

# Atlas

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Society

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## Acknowledgements

The academic journal *Atlas* was established by the DU Geographical Society in 1967. Produced intermittently over the years, it has gone from strength to strength since its 2015 revival. As an homage to the journal's roots, *Atlas* #17's fantastic retro cover, designed by Laura Nash, takes its inspiration from a box of old issues discovered in the Museum Building. Although the journal is no longer sponsored by Guinness or Shell, other things have remained constant, such as the brilliance of the TCD Geography students and staff, and the importance and relevance of the discipline of Geography.

I would like to express my heartfelt thanks to the following people for their involvement in the production of this year's journal: To begin, to all those who submitted their work to *Atlas*. We received a huge volume of submissions, and choosing between them was a difficult task, a testament to the high quality of the work under review. Next, to my invaluable Editorial Committee: Andrew Duggan Murphy, a previous editor himself; Ellen Treacy, and Laura Nash. Sincere thanks also to Cian O'Callaghan and Molly McGrath for writing the President's Foreword and Chairperson's Greeting. I would like to thank the TCD Association and Trust for their financial assistance in covering printing costs in full, without which *Atlas* would not be possible. Thanks must also go to our wonderful treasurer Mark McMahon for liaising with the Trust. I would like to express the gratitude of the society to the Alumni of Trinity College Dublin who donated to this generous fund.

Finally, on behalf of the Society I would like to extend our deep gratitude to Gillian Marron, librarian of the Freeman. In appreciation of all her work over the years we would like to dedicate *Atlas* #17 to Gillian.

It has been a pleasure and a privilege to edit *Atlas #17*, and I am extremely proud of the result. It has been a joy to be a part of the DU Geographical Society throughout my time in TCD, and I would encourage anyone and everyone to become a member; to quote from the *Atlas* of 1972, “*It’s worth joining*”.

*Lizzy Gageby Bell*

Head Editor

*Atlas #17*

## **President's Foreword**

2019 is the Year of Geography. This initiative is headed by the Geographical Society of Ireland, and aims to shine a light on the diverse work that geographers do and the sophistication of the modern discipline. While the title is more self-appointed than externally anointed, it seeks to raise at least two urgent concerns. It aims firstly to challenge the recent decision by the Irish Government to remove Geography as a core subject from the Junior Certificate programme, and secondly seeks to demonstrate the centrality of Geography to understanding and solving contemporary challenges such as climate change, global inequality, and increasingly contentious issues like migration and belonging.

As part of the initiative, geographers working in various fields took to Twitter using the #IAMAGeographer hashtag to tweet what the discipline has taught them or how they use Geography in their work. While the academic responses amply demonstrated how crucial Geography is in grappling today's societal challenges, the non-academic tweets confirmed what those of us who teach the subject always knew but found hard to adequately articulate: Geography graduates are everywhere, hidden in plain sight in an amazing array of jobs and, moreover, they are applying their Geographical skills to excel in them. Unlike some other vocational courses, Geography does not prepare us for a particular profession, but helps us to understand our world. This is something that the members of the DU Geographical Society know very well. Under the brilliant Chair Molly McGrath – and supported by a stalwart Committee – the Society has once again surpassed itself with a stellar set of year-long activities. Geo-Week focused on Geography and the Sustainable Development Goals, the International Trip to Sofia included a visit to the Irish Ministry, and the Flat Earth Ball took a swipe at the virulent trends of 'Post-truth' politics propelling populist leaders to power. In each and every one of their

endeavours the Society took an approach that was critically-minded, socially engaged, and entertainment focused; not an easy balance but one that is effortlessly navigated in the Society's activities. In this regard, the Society and its members are the best ambassadors for Geography that we, as staff, could possibly hope for.

This year was less turbulent – though no less momentous! – than the last. There were no big cabinet reshuffles. Despite the turbulence of ongoing TEP reshuffling, Molly and the rest of the crew kept an even keel on the Society ship. I remain always impressed by the organisation and dedication of the Committee. Thank you to Molly, Megan, Mark, Laura, Lizzy, Niall, Eoghan, Ellen, Emily, Edward and Andrew for making my (however small) job as Honorary President an extremely pleasurable one. This year I did manage to gather a staff, postdoc and postgrad team for the table quiz, following my very poor showing in 2017, so I'll call that a personal win.

As a document and milestone for the Society's ethos and activities, *Atlas* reflects the serious scholarly and critical engagement with Geographical thought that underpins everything the Society does. In the spirit of the Year of Geography, the selected articles in the 2019 edition grapple with gender identity, colonialism, carbon trading, and Martian geomorphology among other topics. Geography, the ultimate synthesis discipline, is the only one that could hold these topics together. Special thanks and recognition to Lizzy Gageby Bell, who edited this year's edition, for aptly demonstrating this in her editorial choices. In a world characterised by growing uncertainty and division, Geography is more important than ever to understand the root causes and respond in effective ways. Some of the answers are in here, this the 17th volume of *Atlas*. What are you waiting for?

*Cian O'Callaghan*  
Honorary President



## Chairperson's Greeting

Welcome to the Dublin University Geographical Society's annual publication of *Atlas*! I am extremely grateful to the editorial committee: Lizzy Gageby Bell, Andrew Duggan Murphy, Ellen Treacy and Laura Nash, for overseeing the society's long-established publication for this year. I would like to thank all those who took the time to submit their essays and I want to congratulate all the authors whose work has been included in this year's edition of *Atlas*. I would like to extend my appreciation and gratitude to the Alumni office, without whom *Atlas* would not be possible.

It has been my true honour and pleasure to have been elected as the Chairperson of the Dublin University Geographical Society for its 59th year. The main focus I had for the society this year was inclusion and communication among the committee, and particularly within the geography department. I wanted to encourage engagement so that everyone had the opportunity to attend our events, trips, meet new people and make lifelong friendships, which I believe is a core aspect of the society. I am truly grateful to have met so many people and have been able to attend such fantastic events thanks to the society over the last four years.

I have enjoyed every aspect the role of chairperson entailed. Organising and overseeing events, such as our unforgettable international trip to Sofia, Bulgaria. Our biggest and most successful Christmas pub-quiz, with the room exceeding capacity! The beloved Bingeo. Our first mystery tour and the society's largest national trip, as forty-two members got to experience the wild shores of Bundoran, Donegal. Finally, the annual society ball, this year named [flat] Earth Ball, was a massive success and a thoroughly enjoyable night.

The society had a truly successful and ground-breaking year and that is thanks to this year's hard-working committee. Our year reps: Ed, Emily, Ellen, Eoghan and Niall. Our OCM: Andrew.

Our librarian, Lizzy. The extremely talented Laura, our PRO. Particularly, the secretary Megan and the treasurer Mark who helped me endlessly. Thank you all for being so generous with your time in order to ensure the continued success of the society in its 59th year. It has been a privilege to have been chair this year and getting to work with you all.

Our honorary president this year was Dr Cian O’Callaghan. I am indebted to him for the time he so generously gave to help the committee and promote the society to his classes, which has been invaluable to the society this year and has contributed to its success.

I hope you enjoy the latest edition of *Atlas*. My hope is that you all had an enjoyable and memorable year with GeogSoc. I look forward to seeing the future of GeogSoc and the continued successes of this wonderful society!

Ní neart go cur le chéile!

*Molly McGrath*

Chairperson

Dublin University Geographical Society

2018/2019

# **A Critical Account of the Representation of Ireland in the Geography of Strabo and Ptolemy**

*Maria Cordero*

## **Introduction**

Little is known about Irish history before the fifth century AD. Two of our best surviving sources of information regarding our past are the classical geographers Strabo and Ptolemy. While their work may not be entirely accurate, it still holds a great deal of value for modern day readers. As will be discussed below, their work sheds light not only on our country's history but also the history of ancient Rome and the history of the study of geography itself.

## **Ptolemy**

*Maps tell us so much more than how to get from A to B, or where C is in relation to D. They can be tools of power and snapshots of history, and reveal the fears and prejudices of their age – Jerry Brotton (2010)*

Claudius Ptolemy was an ancient Roman who was thought to have lived c. 100 AD. He was a “Renaissance man” of sorts, as was common at the time, dealing with all manners of mathematics, astronomy, astrology and of course geography. He wrote three major works in his lifetime: the *Almagest* (an astronomical work), the *Geography*, and the *Tetrabiblos*. In the context of Ireland, his *Geography*, in which he was attempting to give a description of the known Greco-Roman world, is the most crucial.

Ptolemy's work is heralded for its remarkable accuracy in determining latitude and longitude, which he accomplished by measuring the longest hours of daylight and length of astronomical events respectively. He also incorporated many data from secondary sources such as merchants and military figures, and it is well established that much of this work is built upon that of Marinus of Tyre. A more critical attitude to Ptolemy's work, such as that of Tierney (1976:264) would attest to the fact that his work is more of a cartographic effort than a geographical one, as it leaves out much of the qualitative, ethnographic information that Marinus of Tyre is

thought to have provided.

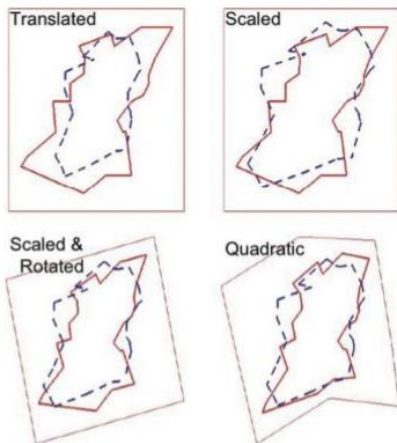
Neither Ptolemy nor Marinus themselves ever travelled to Ireland, which serves to explain many of the inaccuracies in their work. Even Philemon, who Marinus is thought to have been largely influenced by, likely never travelled to the island (Toner, 2000:73). Tierney (1976:257) attests that most river and tribal names recorded by Ptolemy come from Philemon. It is therefore not surprising that much of their writings may be less than accurate. O’Rahilly (1946:41) suggested that Ptolemy may have gotten some of his information from Pytheas of Massalia, however this theory was largely disproven by Tierney (1976:265) amongst others.

