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We shape our buildings, but do they shape us?

Exploring the influence of green urban design on pro-environmental behaviour: a case study of Schoonschip in Amsterdam.

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Abstract

In the context of escalating environmental consciousness, this thesis scrutinizes urban sustainability, with a specific focus on Amsterdam's Schoonschip sustainable housing project. The investigation delves into the nuanced realm of green design, probing its potential and constraints in steering residents towards sustainable practices. This study unveils the subtle yet impactful role of green design in shaping eco-friendly behaviours within urban projects, shedding light on the intricate interplay between physical nudges and communal influences.

Employing a comprehensive approach encompassing semi-structured interviews, an extensive academic literature review, and meticulous observations, this research delves into the intricacies of how green design permeates residents' daily routines. Uncovering instances of residents adopting eco-conscious choices, such as harnessing solar power for laundry and opting for shared transportation, underscores the latent influence of green design and the project's physical environment.

However, the residents interviewed highlighted the paramount role of community strength in truly ensuring the project's sustainability. Shared values and mutual support engender a robust sense of responsibility, acting as positive coercion towards sustainable living. The study accentuates the pivotal contributions of learning and knowledge exchange within the community, fostering a collective sense of ownership and dedication to sustainable values that, in turn, propels residents towards more eco-friendly behaviours.

Furthermore, this research emphasizes the significance of the participatory process within Schoonschip. Involving residents and stakeholders in the project's design and decision-making processes not only cultivates a sense of ownership but also bolsters commitment to sustainable principles. This collaborative approach enhances the efficacy of green design and empowers residents to consistently lead environmentally conscious lives.

Unlike previous studies centred on public spaces, this research uniquely explores how green design influences the behaviours of environmentally conscious individuals within the private sphere of their homes. Special attention is devoted to unravelling the enduring effects of design, recognizing its pivotal role in shaping sustained sustainable behaviours.

Ultimately, this thesis aims to illuminate the multifaceted impact of various aspects of green design, coupled with participatory processes, in promoting pro-environmental behaviour. By comprehending these dynamics, policymakers and urban planners can strategically design projects that foster eco-friendly habits, thus contributing to the transformation of cities into vibrant, sustainable spaces that serve the well-being of both residents and the planet.

Keywords: pro-environmental behaviour, green urban design, nudging, behaviour change

Executive Summary

This research addresses the pressing concern of urban sustainability, aiming to reevaluate how cities are designed and how residents' behaviours can be positively influenced to combat climate change and promote eco-conscious living. The investigation centres on the case study of Schoonschip, a sustainable housing project in the North of Amsterdam, with a focus on the impact of green design on pro-environmental behaviour (PEB). It also explores the perceived and reported nudges of the residents against the observations of the authors and the theory on the nudging potential of green urban design (GUB). Interestingly this showed a divergence between perceived and actual behaviour, and what can be the factors of their nudges. From the perspective of the interviewed residents the prominence of community and knowledge-sharing dynamics shaped mostly their behaviours whereas Green Urban Design (GUD) was perceived as secondary and subconsciously affecting their behaviour. For the interviewed project managers and from the authors observations however, the GUD of Schoonschip had a strong influence on pro-environmental behaviours amongst the residents of the project, thus creating a discrepancy between the reported and actual behaviour and their causalities which might require future further research within Behavioural Sciences and Urbanism.

To accomplish this research, a data triangulation was done by combining qualitative-methods approach with open-ended interviews, a literature review and field observations. The research drew from a transdisciplinary approach to environmental psychology, behavioural science, and sustainable urban development theories to develop the adequate analytical framework.

The main findings reveal that green design and technologies did indeed influence residents' behaviours, albeit often subconsciously. Residents adjusted their daily routines to align with green technologies, such as optimizing laundry schedules to use solar power. However, this change was not always explicitly acknowledged when residents were directly questioned about it. Community dynamics emerged as a central factor in shaping PEB. Residents highlighted the importance of the sustainable community ethos in encouraging eco-conscious behaviours. Shared values and mutual support fostered a sense of responsibility toward sustainability.

Furthermore, knowledge sharing and learning experiences during the participatory process played a pivotal role. These processes created a sense of ownership and commitment to sustainable values, motivating residents to adopt pro-environmental behaviours.

In conclusion, this research challenges the conventional wisdom in sustainable urban planning by emphasizing the multifaceted nature of sustainability. It underscores the significance of social sustainability, alongside green design, in shaping sustainable behaviours.

Recommendations for future research emanating from these findings include addressing the challenges associated with eco-gentrification, exploring behaviour change strategies among less privileged individuals, devising effective means to bridge the gap between sustainability aspirations and lifestyle resistance, investigating the feasibility of green social housing initiatives, and devising strategies to enhance inclusivity within sustainable communities. Collectively, this research enriches our comprehension of sustainable urban development, offering actionable insights to guide policymakers, urban planners, and developers in their pursuit of creating more environmentally conscious and socially inclusive cities.

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Abbreviations

ABG Attitude-Behaviour Gap

NEB New European Bauhaus

PEB Pro-Environmental Behaviour

SDGs Sustainable Development Goals

Introduction

As the world confronts the pressing challenges of environmental degradation and the need for sustainable living, the transformative potential of cities and fostering pro-environmental behaviour becomes increasingly evident, offering a promising pathway towards a more ecologically balanced and resilient future. Cities are complex urban structures where two out of every three people are projected to live by 2050 according to the UN DESA (Elmqvist et al., 2019; United Nations, 2023). Such dense population is also reflected in the energy use and waste generation of cities accounting for over 70% of global CO2 emissions, 50% of global waste and about 75% of global primary energy today (The World Bank, 2022; Ellen McArthur Foundation, 2023; UN Habitat, 2023). The unsustainability of Anthropocentric[1] megatrends[2] such as urbanisation and overpopulation are especially accentuated in cities, and represent great challenges for future generations (Elmqvist et al., 2019). To accommodate such exponential growth, cities are building quickly, often resulting in unplanned sprawling[3] forming megacities and locking in land use and lifestyle patterns such as overconsumption (Lehmann, 2010). Cities reportedly cause major health and environmental complications such as air and noise pollution, urban heat island effects, chemicals, mental health problems and biodiversity loss (WHO, 2023; Capolongo et al., 2011). The global pandemic of COVID19 acted as a 'wake-up call' and moved the transition towards a sustainable urban model from a possibility to a "compulsory target"(Clerici Maestosi et al., 2021). Thus, building urban spaces that intentionally integrate green urban design and the cultivation of pro-environmental behaviour emerge as powerful catalysts for a harmonious coexistence between cities and the natural world, also reflected in the United Nations Sustainable Development Goal 11 (SDG11).

