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Water as a Sustainable Infrastructure and Cultural Symbol of City: Bächle in Freiburg im Breisgau

Sena Çatal
Department of Architecture, Faculty of Architecture, İstanbul Arel University, İstanbul, Türkiye
senacatal@arel.edu.tr

Ece Ünver Demirkıran, Çağılsu Kardeş Yağmur, Ebrike Karaca, Beyza Cabacı
Department of Architecture, Graduate School of Natural and Applied Science, Gazi University, Ankara, Türkiye

Hilal Aycı
Department of Architecture, Faculty of Architecture, Gazi University, Ankara, Türkiye

ABSTRACT

Water, as an indispensable aspect of life, holds significant importance in ecological, biological, sociological, cultural, and various other perspectives. Humans have always tended to settle near water sources, and water has played a critical role in the development and evolution of human civilization. This article investigates the historical and cultural significance of water, with a specific focus on the 'Bächle' water canal system in the German city of Freiburg. Examining the relationship between water and urban development, this research discusses how water infrastructure can serve as both a cultural symbol and a fundamental element of a city. At the same time, it emphasizes the role of *Bächle* in preserving Freiburg's cultural heritage and enhancing urban sustainability. Originating as a practical infrastructure component for irrigation and waste disposal in the 12th century, *Bächle* has transformed into a symbol shaping the city's identity and it cultivates a unique urban experience over time. Beyond its initial function, *Bächle* contributes to the city's livability, serving as a source of recreation and functioning as a communal space for social interactions. In this context, through an interdisciplinary approach, the research integrates historical analysis, urban planning perspectives, and cultural studies to unravel the multifaceted layers of *Bächle's* impact on Freiburg's past, present, and future. The research explores how *Bächle* not only contributes to the practical aspects of urban infrastructure but also plays an important role in improving the quality of life and sustaining the cultural identity of the community. The lessons learned from the *Bächle's* legacy offer valuable insights into creating resilient and culturally vibrant urban spaces for future generations.

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Corresponding Author Contact:

senacatal@arel.edu.tr

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1. Introduction

Water is fundamental for everyone. As it is the primary necessity for both mankind and the Earth, life without it would be unimaginable (Smith, 2013, p.1). Furthermore, water has played an essential role in various stages of evolution and the development of human civilization (Lozán et al., 2007, p.19). Over the centuries, people have tended to settle in wetland areas

or places near water sources. This pattern has, in turn, influenced the cultural, economic, commercial, and social developments of the city (Wylson, 1986, p.3). This evolution co-occurs with human societies' dynamic and evolving needs, requirements, and developmental stages. Thus, the historical and cultural importance of water is related to the very essence of human civilization, symbolizing life and the foundation upon which societies have flourished and evolved (Hattapoğlu, 2004 as cited in Oktay et al., 2015, p.122). In this context, the main focus of the article will be explored through the example of the 'Bächle' water canal system in Freiburg im Breisgau, in terms of sustainability in the Anthropocene Era, which, unlike other waterfront cities, permeates water into the city and becomes a significant symbol.

Although it can be traced throughout history how water as an environmental element has affected human life and urbanization, the human-environment relationship is bound to change within today's changing conditions. The relation between cities and nature is one of the key environmental issues of the 21st century (González, Rubén et al., 2024). As Chakrabarty also mentions in his article, several anthropogenic factors have been frequently encountered in recent years and emerged as a result of the changing human-environment relationship in the world, radical changes such as climate change, biodiversity loss, and global warming, force people to question and reconsider many of their agreed concepts and ideals and cause them to come up with different ideas (Chakrabarty, 2009, p.201). This initiates significant discussions in the Anthropocene Era; revolving around the concepts of sustainability, flexibility, and adaptability.

Global population growth and city planning in the process of urbanization reveal the basis for discussion about the sustainability of these developments in the literature. The requirements for development to meet a series of fundamental needs focus on two aspects; energy-efficiency developments and social integration developments within the framework of sustainability. Recent studies on city and sustainability focus on comparative analysis of green development emphasizing energy-efficient buildings, disaster resilience, environmental consciousness and carbon-neutral plans. However, this study aims to preserve existing city infrastructure as identity, rather than creating it through sustainable and adaptive development (Nursanty et al., 2024)

Researches highlights instances where sustainability had been achieved through the adaptation of existing infrastructure components. Examples include the High Line, Promenade Plantee, and the Ruhr Region of Germany. The High Line used to function as a rail line built in the 1930s as part of an investment in New York's transportation infrastructure (Figure 1.a). However, its use declined with the increase in road transportation after the Second World War, it was partially demolished in the 1960s and was completely closed in 1980. (Seyrek, 2008).

a b

Figure 1. a. View of the High Line shortly after it was built. (https://www.thehighline.org/), b. The High Line Park today (https://www.thehighline.org/)

