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The Solution to Urban Traffic Problems Does Not Lie in Copying the Outward Manifestations of Successful Examples, But in Understanding the Behavior of the System

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***Abstract*— Vienna's transformation into the greenest city by 2020 resulted from a paradigm shift in transportation policies, shifting focus from traditional planning to sustainability. Until the 1970s, Vienna's future was planned—as was customary at the time—with highways, large parking garages, and subways to replace the disruptive streetcars, and without bicycle traffic. However, with the demolition of St. Florian's Church in 1965, a landmark of the 5th district, to make more room for cars, the public became aware of the threat this mode of transportation posed to the city and its quality of life. This had consequences. In the City of Vienna, the share of car trips was reduced from 40% to 27% between 1993 and 2015, while the share of trips by public transportation increased from 29% to 39%. Since 2002, the level of car ownership among the city's population has also been declining, as in other major cities. The causes, however, date back decades before these periods, to public opposition to highways within the city, which led the city government to halt these projects. The second major reason for the shift in Vienna's transportation policy is the period from 1975 – 1980, during which the city not only commissioned the scientific foundations for the 1980 Transportation Concept but also began its practical implementation in parallel and adopted the results in many areas. Urban development concepts followed these principles, which not only addressed the transportation system but also laid the groundwork for environmentally oriented planning and technologies. A new momentum emerged on this path toward a sustainable city, which was ranked as the greenest city in the world in 2020. Despite these successes, however, not only are greenhouse gas emissions from transportation still rising, but political decisions could also jeopardize this ranking through highway projects.**

***Keywords*—Citizen resistance, transportation trends, system dynamics, modal split, urban development, parking management.**

I. Introduction

Without a paradigm shift in the scientific foundations of transportation, Vienna would not have become the greenest city in the world by 2020 and the city with the best quality of life.

II. Problems to Solutions

1. The success is impressive

Vienna was named the "greenest" city in the world in the new "The World's 10 Greenest Cities 2020" ranking. The Canadian-American consulting firm Resonance compiled the ranking. Resonance regularly publishes the "World's Best Cities Report," on which the "The World's 10 Greenest Cities of 2020" ranking is based. For the "Greenest Cities" ranking, more than 100 cities worldwide were compared using criteria such as the proportion of parks and public green spaces, renewable energy use, air quality, public transportation options, pedestrian-friendly routes, and the availability of markets for local products. Vienna stands out in the city comparison for "fresh ideas on mobility and public parks" and for being one of the few major cities with a national park within its city limits. A key criterion for its top ranking is its well-developed public transportation network: "Vienna is the European benchmark for public transit," the ranking's authors note. "Nearly half of the city's population owns an annual public transit pass—and uses it extensively." More than half a century ago, this was neither the city's political goal nor the vision for the future in urban planning.

2. The future of transportation was planned quite differently

After World War II, Vienna, like most European cities, pursued a transportation policy modeled on the U.S. approach to redesign the city to accommodate cars [1]. Tram lines were discontinued [2]; even a parish church—a landmark of Vienna's 5th district on Wiedner Hauptstraße, St. Florian's Church (also known as the Chimney Sweep's Church)—was demolished for "traffic-related reasons" despite a wave of public protest involving over 13,000 signatures, to make way for private car traffic [3].

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Fig. 1: St. Florian's Church shortly before demolition in 1965. On the left in the picture is the New St. Florian's Church by Fritz Wotruba. Source: Archives of the City of Vienna

Green spaces were transformed into gray concrete and asphalt surfaces, and trees were removed to make way for parking spaces.

Fig. 2 Images from downtown Vienna (1970)

Source: Archives of the City of Vienna)

Fig. 3 Schwedenplatz and Karlsplatz 1965.

Source: Archives of the City of Vienna

By the late 1960s, doubts were emerging about the justification for public transit in the street space, at least in the densely built-up districts. In the long term, the focus there was primarily on the subway. Although there was already a desire in 1970 to protect the city from the expected flood of car traffic, "intercepting" traffic at the city limits and parking problems were already central issues. "Private vehicle traffic flowing into Vienna, especially commuter traffic, should be 'intercepted' as far as possible at the city outskirts or before reaching them."[4]

However, policymakers and experts still base their approach on demand-oriented transportation planning that is, the assumption that the inherent momentum of car traffic should be accepted as a given. This is also evident in the planned overarching road network of 1971.

