Our society will be as healthy as our homes.

How does the dwelling architecture from 1840 to 1919 impact the health and well-being of the residents of Vienna and London today?

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Faculty of Architecture and the Built Environment
Delft University of Technology

Ana-Sabina Nistor
6070647

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Tutor: Vincent Baptist

Abstract- This essay explores the relationship between dwelling architecture and mental health, with a particular focus on the housing constructed in Vienna and London between 1840 and 1919, during a period of unprecedented growth that followed the Industrial Revolution. Contemporary building standards guarantee that current dwelling architecture does not have a negative impact on the residents' health. Moreover, the extensive research conducted in recent years on the relationship between architecture and mental health informs current housing design. However, since these practices are relatively new, understanding the impact of older housing on mental well-being is crucial in determining whether those apartments are still habitable. By examining the historical and architectural contexts of Viennese "Zinshäuser" and London's Victorian houses, this study identifies key architectural elements present in these buildings, analyzes what caused specific dwelling architecture typologies to form, and explores how they can affect the mental health of their occupants today. To answer this final section, a comparative analysis of Vienna and London is conducted through a questionnaire, revealing disparities in housing conditions and their effects on residents' mental health.

Keywords: housing - Zinshaus- Victorian hosuing- mental health - dwelling architecture

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Section 1: Introduction

The connection between dwelling architecture and mental health has continued to fascinate scholars and researchers worldwide for decades. Numerous associations have been established between various design elements and our overall health and well-being. As a result of this extensive research, architects are now better equipped than ever to design spaces that are beneficial to human health and mental health. But what do we do with housing that was already built centuries ago? Various predictions estimate that 80% of the architecture we will need by 2050 is alreay built (Grainger, 2022). This begs the question: How healthy are the already-built housing we inhabit? Were considerations for physical and mental well-being taken into account during the design process?

Looking at the case of Vienna, Austria, statistics show that roughly 20% of the population lives in dwelling architecture built in the Wilhelminian period (1840 – 1914), the so-called "Zinshäuser". Moreover, 77% of the residents in Vienna live in rental housing, which implies that they have little to no say in the renovations carried out in their buildings. Were these apartments designed already considering their impact on mental health, or is it possible that 20% of the Viennese population's mental health is affected by design decisions taken more than 100 years ago? What about other capitals, such as London, where many residents still live in Victorian houses?

This paper aims to fill this knowledge gap, analysing how dwelling architecture from 1840-1914 influences the health and mental health of residents in Vienna and London today. This is achieved through an extensive literature review on the impact architectural elements have on mental health, followed by the historical context for the Viennese Zinshäuser, respectively the Victorian s in London, and the analysis of questionnaires on both cities with residents of these housing types. The condolences are then compared in the discussion chapter and a conclusion is drawn in the final chapter.

Section 2: Literature Review on the relationship between housing and mental health

The impact of housing on mental health is a complex and multifaceted phenomenon that has garnered increasing attention in recent years. The physical characteristics of an apartment, such as the apartment layout, environmental aspects, such as natural ventilation and daylight, and socioeconomic factors of housing, such as affordability and accessibility, have a significant positive or negative impact on the resident's mental health. However, given that the average person spends 90% of their life indoors, these findings are not entirely unexpected (Evans, 2003).

Physical aspects of the dwelling architecture, such as insufficient space, restrictive layouts and the inability to control environmental stressors, can significantly contribute to elevated levels of stress and anxiety, ultimately impinging on overall well-being (Hopper et al., 2023). This idea is supported by Evans (2003), who clarifies that a lack of personal control over environmental stressors factors can lead to feelings of helplessness. Therefore, residents who can modify and customize the space they inhabit, as well as adapt its layout, tend to have higher levels of happiness and empowerment, as per Channon's (2019) research.

Another aspect of an apartment's layout that influences negatively our mental health is the lack of legibility and the presence of tall, large structures, long interior corridors, and a

lack of small group spaces (Channon, 2019) (Evans, 2003). This type of setting, which is characterised by a lower surveillance capability, is affecting our need for territoriality and feeling of ownership and was associated in the research of Evans (2003) with both fear of crime and increased levels of crime. It is worth noting that the notion of tall spaces does not encompass rooms with high ceilings, which are associated on a psychological level with an increased sense of freedom, ultimately resulting in higher levels of happiness (Channon, 2019). Another crucial component of human happiness is social interaction, which can be enhanced or impaired through design. Research shows that the provision of small intimate spaces for solitude, as well as social interaction spaces for smaller or larger groups, is associated on a cognitive level with a greater feeling of personal control and comfort (Evans, 2003).

Other physical factors, such as insufficient thermal insulation, which leads to cold and draughty environments, have been linked to higher anxiety levels and lower mental health scores. The same study also indicates that improving the insulation in poorer-quality homes was effective in enhancing the quality of life for the residents (Liddell & Guiney, 2015).
Environmental factors, such as inadequate indoor air quality, lack of natural ventilation, sunlight and acoustic and visual privacy have also been associated with various physical health impacts, such as asthma, hypertension upper respiratory tract infection or poorer sleep quality. Prolonged exposure to these factors can also have an impact on mental health, leading to increased levels of anxiety and stress (Hooper et al., 2023). Evans (2003) and Channon (2019) further detail these aspects, noting that the lack of daylight exposure is associated with increased levels of seasonal affective disorder. Moreover, spaces with no natural light can cause distress or disorientation due to the lack of visual references, and, in cases where the exposure to daylight from windows is limited, disruptions in the circadian rhythm of cortisol (Evans, 2003).

The placement of windows in an apartment is also linked to the perception of privacy. An increased perception of privacy, which is likely linked to one's need for territoriality, can be achieved by allowing a distance of at least 20 meters in-between facing windows and placing rooms with similar functions facing each other (Channon, 2019). Additionally, the placement of windows has a significant impact on one's exposure to natural elements, which stimulates curiosity and creates a sense of fascination, leading to improved happiness levels, recovery from cognitive fatigue and stress, and overall comfort. (Evans, 2003)
The absence of adequate acoustic insulation has also been found to have adverse effects on mental health, including heightened irritability, elevated levels of anxiety, increased expression of aggression, sleep disruptions and, in severe cases, panic attacks. (Evans, 2003; Channon, 2019).

