Spanish Philosophy of Technology – Contemporary Work from the Spanish Speaking Community

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Part IV. New Technological Frontiers

Part V. Case studies

Technique and Technology in the Practice of Distance Running

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Abstract Recent accounts of the development of the philosophy of technology identify a distinct empirical turn in the 1980s and 90s (Mitcham, Kroes, and Meijers, 2001; Brey, 2010) characterized by a focus on specific technologies and an understanding of technology as a contingent product of a heterogeneous array of factors. In this contribution, I explore the overlaps of this so-called empirical turn with other research fields such as science studies, practice studies or even consumer research via a case study on sports technology, that of the running shoe.

1. Introduction

In his well-known book *Thinking through technology* (1988), Carl Mitcham divided philosophical research on technology into two broad traditions: engineering philosophy of technology and humanities philosophy of technology. Over the following decades, the field has developed and spread, rendering it difficult to sustain the distinction between a pro-technology and analytic attempt at a technological philosophy and a critical and interpretative reflection on technology itself. Bringing order to such diverse and divided research area is not an easy task, even more so because the philosophy of technology cannot be neatly separated from other analyses of technology.

Recent accounts of the development of the philosophy of technology identify a distinct empirical turn in the 1980s and 90s (Mitcham, Kroes & Meijers 2001; Brey 2010). While classical philosophy of technology focused largely on technology in general, new research following the empirical turn focuses on specific technologies, understanding technology as a contingent product of a heterogeneous array of factors

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including social aspects. This narrower perspective, centred on particular case studies, departs from traditional philosophical approaches to technology as a phenomenon. It thus avoids global deterministic stances regarding technology as a whole, as well as both indiscriminate technophilia and technophobia. This so-called empirical turn shares a great deal of cross-fertilization with other research fields such as science studies, practice studies or even consumer research (Ingram, Shove & Watson 2007).

Where these research traditions overlap, it is possible to track the evolution of technologies understood as complex systems of materiality, practices, and meanings in context. In this chapter, I will explore these overlaps via a case study on sports technology, namely that of the running shoe. The birth of the modern running shoe can be related to the social boom in running culture that commenced in the 1960s and 70s and underwent a second revolution around the turn of the century. Since then, as a technological artefact, the running shoe has been transformed from a rather simple protection of the foot to a high-tech tool. This case study has an additional element of interest. The recent emergence in recreational running of an "anti-technology" movement that defends the benefits of barefoot running may be understood as the advent of a new social group that has destabilized the technological trajectory of running shoes, promoting the introduction of new lines of research and technological innovation.

Running cultures and running shoes are being simultaneously produced in these case study, in a process that challenges extensionist views of technology, displays the co-evolution of humans and non-humans, and shows the interchanging roles of experts and lay users. The history of the running shoe could thus provide some insights into the evolution of practices, technologies, and users in "context", bringing together different approaches involved in the empirical turn in research on technology.

2. The empirical turn and its consequences

Bicycles may be a good starting point for discussing the empirical turn and its consequences. In 1984, they were the case study chosen by Wiebe Bijker and Trevor Pinch to present their Programme on the Social Construction of Technology (SCOT). Stabilized technologies, they argued, are the contingent product of complex processes of variation and selection, in which social groups and their interest shape artefacts by selecting among competing designs for a given technology in construction. In their seminal paper, Bijker and Pinch (1984) took the air tyre as an example of the power of dominant social groups to impose their concerns and definitions of the artefact, i.e., their power to shape technology.

However, bicycles were also used as a case study to point out some limitations of the original SCOT programme. In their insistence on relevant social groups, Pinch and Bijker not only forgot about "irrelevant" social groups (Winner 1993), but also about social and cultural meanings at large. A decade after the appearance of bicycles on the science studies map, Paul Rosen (1993) returned to them, arguing that the "invention" of mountain bikes around 1980 reveals some shortcomings of the SCOT approach as

regards the nature and agency of social groups and the wider social context. His main problem with Pinch and Bijker's approach is their simplistic account of society, made up of underanalysed "relevant social groups" and a never reached "third stage" of wider social factors. In Rosen's reconstruction of the history of the mountain bike –its origin, development, and current precarious stabilization–, he maintains that the "wider social context" is essential to understand both the shaping of technology and the nature and dynamics of the "relevant social groups" involved. Social context, Rosen argues, cannot be a final and secondary step, because social groups and their problems cannot be accounted for without it. Somehow paradoxically, according to Rosen, SCOT analyses tend to focus on the inner workings of technology, thereby losing the crucial information that its social context can provide.

In Rosen's view, social and cultural meanings, marketing strategies and economic forces show up as relevant factors in the modelling of technologies. Born out of the drive and creativity of a bunch of Californian young bikers in the 1970s, mountain bikes have developed from an artisanal artefact made from junk parts of old bicycles for their mountain adventures into a complex technological product made up of parts manufactured all over the world. In modern mountain bikes, meanings of nostalgia and adventure are combine with a post-Fordist industry that promotes decentralization and constant innovation, making stabilization improbable. In this new context, marketing strategies gain relevance. The mountain bike industry creates at one and the same time both products for markets and markets for their products, selling nature –what Rosen (1993, p. 499) calls "de-modernizing themes of frontiers, pioneers, adventure, wilderness…"– through technology. These strategies give rise to new social groups of mountain bikes enthusiasts attracted by appeals to nostalgia and youth. Mountain bikers, including those who use their bikes mostly to move around the city, subverting the original technological script, are constructed in the same processes as the artefact itself.