The High Line which was transformed into a park and pedestrian transportation line in 2014 with the transformation project that started in 1999, symbolizes the commercial history of the region and today has become a social, economic, and aesthetic center of New York City (Figure 1.b). This area not only symbolizes the past but is also a social meeting point that reflects the dynamism of city life. A similar example is the "Promenade Plantée" in Paris, which opened as a park in 1993 (Bezgin, 2014). Similarly, the Ruhr region in North Rhine-Westphalia, Germany, has been transformed from an industrial past into a cultural and ecological focal point (Sozer, n.d.) (Figure 2.a). The transformation of this region is an impressive example of how cities serve as social memory and how this memory influences the transformation of urban space (Kaçar, 2016) (Figure 2.b).

a b

Figure 2. a. Ruhr region in the early 18th century (https://www.arkitera.com/), b. Ruhr region today (https://www.arkitera.com/)

Considering these examples, in the heart of Freiburg im Breisgau, Germany, a network of water canals, known as *Bächle*, weaves its way through the historic streets, adding a distinctive sense to the cityscape. These centuries-old canals are not just waterways; they play a vital role in shaping the essence of life and cultural identity in this German city. In this general context, the main research question is, *can an element of a city's infrastructure become a symbol of the city itself?* This article explores how the *Bächle* not only contributes to the practical aspects of urban infrastructure but also plays an important role in improving the quality of life and sustaining the cultural and historical identity of Freiburg im Breisgau.

The historical context of the *Bächle*, from its origins to its current significance, will be presented, as well as the interplay between water, architecture, and Freiburg's cultural heritage, emphasizing the significance of sustainability. By examining the *Bächle*, the research aims to address the gap in the literature on the role of water infrastructure in urban identity and sustainable city planning.

Bächle water canals provide a space for physical activities within a social, urban, and environmental context, creating memorable experiences that link city infrastructure with collective memory. This example illustrates how urban infrastructure can become cultural symbols and highlights the role of water resources in promoting social and ecological sustainability.

2. Methodology

The concept of sustainability is used in various perspectives in literature, primarily emphasizing energy and material preferences while other discussions are on theoretical discussions concerning social and environmental studies (Koglin, 2009, p.10). The sustainability of infrastructure key research streams includes green infrastructure, sustainable buildings, and assessment methods with emerging themes in cost-effectiveness, project management (Thomé et al. 2016, p.144). As well as the method of energy and cost management studies, issues in the integration of human, and social responsibility values in environmental sustainability come across with infrastructure concepts mainly in the cases of growing and future cities. Freiburg im Breisgau, stands out with its restored *Bächle* streams running through the city streets, complemented by textures that collectively create an organic and sensory-rich urban environment, fostering a deep connection with landscape and antiquity (Beatley, 2011, p.52). Even though it is an infrastructural component of the city, the concept of *Bächle* not only preserves the historical layers of the city but also establishes a sustainable and adaptive image for the urban environment.

While water and infrastructure are often regarded as integral components of a city's systematic network, Lynch (1960) enlightens us on the critical role of interaction with the physical form in preserving environmental perception. Beyond being a mere infrastructure, *Bächle* has evolved into a routine loaded with practical and emotional meanings representing a physical landscape phenomenon within the city. Lynch emphasizes that the physical environment processes these elements, generating lively and rich images that are expressive and adaptable to changing needs. This process reveals new groupings, meanings, poetics, and imaginable environment should also be open-ended. Based on this concept, user participation becomes a vital criterion in the dynamic and transformative usage of *Bächle* throughout its historical development, ultimately shaping its role as an urban image (Lynch, 1960, p.157). In this context, Freiburg's *Bächle*, a historical water infrastructure in the old city, stands out as a sustainable and adaptable infrastructure as the cultural component of the city. Water canals, which have become a distinctive component of the city, will be examined in the context of sustainable theory, which covers the social sustainability of the city along with the environmental and historical layers of its adaptive identity. The main problem in this research is how this component, which is responsible for providing water, fire control, and drainage, has adapted as a cultural element. The methodology of the study involves analyzing the adaptive evolution of *Bächle* throughout its historical development and the literature review. Additionally, the study evaluates the discursive formations of oral history to reveal the user experience associated with *Bächle*.

3. Sustainability and Adaptability of Water Infrastructure

3.1 The Importance of Water for Urban Settlements

Water has always been a fundamental aspect of civilizations throughout recorded history, playing many significant roles in cultural development (MacGilvray, 2003, p.23). In the contemporary context, the role of water in cities goes beyond functionality; it plays a vital role both environmentally and culturally. Within urban landscapes, water functions as a key regulator of ecology, coordinating a delicate balance that sustains biodiversity and green spaces. The creation of recreational areas, often intertwined with water bodies, not only enhances the aesthetic appeal of cities but also fosters community well-being. Many prefer spending leisure time in nature or, at the very least, seek out public recreational spaces within urban areas. Rivers, lakes, and other bodies of water, along with their waterfronts, can be especially important in this context (Maciukenaite & Povilaitienė, 2013). Furthermore, water sources are important on a global scale, contributing significantly to climate control and providing a natural cooling effect that helps to lessen the impact of the heat island effect in many urban locations (Hosseiny et al., 2021). This dual contribution highlights the broad effects of water in urban environments on both local and global environmental dynamics.

