THE HYBRIDITY OF CANALS AS THEY TRANSITION
MERVIN HARTOG

Introduction
Historically canals were an important factor during the development and growth of cities. The canal systems of today only represent a fraction of the numbers that once drove the economic growth, they were a prerequisite to further urban growth and trigger the industrialization of cities. Canals were an infrastructure that dictated the movement of bulk raw materials like coal and ores, which were not affordable without the usage of water transport. The usage of these raw materials dictated the industrial development leading to the growth of new industries, economies of scale and raised the standard of living. The larger ship canals that withstood the advancement of the urban development and its surrounding infrastructure have pertained some of its original function. Being predominantly used by bulk cargo and ship transportation industries, while the smaller inland canals that once pertained significant importance in the overall network have either been filled in, abandoned or have been repurposed. ¹

The overall replacement of the canal system was a gradual process, where the shipments through canals were slowly being substituted by a faster, cheaper and less geographically constrained system, which was embodied in the form of the new railway system. It was this flexibility that allowed for a more direct routing from one station to the next. As new transport continued to develop the canals began to lose the ability to compete with the new systems, slowly switching to recreational purposes while lock and dam systems were maintained for flood control. The significance of the canals within cities will be questioned throughout the essay, as the relationship of the water system and the urban fabric has changed through the course of history.

Strasbourg, a city containing an intricate canal system was initially the Roman military settlement Argentoratum. The location was a strategic point, being an island that was surrounded by the Rhine, Ill and Bruche rivers. The city continued to expand over time, leading to developments in the existing water system. ² The development in the canal system around Strasbourg was dictated by the needs of the city, being initially a military settlement the fortification was integral part of the city. Canals such as the Canal de la Bruche were dug in order to obtain raw materials. Whereas smaller trenches were formed around the fortification areas as a buffer zone, as the city developed these trenches were covered overtime. ³ While some of smaller canals remained, many canals related to the fortifications were filled over time. The function

¹ Wilde, R., 'The Development of Canals in the Industrial Revolution'
² The Editors of Encyclopaedia Brittanica
³ Claerr, E
of the remaining canals changed from a navigational and trade purpose to recreational activities.

The canalization of existing rivers along the digging of new canals has been an ongoing trend. An example of this would be the Rhine River, which experienced canalization over time in order to straighten areas and create artificial beds that improved the navigational purpose of the river. It is the continuing act of tampering with existing rivers and artificial canals, which has made the clear distinction between natural and man-made water structures a grey area. The cases that will be discussed through the essay are examples of canal and river systems that have adapted and changed due to external changes. They provide a wide scope of different scenarios in which the notion of the canal is questioned and needs to adapt in order to survive in the new system of today’s society. The clear border between man-made and natural water systems has faded as hybrid systems grow due to the continuous adaption of the water network. This led to the question of:

To what extend have canals been adapted into the modern day urban landscape? With new modes of transport and the continuing growth of cities, do canals still possess a purpose within the city?

Canal du Midi – Recreation

With the canalization of natural rivers the clear distinction between man-made and natural water systems has faded over time. However when we look at the Canal du Midi, which was one of the first canals dug in France, it can be considered a prototypical example of the notion of a man-made canal. The Canal du Midi is a canal that links Toulouse to the Garonne and was dug in the 17th century. The project was initiated with the purpose of linking the Atlantic and Mediterranean, providing an inland route that in turn avoided the treacherous route around the Iberian Peninsula. It was in the 19th century that the Garonne Canal was dug which extended the Canal du Midi, linking the Atlantic with Mediterranean. The canal became a popular route for trade, leading to the adaptation of boats in order to travel along this route. Freighters were even specifically designed in order to travel through the canal. This in turn also opened up cities such as Toulouse to trade.

When we look at the Canal du Midi in comparison to the Rhine River they possess similar purposes. However unlike the Rhine, the Canal du Midi is an artificial channel that contained an extensive system of locks as it travelled through the country. The canal is considered a summit-level canal, which meant that it connected two river valleys and that the canal rises and falls. Traditionally cities were built alongside rivers, however a man-made canal has the advantage of creating an entire new route, linking cities alongside.