While the original SCOT approach focused on stabilization, modern mountain bikes are only partially stabilized artefacts. Their design is continuously changing in order to attract consumers and produce increasingly specialized bikes. As new type of bikes for new social groups emerge at each step, diversity rather than stabilization becomes the norm (Rosen 1993). Moreover, following post-Fordist trends, bicycle production is nowadays radically marked by delocalization. Design, frames, and other components are manufactured and assembled at different geographical locations, giving rise to political and economic issues well beyond the original SCOT approach.

The "seamless web" (Hughes 1986) of mountain bikes and their social, cultural, and economic context presented by Rosen becomes even broader-ranging as later analyses explore the co-production of bike technology and bike culture (Rosen 2002). A rather simple technological artefact, like a bicycle, is embedded in complex "sociotechnical ensembles" (Bijker 1995),[105] composed of social and material relationships between

[105] According to Bijker, the "sociotechnical ensemble" as a unit of analysis refers to Callon's principle of general symmetry, "society is not determined by technology, nor is technology determined by society.

industry, users and their diverse interests and needs, sport authorities, environmental problems, and policies. These interactions are inscribed in the artefact bicycle, which evolves as a result of them. Rosen narrates the rise of different "bike countercultures" resisting the stabilization of the artefact brought about by the cycling industry and sports regulations. These appropriations of the bicycle reflect positions of resistance: to the pervasive "car culture", the constraints on innovation imposed by the interests of the industry, and the invisibilization of female riders in bicycle design. Through widening his focus, Rosen enters the field of the politics of technology.

As a paradigmatic case study of contemporary social-oriented analysis of technology, bicycles exemplify a number of common trends in a family of approaches emerging from the social constructivism of the 1980s. Technologies and societies are mutually shaped in processes of co-production, transcending both social and technological determinisms. Technology, economics, politics, and culture (material and social elements) develop together in the construction of technological systems. Of course, together with their design, technologies carry "scripts" that guide their use and impacts (Akrich 1992), reach "momentum" (Hughes 1987) or present "obduracy" (Bijker 1995), making them difficult to revert. Technology is a powerful modelling force of our societies. However, technology is not autonomous in the strong sense of the term. Human agency plays an active role in maintaining stabilized technologies and has the capacity to destabilize, resist and rewrite "scripts". Technology, even simple artefacts, is political and has politics in a variety of senses. A growing number of voices are now calling for what Brey (2014) terms a constructive philosophy of technology, implied in the solution of social problems. Although Brey does not think this constructive analysis of technology should also be necessarily constructivist, ten years earlier, Wiebe Bijker (2003) had argued that STS scholars may be the answer to the need for public intellectuals committed to technology problems.

Bicycles also reveal the interest and complexity of everyday technologies. "Mundane technologies", as opposed to exotic or novel technologies, are those so integrated in our lives that they remain mostly unnoticed, i.e., they are taken for granted (Michael 2000a, 2000b). While many analyses of the social impact of technology tend to focus on technological systems linked to radical social changes, such as information technologies and biotechnology, mundane technologies permeate our everyday life, serving the "production and reproduction of local social configurations" (Michael 2000a, p. 3). We might likewise add, they are also a potential locus for resistance and reconfiguration. Mundane technologies carry scripts that guide our lives in conjunction with them, but they are also appropriated by their users in unexpected ways. The 'context' of a technology (if such a term may still be applied) is constituted both by the conditions of its design and production and the practices of its users.

Bicycles as a case study show, all in all, that, through the empirical turn, social-oriented philosophy of technology in a sense weaves its own "seamless web" with

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Both emerge as two sides of the sociotechnical coin during the construction processes of artifacts, facts, and relevant social groups" (Bijker 1995, p. 274).

social studies to build an image of technology as a process of production of unstable sociotechnical ensembles in which material, social, organizational, and symbolic elements converge. Research on technology has come all the way from macro to micro analyses and back again; although this time against the backdrop of well-developed case studies. Recent attention to "mundane technologies" and the particularities of their interaction with their users points to yet another common space that the philosophy of technology may share with a related "turn" in science studies: the turn to practice (Pickering 1995; Satzki, Knorr-Cetina & von Savigny 2001; Shove & Pantzar 2005).

I will follow the thread from the paradigmatic example of bicycles to present sport as a field where co-production can be seen in action. Sport offers a wide range of opportunities to explore "the coevolving relation between human and nonhuman actors (objects) jointly implicated in the process of 'doing'" (Ingram, Shove & Watson 2007). Practice-oriented approaches, focused on the interlocking between human competences or skills and materialities, are well suited to analyse these relations and may offer a more integrated image of sociotechnical ensembles.

