EARTH SHAPERS

Also by Maxim Samson

Invisible Lines:
Boundaries and Belts That Define the World

EARTH SHAPERS

How Humans Mastered Geography and Remade the World

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Introduction

Do we choose the path that already exists, or create a new one instead? Sidestepping the obvious metaphor, my question refers more plainly to the innately human way in which we interact with our daily surroundings. We see traces of this engagement everywhere. Mere steps away from a pavement specifically provided for our daily perambulations runs a trail of bare earth, carved into the ground by countless feet, to undercut a corner that obligates a few extra strides. Walking through a park, another route might have been engraved into the grass to reach a sports field as directly as possible, allowing its athletic creators to save as much energy as possible for the pitch. And by a busy road is the evidence that hundreds of people have refused to take the risk of waiting for a traffic light to change, or for a driver to permit them to cross, for a little further along, a pair of bald patches engage in a staring competition across the greying tarmac.

Both in origin and in name, these 'desire paths' reflect how we interact with the world around us. Where we consider a feature of the existing landscape unfit for purpose, we either abandon it, or tweak it according to the Goldilocks principle, to ensure that it's just right. For most of us, the routes we forge are unintentional: seldom do we think hard about the new pathways we're incrementally creating when we trudge across the grass, even if some open-minded architects and urban planners now willingly inspect these routes in order to adapt their future projects to users' preferences.[1] Eventually a distinct route materialises, sealing the fate of

the land below, for the clearer the path becomes, the more people acknowledge its legitimacy as a route and vote quite literally with their feet on its future. Formerly a vestige of disobedience, a sign of defiance against inflexible design, the desire path now invites conformity. What had once been an organic expression of our human inclination to transform the planet according to our needs and desires now has the appearance of having always been there.

Desire paths, along with their deeply sunken counterparts, holloways, are micro-scale exemplifications of our broader desire to mould and remould our world so that it becomes more interconnective – a phenomenon I call *earth shaping*. In keeping with geography's literal Greek meaning of 'earth writing', cultural geographers call attention to the notion that our planet's various 'cultural landscapes',[2] fashioned by humans onto the natural world, can be 'read' like story-filled texts.[3] Earth shaping adopts the same principles, but adds to them a specific emphasis on the manifold power of geographical connections. Human history has been written in geographical connection – and when you know what to look for, these stories, both obscure and renowned, are everywhere. This book explores the reasons why we engage with our surroundings through connection, and how, through our actions, we write ourselves and a very specific history into the ground.

This is an opportune moment to examine our planet's multifarious linkages, for never has the importance of geographical interconnectivity been as palpable, nor so easily overlooked, as it is now. For millions of us, a day without accessing the internet is unthinkable, whether to read news stories from other countries, connect with family, friends and colleagues without needing to leave our seat, or consult an email inbox filled with tiresome scams and spam from places we've never been. (By the same token, how many of us check that the accommodation we're planning for a trip offers Wi-Fi, particularly in rural areas and countries where internet access remains scarce?) Almost any item we see or

touch in our homes has already taken a veritable odyssey to reach what still may not be the final destination in its roving life. And belatedly, considering that over two centuries ago the eminent Prussian geographer Alexander von Humboldt warned of the damage wrought by human practices on natural contexts and processes, more and more of us are cottoning on to the profound ways in which our actions affect the environment, whether locally or thousands of miles away. Interconnectivity is everywhere – and yet most of the time, we barely notice it at all.

Nor is our fashioning of geographical connections something new. Ancient trade routes such as those running from China to Greece (the Silk Road) and from southern Arabia to the Eastern Mediterranean (the Incense Route) remain legendary for their role in facilitating the exchange not only of the commodities that give them their names – and many others besides – but of culture, ideas and knowledge as well. From the trio of exotic gifts given to Jesus by the biblical Magi to the Buddha's wanderings across the Indian subcontinent, it is easy to take for granted the sheer extent to which our world and our narratives about its history have been shaped by connections. More often, our attention is drawn to issues of *dis*connection: border disputes, segregation, the hazards associated with crossing natural obstacles such as deserts, oceans and mountain ranges. Far less often do we think so deeply about our planet's many connective phenomena – except, of course, when they fail to work as expected.

In tandem with our widespread interest in the world's various boundaries, we are hard-wired to think in terms of discrete places, of countries and cities, hills and lakes, buildings, monuments, parks and more, which can inspire us, nourish us and allow us to situate ourselves on the planet. The linkages *between* them do not generally captivate us to the same extent, a truth that becomes apparent whenever we travel. Whether on our daily commute or to visit a distant land, we tend to be more concerned about specific endpoints than the fuzzy areas in between, which, notwithstanding

any eye-catching areas of outstanding natural beauty, we barely register as anything more than a kind of ambiguous middle space. Yet the connection – the route we followed, in such instances – is part of what makes the places at either end meaningful, having enabled our journey and possibly even permitting the sites in question to have developed in the first place.

To return to desire paths, it would be too easy to classify them solely as markers of convenience. This certainly is a factor, but it's not the end of the story. By chiselling a physical pathway to expedite our journey between discrete places, we carve ourselves, our stories and our ideals into our surroundings. In reshaping and fusing the locations most relevant to us, we bend the planet to our will, writing our history on the landscape and leaving behind a continuously evolving palimpsest of memories, tales and philosophies. In time, the connections we etch can become so familiar, so normal, that we no longer even question their *un*natural origins. This is the power of earth shaping.