Lastly, housing factors related to social sustainability also affect resident's mental health. In their 2015 article, Mason et al. highlight the correlation between mental health and the unaffordability of housing, with low- to mid-income renters being particularly vulnerable. Housing security, which is influenced by factors such as housing quality, tenure, and location, has been extensively studied and found to be linked to our overall well-being. Inadequacies in any of these aspects can result in heightened levels of stress, as indicated by Bentley et al.'s recent research in 2022.

Section 3 The housing evolution in Vienna between the 1840s and the 1910s

3.1 Historical context for Vienna in the "Zinshaus" (1840-1919)

Vienna of the 19th century can be defined by the transition from a small medieval town to a multi-national metropolis with a thriving industry and development, primarily driven by the German Revolution of 1848-1849 and its aftermath and the rapid pace of industrialisation (Suitner,2020; Swittalek, 2023). With the rapid population growth accompanying this transition came an increasing need for housing, particularly among the lower working class, which led to the architectural densification of the suburbs and the city's vast expansion (Kose, 2017). The Gründerzeit multi-storey rental house, or "Zinshaus," emerged as a popular housing model in the style of strict historicism during this period (Swittalek, 2023). The Gründerzeit period, during which these houses were built, can be divided into three stages: the Early Gründerzeit (1840-1870), the High Gründerzeit (1870-1890), and the Late Gründerzeit (1890-1918) (Kose, 2017). Significant economic, social and technological changes also occurred during this time in numerous other cities across Europe, leading to a period of tremendous growth, commonly referred to as the Wilhelminian era (Swittalek, 2023).

Vienna's residential construction and city development took a significant step forward in the 18th century with the abolition of the court quarters obligation in 1781, long before the start of the Gründerzeit. Prior to this, homeowners in the city centre and suburbs were required to provide rooms for court servants and rent them out at low rates. This obligation contributed to overcrowding and made it challenging for citizens to find adequate housing (Stadt Wien, n.d.). The abolition of this requirement helped significantly improve the population's living conditions, however, due to population growth through immigration and a significant increase in the birthrate, the city continued to face housing shortages (Gschwandtner, 2023).

The construction of the railway lines, starting with the first one, the Northern Railway, in 1837, favoured population growth and enabled the transport of bulk materials, strengthening the city as an industrial and economic centre (Stadtplannung Wien, 1998; Gschwandtner, 2023). Due to this, between 1800 and 1848, Vienna's population registered a growth from 230.000 to 430.000 (Gerzabek, 2012). A reform and redistribution of planning competencies between the municipality and private landowners followed in 1849-1850 as a result of the 1848 revolution (Suitner,2020). The city's industrial centres continued expanding, and the new liberal capitalistic Vienna kept attracting new workforce from within the Austro-Hungarian monarchies, which led to the reconsideration of the city's fortifications (Suitner,2020). The city began to expand outside of the city walls with the construction of new public buildings (Berenger & Simpson, 2014).

With the beginning of the city expansion by the Ringstrasse development in 1858, the architecture emerging in the New Vienna also changed (Suitner,2020; Swittalek, 2023). The Gründerzeit buildings, which by then were characterised by facades with a pronounced flat architectural language, developed a greater plasticity, having a clear and pronounced monumentality architectural language inspired by classical historical periods (Swittalek, 2023). The renovation of the Vienna Ringstrasse aimed to enhance the city's aesthetics and reputation by constructing these numerous buildings influenced by historical periods. Unfortunately, this led to increased rental costs in the central area, causing the displacement of many residents, particularly craftsmen and merchands (Gerzabek, 2012).

After a long period of regular floodings, in 1870, the Danube's stream was finally regulated by splitting it into three branches. This prevented future flooding and allowed the city to expand evenly (Stadt Wien, n.d.-a). Another major event that occurred in the 1870s and that heavily influenced the urban development in the Grundzeit period was the sudden collapse of the Viennese stock market on the 9th of May 1873, which was a turning point for the economy and the Gründerzeit dwelling architecture, as the private funding for the buildings around the Ringstrasse was retracted (Stadtplannung Wien, 1998; Gschwandtner, 2023). This event also led to a significant political shift through the forming of a new political wing, which primarily included traders, craftsmen and farmers, led by the lawyer Dr Karl Lueger, who later in 1897 was elected mayor of the city of Vienna (Boyer, 1995). Historicism as a movement in architecture continued after the collapse of the stock market; however, later, it became increasingly contested both architecturally and socially. Due to the significant changes in the political stage, new architectural representations were adopted, with the work of Otto Wagner symbolising this change (Swittalek, 2023). The population of Vienna continued to grow, reaching 2.1 million residents by 1910 (Musil et al., 2021).

3.2 Housing typologies and the consideration of health and well-being during the design process.

During the Gründerzeit, numerous apartment typologies emerged. Among the first ones was the one responding to industrialisation and the quick need for housing for workers. The residential-commercial building model, mainly used as workers' apartments, emerged in the 1860s and was characterised by having businesses, warehouses, stables, utility rooms, servants' apartments or offices on the ground floor, narrow atriums, and limited green spaces. The apartment sizes ranged from 25m2 to 45m2, only had a small kitchen, and often had communal sanitary rooms protruding into the courtyard (Gschwandtner, 2023; Swittalek, 2023). These apartment types were also located in dedicated worker's apartment blocks and were mainly located in the suburbs of the city, beyond the city belt and outside of shopping streets. They were constructed in a cheaper manner, with limited design features on the facade (Musil et al., 2021). The living conditions in these apartments were, however, unquestionably inadequate, as they were overcrowded, with apartments sometimes shared between ten people, had high rental costs and high mobility, with half of the residents changing their residence every year and often having pest infestations (Musil et al., 2021).

Figure 1: Example of housing for workers in Vienna from Wien, Z. (1998). Architecture in Vienna, p. 221. Princeton Architectural Press.

In order to improve the hygienic conditions for these apartments, the City of Vienna established in 1887 the first public bath, with many more opening in the following years, commonly named "Tröpferlbad" (Pohl, 2019). Moreover, the ventilation and lighting of these apartments were being criticised increasingly by the Society of Physicians in Vienna. Starting with 1894, medical opinions on the apartment's impact on resident's health started playing a key role in the building regulations, leading to a series of renovations in the Early Gründerzeit housing sector and to the demolition of four to five-storey buildings in the old town (Bobek, 1966). The new workers' apartments had sanitary facilities inside the residence rather than in the hallways, the gang kitchen became increasingly rare, and the living density in the residential units significantly decreased (Bobek, 1966). Therefore, concerning the Gründerzeit workers' apartments in Vienna, it can be concluded that health only played a role in their design years after the housing model first emerged.