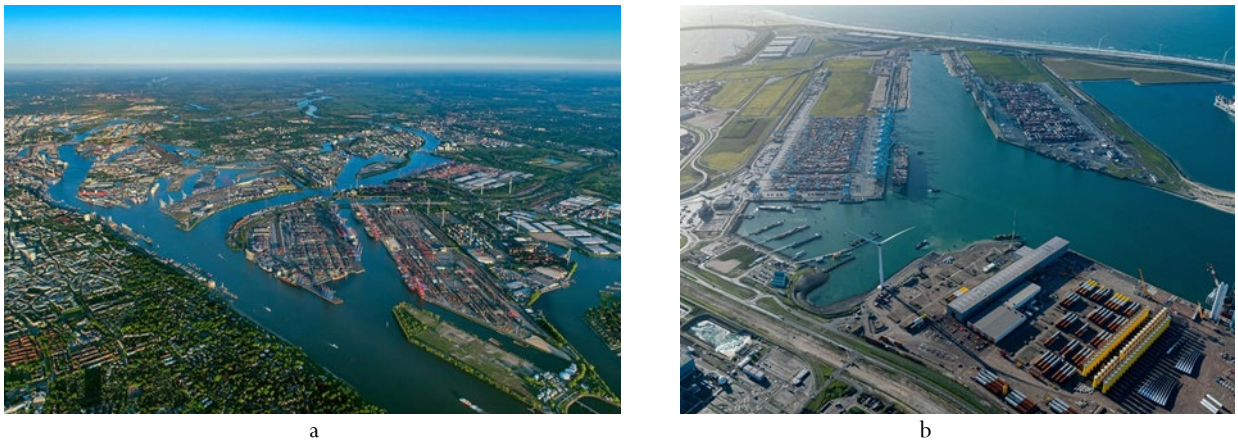
When exploring the complex dynamics of cities, it is apparent that water acts as a binding source, influencing many aspects of urban life. It leaves a lasting imprint on the course of history, impacting settlement patterns, architectural decisions, and the basic foundations upon which cities are constructed (Heckenast et al., 2020, p.2). Waterways, acting as arteries, have played a crucial role in trade and commerce from an economic standpoint. Water has also driven technological innovation and sustained industries for centuries. The role of water in transportation is equally profound, with rivers and canals historically serving as natural highways, facilitating connectivity and trade networks. Socially and culturally, water serves as a focal point for community life, with waterfronts often becoming hubs for social interactions, cultural events, and recreation. Additionally, water bodies contribute to the ecological fabric of cities, supporting diverse ecosystems and enhancing overall biodiversity.

The interplay between urban development and water has generated various functions as cities evolve. These functions, integrated into the urban fabric, significantly influence city development. Water thus emerges as a key element, shaping not only the city's resource profile but also its distinctive identity. (Aybay, 2006 as cited in Oktay et al., 2015, p.123). As a result, the complex relationship between water and the city goes beyond practicality to shape the fundamental fabric of urban identity and life.

3.2 Relationship Between Water and Cities and Water as an Infrastructure Element

Waterfront areas have great potential for urban planning and development, being adaptable to social and economic shift with higher commercial and industrial growth. Moreover, waterfront areas are preferred by society for their recreational qualities (Ali et al., 2020). Water has traditionally played a significant role in the urban planning of European cities. Based on how the relationship with water forms, these cities can be divided into three primary categories: port cities, riverfront cities, and canal cities.

Historically, trade, transportation, and defense have all been based in port cities, which are those that are located on the coast. European port cities include Amsterdam, Rotterdam, and Hamburg (Tommarchi, 2021), (Figure 3.a, and Figure 3.b). Port cities, distinguished by their role in transoceanic trade, continue to be central to both commerce and culture, holding significant historical importance in international trade networks, as acknowledged by Bilgin. (Bilgin, 2012, p.10).



a b

Figure 3. a. Hamburg Port, 2022, b. Rotterdam Port, 2023 (https://oevz.com)

The river symbolizes a riverfront city's identity, with the waterfront as its symbolic representative. The river shapes social connections, enhances quality of life, and offers recreational opportunities, while also playing a crucial role in the city's or

nation's image. (Petrtýlová & Matej, 2022). Major rivers have given rise to riverfront cities that depend on them for commerce and industry. European river cities such as Vienna, London, and Paris are all located along famous rivers like the Danube, Thames, and Seine (Castonguay & Evenden, 2012) (Figure 4). These cities have long been significant hubs for inland trade, transportation, and defense. Their riverfronts are frequently home to well-known landmarks and active public areas.