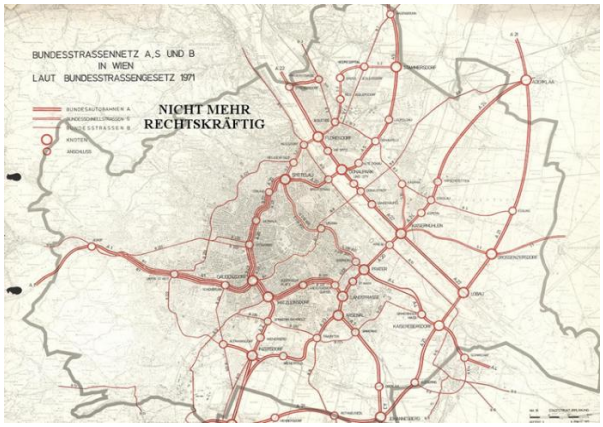

Fig. 4 Vienna Motorway and Expressway Network 1971

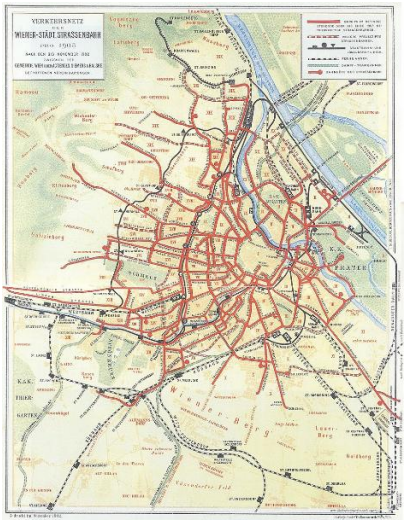

Fig. 5 Vienna Rail Network 1903

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The planned motorways and major thoroughfares were to be designed and built to meet future traffic needs, as outlined in the Federal Highway Act. (Transport Concept 1971) This was not questioned by experts in city administrations and ministries, nor by university professors working in engineering firms at the time. Similarly, there was a conviction that existing modes of transport—trams and bicycles—were relics of the past.

3. Trams as a Disruptive Factor

Urban public rail transport, Vienna had a dense rail and tram network before World War II (Fig. 5), which was to be replaced by buses and subways: "In the long term, the tram cannot be replaced in Vienna. However, the main goal of transport expansion must be its elimination, especially in densely built-up areas or within the Belt Ring, through the use of subways, commuter rail, and buses." Therefore, the trams on the Ring were to be discontinued with the opening of the U2. Regarding the future of the suburban railways—at that time, the Badner Lokalbahn, which ran on tram tracks in Vienna—the following statement is found: "Operation on tram tracks in densely built-up areas should be abandoned in the short term, or at the latest in the medium term." "At that time, the trams were so severely hindered by car traffic that during peak hours, travel speeds dropped, in extreme cases, to walking speeds (4 to 5 km/h) and below. Due to the severe obstruction caused by other modes of transport, the theoretically achievable capacity—namely 16,000 seats per hour and direction—cannot be reached." The 1970 transportation plan does include a comparison of the space requirements for cars, buses, and subways—203:27:9 meters in width—to transport 40,000 people per hour in each direction. In practice, this had no effect. People succumbed too readily to the idea of a car-friendly transportation system imported to Europe by the United States as the victorious power.

Just how little faith there was in the future of streetcars is evident in the underground route of Line 2, which is described today as follows: "The unfortunate route of Line 2* through a 1.8 km-long tunnel between the Secession and City Hall on 'Lastenstraße' + began on October 8, 1966, when Vienna's first underground tram (U-Strab) was opened. From that point on, rerouting the Ring lines (all trams that travel at least a section of the Ring are called that) or radial lines between Schottenring and Karlsplatz were no longer possible, as all routes running radially toward or away from the Ring now had no track connection to Line 2.

However, it is precisely the frequent events on this section of the route that have led to the elimination of surface-level rail-based public transportation on the relevant section of the Ring. As a result, Line 2 was deprived of its important role as a detour route for tram traffic near the Ring." [5] At that time, trams were not given priority at the intersection's traffic lights.

The bicycle as a mode of urban transport does not appear at all in this "Traffic Concept for Vienna" [6] from 1970. In 1954, it was considered unlikely that motorization would exceed 62 cars per 1,000 inhabitants. Acting City Councilor Kurt Heller also expressed this sentiment at the opening of the Gürtel underpass, stating, "The era of full motorization is behind us." Even the scientific community did not know any better at the time. For Germany, full motorization was calculated in the 1954 forecast (Zimmermann) at 62.4 cars per 1,000 inhabitants, and a year later for Austria at 61.7 cars per 1,000 inhabitants. Reality has so convincingly surpassed these forecasts that they continue to shape thinking and action in professional circles and politics to this day.