That we choose to mould a more meaningful and interconnected planet might seem prosaic or banal, but it does not mean it is unimportant, uninteresting or devoid of purpose – very much the opposite, in fact. It allows us to acquire resources, build alliances, increase our influence and rejuvenate damaged lands. From the forging of sustainable food supplies to the construction of effective irrigation channels, the reasons why civilisations have risen and fallen are profoundly tied to their ability to shape the earth in their favour for the long term. Few of us can live in complete isolation from the rest of human society, necessitating that we rework our environments to make them better connected, whether internally or with the outside world. At the smallest of scales, even desire paths bring intrigue: the social network Reddit features two separate bulletin boards devoted to showcasing the logical and, in most cases, hilariously lazy routes sculpted into the ground by shortcut seekers globally, while a third is dedicated to the signs and barriers erected by frustrated conformists

in response. And, broadening our scope, desire paths have been fundamental to the modern history of the American West, among other places, these trails being blazed and followed by thousands of wagon-riding settlers in the nineteenth century, whose energy, ideas, faith and diseases have all, in one way or another, shaped the evolution of California, Oregon, Utah and more. Geographical connections are a key piece of our planetary puzzle: without them, the image remains fragmented.

In some cases, the connections we seek to produce are practical, pragmatic, logical. In others, connections are more conceptual, ideological or idealistic. Often, our connections are rooted in both types of interest, using the notion of networks to help fashion linkages that are more tangible. The potential advantages of earth shaping are as enormous as they are varied. There is one significant challenge, and one major problem, however: earth shaping is not monolithic, and it is rarely equitable. As a result, the connective vision sought by some is unlikely to be appreciated by all.

At first glance, Ras Lanuf is a thoroughly ordinary sort of place. Neat, beige homes and stocky palm trees line tidy streets, while a handful of banks and shops, mosques and schools serve the various daily needs of this small Libyan town's residents. A little further along the crystal-clear Gulf of Sidra, a modest commercial port conveys black gold far and wide, each ship provoking some periodic excitement in an area that, today, sees little action. Considering that Ras Lanuf's one obvious distinguishing characteristic – its enormous and lucrative oil refinery – made it a key battleground during the war-torn 2010s, the town's return to relative obscurity is a change that its residents most likely cherish. Beyond the refinery, the town certainly looks little different from many of the other settlements of Sirtica, a vast, barren region of ochre sands and scattered oil fields between the Mediterranean and the Sahara. Yet scratch beneath the surface and Ras Lanuf becomes improbably remarkable, a place whose past, present and future

have been shaped and reshaped by various powers, seeking to forge competing conceptions of connectivity both imagined and real.

This area was first put on the map, literally as much as figuratively, in the fourth century BCE in a brief and tangential story of a diplomatic dispute told by the ancient Roman historian Sallust. Following a long period of warfare, the Carthaginians (from modern-day Tunisia) and the Cyreneans (from a Greek colony in what is now eastern Libya) sought to define a mutual border somewhere in the featureless desert plain between them. The unorthodox arrangement was that both parties would send a pair of runners from their respective capitals on the same day, at the same time. The point where they met would mark the location of the new border. Unfortunately, this agreement quickly proved controversial: the Carthaginian team of twins managed to proceed considerably further than their Cyrenean counterparts, who accused the former of cheating. Unwilling to yield, the Carthaginian brothers ultimately agreed to be buried alive at the meeting point. To honour such a show of patriotism and bravery, which allowed Carthage to claim a much larger territory than the losing Cyreneans had anticipated, a pair of altars was constructed on the spot where the twins were buried, on the outskirts of what is now Ras Lanuf.[4]

Whether Sallust's tale was true, apocryphal or somewhere in between, it proved irresistible over two millennia later to the region's dominant power in the 1930s. Under the fascist leader Benito Mussolini, Italy was a nation deeply intrigued by the opportunities geographical connection can provide, first occupying and unifying the historic provinces of Tripolitania (a region that had once been a significant part of the Carthaginian Empire) and Cyrenaica as a single entity,* and then tacking this newly

* Although both of these ancient provinces had already been claimed by an array of foreign powers over the centuries, until the Italian occupation they were nevertheless treated separately from one another administratively and politically.

integrated 'Libya' conceptually onto its self-proclaimed empire. With the territories attached and traditional borders overcome, a triumphal arch was promptly erected in the very location where the Carthaginian altars, by now long since disappeared, had once stood.[5]

Superficially, one might think that the arch emphatically honoured the two brothers, being named for these Philaeni* and depicting the twins both as bronze statues and on bas-reliefs.[6] However, other aspects of the arch's design were chosen to ensure that Rome would be at the forefront of viewers' minds, a hazardous Mediterranean voyage away though it was. The architect Florestano Di Fausto constructed the arch from the same white travertine stone as that found throughout the Eternal City, thereby drawing a conceptual link between North Africa and the ancient Roman capital. The arch's decorative elements went a step further, with a carved panel depicting Mussolini saluting the King of Italy, Victor Emmanuel III, in front of Rome's seven hills, and an unmissable inscription attributed to the Roman poet Horace, declaring (in Latin, of course), 'O fostering Sun, may you never see anything greater than the city of Rome'.[7] Though some observers drew comparisons of their own – British troops fighting in the Second World War's North African campaign likened it to London's Marble Arch[8] – for Italy, this monument was both a physical manifestation of its imperial might and a symbol of its ability to join new territories to the motherland.

