World Champion Emma Coburn and her husband-coach Joe Bosshard. Coburn is sponsored by New Balance, although other Team Boss members Aisha Praught Leer, Kate Grace, and Laura Thweatt, are sponsored by Puma, Nike, and Saucony, respectively.

Even without a national (or global) roster of professionals, it would seem reasonable for brands who are investing in athletes to advertise who they are supporting. Unfortunately, that is not the case for many brands. While conducting research, I was able to find limited sponsorship and roster information about the Bowerman Track Club (Nike-sponsored), Brooks athletes, On Athletics, Team Boss (informally, through message boards), the Mammoth Track Club, and Dark

⁴³ I also know that Germany and Spain keep a list of their elite athletes, although from my limited knowledge of those countries and languages, I do not know if those athletes are supported by the sport's national governing bodies.

⁴⁴ Until very recently, this list included Keira D'Amato, who has had an incredible year: while working as a realtor and raising two young children with her husband during a pandemic, she set the American 10-mile record for a women's only race, won the Michigan Pro Half Marathon, and ran 15:04 in a 5000m time trial (Strout 2021). She signed with Nike in early 2021.

Sky Distance (an Under Armour team). That list was clearly incomplete, and I turned to industry experts in search of better estimates of the total number of professional runners.

Sarah Lorge Butler, an author and editor at Runner’s World, estimated that “if you’re looking at American athletes in the 800, 1500, 3000 [steeplechase], 5000, 10,000, marathon — there are about 75 professional women and 75 professional men. I’m thinking about 10 true pros in each event and then 20 in the marathon. But that might be generous.”⁴⁵ Jonathan Gault, a staff writer at LetsRun.com, gave a rough estimate of 300 professionals, but after thinking about it more, came back and said he thought that might actually be low.⁴⁶

Jesse Williams, the former senior sports marketing manager at Brooks and current owner of Sound Running,⁴⁷ thinks of the American professional running world as a three-tier system⁴⁸:

1st Tier - Athletes with contracts and probably also in the USADA testing pool. 2nd Tier - Athletes with contracts (sole income) but not quite in the testing pool. 3rd Tier - Athletes getting some support from local teams/clubs and maybe free gear or a bit more. Maybe they win some prize \$ in road races but running is probably not their full-time job.

The first two tiers of Williams’ formulation include somewhere between 193 and 222 athletes, spread out over eleven brands.⁴⁹ These runners are men and women in the United States who make “their living from the sport and compete in the events where the shoe technology has recently experienced significant change.” From an athlete’s perspective, Aisha Praught Leer, who is also a member of World Athletics’ Athlete Commission, along with her training partners Kate Grace and Laura Thweatt, gave an “educated guess” of “around 800-1000 paid professional track and marathoners worldwide (all running events),” with “around 200 people in the US.”⁵⁰

New Balance alone has approximately 200-250 professional runners (sprints to the marathon) worldwide, according to Kevin Quadrozzi, the brand’s senior sports marketing manager, and New Balance is “definitely on the smaller side looking at ‘professional running rosters’ in the industry.”⁵¹ Extrapolating this approximation out to the eleven major brands mentioned by Jesse Williams, there could potentially be 2,200 to 2,750 professional runners

⁴⁵ Sarah Lorge Butler, Twitter message to the author, 18 Feb 2021.

⁴⁶ Jonathan Gault, Twitter message to the author, 18 Feb 2021.

⁴⁷ <https://www.soundrunning.run/>

⁴⁸ Jesse Williams, email message to the author, 18 Feb 2021.

⁴⁹ Williams’ breakdown of the athletes sponsored by each brand was: Hoka: 15-20, New Balance: 25-30, Brooks: 26-28, Nike: 55-70, Adidas: 20-22, Reebok: 10, Puma: 8, On: 7, Saucony: 11, Mizuno: 8-10, Asics: 8-10.

⁵⁰ Aisha Praught Leer, Instagram message to the author, 20 Feb 2021.

⁵¹ Kevin Quadrozzi, email message to the author, 22 Feb 2021.

(sprints to marathon) worldwide, and maybe 1,474 to 1,837 professionals specializing in events from the 800m to marathon (assuming that one-third of New Balance's athletes specialize in events shorter than the 800m). This estimate presupposes that New Balance's numbers are a reasonable average, which may not be accurate, given that in Williams' estimate New Balance was not "on the smaller side" for US distance athletes, as Quadrozzi thought (see footnote 46).

These varied estimates and secretive, complicated sponsorship contracts tell us more about professional running than a single, neat statistic could: there is still room for amateurs in "professional" (elite) running, and this semi-professional environment allows for wider participation at a high level than other, league-based sports. Additionally, because an athlete never truly knows who else they might be competing with for sponsor support, or what other benefits a different contract could bring them (salary, coaching staff, location, etc — to be fair, there are agents who handle these negotiations and mediate between brands and the athletes), any way for them to stand out from the crowd is indispensable. Social media followings, fan engagement, and lifestyle choices off the course are becoming bigger and bigger factors in who is seen as valuable⁵² (Strout 2021), but being a professional athlete is still primarily about running fast and competing well. Because of this, the new shoe technology does not only affect those winning races on the largest world stages: it also affects the kid coming out of college looking for a sponsorship, or a middle-of-the-pack athlete in the midst of contract renegotiations. For them, what is fair or legal can have a huge impact on their ability to enter into or remain in the sport — for better or worse.

Missing Out

Despite the existence of national and world championships that occur more frequently than the four-year Olympic cycle (and that have the same caliber of performances), qualifying for the Olympics is one of the single most important things an athlete can do to keep their sponsorship contracts and increase their salaries. Professional runners especially suffer from the lack of publicity in non-Olympic years, and they rely heavily on Olympic appearances.⁵³ For

⁵² See also the Tinman Elite team: a group of tech-savvy young men centered around one runner, Drew Hunter, who typically performs well, but the remaining team members do not often win races, set records, or make it to a podium position. Their value to their sponsoring brand, Tracksmith, comes from their media presence more than from their racing prowess (or lack thereof). <https://tinmanelite.com/>

⁵³ There is much to discuss about media coverage and publicity in running; this is unfortunately not the place. However, I will say there has been a lot of interesting discourse on this topic in the wake of the pandemic, which forced runners to get more creative about engaging in the sport.

some non-Nike runners, the carbon plate shoes represented a threat to their shot at coming out ahead of Nike athletes. A key example of this can be found in Kara Goucher's story.

In the 2016 women's US Olympic Marathon Trials, Kara Goucher, a former Nike athlete and whistleblower on the Alberto Salazar doping case discussed in Mile Three,⁵⁴ finished fourth behind Amy Hastings-Cragg (Nike), Des Linden (Brooks), and Shalane Flanagan (Nike) (figs. 32-34). Hastings-Cragg and Flanagan were both wearing early, disguised prototypes of the Nike Vaporflys. The top three went to Rio. Because she finished fourth, Goucher was one spot away from getting a spot on the Olympic team.⁵⁵ After the trials, she said she had done all she could in the race, and that the top three were "just better" (Pielke 2020).



Figure 32: Amy Hastings-Cragg (left) and Shalane Flanagan (right), wearing prototypes of the Nike Vaporfly 4%, during the 2016 US Olympic Trials Marathon in Los Angeles. Image from Kelvin Kuo / Associated Press.



Figure 33: Des Linden during the 2016 US Olympic Trials Marathon in Los Angeles. Image from Bush 2017.



Figure 34: Kara Goucher during the 2016 US Olympic Trials Marathon in Los Angeles. Image from kevmfoto.com.

However, according to Roger Pielke, a professor and author at the University of Colorado Boulder,⁵⁶ had Goucher been wearing the Vaporfly prototypes, she could have improved her time enough to nab a spot on the team to Rio. Using the same running economy/time improvement correspondence found in the 2019 Hoogkamer, Kipp, and Kram study referenced in Mile One, if

⁵⁴ For more on that chapter of Goucher's story, see

<https://www.womensrunning.com/culture/people/goucher-on-alberto-salazar-doping-violations/>

⁵⁵ Technically, because the 2016 US Olympic Marathon Trials were not a Gold Label race, Goucher could have been fourth and still made it to Rio if one of the women ahead of her did not previously have an Olympic standard time. However, in this case, all four top women had already met the Olympic standard. The Olympic qualifying processes are more complicated than one might think.

