Landscape in Flux

Precision and error of the natural phenomena affecting the coastline

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January 2021

Borders and Territories

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Abstract – Natural phenomena are continually changing the coastline and sculpting the land in various ways. By surveying these changes a map can be produced of a landscape in flux. But if the landscape is ever changing, what does it tell us about the precision of flux. The essay also tries to give an answer to the question if there can be error in flux or if the essence of flux is made out of error. First it will be introduced by looking at the representability of open source satellite imagery and the intelligence behind the processes they go through. In the process minor errors can appear that can affect our resolution of a place by looking from afar. These errors are tried to make apparent by mapping out three different types of natural phenomena in combination with man made architecture. The topic will be surveyed with the use of a case study surrounding Gwadar, Pakistan.

Keywords – coastline, flux, error, precision, open source, Gwadar

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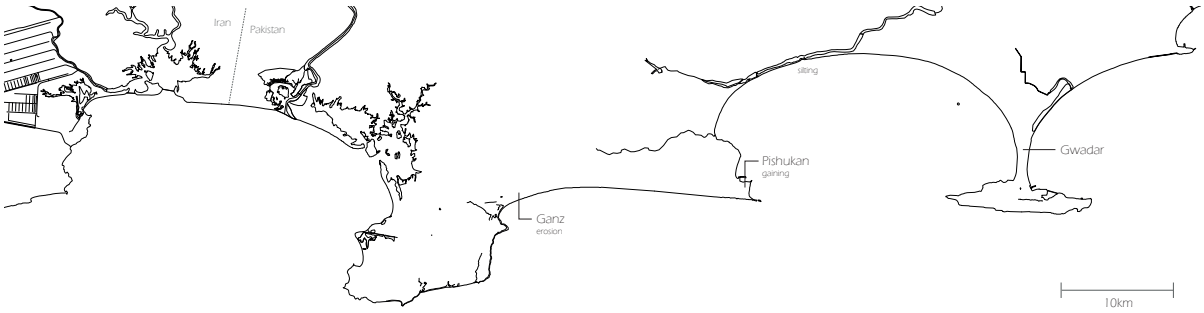
Introduction

Water has always been a divider or indicator of territories. Going back to ancient times a large river has been the end of one's territory due to the lack of resources that make it impossible for crossing the river. Crossing it would enter someone else's. A stream of water would indicate vital grounds surrounding it to use as agricultural land, even claiming the land up until the source. In mountainous areas the deviation is indicated by the absence of water, meaning the watershed line. And in the most clear separation the ocean or sea dividing land and water; mass and fluid. Due to the constant motion of the water, there have been lots of disagreements around the political borderline between lands. At the political borderline between Austria and Italy there is a small portion of the line which is on top of a glacier. This makes it difficult to measure where the watershed line exactly is. There have been multiple experiments to map out the movement of a glacier, for example with colored stones with dates written on them. These stones were placed on top of the glacier in a carefully chosen line along the width of the glacier and mapped with coordinates. After a while the stones were searched and mapped again and the deformed line would give an estimated change in the movement of the glacier. Here the question of precision arises. The stones can be affected by other phenomena such as gravity and the melting of water underneath. After completing the experiment multiple times faults in the system occurred, because the stones were actually falling through the ice. In the case of the glacier dividing Austria and Italy a different system is used. On the Gräfferner glacier in the Ötztal Alps a set of 25 measuring devices have been installed. These devices are placed in a 5 by 5 grid to carefully map the watershed line on top of the ice sheet. Because the glacier is constantly moving, the watershed lines move with it. This line is drawn by a machine tracing, in real time with data received from the sensors, the political borderline between Austria and Italy. Both countries have hereby agreed upon a moving border since 2014. (Ferrari, Pasqual, & Begnato, 2019) This is a clear example of mapping a landscape in flux. But what does the result tell about the precision of flux and can there be error in flux?

Looking closer at the case study of Gwadar; a fisherman's village relying completely on the Arabic Sea. Gwadar is located in the west of Pakistan situated only 70 kilometers to the border of Iran and more than 500 kilometers from the largest city Karachi. The village has recently become visible on the global radar due to the Chinese investments to make Gwadar into a world trade port along the New Silk Road. It has always relied on its fishing industry which is now being disrupted by the newly built infrastructure along the peninsula. The coastal area of Balochistan is affected by constant natural phenomena such as sandstorms, erosion and drought; shrinking the peninsula of Gwadar and slowly running out of drinking water. The Chinese investments have promised a better future for Gwadar, but momentarily are only affecting the lives of the locals in a negative sense by cutting off access to the sea and securitizing the whole area in a strict manner.

