Conecting infrastructure and urbanism

RESUMEN. Desde el inicio, el desarrollo y la expansión de las ciudades siempre han sido apoyados por las infraestructuras. Sin embargo, la correlación entre la concepción de las redes de infraestructura y el proceso de urbanización sigue siendo subestimado en la historia de lo urbanismo y de la planificación. Así, esta investigación en curso se evalúa la implicación de esta correlación en un contexto específico como la de Lisboa y su Cinturón Ferroviario. El objetivo es proporcionar una lectura interpretativa de la morfogénesis del paisaje y el territorio de el Cinturón Ferroviario de Lisboa a través de la superposición de los estratos de infraestructura y el proceso de urbanización desde mediados del siglo XIX hasta la primera década del siglo XXI. Usando sólo documentos oficiales de varios archivos y se basando en un método riguroso y preciso (GIS), una sucesión de lecturas iconográficas, sobre todo a partir de cartografías, de la ciudad de Lisboa es compuesta en seis períodos consecutivos: 1865, 1914, 1949, 1971, 1993 y 2009.

PALABRAS CLAVES: Infraestructura, urbanismo, paisaje, territorio, cinturón ferroviario, Lisboa

ABSTRACT. Since the early beginning, the development and expansion of the cities have always been supported by infrastructure. However the correlation between the conception of the infrastructural networks and the urbanization process remains underestimated in the history of urbanism and planning. Thus, this ongoing research assesses the implication of this correlation in a specific context such as Lisbon and its Belt Railway. The aim is to provide an interpretative reading of the morphogenesis of the Lisbon Belt Railway landscape and territory through the overlapping of the infrastructural strata and the urbanization process from the mid 19th century until the fist decade of the 21st century. Using only official documents from various archives and based on a rigorous and precise method (GIS), a succession of iconographic readings, mainly from cartographies, of the city of Lisbon is composed in six consecutive periods: 1865, 1914, 1949, 1971, 1993 and 2009.

KEYWORDS: Infrastructure, urbanism, landscape, territory, belt railway, Lisbon.

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Biografía

Heraldo Ferreira Borges es arquitecto urbanista y en los últimos diez años se ha dedicado a lo desarrollo de proyectos de arquitectura, diseño urbano y paisajismo para el que ya ha recibido varios premios y honores. Actualmente desarrolla su tesis en Diseño Urbano y Proyecto del Espacio Público en la Faculdad de Arquitectura de Lisboa.

Biography

Heraldo Ferreira Borges is an architect and urban planner who in the last ten years has been devoted to the development of architectural, urban design and landscaping projects for which has received several awards and honors. Currently he is developing his thesis in Urban Design and Public Space Project in the Faculty of Architecture of Lisbon.

Deconstructing the black box

Considering the current urbanistic scenario of the contemporary metropolis, specially in Mediterranean Europe, where a dispersed urbanisation pattern is functionally linked by a intensively knitted network of transport infrastructure[1], one may wonder why the correlation between the conception of this network and its attendant urbanisation patterns remains underestimated in the history of urbanism and planning. In this context, and taking the city of Lisbon and its Belt Railway (LBR) as the case study in progress, the definition of important premises was required:

– the need to exceed the monolithic logic of performance and the gap between the disciplines of engineering and urban planners and designers;

– the potential of the infrastructure as an urbanistic instrument in a local and metropolitan development strategy;

– the impact and transformation due to the future major infrastructures projects, such as the Third Bridge over Tagus River, the RAVE Project (the high speed train) which will connect the New International Airport to the International Train Station (Gare do Oriente) and the new connection with the Cascais (leisure suburb) railway.

The studied period runs from mid 19th century until the beginning of the 21st century and provides an interpretative reading of the morphogenesis of the LBR's landscape and territory through the overlapping of the infrastructural layer and the urbanization process. It's organised in six consecutive periods (1865, 1914, 1949, 1971, 1993 and 2009) and is built-up by a succession of iconographic readings of official documents, mainly systematic georeferenced cartographies (scales 1:25.000 and 1:50.000). The organization of the collected material is the ground for the visual narrative of this process.