Figure 4. Thames River along London, 2023 (https://www.thamesclippers.com)

Canal cities, like Venice and Amsterdam, feature vast networks of canals that were built for defense and transportation at first but are today used for tourism and recreational purposes (Figure 5.a). These cities frequently have distinctive water-based transportation and infrastructure systems, and their canals have always been important to their historical and contemporary economic and cultural life. Important components of the infrastructure in many medieval European cities are the historical quay walls constructed alongside rivers and canals (Hou et al., 2023). Furthermore, until the 19th century, Munich's man-made canal systems called "Stadtbäche" served a variety of purposes, including supplying water for drinking, trade, waste disposal, and defense (Winiwarter et al., 2016), (Figure 5.b).

a b

Figure 5. a. Aerial View of Amsterdam Canals, 2021 (https://www.traveloffpath.com), b. Man-made canal systems in Munich called "Stadtbäche", 1907 (https://www.mucbook.de/stadtbaeche)

Significantly, some European cities can be classified into more than one category because of their unique relationships with water, in addition to the three primary categories. Hamburg is in a unique situation to be both a port and a riverfront city, whereas Amsterdam serves both roles of being both a port and a canal city (Bilgin, 2012). The dynamic relationship between urban growth and water resources is emphasized by the historical significance of water in the establishment of various European cities. For these cities, preserving forests in urban areas and incorporating water-sensitive urban architecture has become essential, supporting their efforts for environmental sustainability and conservation. As these cities develop further, this complex method of urban planning and development will become increasingly important. The adaptation of water as an infrastructure element within the city appears to be an important strategy for ensuring the sustainability of these infrastructure elements as they navigate the impacts of urbanization on water resources.

3.3 Sustainability of Water Infrastructure Through Adaptation

In the context of metropolitan and urban sustainability, as well as the management of water resources, urban water infrastructures emerge as pivotal components. These infrastructures not only deliver essential services for economic and social development in densely populated areas but also significantly influence societal perspectives on water, recognizing it as one of the most precious and limited resources.

Transitioning from this broader context, the city of Freiburg im Breisgau, located next to the Dreisam River, distinguishes itself among waterfront settlements through its unique cultural relationship with water. The Dreisam River seamlessly integrates into the urban landscape, providing not only essential recreational spaces for activities such as cycling and walking but also fostering community interactions and a connection to nature (Freiburg Wirtschaft Touristik und Messe GmbH & Co. KG, n.d.). Drawing parallels with canal cities mentioned earlier, Freiburg has a rich history of utilizing water canals for both practical and cultural purposes. The intricate system of water canals in Freiburg, known as *Bächle*, not only serves as part of its historical infrastructure but also plays a defining role in shaping the city's identity. Initially constructed as mere infrastructure elements for irrigation, waste disposal, and firefighting, *Bächle* has evolved to make a significant cultural contribution to the city's identity (Leonardi, 2010, p.61).

While infrastructure plays a vital role in supporting cities and societies, its relevance can diminish over time, especially when confronted with dynamic shifts such as climate change and population fluctuations (Taheriattar, 2020, p.67).To address this challenge, adaptability or flexibility in infrastructure design is proposed as a crucial solution when facing evolving design requirements over time (Conrad and Raucher, 2013; Scholtes, 2007; Slaughter, 2001; Taneja et al., 2012 as cited in Taheriattar, 2020, p.67).

As infrastructure is designed for long-term operation, it needs to be adjusted to accommodate future changes (Taheriattar, 2020, p.67). (Fiorani et al. (2017) describe adaptive reuse as a process involving not only functional changes but also alterations in the relations between orientations and spaces (Takva et al., 2023, p. 26). Adaptability (the ability to adapt) causes the infrastructure to remain in operation by responding to future changes; thus, enhancing sustainability (Conrad and Raucher, 2013; Gosling et al., 2013; Scholtes, 2007; Taneja et al. 2012; Wilkinson et al., 2009 as cited in Taheriattar, 2020, p.68). Relating back to the broader discourse on sustainability, Hiessl, Walz, & Toussaint (2001) argue that sustainability involves using current infrastructure as a foundation for the future. This forward-looking approach prompts consideration of improvements considering changing dynamics such as population growth, shifting moral standards, and technological advancements (Hiessl et al., 2001, p.7). Applying this perspective to *Bächle,* sustainability is redefined as 'using existing infrastructure as a foundation for the future,' showcasing its transformation from a functional water carrier to an element of recreational and cultural significance.

In the urban context, water consistently offers distinctive experiences to users due to the potential it possesses (Uzun, 1990 as cited in Oktay et al., 2015, p.122). Despite losing its practical purposes over time, *Bächle* remains a prominent feature, contributing to the city's charming aesthetic and overall sustainable urban design. Historically used for irrigation, waste disposal, and firefighting, *Bächle* exemplifies the versatile role that water has played in the city's development. Furthermore, *Bächle* serves as solid proof of Freiburg's commitment to environmental sustainability, aligning with the city's efforts to preserve natural resources and promote eco-friendly urban practices. *Bächle* stands out as a remarkable example worldwide, showcasing how an infrastructure design can evolve into a cultural symbol, characterizing the cityscape.

