CITIES IN THE DIGITAL AGE

EXPLORING PAST, PRESENT AND FUTURE

COORD.
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CITCEM
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CIDADES NA ERA DIGITAL: EXPLORANDO PASSADO, PRESENTE E FUTURO

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VIRTUALIZATION AND THE PRESERVATION OF RAILWAY HERITAGE*

FERNANDA DE LIMA LOURENCETTI**

INTRODUCTION

In order to promote a reflection on the use of virtual media in the design of sustainable urban projects, this paper will present a way of management and valorization of historical railway heritage. Broadly speaking, this work is based on the creation of an industrial inventory of Araraquara, a Brazilian city located in the state of São Paulo, Brazil, to highlight the influence of the *Estrada de Ferro Araraquarense*[1] on the development of the State's hinterland. Araraquara was the first city of the old railway, the reconstruction of its history allowed discovering many industrial heritage areas related to the expansion of the railway across the unknown territory of São Paulo between the late 19th century and the early 20th century.

The creation of technical industrial heritage files of all industries established along the railway line aims at encouraging the development of a database to support the creation of a virtual museum. This initiative would allow showing and illustrating the importance of the Araraquara railway line, along the history of the industrial expansion

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[1] My interest in this railway began with my Master's thesis *Estrada de Ferro Araraquarense in the Framework: The industrial landscapes of the West of São Paulo State as a heritage of the mobility* developed under the Erasmus Mundus TPTI (Techniques, Patrimoines, Territoires de l'Industrie) programme, implemented by Université Paris – 1 Panthéon-Sorbonne, Università degli Studi di Padova and Universidade de Évora in 2015.

of São Paulo. Between 1885 — when the first railway station was built in Araraquara — and 1950 — when the train reached its last stop in the state of São Paulo —, industrialization followed its tracks. Currently, many of the listed industries are in ruins or no longer exist. The lack of importance given to the industrial heritage in Brazil is related to the abandonment of these old industries, which causes the growth of certain crime rates.

As time goes by, the railway becomes an increasingly significant part of this scenario and, at the same time as the industrial heritage, the railway infrastructures and their entire history, an important technical heritage, are being marginalized. The preservation and valorization of the railway heritage depend on its acknowledgement by the population as a component of urban identity.

France, one of the countries seen as a good example in the heritage field, was a pioneer in the production of inventories. Currently, it is working on the dissemination of virtual databases to help researchers and other interested parties to preserve their memories. One of the most famous French digital databases is *Architecture – Mérimée*, a virtual platform that everyone can access and help to upgrade.

Platforms like this lead France to the «Big Data Challenge», which arises from the accumulation of large amounts of data that must be organized and verified[2]. Some countries, such as Portugal (*RENNER Living Lab and Smart Cities Portugal*)[3] and the United States (*Legacy Cities Design*)[4] have built virtual platforms to be able to share their urban experiences. These initiatives are also ways of dealing with the «Big Data Challenge».

The municipality of Araraquara, in the State of São Paulo, is deactivating its urban rail tracks and, therefore, this line, with a length of approximately 15 km, which divides the city into two spatially and socially different parts, needs to be addressed within the scope of an urban rehabilitation project. So, to reintegrate this infrastructure into the urban grid, it is important to highlight its contribution to the city's development and, nowadays, the most efficient way to achieve this is by using new technologies to draw people's attention.

The 1990s witnessed the emergence of several debates about whether virtualization was a threat or an opportunity for traditional museums[5]. Institutional museums, like the *Cité des Sciences et de l'Industrie* in Paris, use virtual exhibitions to highlight the influence of this means of transportation by emphasizing the relationship between its development and that of the urban environment through the use of virtual and interactive technologies. Therefore, virtualization can become an important tool for the preservation, valorization and reintegration of the Araraquara railway heritage into the urban grid.

