BREATHING NEW LIFE INTO WATERDRIEHOEK'S INDUSTRIAL LEGACY

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ABSTRACT

This research explores the relationship between industrial heritage and human well-being in the Waterdriehoek region of the Netherlands. It is focusing on the steel factory buildings in Alblasserdam. As many industrial structures from the late 19th and early 20th centuries face vacancy, the challenge of revitalizing these sites while addressing environmental and health concerns is crucial. Using a qualitative approach, the study combines desk research with a case study of the steel factory to assess its architectural qualities and impact on human well-being. Key questions investigate the preservation of industrial architectural values, the coexistence of heritage and residentials, and design strategies that promote well-being. Findings indicate that while the factory's features, such as natural light and spaciousness, enhance user well-being, challenges like pollution and limited green spaces remain. The research emphasises the importance of a comprehensive design approach, argues for strategies that integrate social, natural, and evidence-based elements. This approach aims to connect historical industrial use with future community needs, ultimately fostering well-being in revitalized areas.

KEYWORDS

Waterdriehoek, Alblasserdam, FN Steel, factory, industrial heritage, industrial architecture, revitalizing, dyke, dyke house, architecture, well-being, values

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1. INTRODUCTION

Due to the transition from deindustrialization to a knowledge economy or reindustrialization, many industrial structures built in the late 19th and early 20th centuries have become vacant. Consequently, they have turned into monuments that represent the technologies of the past and associated with pollution (Louw, 2018). In some parts of the Netherlands, former factory sites have been integrated into vibrant urban life. In the Waterdriehoek, however, industry remains in full operation. While some former shipyards became empty, for example Kloos in Alblasserdam (Kramer, 2021), most industrial buildings are still utilized for industrial purposes. Nonetheless, the question remains as to how long residential and industrial areas can continue to coexist in this manner.

However, the coexistence of industry and residential areas in Waterdriehoek has been challenging. With a growing population, environmental and health issues have become more prominent. For example, PFAS contamination around Dordrecht (Chemours) and lead found in gardens near the steel factory in Alblasserdam. These problems illustrate the ongoing tension between industrial activity and residential life. The illustration below shows various companies within the Waterdriehoek that own buildings constructed from the late 19th century to the mid-20th century.

Definition industrial heritage:
“The social and material culture directly or indirectly related to the people engaged in the creation of infrastructure and the production and distribution of raw materials, objects, and energy” (Morin, 2014).

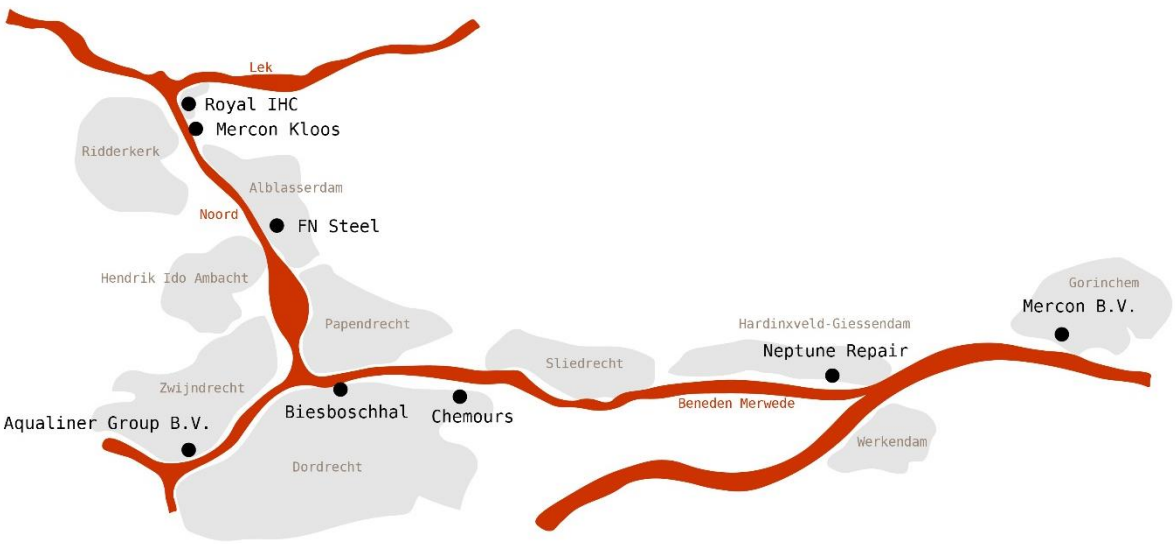

Figure 1: Industrial companies along the rivers in the Waterdriehoek.