As a result, much of the data in his work, particularly the names of places and rivers (covering 15 rivers, 6 promontories, 10 cities and 16 tribes) were received from merchants who had travelled to Ireland. This source of information had two major issues: travellers were likely not familiar with the country in its entirety (which may explain why Ptolemy gives a more accurate description of Ireland’s East Coast than its West) and they for the most part spoke no Irish. Mac an Bhaird (1991-93: 1-2) writes strongly that almost no foreign scribes had any success in reproducing Irish names correctly.

Much ink has been spilled by scholars attempting to match Ptolemy’s named cities to their contemporary equivalents. Many of these attempts to find matches use the etymology of the names and their possible similarities to Irish place-names. It was pointed out by Orpen (1894:116) however that using this “resemblance of sound” between Ptolemy’s names and the modern Irish language is not reliable. Anyone with a knowledge of the country’s history will know that the language of Irish, as well as the names of our cities, have changed dramatically in the intervening centuries. Toner (2000:78) applies the same critique to work on tribal names, as almost all tribes would have disappeared or become irrelevant before the next works were written on Ireland.

Raftery (1994:206) attributes the fact that many of the place names have been apparently “British-ised” to the fact that British merchants likely just miscommunicated names heard from natives. Further mistakes were very likely introduced as the work itself was then copied into Greek and later into Latin around the fifteenth

century. Another noted issue with using merchants as a source is that many locations which Ptolemy recorded as towns were likely just places of assembly (MacNeill 1919:138), which is believed to be the case for Ptolemy's city 'Manapia', located in South Leinster. Despite its flaws, Ptolemy's map does provide some confirmation around the prehistoric division of Ireland into five parts, which was noted in pre-Patrician works (Darcey and Flynn 2008:61).



*Figure 1: One example of a mathematical approach to interpreting Ptolemy: Mintz's four mathematical translations attempting to shift Ptolemy's map towards its most accurate modern equivalent. (Mintz, 2009:7)*

Ptolemy's work didn't merely consist of lists of place names however, and much of the commentary on his work is surrounding his measurements and cartography. Scholars writing about Ptolemy's Ireland are quick to point out that he has placed Ireland about  $5^\circ$  too far North (Thomson 1948:21). Academics such as Darcey and Flynn (2008:49-69) have reviewed his work mathematically, calculating the error in his figures and performing transformations on his imperfect "map" (out of interest, Darcey and Flynn estimate his longitudinal error to be about  $15^\circ$  and  $1/3^\circ$  error in latitude). The criticism of this line of research is that (thanks to modern science) we are now well informed on the dimensions of Ireland. Toner (2000:74) went as far as to say that speculation around Ptolemy's *Geography* "does not help to refine our knowledge of Ireland or Ptolemy". What, then, is the relevance behind studying his work at all?

Ptolemy's efforts to describe Ireland first of all tell us that Ireland was somewhat relevant to the Ancient Greeks and Romans.

Although we have some record of Ireland having traded with Ancient Rome, Ptolemy's work gives us details of such trade (even if he did so unknowingly). For example, his work outlines that it takes 20 days to travel from the East to the West of the island, indicating that at least some merchants travelled the inner island and as well as the coasts (Freeman 2001:67).

In a broader sense, we use his work to more generally critique the idea of maps as ideal, objective sources. Ptolemy's methods of data collection and measurement may seem inaccurate at best to a modern geographer, but they can shed light on just how geography was done at the time. Just as a future historian may look at a modern map and see a reflection of our political climate (for example the central placement of Europe on most maps), so too can we look at Ptolemy's map and learn about the capabilities, opinions and motives of ancient Rome.

## **Strabo**

*The myth that ethnographers are people without personal identity, historical location and personality, and would all produce the same findings in the same setting, is the mistake of naïve realism. –Brewer (2000:99)*

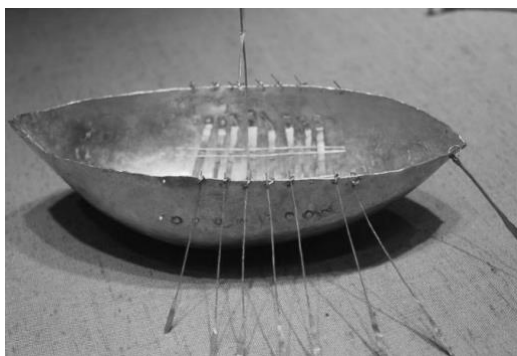
Strabo predates Ptolemy by about 100 years, and was alive during the transition from the Roman Republic to the Roman Empire. While he did famously travel much of the known world (the *oikumene*), he was similar to Ptolemy in that he never visited Ireland personally. As a result, his writings on the country are also flawed. As noted by Pothecary (2015) in relation to his work in Roman Asia, his work was largely written in his later life and even in regards to the places he did visit he likely forgot many details by the time he recorded his travels. His work differs in that it is a largely ethnographic description rather than a quantitative one, and therefore is also susceptible to much criticism.

It is a general criticism of Strabo's work that he seems to view the world through a very binary lens; seeing people as either civilised or uncivilised, or as Roman or un-Roman (Van der Vliet, 2003:257). This dichotomization leads him to often skew his findings to fit this preconceived worldview. A related dimension to take into account

when viewing his work is that Strabo wrote with a clear audience in mind; the Roman army. It was strictly a strategic work, like much of the geography after him, designed to assist in the colonisation of the world by imperial powers.

It is not surprising then that he did not write extensively on Ireland (*Ierne*) as he says himself of the region that “for governmental purposes there would be no advantage in knowing such countries and their inhabitants... They can neither injure nor benefit us in any way because of their isolation.” (Strabo, 1923:447). Perhaps many Irishmen would have been content with Strabo having not written about Ireland at all, as what he does write is less than flattering.

Strabo’s description of the Irish people portrays – in only a short passage – accounts of both cannibalism and incest (Strabo, 1923:259). This was not the first description of its kind, with Diodorus Siculus (V, 32) also writing about the cannibalism and savagery of Irish people. It is likely therefore that Strabo was either influenced by this work directly or that this was a common idea of Ireland at the time. It is worth noting that during the period in which Strabo’s *Geography* was written (c. 7 BC), Ireland was almost certainly trading with Rome, as artifacts such as those found in the ‘Broighter Hoard’ found in Northern Ireland date back to around this period (Laing, 2005). We can therefore say with some confidence that Strabo’s depiction of the Irish people as complete savages is not entirely accurate.



*Figure 2: Broighter Gold Boat, Dublin, October 2010. Commonly dated to approximately the same time as Strabo’s Geography was written (Wikimedia Commons)*

Strabo does add a disclaimer to his comments that he was “saying this only with the understanding that (he has) no trustworthy witnesses for it” (Strabo, 1923:259). Strabo

makes a similar assertion at the preface of the *Geography* to the effect that minor errors in the book should be ignored in respect to the breadth of the subjects that he has covered. In this sense, we can imagine that Strabo did not see Ireland as a place of very much relevance, and was therefore not hugely concerned with an accurate portrayal. Tierney (1976:260) suggests that this disclaimer was influenced by, if not taken from, the previous writer Pytheas, who made a point of distinguishing between his first-hand knowledge and “hearsay”.



Figure 3: Depiction of Irish ‘atrocities’ during the Rebellion of 1641 by Wenceslaus Hollar, showing a similar rhetoric to that of Strabo towards Ireland (Wikimedia Commons)

It is entirely possible however that Strabo’s less-than-flattering description of Ireland was more than just an oversight, and was in fact part of a wider belief system he held regarding the “civilised” world. One glaring mistake of Strabo’s was placing Ireland some 800 km above Britain, despite the fact that he was familiar with Caesar's previous work which contradicts this (Freeman 2001:39). In doing this, many believe Strabo was bolstering an argument that the island *Ierne* was the edge of the civilised world; an argument that is further strengthened by the image of the Irish people as almost complete animals. This is not unprecedented for Strabo, for example he condemns the “barbarian” people of Caucasus for taking new wives after having had children with previous ones, despite this being a practise in his Rome (Van der Vliet, 2003:268).

There is also a distinct “deterministic” tone to Strabo’s writing about the Irish, claiming that it “is such a wretched place to live in on account of the cold” (Strabo, 1923:271). This fits into the worldview of civilisation going through a sort of outward evolution, with warm



Rome at the centre and the farthest stretches of the known world playing host to the most barbaric of people (Van der Vliet, 2013:259). This viewpoint was certainly not unique to the classical world however, and perpetuated right through to the twentieth century if not to the present day. One such example is the work of Ellsworth Huntington in 1915 that attempted to assert the racial superiority of Europe and North America over other continents due to their more favourable climates. It is of course unclear whether this rhetoric stems directly from the work of Strabo, but there is a clear comparison to be drawn between his work and that of later imperialists.

Strabo's work is thought to have directly affected that of much of Renaissance Italy in a more tangible sense. Haywood (1996:467-486) contests that the rediscovery of Strabo's work in the Renaissance period may have contributed to the general distaste for Ireland at that time (it had been viewed relatively positively up to that point in the late medieval period). Strabo's Rome-centric view of the world may have resonated with Renaissance Italian geographers, who found it similarly convenient to portray Ireland as an uncivilised country serving "the purpose of shielding Europe from the Beyond" (Haywood 1996: 479).

## **Conclusion**

Studying what ancient writers have documented about something we know ourselves with great familiarity can seem a thankless task; what is the value in trying to determine where Ptolemy's Irish rivers were located if we can consult any modern map to know any precise coordinates? The search for meaning in these works goes beyond the literal features that they were describing and delves more into what they saw as the function of their "Geographies".

The fact that Ptolemy recorded in remarkable detail the topography and location of Ireland shows that it was a place of relevance to him and gives us a clear record of merchants having travelled to our shores. Strabo's depiction of Ireland as a barbaric land that was just about regarded as habitable gives us a wealth of knowledge about how the Romans at the time viewed themselves and the rest of the world. Both works draw the attention of the modern geographer attempting to quantify exactly what the study "geography"

is, and what purpose it serves. Overall, their combined work on Ireland may in fact serve as a mirror, and shed more light on them and their world than it does on ours.