This interpretation goes side by side with a reflection on the general context (political, social and economic), the urban planning concepts by the municipality and the Portuguese railway companies (CP and REFER) and the architectonic and urbanistic theoretical approaches, in their various movements. The overlapping and cross reading of these two approaches allows a diachronically reading of territorial transformations, as well as a support for interpretative morphological drawings. Each chapter is concluded by a cartographic interpretation of the process.

It should be pointed out that these are mere initial findings in an ongoing research project which, otherwise, contributes to complement the history of urban studies and analysis of the potential and the challenges that the

project of the infrastructure provides for the construction of the contemporary landscape and territory.

From the urban infrastructure to the infrastructural city

The history and development of infrastructure are intertwined with the history and development of cities. Thus, both their origins and their destinies are inextricably linked. The cities have always been developed, because of and through the infrastructure, in a constant and reciprocal relationship between desire and its fulfilment. The infrastructure is the foundational element of the cities. In *El soporte infraestructural de la ciudad* (2002), Herce Vallero and Miró Farrerons observe that the construction and expansion of cities occurred always supported by the pre-existing infrastructural in a continuous process of replacing its elements and functions.

In the early days of the city, the main issues to be resolved were of infrastructure character and had as main substrate geography, or more specifically the topography and hydrography. The choice of ideal location, the defense constructions, the water supply and the domestication of adjacent land, were the first actions to conquer the territory and the constitution of the city. By stating that "the supreme architecture of Venice is the constitution of its territory", Mendes da Rocha (ARTIGAS, 2002, p.71) shows us the importance of infrastructure as foundational elements of the cities. With the bases of urbanization guaranteed, the next urbanistic need to be considered resides on the circulation, drainage and irrigation that would be the basis for productive and commercial activities.

Until the end on eighteenth century, the main infrastructures were limited to paths (streets and roads), to irrigation canals and defenses (usually walls). The paths had threefold function of access, circulation and drainage of rainwater and also the so-called blackwater since only in the mid nineteenth century it would appear the first modern systems of sewage and drainage. Thus, paths and drainage share the same origin. The walls constitute not only the cities defenses against invaders, but also served as a boundary between urban and rural/natural and as a constraint to urban growth. At that time, the concentric growth of the classical nuclear city adding expansion rings along centripetal patterns of movement was the common model.

If during eighteen centuries infrastructure had a slow development from the early nineteenth century with the advent of modern systems of water supply, sewage and public lighting and especially the railways, urban infrastructures meet a quantum leap and become the major engine of development and territorial expansion. According to Joel Tarr (1988, apud DUPUY, 1991) this jump also marks the beginning of the transformation of the *pedestrian city* to

the *networked city* and a new form of theoretical and practical concept of urban projects.

In fact the term infrastructure appears for the first time on 1875 in France as a railroad engineering term and designated the earthworks of a railway track[2]. Only after the World War II, NATO reemerged this term referring to fixed military installations and just in the 1980's after the publication of a public assessment entitled *America in ruins: The decaying infrastructure*, the term started to be used by the urban planners to designate the basic facilities, services, and installations needed for the functioning of a city, such as transportation and communications systems, water and power lines, and also public institutions.

Generally, the new possibilities of hygiene, comfort and circulation, offered by modern infrastructures, are present in the theories and projects from Haussmann to Le Corbusier, through Cerdà, Olmsted, Howard and Wright. However they were always approached mostly through a technological bias, leaving the technical decision for the engineers without understanding all its social significance, their spatial range and its strategic territorial capacity (DUPUY, 1991). In other words, we can say that the beginning of the infrastructuration of the modern city was also the beginning of its conceptual, projectual and physical fragmentation.

After the end of World War II, this fragmentation will become more pronounced with the reconstruction of the main European cities involved in the conflict not only because of the increasing specialization of infrastructure and technical disciplines reserved for the engineer but also because of the gradual spread and increase of car mobility.

In an article recently published in Lotus Magazine, Marcel Smets (2001) also points to a practice divided between the disciplines of architecture, urbanism and engineering where a well-organized corps of engineers still consider this area (the infrastructure) his "private hunting ground" while "the architects and landscape designers are usually involved to smarten up the elegance of the constructions or decorate the leftovers once the implantation has been fixed." Smets also cites Marc Mimran, author of the iconic Solferino Bridge, for whom the infrastructure projects are mostly done in a stereotypical way.