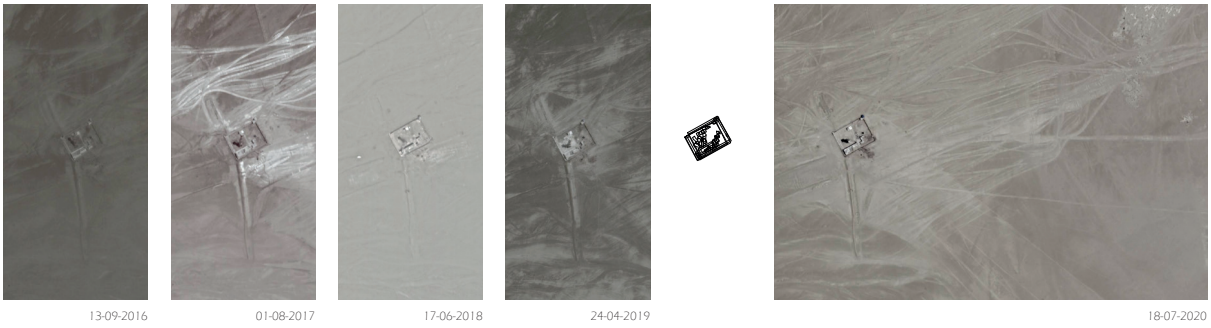
The way Gwadar is researched upon, we have to take into account the place is observed through the lenses of open source imagery and with a rather biased view of a Western perspective. The mentality of my perspective is focused a lot on improving situations which are in essence already progressively developed. In the situation as Gwadar, where the way of living goes its own way, from hearing the need for drastic change isn't much present. And there's definitely no demand for a developer who looks from a far and transforms the whole region.

Approach



[1] [Coastline surrounding Gwadar, Source: Open Street Map]

This essay will focus on three locations surrounding Gwadar where the sea is constantly shaping the coastline. At these locations different types of natural phenomena are the cause of the coastline being in flux; erosion, silting and gaining. [1] These natural phenomena are at interest here because they are either taking away land resulting in possible disasters, changing frequently it produces a unique type of soil or adding land by a natural process. The places are located at the West of Gwadar and chosen because of its effect it has had on local life. After looking carefully in a zoom-in view at places along the coastline throughout the historic images of Google Earth's satellite imagery, it is apparent our view is distorted. The imagery shown underneath is through satellite images geolocated on top of each other and traced. Through man made architecture the faults in the satellite images are made visible. [2]



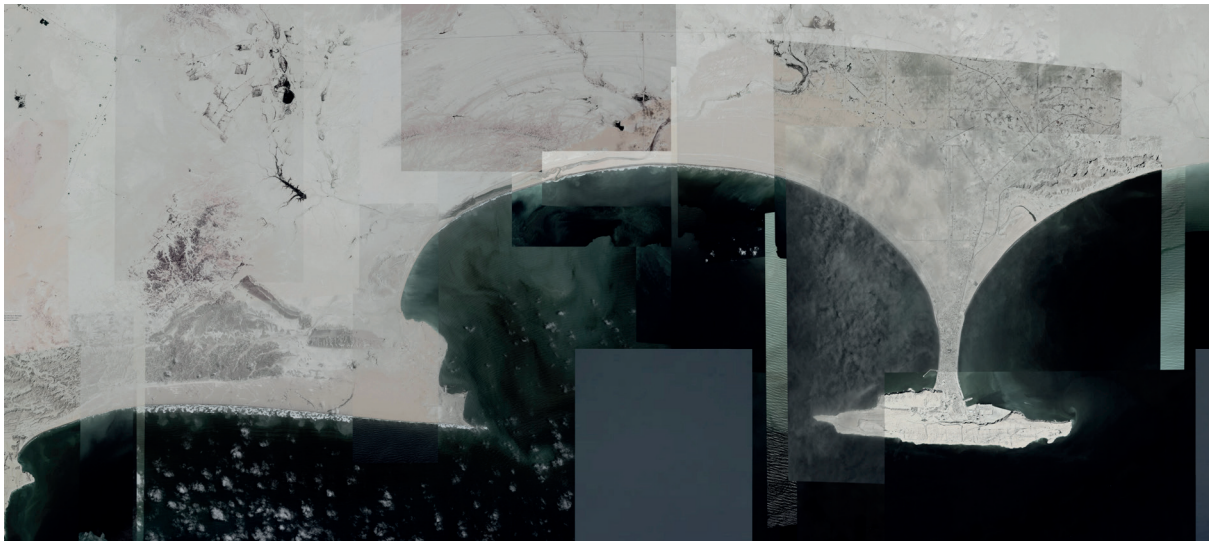
[2] [Faults in satellite imagery, source: Google Earth Satellite imagery traced in QGIS]