PROBLEM STATEMENT

The growing population and expanding industry in the Waterdriehoek area present significant challenges. These two developments are often incompatible due to the historical and ongoing pollution from local plants. The Waterdriehoek contains a richness of industrial heritage, some of which are vacant while others are still in use by companies. A challenge is that the buildings require maintenance and do not always meet current standards for companies. At the same time, these buildings have a significant impact on the identity and atmosphere of the area.

AIM RESEARCH

The aim of the research is to gain insights into the existing qualities of the industrial heritage in the Waterdriehoek. Additionally, it provides insights into how new qualities (from a human well-being perspective) can enrich the building for future repurposing.

RESEARCH QUESTIONS

The problem statement and the aim of the research leads to the following research question:

How can industrial heritage in the Waterdriehoek, built between dyke and water, be revitalised in a way that promotes well-being?

- What is the relation between industrial heritage and the dyke (houses)?
- What qualities and values, in industrial architecture, should be preserved when revitalizing the building?
- In what ways does the built environment impact human well-being?
- How can architects integrate design strategies to promote well-being within building environments?

METHODOLOGY

This research is based on a qualitative approach to understand the complexities of the industrial building's qualities and their impact on well-being. The study begins with desk research, conducting a review of existing literature. For the investigation into the values and qualities of industrial heritage in the Waterdriehoek, the steel factory (FN Steel) in Alblasserdam has been chosen as a case study. It serves as an example of the typical industrial architecture built in the late 19th and early 20th centuries in the Waterdriehoek. For analyzing the steel factory, the structure of the second chapter is based on Stewart Brand's concept of shearing layers, alongside literature on industrial architecture from the late 19th to early 20th centuries. This provides a contextual framework for understanding the building's design and functionality. Additionally, the well-being aspect is assessed through relevant literature and journals on environmental psychology, BREEAM NL, and the Well-Building Standard. By integrating these theoretical frameworks with practical insights, the methodology enables an exploration of the relationship between industrial architecture and human well-being.

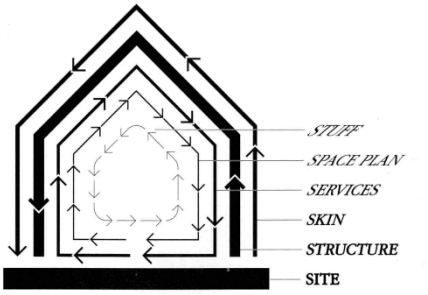

Figure 2: Shearing layers by Stewart Brand (https://stadspatronen.net/hetbouwenvoorlanger).

RELEVANCE

Along the waterfronts of the Noord and Beneden Merwede rivers, there are many industrial buildings. Over the years, many industrial areas have grown and expanded, creating a contrast between residential and industrial zones. In recent years, the question of how to deal with these buildings when they become vacant has arisen. Industrial architecture offers opportunities in terms of character and as a reminder of a thriving period, but it also presents significant challenges in terms of construction techniques and the enormous volumes of the buildings.

2.ANALYSIS STEELFACTORY, ALBLASSERDAM

This text delves into the historical and architectural context of the steel factory along the River Noord in Alblasserdam. Key aspects include the scale, materiality, and craftsmanship of the buildings, as well as the functionality and atmosphere of the factory spaces. Overall, it aims to highlight the site's cultural and architectural values.

SURROUNDINGS

The steel factory is located next to a dyke. This is part of a long dyke ring that protects the polder from the water. It is notable that the dyke houses are often positioned on one side of the dyke, typically on the polder side. The industrial buildings are located between the dyke and the river, and this area is often raised to the height of the dyke. This positioning allows for the transportation of materials and products via the river, and the elevated ground level prevents flooding.