However, cities not only present important challenges in the wake of Climate Change, but also a great deal of opportunities to face them. In fact, cities are generating more than 80% of global Gross Domestic Product (GDP), and therefore have a crucial economic and political agency over the sustainable transition of urban spaces (The World Bank, 2022). The growing agency of cities is also visible through recognised city networks such as the C40, ICLEI and the Global Covenant of Mayors[4] where knowledge transfer and sustainable transformation accelerator initiatives are shared between cities. The European Commission has been an important enabler of this development via numerous projects such as Horizon Europe[5] or more recently the New European Bauhaus (NEB). The NEB, launched in 2020, stands out in its unique approach to green urbanism: a "creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences" (Europa.eu/new-european-bauhaus). NEB brings a social and cultural aspect to the EU Green Deal and encourages experimentative dialogue across cultures, disciplines, genders, and ages for green urban design as catalyst agent for

[1] The 'Anthropocene' is a geological term used to define an apparent "new human-dominated geological epoch (…)which would mark a fundamental change in the relationship between humans and the Earth system" (Lewis & Maslin, 2015)

[2] Megatrends are "structural shifts that are longer term in nature and have irreversible consequences for the world around us" according to BlackRock, the world's largest asset manager (BlackRock, 2023)

[3] Sprawling is, according to the Cambridge Dictionary "the spread of a city into the area surrounding it, often without planning". This term has a negative connotation and refers to the "undesirable aspects of urban development, primarily in suburban areas" (Johnson, 2001). These can be political, fiscal, environmental and social to just mention a few.

[4] The C40, ICLEI and the Covenant of Mayors are some of the most influential and changemaking network of actors in the urban scene confronting the climate crisis.

[5] The European Commission's research and innovation programme Horizon Europe features the Missions Cities which aims at delivering 100 climate-neutral and smart cities by 2030, and "ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050" (European Commission, 2023)

change (ibid.). Thus, cities are also centres of innovation and experimentation providing sustainable solutions.

> "If the European Green Deal has a soul, then it is the New European Bauhaus which has led to an explosion of creativity across our Union."
>
> *Ursula Von der Leyen, President of the European Commission*

Building environmentally consciously is a pressing responsibility for cities since the current building sector accounts for about 40% of global energy related carbon emissions (28% from operational emissions such as heating and cooling, and 11% from materials and construction), and the global building stock is expected to double in size by 2050 (World Green Building Council, 2019). More human and nature centred urban planning schools have emerged in the last twenty-five years or so, movements like 'Biophilic design' (Kellert, 2008) or 'Green urbanism' (Beatley, 2012; Lehmann, 2010) capture the importance of cities and urbanism in creating more sustainable spaces and lifestyles (Lehmann, 2010). Green urban design or green urbanism is the architectural and urban planning movement defined by Beatley as "dramatically more ecological in design and functioning and (…)has ecological limits at its core" (Beatley, p.5, 2012). This approach has shown important positive effects on lowering Co2 emissions, urban noise and air pollution, contributing to overall better Quality of Life (QoL[6]) (Capolongo et al., 2011; Lehmann, 2010; Mouratidis, 2021). The idea is not completely new either as visionary artists and architects such as Friedensreich Hundertwasser (1928-2000)[7] pushed the boundaries of the built industry through their deeply experimentative and innovative designs combining ecology and architecture already in the 1980s (see Figure 1)(Chiavoni, 2017).

Figure 1: View from the sky of the Hundertwasserhaus in Vienna, Austria showcasing the urban ecology theories in practice of Hundertwasser, built in 1986 (image from 'Food for Thought', 2020)

Nonetheless, there is an unequivocal acknowledgment that sustainable technology alone will not be sufficient to transform urban spaces as the cultivation of pro-environmental behaviour is a crucial component of addressing environmental challenges and shaping the trajectory of our cities towards a more sustainable future (Beatley, 2012; Clerici Maestosi et al., 2021; Müller-Eie & Bjørnø, 2015). In McKibben's words, solving the urban sustainability dilemma will need

[6] Quality of Life is defined by the World Health Organisation as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns"(Mouratidis, 2021; WHO, 1996)

7 Friedensreich Hundertwasser was an Austrian architecture doctor, ecological activist and philosopher, especially known for his commitment to a more human architecture in harmony with nature and his visionary ecological commitment.(Chiavoni, 2017; The Hundertwasser non-profit foundation, 2023)

both "cleverer technologies and humbler aspirations" and it is the aim of this thesis to bridge these two worlds (Bill McKibben, 1998, p.75). Pro-environmental behaviour (PEB) is a "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production)" (Kollmuss & Agyeman, 2002). PEB has been conceptualised by various authors in behavioural science, environmental psychology and sustainability studies (Daryanto & Song, 2021; Gifford et al., 2011; Pichert & Katsikopoulos, 2008; Scannell & Gifford, 2010b; Truelove et al., 2014; Whitmarsh & O'Neill, 2010; Wu et al., 2015; Zhang & Tu, 2021), but this study will follow Kollmuss & Agyeman's 2002 conceptual model and definition of PEB. According to this model and generally agreed in academic literature, PEB can be induced by a set of external (infrastructure, social and cultural factors etc.) and internal factors (knowledge, values and attitudes etc.), and discouraged by certain barriers such as 'old behaviour patterns' (Kollmuss & Agyeman, 2002). In Xie et al.'s 2020 study it is shown that the post-occupancy[8] behaviour in buildings (such as energy consumption) is what truly determined the sustainability of the building overall (Xie et al., 2020). PEB is important for driving the demand side of the economy towards sustainable solutions and circular systems, but it needs to be further understood (Xie et al., 2020). In addition, academic literature and numerous case studies have shown that the built environment is able to influence the behaviour of citizens (Gifford et al., 2011; Kellert, 2008; Kollmuss & Agyeman, 2002; Williams et al., 2010; Wu et al., 2015; Xie et al., 2020; Zhang & Tu, 2021). As follows, the role of green urban design (GUD) needs to be reassessed in order to induce pro-environmental behaviour, and thus sustainably transform cities into liveable and climate adapted spaces.

Finally, this raises the questions whether the built environment could act as a 'nudge' for PEB. A 'nudge' or 'nudging' is a behavioural intervention that is broadly applied to encourage behavioural changes (in this case, towards sustainability) via monetary strategies, informational strategies, and structural strategies (Zhang & Tu, 2021). Green design strategies can also act as rewards and punitive measures to provide awareness and nudge for action (Xie et al., 2020). In fact, Zhang et al. 2021, demonstrate in their study of green residential buildings that the intimate and consistent connection between people and their living environment may generate more subconscious but durable behavioural effects that can be translated into a lasting sustainable lifestyle. For this thesis research, the focus will be given specifically to residential buildings since many PEB choices are made within the private 'home'—"from heating and cooling, to food choices and other purchasing decisions, to being the site from which commuting begins—and all these directly or indirectly influence sustainability and GHG emissions"(Gifford et al., 2011). Further exploring the influence of green urban design within the residential space should give great insight into the potentiality of inducing PEB at the source of decision making.

In this study sustainable individuals will be assessed, as most of the residents of Schoonschip are engaged and environmentally aware individuals. In academic context, a sustainable individual is commonly characterized as someone who consistently engages in behaviours that consciously seek to minimize their negative impact on the natural and built environment. This includes efforts to reduce resource and energy consumption, use non-toxic substances, and minimize waste production (Kollmuss & Agyeman, 2002). Sustainability in an individual is often assessed through various indicators, such as their choices related to energy conservation, transportation modes, food consumption, waste disposal, and material purchases (Gifford,

[8] Post-occupancy is the assessment of a building's performance in use after it has been built and occupied, generally conducted in urbanism or architecture projects (MacDonald, 2020)

2014). Academic literature in environmental psychology and sustainability studies explores the psychological and behavioural dimensions of individuals contributing to a more sustainable and environmentally conscious lifestyle.