To what extent is the mapped distortion changing our view on a place? Or can it even be a right representation, as we could look at the world as mass in flux? As the world is 'flying' through the universe and tectonic plates are ever changing the environment we live in. In art the constant motion is often addressed as the essence of the work. For example the work of Marcel Duchamp; *Nu Descendant un Escalier (Nude Descending a Staircase)* where an abstract figure is walking down some stairs while seeing every movement superimposed or a large collection of the work of Daniel Spoerri on *Eat Art* where he would freeze the end result of a feast, showing what has happened. Architect, academic Francesca Hughes confronts us in the introduction of the book; *The Architecture of Error* with*: … when artists talk about their work we learn not so much about their work as about the*

delusions under which they work. When architects talk about their work they will almost always mention the word "precision." But when as architects we talk about how "precise" a drawing, a detail, a material system is - something we frequently and automatically do both in practice and, even more so in education – we betray, … (Hughes, 2014) Architects have a fetishization for drawing with huge precision, but not only is the building made by others, it is made in another medium; matter. Nowadays most drawings are made on a computer which is able to project towards an invisible precision. In 1963, when the first computer sketchpad was being introduced in a TV show a form of false precision was shown. Two lines appear to be attached to each other at their ends, but when zoomed-in the lines are seen to be detached. When zooming out the line becomes a grain on the screen, which later will be called the pixel. (Hughes, 2014) Before addressing the natural phenomena affecting the coastline, I will give an introduction on the visibility and its precision through which I have been experiencing Gwadar and its surroundings.

Visibility

The only way of getting to know Gwadar was through the screen and some verbally transmitted anecdotes. We have to take into account how the intelligence behind these publicly available imagery works. For example the technology of drone detectability can already make an immense precise image in the resolution of 1.8cm per pixel, but is only used in the military. If these images were to be available for everybody, the human rights were to be violated. This is why the public available resolution of satellite imagery is 31cm per pixel, to make people untraceable. (Weizman, 2017)

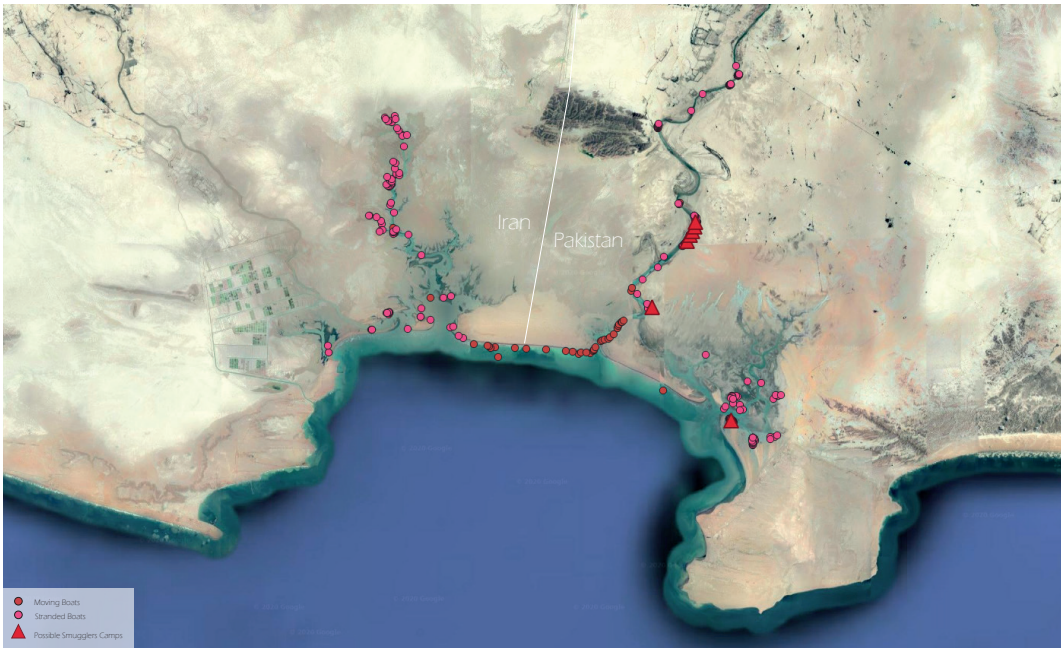


[3] [Layering of satellite images, Source: Google Earth]