In writing a distinctly fascist worldview onto a remote part of the North African landscape, the arch was therefore critical to returning Rome – and by extension, Italy – to some of its ancient dominance in the Mediterranean. Whereas the ancient Carthaginians had sought to divide themselves from enemy Cyreneans, the modern Blackshirts embraced connection, reappropriating the

* This Greek term, meaning 'lovers of praise', suggests that at least one of Sallust's sources was more than a bit disgruntled at their achievement.

Philaeni story in the process of reviving their forefathers' practice of building arches to celebrate the incorporation of new territories, including in North Africa. Still, Italy's connective vision was not merely symbolic or conceptual. To reinforce the sentiment that, in one way or another, all roads lead to Rome, the colonists additionally conceived another engineering project to impose upon the landscape.

Eventually stretching nearly 2,000 km (around 1,200 miles) from Tunisia in the west to Egypt in the east, the Libyan Coastal Highway would allow Italy to replace slow, infrequent steamship voyages with a modern, militarised transport artery,[9] and provide a logical axis for all sorts of auxiliary connective infrastructure in the region, including aqueducts, embankments and pipelines. Through setting thousands of its liraless natives to work in North Africa, Italy regarded this earth-shaping project as more than just a practical tool of 'civilisation', by which barren lands would be converted into useful, cultivable, integrated territory.[10] The road's status as an infrastructure project of some repute also helped Il Duce 'justify' the new Libya's incorporation as a fully fledged Italian province, a 'Fourth Shore' connected emotionally and officially with the lands along the Tyrrhenian, Adriatic and Ionian coasts to the north.[11] Reinforced by the efforts of Italian archaeologists in excavating ancient Roman sites such as Leptis Magna along the highway, and sending their treasures to museums back home, the feeling, on the European side of the Mediterranean at least, was that Libya's bonds with Italy were historic and profound.

Such connections do not tend to be fully consensual, however. Although many locals quickly came to view the arch specifically as a symbol of Italian imperial power – as Mussolini had intended – they detested it for the same reason that the fascist leaders prized it. It is certainly no accident that shortly after his successful coup d'état and revolution in 1969, Libya's long-time authoritarian leader Muammar Gaddafi dynamited this monument

to smithereens. A visitor to Ras Lanuf can no longer see the landmark that briefly distinguished this otherwise little-known location (though the bronze statues and fragments of the bas-reliefs did manage to survive and have since been preserved at a nearby museum).[12]

The highway, on the other hand, has not merely survived; it has become fundamental to the country's continual vicissitudes and evolution, integrating it as one while inviting discord and tension ever since. Independence, achieved little more than a decade following the road's completion, has seen different leaders retain the name 'Libya' and the borders created by Mussolini. Whereas most of the Italian-style villages the highway once connected have gradually been abandoned,[13] the road itself has been widened and repaved, allowing the old colonial objective – replacing Indigenous nomadism and subsistence pastoralism with fixed settlement and private property ownership – to be realised.[14] Even in the new millennium, the legacy of the road remained so influential that Gaddafi convinced Italy to build his country a *new* highway untainted by colonial oppression, in return for his support in curtailing migrant flows from Africa to Europe. However, before construction could begin on this modern transport link, the outbreak of civil war saw the original route's own purpose morph instead. It became a key conduit for people seeking to either join or flee violence, a popular trafficking route and (particularly close to refineries and ports) a key arena of conflict itself.[15] By April 2019, amid a military offensive launched by the eastern military commander Khalifa Haftar to capture Libya's western region, the writing was on the wall: the highway once conceived as Libya's physical nexus and conceptual axis was now so embroiled in strife, so broken, that it needed to be closed. More than a year would pass before Libya's 'essential lifeline' connecting west with east opened again.[16]

The arch is no more, and the highway, damaged, repaired and enlarged since the 1930s, looks very different now from in

Mussolini's time. Today, the scars of Libya's recent conflicts represent the most conspicuous layer in the region's intricate palimpsest, inscribed two and a half millennia ago by the Carthaginians and progressively complicated by North Africa's metamorphosing powers and their respective geopolitical concerns. The connective relevance of the road once created to unify Italy's North African territories has evolved: it has been reworked among other European-created road clusters into a post-colonial, pan-African highway tying west (Senegal) with east (Egypt), emotionally as well as practically.[17] Although it is not currently possible to travel as far as Dakar, owing to the long-term closure of the Morocco–Algeria border, from Ras Lanuf one can feasibly drive far further than the Italian colonists had anticipated. Like many other places across the world, this small coastal town may appear entirely mundane at first glance. That is, until we consider its relationship to other links in the chain. Every landscape tells a story – the challenge is knowing where to look.

Each of the chapters in this book presents a distinct means by which we use the power of geographical connection to shape and reshape the world. They span the globe both geographically and temporally, yet each shares a theme of humans seeking to tweak their surroundings in order to write their worldview onto the earth. However, earth shaping is never apolitical, and its impacts are often far-reaching. Just as these connections have all profoundly shaped local landscapes, creating ramifications and legacies that transcend borders, they have simultaneously been confronted by opposition, whose visions of connectivity can differ quite significantly.