Parking in 1970 was based on projected demand from the resident population, workers, tourists, and visitors. The solution is to provide even more parking spaces in the city, both on the street and in garages. Section 2 of the Reich Garage Ordinance [7] was also adopted by socialist Vienna and remains in effect to this day, even though its requirements cannot be implemented in densely built-up urban areas. Public space is therefore primarily made available for cars. The interconnection with other modes of transport is still lacking. The sectoral perspective dominates. The consequences—namely, that the cars parked in garages then appear on the surface and lead to obstructions that undermine the functionality of public transportation—seem to have been ignored. [8] What was stated in the preamble to the Third Reich's Garage Ordinance of April 1, 1939—"The promotion of motorization…is the goal" [9]—determines the thinking and actions of those involved in urban and transportation planning.4. A “Both-and”: Subway Construction and the Downtown Pedestrian Zone

In connection with the subway construction, the city planning department (MA 18) wanted to design Stephansplatz and the adjacent shopping streets as “pedestrian areas” to restrict through traffic[10]. The pedestrian zone established later was not the goal at the time; rather, it was a temporary restriction on through traffic with guaranteed access for deliveries.

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Senate Councilor Engelberger, then head of urban planning, asked me to develop the framework for this.[11] The main question that dominated discussions in urban planning at the time was: Where will the cars go if they can no longer drive through the city center? That amounted to around 120,000 cars passing through the city center daily.

However, between planning and implementation lay the problem of convincing citizens—and especially business owners—of the benefits of this solution. They had organized opposition to the project and enlisted the support of professors from the University of Vienna to fend off what they saw as an attack on their economic livelihoods by the traffic management plan I had developed and advocated. What is laconically described in the reports as "1974/1975: First car-free pedestrian zone implemented in historic old town (first district)" was the result of an intensive process spanning several years, which concerned the overall organization of Vienna's city center and not just a few pedestrian streets. Unfortunately, options that did not seem feasible to policymakers were ruled out, such as closing half of the parallel Zweierlinie[12] running alongside the Ring to reduce car traffic in the inner districts. The reason was the surface design [13], which had been planned and built only eight years earlier with the relocation of the trams into the tunnel. As a partner in this phase, the City of Vienna commissioned architect Viktor Gruen, who had returned from the U.S., to develop the urban planning concept for a car-free city center [14]. His images, disseminated through the media, of streets filled with pedestrians, were helpful during this phase, even though he was not actively involved in traffic planning or technical issues.

Fig. 6 a: "Krone" poster opposing the highway projects. Photo: Gruen, B. Lötsch "Krone" Archive.

Fig. 6 b: "Krone" poster opposing the highway projects. Photo: Gruen, B. Lötsch "Krone" Archive.

5. The cause of the turnaround: public resistance and political learning

In 1970, spurred in part by the movement against the demolition of the Rauchfangkehrerkirche, growing resistance began to form among the public and young environmental and transportation scientists against the planned urban highways; the project planners attempted to counter this by renaming them "high-performance roads." A ploy that failed at the time and only intensified the resistance was also supported by the influential Kronenzeitung[15].

Slavik caused a major media sensation on September 2, 1972, with his statement at the Alpbach Forum that he was an "absolute opponent of the Gürtel and the Danube Canal highways" (the term "high-performance roads" [16]), thereby effectively burying the relevant plans from the 1960s.[17] This decision, which was also adopted by the City Council[18], can be described as the starting point for a shift in Vienna's transportation policy. Parts of the highways, such as the Brigittenauer Bridge or the Gürtel exit, were already under construction at the time.

Initially, work continued based on Gruen's proposals, which suggested a "pedestrian protection zone" for the inner 1st District, surrounded by the Ringstraße and featuring underground parking garages branching off from it. Among other things, an underground garage beneath Heldenplatz.

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6. 5,000 cars beneath Heldenplatz save the Ringstraße trams

To replace the space reclaimed from car traffic, the city planned a large parking garage with 5,000 spaces beneath the historic Heldenplatz. For safety reasons, public garages must be able to be evacuated within certain specified time frames, which requires proof of traffic flow for the entry and exit points. The locations of the entry and exit ramps were dictated by urban planning: the tram routes along the Ring. According to the concept—and the underlying models—these were no longer necessary after the opening of the U2 subway line.