To explore the interlinkages between green design and PEB, this thesis will base itself on the case study of Schoonschip in Amsterdam (The Netherlands) (see Figure 2. an illustration of Schoonschip from the open-source website 'Greenprint'). Schoonschip is a floating neighbourhood, located in the North of Amsterdam, on the Johan van Hasseltkanaal. It is an ecologically and socially sustainable neighbourhood, housing 46 households and about 144 residents on 30 arks (Schoonschip Amsterdam, 2022). The project was chosen for this thesis for its use of green urban design and the sustainable engagement of its residents. The project will be further introduced in detail in Chapter 2.

Problem definition

Cities, as hubs of pollution, are shaped by various factors, including transportation systems, housing solutions, provisioning, urban food systems, waste streams, and overall design. Only recently has the sustainability of urban spaces become a priority during the design phase. Technology and innovation contribute to sustainable solutions, but behaviour also plays a crucial role. The question arises as to whether intentionally designing urban spaces as green and sustainable encourages pro-environmental behaviours. This study delves deeper by examining a housing project initiated by environmentally conscious individuals, who are already involved in numerous initiatives to reduce social and environmental impact. This unique scenario offers an opportunity to investigate the nudging potential of the built environment, exploring whether it can further, maintain, or discourage sustainable behaviours.

Currently, cities foster pollution through resource-intensive and unsustainable behaviours. Urbanism and architectural theories suggest that the built environment influences individual choices and behaviours, acting as a nudge towards predefined behaviours. This form of nudging is commonly employed in urban planning to optimize infrastructure use. However, the extent of this nudge, particularly within the privacy of homes, remains unclear. Scholars like Pichert et al. argue that behaviour is shaped by convenience, emphasizing the need to shift from a 'grey' default to a 'green' one. This concept marks the inception of nudging in the built context (Pichert & Katsikopoulos, 2008). Environmental values and energy-saving actions in households are found to be positively correlated (Pothitou et al., 2016). Steg et al. note that physical and technical innovations induce behaviour changes, but the correlation is low (Steg & Vlek, 2009). The study explores whether a nudge in the home can lead to spill-over pro-environmental behaviours in sustainable individuals or widen the attitude-behaviour gap. For instance, Pichert et al. suggest that the green design of homes may prompt individuals to adopt pro-environmental behaviours and develop environmental values that extend beyond the home.

The challenge becomes particularly intriguing when examining already sustainably minded individuals, a group often central to studies on Pro-Environmental Behaviour (PEB) that grapple with the Attitude-Behaviour Gap (ABG). This paper distinguishes itself from previous research by shifting focus away from green design in public buildings or offices, as explored by Vischer (2008), Wu et al. (2015), Xie et al. (2020), and Zhang & Tu (2021), and from behavioural change among sustainably indifferent groups. Instead, it qualitatively investigates the impact of green design on the behaviour of pro-environmental individuals within their homes, as noted by Sengers et al. (2019). Special emphasis is placed on studying the long-term effects of design, or 'post-occupancy' behaviour, by interviewing the residents on their

perception of the effects of the design of the project on their behaviour even years after the completion of the project, recognizing this phase as critical in determining the lasting impact of the built environment (Castán Broto & Bulkeley, 2013; Xie et al., 2020). Müller-Eie & Bjørnø emphasize the intentional choice of urban individuals to engage with provided green infrastructure, services, and facilities for behaviour change, underscoring the significance of understanding individual behaviour and motivational factors in Pro-Environmental Behaviour (PEB) for effective urban sustainability strategies (Müller-Eie & Bjørnø, 2015).

This study aims to unravel the effectiveness of nudging toward PEB through various green design factors within homes. The insights gained from this research have implications for policymaking and urban design improvement. By understanding the anticipated behaviour resulting from specific green designs, policymakers can strategically plan urban projects to favour desired PEB outcomes, such as promoting shared urban transportation systems and fostering local entrepreneurship.

This issue posits a hypothesis that this study aims to validate or refute: The inquiry centres around the uncertainty of whether the green design implemented in Schoonschip has facilitated a shift in resident behaviour towards Pro-Environmental Behaviour (PEB), or if it is inadvertently engendering a rebound effect wherein the convenience afforded by the project's green design and technologies fosters unsustainable behaviours.

Aim and research questions

This thesis seeks to contribute to the expanding body of research at the intersection of green urban design and pro-environmental behaviour. Specifically, the research delves into the potential of green urban design to act as a nudge for sustainable residents. The investigation focuses on sustainably engaged individuals, offering a distinctive case for studying how the built environment influences them, aiming to enhance comprehension of this impact. Employing qualitative analysis and a case study approach, the study scrutinizes the habits and perceptions of these individuals, aiming to identify the key green design features of Schoonschip that play a pivotal role in either instigating new pro-environmental behaviours or fostering existing ones.

Accordingly, the following are the Research Questions (RQs) this thesis sets out to answer:

Main Research Question: RQ1.

- *To what extent can green design induce pro-environmental behaviour in the home of sustainable individuals?*

Further Research Question: RQ2.

- *Which green design features have been perceived to be influencing sustainably minded individuals' behaviour in the Schoonschip neighbourhood, and why?*

Scope and delimitations

To answer RQ1. The triangulation of three sources of data was used to enhance the credibility and reliability of findings. First, a thorough academic and grey literature review was done, using academic research engines such as Google Scholar or Lubsearch (Lunds University online library) to inform the theoretical understanding of the research problem and build upon

previous studies. Then, the transcripts drawn from ten semi-structured interviews allowed to gain evidence of the resident's perspective directly. And lastly, some observations were made by the author during the project site visit in April 2023.

To answer RQ2. The analytical framework drawn from Behaviour Science theory gave structure to the analysis of the interview transcripts and the project visit observations, complemented by the open-source website of the project (which can be found at : https://greenprint.schoonschipamsterdam.org/ ; https://schoonschipamsterdam.org).

- Why study the perception of the residents rather than the actual behaviours?

Perception often plays a significant role in shaping behaviour, and understanding how individuals perceive the influence of green urban design can offer valuable insights into their decision-making frameworks. Firstly, perception influences attitudes and intentions, which in turn can drive behaviour (Albarracín, 2018). If individuals perceive green urban design to have a substantial impact on pro-environmental behaviour, their attitudes and intentions towards sustainable actions might be positively influenced. However, actual behavioural changes might not always align with these perceptions due to various factors such as habit, convenience, or external constraints (Albarracín, 2018). Secondly, studying perceived impact provides insights into the psychological mechanisms guiding behaviour. Human behaviour is often influenced by subjective interpretations of the environment, including beliefs, values, and perceived norms. The field of behavioural economics emphasizes the significance of nudging in influencing choices (Adkisson, 2008). Perceived impact acts as a psychological nudge, shaping individuals' attitudes and expectations. Studying this helps identify whether perceived impact serves as an effective catalyst for desired behavioural changes or if there are discrepancies that need to be addressed. Thirdly, understanding the gap between perceived impact and actual behaviour is crucial for effective interventions. If there's a disparity between how individuals perceive the impact of green urban design and their actual behaviours, it indicates a potential area for intervention for urban planners and policy makers. Bridging this gap might involve strategies to align perceptions with realistic behavioural changes or addressing barriers that impede behavioural adoption despite positive perceptions.

- Why chose Schoonschip as case study?