We will explore geographical interventions designed to build *order*, a truth known by the ancient Romans in their expansive road network. Less well known but no less impressive was the remarkable road system developed by the Inca in the Andes, which cut across some of the planet's most forbidding terrain. In

Chapter 1 we will meet this fastidiously maintained and distinctly hierarchical network, the Qhapaq Ñan, which was fundamental to enlarging and managing the Inca's domain. The road system additionally wrote a series of conceptual connections onto the landscape, structuring both Cusco and the empire itself, Tawantinsuyu, into four quarters according to invisible ritual pathways. Ultimately, though, Tawantinsuyu was crippled by its road system's extent, efficiency and engineering excellence: Spanish conquistadors harnessed this extraordinary feat of geographical intervention for their own ends, capitalising on its functional advantages to quickly reach Cusco, plunder its resources and decimate this short-lived empire.

In other cases, *extraction* can be built into the landscape from the ground up, as was the case with Mozambique's railways, which we will explore in Chapter 2. Portuguese colonisers conceived these routes as a means of conveying Southern Africa's mineral wealth from the interior to the coast, while sending cheap labour the other way. However, the Portuguese weren't alone in recognising the economic and geopolitical potential of railways, and in a short time, the routes intended to legitimise their sovereignty were fashioned according to their colonial rivals' interests instead. From a brutal civil war after independence, to ongoing disputes concerning the power of foreign industries, Mozambique's past and present have been profoundly shaped by the distinctly fragmented assortment of railway networks left behind by European colonisers, whose primary purpose remains extraction.

One of the more familiar ways we interact with the world around us is in the name of *convenience*, and nowhere better epitomises this than the Panama Canal, the subject of Chapter 3. Arguably humanity's most impressive infrastructural achievement, a water connection between two oceans whose development impelled a nation's (quasi-)independence and whose administration strained relations between its communities, this canal has become essential to modern life across the planet. Indeed, the

Panama Canal, an aquatic desire path of sorts, more than simply accelerated the global transportation of goods. Its completion under US command additionally marked a paradigm shift in the global power balance, in which a new, technologically advanced superpower would position itself at the focus of the world's attention.

The United States' claim to being the planet's figurative and geographical centre has remained robust more or less ever since. But one of the contemporary world's most ambitious nations is striving to become a realistic rival. Chapter 4 explores how Saudi Arabia is using the power of geography to *reimagine* our planet and our relationship with it, concentrating on its flagship 'smart city' THE LINE. Not only does this city seek to redefine Saudi Arabia as a hub of talent and innovation at the crossroads of Asia, Africa and Europe, but in championing a profoundly interconnected design, THE LINE also demands that we rethink what a city even is and looks like. Both lustrous idyll and Orwellian dystopia, this controversial city represents an intriguing case of how imagination and ambition, along with physical and conceptual connection, can fuel a rebranded and refashioned landscape.

A different way in which geographical connections can spark the imagination rather than being solely tangible provides the theme of Chapter 5: *resistance*. We tend to think of geography as distinctly physical elements of the world around us, and in the case of resistance, this is as true of military tunnels in Vietnam or Gaza as the interconnected basements used by Prohibition-dodging bootleggers in Moose Jaw. However, in other cases, connective resistance networks assume a more conceptual form, such as the Underground Railroad tying together the safe houses used by enslaved African Americans to flee northwards in the nineteenth century. This chapter's case study combines elements of the two: it was conceived in secret and its physicality was unusually ephemeral. Yet the Baltic Way's (or Baltic Chain's) effectiveness owed much to its conspicuously public manifestation, a human

chain tying together three nations whose principal commonality was their opposition to the Soviet regime. On top of enabling Estonia, Latvia and Lithuania to wrest themselves from foreign occupation, the Baltic Way enabled these historically dissimilar states to view their pasts and futures as intertwined and, correspondingly, to be regarded as a continuous geographical buffer against Russian aggression. This protest – thanks to which new alliances were created, freedoms were achieved and frontiers were drawn – encapsulated the power of geographical connectivity in remoulding a planet whose future is malleable rather than fixed.

A concern with the future is additionally relevant to the many geographical interventions that seek to *restore* damaged environments and regions. The case study presented in Chapter 6, the Great Green Wall, epitomises geography's potential to inspire collaboration in the face of multiple and interrelated environmental, social and political challenges. Having originally been conceptualised as an uninterrupted tree buffer stretching from the Atlantic Ocean to the Red Sea, this initiative now necessarily defines itself more loosely as an interconnected mosaic of re-greened and productive territory at the Sahara's southern edge. However, despite some important successes in rehabilitating arid lands, a fateful melange of desertification, poverty, terrorism and conflict continues to forestall the development of the very project conceived as a panacea to these problems, and magnifies the challenges of tackling issues that, like the initiative itself, transcend national borders.