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# **Evidence for the First Human Colonisation of the Americas: A Review**

*Conor O'Neill*

## **Introduction**

The early Human colonisation of the Americas is an extremely vibrant and contested area of palaeoanthropology. While there is general agreement that the first people entered the Americas via a land bridge between Siberia and Alaska known as Beringia, the question of when that occurred and what routes were taken from there is highly contested.

The classical theory of early human colonisation of the Americas for much of the last century centred on the Clovis people. An ice-free corridor between the Laurentide and Cordilleran ice sheets in Canada provided the route for small groups of humans using stone tools to travel southward into the modern-day United States. This was thought to have occurred around 11,000 cal yr BP (Waters and Stafford Jr, 2007). These first humans developed the distinctive Clovis tools which have been found and dated securely at a number of sites, mostly in North America and some in Central America (Waters and Stafford Jr, 2007).

However, more recent improvements in radiometric dating, environmental reconstructions, and genomic data mean that the 'Clovis First' paradigm has been increasingly questioned, to the point where it is now almost entirely abandoned in favour of earlier colonisation dates (Erlandson, 2013; Halligan *et al*, 2016). This essay will examine the new theories which have emerged, especially the coastal migration versus inland corridor theory, and the most up-to-date genetic evidence for the timing of the first humans in the Americas. It will also examine whether humans populated the Americas in one wave, or in multiple migrations.

## **Clovis First**

Sites containing Clovis artefacts, typically distinctive stone tools, are widespread around the contiguous United States. The first appearance of Clovis sites across America has been dated to around 11,000 cal yr BP (Waters and Stafford Jr, 2007). Generally accepted during the 20th Century as the first humans in America, there have since been further site discoveries in North and South America which are earlier than the radiocarbon Clovis dates. An example is the Page-Ladson site in Florida (Halligan *et al*, 2016). Page-Ladson is a submerged river site containing late Quaternary sediments; within these sediments are wood samples, stone flakes, and biface tools (Halligan *et al*, 2016). As the wood and tools were contained in the same secure stratigraphy, a radiocarbon date on the wood samples could be used to date the stone tools. Dates from the biface tool and other artefacts give a range of about 14,550 to 14,200 cal yr BP (Halligan *et al*, 2016), much earlier than the Clovis dates put forward by Waters and Stafford Jr (2007). Possibly the most well-known pre-Clovis site is Monte Verde in Chile. This site contains definite artefacts, such as flakes, projectile points, and bifacial pebble tools (Dillehay *et al*, 2015) which have been dated to about 18,500 to 14,500 cal yr BP, and is widely accepted as evidence of early human occupation which pre-dates Clovis technology (Goebel *et al*, 2008).

As these examples show, Clovis humans were not the first colonisers of the Americas. The findings above show that humans were in America earlier than was thought during much of the 20<sup>th</sup> century. This brought into question the ice-free corridor that was thought to have provided the route south.

While the opening of the ice-free corridor in Western Canada occurred around 15-14,000 cal yr BP, this does not mean that the route represented a viable migration option for humans at that time.

Pedersen *et al* (2016) analysed lithological and biological change in sediment cores from Glacial Lake Peace, a proglacial lake which existed in the corridor during glacial retreat. By examining pollen grains and environmental DNA in the sediments, they were able to reconstruct the environment of the ice-free corridor as it first opened up. They found that the corridor opened on its northern and southern ends initially, with a central section the last to clear. Vegetation had spread by about 12,600 cal yr BP, with animals of various sizes moving in about 100 hundred years after that (Pedersen *et al*, 2016). It was only from this point (about 12,500 cal yr BP) that the corridor represented a viable option for humans to travel through.

This means that the humans occupying sites such as Page-Ladson and Monte Verde cannot have travelled through the interior route. Furthermore, the corridor was also not viable before the appearance of Clovis. It has thus been suggested that a Pacific coast route may have been used instead by early humans entering America.

### **Coastal versus interior**

With the discovery of pre-Clovis human occupation sites, questions of both when the first humans entered America and by what route have intensified. The possibility of a coastal route has become more mainstream recently (e.g. Llamas *et al*, 2016; Erlandson, 2013).

While the ice-free corridor theory was the main route put forward for human migration southwards for much of the 20<sup>th</sup> century (Waters and Stafford, 2007), its viability as a route has been questioned recently. Already mentioned above is the fact that human sites which pre-date the opening of the ice-free corridor have been found south of the ice sheets (Pedersen *et al*, 2016). Beyond that, the harsh conditions within the corridor have been described as unsuited to supporting a human migration. Dixon (2013) notes that for a long time the corridor was biotically impoverished, with large proglacial

lakes and boggy terrain acting as barriers to any colonizing species. It has also been suggested that, for a number of environmental reasons, it was more favourable for southern species to move north through the corridor, rather than northern species to move south (Dixon, 2013).

Not all recent literature on the ice-free corridor has been negative. Potter *et al* (2017) suggested that the analyses by Pedersen *et al* (2016) and others were premature in their criticism of the corridor. For instance, they say that wood recovered from the base of lake sediments in Boone Lake, near Glacial Lake Peace, dated to about 13,555 cal yr BP is evidence of forestation in the corridor at least 1000 years earlier than Pedersen *et al* (2016) proposed. They also claimed that populations which had been living in Beringia for an extended period would be quite adapted to harsh conditions in the ice-free corridor, and suggest that it was viable by 14-13,000 cal yr BP. However, the finding of wood in the lake is not entirely convincing as it does not prove that the route was viable. It is a very long corridor, and humans travelling through it would need a plentiful supply of food and fresh water to survive the journey.

Erlandson (2013) proposed that a coastal route south from Alaska may have been used, due to certain advantages provided by such a route. Part of the basis for this is that it represents a relatively linear route with no major geographic obstacles. As it is mostly at sea level, it doesn't require the crossing of mountain ranges, which provide both a time and climatic barrier. It also gives access to productive coastal habitats, which offer abundant marine species as food (Erlandson *et al*, 2015). These coastal habitats were also possibly similar to Beringian habitats, meaning they required less adaptation than an inland route along the ice-free corridor (Erlandson *et al*, 2015).

The Northwestern coast of America was likely de-glaciated in many parts by about 16,000 cal BP (Dixon, 2013), providing a route for humans to move along the coast. One major issue with the coastal route theory is the lack of sites containing human evidence dated prior

to about 13,000 to 12,500 years ago (Dixon, 2013). While sites on the coastal regions of the Americas have been dated to around the same time as Clovis sites (Erlandson *et al*, 2008), the lack of fossil and lithic evidence clearly predating them means that determining which route was taken is difficult. The southern coast of Beringia is one area that has a particular lack of archaeological sites dating from this time (Potter *et al*, 2017); if the coastal route was used, one would expect to find human sites from this time along it. Instead, the oldest human occupation sites are in the interior, such as the Bluefish Caves dating to 24 thousand years ago (ka) (Bourgeon *et al*, 2017). One point made by a number of authors is that sea level has risen considerably, by about 100-120m (Dixon, 2013), since the time of deglaciation. This has potentially inundated sites containing evidence of the earliest human presence on the American Pacific coast (Dixon, 2013; Erlandson, 2013). However, Erlandson (2013) points out that the Pacific coast of America generally has quite a steep continental shelf, meaning the effects of sea level rise have likely not been as sharp as on the Atlantic coast. This seems quite a sweeping statement, so it should be treated with caution. Nevertheless, the lack of human fossil and lithic evidence on the Pacific coast is problematic.

Fossil and lithic evidence alone will probably not be sufficient to determine which route the first humans took when moving into the Americas. Fortunately, advances in genetic reconstructions which are discussed below have led to better understanding.

### **Genetic evidence**

Genetic evidence can be used to further the understanding of two key areas; the timing of the arrival of humans into the Americas, and whether America was populated by a single wave or multiple waves in succession. An examination of mitochondrial DNA (mtDNA) and Y chromosomes has shown that, in modern Native Americans, there



are five mtDNA founding haplogroups and two Y chromosome haplogroups (O'Rourke and Raff, 2010). All of these haplogroups are also found in native populations of Siberia, whereas only one (X) is found in Europe or central Asia (Goebel *et al*, 2008). Work on ancient Native American DNA gives the same results (Goebel *et al*, 2008); combining the ancient and modern DNA shows that the first humans into America originated from Siberia, an assertion that is also made by Llamas *et al* (2016). The separation from Siberian humans most likely occurred during the Last Glacial Maximum (LGM). An estimated date range for when this divergence occurred was worked out by examining gene flow to be between 24.9 and 18.4 ka (Llamas *et al*, 2016). Llamas *et al* (2016) were able to calculate this by sequencing the mitochondrial genome from 92 pre-Columbian skeletons which ranged in age from 8.6 to 0.5 ka.

The estimate from Llamas *et al* (2016) for the separation of Siberian and Native American ancestral populations (24.9 to 18.4 ka) is concurrent with the LGM. As the LGM saw massive expansion of ice sheets along the coast and interior of Canada, the population present there at that time were likely trapped and used Beringia as a refugium (Llamas *et al*, 2016). Again, genetics were used to support this; while the lineage shows very little diversity for thousands of years (while the population was constrained geographically and thus small in size), it shows a sudden increase in diversification starting around 16 ka (Llamas *et al*, 2016). This coincided with an increase in effective female population, and Llamas *et al* (2016) state that the population increased by a factor of 60 between 16 and 13 ka. Hence, they suggest 16 ka is the likely time of first entry southwards into the Americas following the isolation period in Beringia. The findings on the population bottleneck and Beringian standstill period, preceding expansion around 16 ka, were also put forward by Skoglund and Reich (2016).