The choice of Schoonschip as case study for this thesis was due to multiple factors. Firstly, the project was geographically approachable from Lund University, then the residents of the project spoke English and were responsive to the research requests, and finally because the project showcases unique and innovative green urban design features which could visibly impact the life of its residents as compared to a common housing project in the Netherlands (here by 'common' meaning a housing project that is not incorporating sustainably innovative and resource efficient design features). However, the uniqueness of this projects in its geographic and cultural context mean that the generalisability of the results should be carefully handled in future research. Schoonschip provides an opportunity to study the effects of green urban design on behaviour, and sustainable solutions for living on water which is an issue that is affecting an increasing number of urban spaces in the world. It is also an example of alternative housing solutions, thus enlarging the definition of green urban design and opens up the conversation on what is deemed possible.

Schoonschip was started in 2008 and was called complete in 2020 with the addition of the final houses. This project is thus tied to the temporal and spatial limitations of the available technologies, knowledge, and influences of the time. It should be noted that the project was only accessible for individuals able to purchase upfront their house and dedicate the necessary time and effort required by the participative nature of the project. Additionally, although the

project initially aimed at providing social housing, this did not happen in the end (the average house costs between €300,000-800,000 (Dimitropoulos, 2021)). This raises the question of accessibility and eco-injustice which however will not be the topic of this research but should be addressed in further research.

Finally, it needs to be acknowledged that this thesis is based on the study of a project set in the Netherlands, a culture that encourages sustainable solutions and lifestyle choices with financial incentives, the necessary infrastructure and knowledge networks, which all allowed for this project to happen.

Ethical considerations

Participation in the interviews was entirely voluntary and the participants agreed to the consent form before the start of the interview and given ample time to consider their participation. Participants are kept anonymous and only mentioned under their role in the project (resident, project manager etc.). The participants won't suffer any disadvantage or damage from their participation in the study and the information disclosed by them has only been accessed by me and coded under the IIIEE student archive system. The results of the research won't be in any way intentionally harmful the reputation, dignity or privacy of the subjects. Data has been carefully stored under coded files to avoid any damage and leakage of data.

The research design has been reviewed against the criteria for research requiring an ethics board review at Lund University and has been found to not require a statement from the ethics committee.

Audience

This thesis is intended towards a variety of professionals such as urbanists and architects, behaviour scientists and researchers, policymakers and urban developers. It hopes to provide insight for urban planners, investors, city Mayors and architects into green urban projects as solutions for the SDG 11 and liveable city roadmaps. Better understanding the interactions between the built environment and people can be a powerful tool which needs to be further discovered to create impactful and changemaking sustainable urban environments.

Disposition

Following the presentation of the background and definition of the problem, Chapter 1 introduced the research questions along with the scope of this study and its intended audience. In Chapter 2 the Schoonschip case study is introduced with its various features, the process of making the project and its initial ambitions. In Chapter 3 an extensive literature review is conducted with the aim of investigating the role of green design in sustainability and theories of pro-environmental behaviour. Chapter 4 elaborates upon the methodology and the research design and analytical framework developed to conduct this study. Chapter 5 presents the results of this study, followed by their analysis according to the analytical PEB framework. Chapter 6 provides an interpretation of the results which serves to answer the research questions. The findings are then discussed in comparison with previous research on the topic and the methodological approach and analytical framework are reflected upon. Lastly, Chapter 7 provides the core conclusions of this study while highlighting the contribution of this research within the field. In addition, new research gaps are emphasised along with recommendations for future research.

The case study: Schoonschip Amsterdam

Schoonschip is a project known for integrating experimental and innovative green technologies and designs into the creation of what the founders call "the most sustainable floating neighbourhood in Europe" (project manager 2). Schoonschip promotes sustainable materials and proximity with nature, social cohesion and the creation of sustainable initiatives on and off the neighbourhood. It is an ecologically and socially sustainable floating neighbourhood, located in the North of Amsterdam on the Johan van Hasseltkanaal, housing 46 households and about 144 residents on 30 arks (Schoonschip Amsterdam, 2022). Together with its participative process, the green design and the resulted synergies all make Schoonschip one of the most elaborate and innovative examples of urban sustainable living and green urban design in Europe.

The project is introduced in its three main phases in this chapter: the origin and conceptuality of the project, the participative process of building Schoonschip, and finally the finished project and post-occupancy dynamics.

Figure 2: Screenshot of the interactive illustration from Schoonschip's open-source website 'Greenprint' accessible at: https://greenprint.schoonschipamsterdam.org/)

Origin of the project

Schoonschip (or "Fair Skippers" in English) is the result of a collective private commissioning or 'self-building', meaning that several private individuals acquired a land and decided on the common project to build together and with hired experts such as architects, sustainability consultants. The project was initiated by Marjan de Blok and Thomas Sykora in 2008 with the idea of creating a "self-sufficient form of life on water as a collective citizens' initiative"(schoonschipamsterdam.org). In this case, 'self-sufficient' designates the reliance on energy and heating from sources created on Schoonschip (solar panels, heat pumps etc.). The project residents are dependent on the municipality for water and waste facilities, as well as sourcing their food from outside the project grounds.

The process

The realisation of the project took more than 10 years of participative design and discussions on every aspect of the project (see figure 5). This entailed recurrent meetings with experts such as architects, urban planner, lawyers and municipality officials for discussing the layout and design features of the project, the development of a feasibility master plan with the help of an external sustainability consultancy (Metabolic) and architect studio (Space&Matter, see figures 3 and 4 below), defining the common features of the houses (they all must have solar panels and a green roof etc.), to partnering up with a shared mobility service for access to electric cargo bikes and cars for the whole community (see figures 3 and 4). The residents created the Foundation Schoonschip to obtain a subsidy by the Steering Group on Public Housing Experiments (Stuurgroep Experimenten Volkshuisvesting) thus allowing the community to hire external consultants overseeing the integration of sustainable technologies (De Regie, Metabolic), architect studios to design the structure of the neighbourhood and each individual house to satisfy energy and water sufficiency requirements required by the municipality (Space&Matter, Waterloft.nl) and thus create a sustainable floating neighbourhood (see schoonschipamsterdam.org/).

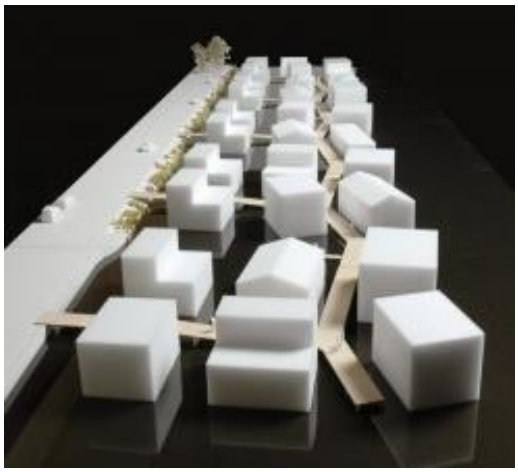

Figure 4: Initial model of Schoonschip (Space&Matter)

Figure 3: Model of Schoonschip and its sustainable features (Metabolic, Schoonschip Amsterdam, 2022)

The completed project

Schoonschip was finished in 2020 and has been operating and changing since. The finished project showcases certain green design features agreed upon by the community during the participative process. These have been categorised in Schoonschip's feasibility masterplan into 'green technology', 'green architecture', 'green community' and 'green mobility' (see table 1 below for a complete guide on the green design features of the project). Each boathouse needs to follow the 'green architecture' requirements such as having a green roof, being connected to the smart grid and using only sustainable materials agreed upon. But each boathouse also has the freedom of using some or all the 'green technologies' available and further personalise their houses beyond these requirements, such as the layout and style of the boathouses, which provides an aesthetic diversity on the project (some houses are covered in wood pallets, others used recycled copper walls, or just covered the outside with solar panels). After the completion of the project an open-source website was set up to gather all the knowledge and lessons the residents have taken from the process of building Schoonschip to help other similar initiatives. This website is interactive and educational, detailing each step of creating Schoonschip. Once the project was finished, the residents set up a touring possibility of the project for schools, individuals, and organisations. To run this and other external communication tasks, the residents distributed responsibilities amongst themselves to answer outside queries.