However, the (unauthorized [19]) review of the model calculations showed that while the surrounding road network can easily handle the peak traffic loads from this garage, building the garage in this form—and even its operation—will lead to problems. It also became apparent that the tram calculation model did not perform behavior-sensitive calculations and did not allow passengers to react to changes along their routes, such as transfers. The recalculations using behavior-sensitive models showed that the Ring Lines are indispensable for the future of public transportation in Vienna and should not be discontinued; rather, they should be served by existing and new cross-city lines.[20] With these results, it was possible to convince city planners to retain the Ring Lines even after the opening of the U2.

For Wiener Linien, they are now among the busiest “core routes” in the tram network. In 2008, lines D and J, as well as 1 and 2, were connected to form cross-city lines. [21] The passenger growth of over 30% confirmed, decades later, the results of the study conducted 30 years earlier. One can imagine the consequences of clinging to the previous “decision-making criteria” for the entire public transit system in Vienna. With this work, however, the inherently unjustifiable principle of “discontinuing trams and replacing them with subways and buses” was broken for the first time, albeit not definitively.

7. Sternwartepark in Vienna, a turning point in the perception of green space

This mayor’s term also saw a decisive turning point in green space policy: In Sternwartepark, a 58,891 m² area surrounding the Vienna University Observatory in the so-called Cottage District of Währing, the new building for the university’s zoological institute was to be constructed in the early 1970s, which would have reduced the green space by 3,615 m². A citizens’ initiative by residents opposed the construction project and demanded that the park be opened to the public.

The referendum initiated by the mayor—a first for Vienna, in which he and his party sided with those in favor of the development—resulted in a defeat, as a majority of 57.4% rejected the development.[22] The mayor was forced to resign, and nature became a politically sensitive issue in Vienna.

8. A New Approach to Gathering Foundational Data

The city administration initially lacked a valid traffic plan, and Slavik's successor, Mayor Gratz, attempted to have the scientific basis for the 1980 transportation plan developed by experts not presumed to be guided by personal economic interests. At the time, this was a principle of the city to prevent solutions that served the future order books of engineering firms and construction conglomerates rather than the city and its population. Here is the foreword by the editor, Municipal Department 18, to the volume on bicycle traffic: "The changed conditions in the transportation system and the rapidly increasing demands placed on it made the creation of a transportation concept necessary. This is a continuation of the 1970 transportation concept and the 1972 urban development survey, and one of the 13 chapters of the urban development plan. However, the transportation concept differs from the other chapters in that, beyond their objectives, it also aimed to propose short- and medium-term measures to address the sometimes-critical conditions in Vienna's transportation system. Furthermore, it was necessary to develop medium- and long-term objectives for controlled spatial development in Vienna.

To ensure that the results of the transportation concept align with the goals of the urban development plan, it was necessary to address the objectives of the urban development plan through a mutually influential opinion-forming process and to incorporate them as a guiding principle into the transportation concept.

Therefore, in addition to the Urban Development Plan Working Committee, a Transportation Concept Working Group was formed, which, under the leadership of MA 18, included representatives of the Austrian Federal Railways, the Federal Ministry of Transport, the Federal Ministry of Construction and Technology, and the managing director of the Transportation Association Organization, as well as the relevant departments of the City of Vienna (MA 4; MA 18; MA 22; MA 28; MA 38; MA 39; MA 46, and the WVB).

University professors Dipl. Ing. Dr. Raimund Dorfwirth, Dkfm. Dr. Peter Faller, Dipl. Ing. Dr. Hermann Knoflacher and Prof. Dipl. Ing. Dr. Rupert Schickl was commissioned as independent expert consultants.

They addressed the respective subject areas with the relevant specialized departments in a "small working group" and, based on foreseeable development trends from the expert's perspective, presented proposals for measures. Traffic engineering analyses of network variants (traffic redistribution) for public transportation were conducted under the University's ongoing contract.Prof. Dipl.Ing. Dr. E. Engel.

The consultants' proposed measures served as the basis for decisions on the weighting and ranking of the packages of measures in Part B of the Transportation Concept. This volume by Knoflacher, H., and Kloss, H.P., titled "Bicycle Traffic," together with the other chapters listed in the table of contents, constitutes Part C of the Transportation Concept. Vienna, December 1980" [23]

The team was tasked with addressing pedestrian traffic, stationary traffic (parking), traffic signal systems, tram acceleration, and traffic safety. Since bicycle traffic was missing, I approached the responsible city councilor to bring this omission to his attention and received the following response: "What do you want with bicycle traffic? I had to ride a bicycle from Vienna to Prague during the war—that was enough for me." Moreover, that also reflected the general situation in Vienna at the time. Thanks to the support of the vice president of ARBÖ, Ing. Hans Hobl[24], this important mode of transport was eventually addressed, as mentioned above. The work is documented in several volumes, or double volumes [25].