⁵⁶ University of Colorado Boulder is also Kara Goucher's alma mater. Pielke has a wide range of research topics, including climate change, sports governance, and science and technology policy.

Goucher were to experience a 3% improvement in her running economy and a roughly 2% improvement in finishing time, she would have theoretically run 2:27:27 — 53 seconds and faster than Hastings-Cragg’s winning time of 2:28:20 (Pielke 2020). Even if she were a relatively low-responder in the shoes, a 1% improvement in her time (90.24 seconds) would have resulted in a finishing time of approximately 2:28:52, putting her ahead of Flanagan’s 2:29:19 for third place (and likely also ahead of Linden’s second place 2:28:54 — but with Goucher’s theoretical time landing so close to Linden’s actual time, a head-to-head finish is not something I am as willing to hypothesize about).

Goucher has been outspoken about the shoes in the time since the 2016 trials, advocating for a ban on designs that came after Nike’s 2016 leap into carbon plates:

I do feel like it was not a level playing field... I felt... similar to how I felt when I learned people ahead of me were doping. I could handle not being good enough to make our [Olympic] team, but learning that a propulsion device in a shoe might have kept me out was just devastating... There were many athletes from non-Nike brands asking me to stay on it, but they were too afraid to voice their concerns themselves. They felt helpless... [Banning new technology would make sure that] we would be seeing the best athlete win rather than have results muddled by who has the latest technology, propulsion, or spring device in their shoe. (Pielke 2020)

Her narrative contrasts “true effort” and unfair advantages, and firmly places Nike’s shoes on the wrong side of that demarcation line. She is adamant in her assertion that the shoes made a difference in this case, and implies that pre-2016 technology did not affect the sport in any significant way. Goucher is used to standing alone when speaking out, but in that interview she was sure to emphasize that there are others who agree with her. She marks out a “them vs. us” scenario, making it clear that she believes the running community is not united on this front: it is Nike and their athletes vs. everyone else.

Pure Running

We should not be surprised by negative responses to the shoes from some in the running community: almost any change to sports equipment comes with some resistance, particularly in sports (like running or swimming) where tools are not embedded in the nature of the game. In those sports, there is technically no need for any equipment at all: theoretically, you could swim naked, in natural bodies of water and still be swimming, just like you could run naked, without

shoes or watches or hats or special moisture-wicking fabric, and still be doing the activity recognized as running. The introduction of any equipment to those contexts will always alter the experience, noticeably or otherwise. As Langdon Winner more eloquently stated in his magnum opus on the critical analysis of technological developments, *The Whale and The Reactor*: “If the experience of modern society shows us anything, however, it is that technologies are not merely aids to human activity, but also powerful forces acting to reshape that activity and its meaning” (Winner 1986, 6).

Humans have a complicated relationship with technology. We want technology to help us complete tasks easily, but we are also sometimes wary of technology because we are afraid that new technology will undermine our humanity — that by using such tools, we might become less human. We see these tools as things that could take away our humanity because we are very protective of what a human is, and especially in sport, we are protective of what a human should be able to do.

So when a piece of technology makes itself known in a community (such as running) which thinks of itself as not, in fact, needing technology (despite possible evidence to the contrary), that technology is often framed as an “impurity.” Making claims to an intrusion on the purity of running presupposes a correct form of the sport — if there was not a standard for what the sport is or means, then there also could not be a way for that standard to be made impure. Think of this like a recipe: if you’re following a very strict, clearly defined recipe, then when a stray ingredient is added, you can definitively say that what you are cooking is no longer the pure recipe. If, however, you are not following any predefined recipe, then adding any ingredient, whether you have used it before or not, can not be identified as an impurity, because there is no way of knowing if it was supposed to be there in the first place.⁵⁷ Running as a sport does have, in some sense, a pure recipe. There are rulebooks and guidelines governing official competitions which theoretically make identifying any missteps easy. In practice, however, these rules are vague, difficult to enforce, and easily bent. Additionally, the sport still exists outside of official competitions and legislated rulebooks. In this context, new additions or interpretations cannot be definitively labeled as impure versions of running.

⁵⁷ Mary Douglas’ 1966 book *Purity and Danger* deals with similar ideas of matter out of place, and for an interesting discussion on moral disgust, anomalies, and social categories, I would also recommend Timothy Renick’s 1998 article, “A Cabbit in Sheep’s Clothing: Exploring the Sources of Our Moral Disquiet About Cloning.”

When people like Kara Goucher claim the shoes are bad for the sport ([and they do this often on Twitter](#)), as seen in the archive of tweets found in the appendix), they draw on their ideas of what running should be: in their minds, a runner's times should be comparable across generations, the race distance should be equally as difficult now as it was decades ago and completing it should always mean something. For them, the history of the sport is as important as the current moment. In this framework, athletes of the past should be able to be compared to