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[2] FINGUERUT & FERNANDES, 2014: 36.
[3] SMART CITIES PORTUGAL, 2016.
[4] As an online platform, Legacy Cities Design shares some innovative projects of cities that lost a big number of population and jobs. Available at <http://www.legacycitydesign.org/about>.
[5] NEGRI, 2011.

VIRTUALIZATION AS A TOOL

Virtualization does not necessarily need to be associated with the immaterial or the unreal. The French philosopher Bernard Deloche[6], of the Université Lyon 3 and a member of the INCOM (International Council of Museums), made a series of studies on museology, one of which is based on the concept of virtual museum. He explained that in order to give life to such a museum, there is the need to use «substitutes»[7]. This kind of method allows preserving the original object, or items that cannot be integrated into a museum, by using alternative techniques. This concept is not new and it is not solely related to the new means of communication. It was introduced several years ago, when the philosopher mentioned the Alexander School's inventory, which displayed machine miniatures in order to preserve the memory of their existence.

> *The inventory is, therefore, one of the operations of the Museum (the act of making an inventory), yet delocalized: a museum without collections and buildings — or, at least, without buildings intended for the preservation of collections. In short, a museum that is reduced to one purpose: to transcribe the sensitive reality into a symbolic support using various techniques (writing, photography, drawing, photogrammetric paths, etc.). In fact, since its inception, an inventory involves the exploration of information and image databases. Unlike a classical Museum, an inventory archives a potentially unlimited number of works and allows, thanks to its computerized image databases, accessing data at a speed that has nothing to do with the traditional consultation of manual files*[8].

Inventories are a virtual way of preserving memories and they make it possible to preserve items that cannot be kept in their material form, as in the traditional Institutional Museums. Cassiano dal Pozzo made a catalogue of watercolor paintings that allows disseminating the knowledge obtained in the 17th century in a variety of fields, including biology, geology, zoology and botany, which is based on the preservation of objects with a short life span. François de Clarac made an inventory to support an Ima-ginary Museum of Modern Sculptures, based on the sculptures kept at the Louvre Museum, which cannot be brought together and displayed in a single space[9].

> […]*Virtualization is the very dynamics of the ordinary world, something that we use to share a reality. Far from encapsulating the kingdom of lies, virtual reality is precisely the mode of existence from which both truth and falsehood arise*[10].

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[6] DELOCHE, 2003.
[7] DELOCHE, 2003: 162.
[8] DELOCHE, 2003: 148. Translated by the author.
[9] DELOCHE, 2003: 149-154.
[10] LÉVY, 1995: 101. Translated by the author.

If we combine the concept presented in the quote above with the theory used by Deloche[11], we may infer that any kind of faithful reproduction of something that already exists can be considered a virtualization and may be used to preserve the original object. Some researchers in the painting and sculpture field are against virtualization, some arguing that it is a sort of forgery; on the other hand, in the urban planning field using new technologies to reconstruct the past is a very common form of preservation that, nevertheless, has its dangers. Photos, videos, electronic sketches help researchers reconstruct old urban designs, but over time these reconstructions may undergo chan-ges as a result of new discoveries or different interpretations. Thus, reconstruction is a never-ending task and the result can never be seen as an absolute truth, as it depends on interpretations that may vary for many different reasons.

To proceed with this kind of preservation it is important to rely on a good research on the subject in question, based on old maps or images from different periods. These can be used as references for the development of a new form of representation, which can be designed to provide information to all kinds of visitors, and not only to people who have some kind of specific knowledge. This is important because one of the purposes of the museum is to be informative. According to Pierre Lévy[12], another French philosopher, information is already a virtualization of facts; it is transmitted, interpreted, related to other information that will differ from person to person, and updated by the recipients, if they deem it necessary. Lévy described knowledge itself as something virtual, which can undergo many changes to allow an individual to adapt to new circumstances[13].

Cristoforo Sergio Bertuglia (1999), professor of Urban and Regional Urban Planning at the Politecnico di Torino, stated, in a preamble about Paolo Galluzzi, an Italian historian of science, that in order to rebuild an urban center it is necessary to recover its history and display its legacy as a museum exhibition.