Not only does the resolution of the images available play a role in how we see a place through the screen, the satellite only takes shots in a sky without clouds. Otherwise the image would be of no use. This means we are constantly looking at a place through the lens of a cloudless day without the rough weather which could appear. Even the images and videos that are made publicly available aren't taken in rough weather conditions, but we mostly see the results that are caused by natural phenomena. Furthermore, the satellites take shots of rough surfaces that extend beyond the two dimensional and

overlaying multiple shots to increase resolution. Only the other shots are taken by different satellites at different times, which results in a patchwork of images. [3] While prepared for viewing on screen, the images have to go through a process of orthorectification. Images can be geolocated upon its right coordinates, but to be viewed completely correctly, the images have to be stretched and contracted to remove its internal and external distortions. The process of orthorectification tries to make sure every pixel is viewed upon its assigned coordinate, to see the complete image at nadir. (Zhou, Chen, Kelmenis, & Zhang, 2005) When looking at higher buildings it's often possible to see the sides of the building instead of only the top, this is because the process cannot create what isn't captured.

Even though the resolution isn't most accurate, slightly deformed and the images and videos show a particular moment; places we cannot access are made visible. The location of camps, secret plantations and other sorts of places, that don't want to be discovered, are surfacing. The image shown earlier [2] is, for example, a possible location of a smugglers camp along the political border with Iran. This location is found through surveying small boats crossing the border of Iran via the Arabian Sea and following them along nearby rivers flowing into the sea. [4] Forensic Architecture, a research agency based at Goldsmiths University of Londen, uses publicly available imagery to build up a legal case of architectural evidence concerning human rights violations. (Weizman, 2017) After carefully looking through all kinds of imagery and reads, a sense of the place can still be formed.

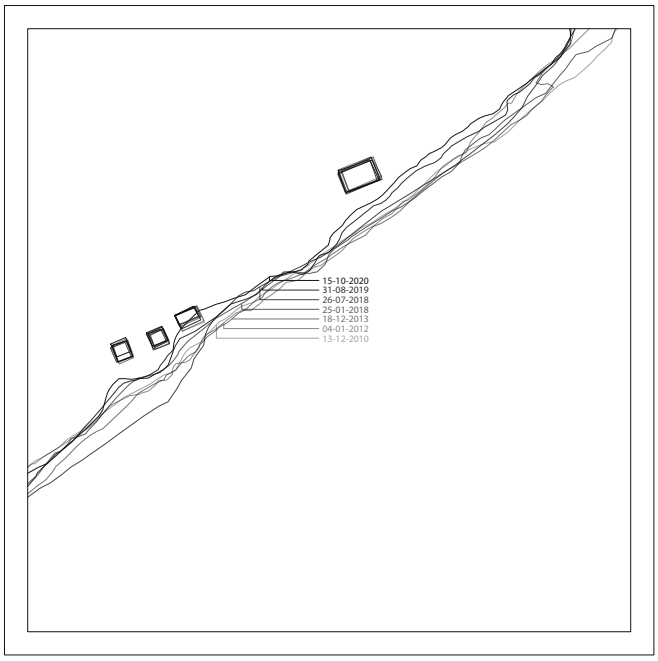


[4] [Mapped boats along the political border, Source: Google Earth]

Phenomena

Erosion

In the year 2019, a small fisherman's village close to Gwadar, named Ganz, has been a victim of rising tides and coastline erosion. Some seaside houses have collapsed as the sea eats out the land underneath. By stacking multiple satellite images of the village through time and carefully mapping the line which divides the land from the sea as far as visible; an attempt is made of mapping out the erosion of the coastline. The area surrounding Ganz hasn't been captured in the high resolution that often; so the outcome of the mapping isn't that significant. But the effect of coastal erosion is visible in the drawing. [5]