Perhaps the reason for this division lies somewhere in the 25 years that coincide with the rise of postmodernism, where the architects by changing their focus from "technology of production" to "technology of representation", as stated by Stan Allen (1999: 49-52), contributed, consciously or not, to their own marginalization in a related matters of infrastructure.

However the understanding of the infrastructure as a urbanistic tool and not only as a mere system of flows whose only purpose is the performance should be the target of a more comprehensive and multidisciplinary

approach. Smets (2010) describes the five most common strategies of mediation: hiding, camouflage, assimilation, detachment and fusion, pointing out the last one as the most promising and interesting. Likewise, Donini (2008) also lists some interface strategies: overlapping (sovrapposizione), accumulation (accumulazione), hybridization (ibridazione) and encapsulation (inglobamento).

These processes of interface and mediation are important not just for the attempt to bridge the gap between engineering, architecture and urbanism but also because they raise new kinds of relationship and dialogue between the urban context and the infrastructures, or the *life-support system* in the words of Varnelis (2009), so they can assume again a key role in the agenda of planning and urban design, since they are perhaps one of the only instruments available for the government agencies with sufficient potential to structure in a wider scale a territory increasingly large and fragmented.

The construction of a singular infrastructure

In the mid nineteenth century, the vast majority of European cities have implemented belt railway lines for several reasons: commercial, as in Berlin, military, as in Vienna, social order, as in London or the combination of two or more of these reasons, as in Paris.

Like these cities, Lisbon is also an irradiator center of several rail lines that connect not only to the nearby leisure suburbs (Cascais and Sintra) but also to other cities in Portugal and to Spain and France (East and North). Aiming for a better circulation of goods and people between the terminals of these radial lines, the first plans and projects for the implementation of a belt railway begin to be developed.

However, suffering from a delay in comparison to other European cities, only in 1888 (with works already in progress) Pedro Ignatius Lopes, an engineer employed by the Portuguese railway company, Companhia Caminhos-de-Ferro Portugueses, presents its plan for the railway network of Lisbon and surroundings.

> *(...) a belt line in the old city of Lisbon, formed by the lines from east of Santa Apolonia to Madre de Deus, by extension of Santa Apolonia to Benfica, until the point where it connects to the line of Cintra, by the line of Cintra, from this point to the current station of Alcantara, by the line of Cascaes between this station and the river bank, and by the marginal line of Alcantara and Santa Apolonia.*[3]

As we can see, the idea, later abandoned, was actually to implement a close circular line starting and ending in Santa Apolónia Station, the first and the

main station of the Portuguese capital, until the construction of the Central Station (also known as Rossio Station). However, like most of the major works in Portugal, the Belt Railway was the target of intense debate among engineers and also of structural, political and financial limitations. Therefore the implemented line (and still functioning today) has a roughly circular form but remains open once the connection between the Cais do Sodré Station and the Santa Apolônia Station was never accomplished.

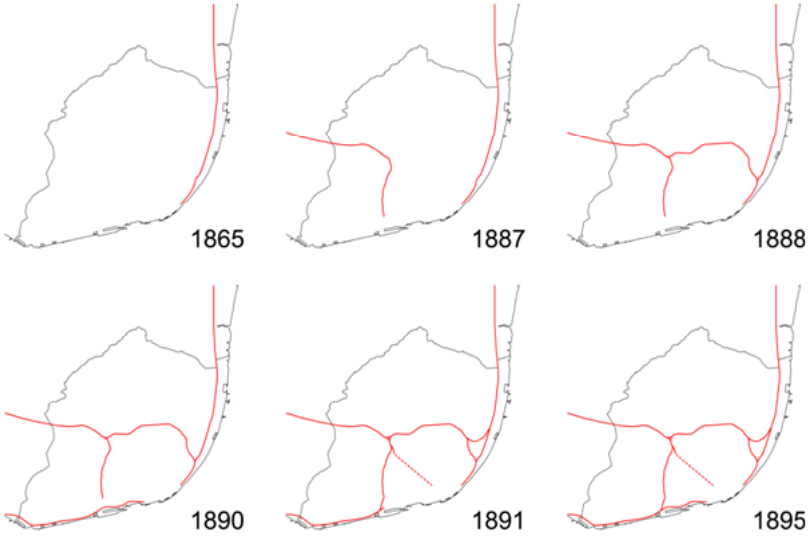

Fig.1. The construction's cronology of the Belt Railway.