4. Bächle's Evolution as a Timeless Symbol in Freiburg im Breisgau

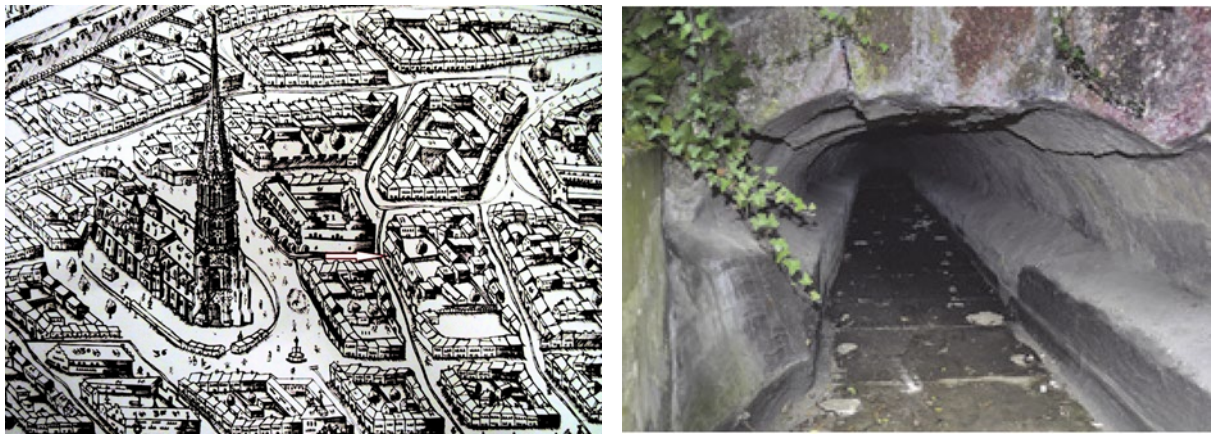
4.1 Origins and Historical Development of Bächle

Freiburg im Breisgau is a city located in the southwest of Germany, in the state of Baden-Württemberg. This town held a strategic position at the crossroads of trade routes connecting the Mediterranean Sea and the North Sea regions, as well as the Rhine and Danube rivers (Hamedani, n.d., p.1). The city's geopolitical location, bordering Switzerland and France, makes Freiburg significant for cross-border trade and cultural interactions. With its unique warm and sunny climate, coupled with its natural beauty, Freiburg serves as a key center for regional tourism (Hamedani, n.d., p.7). Upon setting foot in this intriguing city, visitors encounter the iconic *Bächle* as they wander through the streets, symbolizing an integral part of Freiburg's identity.

The etymology of the *Bächle* derives from the German word 'Bach,' meaning stream. These small water canals, known as *Bächle*, are unique to the small city of Freiburg im Breisgau in Germany (Freiburg Bächle, n.d.). In historical narratives, *Bächle* is a seldom-explored topic in the historical research of the city of Freiburg. There is no definitive information on when these small water canals in Freiburg were constructed, and researchers have approached the subject in various ways, without reaching a consensus. According to the famous German professor and

engineer Max Buhle, *Bächle* was considered a version of ancient waterways accompanying field roads even before the city was established (Untermann, 1995, p. 12). Another hypothesis suggests a close connection between the construction of commercial canals and the establishment of city streams. Despite these various conjectures, the most plausible scenario is that this infrastructure system was built in the late 12th century, during the founding period of the city. With the market established in 1120, rows of stone houses emerged along the planned streets in Freiburg. The pitched roofs of the houses directed rainwater onto the streets, necessitating the drainage of surface water. Following this urban planning and construction, the *Bächle* system, which still exists today and spans 11 km, was established between 1175 and 1180 (Himmelsbach et al., 2020, p. 279 & 2023).

Bächle was initially designed to serve the city by providing service water, fire protection, surface drainage, and waste disposal. The water of the *Bächle*, which surrounds the city like a network of intricate veins, is directed from an industrial canal beneath the Schlossberg (the hill covered with trees in Freiburg) and transferred to Schwabentor (Swabian gate in the center of the city) through a tunnel with a length of 500 meters (Figure 6.a, and Figure 6.b).



a b

Figure 6. a.Sickinger Map, Freiburg im Breisgau, 1589 (Buhle, 1898), b.View into the vaulted brook tunnel in Freiburg's Schlossberg (Himmelsbach et al., 2020)

"Bächlebrücken" ("Kähner") are present at Christoffelstor, Prediger, and Mönchstor, the historical gates of the city, crossing the ditch between the old town and Neuburg Vorstadt to reach Lehener Vorstadt (Untermann, 1995, p. 9). In the early days of the city, *Bächle* consisted of straight, paved canals in the middle of the streets (Figure 7). Between 1840 and 1858, these canals were relocated to the roadside, and the water was directed into round sandstone canals. This adjustment aimed to enhance the convenience of using the streets (Untermann, 1995).