The excavation of Canal du Midi was a pivotal moment in history, being a canal that became an integral part for inland trade. Allowing larger cargo to be transported without the need to travel around Spain. As new modes of transport were presented the Canal du Midi began to struggle, as the introduction of the railway system brought a cheaper and more flexible transport system. Losing its initial purpose while being such a large-scale project, the need for re-purposing was essential. Unlike smaller scale canals, this canal connected multiple cities and traversed along entire regions. Taking advantage of the mesmerizing changes in landscape as one follows the canal from east to west. The introduction of recreational activities such as bicycle routes and boat tours put the canal back on the map, it also meant that no major changes were needed. The canal also functioned as a reservoir for agriculture during dry seasons; the state had

4 Edwards-May, D., ‘Canal du Midi’
5 Mekerji, C., Impossible Engineering: Technology and Territoriality on the Canal du Midi p.15
6 Marsh, C. and E. John Davies, Canals and inland waterways
7 Mekerji, C., Impossible Engineering: Technology and Territoriality on the Canal du Midi
irrigation pumps installed along the canal. The insertion of this function along the canal system was one of the primary reasons for maintaining the canal after losing its initial commercial function. This along with gaining the status as a World Heritage Site by UNESCO meant that original state of the canal was preserved and maintained.

The Canal du Midi is in essence a prototypical example when it comes to the historical changes that a canal experiences. Being initially an element that improved a city's trade possibilities along with other factors. The introduction of railway and road systems meant that its initial advantage began to fade. Being this entire man-made entity, containing an extensive succession of locks that move through valleys and different landscapes. The entirety of the project pertained a significant value, as urban fabrics have merged alongside the embankments of the canals. As mentioned before the canal opened up possibilities for trade in cities such as Toulouse.

The canals in Strasbourg transitioned in a similar fashion, being initially important transport routes in order to obtain raw materials along with smaller canals that functioned as buffer zones along the fortification. However as new modes of transport were introduced and the fortifications broke down. The function of the canals needed to change or be removed. The expansion of the city contained repercussions for the surrounding canals that once were the peripheries of the city. Currently the canals have become more of a dividing factor, creating segments in the city that are connected by bridges. While the Canal du Midi being on a grander scale, meant that it did not divide cities, but rather passed through landscapes were settlements would be positioned alongside it. The canal remained an element that connected cities through the medium of water, as private boats and tourist boats moved from one city to the next. The shift towards recreational activities meant that canals could still function and remain a defining landscape feature within or outside the city.

Lowell – industrial heritage

The case of Canal du Midi shows a transition of a canal system where no physical changes were needed in the existing structure. While irrigation pumps were integrated into the system, the original framework remained and continued to be maintained. The city of Lowell, Massachusetts provides a system of canals that adapted over time in order to become part of the intricate industrial system of the city. The canal system was initially part of a transport route, starting with the Pawtucket Canal that mitigated and increased the flow of timber and transport of agricultural products. However as demand dropped the flow of transport followed. The function that it originally held as a transport route began to shift over time. A complex canal system was introduced that interflied with the original system. Francis Cabott Lowell initiated this idea in order make use of the potential power that the Pawtucket Falls possessed. The complex canal system was meant to harness the power of the Pawtucket falls along with the surrounding rivers. The original Pawtucket Canal became the feeder of the system that started in 1822. As the system expanded more canals were added, branching out from the original canal in order for the water to drive the machinery of the mills. The textile mills were built alongside the canal, providing an integrated system. The usage of the canals put Lowell on the map as one of the first great industrial cities in United States.

The synergy between the canal system and the textile industry in the city meant that the city placed a heavy reliance upon the canal system. The growth of the textile industry in Low-
ell depended on the efficiency of the canal system. However overtime the city lost its status, as neighboring cities began to grow. Due to the one-sided nature of the canal, which was pushed by the city. The loss of importance of the textile industry had a heavy impact on the canal system. However the integration of the canal system into the urban fabric as a source of power shows a high level of synergy and dependency on the system. While being a delicate system the level of interaction between land and water is quite high. The canal system like the industrial elements of the city are defining element of the urban fabric. The level of importance was to such a degree that the historic districts were preserved, introducing the Lowell National Historical Park and Preservation District. The industrial structures of Lowell contained a lasting heritage, which included the canal system.

Becoming a historical monument despite losing its function in the industrial system and shifting towards recreational purposes has led to the complete preservation of the system. The historical significance provided the opportunity of maintaining the original system, however unlike the case study of the Canal du Midi in which a new working function was implemented. The canal system in Lowell has become more of a museum piece rather than a system that has been revitalized. While tours are organized through the canals the, the economic significance that it once pertained as an industrial system has been lost. However the canal remains a cultural aspect of the city, containing historical significance for locals and visitors.