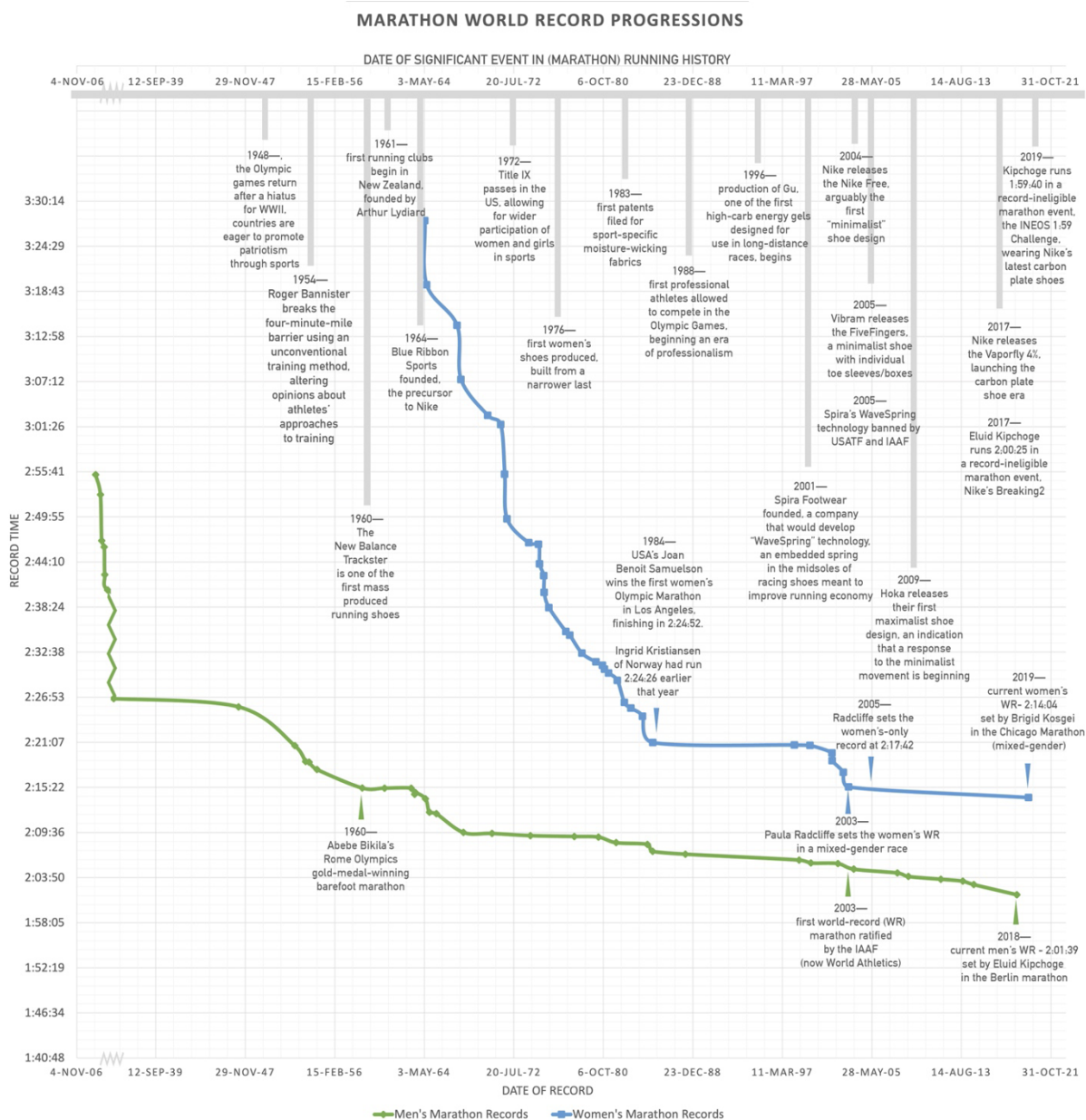


Figure 35: Progression of world records in the marathon (1906-2019) graphed along with notable moments in running history. Table created by Hannah Martin with data from Butler 2011; Green 2012; Gu Energy Labs 2021; Kuznetz 1985; Moran 1984; Roos 2020; Thomas 1985; World Athletics, "World Record Progression of Marathon. Female, Senior, Outdoor" 2021; World Athletics, "World Record Progression of Marathon. Male, Senior, Outdoor" 2021

athletes of the present, which is not entirely logical because legal frameworks, training philosophies, nutritional strategies, and equipment have always changed from year to year (fig. 35).

The relevant inequality for such purists is not just who is fastest but how much work it takes to become the fastest — their ideal is an athlete who is willing to put in more work than everyone else and is then able to defeat the competition. The irony of the new shoe technology is that the shoes were, at their literal core, designed to be fast *and* to aid recovery times so that an athlete could do more of the work that would allow them to be fast. They represent the ideal of constant improvement, of always being faster than you were before, of doing whatever needs to be done to be better. However, their development is, at the same time, a clear and decisive step beyond what could be called a purely human effort; it pushes past the plateau of what would otherwise be possible, not unlike other technological developments in the sport prior to the shoes. The shoes in and of themselves are a human achievement, a testament to the advanced engineering and investment in athletics. They are able to narrowly avoid the realm of doping — of permanent physical enhancement — because they are still an implement that is used and discarded. Simply owning the shoes does nothing to improve a marathon time, they must still be put on, and the athlete’s individual aerobic engine (among a plethora of other biomechanical, musculoskeletal, and biochemical processes) must still power them.

Rebuttals of the purist view of running focus on the other improvements in training and technology that have been happening in smaller, less visible increments than the recent developments in shoes. Pete Julian, the current head coach of the Nike group formerly known as the Oregon Distance Project,⁵⁸ has been adamant on this front. An interview from the running media hub FloTrack on 28 February 2021 with Julian, following some incredible performances from his athletes at a professional track meet in Texas, is partially transcribed below:

Interviewer: Even though there wasn’t a global championship last year, it seems like every mid-distance and distance event on both sides took a step forward last year. Is that how you see it?

⁵⁸ Julian had been the assistant coach under Alberto Salazar, but had always maintained his own training group separate from Salazar under the same team name. When Salazar was handed the four-year ban in 2019, Julian took over as the official head coach, even though the Oregon Distance Project was technically disbanded. The athletes do not currently have a team name, although mid-distance standout Craig Engels has allegedly been campaigning for the name “Pete’s Dragons.”

Pete Julian: [sighs] I don't know... I mean, people were running fast before. ... So I know there's a lot of talk of the shoes, and the shoes are great, I get it, but... if you really wanna get down to it, we're sorta just repeating stuff that's already been done... When I ran 28:05 [in the 10k] I was one of the better guys in the world, and now that wouldn't even get me books on a college scholarship [laughs]. You know? That's what progress looks like. And the tracks are better, the shoes are better, the athletes are better, the coaching is better across the board, the coaches are talking to each other. There's a lot of information out there. The stuff they've been doing in the weight room, the nutrition, just, things are getting better, and there are some dinosaurs out there who refuse to believe it and they just wanna say, 'oh, it's just the shoes.' Well, it's not. It's not. Believe it or not, the athletes are actually getting better. It's just more of a professional type thing. And you know, this is, Koko [Kostanze Klosterhalfen], you see her out here running 31 minutes [in the 10k] on a windy night pretty much by herself. I'm sorry, that's not the shoes. Because she could have put on her Streak LT's and done it, I've seen her do it at practice... These women are just running fast, man [shrugs]. And these guys are running fast, these men are running fast, it's awesome to see. (Julian 2021, 2:57-6:10⁵⁹)

Over and over, Julian insisted that “it’s not the shoes” and the athletes are “just running fast.” One would expect Julian, as a Nike coach and functional Nike brand ambassador, to be praising his company’s technology while also bringing the focus back to his athletes — and he did do this, briefly admitting “the shoes are great, I get it.” He emphasized progress, making the case for improvements in times as good for the sport. What is interesting about Julian’s response, and the response of other pro-carbon plate shoe individuals, is the line they have to walk between supporting the technology and acknowledging the agency and talents of the athletes using it.

Craig Engels, one of Julian’s Nike athletes, made this same maneuver in another interview from the Texas meet with FloTrack on 26 February 2021. In this interview, Engels is clearly a huge fan of Nike’s shoe technology (their new spikes, specifically, which are designed to be Vaporflys for the track). At one point he said, “I don’t know why athletes are saying they don’t help, but spikes in general help. So, uh, I don’t really know what the argument is, I can’t take a stance, but the shoes are definitely awesome. I mean, any high schooler, any college kid should be racing in these shoes, they’re the best technology out there” (Engels 2021, 4:05-5:52). Engels is right when he said “spikes in general help”: there is a reason why athletes wear different footwear for training than they do for racing. Both track spikes and road racing flats are lighter than the shoes an athlete wears during normal workouts; recall the 2016 University of

⁵⁹ Watch the full interview here: <https://www.flotrack.org/video/6905643>

Colorado study which demonstrated that added shoe mass degrades running economy, and showed a proportional relationship to increased times in 3000m time trial performances (Hoogkamer et al 2016, 2180). Engels made a smart rhetorical move by pointing out the already accepted advantage of previous track spikes. In his view, Nike is just “ahead of the curve” in terms of improving on the old designs, and this new iteration should not be thrown out simply because it is more effective in achieving the same goal of running faster than your opponents in a race.

Still, when asked which shoes he will wear in upcoming races, he wavered⁶⁰ in his argument that the spikes are a necessity for anyone wanting to run fast on the track:

Interviewer: So you wear these for the longer stuff [camera looks at Engels' Nike Air Zoom Victory spikes] and then you're gonna wear...

Craig Engels: Dragonflies, yeah

Interviewer: ...Dragonflies for the 1500?

CE: Um, yeah I don't know if my footstrike is the best for those Victorys, so I might go back and use the old ones, um, and I mean I can't see myself running much slower, like I don't think it's... [shrugs] but they do, like mentally, help you get up on your toes for sure. So I don't know what the argument is. I think people are thinking they're cheating, but I guess so is the Mondo [track] surface compared to cinder, so, it's, yeah [shrugs], I mean it's tough. (Engels 2021, 4:05-5:52⁶¹)

Here, Engels speculated that he might go “back to the old ones” and not wear the new spike technology. However, after positing that the new spikes are the fastest shoes on the track, he had to backpedal a bit and stress that he would not necessarily get slower although the shoes “mentally” help.

At that same Texas meet in February 2021, Mason Ferlic, an unsponsored, former national-title-winning runner at the University of Michigan (where he currently serves as an assistant coach⁶² while training and continuing to compete at a high level), gave an interview

⁶⁰ To be fair to Engels, he had just finished a 5k (a race distance he does not often do and which he does not enjoy) immediately before the interview. Engels was still in a bit of a post-race stupor, telling the interviewer several times that he might be about to puke. I think his interview is still worth examining despite this: Engels is giving honest answers (it is not easy to lie after a hard effort on the track), and he is not the only one who is expressing these ideas.