The Great Green Wall elucidates the potential of geographical connections in protecting our fragile planet, all while the same region's long-established trading routes are exploited by smugglers and extremists for more malignant purposes. It reflects how earth shaping does not assume a single form, and how just as geographical connections can be moulded carefully to preserve the environment, they can alternatively be modified much more substantially for quite different ends. Chicago, the focus of Chapter

7, presents an informative case of the same geographical connections cherished by some, being *co-opted* and manipulated beyond recognition. Here, settlers profited from Indigenous knowledge of the American Midwest's ridges and waterways to first seize and then reshape a gently managed natural environment into a bustling industrial metropolis. To this day, the battle for recognition persists in a city whose Indigenous origins and ways of life – which were informed by a spiritual concern with the interdependence between humans and nature – were quickly obscured by one of the most conspicuously systematic forms of earth shaping in history.

The substitution of Indigenous understandings of earth shaping for a distinctly modern approach rooted in materialism and control might suggest that traditional beliefs are destined for marginalisation in the contemporary world. However, across the planet, millions of people continue to regard powerful metaphysical connections between specific places as sources of *vitality*, from the straight, invisible ley lines allegedly running between a miscellany of prehistoric and historic landmarks,* to India's Char Dham, a Hindu pilgrimage circuit joining four sacred sites aligned in a neat diamond shape. In Chapter 8 we will consider the Baekdu-daegan of Korea, which embodies the enduring influence of traditional beliefs in reshaping our world. This chain of mountains directing the distribution and configuration of the peninsula's settlements provides an unlikely source of shared national pride for the planet's least friendly neighbours. Reinforced by leisure activities and political actions that emphasise its cross-border bonding

* Although the originator of this theory, the English amateur archaeologist Alfred Watkins, had suggested that such lines simply represented ancient trade and navigational routes, the notion has since become better associated with esoteric movements that claim they demarcate mystical earth energies and can be used to guide and communicate with extraterrestrials – a form of connection many others deem far-fetched.

potential, the Baekdu-daegan provides much-needed hope that someday, Korea can become one again.

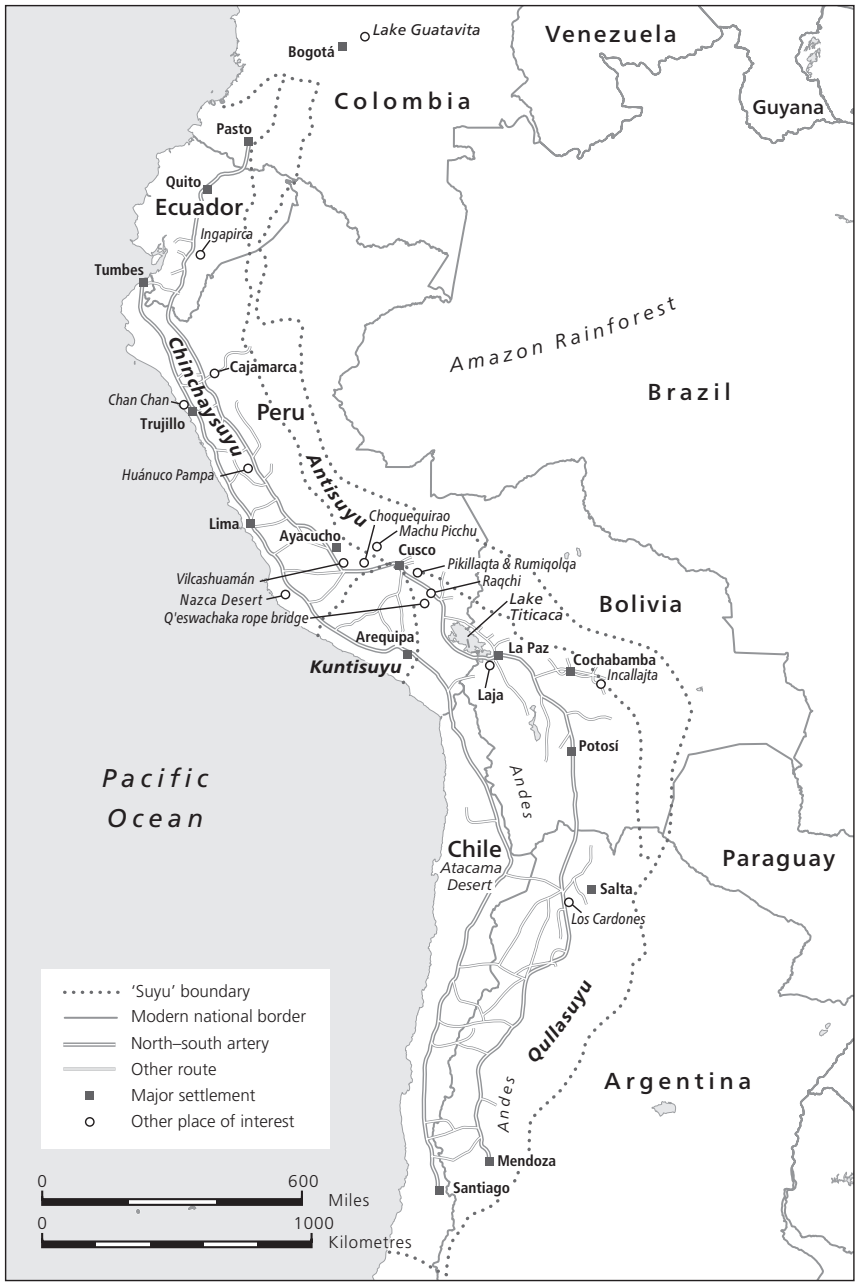
Encompassing different continents and addressing a range of pertinent issues, through these eight chapters we'll see time and again how we humans mould our surroundings, feeding a perpetual desire and determination to manage our complex world as we see fit. For geography is never an inevitability, and connection is rarely innocuous. The story of Ras Lanuf typifies how a humble place can become significant due to the multiple, consequential types of connectivity, ideological as well as pragmatic, in which it is bound. The essence and evolution of the locations I've chosen to focus on are similarly tied to a framework of connection. Political and potent, grounded and germane, these connections all illustrate the uniquely human ways in which we engage with our planet and our dedication to adjusting it according to our perceptions and priorities. It's never sufficient to think about a place in a vacuum, and it's wrong to assume that our relationship with the world is inexorable. Looks can be deceiving, obligating us to delve ever more deeply into our surroundings and the processes and choices behind their appearance: for by examining geographical connections, we become better able to control the present and direct the future.