> *It is not just a question of creating entirely virtual museums (a phenomenon that is, nevertheless, present and has the ability to develop itself in surprising ways, opening up possibilities that are currently unimaginable) but also, and above all, of introducing virtual elements and, with these, a crucial innovation into the so-called real museums*[14].

However, the Institutional Museum can use virtual reality as an element of its exhibitions. This can improve the museum's educational component and enhance its repertoire by enriching the collection. Additionally, virtual accessories can be easily upgraded, as they are open to the insertion of new information. Building a space for the Chair

[11] DELOCHE, 2003.
[12] LÉVY, 1995.
[13] LÉVY, 1995: 36.
[14] BERTUGLIA *et al.*, 1999: 255. Translated by the author.

Museum of Lyon is unfeasible, but a virtual museum can include countless objects and offers the possibility of continuously adding new ones.

A virtual museum can be used as a way to disseminate knowledge and to rebuild a specific period of history. The case presented in this paper is merely part of an extensive legacy whose value can be recognized by society and enhanced by studies on other cities crossed by the *Estrada de Ferro Araraquarense*. Virtual reality can be used to put all the pieces of the history of the state of São Paulo's industrial, technical and territorial development together. This railway heritage, the product of many changes occurred throughout the years, will always have an impact on urban life, even after the decommissioning of the line. A sustainable urban planning strategy is already on the municipality's agenda, and bringing virtual reality to Araraquara opens the door to the introduction of the concept of Smart City.

SMART CITIES AND DATABASES

Many studies are currently being developed on Smart Cities, as they have become one of the most sought-after solutions within the urban market. Studies made by the Smart Cities Portugal group (2014) show that, according to ABI Research (2011), between 2010 and 2016, the global market of technologies that support smart city programs and projects would grow to 31 billion dollars. Generally, these technologies use Geographic Information Systems to collect high-resolution geographical data which are interpreted in order to allow assessing the current potential of cities with a view to support future sustainable urban planning projects.

The transportation system is one of the many items assessed in territorial potential surveys. One of the best-known transportation solutions is the Light Rail (LR). The Institute for Transportation & Development Policy (ITDP) made a research that showed that 17 cities in the United States, Europe and some Asian countries have already replaced their viaducts; these initiatives aim at saving money, as the costs with viaduct preservation are rather high, and at revitalizing large urban areas[15]. In a research made in 2013, Smart Cities Portugal (2014) observed that mobility is the second largest field of activity when it comes to providing products and services to solve urban problems. Most of them are based on the development of electric mobility, parking management and integrated ticketing solutions.

There is the need to establish a connection between the city and its territory, but the communication within road networks is complex and generates its own kind of social structure. To change the forms of mobility is to change the city's dynamics, as well as some of its social values. In many cultures, the car is seen as a sign of social status, independence and comfort. So, it is not possible to ignore the city's history and the people's

[15] SILVA, 2015: 16.

culture while developing new products. That is the reason why one of the principles that support smart cities is the inclusion of different social players.

There are many initiatives aimed at defining ways to generate interactions between the citizens and the urban planners in cities known as «Legacy Cities», affected by the loss of population and jobs. The most famous one is «Placemaking», based on the creation of emotional connections between places and people. One of its challenges is the revitalization of old railways left by the industrial era. Just like Araraquara, many cities saw their railways face neglect, generating industrial hub corridors.

> *The road, rail and water systems that serviced industry are not effectively integrated or designed to allow different types of access, and often have to be retrofitted to allow for non-motorized transit. Moreover, the existing transportation networks are often woefully insufficient and underfunded. This limits options for residents and for disconnected, often racially segregated, neighborhoods. Connectivity and accessibility are significant challenges* […][16].