⁶¹ Watch the full interview here: <https://www.flotrack.org/video/6900796-craig-engels-is-not-a-fan-of-the-5k>

⁶² You can read his assistant coach bio here:

<https://mgoblue.com/sports/mens-track-and-field/roster/coaches/mason-ferlic/517>

with FloTrack that made a distinction between “pure” racing and what happened on the track that weekend. Part of his interview is transcribed below:

Interviewer: And you said you don’t like the spikes but you wear the spikes? Is that a fair assessment?

MF: [sighs] Look, uh, I’m an engineer, so like, [gestures to his Nike spikes] these are a great piece of technology, you know? Unfortunately, I think the governing body of track and field kind of, kind of whiffed on that one and like they, instead of coming down with like good guidance, they kind of opened the Pandora’s box for a new era in the sport that now is kind of recalibrating it in a way where we can’t keep up. And as athletes, I mean there’s an athlete here that I’m good friends with that’s sponsored by a different company and like, I just told him while I was talking to him, look, dude, if you’re knocking on the door of the Olympic standard time, there’s a pair of spikes that gets you ten seconds right now. And like, how is that fair for athletes, you know, that are maybe beholden to another brand? (Ferlic 2021: 7:52 - 10:55⁶³)

Earlier in the interview, Ferlic had described the spikes as “ruining track.” He elaborated in the above excerpt that he believes the shoe technology is taking away from the achievements of the athletes because it is impossible to know how much of an effect the shoes had on a performance. He frequently referenced cross-country, a sport where athletes rarely run on the same course twice, and no two courses are the same, making finishing times variable and difficult to compare⁶⁴:

Interviewer: Is it ten seconds in a 5k, you mean?

MF: Yeah. Sure, maybe more. You know, it’s like, who knows? And that’s like the problem is like you see these amazing times of athletes that had [the spikes] a year before anyone else when no one realized how good they were and it’s like, I think it’s a little unfair, right? Uh, that’s why I love cross country. Like me against [Paul] Chelimo was Terre Haute [Indiana], in 40 degrees, sleeting rain, who’s gonna be stronger, tougher, and fitter on the day? And, like, it didn’t matter what was on our feet, didn’t matter the pacing or light system on the track [gestures around at the track] it’s just, like, racing. And, uh, I think we’re just going to have to come to grips with that as a sport. (Ferlic 2021: 7:52 - 10:55, continued)

⁶³ Watch the full interview here:

<https://www.flotrack.org/video/6905559-mason-ferlic-takes-5000m-talks-spikes-steep-and-win-over-chelimo>

⁶⁴ One weekend, an athlete could be running on a hilly course with many turns and narrow trails, which lends itself to slower times, and on another weekend, they might be racing on a manicured course that looks more like a track on smooth grass. The latter course will probably be faster, but the athlete might have a better race on the former course, relying on strategically timed moves and guts to put down a great effort against their competitors (which is what Ferlic referred to when he talked about his races against Paul Chelimo in Terre Haute).

These mano-a-mano competitions are what Ferlic and other purists think should be glorified more than times. Such subjective, emotional, and dramatic performances are seen as places where the human spirit is put to the test more than in a time trial or contrived race to beat a quantitative mark — and in this formulation, these tests of the human spirit are the point of running.

Still, Ferlic admits he will wear the shoes, because they are beneficial to him, with a caveat clarifying that he is also working “super hard” to improve his performance beyond the shoes:

MF: ...Like I'm gonna wear them because I'm not an idiot and I know I would be leaving seconds to my competitors if I didn't wear them, but... that moment has passed to do anything about it. Now we just have to, now we have to deal with the collateral damage as athletes and fans of the sport. So, um, any athlete, look, everyone's training hard. I think I'm the fittest I've ever been, I'm training super hard, right? I had a great three weeks down in Arizona, great track workout, best times I've been running, but you have to acknowledge the benefit of the spikes I was wearing tonight [gestures to the track]. I want to say I'm fit but, yeah part of it was the spikes. Now, I beat guys who were also wearing the spikes, and most people are wearing good footwear nowadays, but you just don't know, you know? And if I had finished third, I probably would be blaming not having the spikes for my loss [laughs]. So I think we just need to have an open, honest conversation about it, and I think athletes need to give more credit to the footwear. Like, other brands are catching up, and I like the other technology advancements out there, just like what happened on the road four years ago, but there's this lag period where it's inequitable, and the rich get richer, and everyone's left scrambling to catch up. When you're an athlete like me... who didn't get renewed in my contracts right before COVID, part of you has to wonder, well, was it because I didn't have exclusive access to the early spikes and wasn't running ten seconds faster in the steeple? You know? Like it's just a weird part of the sport [shrugs]. (Ferlic 2021: 7:52 - 10:55, continued)

As an engineer, Ferlic understands that the technology is effective, and he understands the potential consequences of not using it — the extra ten seconds off of someone's 5k time could be the difference between making the Olympic standard or not, or getting your professional contract (i.e., your job) renewed — so he wears the shoes because he is “not an idiot.” Like Julian and Engels, he still believed his performances were influenced by his own training and fitness but he did not make the full rhetorical shift that Julian and Engels did when they denied or minimized the role the technology plays.

The perspective held by Ferlic exists in a tenuous middle zone between total acceptance and total rejection of the technology. It is shared also by Brooks-sponsored 2018 Boston

Marathon champion and world-best in the 50k, Des Linden, who has been known to counter with the simple response of “adapt or die” when questioned about carbon plate technology in competition shoes.⁶⁵ In one news article, she is quoted saying “I hate the concept... But I love the shoe” (Associated Press 2019).

Linden is one of many elite athletes whose shoe sponsor — Brooks, in Linden’s case — were left to play catch-up after Nike’s carbon plate designs burst onto the scene, but she has been careful not to condemn the technology altogether, recognizing that to keep her career viable, she would likely need to adopt it at one point or another. She draws her own careful line in the sand regarding technology development:

It is an arms race, and it should be a foot race... We should find out who the best athlete is and who can cover 26.2 [miles] better than the other person. Not who has the newest, greatest technology... I’m not sure how much I can say about the Brooks shoe. I’ve had conversations with them where it was like, is this ok to wear?... The technology is not something that is not available to the public. It seems like we’re in a good spot... Now that [the Nike shoes] are available, it’s everyone playing catch-up. I think that we can get there, but also, are they going to put a hard stop against how far this can go? (Zaccardi 2019)

By being very clear that the technology in her shoes is something that the public could theoretically have access to, Linden absolves herself of cheating or cheapening her own results by wearing secret super-shoes. The operative word there is *secret*: Linden will use new technology as long as it’s done in the “right way.” Still, she uses language analogous to that of Goucher and Hall when she makes a distinction between the “best athlete” and “who has the newest, greatest technology.” Of course, what one sees as the “right way” is dependent on the social framework in which one is operating.

When Julian and Engels use the rhetorical shift from praising the shoes to praising the athlete, the same shift seen in the Air Jordan and Shoe Therapy commercials, they are matching their thoughts about the technology to existing running culture. They are attempting to establish this paradigm shift in footwear as one that does not change the nature of the sport, but rather as one that could contribute to the sport’s overall goals. Linden and Ferlic praise the technology more begrudgingly and wish that the sport’s governing bodies had prevented it from taking over as completely as it did, but they nevertheless admit that it is effective. Regardless of their personal feelings towards the technology, they adopt it because it serves their purposes. It alters

⁶⁵ Recall, also, that Linden placed second in the 2016 US Olympic Marathon Trials in between Nike athletes Amy Hastings-Cragg and Shalane Flanagan, who were wearing the first prototypes of the Nike carbon plate shoes.

their relationships to their achievements, but they want to continue on in the sport, and the technology appears to be an inextricable part of that continuation.

As established in *Mile Two*, running exists as both a finite and an infinite game. Running became popular in the mid-twentieth century as a way for sedentary people to improve their overall fitness, and today running is used by many people as an escape from the tedium of daily life; thus, the infinite game of running is wrapped up in ideals of personal fulfillment, growth, and possibility. Finite, competitive running is focused on performance and competition, and on measurable, concrete changes (for better or for worse). Of course, competition is often also used to reach goals of personal fulfillment and growth — or in the case of professionals, to earn a living — and thus, the uses and meanings of finite and infinite games are not able to be separated entirely. The new shoe technology, which has a proven and positive impact on an athlete's running economy, can both help an athlete achieve their more ephemeral, infinite goals and also help them win finite races or improve on previous marks.