1

Order: The Qhapaq Ñan

In the memory of people I doubt there is record of another highway comparable to this, running through deep valleys and over high mountains, through piles of snow, quagmires, living rock, along turbulent rivers; in some places it ran smooth and paved, carefully laid out; in others over sierras, cut through the rock, with walls skirting the rivers, and steps and rests through the snow; everywhere it was clean-swept and kept free of rubbish, with lodgings, storehouses, temples to the sun, and posts along the way.

Pedro de Cieza de León[1]


Lake Guatavita
Bogotá
Venezuela
Colombia
Guyana
Pasto
Quito
Ecuador
Ingapirca
Tumbes
Amazon Rainforest
Brazil
Chinchaysuyu
Cajamarca
Chan Chan
Trujillo
Peru
Antisuyu
Huánuco Pampa
Lima
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Ayacucho
Cusco
Pikillaqta & Rumiqolqa
Raqchi
Vilcashuamán
Nazca Desert
Q'eswachaka rope bridge
Lake Titicaca
Bolivia
Arequipa
Kuntisuyu
La Paz
Cochabamba
Incallajta
Laja
Potosí
Andes
Pacific Ocean
Chile
Atacama Desert
Paraguay
Salta
Los Cardones
Qullasuyu
Argentina
Andes
Mendoza
Santiago
'Suyu' boundary
Modern national border
North–south artery
Other route
Major settlement
Other place of interest
0
600
Miles
0
1000
Kilometres

There are very few places in the world that inspire as much awe as the western portion of South America. In Colombia, famed for its verdant and vertiginous coffee plantations, the Sanctuary of Las Lajas may be the continent's most striking pilgrimage destination, its Gothic Revival arches and statues of angels extending across a deep river canyon (rivalled only, perhaps, by the Zipaquirá Cathedral, built deep in a salt mine and illuminated with purple lights). In Ecuador, combining a perfectly conical shape with a snow-capped peak, steep Cotopaxi is for all intents and purposes the quintessential volcano, while a short drive away, reclusive spectacled bears and cacophonous cocks-of-the-rock are just two of the many species that render the country's cloud forests among the planet's most biodiverse environments. In Peru, the Nazca Desert's ancient and enigmatic geoglyphs continue to elicit theories both plausible and fanciful as to their purpose and origin, while the hues of the kaleidoscopic Vinicunca are more majestic even than its alternative names, Rainbow Mountain or Mountain of Seven Colours, would suggest. Spreading over the southern border into Chile, the bone-dry Atacama Desert, whose orange and red soils are warmer than the air above, presents otherworldly landscapes befitting a place long used by NASA to test its Mars rovers. Meanwhile to Peru's south-east, Bolivia's Uyuni salt flats, etched with natural polygons and, on occasion, gleaming like an endless horizontal mirror, are as breathtaking as their altitude of over 3,600 metres (about 12,000 feet) above sea level. And further south, *gastrónomos* may be interested in knowing that Argentina's Mendoza region is now one of the world's foremost wine producers, while Salta boasts more than just some of the

country's finest architecture from the Spanish colonial period; it is also famous for its succulent and spicy empanadas.

Yet though these illustrious archaeological sites, spectacular vistas and grand cities are all highlights of South America, beneath – or rather, between – them all is a feat of earth shaping so exemplary that it astounded the Spanish conquistadors and allowed a small Indigenous kingdom to become perhaps the best-administered empire of all time. Romanticised by some as the civilisation that built Machu Picchu and domesticated cheery llamas and alpacas, and deprecated by others as a brutal people with a penchant for sacrificing children and recycling enemies' body parts into cups and drums,[2] the Inca were exceptional in their recognition that geographical connection can bring order to the human and natural worlds alike. In under a hundred years, a non-literate civilisation from Cusco that didn't use wheels, arches, maps, machines or currency and couldn't smelt iron demonstrated that roads can be used as a tool for formalising control over a multitude of previously fragmented regions and rivals across a uniquely extreme assortment of natural landscapes.

Stretching for 40,000 km/25,000 miles (and almost certainly far more) along the world's longest above-water mountain range and the highest outside Asia, this road system, the Qhapaq Ñan, connected the planet's largest rainforest, the Amazon, with its driest hot desert, the Atacama, and its tallest volcanoes, such as Ojos del Salado, with its biggest ocean, the Pacific. In fusing the four *suyus* (regions) of their empire Tawantinsuyu, the Inca's 'great road' or 'way of the powerful' materialised their distinctive integration of engineering and spirituality, and demonstrated their capacity to oversee every aspect of their domain.[3] That is, until that same network's very calibre was used against them, bringing the short-lived empire swiftly to its knees.