Any smart solution must be based on a mainstream integration of technology and on connections between diagnoses and databases. So, Big Data is the main challenge faced by 21st-century urban planners[17]. Residents should be included as part of long-term solutions and, in this context, the preservation of heritage should be taken into account in any urban planning strategy concerned with social habits and urban development, as highlighted since the publication of the *Athens Charter* in 1931.

> *Ventura (24) mentions the attention paid by Giovannoni precisely to these two management and intervention scales: the large transportation networks and the communications network, which induce urbanization beyond the existing city and the "nuclear urban spaces"* […][18].

This is a reference to the book *Vecchie città ed edilizia nuova* (1913), by Gustavo Giovannoni, which already addressed concerns about the «new concepts of urban planning», highlighting the importance of both transportation and communication. The French historian Françoise Choay points out that, in this book, Giovannoni tries to establish a connection between «urban traditions» and «technological changes» as two sides of the same coin[19]. The relationship between new technologies, urban development and heritage preservation became inseparable from social progress ever since the first concerns about urban heritage and the creation of urban strategies emerged.

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[16] NEW SOLUTIONS GROUP, 2013: 40.
[17] FINGUERUT & FERNANDES, 2014: 36.
[18] CABRAL, 2015. Translated by the author.
[19] CABRAL, 2015.

In this context Vittorio Guido Zucconi provides a new interpretation of Giovannoni's analysis, dividing the design of an urban planning strategy into three parts: the first one is the thesis, which presents all the problems and losses faced by the old city; the second part is urban expansion, which presents the changes occurred in urban planning over the years and how they coexist; and the last one is the result of a merger of all the theory into an urban design that is able to unify the entire city. Combining these notions with what the «digital era» is able to provide to the urban market, the database is the first step of interpretation towards a sustainable urban design strategy.

ARARAQUARA DATABASE PROPOSAL

The industrialization of Brazil began after the Portuguese Royal family's arrival in the country (1808) and reached the Araraquara region via the plantation of coffee. This product was not the most common in the region, but it was the country's most important output and the one that financed most of the railways built across the state of São Paulo. So, agricultural machinery began being introduced in the Araraquara region a few years after the arrival of coffee, in the 1880's. However, the most intense period of urban expansion began after the railway reached the city, in 1885.

Currently, the city is crossed by a railway branch that is approximately 15 km long. This scar divides the city into two parts: the historic centre, which witnessed the construction of tall buildings and large infrastructures, and the old working-class districts, where the social areas are still concentrated today. The railway was deactivated in 2015, following a popular request approved in 2005. The population was weary of the accidents and the pollution associated with the trains. They were only serving corporate interests, as the passenger service had been suspended in 2001[20], so, for the residents, the old railway was merely a dark, dirty and dangerous passageway.

To change the people's opinion on the railway, we need to tell another part of its history. The Araraquara urban heritage survey was prepared following the development of a comprehensive historical research. This knowledge base was crucial for understanding the decline of the railways and the industrial development process, making way for a series of heritage analyses. Considering what we have mentioned above, having a catalogue will allow virtualizing an array of information that is fading away. However, to ensure the reliability of the information that is collected, we should take into account many other facts and sources. So, the identification of Araraquara's industrial heritage began with a comprehensive research on the Brazilian industrialization process and on the city's history.

Once these data had been collected, we prepared a series of lists to organize the industries found by production type and year of arrival. However, this became our first

[20] MARTINS & BERGAMIN, 2012: 182.

challenge, as some documents and newsletters showed the industries' names, but did not include any further information — not even the year of inauguration —, a fact that highlighted the importance of the first collection of data. This first catalogue comprises 71 industries, which should be studied in further detail. Many of them no longer exist, others are merely destroyed buildings, but some are still operating.

Despite the fact that we did not find as much information about each industry as we had expected, this first survey allowed revealing that many of these industries were located in areas surrounding the railway and that they arrived in Araraquara after the trains did. Furthermore, the catalogue illustrates the importance of the food market to the Araraquara region, as more than half of the data correspond to food producers. However, given that so much information has been lost, we were only able to find basic data regarding 16 of these industries, which we used to create a preliminary inventory based on the datasheet shown below.