Other typologies of small apartments emerged from the 1880s onwards, ranging from 45 to 70 square meters. These flats included sanitary facilities in their perimeter and generally had two rooms, an entrance room, and a gang kitchen (Switalek, 2023).

During the Gründerzeit periods, the differentiation in the architecture for different social classes became increasingly apparent. It came as a result of the common social mix in the Gründerzeit buildings, where the first floor was typically occupied by the owner, while the second and third floors were available to rent (Bobek, 1966). Due to this, significant differences appeared in terms of location, construction quality, floor plan, window span and the existence of balconies. The middle-class rental apartments were fundamentally distinct from the previously discussed typologies. They were mostly found in the historic centre of the town, as well as in the central areas of districts 2, 17 and 18. The building blocks in which they were located were often more spacious, usually having five stories, having a higher construction quality and a more spacious courtyard, the most common model being the monastery courtyard building model (Bobek, 1966; Musil et al., 2021; Switalek, 2023). Their sizes ranged from 55 to 110 square metres, and they included an entrance hall, separate kitchen, toilets, two to three rooms, which were generally spacious, and occasionally even a dedicated servant's room (Switalek, 2023).

Moreover, there were also upper-class apartments, usually located in the less standardised Zinspalais, or the "interest palaces". Their floorplan included a generous entrance hall, drawing room with alcoves and bay windows or balconies, four, five or six rooms, a separate service wing with kitchen, servants' rooms and toilet. The living rooms faced the street, while the bedrooms were arranged in a separate wing facing the courtyard, ensuring reduced noise levels and better views of nature. The spacious staircase for the lords served the street wing, while the servants used a small staircase in the courtyard (Switalek, 2023).

To this day, the Viennese architectural landscape is still highly characterised by the buildings constructed during the Gründerzeit period, with many districts in the Inner city consisting primarily of this construction type (Switalek, 2023). In 2011, they accounted for 20% of the total building stock, approximately 32.442 buildings (Franz & Gruber, 2018; Kose, 2017).

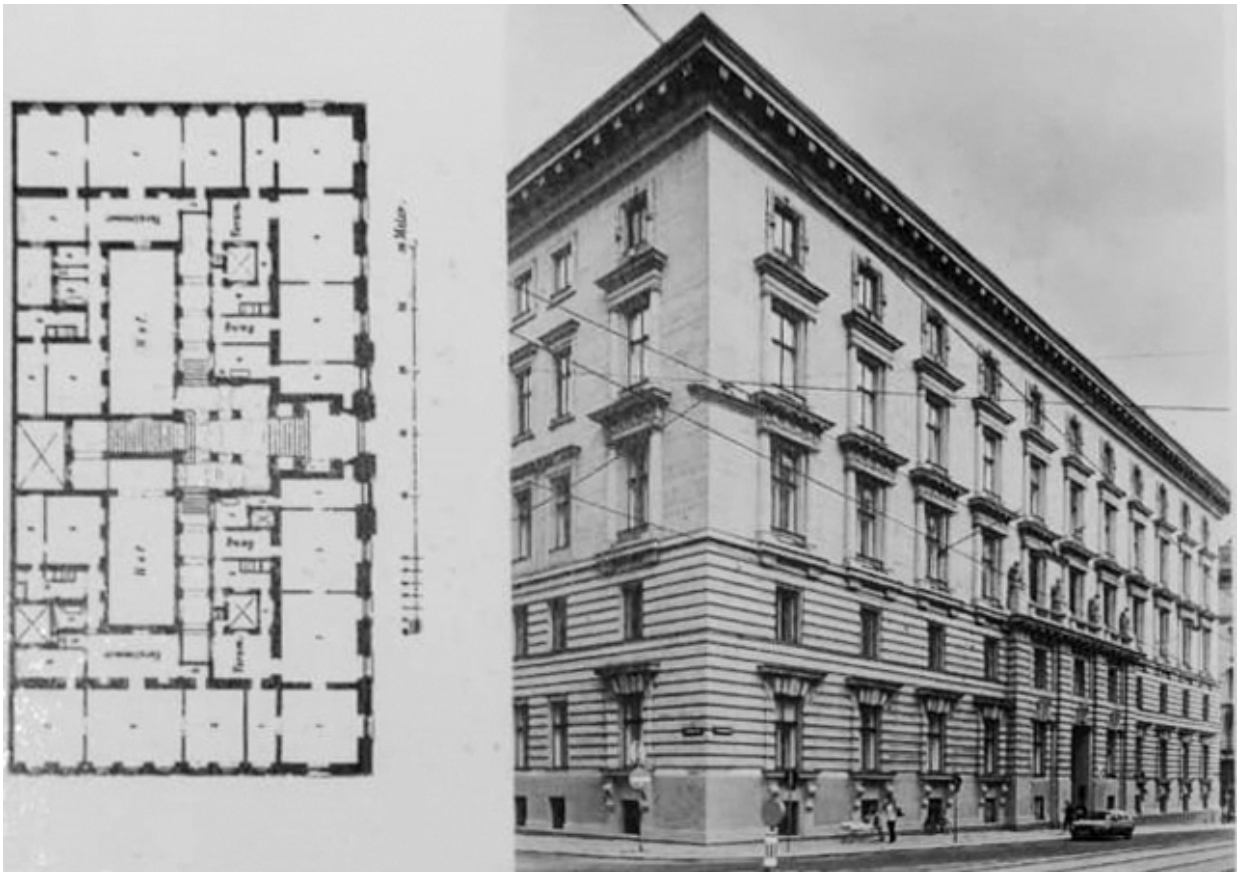

Figure 2: Example of Zinshaus where the differtentiation between social classes is evident from Wien, Z. (1998). Architecture in Vienna, p.110. Princeton Architectural Press.