The following table is a summary of the green urban design features of the project, organised in categories defined by the Schoonschip feasibility masterplan. For further information, see Figure 11 of the finished project with its green urban design features in the Appendix.

Table 1: The green features of Schoonschip. Source: schoonschipamsterdam.org, Greenprint.schoonschipamsterdam.org

Schoonschip green design & technology features			
Green technology	**Green architecture**	**Green community**	**Green mobility**
isolation energy efficiency rating EPC=max 0; thermal energy heat pumps from surface water in collaboration with Aquathermia to heat and cool buildings sustainably; passive solar energy (building orientation, insulation, heat generation from ventilation system); solar water heaters; heat recovery system in showers for heating of buildings (Aquathermia); photovoltaic solar panels for electricity and individual battery per household; smart grid within the community; separated grey (i.e. washing machine) and black water (i.e. toilet) for the Waternet's (tap water supplier for Amsterdam and area) pilot project for biomass creation; smart grid for trading energy efficiently amongst the households	sustainable materials & installations (recycled plastic, local FSC certified wood, hempcrete insultation, timber framing); floating garden & green roofs; unique designs creating with Space&Matter integrating common ambitions and frameworks	joint food purchasing: fresh produce with direct contract with local farmers and restaurant leftovers; jetties & collective spaces: these favour social cohesion and engagement to the project's development; owners' association & foundation 'Pioneer Vessel' for knowledge transfer between sustainable projects own website (schoonschipamsterdam.org) & interactive opensource educational website (Greenprint), a committee for meetings and events: events such as clothes swaps, workshops, celebrations	shared cars, electrical bikes/cargo-bikes

Literature review

In this chapter, an extensive review of pertinent academic literature, encompassing key theories and concepts, is presented, forming the foundational framework for addressing RQ.1. Subsequently, the analytical framework, drawn from the field of pro-environmental behaviour sciences, is introduced, serving as the structural guide for the analysis of data pertaining to both RQ.1 and RQ.2.

In addressing RQ.1, which explores the extent to which green design can induce pro-environmental behaviour in the home of sustainable individuals, an exploration of various theories and academic concepts becomes imperative. This literature review, rooted in urban planning, environmental psychology, and behaviour science, offers an interdisciplinary examination of essential ideas. It aims to establish a robust academic context, laying the groundwork for a comprehensive understanding of the data that will be collected later in the study. The following are the main themes and problems identified as central discussions in the academic literature relating to green urban design and pro-environmental behaviour.

Design for sustainability

The first theme to examine is the role of design in achieving sustainability. According to the Strate School of Design, designing is the process of envisioning and planning the creation of an object, a service or even a system. It is about creating solutions for people, physical items, or more abstract systems to address a need or a problem. In this sense, urban design can be understood as a powerful tool for planning and creating solutions to tackle sustainability issues of the urban space.

- How is design contributing to the sustainability agenda?

Design significantly contributes to the sustainability agenda, serving as a potent tool for communication and education, fostering green values and habits in citizens' lives (Boule, 2020; Elmqvist et al., 2019; Wu et al., 2015; Zhang & Tu, 2021). Research by Wu et al. highlights that interaction with green buildings enhances environmental values and behaviours, making design a crucial driver for sustainable lifestyles (Wu et al., 2015). Moreover, design operates as persuasive communication, shaping societal norms and encouraging sustainable behaviour (Stegall, 2006). It transcends the creation of mere "sustainable products," aiming to envision a holistic approach that promotes widespread sustainable behaviour. Additionally, green design goes beyond efficiency-focused supply-side policies, empowering citizens to actively engage in the sustainability agenda by making informed consumption choices. Lehner et al. emphasize the impact of green design in domains such as food, energy, and mobility, providing consumers with awareness and agency to influence sustainability requirements in urban spaces (Lehner et al., 2016). Furthermore, green design initiates a paradigm shift, transforming households into energy 'prosumers' with the integration of rooftop solar panels and smart sensors (Pothitou et al., 2016). Examples like Schoonschip showcase the active role of households in energy production and sharing, contributing to a sustainable community (Shoonschipamsterdam.org). This shift not only recognizes the household's impact on sustainability but also fosters a collaborative approach to energy consumption and production.

The conventional focus of design for sustainability, often termed 'eco-design,' predominantly centres on product design, with extensive research exploring triggers that bridge the gap between individuals' attitudes and purchasing behaviour in this domain (Lilley & Wilson, 2013; MacDonald & She, 2018). However, this emphasis has been less prevalent in the realm of

urban design and planning, where the incorporation of sustainable features into the built environment is a relatively recent development (Wu et al., 2015). Green design movements in urban planning gain momentum due to stricter regulations and heightened demands from private stakeholders (Steg & Vlek, 2009). 'Ecologically Intentional Design' and 'Biophilic design' are two prominent movements in green urban design, emphasizing the integration of natural systems into the built environment for enhanced comfort and well-being (Stegall, 2006; Africa & Sachs, 2016). These movements underscore the importance of designers acquiring skills beyond traditional aesthetics to effectively promote sustainable behaviour.

Despite the growing visibility of green urban perspectives at decision-making levels, there is ongoing debate among researchers about the definitive influence of green buildings on people. Cairns et al. highlight the need for further research on the public perception and acceptability of green projects (Cairns et al., 2014). Daryanto et al. and Scannell et al. stress the importance of cultural context in understanding the relationship between place attachment and pro-environmental behaviour (Daryanto & Song, 2021; Scannell & Gifford, 2010). Wilkinson et al. and Steg et al. advocate for investigating contextual factors and engaging experts such as architects and urban planners to comprehensively understand the impact of green urban design (Wilkinson et al., 2013; Steg & Vlek, 2009). Vischer et al. call for more research on the effects of sustainable building features on occupants' behaviour, particularly in the workplace (Vischer, 2008).

Notably, the majority of research on the influence of green urban design focuses on public buildings and offices, with limited attention to residential buildings (Gifford, 2014; Xie et al., 2020). While some exceptions exist (Wilkinson et al., 2013; Zhang & Tu, 2021), the impact of green design on homes remains largely unexplored. Zhang & Tu (2021) stress the insufficient attention given to the impacts of green residential buildings on residents' well-being, emphasizing the need for more research in this specific area. Recognizing the differences in activities and preferences between occupants of residential and office buildings, Gifford (2011) underscores the importance of understanding residential environmental psychology to unlock the roots of pro-environmental behaviours and address barriers in urban initiatives.

- What is nudging and how can it be instrumental towards sustainability in the built environment?

In understanding how the built environment can induce behavioural change, the concept of 'nudging,' as coined by Thaler and Sunstein in 2008, emerges as a subtle yet powerful tool rooted in behavioural economics and marketing (Thaler and Sunstein, 2008; Lehner et al., 2016). Nudging involves altering the decision environment to predictably influence behaviour without restricting options or significantly altering economic incentives (Thaler and Sunstein, 2008). In the context of the built environment, this is executed through 'choice architecture,' wherein green alternatives and designs are presented to encourage pro-environmental behaviour (Lehner et al., 2016).