Although the objective advantages of public transportation were known among experts, there was a lack of both cross-modal, scientific, and empirically sound foundations for implementing the required measures and, consequently, of resources to effectively counter the momentum of individual motorization and its advocates. Over the course of four years, the available literature on these topics was collected and analyzed, and local and international data were evaluated, with the person—rather than the car unit—introduced as the common unit of reference, enabling objective comparability. Based on these foundations, some measures were already implemented during the study. The share of pedestrians, reported at 35% at the time, continues to underestimate its central importance today because it does not account for all access, transfer, and exit routes to public transportation, nor to parking spaces in public spaces. If these routes—which are important for the design of the city and the transportation system—are taken into account, the share of pedestrians in the public street space exceeds 70%[26]. Furthermore, pedestrians have entirely different expectations regarding the design of public spaces.

However, this was not incorporated into transportation planning until many years later.

9. Initial approaches to what developed into a paradigm shift in transportation

Crucial to sustainable transportation planning was the principle of mode priority: “About the priority of individual modes of transport, the sole metric is capacity, expressed in passenger-trips per unit of time. The measurement system of passenger car units per unit of time should, in principle, be abandoned, as it does not allow for adequate consideration of public transit. Priority should be given to the mode of transport that demonstrates or is intended to demonstrate the greatest capacity.[27]

Instead of planning adjustments to accommodate the self-perpetuating momentum of car traffic, goals should be set that not only align with operational and economic conditions but also meet ecological, urban planning, and environmental requirements. This marks a fundamental break with the prevailing practice of transportation engineering at the time—and in many cases still today—as well as with the conventional doctrine in the relevant disciplines. These studies provided public transportation with a factual and scientifically sound foundation that has led to a rethinking and reorientation of practices to this day.

Based on quantitative indicators, car traffic was thus stripped of the priority it had previously enjoyed in the organization of public road space. In line with this, measures were also proposed to clear streets of parked vehicles through a general parking fee and to accommodate cars in garages at a distance no shorter than to the public transit stop. [28] Due to a limited understanding of the dynamics between parking supply and population shifts at the time, the report on stationary traffic still contains contradictions in its conclusions. However, key elements included the introduction of fees for parking in public spaces, the reclaiming of land for urban-friendly uses, and recommendations to reorganize truck traffic and commercial transport.

For bicycle traffic—which was not a topic of transportation policy in Vienna at the time—a network of over 600 km was proposed for the first phase based on field surveys (bicycle planning can only be done if one cycles oneself) and analyses of topographical and structural conditions, etc. In 1975, there were only 11 km of so-called “memorial bike paths” in Vienna (paths that existed only on paper) and, as it turned out, had either already been reclaimed by nature or were being used as parking lots.

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This created detailed documentation of the implementation of measures intended to mark a turning point toward sustainable transportation in Vienna, as described by Bühler (2019).

10. The Long Road to Practical Implementation

As early as 1978, finalized plans for traffic-calming measures in inner districts 3 through 9 were available, aimed at redesigning street spaces in accordance with the principles mentioned above [29]. Measures that ran counter to decades of habits, expectations, and practice—namely, taking space away from cars to give it to pedestrians and cyclists and planting trees, rather than, as had been the case until then, making more and more space available to cars. For the administration and politicians, this turned out to be a bold step. When asked where to begin implementation, we were advised to present the measures in the 3rd district, which at the time had a solid socialist majority. The presentation of the measures to the district committee met with massive opposition at the time. Implementing this paradigm shift requires strong nerves, a sense of humor, and a great deal of patience, and it is a risk for project-dependent freelance firms.

11. The exceptional situation in Vienna in the 1970s

The situation in Vienna between 1972 and 1980, in which the administration and politicians were open to new approaches and willing to apply scientific findings against the prevailing mindset of the time, was — and remains—an exception, though one with effects lasting for decades. For success that can then be reported on, only materializes under certain conditions.

This can be described by the formula Success = Expertise × Administration × Politics, or 1 = 1 × 1 × 1. However, this must meet the following conditions:

- In all three areas, representatives of the highest professional and moral caliber must be in place.
- They must be independent.
- There must be a solid foundation of trust among all parties.
- The administration must be able to implement measures in the best possible way for the city, its residents, and the economy within the framework of legal and financial constraints.
- Politics must have the courage to allow this new path and support it through laws and regulations—if necessary.
- If even one of these elements is missing, there will be no viable outcome.