3. Technology and sport

Technology and sport have a long history of fruitful relationships. Science and technology play a leading role in the huge progress in terms of records in every discipline. Lighter bicycles, swimsuits that improve performance, oxygen equipment for Himalaya climbers… the list is unending, as is the controversy surrounding most of these technological innovations applied to competitive sport (Dyer 2015). Full body polyurethane computer-designed swimsuits, for example, were central to 98% of Beijing Olympic Games medals and were banned by the International Swimming Federation the following year. Now forbidden as a sort of 'technological doping', these innovative swimsuits show that the boundary between what is legitimate and what is cheating, between what the human body is able to do on its own (whatever that means) and what technological mediation allows it to do, is continuously being negotiated and reconstructed in each episode of technoscientific development and human ambition.

Classic extensionist accounts of technology assume a transparent relationship between artefacts and bodies (Brey 2000). Technologies may boost speed, endurance, or any other ability humans need to excel in sport. Moreover, they do so by extending human capacities. While Paralympic athletes compete with artificial legs substituting their missing natural limbs, able-bodied competitors use technology to enhance the way their natural body perform. In both cases, however, this supposed transparency of technological mediation may be put under scrutiny. Technology does not substitute or enhance human organs and functions innocently. Its alliance with human bodies creates difference and transformations (Kiran and Verbeek 2010).

German long jumper and amputee Markus Rehm is a good example. The Paralympic champion did not succeed in his attempt to compete in the Olympic Games held in Río de Janeiro (2016) alongside able-bodied athletes. Experts were not able to agree on the advantage his prosthetic leg could give him in the take-off of the jump because of the

springiness of his carbon-fibre limb, while allowing that this same limb makes his approach run less efficient. The long jump with a prosthetic leg seems to be quite different than jumping with two natural legs. Substitution is not a simple act.[106]

In the realm of sport, the examples of how new technologies do not result in improved performance, but in a different kind of performance, abound. The artificial does not simply adds to the natural, but reconfigures it. The introduction of klapskate, for instance, signalled a revolution in speed skating (van Hilvoorde, Vos & Wert 2007). In modern klapskates introduced at the end of 20th century, the boot is attached to the blade by a hinge at the front. This way, the movement of the foot is smoother and allows the skater to reach a greater speed than when using traditional rigid skates. The new technology also implied that skaters should re-learn how to perform, i.e., new skating technology called for new skating technique, leaving behind those skaters unable to adapt. The way new artefacts combine with athletes' bodies and skills requires turning the focus to practice (jumping, skating, etc.), where, as active agents, users of the technology become key elements in its understanding. Humans and non-humans together constitute the practice of the sport.

Applying practice theory to innovation and consumer research, Shove and Pantzar (2005, 2010) conceptualized practices as active combinations of materiality, meanings, and skills.[107] They present the invention of Nordic walking, their case study, as a novel integration of pre-existing elements: the skill of walking, the stick as an artefact, and images that relate to wellbeing, health, sport, and nature. In order to stabilize Nordic walking as a sport, the practice of walking with sticks should be separated from the disability arena to associate it with the practice of sport as a way to attain health and wellbeing. Walking with sticks should be something sportier than a simple walk, but nothing as hard and strenuous as other sports in which sticks are used, such us mountaineering or cross-country skiing. It also requires learning the correct technique that characterizes this new sport and differentiates it from the unconscious customary walk to transform it into an expert act with a specific end in itself. Moreover, these combinations of elements are typical of each geographical and cultural context, so that transferring Nordic walking from Finland to other countries consists, according to Shove and Pantzar, in reinventing rather than exporting.

Running for running's sake, not for survival or competition, also had to be invented as a cultural practice. Meanings of wellbeing, health, achievement, and community have developed at the same time as material commodities (apparel, shoes, technologies such as GPS watches, heart monitors, and hydration systems) and the needed skills to

[106] Bionic limb expert Hugh Herr, recent Princess of Asturias Award for Technical and Scientific Research (2016), is another excellent example. A gifted rock climber from his youth, he had both legs amputated after a mountain accident and directed his efforts to fight disability. His smart prostheses are much more than simple 'artificial legs', and his mission to end disability is continuous with the dream of human enhancement through the merging of body and technology.

[107] Their emphasis on material mediation as an essential component of practices is based upon Schatzki (2001), as opposed to alternative analyses of practices such as Bourdieu's, which focuses on routine and repetition.

perform the action. Professional and amateur athletes, coaches, industry, retailers, and race organizers, among other social groups, have shaped the contemporary practice of running in interaction with all these elements, constructing it as a hybrid space in which the boundaries between science and culture, lay users and experts, become blurred. The final result, recreational running, is precariously stabilized in that space, in which users play a creative and active role through their shared practices, experiences, and knowledge (González García 2012).

4. Running as practice and culture

Long distance running is becoming a growing religion. Portrayed as a community of practice, a social world, a culture, a market, a boom or a hype, the Western practice of running has experienced an amazing boom over the last 50 years, the time lapse in which the more laid back practice of jogging has been transformed into the serious running, an activity that deserves academic analysis from a number of different approaches in social sciences and humanities, from sociology and psychology to geography, philosophy, and consumer research (Bale 2004; Bridel, Markula & Denison 2016; Latham 2015).