The Beringian standstill hypothesis, which above has been put

forward by genomic evidence, has also been advanced by archaeological evidence. The Bluefish Caves, in the Yukon in Canada and very close to the Alaska border, contain numerous mammal bones which have been accurately radiocarbon dated (Bourgeon *et al*, 2017) and calibrated to as early as 24,000 cal yr BP. Cut marks on the bones have been associated with humans and the Bluefish Caves are currently thought to have been used as a short-term hunting site. This find is currently the oldest archaeological site in North America (Bourgeon *et al*, 2017). The combination of this archaeological evidence with the genomic evidence above lends significant support to human presence in Beringia and the Beringian standstill period.

This timing supports the coastal entry route theory mentioned above. The population explosion began around 16 ka (Llamas *et al*, 2016), predating the viability of the ice-free corridor, whether the dates from Pedersen *et al* (2016) or from Potter *et al* (2017) are taken to be accurate. It seems plausible that an expansion into newly opened territory, with abundant marine and terrestrial life, and space to expand, would have resulted in this population explosion. This lines up well with the deglaciation of much of the coastal route by 16 ka (Dixon, 2013).

One other point of contention is whether the Americas were populated by a single wave of migration, or by multiple groups. Reich *et al* (2012) examined data from Native American and Siberian genotypes, sampled from DNA collected over several decades. Their findings showed that the vast majority of Native American populations (pre-1492) across the Americas derive ancestry from a single ancestral population, which they estimate crossed through Beringia at least 15 ka. They also found that two separate gene flows from Asia into North America were present, indicating later migrations which gave rise to Eskimo-Aleut and Chipewyan populations in the Arctic and northern Canada (Reich *et al*, 2012). These gene flows are not present in Central and South American populations; these groups fit in with a single

founding population (Skoglund and Reich, 2016). An examination of autosomal DNA identified an allele present in Native American genomic structure that is extremely rare in potential Asian sources; this was used as further evidence for a single founding population (Skoglund and Reich, 2016). A maximum upward limit on this migration was around 23 ka, with this single population then diversifying around 13 ka when population expanded again (Raghavan *et al*, 2015).

### **Another possibility?**

All human remains found in the Americas to date are of anatomically modern *Homo sapiens*. A possible exception is a discovery in California known as the Cerutti Mastodon site (Holen *et al*, 2017). Holen *et al* (2017) presented evidence consisting of apparent stone tools and fragmentary remains of a mastodon, but no human skeletal remains. They interpreted marks on the bones and tools as evidence of the presence of a species of *Homo*. As the site was dated via radiometric dating to about 130,000 ya, this would have meant that it was an earlier species of *Homo*, rather than *Homo sapiens* (Holen *et al*, 2017). This has been questioned critically by other researchers. Ferraro *et al* (2018) noted the absence of any *debitage*, the distinctive debris and leftovers of lithic tool production that are common at other hominin sites. They also claimed that the marks on the mastodon bones were not indicative of hominins (Ferraro *et al*, 2018). Haynes (p. 197, 2017) noted serious problems with the lack of “deliberately shaped lithic tools and cultural features”, with the only objects present the previously mentioned mastodon bones and broken cobbles. Despite replies to these by the original authors (Holen *et al*, 2018a; Holen *et al*, 2018b), the evidence for human presence at the Cerutti Mastodon site is suspect. The assertion by Haynes (2017) that the cobbles at the site do not represent clear evidence of lithic tools, combined with the lack of characteristic *debitage*, are important. The

extremely early date is over 100,000 years before any other evidence of humans in the Americas. As this would radically change the subject, robust data is required to make a conclusion. The evidence presented by Holen *et al* (2017), while interesting, is not enough to prove the presence of *Homo* in the Americas at 130 ka; further research is needed. Critically, human skeletal remains would drastically change the situation; when lithic evidence is combined with primary human skeletal remains, more robust conclusions can be drawn.

## **Conclusion**

The early human occupation of the Americas is clearly a very active research area. With the discovery of pre-Clovis sites like Page-Ladson in Florida and Monte Verde in Chile, the topic has experienced an upheaval recently. From the evidence presented here, it appears that the first Americans entered the land bridge known as Beringia around 24.9 to 18 ka, where they were then isolated from Asian populations. It appears that this population were then isolated in Beringia for an extended period of around 2000 years, known as the Beringian standstill. This has been suggested mostly by genomic evidence which points to a population bottleneck and low genomic diversity. However, the Bluefish Caves finding, when combined with the genomic evidence, means that the evidence for human presence at that time is quite robust.

Genomic diversification ramps up around 16 ka, and is associated with a rapid expansion in population. As this occurs around the same time as deglaciation on the Pacific Northwest, and the ice-free corridor in the interior remains unviable at least for another few thousand years, it appears that the population in Beringia began to expand southwards around 16 ka via the coast. While Potter *et al* (2017) claim that the widespread acceptance of the coastal route is premature, it seems from genomic and paleogeographic evidence to be

the most likely route. Where it falls down slightly is in physical evidence of human presence. Erlandson (2013) makes the strong point that archaeological evidence needs to be combined with genomic data in order to make any strong arguments in this area. Until this happens, the coastal versus interior debate will continue.

Finally, genomic investigations point strongly towards a single population leading to the settlement of the Americas, followed some time later by small migrations into the Arctic and northern Canada. The arguments for the first settlement of the Americas are strongest when multiple forms of evidence are effectively combined; effective use of archaeological sites, genomic data, and paleogeographic reconstructions lead to the most robust and credible explanations.

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# **Embodiment of Gender Identities in Urban Cycling Participation. A Case Study of Female Students in Trinity College Dublin**

*Laura Rankin*

## **Introduction**

Gender differences in urban transport patterns have been identified as a manifestation of uneven spatial power relations that shape real (infrastructure, policy) and imagined (cultural, social) urban landscapes (Cresswell & Uteng 2008). The tendency for cities to accommodate certain demographic groups (heteronormative, male, able-bodied, white) while alienating and impeding others (women, children, disabled, ethnic minorities) has been attributed widely to a patriarchal “embedded urban design that facilitates the male urban experience” (Peake 1993, p. 416). This can be seen in gender gaps in urban cycling participation in low-cycling countries (with relatively low cycling mode share including America, Australia, Canada, New Zealand, The UK, and Ireland). In Ireland, females made up only 37% of all commuter cyclists 2016. Furthermore, the number of female students (of age 19 and over) cycling to college was under half the number of males of the same age (CSO.ie 2018).

These gender gaps have been identified and discussed widely (Aldred, Woodcock & Goodman 2016; Xie & Spinney 2018). These studies often employ qualitative mode choice studies that highlight the role of women’s fear, timidity, and aversion to risk without further examination of the underlying social and cultural factors that perpetuate unfavourable cycling environments and identities. While these analyses do explain to a certain extent the reasons behind gendered participation in cycling in urban areas with relatively poor infrastructural, social, and cultural support for cycling, they fail to account for individual’s choice to cycle in response to the place-



specific symbolic meaning of transport choices, culturally ingrained gender stereotyping and norms, and the construction of gendered identities in urban spaces (Steinbach et al 2011; Horton 2007). It is these factors that will be investigated here.

The aim of this research is to investigate the social and cultural meanings attached to cycling identities and to what extent this affects female students' experiences and perceptions of not/cycling in Dublin city. This paper uses qualitative focus group based research to investigate the embodied experiences and perceptions of female students, both cyclists and non-cyclists between the ages of 20-25 in Trinity College Dublin. In order to comply with journal criteria, the following has been modified to an essay-style format and thus, regrettably, the methodology and majority of results have been omitted. The following discussion and analysis will be based on some of the key themes that were identified during the focus group interviews, and will draw upon respondents own comments, thoughts, and feelings. Respondents have been anonymised and renamed 'cyclist' or 'non-cyclist' with a corresponding letter for differentiation. For example; *cyclist A*, *non-cyclist A*.

## **Literature Review**

The relationship between body and city has become one of increased prominence in feminist urban studies (Longhurst 1995; Grotz 1999; De Craene 2016). Consequently, feminist geographers have turned to more subjective, affective, and emotional geographies that allow for more nuanced analyses of embodied differences and have, as a result, become increasingly concerned with the socio-cultural construction, meaning, and symbolism of gendered identities (Sharp 2009; McDowell 1997) in the urban context.

The concept of embodiment in feminist and cultural geographies "initially emerged in opposition to dominant discourses

of an abstract universalized subject who was implicitly male, white, able-bodied, and heterosexual” (Massey 2001, cited in Mott & Roberts 2013, p. 235). By examining how differentiated embodied subjects are conceived by themselves and others in their spatial contexts, the complex interplay between individuals, wider social relations and cultural norms, as well as the conceptual and actual spaces they create become apparent (Grosz 1999; Longhurst 1995). Furthermore, embodiment has provided an alternative to dualisms; (mind/body, sex/gender, essentialism/constructionism), that have tended to confine traditional understandings of gendered phenomena (Massey 1991), and challenges masculinist rationality “which assumes a knower who believes he can separate himself from his body, emotions, values, [and] past experiences” (Longhurst 1995, p. 98). Embodiment has, therefore, contributed profoundly the post-structuralist and feminist discussions on gendered bodies in their socio-spatial contexts and has facilitated a move to place more empirical value on individual experience, emotions, and subjectivities (Johnson 2008).

Judith Butler’s influential (1993) work on the ‘performativity’ of gender identities, recognises that characteristics of masculinity and femininity are not biologically fixed, but are fluid and open to change through self-reflexive practice and are, thus, subject to change over time and space in accordance with social and cultural norms (1993, cited in Johnson 2008, p. 563). Elizabeth Grosz (1999) describes bodies as socio-cultural entities that are socially, psychically, and representationally produced and argues that “[T]he city is one of the crucial factors in the social production of (sexed) corporeality: the built environment provides the context and coordinates for contemporary forms of body” (1999, p.382). Moreover, how the “subject’s exterior is psychically constructed; and conversely, how the processes of social inscription on the body’s surface construct[s] a psychological interior” (1999, p. 381). Importantly, this highlights the power of the built environment to simultaneously create, confine, and

perpetuate certain gendered identities through its interactions with the body. Understanding gender identities as embodied performances has therefore destabilised conventional understandings of gender and has given rise to new perspectives on gender relations and inequalities that have “been transformed by questions about identities, subjectivities and performances” (Bondi & Rose 2003, p. 23).