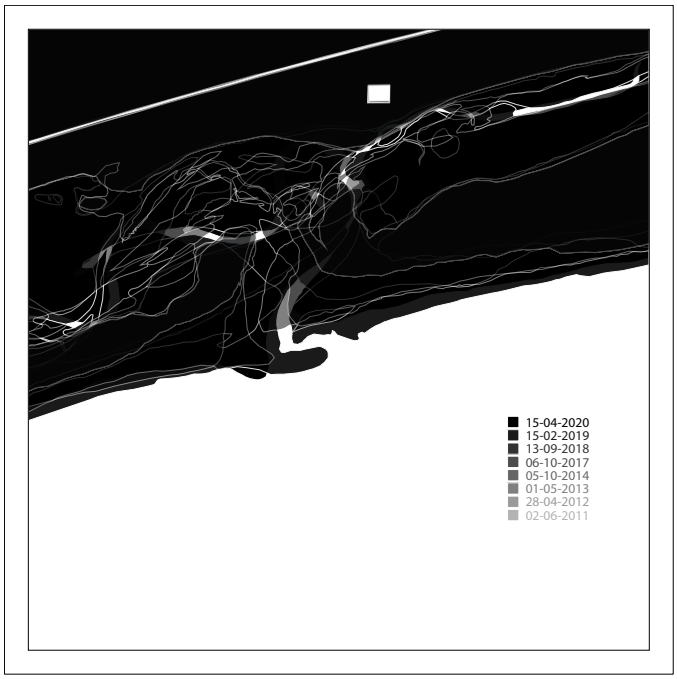


[5] [Erosion in Ganz, Source: Google Earth Satellite imagery traced in QGIS]

An article by Mariyam Suleman, published in The Diplomat on the 27th of December 2019 a picture of a collapsed house in Ganz is shared. (Suleman, 2019) Because of the architecture in the background of the image, in combination with the village being quite small, it is possible to locate exactly where the picture was taken. The drawing above is manipulated following the architecture of the collapsed house. The layers of the drawing are relocated so the top left corner of the house is in the same place. By doing so the accuracy of the erosion taking place has increased, but to get more precise lines a lot more data is needed.

Siltation

Along the West bay of Gwadar two seasonal rivers flow into the sea. Before the actual moment arrives where the rivers find the sea, they both follow the coastline and clash into each other. The area in which this phenomena takes place is creating a very unique landscape in flux. The flows of both rivers and sea are constantly fighting against each other; resulting in a landscape with a rapid visible change. Mapping out the mass and fluid through time ends up in a rather messy drawing. If we then would color in the mass, as in the landscape without human interventions, it is visible there are a few locations within the area which have left a trace through time. Areas which have been only mass or only fluid within the satellite images used. As already mentioned, the human interventions can be an indicator of the precision of the drawing and are a reference point through time. [6]

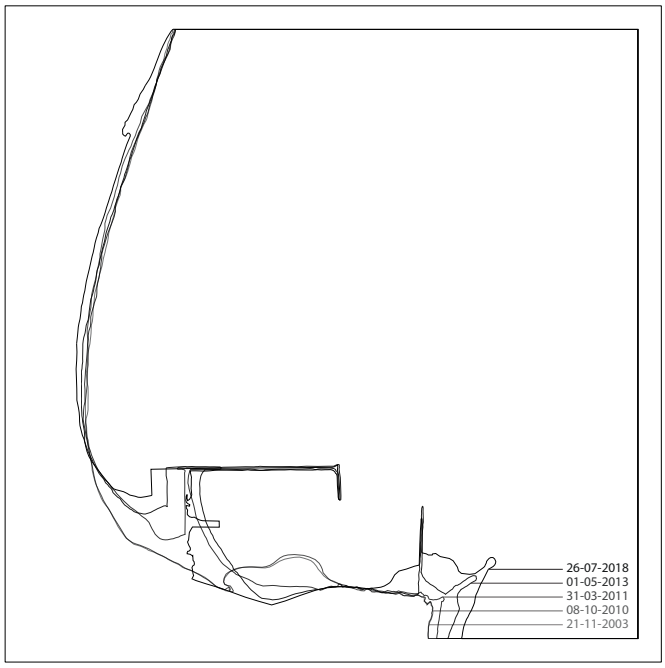


[6] [Silting, Source: Google Earth Satellite imagery traced in QGIS]