In our post-everything society, running serves as a way to get fit, socialize, seek out achievable challenges, or improve one's self-esteem. Recreational running is much more than a simple leisure activity. It shapes not only bodies and minds, but also landscapes, wardrobes, and timetables. Running is now routine, a habit, a normalized activity in Western societies, where runners of all ages and aptitudes have become taken for granted as occupants of streets, parks, mountains and pathways.

Running as a sports activity for the general population emerged in New Zealand in the 1960s. (Lantham 2015). Track and field coach Bill Bowerman, the founder of Nike, exported the practice to the USA in an attempt to solve health problems linked to sedentary urban life. The history of the running boom is thus relatively independent from professional athletics, although there are obvious overlaps. The first running boom arose as part of a *recreational (r)evolution* that normalized the public display of physical activity (Scheerder, Breedveld & Borgers, 2014), previously confined to specialized sports facilities such as gymnasiums and play courts. Desinstitutionalized and desportified, leisure running parted ways with competitive running, changing its scenario from the track and field court to roads, parks and other public spaces.

A second running boom took place around the turn of the century, this time characterized by the fragmentation and diversification of its practitioners. Running became a more democratic activity, spreading to previously excluded groups, paradigmatically women and the elderly. The social group of recreational runners is nowadays composed of a diverse array of people. As running became more popular, business around it flourished (Scheerder, Vos, & Taks 2011). Consumer segments may thus be an appropriate way to classify social groups of runners according with their willingness to acquire running-related goods (such as a pair of running shoes),

experiences (such as entering to run a marathon), or expertise (such as a coach or a physiotherapy service).

Bowerman devised training logs for joggers based on the sophisticated training schedules of his athletes. Since then, the gap between professional track and field and recreational running has widened. Nowadays, however, long distance running has become a peculiar sport in which amateurs and professionals compete alongside one another in many events. In major world marathons, such as those of New York, Boston, Berlin and London, elite runners pursuing records or economic prizes run together with thousands of more or less dedicated amateur runners. Almost 50,000 runners finished the most famous marathon in the world, the New York City Marathon, in 2015. In Spain, Barcelona holds the most popular marathon, in which more than 15,000 runners took part in 2016. Professionals and amateurs share the roads in competitions and also share running-related technologies, although running may constitute a very different practice for each group.

5. The technology of running

Running seems a simple matter, the most natural sport, based on an ability we all acquire very early in our childhood. However, contemporary runners are equipped with a growing number of artefacts: shoes, clothes, heart rate monitors, GPS devices, smart watches, hydration systems, compression garments, sport drinks, and so on. Even complex training schedules and nutrition planning may be considered part of the technologies of running. Among all these, shoes are the most obvious and apparently unavoidable tool for safe and efficient running. “A pair of comfortable shoes” is all the jogger needs to go out on the streets, according to the pioneering 1963 pamphlet *The Joggers Manual* (Lantham 2015).

The advice of looking for a “pair of comfortable shoes” was indeed a great tip for those running novices pounding the pavement in their first miles. Nowadays, long distance runners, both amateurs and professionals, carefully choose the shoes they will be training and racing with. Especially in the case of marathoners and ultramarathoners, a wise selection of shoes is key to success. In a marathon, faster runners will be running for something more of a couple of hours. Runners at the end of the pack will need 5 or 6 hours to complete the 26.2 miles. Such a prolonged effort requires careful attention to one’s feet. A bad choice may make what is already an extreme experience unbearable. The best pair of running shoes is in fact that which goes unnoticed, a perfect mundane technology that is taken for granted. However, not even running shoes are compulsory. At the same time as the first jogging boom began to emerge in America, Abebe Bikila ran and won the Olympic marathon in Rome barefoot (1960).

The emergence of the running shoe has in fact been described as a consequence of the spread of the practice of jogging (Tenner 2004). From the “comfortable pair of shoes” of the 1960s to modern and highly specialized trainers and racing flats, the history of the running shoe may be written alongside the history of the running craze. This most basic piece of running equipment has experienced a slow, yet evident,

evolution since the advent of the jogging boom. Running shoes have progressively incorporated new technologies at the same time as running has gained in popularity among the Western urban population (Shorten 2000), constituting a growing market for athletic footwear companies.

Converted into a complex artefact that needs expert knowledge for its selection, the running shoe has taken on new meaning as a tool to avoid injury, a crucial goal in the social world of runners. Although the general population was advised to take up running as a healthy activity, an excessive amount of recreational runners get injured every year. Muscles, tendons and joints suffer the repetitive impact of running and modern trainers promise to help elude these side effects: Achilles tendinitis, plantar fasciitis, runner's knee, shin splits, IT band syndrome and the like.

The trainer that has become consolidated over the last 30 years is a well-cushioned shoe, with a drop of approximately 12 mm from heel to toe, and with arch support. Cushioning developed in order to decrease the impact of each stride, under the assumption that reduced impact will prevent injuries. High heel-to-toe drop was meant to reduce stress on the Achilles tendon, while arch support is supposed to help overpronating runners.[108] The modern running shoe thus evolved from the 1970s and 80s to the beginning of 21st century, gaining weight through systems of cushioning, stability and control, guiding foot movement to reach an ideal stride, and elevating it from the terrain to absorb impact.