Nudging proves to be a valuable and complementary tool alongside traditional policy instruments, laws, and economic tools in achieving Sustainable Development Goals (SDGs). Governments and city mayors are increasingly drawn to nudging for its subtlety in shifting lifestyles towards greener and 'low-carbon' habits, aligning with carbon reduction ambitions while avoiding radical regulation to mitigate public backlash (Whitmarsh & O'Neill, 2010). Nudging, therefore, emerges as a cost-effective and socially acceptable approach, providing citizens with sustainable choices while allowing autonomy in decision-making (Whitmarsh & O'Neill, 2010).

The efficiency of nudging is particularly evident in targeting automatic, intuitive, and non-deliberative choices, such as consumer habits related to energy use, food, and mobility, which may elude other policy tools (Lehner et al., 2016). This effectiveness stems from insights in behavioural sciences, which challenge the assumption of rational decision-making in mainstream economics, emphasizing the importance of behavioural biases and decision context (Lehner et al., 2016). Nudges focus on enabling behaviours beneficial for society and individuals' long-term interests, without attempting to change value systems or increase information provision (Lehner et al., 2016).

Notably, nudging induces what is termed a 'catalyst behaviour,' which, according to Whitmarsh & O'Neill (2010), can create spill-over effects, leading to the adoption of other environmentally beneficial behaviours. This is particularly crucial in initiating pro-environmental behaviours that require a high time-cost initial investment from individuals (Whitmarsh & O'Neill, 2010). Susan Carruth, Head of Behavioural Design at Danish architect 3XN/GXN, highlights the importance of social proof and the natural urge to imitate others in behaviour change. Leveraging mirror neurons in the brain, designers can use intuitive visual cues, such as nudges in the built environment, to promote environmental behaviours (Boule, 2020).

In summary, nudging stands as a strategic and effective approach in the built environment to influence behaviour positively, providing a nuanced means to address environmental challenges and contribute to broader sustainability goals.

- Can buildings nudge?

Examining the efficacy of nudging within the built environment raises crucial questions about its extent and impact. The literature underscores the significant influence of residential buildings, especially in key consumption areas contributing to 75-80% of environmental impacts in industrialized nations: housing, transport, and food and drink (Lehner et al., 2016). Zhang & Tu (2021) emphasize the intimate connection between individuals and their living environment, asserting that the design of residential buildings plays a pivotal role in creating nudges for sustainable lifestyles. Green buildings, apart from being avenues for behavioural interventions, also provide specific facilities and sustainable education, fostering long-term behavioural changes (Zhang & Tu, 2021). Visual form emerges as a powerful educational tool, known as the 'vividness effect,' making environmental messages visually impactful and memorable (Wu et al., 2015). The physical design changes that make desired behaviour more evident are deemed most effective (Gifford, 2014). Architects and engineers, recognizing the influence of the environment on behaviour, are incorporating nudges into the design of various spaces (Boule, 2020).

However, the application of nudges in the built environment encounters limitations. The contextual factors, such as the availability of recycling facilities or public transport, are often omitted in environmental behaviour theories, necessitating further study to unveil barriers to sustainable urban development (Gifford et al., 2011). Moreover, the literature highlights the importance of punitive and rewarding systems in nudging for pro-environmental behaviour, suggesting a need for a multifaceted approach (Xie et al., 2020). The scarcity of studies on intentional nudging for environmental behaviour in the built environment is a critical gap. Existing studies predominantly focus on office buildings, public spaces, subways, streets, and parks, neglecting the private space of residential homes (Boule, 2020; Vischer, 2008; Xie et al., 2020). This lack of research poses challenges for policymakers aiming to develop targeted and effective urban projects and policy tools (Wilkinson et al., 2013).

In conclusion, while nudging within the built environment presents a promising avenue for fostering pro-environmental behaviour, addressing contextual factors, incorporating punitive and rewarding systems, and expanding research into the residential sphere are critical steps to optimize the impact of nudges and overcome their limitations.

The role of behaviour in achieving sustainability

The second critical area for exploration is behavioural science, and whether it holds the potential to profoundly shape the design of the built environment, fostering heightened awareness and encouraging sustainable behaviours.

To engender enduring and transformative societal sustainability, a synergistic approach involving both technological innovations and behavioural changes is imperative. This necessitates interdisciplinary learning drawn from diverse academic research, industries, cities, and communities, fostering active participation in shaping this transformative process (Clerici Maestosi et al., 2021). The interplay between technology and behaviour emerges as a linchpin for a green transition in cities (Cairns et al., 2014; Clerici Maestosi et al., 2021; Khansari et al., 2014; Moseley & Stoker, 2013; Müller-Eie & Bjørnø, 2015; Pothitou et al., 2016; Steg & Vlek, 2009; Stegall, 2006; Williams et al., 2010; Zhang & Tu, 2021). Steg et al. contend that while technical efficiency gains are crucial, human behaviour changes are equally vital, especially considering the potential 'rebound effect' or 'Jevons paradox,' wherein efficiency gains may be offset by increased resource consumption (Steg & Vlek, 2009; York & McGee, 2016). Xie et al.'s study highlights the centrality of post-occupancy/user behaviour in determining a building's sustainability, underscoring a potential discrepancy between design intent and actual energy consumption (Xie et al., 2020). Stegall (2006) reinforces this perspective, stating that even impeccably designed sustainable products may not be truly sustainable unless used responsibly and returned for recycling. Quoting Stegall (2006), "The crisis of sustainability is more than simply an issue of poor technology; it has emerged as an extremely complex sociological dilemma, where the lifestyle that we have adopted is rapidly eroding our ability to survive." This encapsulates the recognition that sustainability is not merely a technological challenge but a complex sociological issue. It is pivotal to ensure that established sustainable technologies are not only adopted but used correctly, fostering pro-environmental behaviours for sustained results, this idea is visually represented in Williams et al.' infographic in Figure 7 below (Xie et al., 2020). In the context of buildings, the efficacy of sustainable technology hinges on resident engagement; without it, the potential for sustainability remains unrealized (Zhang & Tu, 2021). This nuanced approach emphasizes the intertwined nature of technological and behavioural aspects in achieving lasting sustainability.

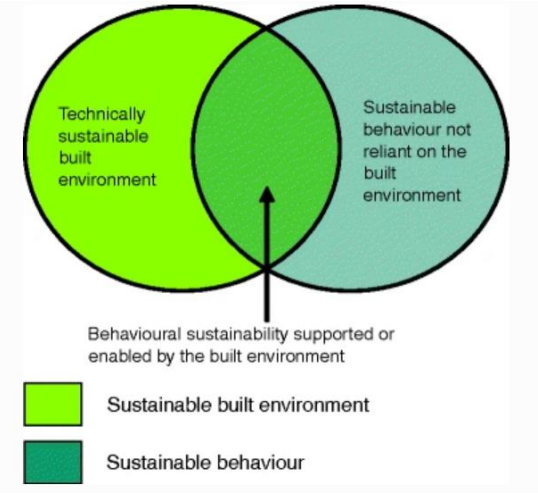

Figure 5: The complementarity of technology and behaviour for sustainability in the built environment (infographic by Williams et al., 2010)

- What are the drivers and barriers of PEB?