In the past, people lived on and around the dyke. These were the safe places to live, providing protection from the water. The surrounding area was the working area, where agricultural activities took place or where people fished. Most of the dyke houses were built long before the steel factory. The first houses were originally constructed in the year 1870. The other dyke houses were built between 1870 and 1935. Then, in 1938, the construction of the first factory halls of the Nederlandse Kabelfabriek was completed. In the following years, the factory gradually expanded.

The steel factory is located along the river Noord in the province of South Holland. This river forms an important connection between the rivers Lek, Beneden Merwede and Oude Maas and is part of the Dutch Delta system. In the past and today, water is an important factor for the local economy, such as shipping and industry.

The factory is located in the village of Alblasserdam. This village has around 20,000 residents in 2024, and the people initially relied primarily on agriculture. Over time, this shifted to sailing ships, and later to steamships, which established themselves along the River Noord (Geschiedenis van Zuidholland, 2024).

SITE

The relation between the scale and heights of the dyke houses and the industrial buildings are different. The dyke houses are built to human scale, whereas the industrial buildings are constructed to the scale of machinery and the industrial process for making steel wire. The height of some halls reaches up to 30 meters, without any intermediate floors.

Maintaining the atmosphere at the factory site, is often combined with the preservation of as many original machines and elements as possible. This can pose a challenge when assigning a new function, as finding a good balance is necessary. In modern style, which often involves minimalist interventions, there is a clear contrast between old and new. This aligns with contemporary heritage practices, where a clear differentiation between old and new allows for a more nuanced and layered readability of the building (Louw, 2018).

SKIN

The facades of the factory are made out of a combination of bricks, steel columns and steel window frames with glass. The brickwork bonding is a 'halfsteensverband.' This type of bonding is a single layer of brick that can be laid quicker because it requires less cutting and size irregularities are not an issue. The steel columns are painted with a royal blue colour paint. This colour can also a common for other industrial buildings along the rivers in the Waterdriehoek and serves, among other things, to protect the steel against corrosion. Steel has been used for the window frames, a logical choice in terms of allowing natural daylight and saving materials (Louw, 2018).

In terms of craftmanship, there is a clear distinction between the dyke houses and the factory. The dyke houses are rich in ornamentation, evident in the decorative brickwork, window frames, ‘nokmakelaar’, and gutters. In contrast, the factory shows little of the same craftsmanship. Here,

craftsmanship is found in other elements, such as the imposing trusses. This difference is partly due to the category within which the building falls and the mindset at the time of construction. Factories from the early 20th century in the Netherlands focused on efficient processes, making ornamentation unnecessary (Bürklin, 2019).

STRUCTURE

The steel trusses in the factory buildings are impressive due to their slender steel beams in combination with their span. In the past, these structures were calculated by hand, but the software used today for structural calculations cannot compute the truss in the factory hall because it is too complex. This complexity adds extra value to preserving the structure, but it also complicates any potential transformation of the building. Industrial buildings and elements are often constructed to withstand high stress, immense heat, and heavy machinery, but they have also endured significant wear and tear over time (Louw, 2018).

SPACE PLAN

The focus of the steel making process was on efficiency, particularly meant for an optimal circulation. The space plan was based on the dimensions of materials and machines. As a result, the human scale was not taken into account (Louw, 2018). See the image next to this text for the process of making steel wire.

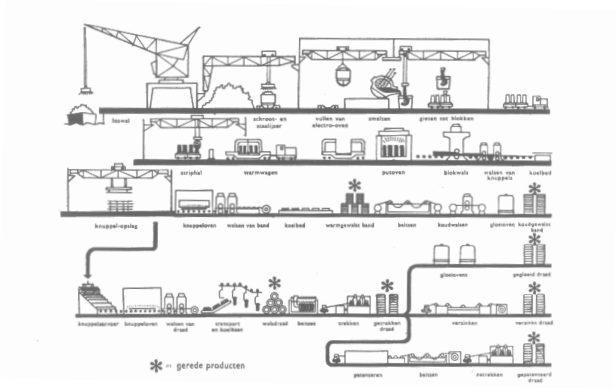

Figure 3: Process of making steel wire at the steel factory in Alblasserdam between 1965 and 1974 (source: 1088_1290 Schema van het proces voor de productie van staaldraad in de kabelfabriek in Alblasserdam. - Regionaal Archief Dordrecht).