Half a millennium on, the Inca are long gone and most of the Qhapaq Ñan has been lost to time. Yet from ethnicity to socio-economic status and from national symbols to sacred spaces, the

identities of all six of the countries to inherit the lands it joined and the lives of millions of their inhabitants are still linked both directly and indirectly to pre-Columbian America's greatest infrastructure accomplishment. South America's modern borders conceal the meaningful interrelationships between sites from Colombia in the north to Chile and Argentina in the south, but written into the landscape, countless stories of ritual and trauma, settlement and abandonment survive, all facilitated or provoked by a power-laden, pedestrianised road system. As part of the basis of Andean geography, history and spirituality, the Qhapaq Ñan beseeches us to look more deeply, to acknowledge that the connections between iconic places can matter at least as much as the places themselves. Tawantinsuyu's notoriety may be incommensurate with its longevity, but its comprehensive legacy lives on in its road network, which is instantaneously perceptible, should one scratch beneath the surface.

The Qhapaq Ñan was an Inca achievement, but just as with any other imperial power throughout history, this civilisation did not start its work on a blank canvas. Though the Andes present numerous obstacles to infrastructure development, various prior communities had already proved that through ingenious engineering techniques appropriate to local landscapes, it was possible to develop thriving civilisations.

For 600 years from approximately 100 to 700 CE, the Moche along northern Peru's freshwater-deprived coastal desert had dug deep trenches as irrigation canals to divert river water to fields. Their successors in the region, the Chimú, then replaced these channels with contour canals that maintained a slight but constant slope to redirect water as far as 70 km (over 40 miles) away.[4] In fact, for the Chimú, these water connections were just one part of a sophisticated irrigation system, comprising sunken gardens called *huachaques* (which allowed farmers to work the moist soil beneath the dry topsoil), walk-in wells to tap groundwater

and major reservoirs for storage.[5] As a consequence of their outstanding surveying and engineering skills, before their eventual conquest by the Inca in around 1470, this moon-worshipping civilisation had also managed to construct the largest city in the Americas and the biggest adobe settlement on the planet, Chan Chan.[6]

Another Indigenous civilisation, the Wari, left its mark on Peru's southern highlands several centuries before the Inca emerged, constructing the walled settlement of Pikillaqta close to the future Inca capital, Cusco, and – even more helpfully to the latter – what was likely an aqueduct at Rumiqolqa. According to local legend, this was developed as part of a competition between two suitors to the beautiful daughter of a Wari leader, who, anxious about her people's future subsistence, demanded that the young men first prove their ability to provide the community with a reliable water supply.[7] The Inca later appeared to adopt and expand this impressive roadside structure, likely using it as part of a regional canal system as well as both quarry and gateway to their capital.[8]

Further south-east over the contemporary Bolivian border, for centuries the Tiwanaku established their own civilisation near Lake Titicaca, reworking hillsides into step-like *andenes* terraces to minimise soil erosion, reduce frost damage and control the amount of water available to crops such as maize, and constructing *waru waru* cultivation and irrigation systems, characterised by alternating embankments and canals.[9] Though the reasons for their downfall, also around 1000 CE, remain disputed, they, like the Moche, Chimú, Wari and other groups in modern-day Peru and Bolivia, laid the literal, crucial groundwork for the Inca, creating trails and roads convenient for expansionist purposes.

Indeed, just as the Wari had constructed roads to stretch their empire from their eponymous capital near Ayacucho in south-central Peru both south-east towards Lake Titicaca and far further

north-west to Chachapoyas and Piura,[10] the Sapa Inca (Emperor) Pachacuti recognised that this infrastructure represented the most effective means of first claiming and second administering distant lands. Having ascended to the Inca throne in 1438 unexpectedly, fending off an invasion by the Chanca after his terrified monarch father and presumptive heir older brothers fled, Pachacuti quickly initiated a programme of growing Cusco into a road-based empire.[11] Comprising two main north–south highways interconnected by various shorter, transversal west–east roads, this ladder-shaped network was like nothing South America had ever seen. The western route largely followed Peru's coastal plains, before deviating further inland through the Atacama Desert to hug the foothills of the Andes at least as far as Chile's capital, Santiago. Meanwhile, the eastern route ran through the undulating grasslands of the Central Andean plateau before dividing to circle Lake Titicaca.[12] Other than this relatively short split, this highway was otherwise largely continuous from Pasto in southern Colombia all the way to Mendoza in western Argentina – a distance of approximately 6,000 km (3,750 miles), not dissimilar to that between Lisbon and the Caspian Sea, but at an average altitude of 3,000 metres (10,000 feet) above sea level (and sometimes climbing as high as 5,000 metres/16,000 feet).[13]