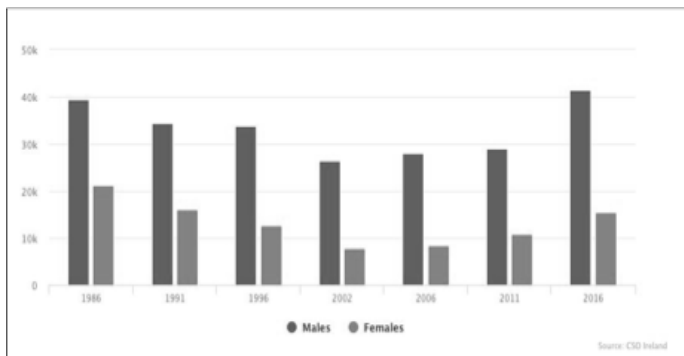
As Bondi & Rose (2003) note, issues of women’s fear have dominated emotional and affective geographies (Sharp 2009) of urban spaces. This tendency has been bolstered by normative expectations around women’s supposed timidity and irrationality, and the assumption that women are inherently more fearful than men (Bondi & Rose 2003). This view has been problematised and challenged for its victimisation of women and its misrecognition of gender identities in mainstream accounts of urban life. Therefore, efforts have been made to shift the focus away from fear towards a promotion of women’s ‘spatial confidence’ (Koskela 1997 cited in Bondi & Rose, 2003 p.234), whilst at the same time recognising the role of masculine identities and performance as fundamentally important.

Van Bekkum, Williams & Morris (2011) note that infrastructural preferences, perceptions of safety, and inherent gender differences in risk aversion (Useche et al 2018) have been disproportionately discussed as barriers to female cycling. However, there is a small but growing literature in this field. Law (1999) suggests that in order to understand the meanings of mobility, gender should be treated as a cultural category rather than just a demographic variable. Steinbach et al (2011) draw upon Bourdieu (1978, 1990) to demonstrate the cultural and social expectations linked to the ‘non/cycling habitus’ in London. Mackintosh & Norcliffé (2007) discuss how Victorian gentleman’s cycling clubs encouraged an explicitly masculine cycling ethos in the public sphere while women used and interpreted (Ward 1896; Willard 1895) the bicycle as tool of domestication that “did not have to be an unruly and masculine

mayhem-maker in the city's streets." Thus, encouraging women to cycle "without compromising their domestic inclination (Mackintosh & Norcliffe 2007, p.165). Horton (2007) further explores the socio-cultural construction of the protective 'warrior cyclist'; a prominent cycling identity in low-cycling countries, perpetuated by an 'existential fear' of motor vehicles that has become embodied disproportionately by a specific demographic group; white, able-bodied, middle-aged men. Furthermore, that culturally ingrained gender stereotypes and norms around 'femininity' and risky-behaviour have worked to perpetuate gender gaps in cycling. Emond et al (2009) conclude that while physical and social factors are strong determinants in men and women's decisions about cycling, individual gender-specific influences were the most important.

### **The gendered non/cycling body**

The latest census figures, as well as a study by Lawson et al. (2012), support the claim that there are fewer females cycling in Dublin. In 2016, only 37% of all commuter cyclists in Dublin city and suburbs were female (CSO.ie 2018). This is clearly not a new trend, as Fig.1 shows (see over):



**Fig 1.** Numbers cycling to work in Ireland (1986-2016).

Source: CSO.ie (2018)

Respondents discussed a number of potential explanations for the cycling gender gap in Dublin based on their personal experiences and perceptions of not/cycling as a gendered traveller, however the perception of cycling as a masculine activity emerged as a strong theme.

Non-cyclist B felt that

*it's quite masculine. A lot of sports in general I think are considered quite masculine. And like, I went to an all-girls school where there was no emphasis on sport at all.*

Cyclist B:

*You can't look like an 'ideal woman' who's there in her high heels and skirt and fab makeup on, you just look the polar opposite of that, all sweaty and gross.*

The assumption that it would not be possible to cycle in Dublin without becoming 'sweaty and gross', may be explained by the perception of cycling as a sport, as non-cyclist B expressed. This, in turn, may be bolstered by the prominence of those who "identify themselves as 'a cyclist' rather than just 'a person who cycles'" (Steinbach et al, p.1125). 'The cyclist' is inclined to express their

identity through a particular style; *all this fancy cycling gear, like high-vis and lycra stuff. Proper products that are designed for professionals (cyclist A)*. This identity has come to dominate the popular public image of urban cycling in low-cycling countries and tends to be embodied by a particular demographic group; middle aged, middle-class, white men (Horton 2007). It was mentioned that the Bike to Work scheme has likely increased representation of this demographic. Consequently, as respondents noted, there is a perceived correlation between cycling, sport, and masculinity in Dublin and a notion that cycling is an activity suited only to a certain '*type of person*'. Furthermore, cycling was mostly seen to be incompatible with the expression of a 'feminine' gender identity. This was discussed in terms of clothing the body in a conventionally gendered way i.e. skirts, dresses, makeup. This assumption was contested by some who noted that it was possible to cycle and maintain a 'feminine' aesthetic. Cyclist C:

*Well, I wear skirts and dresses and all when I cycle in the summer. Yeah, like my skirt would be blowing in my face going down-hill. I don't think it makes cycling more difficult at all though, but you do get people cat calling you so I'd usually wear shorts under my skirt/ dress which makes me feel less objectified.*

However, Cyclist C felt that sometimes her overtly feminine appearance made her the object of unwanted attention and that she had to consider how to dress in order to '*feel less objectified*'. Thus, it is clear that females who cycle must consider how to present themselves, as a gendered traveller, in ways that other taken for granted forms of transport do not (Steinbach et al 2011).

Furthermore, Non-cyclist A expressed concern that her sexuality might be misread if she were to cycle:

*I would also be afraid to cycle because I already look quite masculine. It'd kinda perpetuate the whole 'dyke on a bike'*

*thing and I don't need any more reason for people to think I'm a lesbian, not that there's anything wrong with that but I feel like it'd put guys off which I don't want!*

This highlights the extent to which cycling has become culturally and socially read, as well as how this can work to perpetuate stigmatised identities i.e. 'dyke'.

### **Fear vs. empowerment**

Cyclist C recalled feeling unsafe while cycling in Dublin:

*I find when I'm cycling really late at night I feel like it's unsafe to stop at traffic lights, like the traffic lights near Christ Church. Whenever I stop there and it's late and there's no traffic I find that people can come over to you and talk to you or like cat call you. I remember one time a car came up while I was stopped at a light and they were whistling at me so I just went through the red light. Actually, my friend had an awful experience on a bike near Thomas Street where someone came up to her and grabbed her while she was waiting at the lights.*

However, cyclist A felt as though cycling offered her a form of protection from the threat of street harassment:

*I was talking to a friend about harassment she'd get on the street from men on the way home [walking] and I was really surprised but then I was thinking I don't walk on the streets ever, so I actually don't come across any of this. You're literally just like flying above society so you don't notice like loads of things that are going on. You're really insulated from things like sexual harassment. Even if someone does scream at you when you're on a bike, you're gone, you're not in danger in that way. Maybe you'll be hit by a bus but at least it won't be a harassing bus! It's a pure physical danger as opposed to danger coming from social things.*

Horton (2007) argues that cycling's relative 'strangeness' (unusualness) in low-cycling countries renders the female body more visible and thus more vulnerable. However, cyclist A's account suggests that cycling can also offer a form of protection from harassment and danger that women experience in urban spaces. As Tonkiss suggests, urban spaces present women with the "double edge of visibility and invisibility" (Tonkiss 2005, p. 95 in Steinbach et al 2011). Furthermore, cyclists felt that cycling made them more sociable giving them freedom and independence that other forms of transport would not. There was also a sense that others admired them for cycling suggesting a form of social empowerment influenced by their decision to cycle. This clearly influenced cyclist A's psyche in that it provided her with a sense of superiority.

### **Discussion/Conclusion**

As Aldred, Woodcock & Goodman (2016) note, the impact of gender on cycling is country specific as both physical (infrastructural) and perceived (social and cultural) barriers have been overcome in countries such as Denmark, The Netherlands, and Germany, where typically more bicycle trips are made by women than men (Garrard 2003). However, this is still not the case in low cycling countries, including Ireland, where gender disparities in urban cycling participation are significant.

The Victorian distinction between the public (masculine) and domestic (feminine) cyclist (Mackintosh & Norcliffe 2007) can still be seen to impact the construction and understanding of cycling identities in Dublin. The dominance of 'the cyclist' (Horton 2007) has reinforced the association between cycling and 'masculine' behaviours which can alienate those who do not perceive cycling as compatible with the expression of 'feminine' identities, but for others cycling can be used to express an empowered feminine gender



identity. Cycling's 'strangeness' has increased the public visibility of the cycling body which can urge females to consider how to travel as a gendered traveller in ways that other normalised forms of transport would not. While this visibility may increase vulnerability to harassment and other forms of street violence, it can also provide women with an empowered identity; physically, socially, and mentally.

Socio-cultural norms and expectations around the performance of gendered identities are clearly still influencing the perceptions of cycling as a gendered mode of transport in Dublin. However, the power of cycling as a metaphorical and literal vehicle for the perpetuation of a dominant cycling identity is being challenged by the embodied experiences of those who use cycling not only as a means of transport, but also as a tool of empowerment that challenges the dominant perception of cyclists and the normative gendering of urban space.