Choosing running shoes is a complex decision. Factors like the weight and sex of the runner, footstrike pattern, training speed, weekly mileage, and usual running surface are relevant factors to consider. Expert advice, usually from retailers or podiatrists, has become the recommended practice for the responsible runner.

6. From technological to natural running

However, several studies published from the late 1980s state that the aforementioned allegations are not backed up by scientific evidence (Frederick 1986). What evidence does seem to show is that, at best, high-tech running shoes do not prevent injuries; and, at worst, they may be a risk factor for injury. Steve Robbins, an enthusiastic advocate of 'freeing' feet, published a series of papers as early as the late 1980s arguing that contemporary running shoes were mainly to blame for the running injury epidemic (Robbins & Hanna 1987; Robbins & Gouw 1990, 1991). According to Robbins and his co-authors, as footwear reduces sensory feedback, runners on modern shoes unconsciously underestimate the impact of each step, overstriding and pounding the pavement heavily with their heels. Barefoot runners, however, who get direct feedback from their naked feet, absorb the shock more efficiently by landing on the forefront or mid-part of their feet and shortening their strides. Long-term use of shoes also weakens

[108] A runner overpronates when the inward rotation of his or her foot is excessive during running, flattening out the arch foot. Overpronation is related to a number of injuries (Hintermann & Nigg 1998).

natural foot structures, well adapted for barefoot running, making them more prone to injury.

Scientific warnings regarding the difficult relationship between running shoes technology and injuries have developed over the years hand in hand with the increasing reliance on the technological fix prescribed by shoe makers, retailers, and podiatrists. However, the growing dissatisfaction of some groups of runners eventually gave rise to a new understanding of the practice of running and the role of technology. The bestseller *Born to run* (2009) constituted an important turning point in the social perception of running shoes. Mixing narrative and essay, journalist and amateur runner Christopher McDougall relates the story of his redemption from persistent injuries through barefoot running. Scientific literature on human evolution and running biomechanics, together with the experiences of traditional running communities such as the Tarahumara from Mexico, make up an allegation against the technologization of running. McDougall denounces shoe companies for selling science and technology without evidence. According to the new credo, the human species is naturally adapted to running, though not with those heavy, cushioned, motion-control shoes sold at speciality stores, but rather… barefoot.

Anthropology Professor at Harvard University Daniel Lieberman stands out as the scientific authority backing up McDougall arguments. His *Nature* paper (Lieberman 2010), in which he compared contemporary the footstrike patterns of shod and barefoot runners, put the debate on the scientific map. Lieberman argued that humans have run barefoot or almost barefoot during all their evolutionary history and that human anatomy is well adapted to long distance running. By comparing footstrike patterns, he showed that barefoot runners tend to land on their forefoot or midfoot, while runners shod with modern trainers do so on their heels. Heelstriking is only made possible by bulky, well- cushioned shoes, because otherwise it is too painful. With their cushioned sole and high drop, running shoes change the way we humans are adapted to run and are responsible for a good number of common injuries. The technological fix does not protect runners from injuries; it causes them. It was marketing, not science, what has got runners to buy extremely expensive artefacts that offer them no benefit (Clighan et al. 2008; Richards, Magin & Callister 2009).

McDougall's book was illuminating for thousands of desperate runners. Tired of biomechanical analysis, expensive running shoes, and orthopaedic insoles, they found a simple and hopeful alternative. To solve their problems, they should do just the opposite they were told to do: re-learn to run barefoot, as we are adapted to do. From the USA to the rest of Western countries, 'natural running' became a fast growing trend. The barefoot running movement developed counter to accepted expert knowledge, while new information and research opened up new perspectives on running and technology. Until then, to be an informed runner meant following the advice of podiatrists, physiotherapists, and experts. To explore the possibilities of barefoot running, however, means looking for alternative sources of information and relying on peer advice and experiences (Rothschild 2012). Now, scientific evidence for barefoot running, still scarce and fragmented, is a question of debate and does not appear as a corpus of hard

facts, ready to adopt by the responsible runner. The black box is open (Jenkins & Cauthon 2011; Bowles et al. 2012).

Barefoot running is not a stabilized practice, with a well-defined, fixed combination of technical and cultural aspects. Its definition is in progress and material elements (shoes), skills (running technique), and meanings (its 'natural' character) are being negotiated through both expert knowledge and shared experience. The Internet and social networks enthusiastically received the new boom and opened up a good number of spaces in which users can share knowledge and experiences.[109]

Running has undergone some important changes with the emergence of barefoot movement. Barefoot running is, literally, a new way of running for Western practitioners. From a biomechanical point of view, it clearly differs from shod running. In fact, the biomechanical difference between barefoot and shod running is the main argument for discarding modern shoes. Going barefoot thus requires forgetting old habits acquired through the use of shoes and re-learning the 'natural' way of running.