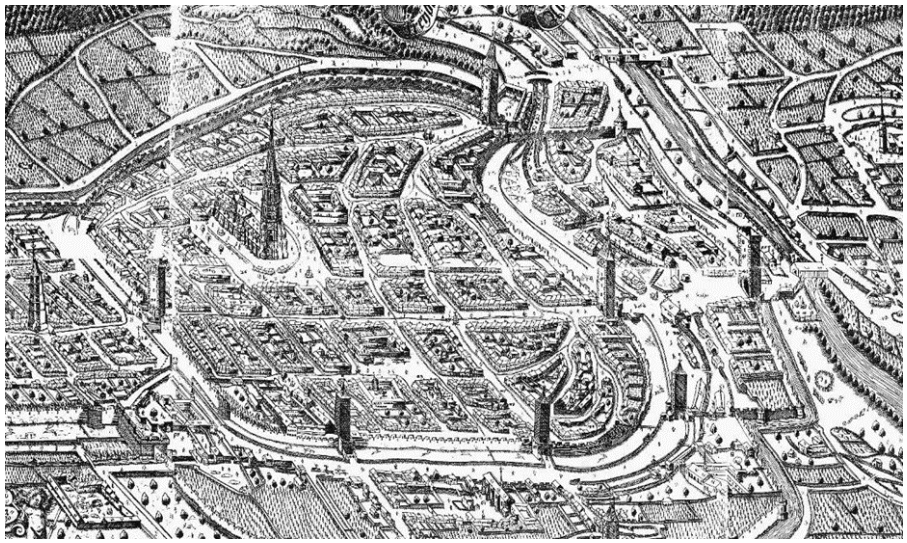


Figure 7. Sickinger Map, Freiburg im Breisgau, 1589 (Buhle, 1898)

In medieval suburbs, city waterways were also prevalent. Towards the end of the 19th century, with the construction of the sewage system, *Bächle* partially lost its practical function. Although these functional water canals no longer served practical purposes as extensively as before, they remained a beloved and valued element by the public. In the phrase of Buhle, *Bächle* had become nothing more than a city decoration (Buhle, 1898, p.117). The development of vehicular traffic after 1945 led to the overlapping of specific areas, especially in narrow streets and alleys, until the 1960s. Establishing a pedestrian zone in the city center from 1969 onwards gave new acceleration to the modern *Bächle* production. Today, the *Bächle* system still covers an area of approximately 5 km in the old town, serving as a boundary between the light rail system and the pedestrian area in the Kaiser-Joseph-Strasse and Bertoldstrasse areas. Over time, some covered sections of *Bächle* were rediscovered and selectively renewed during the expansion of the pedestrian zone (Stadtentwässerung in Freiburg Im Breisgau, 2023).

Bächle is remembered as an extraordinary engineering achievement given the period in which it was constructed (Himmelsbach et al., 2020, p. 279). While the historical story of *Bächle* was initially planned and utilized as a practical element for basic needs, it has stood out not only as an infrastructure design but also for its impact in facilitating the daily lives of the city's residents. These small water canals have added a unique touch to the urban fabric throughout history, making significant contributions to the development and sustainability of the city's social identity. Today, these little streams not only serve a practical function for the city but have also become elements that characterize the cityscape, providing substantial experiential value to the city (Figure 8).

Figure 8. Daily life in Freiburg, April 1978 (https://www2.landesarchiv-bw.de/).

4.2 From an infrastructure design to a city decoration

Freiburg has been a pioneer in sustainable urban development since the 1970s, maintaining its leadership through various dynamics. The city has implemented decisions by the municipal council to reduce vehicular traffic, and alternative public transportation options have been present in the city since the 1980s as an extensive network. Regulations enforced by the Freiburg Sustainability Council are characterized by participatory and inclusive policies, earning the city numerous awards to date. Sustainability in Freiburg is grounded not only in specific regulations but also in raising awareness among the community and encouraging participatory roles in development. This approach has enabled awareness throughout the city's entire structure, encompassing housing, transportation, infrastructure, landscape, energy, and natural resources. (Pflaum, S.A., 2016,

p.136) Freiburg's combination of scenic beauty, favorable climate, access to the Black Forest, cultural attractions, and a commitment to sustainability makes it a popular hub for regional tourism, attracting visitors from Germany and beyond.

The *Bächle* were initially designed as infrastructure, but over time, they have evolved into a distinctive city decoration. In the center of Freiburg im Breisgau, Germany, the *Bächle*, a complex network of tunnels filled with water, not only winds through the streets with refreshingly cool waters but also tells a tale of customs, traditions, and a dedication to raising the next generation of city dwellers. For generations, people have enjoyed the Freiburg *Bächle*. During hot summer days, the water provides a refreshing escape, enticing groups of children to engage in the timeless joy of racing boats. Even adults find comfort in putting their feet cool in the flowing stream. However, beneath the surface of this picturesque scene lies a history intertwined with legends and practicalities. Legend has it that if an unmarried person accidentally falls into a *Bächle*, they are destined to marry a Freiburger. This whimsical belief adds a touch of charm to the waterways, turning them into storytellers of a unique cultural narrative (Newman, 2020).