Valencia River - Park

While canals have changed throughout time, being affected by the surrounding urban fabric, losing its initial function as a transport route. The discussion of canals being repurposed has been evident globally. However in Valencia one of oldest cities in Spain the existence of a river caused for immense problems, which eventually led to a plan to divert the river. The city of Valencia initially had the Turia River going through city, however after experiencing major damage during a flood in 1957. The city embraced the concept of diverting the river in order to reduce flood risk. The issue of flooding has been a problem globally, as cities as discussed previously tend to position themselves near a source of water. Valencia undertook a major shift by diverting the river around the southern periphery of the city.

The diversion of the original water system meant that the old riverbed dried up. The remnants of the riverbed remained within the city, this blank canvas that lacked any function provided an opportunity for the city. This led to the creation of the ’Jardín del Turia’, a landscape project that provided a new park tracing the original riverbed. When traversing through the city, the remnants of the riverbed are evident, while its original function had been lost the original morphology remains. Having a deep embankment crossing through the city, while bridges cross over the new park. When we look at the levels of interaction, the aforementioned river that crossed through the city could be considered a barrier or a dividing element. It the repetition of the bridges that provide a connection, the park offers a soft transition as one crosses from one urban landscape to the next. The levels of interaction between people on the public space increased, while the river may provide a platform for private boats. The new park contains a multitude of different elements such as sports fields, walking routes, fountains and event spaces. It is this sense of diversity that allows for the public to not only see the park a scenic element like a river, but a public space that can be explored.

However while the reformed riverbed integrated itself within the city, the diversion of the original Turia River creates two zones that

---

12 Lorenzo, A., Hidden Waterways of the Lowell Canal System p.44
13 Friesema, H. Paul., Lowell National Historical Park, management plan: environmental impact statement p.10
14 Valencia Bonita, They plan to transform the Turia riverbed into a large green corridor
15 Phelps, B., How Valencia Turned A Crisis (And a River) Into a Transformative Park
are affected by the project.\textsuperscript{16} Unlike the previous aforementioned projects where the main structure remained, here the entirety of the canal, which originally flowed through the center of the city, is now moved along the southern edge. The cost that are linked with such a project may question whether other measures could control the water system by introducing dams, water retention basins or other measures. By diverting the river, the problem is simply shifted towards the edge of the city while future repercussions remain rather unclear. The canal also disassociates itself to a certain degree, being initially closely linked with the city center of Valencia as it meanders through the city as it enters the sea.

**River Aire – Renaturation**

Besides change in function of canals there has been an ongoing trend of renaturation of canalized rivers. In Switzerland such an example can be found in the Aire River. The Aire River was gradually canalized over time in order drain agricultural lands and remove accumulated sediment. The system slowly lost its initial form and became a man-made structure.\textsuperscript{17} However in 2001 a competition was introduced in order to restore the canal to its former state. This example shows a form retracing the development of the canal, instead of adapting to the current landscape. The revitalization of the Aire River aims at going back to its initial nature as a river. The project is divided into different phases, which started in 2002 by introducing two flood retention basins on the existing floodplains and restoring the channel to a meander band that it was originally connected with. The project also inserts artificial elements such as concrete steps along the banks of the canal in order to stabilize certain point within the canal system.\textsuperscript{18}

Unlike canals that were dug in order for navigational and trade purposes, this canal was a natural element. However interference of the urban fabric created changes. Whether renaturation is the correct way of repurposing this canal becomes a question. As the river initially flowed through valleys, which historically contained farming areas. The introduction of dykes and artificial straightening of the channels increased the flow of the river providing a higher gradient while draining surrounding agricultural land. However while this occurred the problem of flooding was simply moved further down stream. Solutions during this time period were short term as they simply looked at a single problem and added elements to prevent it. An example would be the positioning of houses in the floodplain downstream of the Pont des Marais in 1987. The risk of flooding was reduced by diverting the canal, however instead of removing the houses and buying out the owners.\textsuperscript{19} The state decides to implement an engineering solution in order to maintain the houses. While this may be the answer in certain cases, it is evident that canalization of the Aire River was initiated in order to benefit the urban fabric while the repercussions on the natural environment had less importance. These problems have now come forward which led to the concept of renaturation of the Aire River.