SURFACES

The indoor walls are primarily made of brick, a natural material derived from clay, offering both durability and sustainability. The bricks are laid in a "halfsteens verband," a brickbond pattern where each brick overlaps half the length of the one beneath it, providing added strength and stability. These walls are strategically built between steel trusses and beams, integrating seamlessly into the building's structural framework.

All floors are made of concrete and rest on top of the steel construction. This type of flooring offers several advantages: it is relatively inexpensive, durable enough to support heavy machinery, and suitable for storage use within the factory.

The ceiling on the second floor is designed to be lightweight, as it does not need to support heavy machinery. This approach minimizes material usage while ensuring structural integrity.
The ceiling is constructed from modular panels, each measuring approximately 100 by 25 centimeters. This modular design allows for easy installation, enabling quick assembly without compromising on quality. Overall, the concrete light cassette ceiling effectively combines functionality and efficiency, creating a bright and open space that enhances the environment on the second floor.

STUFF

Throughout the entire three-story building, original industrial lamps made of enamel hang. Enamel is a material created by applying a thin layer of glass or ceramic to metal. This lighting material is ideal for buildings with industrial functions. Enamel is resistant to rust and corrosion, which allows lamps to last longer. Another important aspect is that enamel can withstand high temperatures, which is crucial for a factory where steel is produced. In addition, the lighting, alongside natural daylight, aimed to stimulate higher productivity.

During the process of making steel wire, an overhead crane is used, particularly at the beginning when scrap and steel are placed into the electric oven. Then, a crane is needed to pour the molten iron into blocks. Once the blocks have been melted down into metal beams, a crane is also necessary to store these beams. These cranes are designed to safely move heavy materials or machines. In the three-story building, an overhead crane can be found in almost every space. One overhead crane was made

by Figee from Haarlem (now KenzFigee) and another by Thole from Enschede (which no longer exists).

3. BUILT ENVIRONMENT & HUMAN WELL-BEING

This chapter describes the field of environmental psychology and outlines several environmental characteristics that influence human well-being. It concludes with practical ways to apply this knowledge when designing a building or space.

ENVIRONMENTAL PSYCHOLOGY

Our environment is one of the factors that influences human behaviour and well-being. It consists of various elements, including light, acoustic comfort, air quality, nature, wayfinding, and the personal space an individual needs. These characteristics impact both mental and physical well-being. Environmental psychology, which studies these human-environment interactions, offers insights for designing buildings that meet user needs effectively (Hamel, 2013). The book 'Environmental Psychology: An Introduction' defines environmental psychology as: 'The discipline that studies the interplay between individuals and the built and natural environment' (Steg, 2019). Figure 4 illustrates the cognitive process of perception and its behavioural outcomes.

