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## **Trolleybuses and the European cityscape : energy choices under environmental pressure (London, Paris, and Rome, 1930s)**

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During the interwar period, the European cities faced new mobility problems. The substitution of horse power by different kinds of motors, which began before the First World War, was only completed during the 1930s. Beside the intensification of car traffic, one of the most striking changes of that time is the dismantling of tram networks, which occurred in a few cities. At least London, Paris and Rome have chosen to totally or partially dismantle their tram networks and to develop different enhancements of mobility. A new system, the trolleybus, could easily find a place on the dismantled tram lines, for energy and cityscape reasons. This was the case in London, whereas Paris only used motor buses in place of trams. Rome followed an intermediate way by developing a mix of mobility, based on trams, trolleybuses and motor buses.

Our paper will address the different elements behind the decisions made in the three cities on the question of trolleybus. The hybrid nature of this system, powered by electricity supplied by overhead wires but rolling on pneumatic tires, leads to special links between energy and cityscape. We will try to understand the role of these environmental factors in the debates of the 1930s. Our hypothesis is that these environmental considerations have been partially exploited in order to hide other kinds of reasons behind the choices made in the different contexts, such as industrial interests, social fears or political choices. And this game explains the adoption or the rejection of trolleybuses. As a result, despite transfers and rivalry between cities, the 1930s built original mobility supply in these three European capital cities.

### 1. Three urban backgrounds

Among the European capital cities during the Interwar Period, London, Paris and Rome were remarkable for the fact that they chose to totally or partially dismantle their important tram networks.

However, the urban landscapes of the three metropolis were very different, particularly between Rome and the two others. The new Italian capital, only chosen in 1871, was deeply marked by its historical context, inherited from the Roman Empire or the Renaissance. Simultaneously the city was involved in a process of building a new face for Mussolini's capital, based on a strange mix between modernity and discourses on the Antique heritage. But the whole city was also involved in dynamics of extensions without rules on

the margin of the agglomerated area (the so-called *borgate*). The development of urban population was based on the urbanization of new districts, far from the image of the Eternal City and its center.

In Paris and London, the focus on history was much lower, because the cityscape was much newer. Due to the 1666 fire and the early industrialization process in London, and to the huge works achieved during the Haussmannian cycle, from the mid 1850s onwards, both capitals had renewed most of their buildings and streets. But they followed different patterns. Whereas the urban area of London was relatively homogeneous in terms of density, Paris deliberately chose a model of a very dense city center poorly linked to low-occupied margins. The metro networks of the two main European cities of the Interwar Period reveal these important differences. In both cities, the process of extension was important, with suburbs growing.

In terms of population, figures are available for 1931 for the three cities, even if the census are probably not based on common definition of the urban area. London was clearly the biggest one, with 8.1 millions inhabitants in the Greater London (4.4 millions in Inner London), followed by Paris (4.9 millions inhabitants in the Seine *département*). Rome was far from being a world metropolis, with 0.9 million in habitants, but its demographic dynamic was very strong.

In this panorama, we notice that Rome was also a political exception, with the specificities of the fascist regime, which led to decision processes very different from those of the democratic countries, like France and Great Britain. One of the most important consequences of these political differences is also the impact of the 1929 crisis on the cities: whereas London and Paris knew bad economic situations, with a decreasing transport traffic, Rome was in a different dynamic, due to its more self-sustaining regime.

## 2. Energy transition and cityscape, the memory of the *Belle Epoque*

In matters of transport, Paris and London followed a similar path, when Rome was in a different phase, because of its size and its new role as capital of Italy. During the 1920s, the British and French capitals enjoyed a diversity of urban transport networks providing a high-level of services, mainly based on three technologies: underground, bus and trams. Whereas, in Rome, no underground was available, so that the overground systems were running after a rising transport demand, more dispersed year after year.

But, one of the common points of transport history in these three cities deals with the difficulties faced by electric trams. Whereas many cities in the US or rural areas in Europe had developed overhead wires along tram lines from the 1890s onwards, the main European cities were reluctant to adopt the new systems in their streets.

There are various reasons for such a debate on overhead wires. The open argument is the preservation of the cityscape, that could be altered by electric wires. But the argument is not really acceptable in cities where the urban landscape had been deeply modified by the industrial era, like Paris, for instance. Another argument, not so clearly expressed, is based on the social representations of transport systems. Because horse-drawn trams had already been confronted to rejection from city centers, they were mainly developed in the peripheral areas. Moreover, the lower operating costs of trams allowed lower fares, so that trams were identified as the working-class transport system. And they became less and less acceptable by city centers and *bourgeois* districts.