The fact that this was possible in Vienna for a long time is thanks to the key figures of that era and a stable political majority of the Social Democrats. A dedicated unit was established within the municipal administration for bicycle traffic, monitoring of delivery times in the downtown pedestrian zones was improved, a truck nighttime driving ban for the entire city was implemented in Vienna in collaboration with the Chamber of Commerce[30], and parking management[31] was introduced in the 1st district in 1993—to mention just a few of the measures from the consultants' reports that were "set in motion." However, these had an impact that extended beyond the political terms of office at the time.

12. A new planning method[32]

This was developed in connection with the City of Vienna's flood protection. "The competition for the Danube area (1972) is the first and the most successful example of a new, dynamic, and process-oriented planning approach. It concerned one of Vienna's most complex metropolitan areas, where urban expansion had reached a new dimension. However, this also meant that planning requirements had changed. The engineering project for the expansion of Vienna's flood protection along the Danube, initially conceived exclusively in functional terms, was now linked to the urban planning goal of "bringing Vienna to the Danube."

In an iterative planning process, experts from various fields, representatives of the administration, authorities, and political parties, as well as those affected by the planning—the public, district and interest groups, and potential users—were brought together in recurring discussions ("couplings") to develop plans and projects jointly.

The project organization was active from 1974 to 1977. To ensure the implementation of the recommendations, a Danube Advisory Board was established from 1977 to 1979. Overall, the innovative planning process transformed what was initially a technocratically conceived "flood relief channel" into a new nature and recreational space of citywide significance. In 1981, the 21-kilometer-long Danube Island was partially opened as a recreational area; in 1983, it was declared a protected recreational area. Parts of the entire site—between Floridsdorfer Bridge and Steinsporn Bridge—were designated as the "Forest and Meadow Belt (SWW)." This marked an important step toward sustainable urban development, making the island not only the most popular local recreational area for Viennese residents but also an unforgettable experience for visitors to Vienna. The Danube Island is just a few minutes from the city center via the U1 and U6 subway lines.

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13. External and Internal Resistance

Even in the "pure sciences" such as physics, it cannot be assumed that scientific findings and their empirical evidence will be accepted by those not involved in the research.[33] This is even less the case in fields where such findings affect massive economic interests, successfully established administrative structures, and thus political power dynamics. Lobbies of powerful corporations with interests in the automotive, energy, construction, cost, and profit sectors—which sought to maintain and expand the automatisms of traditional transportation planning—attempt to influence each of these three areas, as shown by the courts of auditors' audit reports. Vienna is no exception. The halt to highway construction on the Gürtel in 1972 was no reason for construction companies to stop seeking ways and means to secure lucrative contracts after all. When a highway over the Gürtel proved impossible, a traffic problem was manufactured through the media[34]—following a tried-and-true pattern involving experts aligned with the project—to push through a tunnel solution, which, fortunately, has not yet succeeded [35].

While the development of the Danube Island was prevented, investors instead pushed through high-rise projects on both banks of the Danube around the subway stations—projects not originally planned for Vienna [36]—which fundamentally altered the city's skyline to conform to the international model of capitalist urban development[37].

Fig. 7 Cluster of high-rises around the subway station on the left bank of the Danube.

A positive example is the correction of the failed 1996 redesign of Mariahilferstraße through the Greens' commitment in coalition with the Social Democrats in 2016.A positive example is the correction of the failed 1996 redesign of Mariahilferstraße through the Greens' commitment in coalition with the Social Democrats in 2016.

Fig. 8 Mariahilferstraße before 1990, after 1996, and after 2016

Source :photos https://www.wienschauen.at/mariahilfer-strasse-die-wiederentdeckung-der-fuesse-verkehr and https://www.derstandard.at/story/2000045493786/die-transformation-der-mariahilfer-strasse

Today, under political pressure from districts governed by the Greens, measures to green the city and remove paving from asphalted and concreted areas are being implemented more easily, because the benefits of sustainable technologies and a return to the ecological integration of the city are gaining ground not only in the transportation sector but, above all, among the general public. For example, Wiener Linien has successfully launched a comprehensive program to advance sustainable technologies and green its entire infrastructure.[38] Research for the future, bee habitats, 100% green electricity, electromobility, greening for cooling, solar energy, maintenance plans for every single area: Protective measures for biodiversity and the public transit network are to become a network of biodiversity