However, motivating new behaviour patterns isn't always easy, nor does it come fast. According to Cairns et al. (2014), only a limited percentage of the population will be proactive and initiate sustainable behaviours (also called 'first-movers' in marketing strategy), however the rest (about 80% of the population) needs more reason to change their consumption habits. Figure 10 below illustrates this by categorising according to Joyce et al.'s 2004 'Theory of sustainable behaviour' following a normal curve with three motivational groups: proactive (first movers), complacent, and negative. According to the authors, the complacent and negative groups explain why governments, urban planners, engineers are crucial actors in nudging more citizens beyond the 20% 'proactives' first movers towards a more proactive approach to sustainable behaviour (ibid.).

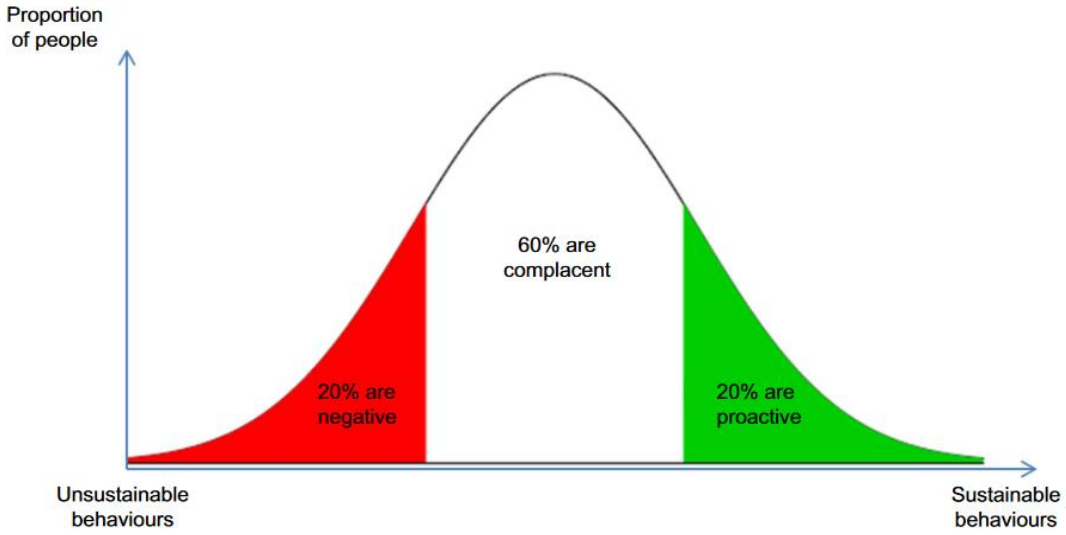

Figure 6: Theory of sustainable behaviour by Joyce et al. 2004 (Cairns et al., 2014)

Defining what shapes and inhibits pro-environmental behaviour, or what pushes citizens into either of Joyce et al.'s categories, is a complex task researchers have been working at for years, and cannot be explained or visualised through one single approach (Kollmuss & Agyeman, 2002). According to Kollmuss and Agyeman, PEB can be defined as "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production)". However, the drivers and barriers to PEB in academia are numerous and sometimes differ depending on which academic discipline we are analysing PEB from. To summarise the findings the table below was created, listing the main factors influencing PEB in academia so far (an informative, non-exhaustive list). These factors can all be drivers or barriers subject to their ability to facilitate PEB or not (see Table 2).

Table 2: Academic literature review of factors influencing PEB

Academic discipline	Factors influencing PEB identified in the Academic Literature to date:	Author
Environmental psychology	Perceived costs and benefits; normative concerns; childhood experience; knowledge and education; personality; perceived behavioural control; values, attitudes, and worldviews; felt responsibility and moral commitment; place attachment; norms and habits; goals; affect; and many demographic factors, money and health Lack of facilities (such as recycling, green alternatives etc.)	Gifford et al. 2011 & 2014)
	Pro-environmental self-identity	(Whitmarsh & O'Neill, 2010)
	Perceived costs and benefits, moral and normative concerns, affect, contextual factors, habits	Linda Steg et al 2008
Urban design and planning	Psychological, social and political context is key for acceptability of sustainable projects and behaviour change Demographic (women are more ethical and have more positive health-related attitudes than men); personal convenience (shown to be a stronger influence on positive PEB than external factors); altruism and responsible citizenship (only for about 20% of the population however); psychological factors (convenience, self-determination, self-identity, goal setting, equity, group identity) Desirability and achievability of goals Attribution theory: "people are aware of their own personal control to act but believe that exerting it would make no difference because they do not think problems that are universal in origin are actually caused by them" Personal control: uncertainty, lack of control, no perceived link to the consequences (of climate change for example); remoteness from effects of non-sustainability; considering climate change as a natural phenomenon (climate change scepticism)	Cairns et al., 2014
	social situations, institutional contexts and cultural norms	(Khansari et al., 2014)
	Individual cultural attributes ; social attributes ; psychological attributes	(Müller-Eie & Bjørnø, 2015)

	political beliefs, attitudes, and level of education	(Grosvenor, 2015)
	Convenience, accessibility, rewards and punitive measures, internal psychological motivations, responsibility, awareness	(Xie et al., 2020)
Environmental sciences	internal factors such as environmental awareness, values and attitudes and external factors such as social norms, interaction with other individuals and financial constraints"	(Pothitou et al., 2016)
	Lack of knowledge, emotional blocking of new knowledge, existing values prevent learning, existing knowledge contradict environmental values, lack of external possibilities and incentives, lack of environmental consciousness, lack of internal incentives, negative or insufficient feedback about behaviour, old behaviour patterns	(Kollmuss & Agyeman, 2002)

This table shows that there are many ways to investigate PEB, however a framework that encompasses most of these factors and stands out as a pertinent tool for the analysis of this thesis is Kollmuss and Agyeman's 2002 PEB framework. This framework provides the angle with which this thesis perceived PEB and will be introduced in more detail in chapter 3.2.1 below.

- Pro-Environmental Behaviour and buildings?

The need for PEB is widely recognised and their importance in an urban context, where dense population and urbanisation influences the many, is beyond doubt. However in most built and natural places, too little is occurring to ensure sustainability according to the environmental psychologist Robert Gifford (Gifford, 2014). The potential influence of the built environment on PEB is a new and exciting venture for urban planners and architects to work together with policymakers and city mayors on encouraging more direct and undirect behaviour changes through green urban design. Green building, a new sustainable urban form, can be used to "enhance people's well-being and induce pro-environmental behaviours, which can lead to social sustainability in addition to environmental sustainability" (Zhang & Tu, 2021). Particularly regarding energy use and consumer habits, green buildings can encourage users to adopt more environmentally friendly practices and alternatives, and eventually form PEBs (Xie et al., 2020). However the nudging of people through the built environment also encounters some notable limitations. For example, Bovens and Sunstein raise ethical concerns of using nudges to influence behaviour without the individuals' explicit consent related to potential for manipulation (Bovens, 2009; Sunstein, 2014). Additionally, nudging strategies may not be universally effective, as cultural differences can influence how individuals respond to particular cues or incentives in the built environment (Farrow & Grolleau, 2017). And while some argue that place attachment can induce pro-environmental behaviour, others suggest that the association between person-place bonds and more frequent pro-environmental behaviour is unclear (Scannell & Gifford, 2010a). The link between the built environment and pro-environmental behaviour thus requires further research.