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## **Assessing the Application of Earth Analogs in the Study of Martian Geomorphology**

*Keela Conlan*

The increasing need for access to a concrete, reliable source of information for scientists and geomorphologists who study planetary bodies within our solar system has been tackled through the use of earth analogs. Earth analogs, or terrestrial analogs, are applied to external planetary bodies which are believed to have similar environmental conditions to those experienced on Earth within that period to which the recorded analog relates. These analogs form a pool of information from which scientists can theorise certain conditions of an extra-terrestrial location. According to Osinski (2006), terrestrial analogs are locations on Earth, which “approximate the geological, environmental and putative biological conditions on a particular planetary body”. They can be used to decipher these conditions at present or at a past time scale, depending on the similarities of the conditions from the analog to the planetary features they will analyse. Due to the proximity of Mars to Earth compared to other planets in the solar system, many Earth processes are similar to those which occur on Mars. However, as Mars is not an inhabited planet, we are unable to obtain much concrete data without using Earth analogs to develop information for the processes and conditions of the features present there.

When using Earth analogs as a tool to explore the geomorphology of Mars, a geologic perspective is used as a framework for interpreting these features. According to Garry & Bleacher (2011), the geologic analogs used in this context are defined as “environments, morphologic features, structures, or processes that serve as a basis for comparison of similar features on other planetary bodies.” Through use of these recorded analogs in areas which contain

similar observed conditions, a theory can be developed regarding how these features formed based on the analog. These analogs are important as a means of understanding processes that occur in both past and present conditions on other planetary bodies throughout the solar system. They have been used as a fundamental part of space exploration and new understandings gained within the field of planetary science for most of the twentieth century. Terrestrial analogs are also often used as a training and testing method for both astronauts, and machinery and equipment before they depart on missions into space (Garry & Belcher, 2011). The sites from which analogs are taken offer conditions similar to what the machinery or astronauts will experience upon arrival at their extra-terrestrial destination, and therefore act as a trial or test to develop skills and methods of operation.

These terrestrial analogs can match to conditions from both current and past climates found on other planetary bodies. Earth analogs have been successfully used mainly on Mars and the Moon, but they can be used on any extra-terrestrial body within our solar system, should the conditions have a sufficient number of similar characteristics (Léveillé, 2010). There are many origins of these terrestrial analogs which are used today, and in many ways the current type of analog used is a combination of a number of factors taken from these past ideas.

The first pre-analog idea proposal was developed by Urey (1952), suggesting that scientists could learn to better understand planetary bodies in our solar system and their associated moons, through the study of our own moon. This study of the moon would offer a detailed account, or analog, which could be replicated and contrasted in terms of other bodies in space. For example, the exploration of crater impacts on Mars would enable a thorough account to be formed of the geomorphological features on a planetary body outside of Earth, making it possible to use these results to explore

meteor craters on any number of other planets and their moons. Other pre-analog methods of obtaining information from extra-terrestrial bodies include comparing aerial photographs from locations of Earth to images taken on the surface of Mars with the Mariner (Belcher et al, 1971). This showed glacial, thermokarst and aeolian surface features, which were comparable to Earth features. Similarly, Baker and Milton (1974) examined channels on Mars in terms of their similarities to the terrestrial site of Channelled Scabland, Washington. They were able to conclude that one or more large catastrophic flood event occurred with the history of Mars to form these features. The collection of these different sources of information was the starting point for the use of Earth analogs to explore the geomorphology of other planetary bodies, in particular the moon and Mars.

At first, scientists used terrestrial analogs to study our moon, a densely cratered planetary body, allowing astronauts to train in an environment which highly resembled the lunar geology they would encounter. An example of this is the Apollo experience, in which astronauts trained in earth processes which also occurred on the moon, enabling them to deal with lunar conditions upon arrival (Garry & Bleacher, 2011). However, the need for a greater understanding of the processes that take place on the Martian surface has increased the use of terrestrial analogs to approximate current and past conditions on the planet (Kumar et al, 2010). The development of instruments and equipment for use on Martian surfaces in future missions, which will examine what kind of biome was present on early Mars, has been greatly accelerated through the role of analogs (Wharton Jr et al, 1989). The need for accurate analogs reflecting Martian conditions is more important than those for the moon, as the planet of Mars has not been visited by humans yet. This means we are unable to confirm the accuracy of these assumptions without the data to confirm that these terrestrial analogs reflect Martian geomorphology.

Earth analogs have been incorporated into the exploration of

Martian geomorphology in many ways. Different analog sites on Earth are useful for identifying different types of features on Mars. The Dry Valleys of Antarctica are used as analogs for Mars, as the climatic conditions of many of the sites are believed to be very similar. The arid and icy conditions of the Alaskan ice sheets replicate current climate conditions on Mars due to the lack of liquid water at the site, which is due to the freezing temperatures of the region. In the aftermath of the Viking lander missions, the amount of analogs used to explore the Martian surface increased, dealing with more dune sites and other desert features (Léveill , 2010). Arcone et al (2002), explores the use of ground-penetrating radar within the Dry Valleys of Alaska to examine its permafrost. Using this radar, it was found that the valleys were kept relatively free of snow due to the polar desert climate the area experiences. The Alaskan dry permafrost on these ice sheets reached up to 600m deep, comparable with possible conditions being experienced on the Martian surface. The use of this ground-penetrating radar within these analog sites will allow future equipment to be designed specifically for the exploration of Mars, with the similar surface geology of the two locations allowing for assumptions to be made regarding the permafrost present on Mars, through using the findings from the Dry Valleys.

Another area of research of terrestrial analogs for use on Mars is examining geomorphological features present on meteor craters throughout the planet's surface. Features that are believed to be gullies, alluvial fans and aeolian features have been observed on impact craters, but due to limited access to the Martian surface, geomorphologists can't be positive of what exactly they are or how they were formed. Therefore, we can see the importance of using Earth analogs to track and obtain information regarding the origin of these features. Features on the Martian impact crater, Mojave Crater, that are believed to be alluvial fans have been compared to alluvial fans found in southwestern California (Williams et al., 2006). The use of

this terrestrial site as an analog would enable us to decipher the processes behind the Martian features when they were formed, and if fluid was involved in their formation. According to Williams et al. (2006), alluvial fans are features formed from fluid sediment transportation from upland to lowland areas. The fans present on Mojave Crater are associated with climatic conditions that are similar to the conditions present in southwestern California, making this particular analog appropriate for research in this area.

Similar features to alluvial fans are pipes found on Gale Crater on Mars. These pipes are also thought to be features resulting from fluid sediment transportation and are described as elevated cylinders that have partially cemented rims and a concentric internal layering (Rubin et al, 2017). A terrestrial analog site that contains features comparable with those found on Gale Crater is the Colorado Plateau, which Rubin et al. (2017) explores. A study of 26 accounts of these pipes found in the Colorado Plateau was published. The variety of this analog allows geomorphologists to better understand the formation of the pipes on the impact crater on the Martian surface, with the pipes present in this area matching the definition provided above of those found on Gale Crater on Mars. Therefore, the Colorado Plateau is considered a good analog for this Martian area, as it offers geomorphologists new insights into the origin of the pipes formed.

However, there are unfortunately limitations to the use of Earth analogs in establishing a concrete set of ideas regarding Martian climate and geomorphology. Terrestrial analogs can only positively account for processes which occur on Earth, under particular conditions present at the site of the analog. With our lack of information about many areas and regions on Mars, we can't completely match a terrestrial analog site to a region on another planetary body, we can only apply the best fit. There are multiple variants that could take place on either planet, which are not accounted for, which may therefore skew results. In the case of the pipe



formations on Gale Crater, Mars, it is difficult for geomorphologists to interpret the direction of sediment movement (Rubin et al., 2017). It is exceptionally difficult to distinguish between upward and downward sediment movement of the sites on Earth, meaning it is virtually impossible to see this on Mars without the development of more specialist equipment. This limits the use of terrestrial analogs in interpreting the geomorphology of the Martian surface.

In the case of using thermal ice-melt probes, Winebrenner et al (2013), discusses how using sites on Earth as analogs can help geomorphologists to understand processes present in similar sites on Mars. They suggest subglacial volcanoes in Iceland as an analog for ice-volcano relations on the Martian surface, the presence of Brine transportation within the Antarctic shelf as a way of describing what is believed to be a similar type of flow beneath the chaos region of Mars, and also the use of subglacial lakes beneath the Enceladan ice shelf in Antarctica as a terrestrial analog for the hypothesized Perrier Ocean on Mars. These analogs are all effective in theory however when using the thermal ice-melt probes, it takes teams of several people to deploy the instruments into the ice. As this is only a challenge on Earth, it is logistically impossible on Mars without a team of astronauts on site to work the machinery and probes.

In conclusion, our understanding of the geomorphology of the Martian surface, though still relatively limited, can be mainly attributed to the use of terrestrial analogs. Through these analogs, geomorphologists are able to form assumptions of the Martian surface, in particular based on the environmental, geological and biological conditions of the planet (Osinski, 2006). However, much of the planet is still unexplored due to the lack of human presence. If Earth analogs continue to develop, it will help the knowledge base of Martian geomorphology to continue to grow. Also, through using data collected by the Curiosity Rover on Mars, scientists will be able to confirm the appropriate use of Earth analogs on the past and present

conditions of Mars, therefore enhancing that data base of our knowledge of the Martian terrain. This will enable more of these terrestrial analogs to be used, and ultimately developing as much knowledge as possible from the planet without the presence of humans to take these measurements in person.

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## **Carbon Trading: A Necessary Solution or a Dangerous Distraction?**

*Eleanor Scott*

The Kyoto Protocol of 1997, and its introduction of carbon trading into mainstream international economic policy marked an end to the supremacy of “command and control” style environmental policy. The essence of the Kyoto protocol established Neoliberal environmentalism as the ethos of the developed world. This protocol propelled the notion that laissez-faire policies hold the key to saving the future of our planet. This multilateral agreement established the basis of the European Union Emissions Trading Scheme in 2005, the world’s largest emissions trading scheme and the Paris agreement of 2015 (Ellerman and Buchner, 2007). In comparison to the Rio Earth Summit of 1992 the Kyoto protocol did not rely on vague non-binding qualitative goals for the reduction of emissions. No longer was it left to governments to pass individual legislations to meet targets. Instead, quantitative binding targets were set and better yet, a means to how to achieve these targets was provided, carbon cap and trading. This marked the introduction of emissions trading into an international agreement on the prevention of climate change. This innovation in environmental policy cemented the idea of using the market to address its own failings and established the idea that market mechanisms can solve the “market failures” of environmental degradation (Stroup, 2008).