This process is to be observed in London, Paris and Rome, as well as Bordeaux, for instance, whereas in some countries, such as Switzerland, overhead wires were nearly not discussed. The result of these debates is the technical atomization of the industry of trams and the constitution of distinct cityscapes. For instance, the western part of London around Hyde-Park or the Boulevard in Paris were preserved from tram lines. Ironically, one of the most ancient European city, Rome, did not resist as long as the modern capitals of the industrial world. After debates occurred during the 1890s and the beginning of the 1900s, electric trams with overhead wires were introduced in the whole city, even in the historical center, like the via del Babuino, for instance.

For the history of trolleybuses, these debates on overhead wires and trams is an important milestone, because these tensions between aesthetics and transport networks, with a more or less visible social background, shed light on the way trolleybuses were discussed or not.

### 3. The situation during the Interwar Period

The modal landscape of the three cities was deeply transformed during the Interwar Period. London, Paris and Rome were the main cities involved in a dismantling processes of tram lines at that time. But, whereas in Paris and London, the technical doctrine focused on the total substitution of trams by other transport systems, in Rome, the game was more complex.

For reasons linked to the old-fashioned configuration of tram networks, to the gap between an emerging oil-pneumatic sector and an older iron-electricity sector and to the development of car traffics hindered by trams, the British and French capitals began to dismantle trams by the end of the 1920s and the beginning of the 1930s. Progressively, the substitution became a political and technical aim.

In Rome, the decision was more clear, inscribed in a reform of transport networks realized in 1930, but limited to the city center, within the Aurelian Walls. Under the lead of Mussolini, who denounced the “stupid contamination of trams”, the Rome transport authority (ATAG) chose to substitute trams with buses and trolleybuses. But, simultaneously, trams were reused in order to operate new lines in the growing suburbs of this young metropolis. Whereas Paris and London eradicated trams, a project achieved respectively in 1938 and 1952, Rome gave to trams the possibility to fully use their potentiality. Whereas trams were blocked in the narrow streets of historical districts, they could eventually find better operating conditions along the wide radial axis of the suburbs.

#### 4. The trolleybus as a solution?

Despite these differences, the three cities faced a common problem: what kind of systems could be used in replacement of trams? The answer brought by each capital reveals a specific relationship between energy choices, cityscape considerations and modernity.

Whereas Siemens had presented the first prototype of trolleybus in the 1882 in Berlin, this industrial field did not develop before the 1900s, when some cities adopted trolleybuses, mainly in central Europe (Vienna, Milan). In Paris, a quest for alternatives fuels was launched after the First World War, but without real pressure of the international scene. Oil was then the most efficient and cheapest energy for buses, but was mixed with alcohol and benzol in the Parisian bus fleet, whereas trams used electricity, mainly based on coal but also on hydroelectricity.

Trolleybuses were experimented but without a real necessity of development. Aesthetic considerations were reactivated by this new system which was not a good point for its development. So, Parisian technicians did not trust overhead wires as a solution and only consider battery systems. But the battery of that time could not provide the energy supply necessary for modern buses. So, the only solution was to let the trolleybus as a possible solution if heavy contextual conditions had changed.

As a result, in Paris, as well as in London and Rome, no line was operated with trolleybuses before the dismantling of trams. But this process led the three cities to three very different choices. Whereas London massively used trolleybuses in order to replace trams, Paris used only motor buses, whereas Rome built a more complex doctrine crossing trams, trolleybuses and motor buses.

The new authority for London Transport, the LPTB, unified the different transport systems of the agglomeration in 1933. This very important reform was clearly visible through marketing and branding actions, such as the unification of all the signs of the various transport systems under the famous roundel. This new authority chose to invest important capitals in the development of transport services and one of its priority became the substitution of trolleybuses for trams, as a sign of modernity and renewal of the field of transport operation and transport policy. Trolleybuses were an interesting solution, because they could very easily be implemented along the tram routes, just by adding a second electric line, because the electric current could not run in the rails any more. But, they also allowed to have a general energy policy at the level of the LPTB: electricity produced for the underground could also be used for trolleybuses.