As depicted in a city description from 1896;

> If visiting Freiburg for the first time, you will be pleasantly surprised by the many open streams flowing through the streets with crystal clear water (Freiburg Tourism, n.d.).

Especially for tourists, the city has a unique appearance with these clean water canals, which surround the city like a network, enhancing the beauty of the cityscape and enriching the atmosphere. For someone living in Freiburg or visiting the city, it becomes impossible not to experience this dynamic element of the city.

A foreigner (2023) living in Freiburg:

> Freiburger Bächle holds social significance these days rather than its original practical use and architectural background. During autumn and winter, the Bächle are usually filled with water, often from rain. The ripples of the water in every street have a calming effect. Bächle are at their best in summer. You can witness children playing with their colorful wooden ships, racing them along the channels. As evening approaches, people can be seen sitting, dipping their feet in the cool water of the Bächle, and enjoying picnics with friends and family. Dogs also jump in the Bächle to cool off. People talk about a city myth when explaining the Bächle, which suggests that if you fall into one while walking, it means you're destined to marry someone from Freiburg. I have a friend to whom this myth happened. He stumbled on the sidewalk, fell into a Bächle while visiting Freiburg, and now he is married to someone from there (Avcı, 2023).

People are quite accustomed to *Bächle* being a part of their daily lives. In the first part discusses the importance of water and how it meets fundamental needs in human life. Here, water takes on different meanings, becoming a meeting place for various segments of society with diverse social and cultural backgrounds, ethnic groups, and distinctive characteristics. Whether they are from Freiburg or a tourist, it serves as a space where people from different walks of life come together and interact, transcending their differences.

A resident living in Freiburg (2023):

> There is not a single child in Freiburg who doesn't have at least one Bächleboat on their shelves. Of course, it's not only the children who enjoy Bächle. If you've been on your feet a lot during the day, you can come here to cool off. Holding an ice cream cone or a latte while your feet are in the water can be a fantastic way to conclude a day spent in the city.

The *Bächle* contributes to the liveability and vibrancy of Freiburg. Today, they serve as the course for the Bächle Boat Race and become backdrops for gory crime novels. In the experience of people visiting or living in Freiburg, the *Bächle* provides a cooling element to the city (Freiburg Tourism, n.d.). These small water-filled canals trickle fresh water from the Dreisam River throughout the urban landscape, offering a respite during warm summer days. However, the significance of the *Bächle* goes beyond mere recreation; they represent a dynamic relationship between the city and its residents, especially its youngest citizens (Freiburger Bächle - Ausflugstipp Im Schwarzwald, n.d.).

Architects, developers, city officials, and planners often ignore the impact of the physical environment on children. This inattention and brutality in human relationships can affect a child's development, while the monotony, indifference, and placelessness of the environment can have a lasting impact on their cognitive and emotional development. Children are the citizens of tomorrow and their needs need to be considered in the design and planning of cities for the future (Dubos, 1968, as cited in Lennard & Lennard,1992, p.37).

Figure 9. Bächle Boat Race, 2023 (https://www.reha-verein.de/)

The physical environment plays a crucial role in a child's learning process, as it teaches them the language of the environment and stimulates curiosity. Understanding the world is an individual process, with language being just a small part. The environment must be conducive to learning and should be interested in the person, as it arouses curiosity and provides rewards for the person's interest, keeping them engaged and awake (Mitscherlich, 1971; cited in Lennard & Lennard, 1992, p.37).

In many cities and towns, the physical environment represents a form of sensory deprivation for children, lacking elements that engage their fantasy, curiosity, or affection. Freiburg stands as a model, recognizing the importance of children's access to and participation in the public realm. The *Bächle*, with its ever-flowing water, contributes to a vibrant public space where children can encounter and become involved with their fellow citizens. The public realm becomes a teacher about the human world, fostering social skills, competencies, and a sense of belonging (Lennard & Lennard, 1992, p.38). To further enhance the child-friendly nature of the city, Freiburg embraces environments that challenge and engage children. Streets and squares adorned with fountains, intricate facades, and accessible public art invite participation and attention. Historically, public realms were spaces where inhabitants exercised sociability, celebrated together, and maintained rituals (Lennard & Lennard, 1992, p.38). Recognizing the importance of these spaces, Freiburg deliberately made efforts to revive public places, ensuring they remain vibrant and inviting for all.

Bächle will persist in providing visitors with an exceptional experience by modernizing while actively preserving the city's historical character and tourist charm. Moreover, in M. Buhle's historical article Stadtbäche und Gewerbekanäle, he writes that anyone who comes to Freiburg as a foreigner will be pleasantly surprised by the many open waterways that clear the streets. Like the image of the cathedral, he says, they tend to remain a pleasant memory for anyone who has seen the city. However, *Bächle* points out that they are now only a street decoration that constitutes the cultural identity of the city, even though they no longer serve the practical purposes they once did (Buhle, 1898, p.117).