We have to be willing to accept that the shoes are and are not part of the athlete and that they are and are not responsible for their accomplishments. There is a continuum of opinions and reactions to this new technology: on one end, total acceptance, and on the other, a near-complete rejection. I believe the most productive stance is somewhere in the middle. The shoes are out there, and some aspects of the sport have changed, but the most important and recognizable parts of the sport, i.e., personal growth, fulfillment, achievement, and pushing the limits of human athletic performance, are still present. That does not mean that we should not still be taking a critical look at the technologies we use.

The shoes are tools, and like all tools, they carry with them a history and a politics that should not be overlooked. When we see shoes as external to the athlete, as a thing that they use but which is secondary to their interaction with the environment, we are ignoring the power of that tool. Shoes are an extension of the athlete's body. Their feet are literally encased by the fabric of the upper, supported by the foam of the midsole, and allowed a particular range of motion in the ankle and toe joints based on the geometry of the toe box, the heel drop, the laces, and the outsole. The experience of running is altered by the shoes — they are active agents in the activity, whether or not the athlete wearing them acknowledges this.

The Cool Down

We run, not because we think it is doing us good, but because we enjoy it and cannot help ourselves. It also does us good because it helps us to do other things better... The urge to struggle lies latent in everyone. The more restricted our society and work become, the more necessary it will be to find some outlet for this craving for freedom. No one can say, 'You must not run faster than this, or jump higher than that.' The human spirit is indomitable.

—Sir Roger Bannister
The First Four Minutes, pg 195

The development of the carbon plate shoes is not an isolated narrative; it can be connected to previous shoe designs and ideas about performance enhancing tools (both originating from Nike and from non-Nike sources). The shoes exist within the context of other examples of sports equipment that were introduced, caused controversy, and were banned, limited, or allowed to continue developing (skin-tight buoyancy-enhancing swimsuits and bicycle equipment/frame design fall into both of the first two categories, and clap skates in speedskating are most relevant to the latter). The shoes reveal tensions between finite and infinite games, fair and unfair, achievement and cheating, natural and artificial, legal and illegal, and between pure and impure sport. Through their creation and use, the shoes have challenged what is “essential” about running. Each of these dichotomies struggle with a definition problem. The categories of “natural,” “fair,” or “pure” have to be clearly demarcated in order to know when something definitively falls outside of them. The same definition problems are present in nearly every facet of our lives: upholding “religious freedom” is nearly impossible when a functional definition of “religion” is not provided,⁶⁶ to name just one example with relatively severe consequences.

I picked up the carbon-plate-shoe-controversy thread in the middle of its story. Over one weekend at the beginning of October 2019, Eliud Kipchoge’s sub-two-hour marathon in the INEOS 1:59 Challenge and Brigid Kosgei’s world-record-breaking Chicago Marathon win reset the clock in terms of what was believed to be humanly possible in the marathon. I spent a significant amount of time in the following days watching closely as the running world reacted,

⁶⁶ Religious studies scholar Winnifred F. Sullivan makes a compelling case for this in her 2018 book, *The Impossibility of Religious Freedom*. For an interesting, 25-minute podcast along similar lines, see the New York Times’ April 14, 2021 episode of *The Daily*, “A Legal Winning Streak for Religion,” which can be found here: [Barbaro \(2021\) A Legal Winning Streak for Religion](#)

primarily on Twitter, and I began to ask questions of my own. Some of those questions I have attempted to answer here, others are inherently unanswerable, and still more were beyond the scope of this project.

Both Kipchoge and Kosgei's feats were accomplished thanks to the help of Nike's carbon plate shoes, as well as developments in training, pacing, and a myriad of other factors that play into athletic performance. Earlier versions of the shoes they wore first had the potential to change performance outcomes in 2016, at the US Olympic Marathon Trials in Los Angeles. Networks of people had engaged in a discourse about the shoes beginning in 2016, but these debates exploded in late 2019. Throughout this period, academic and anecdotal evidence more or less proved that Nike's carbon plate shoes conferred a very real performance advantage to the majority of athletes wearing them.

Three general camps of thought emerged in these discussions: that the shoes were ruining the sport; that the shoes were impressive and not inherently damaging, but that they were introduced to the sport in a way that enhanced inequalities; and that the shoes were awesome and were helping to move the sport forward. The first and third categories are most easily identified: the internet, where one can find the widest variety of voices in the running community, does not deal well with nuanced opinions. The running culture in which all of these perspectives exist (in one way or another — running is not devoid of information bubbles or confirmation biases) is influenced by shoe and apparel companies, professionals (athletes and administrators in the sport), and those telling the story of the sport (through various forms of media, which includes both individuals and corporate marketing strategies).

People who saw the new technology as damaging were likely interpreting running as a sport in which tools were not historically embedded (which is true, if one is looking only at the *activity* of running rather than the *sport*). They were less willing to admit to the potential positive power of technology, focusing on the short-term inequalities and unfair use of the shoes (although I am obligated to reiterate here that “unfair” is a difficult term to employ decisively). Those who embraced the shoes were, in my opinion, often too quick to dismiss concerns over their use, and in taking a defensive stance in favor of the shoes, hindered discussions and deliberations over the place of technology in the sport. Those in the middle may have appeared to be existing in a contradiction: recall Mason Ferlic's interview with FloTrack in early 2021 where he won a track race wearing the new Nike spikes, acknowledged that the shoes likely

played a factor in his performance, and lamented that the shoes were ruining the sport of track and field all in the same breath. This moderate take is not the most attractive because it does not offer an easy answer — it does not call for an outright ban or a complete embrace of the shoes; rather, it calls for more careful consideration of technology as well as less secrecy and silence regarding the consequences (positive or negative) of that technology. How one puts that into practice is a question I am not able to answer, beyond offering this thesis as an extended consideration of technology in sport.

* * *

The truth is, in the really big picture, the shoes do not matter. If sports did not exist, the world would continue spinning and global economies would continue functioning. On a smaller scale, however, sport and performance are important to people, and these shoes mean something to the sport of running. Even in the midst of the deadly COVID-19 pandemic, we have continued to find a way to play sports. Blame it on capitalism, blame it on patriarchal ideas of value and violence, blame it on shallow gratification and selfishness, whatever you want, but the fact is that people want to keep playing. Nike's carbon plate shoes initially made me angry: I saw them as a threat, as a representation of everything I thought ruined running specifically and sport in general (see the negative examples listed in the previous sentence). Over time, I have come to see them as part of the intrinsic human qualities that also make us want to keep playing sports even in a pandemic: people are curious and competitive, people get bored, and, sometimes, people just like to do cool things.

These shoes are cool things — it is really cool that Kipchoge ran under two hours in the marathon. I no longer care what was on his feet (as long as there wasn't an outside motor propelling him) because that marathon is an achievement that belongs to him and to the team standing behind him. His legs did that. Their ideas and innovations did that. When Des Linden broke the world best 50k record (50k is a little more than 31 miles, and the difference between a world best and a world record is not worth getting into here), in Brooks' super shoes, I cheered from my kitchen — because she did that, and now there is another kind of race to get excited about (frankly, very few people paid attention to the 50k before Des did it). Sure, it is the shoes, but she also broke the record by over seven minutes. It cannot only be the shoes. The shoes are incredible, they help you run and recover faster, and also, people are really good at pushing themselves.

The carbon plate shoes have, obviously, forced me to think more critically about my sport and about what the achievements of my favorite athletes mean. What the shoes have not done is diminish my enthusiasm for the sport. If anything, they have increased it: in the process of writing this thesis, I have learned much more about racing shoes, running technology, the history of my sport, and the athletes I admire than I would have otherwise. In researching the definition of “professional,” I had the opportunity to geek out about the sport with some interesting and influential people — I had an email chain with a reporter at The Guardian whose articles were central to the development of my ideas presented here; I Instagram direct-messaged a professional runner whose races and story have inspired me for years; and on Twitter, I talked to the woman who edits my favorite running newsletter every week⁶⁷ and is a reliable source for running news. Without these shoes, I would have never reached out to them and made those connections, and I would have never explored the theories and ideas behind the sport that has been an integral part of my life since I was ten years old.