It is exactly for the same reasons that Paris did not consider trolleybuses as a solution. The memory of the hard debates around overhead wires was still alive, may be more than in London. And the sector of transport was not unified but marked by a competition between the underground company (CMP) and the bus and tram company (STCRP), both private companies under public control for their operations. The opposition between these two worlds, which was also based on distinct technical references and rivalry between engineers of different educations, led to see trolleybus more as a bad compromise more than a good solution. Hence Paris based its substitution only on motor buses.

The result of this political and technical configurations can be read in the figures. In 1939, whereas around 3000 trolleybuses were operated in the United Kingdom, only 80 drove in the French cities, mainly in Lyons, Algiers, Rouen and Strasbourg. But London had the largest trolleybus network in the world, with about 1800 vehicles on about 70 routes.

The example of London was clearly evoked by Roman decision makers, but the Roman choice for trolleybus is explained by different factors. First buses used in place of trams offered only degraded service due to their low capacity. Then, international pressures on Italy, following its military intervention in Ethiopia in 1935-1936, threatened its petroleum supply.

Therefore the quest for new energy sources was favored. Finally, the example of London showed that this method could offer to a large and modern city a powerful service.

The first trolleybus lines in Rome opened in January 1937, with Fiat vehicles. The fascist propaganda based its use of these technical devices as examples for the illustration of Italian expertise: one of the lines served the new Foro Mussolini, an important place for the regime. The network was expanded during the next years. The most significant evidence for the faith of fascist Italy in trolleybuses is that the service plan for the Universal Exhibition of 1942 was based on the opening of the first subway line and a network of trolleybuses, two symbols of modernity.

More generally, the fascist period saw the will of the ATAG to modernize its fleet, notably the electric vehicles. The lack of fuel and tires also played for the trams that were developed again, up to replace the trolleybuses on some lines. In 1940, ATAG and Stanga manufacturer developed an articulated tram of a remarkable modernity, because of its capacity, its strong acceleration and its central articulation, which was declined on trolleybuses. Electric systems participated in the self-celebration process of the fascist regime.

Despite these differences between cities, one has to underline the constitution of a somehow negative image of trolleybuses in both cities. London trolleybus were quickly nicknamed *diddler* by the employees of the operator. A negative name that could be, for instance, compared to the extremely positive image of the 1950s Diesel Routemaster, an iconic bus. In France, the general attitude toward this system has been summed up by Pierre Sansot, a thinker of urban life, who described trolleybuses as particularly duplicitous, after it had been eventually chosen during the Second World War. In Rome, contrary to what the collective memory retained - marked by the Mussolini speech - the *ventennio fascista* was much more a period of modernization than of trams dismantling: in this sense, this cycle has an ambivalent character. He also saw the birth of a new high-performance and widely used system: the trolleybus. This is however almost absent from the memory and image of the city, as evidenced by the movie *Avanti c'è posto*, whose action takes place aboard a trolleybus but whose actors speak only of trams and buses!

## 5. Trolleybus choices and the Second World War

At the beginning of the Second World War, the choices made by the three cities in the field of transport appeared to be crucial. As it was the case

during the First World War, Parisians buses were massively used for military purposes and sent outside Paris. Supplied with benzine or alcohol, they could be useful in war conditions. On the contrary, trolleybuses would have been useless outside their electrical networks.

Hence, the cityscape of London or Rome during the war was less transformed than what happened in Paris, where traditional buses totally disappeared, whereas they were key figure of Parisian representations of the Interwar Period. The city and mainly its suburbs were then crossed by buses based on alternative energy sources, such as gas or wood gas generator. On the contrary, in London and Rome, trolleybuses (and also trams) became important transport providers in cities disorganized by war conditions and bombings.

It is only under war conditions that Paris chose to really focus on trolleybuses. With the strong pressure on energy supply, electricity appeared to be the best solution for the operator: possibly produced with national resources, cheap, easy to use. The STCRP planned the opening of new lines in autumn 1939, along with the governmental interest for trolleybuses, that imposed, for every substitution of trams, to take into consideration trolleybuses. But Paris had no trams any more.

The late-coming national discourse in favor of trolleybus was based on the idea that this technology was the logic solution inscribed in a general historical dynamic. Horses, steam and then electricity were supposed to be the successive national energy sources, whereas petroleum was nearly not addressed. The new authorities in Vichy appeared to be very enthusiastic for trolleybuses. The new 1000 coaches plan decided by the new Minister for Transport in January 1941 included a 250 trolleybuses fleet, specially for the suburbs.