The central elements of the Kyoto protocol served to highlight the reduced role of government in the protection of the environment. This process has been occurring since the 1990s, as the private sector becomes increasingly involved in resource ownership, ecosystem services and green innovation (Robertston, 2004; Lemos and Agrawal, 2006). Fixed targets were set for the reduction of greenhouse gas

emissions, ranging from 5-8% from their levels in 1990, for varying states (UNFCCC, 2018). The capping and trading of carbon aims to end the “tragedy of the commons” by granting the right to release CO<sub>2</sub> into the environment to a certain few through transferable permits. To lessen the blow of rigid targets these permits can be bought, sold, banked for later use or earned in the form of offsetting through the reduction of emissions elsewhere (Gorman and Soloman, 2002). As eloquently captured by Bakker (2007), what was once “commons”, the right to pollute, is now a commodity. The purpose of commodifying these permits is that their supply may be reduced over time, thus increasing their demand and in turn, their price. This excess of demand is hoped to bring about innovation in new green technology as firms find new ways to lower emissions and negate the use of emissions permits. The aim is to lower pollution at the lowest possible cost. The questions must be raised, what are the origins of this concept and does this novel idea work in practice? Furthermore, what has changed since the radical environmentalism of the 1960s, with its call for an upheaval of the existing capitalist socialist system to the complete accepting of such an inherently capitalist scheme as emissions trading?

In contemporary debates, it is sometimes felt as if the practice of emissions trading is as old as the market itself, with the implication being that it is the natural and logical route to take in the face of rising global temperatures. The idea of emissions trading and capping has its origins in the writings of Pigou in the 1920s who argued that a well-designed pollution tax would have substantial social benefit (Hepburn, 2007). Further work on the concept was carried out by Nobel Laureate Ronald Coase (1960). Yet, it was John Dales, an economist at the University of Toronto that placed the idea within the circumstances of emissions trading as a pollution control in his work “Pollution, Property and Prices” (Dales, 1968; Makenzie, 2008). The development of emissions trading occurred at a pivotal time for American environmentalism. The decades of the 1960s and 1970s had

brought unprecedented change in the way society views the environment. Events such as the Love Canal disaster (Beck, 1979) and the Three Mile Island nuclear incident (Cable, 1988) caused people to realise the damage anthropogenic forces can have on the planet. The fledging environmental movement at the time was cemented with the release of Earthrise”, an image of the earth from space (NASA, 2013). This image highlighted the fragility of our “Spaceship Earth” and the crucial role we must play as stewards to ensure its continuation (Spier, 2012). If it was not for the emphasis on the environment at the time it is unlikely that such research into experimental methods of environmental protection such as emissions trading would have occurred.

Under the Reagan administration the idea of emissions trading was further explored by the Environmental Protection Agency. This experimentation and research into exploratory environmental policy highlights that caring for the environment was not a partisan issue in the US at the time (Dunlap et al.) Although under today’s Republican Trump administration which has proposed cuts of over one third to the budget of EPA, one is not certain that this is still the case (Davenport, 2017). With Title IV of the Clean Air Act, came the first nationwide scheme for a “tradable permit approach to pollution control” (Joskow, Schmalense and Bailey, 1998; Ellerman, 2000). The capping and trading of sulfur dioxide pollution was established to reduce the effects of acid rain that was ravaging ecosystems in North America at the time (Glass et al.,1980). The goal of this act was to cut SO<sub>2</sub> emissions by 10 million tonnes from 1980 levels, of 26 million tonnes, primarily emitted from the coal-fired power plants fuelling the countries industries (Gerdes, 2012). The project was heralded as a ground-breaking success in terms of novel environmental policy. Emission reduction targets were reached and exceeded. Despite the reduction in emissions, output from the targeted coal-fired plants grew by 25% during the same period (Gerdes, 2012). Furthermore, this new form of

environmental regulation led to increased innovation as firms looked for ways to reduce their emissions in order to avoid paying for costly permits. For example, the quality of SO<sub>2</sub> scrubbers dramatically increased as the removal of 90-95% of the SO<sub>2</sub> from the emissions of a factory proved less costly than purchasing a permit (Burtraw, 2000). In fact, this market driven experiment was such a success that it was estimated to have saved \$1 billion dollars a year when compared to command and control style policies that were suggested in congress in previous years (Stavins, 1998).

Today, policy makers are applying these same methods of emission trading on a much grander scale: to combat climate change. The Intergovernmental Panel on Climate Change has predicted that global temperatures will rise by 2.5 to 10 degrees Fahrenheit over the next 100 years (NASA, 2018), leading to the rising of sea levels and certain ecosystem degradation, undoubtedly putting the planet at risk. It is clear that radical action is needed now. World leaders have recognised that we can no longer grow as we have grown before. Environmentalists such as those within the Club of Rome (Jackson and Webster, 2017) believed that there are absolute limits to growth, that economic progression and the preservation of the environment cannot go hand in hand (Gorz, 1980). According to this school of thought, there is no win-win scenario when it comes to the presumed opposing forces of industry and the environment. Yet while the introduction of carbon trading is an acknowledgement that we cannot continue to grow without checks, as we have since the great expansion following world war two, it does not believe that there must be an inherent trade-off. Carbon trading proposes that economic growth and the environment can thrive in harmony. Proposed increases in prices of carbon permits should gently phase out the use of fossil fuels and we can hope to reap the rewards of a green economy as innovation fuels new technologies. Indeed, according to the EU commission for Energy, Climate Change and the Environment, due to the European

Union Emissions Trading System the European Union are on track for a reduction of 20% in their greenhouse gas emissions from 1980 levels. What's more is the union believe that through this policy they may further reduce their greenhouse gas emissions by 40% by 2030, in line with the Paris agreement (European Commission, 2017, pg.5).

Yet many are not convinced of the promise of carbon trading. Concerns have been raised about the ethics and effectiveness of emissions trading on such a large scale. Many believe that carbon trading is merely a distraction which makes grand illusions to positive change while keeping the polluting parties wealthy. Ignoring the potential ability of carbon trading to reduce greenhouse gas emissions, it must also be asked, is it inherently immoral to price nature or the right to pollute? In doing so are we are licensing to kill? (Caney and Hepburn, 2011).

Academics such as Clive Splash worry that the complex issue of anthropological climate change and its potential solutions become lost in the struggle to create a complex system of handling these new form of financial assets (Splash, 2009). Perhaps we should be focusing on keeping fossil fuels in the earth rather than creating new gains from trade and extending the role of markets (Monbiot, 2015). Today, the trading of carbon permits has "matured" into a speculative industry as investors purchase permits for their monetary value rather than compliance (Capoor and Ambrosi, 2008). This trend is repeated in other industries such as fishing in which transferable quotas are bought for investment purposes (Newell, Sanchirico and Kerr, 2005). This is evidence of a wider change in our "post Breton-Woods economy" in which there is increasing privatization and marketization of public goods (Lohmann, 2012). Is this green-washing of the appropriation of resources such as fisheries? Is there perhaps a warning from the financial crash of 2008 that we are choosing to ignore, perhaps the entangling of the future of the earth's atmosphere with speculative industries is not the answer.



The current system of carbon trading as carried out within the EU is certainly not without its flaws. It has been revealed that too many permits were doled out for free in the initial stages of the scheme as consumption fell below expected levels during the recession (Carrington, 2009). Furthermore, the current idea that we can offset the carbon we release by reducing carbon emissions elsewhere is inherently flawed. Many of these carbon offsetting schemes involve the buying and retiring of carbon permits. Such a scheme occurred within the EU, which transpired to be an entirely fruitless activity, as the supply of the permits already exceeded demand (by 170 million tonnes), meaning that the carbon was never to be released in the first place (Davies, 2007). Furthermore, the Kyoto protocol outlines how firms may offset their carbon emissions rather than reduce them through the plantation of expansive forests. Studies have shown that why this may seem practical as forests act as “carbon sinks”, the opportunity cost of land and “ephemeral” nature of this form of carbon sink makes it a costly and short-term solution (Whitehead, 2011).

Despite the resolutions of many, it is clear that carbon trading is the policy choice of the moment in the prevention of climate change, with China looking to establish the world’s largest carbon trading market within the upcoming years (Feng, 2017). Only time will tell if this policy experiment pays off or if we have lost valuable time and funding that could have been put towards necessary decarbonisation (Mckinnon, 2009). The question must be asked, does carbon trading hold the answer or does the neo-liberal capitalist system in which we reside need to be transformed in order to see real results? This paper acknowledges the urgent need for further research into alternative methods of greenhouse gas emission reduction.

How can we hope to solve the problem of climate change using the very systems that created the problem in the first place? Are we falling folly to distraction techniques as the earth’s temperature continues to rise?

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## **To what extent are smart city initiatives sustainable?**

*Megan O'Byrne*

We are currently living in a world with a rapidly increasing population and increasing competition for dwindling resources. Consequently, one of the challenges for communities and professionals is how we will accommodate more people with the same amount of resources. The smart city model is one of the most popular urban planning agendas currently, with many cities adopting smart projects, cities or even smart nations. The smart city model is not easily defined, but at its core proposes a balance between economic, social and environmental sustainability. This 'balance' would accommodate the predicted rise in populations living in cities. Smart cities have received predominantly positive coverage in the media. However, a growing number of academics have raised doubts as to whether smart cities can be sustainable in every aspect. This essay will explore if current smart city projects are sustainable, and question if they meet social or environmental sustainability standards. Evidently, there is no single definition of a smart city, and this ambiguity may contribute to governments failing to create coherent, sustainable projects. Furthermore, this essay will determine underlying factors that affect whether the city can become sustainable using smart city modelling. This issue is essential to address, as the majority of future populations are predicted to settle in urban environments.