Additionally, the carbon plate shoes have, without a doubt, recalibrated what it means for a race to be a world-class performance, and they have forced the running community to reckon with their relationship to technology. The impact of the tools one uses to run possibly could have been obscured or ignored previously, but is now impossible to miss (Nike made sure of that when they produced huge neon pink and highlighter green super shoes). That does not mean that runners have stopped setting goals, or that people have stopped caring about running — the reality is often the exact opposite. For many people, the shoes have given them an opportunity to run faster than they ever thought possible, and this prospect has likely kept some people in the sport for a little bit longer than they may have otherwise.

Granted, I have never run a race or attempted to reach any goal while wearing any carbon plate shoe (primarily because all major races were canceled during the time I spent writing this thesis, secondarily because I am a little bit stingy) but as both a participant in and a fan of this sport, I no longer believe that the shoes are ruining athletics. Do I wish a company other than Nike had developed them? Sure, but the reality is that Nike has the resources to invest in crazy ideas and other brands often cannot do that in the same way. Do I still cringe when I see high school athletes lining up in a local race wearing \$250 shoes? Definitely, but runners in fancy

⁶⁷ Quick plug for Alison Wade’s *Fast Women* newsletter, edited by Sarah Lorge Butler: <http://www.fast-women.org/about/>

shoes are not unbeatable — Des Linden in the 2016 US Olympic Marathon Trials proved that before we even knew what the carbon plate shoes were.⁶⁸ And, importantly, do I still understand and sympathize with the people who think the shoes have caused irreparable damage to the sport? Absolutely.

* * *

There are lots of other things I would have liked to say or include in this thesis: unfortunately, this project was not the space for all of them (despite my best efforts to mention everything that came to my mind in the footnotes). For instance, in my discussion of the reactions athletes have had to the shoes, a fuller map of the running community could not be provided, and there were many voices cut out of that conversation. For every article, tweet, or interview I referenced, there are several more that I could not analyze or include, which is certainly not to imply that they would not have been valuable.

Additionally, much, much more could be said and needs to be examined regarding the governing bodies of this sport, as well as the consequences of the unique interplay between amateurism and professionalism in running. And what about race? I touched briefly on the disparity in participation between Black and White runners, but cannot claim to have discussed that topic in any measure of depth. Related to that question, do these shoes, and other expensive technologies, accentuate issues of accessibility? What is the history of access and participation in this sport? What impact have shoe and apparel companies, their advertisements, and their products had on that accessibility?

There is also the potential for a large body of comparative work to come out of this topic — nearly every sport has a moment or moments when a new technology is introduced which alters the way participants interact with the activity. Even within running, there are many technologies whose impacts have not, from what I have seen, been fully fleshed out or whose stories have not been widely told. I am thinking here of the foam pits that developed alongside Dick Fosbury's revolutionary high jumping flop technique; the alteration of javelin implements to make them harder to throw, thus requiring a resetting of records; the timeline of the development of various track surfaces (something I attempted to research for this project and for which I had a difficult time finding sources); or the evolution of mid-run nutritional strategies,

⁶⁸ I would be remiss to not also mention Abebe Bikila's gold-medal winning 1960 barefoot Olympic marathon; clearly shoes were not a determining factor there.
<https://www.olympic.org/videos/abebe-bikila-barefoot-to-olympic-gold>

from the runner in the 1904 Olympic Marathon in St. Louis who drank warm distilled water and “a concoction of strychnine and egg whites” (Abbott 2012) to the popular, high-carb, gelatinous goop that I used in my marathon last fall, to name just a few examples. Why did those technologies become what they are today? What controversies or characters are there to learn from in those contexts? How can we build our capacity to see the nuance in those developments and uses of technologies?

Returning to the carbon plate shoes specifically, and running shoes in general, do we understand the environmental impact of the shoes we wear? What happens to the shoes when we are through with them — an especially important question to ask ourselves given that the new carbon plate shoes do not last very long before being worn out. Many components of the shoes we wear are products of fossil fuels; some companies are exploring new ways to use renewable raw materials, but do those new materials have the potential to mimic the performance of the old ones? What kind of carbon footprint are we leaving behind when we lace up our shoes to go for a run? What more could we be doing to make this sport and its technologies “green”?

Given that the carbon plate shoe technology is still relatively new, there is little we know yet about how it will alter the sport going forward — will it draw in more fans? Will it drive them away? Will athletes be able to compete at a high level in longer careers? Will Des Linden’s 50k record accelerate the already rapidly increasing popularity of ultrarunning, and how will the shoes contribute to that, if at all? The differences between a “human” and a “technological” achievement could be discussed ad nauseum and were introduced only briefly here (relatively speaking). Furthermore, at the time of this writing, an exact understanding of how the shoes impact performance from a biomechanical standpoint and how to calculate the potential benefits to any particular athlete are still murky; but perhaps being unable to accurately predict and control human performance is not such a terrible thing.

Appendix

Table 1: World Athletic Competition Rules

<i>Rule</i>	<i>Pre-2020 Content</i>	<i>INEOS 1:59</i>
<i>Competition Rule 31. (Rule 260) World Records</i>	“A World Record shall be made in a bona fide competition which has been duly arranged, advertised and authorised before the day of the event... For individual events, at least three athletes... must be bona fide competitors in the event.”	Kipchoge was the only runner who completed all 26.2 miles, there were no other competitors.

Table 2: World Athletics Technical Rules 6 and 55

<i>Rule</i>	<i>Pre-2020 Content</i>	<i>INEOS 1:59</i>
<i>Technical Rule 6.3.1 (Rule 144) Assistance to Athletes (Assistance Not Allowed)</i>	“Pacing in races by persons not participating in the same race, by athletes lapped or about to be lapped or by any kind of technical device (other than those permitted under Rule 6.4.4 of the Technical Rules).”	Kipchoge’s pacers were switched in and out throughout the race, making them ineligible because they did not start running at the official start of the event.
<i>6.3.3 (Assistance Not Allowed)</i>	“Except for shoes complying with Rule 5 of the Technical Rules, the use of any technology or appliance that provides the user with an advantage which they would not have obtained using the equipment specified in, or permitted by, the Rules.”	Kipchoge’s shoes and the Nike carbon plate shoe line is a source of controversy (which prompted this thesis), with studies more or less proving their advantage for an athlete’s running economy and many runners arguing that such an advantage is unfair.
<i>6.4.8 (Assistance Allowed)</i>	“Electronic lights or similar appliance indicating progressive times during a race, including of a relevant record.”	A lead car projected laser beams on the road indicating the desired pace and positions of the pacers and Kipchoge. Similar light indicators have been used in other road and track races, and while some think these markers cheapen the efforts, it is technically allowed.
<i>Technical Rule 55.8.5 (Rule 240) Road Races</i>	“The Organisers shall delineate, [...] the area from which refreshments can be received or collected. [...] Refreshments shall be placed so that they are easily accessible to, or may be put by authorised persons into the hands of, the athletes. Such persons shall remain inside the designated area and not enter the course nor obstruct any athlete. No official or authorised person shall, under any circumstances, move beside an athlete while they are taking refreshment or water.”	Event officials handed refreshments directly to Kipchoge during the event while the officials rode in moving vehicles alongside him.