Paradoxically enough, war conditions were also the origin of difficulties faced by the development of trolleybus in Paris. Copper shortage and requisition due to the German forces hindered the installation of overhead wires along the streets. When a first line was eventually built, electricity rationing was another problem, solved by negotiations with the German occupiers: a metro station had to be closed in order to open the two first trolleybus lines in 1943, in the near suburbs. Despite war conditions, aesthetic considerations imposed to install a small internal combustion engine on these trolleybuses in order to cross the Neuilly bridge. A kind of legacy of the old debates about trams and their place on public space.

Designing trolleybus lines imposed to address aesthetic stakes whereas the dismantling of trams and the operating of buses had erased these

considerations. The installation of overhead wires along the first trolleybus lines during the 1940s imposed to the transport engineers to draw transversal views of streets and to have a discussion on the implementation of transport infrastructures in the cityscape. This was a new phenomenon in Paris. The story of trams did not impose such a reflection, because trams were first only based on rails very lightly inscribed on the road, later equipped with overhead wires, often rejected. With trolleybuses, the whole process of designing a transport infrastructure placed in its environment became mandatory, under the hard conditions of the Second World War. Moreover the relationship between trolleybuses and public space was stronger than what could be imagined, because, the black out prevented drivers from following the electric aerial line. White marks had to be painted or blue lights had to be installed in order to let trolleybuses operate after sunset.

## 6. The dismantlement of trolleybuses

In Paris, it is only after the end of the war that the operator opened two other trolleybus lines, in 1950 and 1953. And then, the new company (RATP) entered a process of rebuilding its networks, that was mainly based on standardization and rationalization of operation and rolling stock. The Diesel bus appeared as the good solution in order to develop a renewed bus network without any problem of public space design. In such a context, trolleybuses remained marginal and the 4 lines were closed during the 1960s.

Whereas London and Rome had based part of their mobility during the War on trolleybuses, Paris had only poorly developed this system, under the German rule and the Vichy government. In the French capital, trolleybus was probably linked to these dark times. This historical configuration sheds light on the low enthusiasm for this technical solution that frames the Parisian vision of urban transport after the War. Whereas many French cities develop trolleybuses in the same time, such as Perpignan, Metz, Dijon or Tours.

After the War, in the United Kingdom, the choice of motorization is still hardly debated. One of the main arguments of trolleybuses was the use of a national energy source, the British coal, whereas the competitor, the diesel bus, supposed importations from abroad. But the government finally chose not to interfere in the process of choices followed by different cities. As a result, the enthusiasm for Diesel engine, perceived as the more modern solution, proved to be a very efficient process that led British cities to dismantle their trolleybuses. London organized a farewell to trolleybuses

ceremony in 1962 for the last use of this system in its streets, just as it was done with trams 10 years before.

Rome differs from Paris and probably partially from London in the specific view of the modal landscape developed by fascist engineers. The three collective transport systems available at that time - trams, buses and trolleybuses - were conceived as complementary, whereas the two other capitals developed the vision of competition between systems. The fact that Rome was not equipped with an underground probably explains this difference: the city needed the three systems in order to get a mobility supply, likely to match the high demand of a capital city. The language itself reflects this complementarity between systems, with the invention of the word *autofiltramviario*.

During the 1950s, after some repair works due to bombing damages, Rome had the largest trolleybus network in Italy and one of the largest in the world. Trolleybus ran on the most prestigious squares of the city, such as the Piazza San Pietro and the Piazza dei Cinquecento, in front of the brand new railway station, Roma Termini. A process of extension was still ongoing, based on technical synergies with the extension of the electric network and street lights in the suburbs, like Val Melaina or Tufello.

In Rome, during the 1950s, the first displacements of trolleybus lines, due to improvements for car traffic, often led to substitute buses, because overhead wires could not find a new place in a city involved in an automobilising process. The defaults of trolleybus, such as the lack of flexibility or the accelerated aging process due to traffic chaos, appeared then in the full light, whereas the fascist period did not focused on them in a different urban context. Perceived as more modern than trams, trolleybuses quickly became less modern than buses themselves. Roman trolleybuses were also poorly standardized, because they were still somehow prototypes. As a consequence, maintenance costs were high.

So, when buses themselves lost their credit with the transformations for the 1960 Olympic Games, mainly focused on cars, trolleybuses became old-fashioned transport systems. The only one to really disappear of the Roman landscape - contrary to trams - in 1972.