Freiburg's *Bächle* transcends being mere water canals; they represent a commitment to tradition, play, and child-friendly urban design. As the cool waters flow through the city, they carry not only the echoes of history but also the laughter and joy of children racing boats—an essential aspect of a city that values the well-being and development of its youngest citizens.

As an overall evaluation, the decision to restore and widen the *Bächle*, preserving the small canals and relocating them to the edges of the street instead of demolishing them, reflects a strong commitment to adaptive infrastructure, sustainability, and the community well-being in Freiburg. This approach not only maintains a historical and cultural element of the city but also aligns with the principles of sustainability that are deeply ingrained in the values of the residents. Preserving the *Bächle* is not merely a practical choice but also a testament to the active role of individual and social memories in shaping the built environment, as influenced by Halbwachs. By keeping this ancient urban component alive and incorporating it into their daily lives as a landmark, the citizens of Freiburg contribute to the continuity of their cultural heritage. This conscious effort to integrate historical features into contemporary urban planning reinforces a sense of community and belonging.

Figure 10 Bächle, 2023 (https://www.reha-verein.de/)

5. Conclusion

The historical and cultural importance of water is related to the very essence of human civilization, symbolizing life and the foundation upon which societies have flourished and evolved (Hattapoğlu, 2004 as cited in Oktay et al., 2015, p.122). The majority of civilizations have flourished along rivers or originated in regions surrounding river basins. This proximity has facilitated interaction between human settlements and rivers, giving rise to co-evolutionary processes and establishing an internal dynamic coupling mechanism (Wang & Gao, 2020).
In time, the relationship between human settlements and the environment undergoes occasional disruptions and transformations, influenced by diverse factors, including demographic shifts and urbanization. The impact of urbanization is particularly conspicuous in the swift modifications of established infrastructures, giving rise to challenges of disruption and abandonment. This phenomenon is frequently attributed to the rapid fluctuations in population density, moving swiftly from urban cores to peripheral areas. Discussions addressing the reverberations of urbanization and infrastructure prominently bring forth the concept of sustainability.

The concept of sustainability is used in various perspectives in literature, primarily emphasizing energy and material preferences while other discussions are on theoretical discussions concerning social and environmental studies (Koglin, 2009, p.10) The sustainability of infrastructure key research streams include green infrastructure, sustainable buildings, and assessment methods with emerging themes in cost-effectiveness, project management (Thomé et al. 2016, p.144). In this regard, the study examines the intricate relationship between water infrastructure and the cultural identity of a city, using the *Bächle* water canal system in Freiburg im Breisgau, Germany, as a focal point. Through a historical lens, the study explores the evolution of the *Bächle* from its functional origins in providing water, fire control, and drainage to its current status as a symbol deeply ingrained in the city's cultural fabric.

The broader context of the research discusses the importance of water in urban settlements, emphasizing its multifaceted roles in ecological balance, cultural development, and community well-being. It classifies European cities based on their relationships with water, and further delves into the sustainability and adaptability of water infrastructure, emphasizing the importance of infrastructure evolution in the face of changing environments. The study showcases Freiburg's commitment to sustainable urban development, evident in the adaptive reuse of the *Bächle*. The *Bächle* water canal system in Freiburg im Breisgau stands as a timeless testament to the intricate interplay between urban infrastructure, cultural identity, and sustainability. Originally designed in the 12th century to fulfill practical needs such as irrigation and waste disposal, the *Bächle* has evolved into a symbol that transcends its utilitarian origins. The *Bächle* not only serves as a unique urban feature but also contributes significantly to the city's social fabric. From the refreshingly cool waters providing respite during hot summer days to becoming a canvas for the Bächle Boat Race, these water canals have become ingrained in the daily lives and collective memory of Freiburg's residents. Moreover, the *Bächle* exemplifies how a historical infrastructure component can adapt and contribute to contemporary urban life. Its transformation from a functional water carrier to a cultural symbol showcases the city's commitment to sustainability and environmental consciousness. By embracing the *Bächle* as more than just an engineering solution, Freiburg has created a living example of how water infrastructure can enhance the quality of life, foster community engagement, and preserve cultural heritage.

The role of the *Bächle* system, not only as an infrastructure element but also a symbol of identity formingin social memory and city culture, has not been sufficiently discussed in the existing literature. This study enriches the literature on the reuse and adaptation of historical and cultural infrastructures in sustainable city planning. Additionally, it provides significant contributions to contemporary discussions on how water infrastructures can be integrated with ecological and social sustainability.

The article encourages further exploration of similar instances where historical infrastructure evolves to meet modern needs, emphasizing the importance of integrating cultural elements into urban planning. Ultimately, the *Bächle* stands as a dynamic and adaptive element, weaving together the threads of history, culture, and sustainability to shape Freiburg's urban identity.

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