Table 3: World Athletics Technical Rule 5

<i>Rule</i>	<i>Pre-2020 Content</i>	<i>INEOS 1:59</i>	<i>January 2020 Amendment</i>	<i>July 2020 Amendment</i>	<i>December 2020 Amendment</i>
<i>Technical Rule 5.2 (Rule 143) Clothing, Shoes and Athlete Bibs</i>	<p>“Athletes may compete barefoot or with footwear on one or both feet. The purpose of shoes for competition is to give protection and stability to the feet and a firm grip on the ground. Such shoes, however, must not be constructed so as to give athletes any unfair assistance or advantage. Any type of shoe used must be reasonably available to all in the spirit of the universality of athletics.”</p>	<p>Kipchoge’s shoes were unique, unreleased prototypes. Any shoes closely resembling those he wore during the event were not available until mid-2020.</p>	<p>[Continued from “the universality of athletics’ at the end of the pre-2020 content] “To meet that requirement, any shoe that is first introduced after 30 April 2020 may not be used in competition unless and until it has been available for purchase by any athlete on the open retail market (i.e. either in store or online) for at least four months prior to that competition. Any shoe that does not meet this requirement is deemed a prototype and may not be used in competition.”</p>	<p>[Continued from “the universality of athletics’ at the end of the pre-2020 content] “To meet that requirement, for any shoe first introduced after 31 January 2020, the transition note (Note ii.) below shall also apply, any shoe that is first introduced on or after 9 August 2021 may not be used in competition unless and until it has been available through the Athletic Shoe Availability Scheme as referenced in Note ii. (a) below. Any shoe that does not meet this requirement is deemed a prototype and may not be used in competition.”</p>	<p>[Continued from “the universality of athletics’ at the end of the pre-2020 content] “To meet that requirement, for any shoe first introduced after 31 January 2020, the transition note (Note ii.) below shall also apply, any shoe that is first introduced on or after 9 August 2021 may not be used in competition unless and until it has been available through “the Athletic Shoe Availability Scheme” as referenced in Note ii. (a) below. The use of a Development Shoe (defined in paragraph (f) below) or any other similar type of shoe is set out in the transition note (Note ii.)”</p> <p>“Note (ii): Transition Period 31 January 2020 to 8 August 2021. This note has been inserted in recognition of the fact that on 15 July 2020 a Working Group on Athletic Shoes has been established by Council which by the end of the year 2020, in collaboration with manufacturers, will review the entirety of this Rule 5 as it applies to shoes by the end of the year 2020. The following notes (a) to (t) will assist in guiding all stakeholders with the practical application of this Rule 5 as it applies to all shoes (unless otherwise specified, meaning road, cross-country or track and field shoes) until and including, 8 August 2021. This Rule 5, as it applies to shoes, covers International</p>

					<p>Competitions and competitions sanctioned by Member Federations where it is decided the Rules and Regulations shall apply.”</p> <p>“(f) ‘Development Shoe’ means a shoe which has never been Available for Purchase but which a sports manufacturer is developing to bring to market and would like to conduct tests with their sponsored athletes (who agree to test the shoe) on issues such as safety and performance before the shoe is Available for Purchase.</p> <p>(g) Development Shoes are not permitted to be worn at the World Athletics Series and the Olympic Games.”</p>
5.2.1	Did not exist	Kipchoge’s shoes were unique prototypes, and their exact specifications are unknown.	<p>“A shoe that meets the criteria set out in this Rule 5 may be customised to suit the characteristic of a particular athlete’s foot. Shoes made to order to suit the characteristics of an athlete's foot or other requirements are not permitted.”</p>	<p>“However, one-off shoes made to order (i.e. that are only ones of their kind) to suit the characteristics of an athlete's foot or other requirements are not permitted.”</p>	No further change.
5.13.1	Did not exist.	Due to a prior patent application for shoes that looked similar in design, it was rumored that Kipchoge’s shoes had two carbon-fiber plates in the midsole. This is unconfirmed, and no current Nike shoes	<p>“Until further notice, unless specifically agreed by World Athletics in writing, any shoe used in competition: (save for where Rule 5.13.2 applies) must not contain more than one rigid plate or blade made from carbon fibre or</p>	No further change.	<p>No further change, but a note was added:</p> <p>“Note (i): The one rigid plate or blade referred to in Rule 5.13.1 may be in more than one part but those parts must be located sequentially, in one plane, not in parallel (i.e., not stacked above each other), and must not overlap.”</p>

		have more than one plate.	another material with similar properties or producing similar effects, whether that plate runs the full length of the shoe or only part of the length of the shoe”		
5.13.2	Did not exist.	Kipchoge’s shoes did not feature spikes. This rule, however, has implications for competitions on the track and in cross country races.	“[Any shoes used in competition] may contain one additional rigid plate or other mechanism only where used solely to attach spikes to the outer underside of the shoe.”	No further change.	No further change.
5.13.3	Did not exist.	Kipchoge’s shoes likely had a sole thickness of at least 39mm, similar to the Nike Alphaflys.	“[Any shoes used in competition] must have a sole with a maximum thickness of no more than 40mm (save that any shoe that contains spikes must have a sole with a maximum thickness of no more than 30mm).”	No further change.	No further change regarding road shoes, however, a table was added to set out the maximum thickness of shoes in other events (field events, triple jump, track events including hurdles and steeplechase, cross country, and “events under Rule 57 of the Technical Rules”).

Figure 5: Kipchoge's Marathon Times

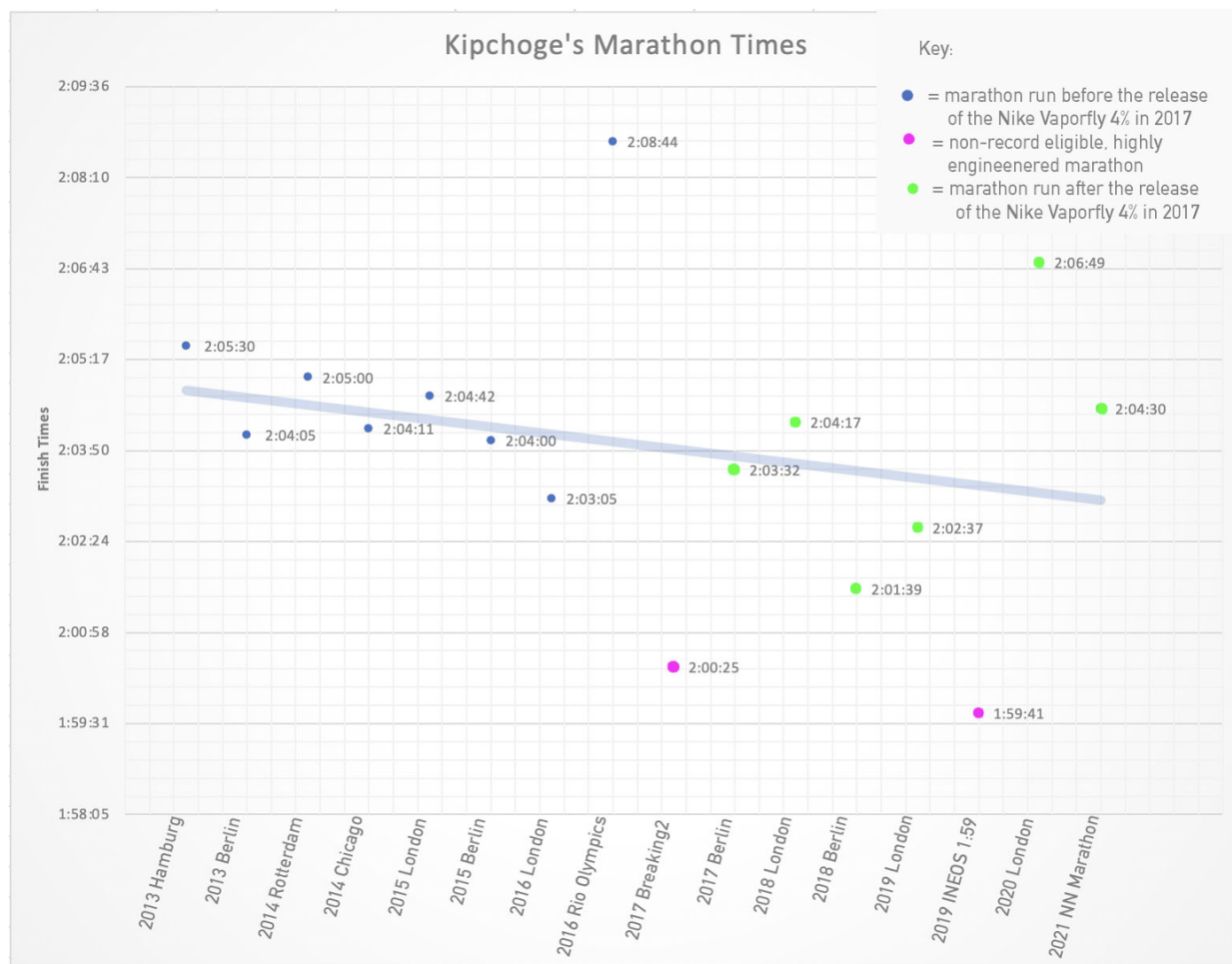


Figure 5: All of Eluid Kipchoge's marathon times (up to May 2021) and linear trendline. Table created by Hannah Martin with data from Kipchoge's World Athletics Athlete Profile and Nike News 2019.