14. Threat to the City of Vienna's Outstanding Position

The Vienna Eastern Bypass, a highway dating back to the Third Reich, was scrapped in 1983 due to the new concept under the Federal Highway Act [39] and resurfaced only in 2003 as the lowest-rated alternative among the available project options [40]. A related study commissioned by Shell [41] on "sustainable transportation development in the Vienna region" would, as a review via a systems-based impact analysis revealed [42], render the city's desired goals unattainable, in contrast to the continuation and intensification of the measures already initiated in Vienna under the 1980 concept. Above all, this project threatens the Donauauen National Park [43], the city's "green image," which was Vienna's unique selling point in the 2020 international ranking, enabling it to secure this top position. As early as 2004, it was evident that the decades-long journey toward sustainability was at risk. Excerpts from the report "Supply Creates Demand – Intelligent Mobility in Vienna Too? " by DI Georg Kotyza, the long-time department head at MA18 and a contributor to the 1984 and 1994 urban development plans, also substantiate this. It reveals a senior official's insider perspective, perceptions, and assessments of changes in political conditions over this period.

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"The new transportation concept for Vienna, bearing the zeitgeisty title 'Master Plan for Transportation,' reveals the old dilemma of Viennese transportation planning: namely, the gap between theory and practice, between aspiration and reality, which has already led in the past to ambitious and progressive plans being unhesitatingly thrown overboard during implementation in the form of construction projects."

"Until now, this dilemma only became apparent at a later stage, when the transportation concepts had long been forgotten; this time, the contradiction between objectives and expansion measures is already a fundamental component of the concept. The 1994 transportation concept's commitment to prioritizing environmentally friendly modes of transportation has been adopted, as has been a standard feature of every transport policy soapbox speech for decades."

"One would now expect a significant boost in investment in public transport and corresponding restraint in road construction. The opposite is the case: While the next phase of subway expansion includes three extensions to the city outskirts (U1 Rothneusiedl, U2 Flugfeld Aspern, U6 Stammersdorf), these can only be justified by a massive and undesirable surge in urban expansion. There are no statements regarding priorities; they are reserved for a future new urban development plan."

"If one now analyzes the expansion measures in the road network, one feels transported back to the 1960s and 1970s, when car-friendly urban development was elevated to a guiding principle of transportation policy. Over several pages, the projects are listed in detail by developer (Asfinag or the state) and by start date. Here, contrary to all the introductory assurances, no expense is spared to expand the Vienna road network so generously that no Viennese citizen has to forgo their freedom of movement. (.. .) A wealth of expansion measures complements the extensive network of highways and expressways in the rest of the high-priority road network, which—again, contrary to the introductory assurances—will create additional incentives for car use and for urban development in areas not easily accessible by public transportation. "

"How is the share of car traffic supposed to be reduced when, at the same time, a massive investment surge is driving the expansion of the road network? (...) How is the additional supply of car-friendly locations—on greenfield sites—supposed to prevent urban sprawl and the uncontrolled expansion of the city? (...) The only succinct response to these contradictions is that the "risk of suburban migration and urban sprawl must be countered through regional planning measures".

Once again, Vienna's urban planning creates the illusion that one can counteract this through spatial planning measures—i.e., through zoning and development plans—and prevent the rezoning of green space into building land. The experiences of recent decades have shown often enough that this fundamental fallacy of spatial planning cannot be sustained in the face of corresponding economic pressure—driven by individual interests—because time and again, planning stipulations committed to the common good have been overridden by real political and economic forces."[44]

Analyses of ongoing urban development projects, such as the heavily promoted Seestadt, suggest that the planned structures cannot meet the expectations they generate. However, a detailed discussion would go beyond the scope of this article.

13. The Key to Public Transportation Success: Parking Restrictions

Short-term parking zones had existed in Vienna since 1959; starting in 1975, they also became subject to fees. The recommendation to clear public streets of parked vehicles and introduce a general parking fee was not implemented until 14 years later. Implementation took place in stages, beginning with the city center in 1993, which created pressure on the surrounding districts, which then had to follow suit by raising the general parking fee. In two-year increments, the general parking fee was gradually extended until, on March 1, 2022, the entire public street space in all Vienna districts was designated as a paid short-term parking zone—as a contribution to climate protection. The foundation for this had already been laid 43 years earlier in scientific literature.

An analysis, however, confirms the scientific expectations regarding paid parking, but not the effect of the discounted annual pass.