3.3 Restoration work put into dwelling architecture from 1840 to 1919

One of the most significant advantages of the "Zinshaus" housing model was its flexibility, which allowed it to adapt to the social and economic changes from the past 100-150 years. This adaptability is primarily due to the use of bricks as a construction material, which is much more flexible than concrete. Due to this, the division or combination between apartments was possible, even across floors. Another reason the dwelling architecture of 1840-1918 is highly adaptive is the generous room heights, ranging from 3.2 to 4 meters, often higher in the ground floor area (Musil et al., 2021).

In 2018, almost a fifth of the total building stock in Vienna were buildings constructed before 1919, attributed to the Gründerzeit or older construction periods(Franz & Gruber, 2018). Between 2000 and 2019, the total stock of housing units built in the Gründerzeit period decreased from 33.1% to 24.1% (Musil et al., 2021). This sharp decline can be explained by a combination of the change in the survey method, as a lot of these old apartments are secondary residencies, as well as an increased number in the demolition of Zinshauer, raising profits through the construction of new residential buildings with more stories and lower ceilings, that are part of the liberalized housing sector(Musil et al., 2021). Due to the changes in construction techniques and building standards, in the early 1970s, around 300.000 apartments were categorised as having substandard living conditions, which led to the implementation of the "Gentle Urban Renewal" movement through the 1974 Urban Renewal Act (Gentle urban renewal and participation - Socialhousing, n.d.). Through this, cost-effective loans were granted with the scope of increasing the quality of housing by refurbishment, with the condition of maintaining the original rental level for existing tenants for another 15 years (Franz & Gruber, 2018). Moreover, this scheme allows the new construction of high-priced penthouses, with the right to occupancy secured by

the city administration (Franz & Gruber, 2018; Musil et al., 2021). Due to this last addition, although initially well-intentioned and still partly effective in the refurbishment of old apartments, the scheme is currently mostly used by institutional actors rather than private individuals willing to restore Gründerzeit apartment blocks (Franz & Gruber, 2018).

While the "Gentle Urban Renewal" scheme is addressed to entire blocks and their surrounding public spaces, another scheme also funded by the City of Vienna is the "small-scale block renewal", which allows for a similar refurbishment of singular Gründerzeit apartment blocks (Stadtplannung Wien, 1998). The separate restoration programme, "THEWOSAN", focuses solely on improving the thermal insulation and energy- efficiency of these blocks (Stadtplannung Wien, 1998).

3.4 Housing affordability

One of the notable benefits of residing in Gründerzeit period apartments is their affordability. These housing units are governed by the Tenancy Law, which caps rent for any building constructed before 1953(§ 1 Absatz 4 Satz 1 MRG). As a result, approximately one out of every five apartments in Vienna, totalling 202.400 in 2019, enjoys the advantage of a capped rent of about 9 euros per square meter, as compared to the average of 12.5 euros per square meter in the liberalized housing sector (Franz & Gruber, 2018; Musil et al., 2017).

Section 4 London housing evolution in the Victorian period (1840-1919)

4.1 Historical context

Victorian London, spanning from Queen Victoria's ascent to the throne in 1837 until her death in 1901, was a time of significant urban development and architectural evolution, driven by the rapid industrialisation and population growth that characterised the era. This period of remarkable evolution continues until the end of the First World War, during the Edwardian era. During this time, London went through unparalleled growth, transitioning from a large Georgian city into the capital of the British Empire, becoming the biggest city in the world in the 1840s, as compared to Vienna, which was barely reaching half of its size, and witnessing a population growth from around 2 million to over 7 million inhabitants by the end of the period (Hall, 1998; Jenkins, 2019; Porter, 1994). This growth was propelled by factors such as the Industrial Revolution, which facilitated economic prosperity and a shift in social structures, and the expansion of the British Empire, which reinforced London's status as a global hub (Hall, 1998). The immense influx of people into the city, especially in the lower classes, led to an increased need for housing, which shifted urban development and resulted in the densification of architectural structures (Daunton, 1978). It is estimated that over 30% of all the houses in Britain today were built before the First World War, predominantly during the Victorian era(Flanders, 2004).

This immense growth, however, did not come without any problems. During the Victorian era and the preceding period, London faced significant challenges in managing its physical and social infrastructure due to rapid urbanization and growth (Hall, 1998). Only between 1800 and 1840 the urban areas witnessed a remarkable surge in population of 156%, a rate of growth that was not matched by the housebuilding investment (Rodger, 1995). After the first railways were established in Liverpool and Manchester in 1830, London's railway preoccupation started in 1836 with the opening of the Deptford station (Jenkins, 2019). This not only resulted in the already limited funds available for residential construction being

depleted due to the new investments in the railway system, but also caused mass displacement of residents and the clearing of whole neighbourhoods (Jenkins, 2019; Rodger, 1995). All these factors caused an increasing rate of overcrowding and deterioration of the quality of everyday urban life (Hall, 1998). The outbreak of cholera in Sunderland in 1831 swiftly escalated into a widespread epidemic in 1832 due to the living conditions and polluted water, causing the death of 5000 people in London alone (Harper, 1978; Jenkins, 2019; Tausky et al., 1986). A year after Queen Victoria's ascension to the throne in 1837, a new cholera outbreak occurred in London (Harper, 1978; Jenkins, 2019). Following these major events and the progressive deterioration in living conditions, death in the United Kingdom's biggest cities rose by 50% between 1831 and 1841 (Hall, 1998).

One of the first attempts to improve the situation was the Public Health Act of 1848, which attempted to improve the water supply, sewerage, drainage, and town maintenance and allowed local authorities to control streets and houses to asses their sanitation levels (Harper, 1978). At the same time, regulations were imposed to define what a habitable cellar was (Harper, 1978). That alone, however, was not enough to put a stop to the epidemics. After the revolutions of 1848 in Europe, the number of migrants seeking refuge in London increased, and so did overcrowding (Daunton, 1991; Jenkins, 2019). In 1849, the city was hit by the second major outbreak of cholera, together with typhus (Jenkins, 2019). Following this outbreak, several detailed reports emerged, one of which finally linked cholera to water (Harper, 1978; Jenkins, 2019). As a result, in 1855, the British Parliament established the Metropolitan Board of Works (MBW) to manage all the sewers and infrastructure in London (Jenkins, 2019).