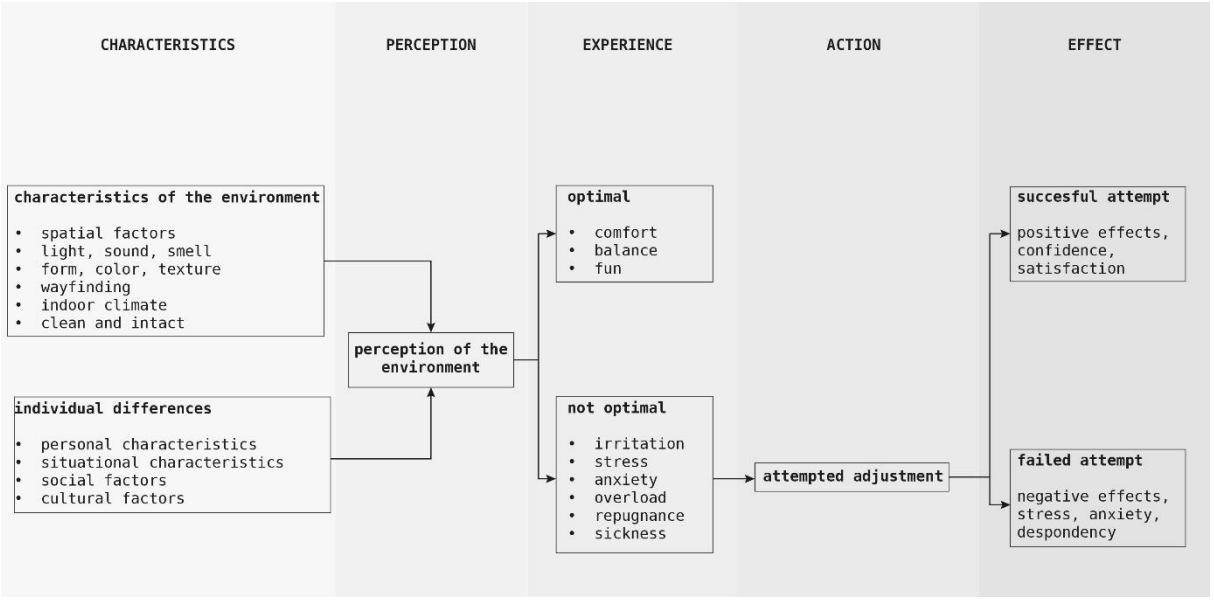

Figure 4: Process of perception (Hamel, 2013).

CHARACTERISTICS OF THE ENVIRONMENT

The following part discusses the influence of various characteristics in the built environment on human well-being. The described characteristics are: light, noise, air quality, nature, wayfinding, and personal space.

LIGHT

Through vision, people obtain most of their information about the built and natural environment. The information received depends on the characteristics of the light source, the optical properties of the objects that reflect the incoming light, and the way light is perceived through the ability to see. Furthermore, light is involved in the chemical and biological processes that occur in the body, making good lighting essential for people's well-being and health (Medved, 2022). BREEAM has established a guideline for adequate daylight in spaces where people spend extended periods of time. An optimal amount of daylight is defined as more than 10 or 15 percent of glass surface area (BREEAM-NL, 2024). To calculate this percentage, the following formula is used:

'Percentage = (Glass surface area in the area or space) / (Usable surface area in the area or space) x 100.'

NOISE

Acoustic comfort is threatened by noise. Noise is defined as an unwanted sound, characterized by its intensity (decibel), frequency, periodicity, and duration (Steg, 2019). Sound can be perceived as irritating or annoying when it is intense, unpredictable, and beyond the individual's control. This can include, for example, loud music from the neighbours that you cannot control (Hamel, 2013). Prolonged noise produces psychological stress and this could lead to an increased blood pressure for both adults and children (Evans, 2001).

AIR QUALITY

Air quality or indoor climate also affects people's experiences and behaviour in a space. An unpleasant indoor climate, such as too cold, too hot, drafty, too humid, too dry, or a lack of oxygen can cause stress for users (Hamel, 2013). Another aspect is that plants or trees also influence air quality. Plants and trees are known for their abilities to remove pollutants, reduce heat, and increase humidity levels (Steg, 2019). In addition, they release essential oils, known as phytoncides, as a protection against harmful attacks from insects, fungi, or bacteria. Research shows that inhaling these phytoncides has health benefits for people. However, plants and trees can also have negative effects on human health by releasing pollen.

NATURE

For a long time, the idea that contact with nature promotes health and well-being has existed (Steg, 2019). A Dutch study shows that nature gives people a healthy feeling (Van den Berg, 2012). Additionally, nature has a stress-reducing effect. The first study to demonstrate that exposure to nature improves human health was conducted by Roger Ulrich in 1984. He had patients recovering from gallbladder surgery in two types of rooms: one with a view of a natural environment and one with an urban view. Patients with a view of a natural environment recovered more quickly. This illustrates the impact that a green environment can have on people's health and well-being. Another study demonstrating the positive impact of green spaces was conducted in the Netherlands with 10,000 residents. The conclusion of the study was that residents with a higher percentage of green space within 1 to 3 kilometres generally reported better mental health and fewer health complaints than those living in areas with relatively less green space (De Vries et al., 2003).

WAYFINDING

Wayfinding is an important concept in environmental psychology. It refers to the behaviour and thought processes people go through when trying to find their way (De Omgevingspsycholoog, 2014). Complexity, visual access and differentiation of a space or environment are considered to contribute to

the understandability of a building (Gärling, 1986; Abu-Ghazzeh, 1996). Urban planner Kevin Lynch discussed the readability of the city in his book The Image of the City (1960). This concept refers to how easily a person can recognize and organize their environment, essentially forming a cognitive map. According to Lynch, five key elements are important for this process: paths, nodes, edges, districts, and landmarks.