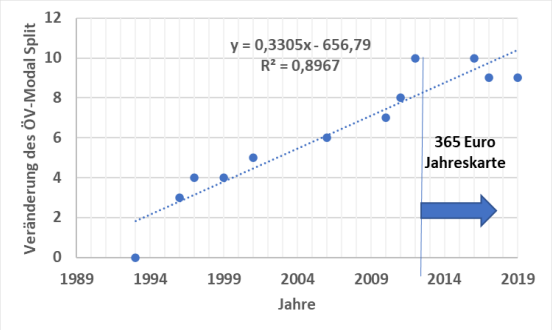

Fig. Change in modal split shares in Vienna 1993–2019.

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However, the question of how the €365 annual pass affects the modal split—and thus the climate impact highly valued by experts and politicians—still needs to be investigated. This financial "structural change"—a 19% price reduction on the annual pass—increased the number of holders by about 80% ,but had no impact on the modal split.

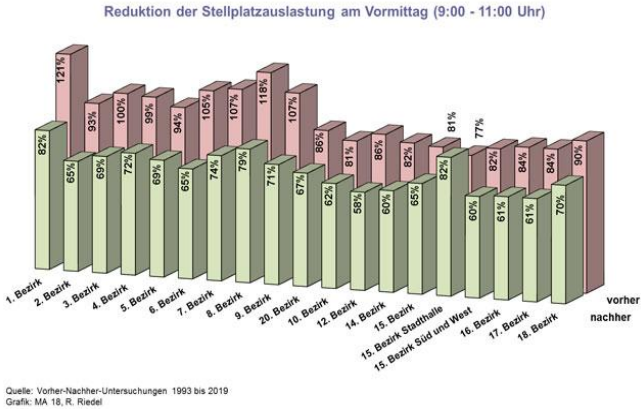

Fig. 10 Effects of parking management

One missed opportunity that has not been fully utilized for nearly three decades is the effect on parking space utilization. Due to the introduction of parking fees, more than 30% of parking spaces in public areas have become vacant [45] and could be easily used to expand green spaces through tree planting, thereby contributing to climate protection. However, this would require redesigning public spaces in parallel with preparations for paid parking, to take advantage of the optimal timing for construction measures immediately after implementation. If this is not done, reclaiming these spaces for green areas will be made more difficult.

III. Summary

Although in most cities transportation planning is integrated into the urban planning department, with the increasing motorization of society, it has shaped the thinking and actions of those responsible for planning and thus the design of the city and its public spaces. While urban development concepts addressed all modes of transportation, investments in automobile infrastructure dominated. In response to these interventions, citizen resistance emerged in Vienna, halting highway planning and construction in 1972 and necessitating a revision of the foundations for the 1980 transportation concept.

In the four years between 1975 and 1979, the focus was on the scientific foundations of transportation and not yet on the "path to a sustainable transportation system," which they can, in any case, substantiate solidly. The defense of existing parks against development by the authorities in 1972 already signaled a shift in Vienna toward opposing the destruction of nature. Sustainability was not yet an issue at that time.

The focus was on the flawed foundations of conventional transportation planning and their consequences, as well as on preserving the quality of life in the city districts. Today, this is referred to as a paradigm shift in transportation, which will be addressed in a follow-up study. Understanding the system's behavior was now possible; instead of copying individual measures, the usual method of transportation policy was used. However, the analysis shows not only how long it takes for demonstrable effects to appear in key indicators such as the modal split, but also that a coordinated combination of measures to reduce car traffic and expand public transportation options, pedestrian, and bicycle traffic is needed to stay on the path toward sustainable transportation development. The foundations laid for the 1980 Transportation Concept were further refined and strengthened through experience and analysis, thereby stabilizing the path toward sustainability. This report highlights, on the one hand, the expectations following the paradigm shift from 1972 to 1979, and on the other hand, the threats that have arisen on Vienna's path toward sustainability. The experiences of recent decades have shown that improving green spaces in the city would not be possible without corresponding interventions in the transportation system. With the scientific foundations available today, implementation technologies and strategies can be deployed that both make the transportation system sustainable and enable the re-greening of sealed surfaces, buildings, and rooftop landscapes. This has led to delegations from many countries, such as India, gathering in Vienna today in search of solutions. However, these solutions are not to be found in the outward manifestations, however attractive they may seem, nor in the narratives of those who know only the "harvest" but have not yet been part of "cultivating the soil and planting and nurturing the fruit-bearing concept." Nevertheless, all of this is only the beginning of what needs to be done. Nevertheless, this always requires constellations without zeros.

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