The relatively fast implementation took place over a period of seven years between 1886 and 1893 and consisted of the following construction phases: the segment between Campolide and Alcântara-Terra was completed in 1886 but was only integrated into the Belt Railway in 1980, on September 10th, 1892 was built and open to exploitation the double track of the segment between Campolide and Chelas and its continuation to Braço de Prata was opened on August 10th, 1893.

The topographical situation of Lisbon made the implantation of the Belt Railway to converge to the bottom of the valley of Alcântara and Chelas, not only because of the low value of expropriation of land but also due to topographical and hydrological facilities. Its configuration embracing the historical core of Lisbon and linking two important industrial areas in the late nineteenth century, Alcântara and Chelas, was crucial to the economic and industrial boost for the emerging metropolis.

Another important aspect to note is that the Belt Railway crossed the major radial axes of access to the city, mainly roads and rail lines that will support the urban growth of the Portuguese capital city throughout the twentieth century. Thus, urban expansion will pass the pre-industrial model of concentric growth by layers for digitiform growth along the road-rail axis of accessibility.

This vectorial growth did not occur at the same time because once again economic and political issues privileged some directions in favor of another at certain times. Besides this, the areas between these vectors often were not fully developed and occupied and remain still today as unoccupied spaces waiting to be used.

Because of that, nowadays, walking through its 7,2 km length, it's easy to observe the varied (both in form and in origin) and sometimes contradictory, urban structures and morphological typologies ranging from marginal occupations and restructuring areas to even more examples of urbanistic and superior architectural erudition. This is what makes the Bet Railway get a special feature since crossing these growth vectors it becomes a rich mosaic as a space-time cut of various experiences, shapes and patterns of urbanization implemented in Lisbon during the last 120 years.

Of rings and axis

From the late nineteenth century to the first decade of this century, the intense productive land use enhanced by the opportunities created by the configuration of a dense infrastructure network helped transform Lisbon from a mercantile city by the Tagus riverbank to the largest metropolis at the Atlantic Coast of the Iberian Peninsula.

This research aims to understand the construction of the landscape and territory of the LBR focusing on the mediation process between the infrastructure itself and the morphogenesis of the urban tissue formed in its surroundings. To do this, a visual narration will be constructed by succession of a systematic iconographic readings produced between 1865 and 2009.

The cross reading of the visual narrative associated with the general context (political, social and economic), the conceptual approaches of the official urban planning (by the municipality and also by the Portuguese railway companies) and the architectonic and urbanistic theoretical references allowed some preliminary commentaries.

1865-1914: The Pedestrian City and the mercantile configuration

The cartography done in 1856 by Filipe Folque shows a compact city by the Tagus River whose center is very evident. It's also notable the strong land use along the riverbank for industrial and port activities, but still without

importance for leisure and recreation, and also the clear division between the urban and rural typology. Regarding the transport network, a radial road configuration, opposed by the first administrative limit, reinforce the role of Lisbon as an important center in the national and European scale.

1914-49: The Industrial City and the construction of the core infrastructures

The cartography of Silva Dias dated from 1911 shows the LBR already in place embracing the original core still very compact. The incipient urbanization towards northeast occurs in a binary way. Two main axis (Avenida da Liberdade and Avenida Almirante Reis) with a socio-economic distinction: the first one is originated from the so-called Plan of New Avenues, project of Frederico Ressano Garcia, French engineer by training with strong Haussmannian influences, and constitutes the "bourgeois" expasion of the city. Both break the first administrative boundarie and a second and definitive is set. The expansion and the industrialization of the city are defined by the following of the infrastructural lines in a digitiform way.

1949-71: The Modern City and the domination of the automobile

The cartography of 1949 continues to show a persistent radiocentric infrastructural configuration enhancing the status of Lisbon as the national, metropolitan and European center. However it's important to point out that gradually the crossings with the LBR became an obstruction for the normal development of the city. The Portuguese modernist experience was predominantly located between the two administrative boundaries. The highways and the modern infrastructures as hospitals and sport facilities was also located in this area. Like many others modernists planning, in Lisbon the superposition of the infrastructural networks, the isolated blocks of buildings and the zooming planning helped to create a fragmented landscape and a disconnected territory;

1971-93: The Post-Industrial city and the urban renewal

The cartography of 1971 reveal that the urban growth is still supported by infrastructures of mobility but other forms of occupation can already be noticed.