Industry (name)	**000 -**
Opening Date	
Entities Responsible for the Construction (name and place of origin)	
Engineers Responsible for the Construction (name and place of origin)	
Type of Industry (infrastructure, basic and transformation industries, capital and durable goods Production, agribusiness, etc.)	
Technical Workers (place of origin and level of education)	
The Kind of Technology Used (place of origin)	
History of the Industry	
Current Situation of the Building	
The Building Location (geographical references and address)	
The Building Design (over the years)	
Photos (over the years)	

Fig. 1. Datasheet used as basis for the industrial inventory

Among the information required to create the inventory, the item «location» drew our attention. The industries located in the areas surrounding the railway were built before the 1950s, while the most recent ones are located outside the city centre, close to the highways. This highlights the significant role played by railway heritage as a connecting element and as a common denominator in industrial development. As a result of this first observation, we designed a special map of Araraquara based on five old city maps from different periods — 1880, 1929, 1938, 1963 and 2014. These maps allow us to have an idea of how the city grew in different railway development stages: before the railway,

after the railway's arrival, during its expansion, after its decline and in the present day. This new virtual survey allowed illustrating the relationship between urban growth and railway expansion. And, once again, the railway proved to have played a key role in the development of the city's identity.

As we can see, all these analyses became possible after the identification of Araraquara's industrial heritage. The creation of a catalogue to be studied in further detail is, undoubtedly, the first step towards the reconstruction of the industrial history of Araraquara. Future studies will allow showing the influence of the railway on the city's dynamics to the present day. Understanding the impact of this infrastructure as the backbone of the Araraquara region's industrialization process will allow people to recognize the importance of preserving its memory. Since part of this memory has already been lost, a careful use of virtual tools to highlight the railway's potential can change Araraquara's future.

A new railway branch was built around the city and some industries have already been attracted by it. Now Araraquara should learn how to deal with both the old and the new railway lines. For the citizens, the new branch represented a new hope for economy, and now they should feel closer to the old railway heritage to achieve a renewed urban life. The city knows the roots of its identity, but it needs to understand its present situation in light of its past to ensure a sustainable future.

CONCLUSION

The use of virtual tools for the preservation of railway heritage allows building databases able to support the creation of virtual museums and the development of urban analyses. The production and dissemination of this knowledge have the power to influence Araraquara's future. All the industries that were identified had some kind of connection to the railway, which was responsible for their arrival in São Paulo's hinterland. This means of transportation fostered the expansion and mobility of different types of trade. On the other hand, we find that some industries changed their location after the expansion of the railway line, leaving behind a series of abandoned buildings.

Virtualization allows creating new urban planning products and the use of databases can be adjusted according to different purposes and interpretations. In the «digital era», the data overlay technique is becoming increasingly common in the urban market. According to Smart Cities Portugal, several companies are already dealing with this type of market and they see Latin America as an increasingly valuable opportunity.

The analyses made while the virtual inventory was being created showed that the concentration of data allows disseminating information that initially seemed to have been lost. An industrial catalogue allows understanding how the collection and organization of data can enhance the value of the railway heritage and give rise to new fields of study. However, in order to be effectively useful for the development of new urban

strategies, this database should be further organized and systematized according to a specific goal.

The use of modern technologies can make understanding and valorization easier when it comes to studying popular awareness of urban planning and heritage. These technologies are giving cities a new status, and showing them how to become sustainable while being smart. The associated technological products should be supported by urban and historical theories that highlight their importance to future changes.

The historical survey and the industrial heritage list made us recognize that creating an inventory is an unavoidable step in the urban planning process that feeds and guides new visions and strategies. This knowledge is an inseparable part of the history of the Araraquara city due to the role the railway played as the main driver of industrial development along the *Estrada de Ferro Araraquarense*, a history that can be preserved by virtualization.

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