Central to the debate surrounding smart cities is the necessity of defining what a smart city is. There are many attempts to define a smart city in the field of urban studies. Soderstrom et al define a smart city as involving 'the creation of new relations between technology and society' (Soderstrom et al., 2014; 309). Caragliu et al state a city can be classified as 'smart' when 'investment in human and social capital, coupled with investment in traditional (transport) and modern

information and telecommunication infrastructure generates sustainable economic development and a high quality of life while promoting prudent management of natural resources' (Caragliu et al., 2011). Caragliu conducted a literature review on work that conceptualised the smart city and revealed six common characteristics. These features include improving administrative and economic efficiency, an emphasis on business oriented urban development, a focus on social inclusion of residents in public services, an emphasis on the role of high-tech and creative industries as being conducive to long term growth, the function of social capital in city development and taking social and environmental sustainability as important factors of growth (Caragliu et al., 2011; de Jong et al., 2015). A large amount of investment is placed in the ICT sector of a city, creating new advanced technology. Using this infrastructure and these facilities, private companies can innovate and provide better services and thus, a better standard of living, to residents. These residents can also be involved in the policy and system development processes (Lee et al., 2012). With more information, companies can meet the needs of the population and protect resources simultaneously. The smart city model is neoliberal in that it focuses on the innovations of private enterprises as opposed to public services (Hollands, 2008; Kitchin, 2015). The smart city label has become very popular in the last two decades (March and Ribera-Fumaz, 2016), and as many cities adopt 'smart' city agendas or plans, urban geographers highlight the labelling confusion that surrounds the smart city concept. The confusion and lack of clarity surrounding the label allows governments and corporations to use the term 'smart' for creating appealing policies or marketing purposes. For example, leading companies in smart city ventures such as IBM and Cisco have begun to alter the wording surrounding new initiatives, now emphasizing inclusivity and community empowerment (Kitchin, 2015). This lack of one singular definition also leads to conflating terms like 'digital city', 'knowledge

city’ and ‘intelligent city’ (de Jong et al., 2015). De Jong’s bibliometric analysis of urbanisation literature shows that it is essential to highlight the differences between sustainable development concepts, as this understanding is central to being able to implement policies effectively (Barton, 2000; de Jong et al., 2015). On the larger question of whether smart cities are sustainable, language is central to this discussion, as it has the capacity to define and create narratives surrounding the successes and failures of smart cities.

Smart city theory focuses on using technologies such as smart sensors, smart grids, autonomous transport infrastructure and renewable energy generation to grow sustainably in social, environmental and economic dimensions. However, the reality highlights that smart cities often develop economically, as private companies create profits from data and innovation, but fail to match that growth in social or environmental sectors (Haardstad, 2016; March and Ribera-Fumaz, 2016). The smart city had originally been proposed by academics and politicians as an innovative and creative solution to urban problems such as high emissions rates, social inequality and environmental degradation (Deakin and Al Waer, 2012; Campbell, 2012; Wheeland, 2016). There are several reasons that many smart cities have failed to achieve the promised sustainable solutions they are founded on. Firstly, the political ideology that smart cities are built upon creates issues in sustainable development. By following a neoliberal model of urban development, where companies are largely autonomous from the state and the planning process is relatively unrestricted, cities can undergo uneven development. If only certain areas or buildings are ‘smart’, patterns of geographically uneven development are perpetuated (Smith, 2008). Without a plan to integrate information systems and smart services, only certain areas will benefit, which is contrary to the smart city ideal of sustainable social growth. This view highlights a reality contrary to the portrayal of smart cities as homogenous projects of ecological urbanism but



rather as the disjointed, disconnected and nonsensical results of unsuccessful experiments. This is known as ‘Frankenstein urbanism’, after Mary Shelley’s fictional monster (Cugurullo, 2017). An example of this can be seen in Hong Kong, a city that is simultaneously one of the wealthiest cities in the world and one of the most expensive to live in. In one area of the city, Hong Kong’s Science and Technology park houses 600 technology companies and vast amounts of data (Hong Kong STP Database, 2017) and in another, poor residents of the city live in ‘coffin houses’ smaller than the average prison cell (Haas, 2017a). One in seven residents in Hong Kong is living in poverty and while the technology and innovation industries boom, the housing market is the most expensive in the world (Haas, 2017b). A similar case has emerged in Dubai, who in recent years has adopted a smart government initiative and have launched many smart initiatives, such as the DubaiNow app that combines multiple government services onto one app. Dubai has experienced huge growth in tourism, trade, finance and logistics, and through embracing technology has become a global city (Bin Bishr, 2017). However, the city is now facing numerous environmental issues such as water pollution, air pollution, and environmental degradation (Alderman, 2010). Furthermore, academics in urban studies have expressed concerns for the future of studying urban environments. Referring to a report on ‘Technology and the Future of Cities’ (Shelton and Clark, 2016), they highlight the new trends that have shifted the focus from individuals and communities, to the collection and analysis of massive datasets on urban trends, showing a shift towards a ‘privileging of the technical over the social’ (Shelton and Clark, 2016). To conclude, most existing smart cities are not socially or environmentally sustainable, as they are focused more on economic growth than on managing resource use and distribution.

Despite their positive coverage in mainstream media, it can be acknowledged that smart cities in practice are not sustainable. The

examples are numerous and include the Indian city Dharmshala, that recently demolished over 300 houses to provide land for new ventures (Chatterjee, 2017) and Amsterdam, which is known as the most energy-efficient city in Europe, yet has emissions that are rising annually (Berthon, 2011). If we hope to create future smart cities that are sustainable, we must address the causes of our current smart cities' failures. As suggested above, one cause is that the political ideology that underpins smart cities makes it impossible to create integrated and sustainable city networks, as private enterprises are focused on profits and not public services (Hollands, 2008; Lee et al., 2012). Similarly, the installations of new technology and ICT has followed the traditionally ecologically insensitive patterns from the last few decades (Cugurullo, 2017). In fact, Kaika states that new urbanism used within this old framework will only normalise the amount of social inequality and environmental degradation in societies but do little to fix it (Kaika, 2017). Another related problem identified is the use of technology to become more sustainable requires materials that are both damaging people and the environment. For example, coltan ore is an essential part of all mobile phone technology, and while smart phones are widely used in the collection of data, many young children are injured or die mining coltan in environmentally destructive open-cast mines (Kaika, 2017). If we continue to consume in a way that is unsustainable, no amount of smart technology will be able to prevent us depleting our resources and our quality of life. We can interrogate the fundamental causes of smart city failure even further, by using the work of German philosopher Max Horkheimer. Horkheimer's book 'The Eclipse of Reason' proposes two concepts that are useful in understanding the instability in the conception of smart cities. The first is that there are two types of reasoning present in societies – subjective reasoning and objective reasoning. Subjective reasoning is more focused on individuals, and on means of carrying out actions. Objective reasoning is focused on larger impacts, and considers

broader issues and concepts, such as happiness, fulfilment and sustainability. In smart cities currently, there is more subjective reasoning present than objective reasoning, which allows for companies and governments to make decisions that are in line with individual interests instead of collective ones (Horkheimer, 1947). The second theory is that the world we live in is transforming from a world focused on ends, to a world focused on means. A risk in smart city development is that city governments and planners are too focused on the means of digitising cities, but not the end goal of sustainability (Horkheimer, 1947). Even in the case of a smart city that was functional and sustainable environmentally, city residents might have to accept that with the collection of big data, might come the eventual erosion of their political rights, such as the right to privacy (Poon, 2017; van Zoonen, 2016). The reasons why smart cities cannot be sustainable now is linked to weaknesses in their ideology – their political positioning, their consumption patterns, their failing to incorporate human rights and their philosophical motivations.

From the birth of humanity, communities have come together to live in cities. Aristotle believed cities were integral to the individual living the best possible life. He stated that an individual's relationship to the city is like that of a hand to the rest of the body – it will not survive if separated from it. He believed 'citizens were part of the city' and reached our true potential within it (Aristotle, 1905). Where cities had previously served practical functions, like defence, they have now expanded to serve larger groups of people, with many services and functions (Shelton et al., 2015). Cities are the product of our ideologies, our resources and technology (Kitchin, 2015). It is within our power to transform cities to fit our ideologies.

The smart city model is one of the modern changes of city form and this essay highlights that current smart cities are not sustainable for many reasons. Firstly, their lack of clear definition makes them harder to achieve. Secondly, both the political ideology

and motivating forces mean that smart cities cannot solve their social and environmental problems (Caragliu et al., 2011). Many examples can be seen in Hong-Kong, Dubai, Rotterdam and Singapore, which have resulted in problems like increased social inequality, deepened poverty, uneven development, water pollution and reducing local wildlife populations (Haas, 2017b; Alderman, 2010; van Zoonen, 2016; Poon, 2017). India's proposed 100 smart city developments is facing increasing criticism and other completed projects like Songdo in South Korea has remained largely uninhabited. Smart cities are being lauded in the media and by policymakers as the solution to urban problems, as they propose non-traditional solutions to problems regularly associated with urban living (van Zoonen, 2016). However, if smart solutions are continued to be implemented with dated techniques, and tied to unsustainable philosophies, smart cities will merely create more problems (Cugurullo, 2017; Kaika, 2017). Can future smart cities ever be sustainable or are they condemned to fail? This will remain to be seen in the coming decades, as cities become more vital to the living of millions more people born on Earth.

In conclusion, current smart cities are not sustainable because they do not meet the sustainable growth requirements in all three areas. They can be sustainable if they alter their fundamental ideologies of neoliberalism and means-based growth. To take Aristotle's comparing of a city to a body, smart technology can be portrayed the 'superior sensory organs' of the city, recording data and diagnosing problems. However, if we fail to use this technology with the right motivations and implement it in a sustainable way, we will not create sustainable smart cities or solve urban issues.

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## A Selection of Photos from the Year

### GeogSoc International Fieldtrip to Sofia/София







## Globetrotters FC



## Geo-Week 2019





GeogSoc at the CSC Awards



## Annual Pub Quiz, January 2019





National fieldtrip up to Bundoran...





... with a stopover in Paris



{Flat} Earth Ball 2019













## Geog On