The economic backwardness in relation to other European cities made with the implementation of the subway lines that are so slow but it was also critical for maintaining the LBR as a valuable option for urban and suburban transportation. While cities like Paris, London, Berlin among other deactivated railway lines located within the urban area replacing them with the subway, Lisbon quadrupled tracks, constructed stations and significantly increased its capacity but has not managed to articulate these two systems.

In 1993, Lisbon introduced a new configuration mainly due to democratization in 1975 and entry to the European Union in 1986. Changes

in the productive system promote obsolescence of industrial, rural and port areas, thereby creating new centers correlated with the economy of informational basis and knowledge based on a road infrastructural network.

1993-2009: The Infrastructural City and the Metropolis configuration

The beginning of the 21st century, in the European context, Lisbon places a key role in the Lisbon-Galicia conurbation. Still completely functional, the LBR, that once surrounded the industrial city, today is immerse on its urban area and becomes a main transport axis and an important connection with the suburban areas and nearby cities. Besides that, the LBR constitutes the backbone of the new urban centralities and its terminal areas will house major infrastructures projects in the near future: Third Bridge over Tagus River, the RAVE Project (the high speed train) which will connect the New International Airport to the International Train Station (Gare do Oriente) and the new connection with the Cascais (leisure suburb) railway.

From the urban point of view Lisbon can be understood as the overlapping of the historical centripetal axes in opposition to concentric boundaries that one by one was overcame.

Final comments

This paper is a short exposition of the conceptual, methodological and theoretical premises that guide the development of a Master thesis in Urban Design and Public Space Project. Besides being a work in progress it's possible to make some comments.

The analyses from the first field work and the initial iconographic readings allow to admit, as an exploratory hypothesis, that the morphogenesis of the landscape and territory of the Lisbon Belt Railway occurs apart from itself, since it was hidden and/or camouflaged always being regarded as a necessary evil where good relationship between urban form and daily life of citizens and the LBR could only be achieved by a strategy of denial.

The current stage of urban development and the need to rethink its logic and the forms of mobility and energy consumption in search of a more balanced metropolis make the assertion in the infrastructurization in a European and international scale, as the installation of the High Speed Train (RAVE), the New International Airport (NAL), the connection between the Belt Railway and the Cascais line and the creation of the Metropolitan Belt Railway, to bring back issues to light about how these new infrastructures will be mediated with the existing urban form. Inevitably what is in stake is a conceptual and practical hybridization between urban design and a project of infrastructures where the logic of one must be blended the other always

fighting against the negative impacts but never denying the existence of both.

Thus, the construction of landscape and territory of the infrastructure necessarily is direct related with the deconstruction of the tunnel effect that characterizes such infrastructures by redefining the contact of the surfaces between itself and its environment through a combination of disciplines whose logics are in the same time conflicting and complementary.

Notes

[1]FONT, A. (ed.) *The explosion of the city: Morphologies, observations and motions within recent transformations in the South Europe urban regions*. Barcelona: COAC, 2004. P. 11.

[2]Journal Officiel de la République Française, 18 août, p. 6743, 3[e] col. ds LITTRE *Suppl.*

[3]Author's translation from the original version "(…) uma linha de cintura na antiga cidade de Lisboa, formada pelas linhas de leste de Santa Apolonia á Madre de Deus, pelo ramal de Santa Apolonia a Benfica, até ao ponto em que elle se liga á linha de Cintra, pela linha de Cintra, desde este ponto até á actual estação de Alcantara, pela linha de Cascaes entre esta estação e a margem do rio, e pela linha marginal de Alcantara a Santa Apolonia". "Comunicação do Engº Pedro Ignácio Lopes sobre os caminhos de ferro em vias de construção em Lisboa e proximidades", *Revista de Obras Públicas e Minas*, Tomo XIX, 1888, p. 273. In: LISBOA, Maria Helena. *Os engenheiros em Lisboa: Urbanismo e arquitectura (1850-1930)*. Lisboa: Livros Horizonte, 2002. p. 132