An appropriate "transition" is, in fact, key to successfully adopting the new practice. While recreational runners took to the streets with their expensive shoes, entrusting their structural and functional problems to experts and technology, returning to natural running requires awareness and attention. Runners should now focus on their body, posture, and movement, replacing running technology by running technique. After years of disciplining our feet, suddenly going barefoot will be traumatic and may cause new injuries. Paradoxically, 'natural running' requires an important learning curve.

Over-enthusiastic natural runners have in fact populated physiotherapy, podiatry, and orthopaedic clinics. Muscles, tendons, and joints suffer when accommodating to what should be natural. Running drills, earlier the exclusive domain of professional athletes, have begun to be practised by recreational runners in order to improve their running technique. Landing style as well as cadence, stride length, and body alignment are all elements to take into account in order to become a competent barefoot runner. Natural running courses and instructors flourish everywhere. Now, when a novice barefoot runner suffers any injury, the cause is not poor technology, but poor technique.

7. From barefoot to minimalist running

From the benefits of barefoot running, we can also subtract a good number of problems. Learning the new ability requires time and effort. There is also a risk of injury if the

[109] *Barefootrunning.com* (accessed October 25, 2016), online since 1997, claims to be the original barefoot site. *Thebarefootrunners.org* is the website of the Barefoot Runners Society, founded in 2009 (accessed October 25, 2016). *Barefootrunning.fas.harvard.edu* gathers scientific information on barefoot running following Daniel Lieberman's research and is partially funded by the Vibram company. *Naturalrunningcenter.com* is led by Dr Marc Cucuzzella and runner Bill Katovsky, a curious combination of authority and experience, representing the hybrid spirit of the new trend (accessed October 25, 2016). *Correrdescalzos.es* and *correrdescalzo.com* are two Spanish websites on natural running (accessed October 25, 2016).

adaptation is not slow enough. Moreover, contemporary running surfaces are not as friendly on runner's feet as the savannah of early hunters. The negative consequences of the spread of the barefoot movement have also been especially worrying for shoe manufacturers. Their business was built upon obedient runners who bought a new pair of expensive running trainers every 1000 km, as advised by experts.

Shoe companies, however, have been readier to adapt than many runners and have sought out new marketing strategies in tune with the new trend. As early as 2004, Nike had already launched its new shoe line "Nike Free", designed to allow the natural movement of the feet (Davis 2014). According to the company, they had observed that some coaches have their athletes run barefoot on grass in order to strength their feet and joints. Apparently, doing some of their mileage barefoot helped prevent injuries. Promoting barefoot running was not an appropriate strategy, though, for a company whose business is selling shoes, so the *Nike Innovation Kitchen* created the first shoe designed to run 'as if' barefoot. "Nike Free" appeared as the first of a new kind: the minimalist running shoe.

Nowadays, the market offers a wide variety of minimalist shoes. Some models are extremely radical, such as Vibram FiveFingers,[110] (with no cushion, zero drop, and individual toe sections) and Huarache sandals (imitating those of the Tarahumara featured in McDougall's best seller). However, most runners seduced by the arguments of 'less is more' have been more willing to try less radical alternatives, at least at the beginning. 'Transition shoes', a tamed version of these radical minimalist variations, thus became the main bet of shoe companies and represented a huge market success. With a bit of drop and a bit of cushion, they offer the 'natural running' experience without most of its risks. Even heel strike runners could moderately use these minimalist shoes to help them change their running style, train their technique, and strength their feet and joints.

Today, each shoe manufacturing company has its 'minimalist line' (Adidas, New Balance, Saucony, ASICS, Brooks, etc.). They do so, however, avoiding taking sides in the controversy and abandoning their traditional buyers. They sell technology and its rival at the same time. Some of them have adopted features such us less drop or weight in all their shoes. Generally, however, they have simply extended their offer by adding a minimalist series to their conventional cushioned and guiding shoes collections.

8. The co-constitution of running practices and running cultures

Barefoot or minimalist running emerges as a new combination between experiences and abilities, artefacts, science, technology, and marketing strategies. A new meaning of

[110] Originally designed for sailing and water sports, its potential use for 'almost barefoot' running was introduced later as a suggestion of an enthusiastic barefoot runner and instructor (McDougall 2009). Vibram received a lawsuit in 2012 for the unproven health claims related to the benefits of its FiveFingers. The company accepted a settlement agreement and moved on.

running related to its 'natural' character, associated with a new technology (the minimalist running shoe), and the appropriate running technique are some of the elements that define this unstable, open practice.

What it means to be a barefoot or minimalist runner is a question without a single answer. Running barefoot is not the same for the Tarahumara or the Kalenjin, who run for a variety of purposes: from ceremonial races to transportation. Western runners also attach very different meanings to the practice. For some, it means resistance to big companies and technologies, a return to a more authentic experience far from the mass leisure activity which recreational running has turned into. For others, runners in pain, it is yet another attempt to escape from injury and keep running. Some runners have even found new uses for which minimalist shoes were not designed nor marketed, such as racing shoes or speed training, a niche previously occupied by traditional racing flats. For these, minimalist shoes may be a means to improve their performance.[111] Nor does the minimalist running shoe have a closed identity: transition, race, training or strengthening, etc.: its promotion and use comprise a diversity of runners and aims.