The first railway construction proved incredibly profitable for London's economy. This caused the emergence of the second railroad mania, which was even bigger than the first one, shortly after the first one was completed, between 1843 and 1845, bringing new infrastructure largely finished in the 1850s (Jenkins, 2019). Due to this, the advancements in health and the instauration of the MBW, the outlook of London started changing in the second half of the century, with its status as a commercial hub being significantly reinforced. The population number was greater than ever, reaching 10.060 by 1854, and the city was no longer muddy, the streets were clean, and the housing character began to change (Tausky et al., 1986). Moreover, while the railroad construction led to a mass demolition of lower-income housing, it also led to the expansion of the city through the appearance of new suburbs with more spacious and hygienic housing (Daunton, 1978). Subsequently, between 1850 and 1914, the real wages increased by 75-80%, starting with a modest growth of 4% in the 1850s and then progressively accelerating to 12% in the 1860s, 16% in the 1870s and 19% in the 1880s (Rodger, 1995). The growth from the 1860s was largely supported by the third wave of infrastructure development concerning the underground lines (Jenkins, 2019). Another factor that positively influenced the urban densification of the city was the provision in 1861 of workmen's trains, with a significantly lower price. These trains allowed tens of thousands of workers to finally move outside the city and the slums (Jenkins, 2019).

The Sanitary Act of 1866 followed, making overcrowding in the apartments an offence in a desperate attempt to stop cholera from spreading further. Two years later, the Artizans and Labourers Dwelling Act made it possible for local authorities to demolish houses that were considered unsanitary and, later, in 1875, even whole districts (Daunton, 1991). However, these measurements would have forced landlords to repair their properties, further increasing the rents and making the properties unaffordable, resulting in the mass displacement of residents and an estimated 10.000 people becoming homeless. Due to this, several

boroughs refused to use the powers of the Act (Daunton, 1991). 1866 also marked the last cholera epidemic and the crash of the stock market, which caused a rise in the unemployment rate (Jenkins, 2019).

The 1870s witnessed a significant housing construction boom that lasted until 1876, which helped improve the housing shortage situation for the middle classes. Similar housing construction surges appeared between 1880-1881 and 1887-1889 (Rodger, 1995). The 1870s were also marked by the Cross Act, which required housing units to have modern plumbing, and the Public Health Act of 1875, out of which London was excluded, as it already had different Building Acts compared to the other counties, which emerged as a response to the Great Fire of London, mainly concerning fire regulations and the restriction of dangerous structures(Daunton, 1991; Jenkins, 2019). Although separate Building Acts concerning London were amended in the following years, it wasn't until 1894 that a substantial London Building Act appeared to regulate the metropolis and improve the housing standards by similar criteria with the rest of the country (Daunton, 1991; Harper, 1978). Until the 1890s, overcrowding in London was a permanent issue, as the people-per-house ratio increased from 7,72 in 1851 to 7,85 in 1881 to 8,02 in 1896. However, starting already in 1891, a decrease in the level was seen until 1911, when 758.000 residents were living in overcrowded conditions (Daunton, 1991; Wohl, 1977). The year 1901 marks the death of Queen Victoria and, subsequently, the end of the Victorian age and the start of the Edwardian period.

4.2 Housing typologies and the consideration of health and well-being during the design process.

During the Victorian era, housing rows were already a common occurrence. As the city began to rapidly expand, green-field site developers aimed to construct as many buildings as possible on the rectangular fields, resulting in the continuation of rectilinear urban patterns, as seen before with Georgian architecture. This approach not only facilitated an increased housing density but also enabled the introduction of standardized floor plans, which significantly reduced planning costs (Rodger, 1995).

A large proportion of the housing produced in the early Victorian times was, however, substandard, with extremely poor ventilation, mainly due to the preoccupation with sanitation and water supply, which was coming from a common belief that diseases were mostly spread by water-borne organisms. Unfortunately, this focus on water safety resulted in neglecting the importance of indoor air quality throughout the Victorian period (Rodger, 1995).

Three common housing types of the Victorian period were the common lodging housing, mainly catered to newcomers who did not have acquaintances in the city to provide them with temporary housing solutions, the cellar dwellings and the terraced housing (O'Neill, 2014; Rodger, 1995). This first typology, although originally designed as a short-term accommodation, became a long-term housing solution with an interior arrangement similar to hostels, often used by families. This is not a distinct housing typology in terms of architecture but rather a separate housing tenancy type. Typically, double cellars, flatted rental houses or terraced housing were repurposed as common lodging housing (O'Neill, 2014; Rodger, 1995). According to Wohl's 1977 research, London had nearly 11,000 of these housing units in 1854, where 82,000 people resided each night. This is again a clear indication of the level of overcrowding, as well as an explanation for the rapid spread of disease in the Victorian era. This housing type was also widely disregarded during that period, as they went against Victorian values, with increased immorality and crime levels visible to the

public. As a result, legislative controls were put in place starting in 1851. The Common Lodging House Act of 1851 aimed to improve the living conditions of these units by reducing bed density and improving their sanitation(Higginbotham, n.d.)

The cellar housing was not any better for the health of their residents. Typically located below terraced housing or warehouses and sometimes in the basements of middle-class houses, these rooms were incredibly small, measuring just 3.65m by 3.65m, with a height of 1.8m. They were completely lacking sanitation, often without windows or flagged floors, which made them dark and damp (Rodger, 1995; Wohl, 1977). During the Victorian era, these types of dwellings were, unfortunately, most commonly occupied by lower-income class or migrant populations who could not afford better accommodations. In Manchester, a city at the heart of the Industrial Revolution, 12 to 15 per cent of the population lived in cellar dwellings (Rodger, 1995). It was not until the implementation of the Public Health Act in 1875 and the subsequent Public Health (London) Act in 1891 that a significant decline in the percentage of individuals living in cellar housing was observed (Harper, 1978; Wohl, 1977).