On both East and West of the location drawn above, the river forms a long strip along with the coastline cutting off direct access from the road to the sea. This way a natural barrier is created protecting the road from larger waves. The sand on top of the barrier gets blown inland either silting the water or reinforcing the coast. The silted water changes the landscape surrounding the estuary and forms a unique type of sediment. This sediment is very fertile and houses many small lifeforms. Although I haven't found any results of this particular landscape, I can imagine it works in a similar way the sand engine in South Holland works. The sand engine is an intervention to replenish the Delfland Coast. Apart from being more cost efficient and dealing with less maintenance, it also helps to restore nature in the surrounding areas. Although the expected results aren't happening at the speed which was hoped for, after the first 5 years new forms of life have been found in and around the sand engine. (Stive, et al., 2013)

Gaining

This next phenomenon is called gaining, because through man made architecture and the natural flows of the water; land is being added along the coast. It can be looked at as a form of reversed erosion. The drawing made underneath [7] shows the most outer line of the cape of Pishukan. Pishukan is located on the other side of the West bay at the same latitude as Gwadar. In the drawing two forms of reversed erosion are made visible, one which is completely machine based (on the left) and one which is gradually being sculpted by nature (on the right). In both examples an intervention is needed along the coastline to make the sediment stay.



[7] [Gaining in Pishukan, Source: Google Earth Satellite imagery traced in QGIS]

To work in a most efficient way first only a wave breaker is built so nature can start its natural process. This way the sediment will reach beyond the calculated, placing itself within the smallest pores and forming naturally. At a certain point of monitoring the shape of the land, the changes aren't that significant from each other anymore. For the gained land, on the left of the drawing, the next process can start; closing of the area to cover from the sea. Now the volume of water needs to be filled with sediment, which is a fully machine based operation sucking sand from the nearby seabed and transferring it to the closed off area. The natural process is what is at interest here, which can't be done at such a large scale without a human intervention.

Conclusion

The natural phenomena are natural processes already embedded with lots of forms of error, by being in flux. But, for example, in the case of gaining land; it is actually transporting land from one place to another which is the same for erosion and silting. Something cannot be created out of nothing and is always a result of system or process. Within a system a particular accuracy is set and if gone beyond this accuracy; error can be found in its precision.

In the case study about Gwadar and its surroundings it was difficult to find accurate information regarding the natural phenomena affecting the coastline in terms of its precision. For a landscape in flux I doubt it is even necessary to have such a precise mapping of changes. To predict what can happen in the future; a survey of the past is needed, but what will really happen can only be estimated, there will always be a form of error embedded in the process. In a way we could say flux consists completely out of error and therefore cannot be mapped in complete precision. The mapping of a landscape in flux is either a momentary estimate or a surveyed average.

Although everything we are looking at through the screen has forms of error, even when viewed in tremendous resolution, senses of a place we cannot visit are made visible. The distortion of the view we are experiencing are results of a carefully calculated system to make sure the finalized image won't cause catastrophic faults. It is impossible to get a precise image on screen of a landscape in flux, but we can use human built interventions to find our way through the distortion and false precision.

Reflection

The navigational disorientation I experienced at the start of the course has now developed towards an understanding of what causes this disorientation. The actual feel of the places has increased, but is a particular view through the screen. The feeling of being lost in a landscape of what is true and precise still stands. But by looking beyond what is visible and understanding the technology behind the system that produces the imagery, I have experienced more of the range of what architecture can symbolize in the search towards an ultimate precision.

Sources:

Ferrari, M., Pasqual, E., & Begnato, A. (2019). *A Moving Border; Alphine Carthographies of Climate Change.* Columbia Books on Architecture and the City.

Hughes, F. (2014). *Architecture of Error; Matter, Measure, and the Misadventures of Precision.* Mit Press Ltd.

Stive, M., de Schipper, M., Luijendijk, A., Ranasinghe, R., van Thiel de Vries, J., Aarninkhof, S., . . . Marx, S. (2013). *The sand engine: A solution for vulnerable deltas in the 21st century?* Coastal Dynamics.

Suleman, M. (2019, December 27). *Near Disaster: Gwadar's Little Village Faces a Crumbling Coastline*. Retrieved from The Diplomat: https://thediplomat.com/2019/12/near-disaster-gwadars-little-village-faces-a-crumbling-coastline/

Weizman, E. (2017). *Forensic Architecture; Violence at the Threshold of Detectability.* Zone Books.

Zhou, G., Chen, W., Kelmenis, J., & Zhang, D. (2005). *A comprehensive study on urban true orthorectification.* IEEE Transactions on Geoscience and Remote Sensing.