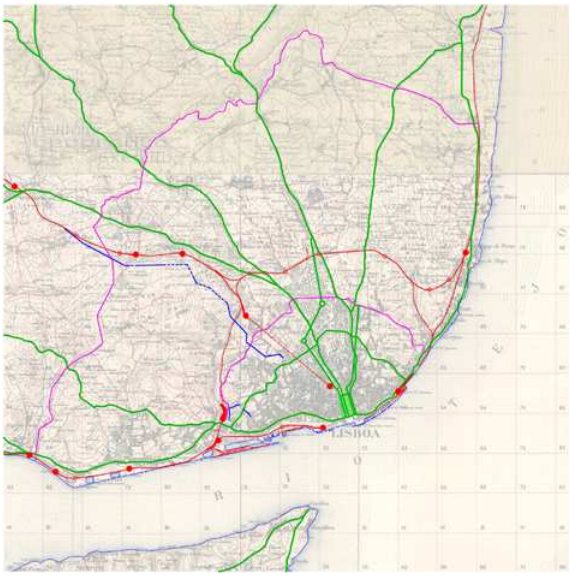

Fig.2. Lisbon 1914: The Pedestrian City and the mercantile configuration. (Map produced by the author based on Military Cartography from IGeoE)

Fig.3. Lisbon 1949: The Industrial City and the construction of the core infrastructures. (Map produced by the author based on Military Cartography from IGeoE)

Fig.4. Lisbon 1971: The Modern City and the domination of the automobile. (Map produced by the author based on Military Cartography from IGeoE)

Fig.5. Lisbon 1993: The Post-Industrial city and the urban renewal. (Map produced by the author based on Military Cartography from IGeoE)

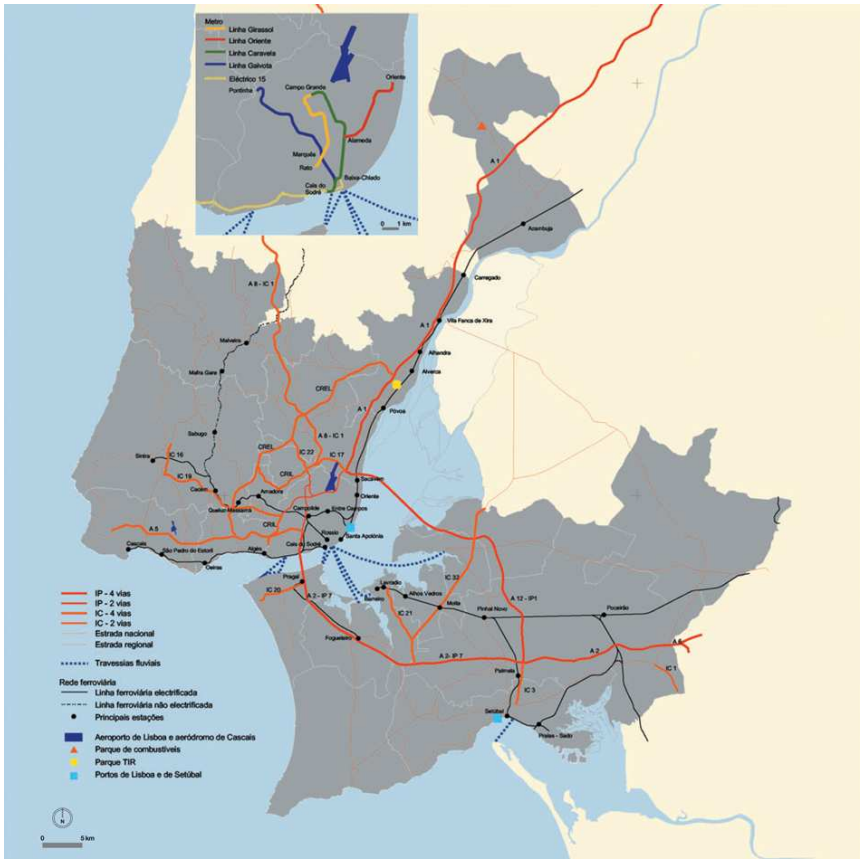

Fig.6. Map of the Metropolitan Area of Lisbon showing the actual infrastructural mobility network based mainly on the road option (represented by the red and orange lines). Source: MARQUES, A. H. de Oliveira; TENEDÓRIO, José António. Atlas da Área Metropolitana de Lisboa. Lisboa: AML, 2003.

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