Finally, terraced housing is what people refer to nowadays when they talk about Victorian housing. It became a popular housing type in the early nineteenth century, with the most common subtypologies being the back-to-back court house and the through terraced houses. The first one had cheaper rents and featured a narrow floorplan that allowed for an increased density of houses in the area. The floor plan was simple, with a square-shaped living room on the ground floor, that had a width ranging from 3 to 4.5m. A set of narrow and unlit stairs led to the 1st floor, where one or two bedrooms were placed. Above it, it was common to have an additional bedroom or a workroom in the attic. Below it, there was often a cellar, which was a sublet. This was the most common type of terraced housing until the 1850s (Flanders, 2004; Harrison, 2017; Rodger, 1995). Given the floorplan of these houses, it can

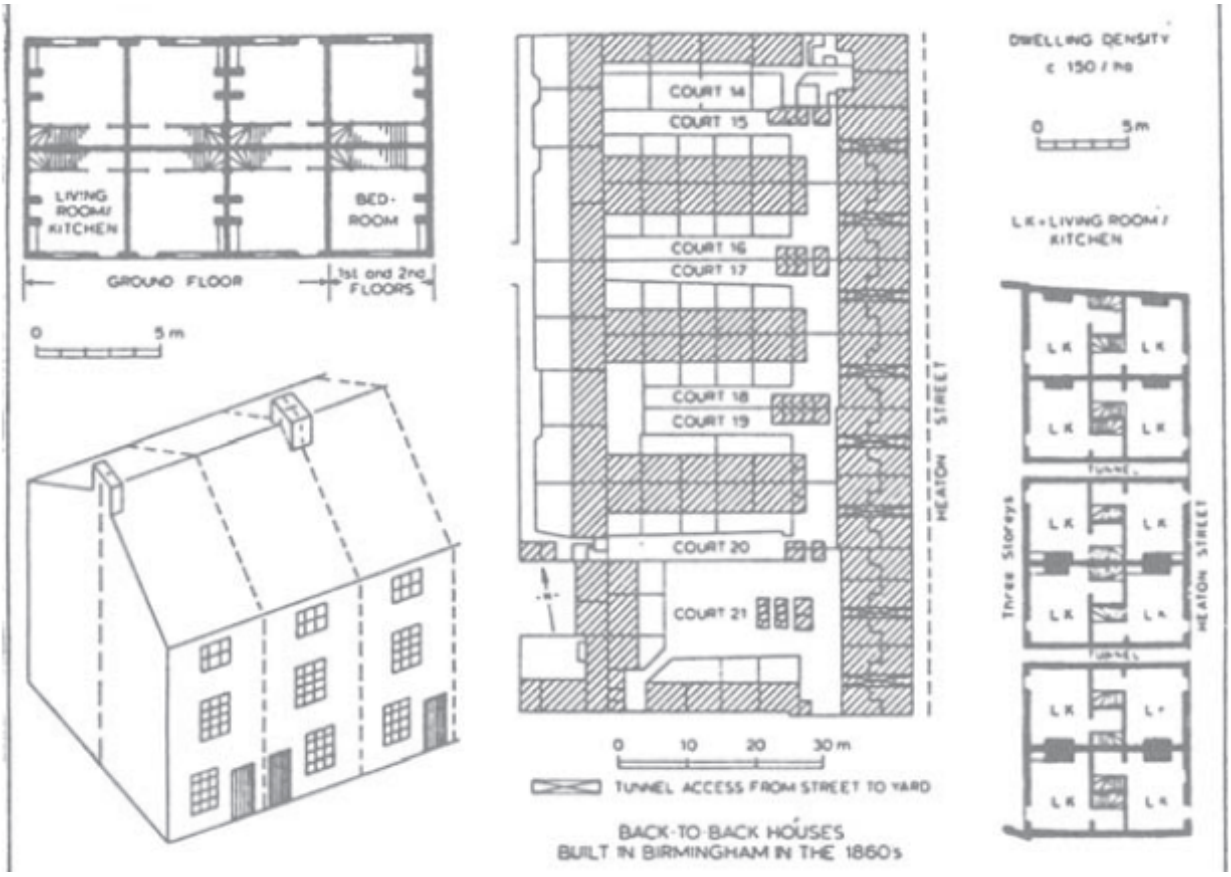

Figure 3: Illustration of back-to-back terraced housing from from Rodger, R. (1995). Housing in urban Britain, 1780-1914, p. 33. Cambridge University Press.

be claimed that the health of the users was not a priority in the design process, as having houses back to back eliminated the possibility of having a rear door or window, highly reducing the effectiveness of the ventilation (Harrison, 2017; Rodger, 1995). This typology of housing further promoted an overcrowded environment, which is evidenced by the urban density of approximately 19.300 people per square kilometre in the 1840s (Rodger, 1995).

The through terraced houses were a more spacious variant of the terraced housing, allowing for a better separation of daily activities and increased privacy. The floor plan was designed with two ground-floor rooms, an entry hallway, and two sleeping rooms with a restroom on the first floor. These houses provided significantly better living conditions than other housing typologies. They featured a small backyard and both front and rear doors and windows, which allowed for better ventilation and more natural light. In the latter half of the century, some houses even included a one or two-story annexe with a scullery, coal room, restroom, or third bedroom on its first floor (Flanders, 2004; Rodger, 1995). The terraced housing of the middle classes was larger, the exterior layer was more solid and made using better brick, and the floor-plan had more spacious rooms and new technologies such as gas lighting, internal bathrooms and flushing toilets. With the railway mania, a large part of the middle classes also moved to the newly built housing in the suburbs. Their terraced housing located in the city was subsequently adapted and transformed into tenement housing, often rented to the working classes, which brought a clear improvement in the living conditions (Wohl, 1977).