Going from barefoot natural runners to minimalist urban runners presents a number of problems mediated by science, marketing, and experiences. The risk of injury, the difficulties of changing one's running technique, and the contradictory evidence found in scientific research are hindering the stabilization of the practice. In fact, many runners remain forever in the 'transition' phase, in an intermediate place between the old and the new practice, showing that stabilization may not be a necessary end point. Runners live actively in this space of open possibilities and unstable relationships in which they had to construct their own practice of running.

Science and technology are at the service of sport. However, their role is not simply that of providing understanding and solutions to basic problems that worry recreational runners, i.e., how to run better and faster without getting injured. Science informs, analyses, and tests the allegations of the parts in conflict, but it is not the "obligatory passage point". Its work runs in parallel with what is happening on Internet forums, social networks and the streets. Technology, on the other hand, has found in minimalist running shoes a way to reintroduce itself in a practice that came into being as an anti-technological movement. Science and technology are thus yet another element in the complex ensemble of interactions from which good running is produced and practised.

The process of the co-constitution of running technologies and running cultures brings together different traditions in the analysis of technology under the empirical turn. The common theme in philosophy of technology of the human/artefact interaction may be situated in the analysis of technologically mediated practices. Practices, understood as "embodied, materially mediated arrays of human activity centrally organized around shared practical understanding" (Schatzki 2001, p. 11), constitute the focus for the production and reproduction of "sociotechnical ensembles" composed of

[111] Contemporary minimalist running shoes share a good number of features with the traditional racing flats athletes use for competition and fast workouts: they are lightweight, low drop and thin-soled (Davis 2014).

material and social relations between human and non-human actors. The inner workings of technology and its interaction with its users –such as the effects of different shoe construction on runners' biomechanics– and the symbolic value shoes have in the constitution of identities (Hockey et al. 2015) are both examples of these relations, which also include knowledge-sharing among practitioners, marketing and manufacturing strategies, and the multiple meanings individually and collectively attached to running as a contemporary lifestyle. The minimalist runner and the minimalist shoe are both being simultaneously produced.

While early social constructivist views described the forces and factors that result in the stabilization of artefacts, understanding artefacts as elements of technologically mediated practices, both individual and social, allows us to give account of how stabilization may be a never reached end, without implying an unsuccessful sociotechnical ensembling. Practices are also an appropriate place from which to analyse the different scripting and resistance strategies of designers and users. In the context of consumption, these may include the joint creation of products for markets and markets for products, as well as the activist or civic practices in which citizens engage in order to resist or re-script industry devised associations.

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References

Akrich, M. (1992). The de-scription of technical objects. In: W. Bijker & J. Law (Eds.), *Shaping technology/building society: studies in sociotechnical change* (pp. 205-224). Cambridge, MA: MIT Press.

Bale, J. (2004). *Running cultures. Racing in time and space*. London-New York: Routledge.

Bijker, W. E. & Pinch, T. (1984). The social construction of facts and artifacts: Or how the sociology of science and the sociology of technology might benefit each other. *Social Studies of Science*, 14(3): 399-441.

Bijker, W. E. (1995). *Of bicycles, bakelites and bulbs. Toward a theory of sociotechnical change*. Cambridge, MA: MIT Press.

Bijker, W. (2003). The need for public intellectuals: A space for STS. *Science, Technology and Human Values*, 28(4): 443-450.

Bowles, C.; Ambegaonkar, J.; Cortes, N. & Caswell, S. (2012). Footwear for distance runners: The minimalism trend. *International Journal of Athletic Therapy & Training* 17(6): 14-18.

Brey, P. (2000). Technology as extension of human faculties. In C. Mitcham (Ed.), *Metaphysics, epistemology, and technology. Research in philosophy and technology*, vol 19. London: Elsevier/JAI Press.

Brey, P. (2010). Philosophy of technology after the empirical turn. *Techné: Research in Philosophy and Technology*, 14(1): 36-48.

Brey, P. (2014). From reflective to constructive philosophy of technology, *Journal of Engineering Studies*, 6(2): 129-136. (preprint version in:
https://www.utwente.nl/bms/wijsb/organization/brey/Publicaties_Brey/brey-2014-constructive-philosophy.pdf)

Bridel, W.; Markula, P. & Denison, J. (Eds.) (2015). *Endurance running: A socio-cultural examination.* London: Routledge.

Clinghan, R. J.; Arnold, G. P.; Cochrane, L. A. & Abboud, R. J. (2008). Do you get value for money when you buy an expensive pair of running shoes? *British Journal of Sports Medicine*, 42: 189-193.

Davis, I. S. (2014). The re-emergence of the minimal running shoe. *Journal of Orthopaedic & Sport Physical Therapy*, 44(10): 775-784.

Dyer, B. (2015). The controversy of sports technology: a systematic review. *SpringerPlus* 4:524. doi: 10.1186/s40064-015-1331-x.

Frederick, E. C. (1986). Kinematically mediated effects of sports shoe design: A review. *Journal of Sports Sciences*, 4: 169-184.