Figure 21: Carbon Plate Racing Shoe Models Organized by Year of Release

2017	2018	2019	2020	2021
 <p data-bbox="240 457 409 478">Nike Zoom Vaporfly 4%</p>	 <p data-bbox="487 499 646 520">Hoka Carbon Rocket</p>	 <p data-bbox="711 457 912 478">Nike ZoomX Vaporfly NEXT%</p>	 <p data-bbox="950 441 1169 462">Nike Air Zoom Alphafly NEXT%</p>	 <p data-bbox="1218 472 1380 493">Asics Metaspeed Sky</p>
		 <p data-bbox="755 609 868 630">Hoka Carbon X</p>	 <p data-bbox="958 577 1169 598">Adidas Adizero Adios Pro</p>	
			 <p data-bbox="966 714 1153 735">Saucony Endorphin Pro</p>	
			 <p data-bbox="974 871 1144 892">Brooks Hyperion Elite</p>	
			 <p data-bbox="990 1018 1112 1039">Asics Metaracer</p>	
			 <p data-bbox="966 1144 1161 1165">New Balance Fuel Cell TC</p>	

Figure 21: Carbon plate racing shoe models organized by year of release. Table created by Hannah Martin with data and images from Metzler 2019; Brooks Sports, Inc. 2020; Dengate 2020; Law 2020; Mazzuchi 2020; Singh 2020; Nike 2021; and Runners Lab 2021.

Figure 35: Marathon World Record Progressions

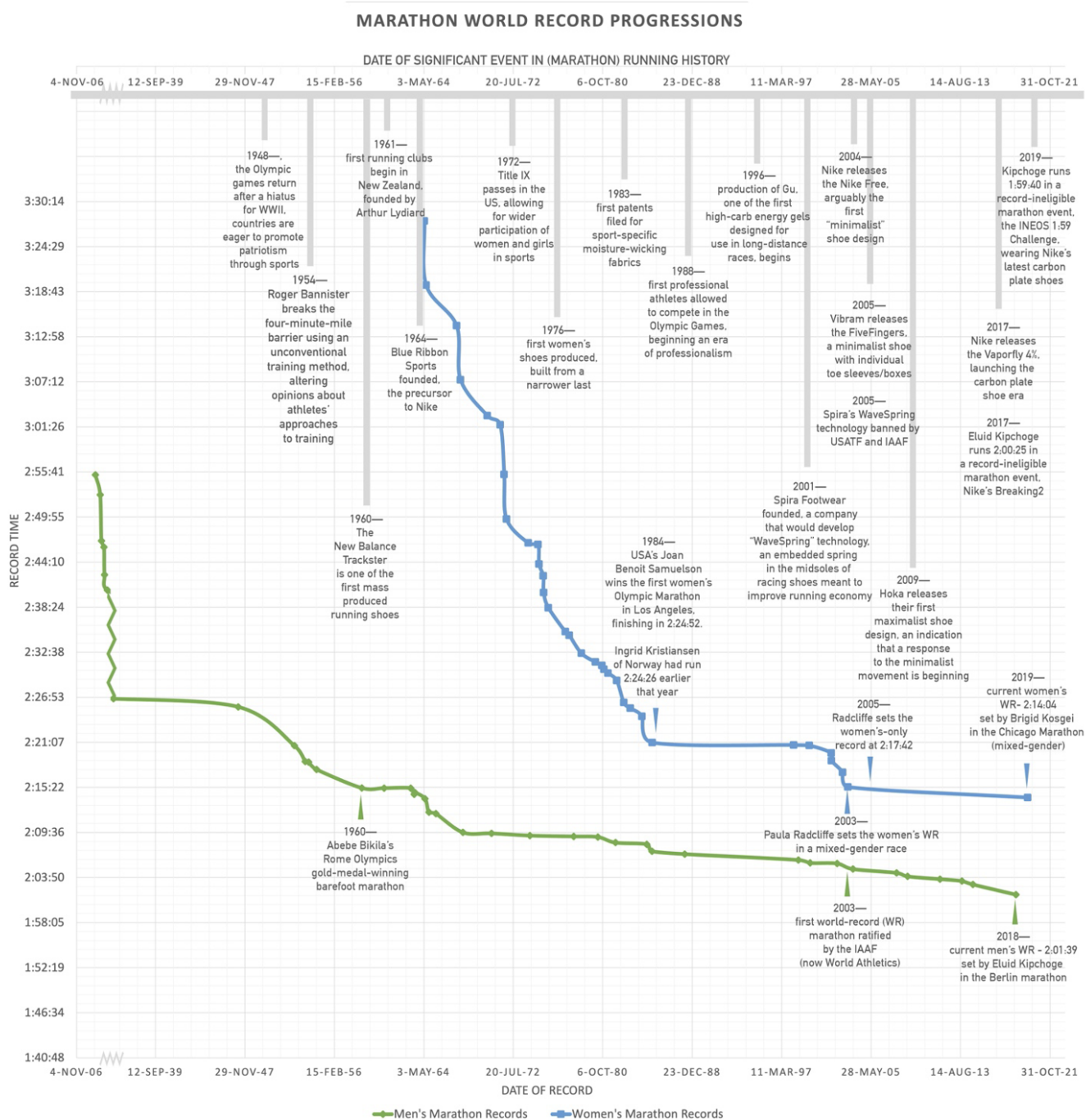


Figure 35: Progression of world records in the marathon (1906-2019) graphed along with notable moments in running history. Table created by Hannah Martin with data from Butler 2011; Green 2012; Gu Energy Labs 2021; Kuznetz 1985; Moran 1984; Roos 2020; Thomas 1985; World Athletics, "World Record Progression of Marathon. Female, Senior, Outdoor" 2021; World Athletics, "World Record Progression of Marathon. Male, Senior, Outdoor" 2021

Archive of Tweets Related to the Carbon Plate Shoes

I began bookmarking tweets that felt relevant to the topic of Nike’s carbon plate “supershoes” following the INEOS 1:59 Challenge on 12 October 2019, and I am in no way claiming that this archive is a complete picture of what the running community (which has no clear boundary or definition) said in response to this technology. However, these tweets were my primary sources for the analysis presented in this thesis and they influenced my approach to this topic in a variety of ways. Because of this, and because social media can be such a difficult thing to cite or return to in the future, I wanted to reference them here for any interested readers.

The tweets collected here are limited by the network I have created on my personal Twitter account, which tweets I saw and interacted with, and what I determined to be “relevant” to the topic at hand — I can only see what is said by those I follow, what is “re-tweeted” by them, what is “liked” by them, or what is occasionally shown to me based on a Twitter algorithm. I have not edited any of the text included in the body of the tweet and have done very little in terms of reformatting what was copied and pasted into this document (admittedly, the formatting I did do is not uniform all the way through either). As best I could, I demarcated which tweets were stand-alone; which were part of a “thread” of messages replying to each other; and which were “quote-tweets” in response to an earlier tweet, which I also tried to include for context. The name and Twitter handle of the person writing the tweet appears directly above their message, and the date and timestamp typically appears directly below the text, although in some cases this data is below the name and handle. A horizontal line delineates between distinct tweets or threads.

The 63-page document with archived tweets can be found here:

<https://drive.google.com/file/d/1LVV5pgKtVsIn2Td0ki0BIZod2IA6prb/view?usp=sharing>

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