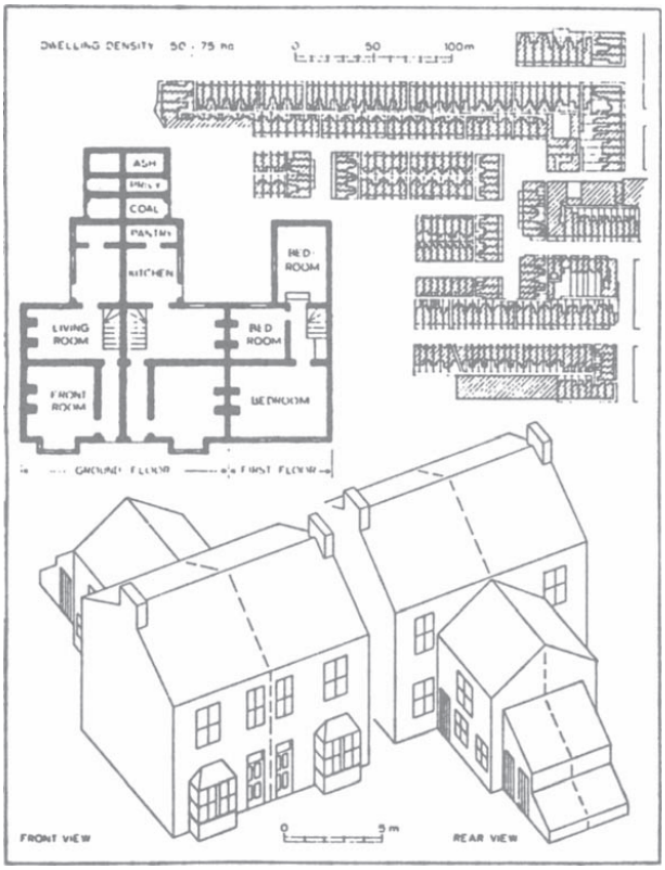

Figure 4: Illustration of through terraced housing from from Rodger, R. (1995). Housing in urban Britain, 1780-1914, p. 35. Cambridge University Press.

4.3 Restauration work put into dwelling architecture from 1840 to 1918

The issue of climate change has become a pressing concern for many governments around the world, including the British government. In order to reduce carbon emissions, the government has set a goal to restore 800,000 homes annually by 2050. This ambitious plan seeks to address the particular challenge posed by housing units built before 1919, which are estimated to have 40% more heating on average than constructions made after 1990 due to the difference in insulation levels (Guillery & Kroll, 2019). The large Victorian houses are especially targeted in this programme; through time, their internal timber floors and partition walls enabled the subdivision and adapting of the houses. The late twentieth century saw significant upgrades to these houses, including modern kitchens, electrical lighting, and the inclusion of toilets in the house, as they were generally located in the yard. However, the apartments' exterior layer still lacks renovation, also observed through the large number of original sash windows, which are responsible for significant heat loss (Guillery & Kroll, 2019). One of the most significant shortcomings of Victorian houses is, therefore,

the wall heat loss, which is currently observed to be about five to six times higher than the permissible limit set by the 2015 Building Regulations in England for newly built dwellings (Guillery & Kroll, 2019). However, improving the insulation of the exterior walls is highly disputed due to the altering manner of the process to the heritage qualities of the house (Guillery & Kroll, 2019)

A number of retrofit projects, such as "Retrofit the Future' emerged in the UK in the past years, aiming to improve the energy efficiency of Victorian hoses by up to 80% (Barrett-Duckett et al., 2014). However, its heritage implications are substantial: the common Victorian brick facade and bay windows are unrecognisable, and the historical character of the building is lost (Guillery & Kroll, 2019).

Figure 5: Example of restauration of a terraced house from Guillery, P., & Kroll, D. (2019). Mobilising Housing Histories (P. Guillery & D. Kroll, Eds.) p. 181. RIBA Publishing. https://doi.org/10.4324/9780429346149\

4.4 Housing affordability

Unlike Vienna's Gründerzeit housing sector, Victorian houses in London are not subject to government-imposed rent caps and fall under the liberalized housing sector. Therefore, discussing the affordability of Victorian houses is essentially discussing the general housing affordability in London. Unfortunately, in recent years, London's housing market has become increasingly unaffordable for those with low to moderate incomes, which is largely driven by the housing shortage and the lack of adequate housing (Brill & Raco, 2021; Murphy & Baxter, 2017). From 2005 to 2017, the rents in London rose by 41%, compared to the rest of Britain, where only an increase of 24% was registered (Murphy & Baxter, 2017). This increase in unaffordability in London can also be seen in the following graph:

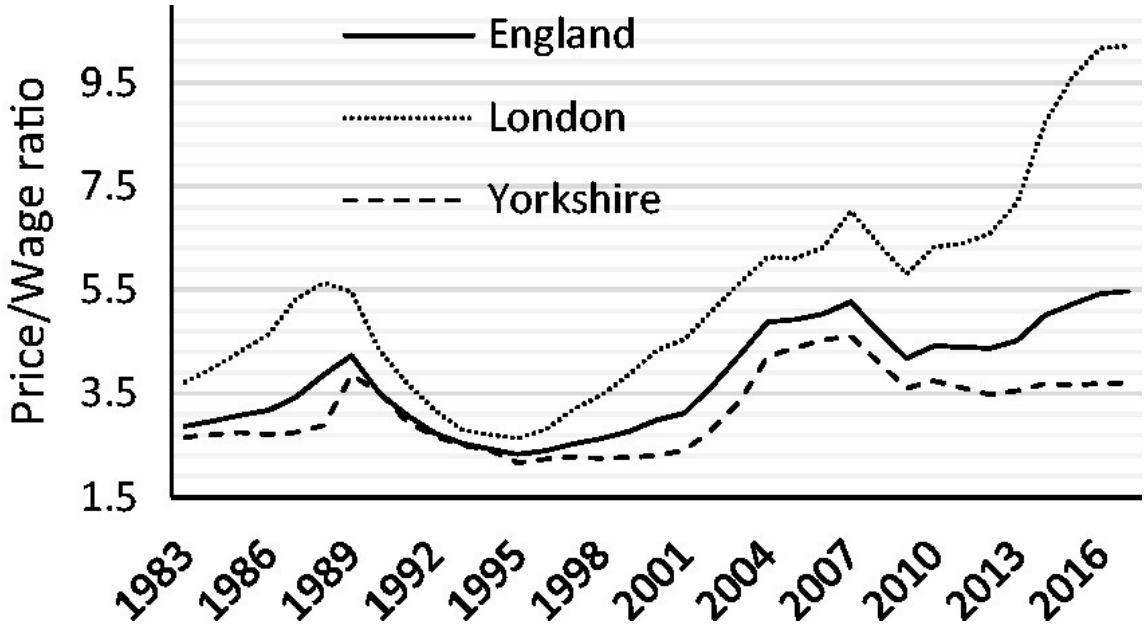

Figure 6: Graphic showing the evolution of the price/wages ratio in housing from Szumilo, N. (2018). The spatial consequences of the housing affordability crisis in England. Environment and Planning A Economy and Space, 51(6), 1264–1286

Section 5 Questionnaire analysing the impact 1840-1914 dwelling architecture has on mental health in the case of Vienna and London

A survey was conducted to evaluate the livability of apartments in London and Vienna. The questionnaire was divided into two main parts, with the first part focusing on the apartment's condition and the second part analysing the impact of the apartment's characteristics on its residents' mental and general health.