González García, M. I. (2012). Correr descalzos. Entre la ciencia y la cultura. In M. I. González García & J. A. López Cerezo, J. A. (Eds.), *Fronteras de la ciencia. Hibridaciones* (pp. 185-198). Madrid: Biblioteca Nueva.

van Hilvoorde, I.; Vos, R. & Wert G. (2007). Flopping, klapping and gene doping: Dichotomies between 'natural' and 'artificial' in elite sport., *Social Studies of Science* 37(2): 173-200.

Hintermann & Nigg (1998). Pronation in runners. *Sports Medicine* 26(3): 169-176.

Hughes, T. (1986). The seamless web: Technology, science, etcetera, etcetera. *Social Studies of Science*, 16(2): 281-292.

Hughes, T. (1987). The evolution of large technological systems. In W. Bijker, T. Hughes & T. Pinch (Eds.), *The social construction of technological systems* (pp. 51-82). Cambridge, MA: MIT Press.

Ingram, J., Shove, E. & Watson, M. (2007). Products and practices: Selected concepts from science and technology studies and from social theories of consumption and practice. *Design Issues*, 23(2): 3-16.

Jenkins, D. & Cauthon, D. (2011). Barefoot running claims and controversies. A review of the literature. *Journal of the American Podiatric Medical Association*, 101(3): 231-246.

Kiran, A. H. & Verbeek, P. P. (2010). Trusting our selves to technology. *Knowledge, Technology & Policy*, 23(3): 409-427.

Latham, A. (2015). The history of a habit: Jogging as a palliative to sedentariness in 1960s America. *Cultural Geographies*, 22(1): 103-126.

Liebermann, D. et al. (2010). Foot strike patterns and collision forces in habitually barefoot versus shod runners. *Nature*, 463: 531-535.

McDougall, C. (2009). *Born to run.* New York: Knopf.

Michael, M. (2000a). *Reconnecting technology, culture and nature*. London-New York: Taylor and Francis.

Michael, M. (2000b). These boots are made for walking…: Mundane technology, the body and human-environment relations. *Body & Society*, 6(3-4): 107-126.

Mitcham, C. (1994). *Thinking through technology*. Chicago: The University of Chicago Press.

Mitcham, C.; Kroes, P. & Meijers, A. (Eds.) (2001). *The empirical turn in the philosophy of technology*. (Research in Philosophy & Technology 20). Greenwich, CT: Jai Press.

Pickering, A. (1995). *The mangle of practice.* Chicago: University of Chicago Press.

Richards, C. S.; Magin, P. J. & Callister, R. (2009) Is your prescription of distance running shoes evidence-based? *British Journal of Sports Medicine*, 43: 159-162.

Robbins, S. E. & Gouw, G. J. (1990). Athletic footwear and chronic overloading. A brief summary. *Sports Medicine*, 9(2): 76-85.

Robbins, S. E. & Gouw, G. J. (1991). Athletic footwear: unsafe due to perceptual illusions. *Medicine and Science in Sports and Exercise*, 23(2): 217-224.

Robbins, S. E. & Hanna, A. M. (1987). Running-related injury prevention through barefoot adaptations. *Medicine and Science in Sports and Exercise*, 19(2): 148-56.

Rothschild, C. E. (2012). Primitive running: A survey analysis of runner's interest, participation, and implementation. *Journal of Strength and Conditioning Research*, 26(8): 2021-2026.

Rosen, P. (1993). The social construction of mountain bikes: Technology and postmodernity in the cycle industry. *Social Studies of Science*, 23(3): 479-513.

Rosen, P. (2002). Up the Vélorution: Appropriating the bicycle and the politics of technology. In R. Eglash et al. (Eds.) *Appropriating technology.* Minneapolis: University of Minnesota Press.

Schatzki, T. (2001). *Social practices*. Cambridge: Cambridge University Press.

Schatzki, T.; Knorr-Cetina, K. & von Savigny, E. (Eds.) (2001). *The practice turn in contemporary theory.* London-New York: Routledge.

Scheerder, J.; Vos, S.; & Taks, M. (2011). Expenditures on sport apparel: Creating consumer profiles through interval regression modelling. *European Sport Management Quarterly*, 11(3): 251-274.

Scheerder, J.; Breedveld, K. & Borgers, J. (2015). Who is doing a run with the running boom? In J. Scheerder, K. Breedveld & A. Danchev (Eds.), *Running across Europe* (pp. 1-27). London: Palgrave McMillan.

Shorten, M. R. (2000). Running shoe design: Protection and performance. In D. Tunstall-Pedoe (Ed.) *Marathon medicine.* London: Royal Society of Medicine.

Shove, E. & Pantzar, M. (2005). Consumers, producers and practices. Understanding the invention and reinvention of Nordic walking. *Journal of Consumer Culture, 5(1): 43-64.*

Tenner, E. (2004). *Our own devices: How technology remakes humanity*. New York: Vintage.

Winner, L. (1993). Upon opening the black-box and finding it empty: Social Constructivism and the Philosophy of Technology. *Science, Technology and Human Values*, 18(3): 362-378.