PERSONAL SPACE

With personal space, a person regulates the distance and proximity to others. This is often an unconscious process. When people step into the personal space, the person would instinctively take a step back. Personal space is often viewed as a circle or bubble around people, but in reality, people find it especially uncomfortable when approached from behind or from the front. Approaching from the side is generally perceived as less intrusive. Furthermore, the size of this space is often seen as fixed, but it is actually flexible. In one situation, the circle around us may be larger than in another. For example, in an elevator, this circle shrinks, while it expands when walking in a park. When a stranger stands close to us in a crowded elevator, it is more accepted than in a park (Rigter, n.d.).

The concept of personal space was introduced by Edward Hall in 1988, who distinguished four different types of personal spaces. Each zone determines the distance maintained between individuals:

- 0 – 0.45 meters: intimate zone
- 0.45 – 1.25 meters: personal zone
- 1.25 – 3.50 meters: social zone
- 3.50 meters +: public zone

However, these are not strict distances that apply to everyone. The boundaries of personal space depend on individual characteristics and the situation. Personal traits such as age, gender, (sub)culture, personality traits, and environmental factors affects the size of this personal space (Aiello, 1987; Gifford, 2002).

DESIGN APPROACHES

Three approaches that promote well-being and healthy behaviour are described below: social design, biophilic design, and evidence-based design.

In social design, human needs are central to the design of a building. In practice, however, these needs and requirements are sometimes less prioritized, leading to a gap between the designer and the user. In social design, research is first conducted into the attitudes and behaviours of the users, and the design is then created based on these findings (Steg, 2019). Biophilic design focuses on integrating natural forms, materials, and processes into architecture. Some argue that modern humans still have biophilia, or an inclination to connect with nature and natural elements. Applying nature in this way to buildings is believed to have a positive influence on our well-being (Steg, 2019). The final approach is evidence-based design, which entails creating new buildings based on the best available evidence from environmental psychology. This approach has had a significant impact on the well-being of staff and patients, particularly in the healthcare sector (Steg, 2019). In addition to these three methods for designing a healthy environment, there are also certifications (WELL Being Standard and BREEAM-NL) that can be obtained if the guidelines are met.

4. DISCUSSION

For the research, the steel factory in Alblasserdam is analyzed. In addition to the analysis is also literature about industrial architecture used. This is focusing specifically on the common elements that are typical for industrial architecture. As a result, the steel factory also represents other industrial heritage in the Waterdriehoek, although differences will exist due to context, function, regulations, for example. The results included an analysis of several elements of the building and its environment, but this research was limited to not analyzing the entire building complex. Other topics, such as services, staircases, tiles, and the crane rail, could also be explored. Additionally, in the chapter about environmental factors, research could also be conducted on the influence of hygiene, textures and colours, for example. Due to these limitations, the focus was on the characteristics most closely related to the field of architecture. To obtain a more comprehensive answer to the research question, it may be interesting to analyze transformed industrial heritage, allowing for more concrete design strategies. Furthermore, a deeper exploration of various environmental factors in conjunction with the desired future function could help the research address the technical requirements for that function more specifically.

5. CONCLUSION

The revitalization of industrial heritage in the Waterdriehoek region presents significant challenges, particularly in balancing the needs of a growing residential population with ongoing industrial industry. The study of the steel factory in Alblasserdam illustrates both the potential and the complications of this coexistence. While the factory's architectural qualities influence human well-being, issues like PFAS contamination highlight the ongoing environmental risks associated with industrial activity. The findings emphasize that preserving the historical and architectural significance of these industrial buildings is crucial for maintaining the identity of the Waterdriehoek. However, modern environmental standards and the need for health-conscious designs require innovative approaches. Strategies like social design, biophilic design, and evidence-based design can guide architects in creating spaces that promote well-being while respecting the region's industrial heritage. Ultimately, successful revitalization will depend on a holistic approach that harmonizes architectural preservation with contemporary needs for health and environmental safety. As urbanization continues to reshape the Waterdriehoek, fostering dialogue among stakeholders will be essential for a sustainable future. This balance is vital not only for the buildings themselves but also for the broader community's quality of life.

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