The concept of renaturation of canals is rather dependent on the location, as the Aire River is located outside of the border of the city of Genève. Hence the surrounding environment does not include high-density housing, which allows the canal system more wiggle room when it comes to for instance restoring the meander band that was artificially separated. However when we look at canalization in urban areas where roads and building blocks surround canals. Here the concept of reintroducing the “natural” elements that were lost over time becomes harder to implement. However the measures mentioned in the different phases of the new project, despite prioritizing the canal, the elements introduced remain rather artificial. Elements that ‘control the river’ and provide a ‘visually inviting habitat’, these are aims set by

\textsuperscript{16} Phelps, B., How Valencia Turned A Crisis (And a River) Into a Transformative Park

\textsuperscript{17} Kondolf, M., Liberty and Human Access for a Peri-Urban River: Restoration of the Aire p.18

\textsuperscript{18} Kondolf, M., Liberty and Human Access for a Peri-Urban River: Restoration of the Aire p.20

\textsuperscript{19} Kondolf, M., Liberty and Human Access for a Peri-Urban River: Restoration of the Aire p.19

\textsuperscript{28} DeLanda, p. 3
the new project. However renaturalization refers to the act of returning to the natural state of the element. The project contradicts this definition and instead tries to rejuvenate the Aire canal by implementing specific design elements. These elements provide a new level of control upon the river system in order to reduce flood risks while also returning some of its natural shape as a river.20

Conclusion: hybridity of natural and man-made

Throughout the essay the four case studies are dissected in order to understand the transition of the canal systems as its function within the urban fabric is questioned. The hybridity of the canals where natural elements are canalized over time to the point in which the original structure faded away is another theme throughout the essay.

The Canal du Midi was a case study where the transition of the canal function was rather minimum. However while the canal remains a historic element, the economical significance that it once possessed as a trade route has been lost.21 This was similarly the case in Lowell where the canals were a driving force for the city, propelling it ahead of other townships during the industrialization period. The transition from an element that once had economic significance too a heritage site meant that it ceased to function to a certain degree. While the canals continued to be maintained and were not abandoned, the canals became a scenic element. While both the Canal du Midi and the Lowell canals lost their stances as economic driving forces, the Canal du Midi still remained a canal that continues to be used for recreational purposes. Whereas the canal in Lowell transitioned into a more stagnated state as a heritage site.22 In the case study of the Valencia River the diversion of river and the canalization of it around the periphery of the city was justified by the situation around that time period. Being confronted by flooding and the damage it caused, however by moving the river the significance it once had was lost. Valencia was also associated with the Turia River, hence similar to the canals in Lowell there was historical value associated with the river.

This case study shows a rather excessive change in a water system, where diverting the river provided an opportunity to revitalize the dried-up riverbed.23 Whereas the new canal disassociates itself from the city, becoming a border along the southern periphery. Lastly the Aire River case study in Genève was an example of renaturalization where sequentially new design elements were introduced in order for the canal to return to its former state. However it was the initial canalization of the river that caused problems regarding the river’s ecosystem and flooding.24 The revitalization project of the Aire shows continuity in the adaption of the canal, however the hybridity of the canal becomes more apparent in this system. The clear distinction between natural and man-made water systems has becomes a faded line. Canals continue to adapt within and around the urban fabric, as they remain a prominent feature within the cities. They connect cities on a larger scale and while the function of a canal may change the historical value remains a important feature.

20 Renaturation de L’Aire, Genève, Superpositions
21 Mekerji, C., Impossible Engineering: Technology and Territoriality on the Canal du Midi
22 Lorenzo, A., Hidden Waterways of the Lowell Canal System p.47
23 Phelps, B., How Valencia Turned A Crisis (And a River) Into a Transformative Park
24 Kondolf, M., Liberty and Human Access for a Peri-Urban River: Restoration of the Aire p.18


Figure 2. 1836 map of canal system in Lowell, Massachusetts, [website], 2010, https://commons.wikimedia.org/wiki/File:1836_map_of_canal_system_in_Lowell,_Massachusetts.jpg (Accessed 18-01-18)

Figure 3. Phelps, B., How Valencia Turned A Crisis (And a River) Into a Transformative Park, Metropolis, 30 June 2012, http://www.metropolismag.com/cities/landscape/how-valencia-turned-crisis-river-into-park/ (Accessed 03-12-17)

Figure 4. Kondolf, M., The River Chronicles, Zürich, Schweizer Heimatschutz, 2014.