Whether by enhancing existing routes or building new ones, the Inca always ensured that their roads were adapted to diverse natural environments instead of following a one-size-fits-all template. In desert regions, short walls prevented sand from caking roads that were built low to be close to essential water sources, while in wetland regions such as around Lake Titicaca, earthen causeways and embankments provided protection from fluctuating water levels. In highland areas at risk of landslides and flooding, roads were typically constructed along upper valley slopes and featured culverts and drains to reduce water run-off, retaining walls to increase stability, and paving stones or cobbles to provide a more uniform surface. Though the Inca typically preferred to

construct straight roads – as with the Recta del Tin Tin, which crosses the high-altitude desert of what is now Argentina's Los Cardones National Park – they, unlike San Francisco's planners centuries later, recognised that steeper slopes necessitated some adaptability on the part of humans, resulting in narrower, winding roads and even flights of stairs. In any case, wherever possible, the Inca tried to bypass those environments most dangerous to travellers: their routes skirted the edge of the Atacama along the Andean foothills, where far more water is available, and ascended far above major rivers in highland areas.[14]

In addition to being excellent road builders, the Inca were outstanding bridge engineers, enhancing their growing empire's connectivity. Recognising that their rope suspension bridges across narrow gorges represented critical choke points during times of war, they deployed full-time overseers to guard the longest crossings, many of whom would weave new cords from wild grasses while on duty to pre-empt potential sabotage.[15] Although the Inca also built a relatively small number of stone-lined culvert bridges over short, shallow stream crossings,[16] the fragility of other types of crossings happened to offer certain advantages to the Inca regime. For instance, the regular maintenance and replacement of a rope bridge acted as a social glue for the communities on either side and theoretically reduced the risk of rebellion,* while log bridges, a good example of which stood on the edge of Machu Picchu, could easily be removed should a threat be detected.[17] Even more hair-raising than these crossings – especially rope

* There is no better evidence of these crossings' power to create social and symbolic as well as physical connection than the fact that the residents of four different Indigenous communities still renew the Q'eswachaka rope bridge south of Cusco for free. Spanning a 30-metre (100-foot) gap across the Apurímac River, this impressive construction collapsed in March 2021 due to a decline in maintenance during the COVID-19 pandemic, prompting teams of workers on either side of the ravine to immediately re-weave it.

bridges, which sagged in the middle and would sway with the slightest wind, spurring terrified Spanish conquistadors to crawl on their bellies[18] – were *oroyas*, hanging baskets used to transport two or three people together over larger ravines.[19] Regardless of type, these bridges were essential to the Inca mission to reach and link otherwise detached areas, and in a reflection of this society's meticulous level of organisation, an official inspector (the *chaka suyuyuq*) was appointed to ensure that every link in the imperial chain was consistent with state policy.[20]

Certainly, to the Inca, the Qhapaq Ñan served as an instrument of control, bringing order to the natural world and miscellaneous populations alike. New territories were either annexed through diplomacy and elite marriage alliances or conquered by force, and were quickly connected to the existing road network. This military-political strategy symbolically indicated Inca dominion, while facilitating the movement of troops to quell rebellions, prepare for further advances and support civil works. Vanquished rivals were intentionally dispersed to distant parts of the empire, and their roads promptly connected with lands these newly displaced people had never seen and from which they would never be allowed to return. Formerly distinctive and multitudinous Indigenous communities were shuffled throughout the growing empire to engineer a form of social integration that served to mitigate opposition along ethnic lines – a strategy whose legacy today includes the significant cultural diversity of cities such as Cochabamba in Bolivia, whose valley the Inca used for the mass cultivation of maize and coca. Almost invariably practical and resourceful, the Inca tended to forgo permanent garrisons (as well as city walls), instead periodically moving their troops along the Qhapaq Ñan whenever a threat was identified or suspected.[21]

Building order into Tawantinsuyu involved far more than constructing a militarised road network and using it to alter its provinces' demographic make-up, however. The Inca elite additionally instituted a highly regulated political, social and economic

system, of which the Qhapaq Ñan was a key component. Though they exerted control differently throughout the empire, consistent in Inca policy was a phenomenal level of standardisation, whereby each person's role was carefully defined and affected how they used the roads – if at all.[22] Of course, the Qhapaq Ñan was used by the Sapa Inca; the relevant roads were brushed clean before he and his gigantic entourage passed through.[23] But much further down the social hierarchy, and hardly less important from a practical perspective, couriers called *chaskis* rushed between official relay stations with small packages and *khipus*, coded, knotted strings that enabled these enviably fit runners simultaneously to play a giant game of telephone and record their accounting without needing to write anything down. Although seemingly primitive in comparison to modern mail transport – lost postcards and birthday presents notwithstanding – this system was suited to traversing some of the planet's most challenging terrain and was impressively fast and efficient, relay teams being capable of covering 240 km (150 miles) in a single day. Still, beyond the most privileged classes and *chaskis* as well as the army, llama caravans, porters and authorised pilgrims, traffic on the Qhapaq Ñan was carefully managed, being prohibited for subjects unless they had been sent by political elites for a special purpose, intensifying Tawantinsuyu's social distinctions as a result.[24]

Two groups given occasional dispensation to take the Qhapaq Ñan were *mitimaes*, colonists involuntarily transplanted to introduce Inca customs to new territories and thereby erode alternative loyalties, and labourers who were part of the *mit'a*. The latter was a turn-based mandatory service system which saw workers drafted to fulfil all sorts of duties required by the state, including farming, mining, constructing temples and fortifications and, of course, building and caring for the empire's roads and bridges. In a society that eschewed private commercial exchange and taxes, and prohibited the common classes from owning property, these workers acted as bona fide jacks-of-all-trades, taking it in