One of the most notable differences between apartments built between 1840 and 1919 in London and Vienna is the available space per resident, from an average of 28 sqm to 34.3 sqm, a difference of more than six square meters. Surprisingly, this difference in the availability of space does result in a perception of greater restrictiveness in the apartment, as previously predicted. On a scale of 1 to 5, where one is the least restrictive and five is the most restrictive, apartments in Vienna were assessed as 2.3, while in London, they are marked as 2.7.

Another striking difference between the two apartment types is the indoor air quality. Vienna's apartment received a remarkable score of 4.8 out of 5, while London's housing only attained a score of 2.9. This considerable difference was also visible in the second section of the survey, where half of the Victorian house residents believe that the poor indoor air quality in their homes negatively affects their mental health. Additionally, 30% of the participants from London reported encountering mould issues at least once during their stay. This aspect is accompanied by an accentuated feeling of lack of control, reported as 2.9, compared to 4.7 in the case of Vienna. This sense of helplessness can further amplify the negative impact on one's mental health, as studied by Hopper et al. (2023).

Two aspects of Victorian houses that have received negative ratings are their thermal comfort and acoustic insulation, with ratings of 2.3 and 2.6, respectively, compared to ratings of 3.9 and 3.2 for Gründerzeit houses. These factors are crucial for maintaining good mental health, as illustrated in a more detailed response from the London survey: "[..] It had 0 acoustic insulation, and the bedroom wall was connected to the stairwell. Getting a good night's sleep was practically impossible.". This indicates that these apartments generally have poorer insulation and, as opposed to the Zinshauser, have gone through fewer restoration processes to improve it.

London apartments outshine those in Vienna only regarding natural views and visual privacy, scoring 3.2 and 3.3, respectively, compared to Vienna's 1.6 and 3. This difference can be attributed to the increased density of apartment blocks and the lack of green spaces in Vienna's inner districts. Moreover, the Gründerzeit housing blocks reach up to 4 stories high, compared to the Victorian apartments, which are organised in houses with gardens, up to 3 stories high.

In the latter section of the survey, respondents were asked to identify factors contributing to their mental well-being while residing in this type of dwelling. According to the results gathered from participants in Vienna, 100% of the people marked high ceilings and affordability as having a beneficial effect on their mental health. This observation is further supported by the fact that around 60% of the respondents spend less than 30% of their monthly income on rent, while the rest spend approximately 30%. Natural light, apartment layout and indoor air quality were also identified as positive contributors to mental health by 65% of the survey respondents. Looking at the negative contributors to mental health,

42% of the respondents marked that no aspect of the apartment is negatively impacting their well-being. However, from the people who did mark something on the list, the views of nature and lack of natural light were the most common traits highlighted, each of them adding to 28% of all the participants.

Further investigating the situation in the UK, one of the most striking facts is that 60% of all the respondents marked their apartments as adding up to more than 30% of their monthly income, which is an unaffordable amount. Unfortunately, the list gets shorter when it comes to the physical aspects of the apartment that positively impact the participant's mental health: 50% of people consider the views of nature and natural light as beneficial, and 30% consider that their apartment layout is a positive factor. On the negative side, the results show that 70% of the participants think that the space available per resident and the thermal comfort negatively impact their mental health, 50% marked the acoustic insulation and indoor air quality and 40% for the natural light.

Section 6 Discussion

It is essential to mention that the two thesis chapters cannot fully capture the complexity of the historical events and actors in the Victorian era in London and the Gründerzeit period in Vienna that led to the construction of these specific apartments. Its intricacies and implications go beyond the housing market, and this thesis only aims to portray a historically accurate yet simplified picture of the societal evolution trends as a mere context for the emergence of specific housing types seen today. The primary objective of this thesis lies in accumulating and interpreting data on the current livability of this dwelling architecture.

Moreover, although the comparative study put Vienna in a positive light compared to London when it comes to the housing evolution, it is important to note that the population growth and the industrialization level of the cities were extremely different. Although Vienna took a greater interest in its resident's health in housing, it also did not face the housing shortage and pollution of water problems at a comparative level. Moreover, by having a social mix in the apartment blocks, Vienna managed to largely avoid the creation of unregulated slums, which are seen in the case of Victorian London.

Section 7 Conclusion

The literature review shows that general health was indeed considered between 1840 and 1919 in the initial design process of housing both in the case of Vienna and London. However, the focus was limited to fulfilling the most fundamental requirements. During this time of rapid industrialization and population expansion, the residents' needs were often disregarded, particularly in the case of London. As a result, the apartments built in that period have many shortcomings that affect their habitability, especially when looking at contemporary standards.

In the framework of this essay, Vienna stands as a positive example: it's Gründerzeit apartments, although gradually diminishing in numbers in the chase of generating additional capital, remain prefered by the city's residens, due to their affordability and due to their positive design aspects. As highlighted by the questionnaire, the apartments are beneficial to one's mental health and general health.The only areas that could benefit from improvement are the thermal insulation and access to natural views, which highlights the general lack of green space in Vienna's inner districts. Addressing these issues would greatly enhance the livability of both the apartments and the city as a whole.

On a opposite side of the spectrum stands London, where the Victorian and Edwardian era housing was deeply affected by one of the largest population booms witnessed by the world during that time, a lack of investment in proper housing due to a focus on growth and industrialization, and an increased incidence of poverty and disease. While health was considered during the design process starting with 44567890, it was only taken into account on a surface level and was merely viewed as a means to prevent the recurring outbreaks of epidemics. The housing generated during this era, while proving their durability over the years, have been shown through questionnaire responses and improved knowledge of mental health's impact on architecture over the past century to be detrimental to one's mental and general health. Although the housing produced during this period has proven its resilience and longevity over the years, improved knowledge over mental health influencing factors in architecture from the past century shows that it is not beneficial to one's mental or general health, fact that is also highlighted by the questionnaire's responses. Their structure lacks restoration, they remain unaffordable, and negatively impact the quality of life of those who inhabit them. London is a hub of innovative architecture, yet it seems to be turning a blind eye to its pre-existing housing architecture, once again overlooking the mental health and general health of its residents, as was seen in the Victorian era. A change is needed.

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