Theories, conceptual and analytical frameworks of green urban design and pro-environmental behaviour

The purpose of this chapter is to expose theories linked to green urban design and pro-environmental behaviour and challenging or supporting this relationship in academic literature, thus providing a theoretical context for the research questions. As it has been previously stated and will become evident during the following pages, theoretical contributions to pro-environmental behaviour (PEB) in urban planning practice have ties to many different schools. The following theories and concepts are essential to the understanding of PEB in the urban design context and provide a theoretical raison d'être to green design itself. Additionally, the following theories and concepts are important phenomenon within PEB that are crucial to understand before entering the analysis of the case study of Schoonschip.

Place theory

Within the field of environmental psychology, Place Theory, also known as Place Attachment Theory, emerges as a vital concept influencing sustainable and pro-environmental behaviour. As described by Robert Gifford, a leading figure in Environmental Psychology, this theory underscores the inherent and impactful connection between individuals and their physical surroundings (Zhang & Tu, 2021). In the case of this study Place Theory provides the basic understanding to the relation of the residents of Schoonschip to the project and how that may or may not influence their behaviour towards more environmentally conscious choices. Place Theory, defined by Wilkinson et al. (2013) as "a person's responses towards the surroundings, impacting their subjective norms towards the formation of pro-environmental cognition and behaviour," establishes a link between individuals and a place, fostering a sense of attachment that shapes specific behaviours (Wilkinson et al., 2013).

According to Daryanto et al., this attachment can instil a sense of responsibility toward the environment of that place, motivating activities that contribute to sustainability (Daryanto & Song, 2021). Moreover, individuals attached to a place may engage in pro-environmental behaviour despite potential challenges (ibid.). Wilkinson et al. delve into the intricate relationship between occupants and green buildings, highlighting how attachment contributes to positive cognitive, emotional, and behavioural responses. This leads to the subconscious development of characteristics associated with being a "green citizen" (Wilkinson et al., 2013). The concept of self-identification with a place is crucial in understanding the protective behaviour exhibited by individuals. The positive impact of social identification on pro-environmental behaviour is evident, as individuals tend to act environmentally for the benefit of the group they identify with (Daryanto & Song, 2021). Encouraging an individual's connection to a natural setting, according to Vaske et al., facilitates the development of general environmentally responsible behaviour (Vaske & Kobrin, 2001). Defining 'place' as a combination of social and physical characteristics, with an emphasis on the social aspect and individual perception, Scannell et al. note its significance as an "arena for social interactions" (Scannell & Gifford, 2010). Culture and attributed meaning play a crucial role in defining a place, with meaning being the perceptual and psychological aspects that form place attachment (Ujang & Zakariya, 2015).

The absence of a sense of attachment, or 'placelessness,' as identified by Ujang and Zakariya, can lead to underlying attitudes that disregard the significance of places, influencing behaviour and contributing to the loss of traditional values. In a globalized world, the diminishing sense of attachment to a place correlates with a reduced sense of responsibility and desire to protect its environment. While some argue that green buildings, with their positive environmental cues,

establish a link between occupants and the environment (Wilkinson et al., 2013), others, like Scannell and Gifford, posit that the association between person-place bonds and pro-environmental behaviour remains unclear (Scannell & Gifford, 2010). This underscores the need for further investigation into the intricate relationship between attachment and actual behaviour, aligning with the overarching aim of our study to explore the potential influence of green urban design in nudging more pro-environmental behaviour.

Attitude-behaviour gap

The Attitude-Behaviour gap is a particularly interesting theory for this study as it allows the reader to gain further understanding on the discrepancies that has been reported in the literature to potentially occur between the attitude and the actions of an individual. In this case this is relevant because the residents of Schoonschip are mostly sustainable individuals (meaning that they strive to minimize their negative impact on the environment and society), and thus scrutinizes whether internal factors such as values and attitudes are sufficient to provoke PEB or if external factors such as GUD can further affect their behaviour. In the conclusion of their study Whitmarsh and O'Neill stated that "none of the PEBs were influenced by knowledge (...) consistent with the widely reported knowledge-action gap (or attitude-behaviour gap) in relation to PEB" (Whitmarsh & O'Neill, 2010). This diagnosis is supported by many researchers and professionals arguing that "high levels of individual environmental knowledge may not necessarily lead to the development of positive environmental attitudes" (Diamantopoulos et al. 2003, Zsoka et al. 2013, Bamberg et al. 2007, Bartiaux, 2008) (Kollmuss & Agyeman, 2002; Pothitou et al., 2016). It is thus interesting to examine what, if not high levels of environmental knowledge are influencing PEB, and what creates this gap between the attitude or knowledge and the behaviour. As Steg et al. notes "people are fairly inconsistent across their behaviour, this is because many other factors also steer behaviour (status, comfort, effort, behavioural opportunities) (Steg & Vlek, 2009). This thesis will provide an opportunity to look closer at the 'gap' since the residents of Schoonschip have (on average) high environmental knowledge, and the study thus provides an occasion to unveil the potential factors behind the attitude-behaviour gap.

Jevons paradox & licensing effect

A critical aspect in sustainability studies is the Jevon's paradox or rebound effect, as articulated by 19th-century economist William Stanley Jevons. This concept suggests that technological improvements geared towards enhancing energy efficiency may inadvertently lead to increased demand, production, and resource exploitation (Louise Ellegaard Fich et al., 2022). While originally associated with coal use, the effect extends to general energy efficiency gains through technologies, including those promoting sustainability. In the context of sustainable behaviour literature, it serves as a cautionary note, signalling that individuals might revert to their customary behavioural patterns after sustainability nudging interventions unless these changes are structurally embedded. Specifically in our study, we hypothesize that residents might end up consuming more resources, such as energy and water, despite having homes equipped with efficient green technologies, potentially due to prolonged use of electronic devices powered by self-generated energy (Zhang & Tu, 2021).

A related concern is the 'licensing effect,' identified as another seemingly paradoxical outcome in sustainability studies. The licensing effect, as defined by Dütschke et al., involves individuals justifying seemingly immoral behaviour, like increased driving, by pointing to prior moral actions, such as purchasing a more efficient car (Dütschke et al., 2018). Multiple studies, including those by Lasarov et al. and Noblet et al., illustrate this phenomenon, where

individuals who have engaged in sustainable behaviours in the past may be less likely to support future sustainable policies and may even deviate from positive examples (Lasarov et al., 2022; Noblet & McCoy, 2018). Wilkinson et al. highlight the potential for moral self-satisfaction, stemming from past sustainable actions like buying a green building, to lead to subsequent inaction, suggesting that individuals may perceive themselves as having fulfilled their environmental obligations (Wilkinson et al., 2013).

This rebound effect and licensing phenomenon introduce a nuanced perspective to our study on the potential influence of green urban design in cultivating pro-environmental behaviour. It raises questions about whether the presence of sustainable technologies and design features in the Schoonschip project, where residents have previously exhibited sustainable behaviour, might inadvertently lead to a sense of moral complacency and a reduced commitment to future sustainable practices. Understanding and mitigating these behavioural complexities is essential for the success of green urban design initiatives.

The conceptual and analytical framework of Pro-environmental behaviour

To explore the influence of green design on behaviour, this study adopts the Pro-Environmental Behaviour (PEB) framework, illustrated in Figure 9 (see below). Derived from Kollmuss and Agyeman's (2002) research titled 'Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behaviour?', which itself drew inspiration from Fliegenschnee and Schelakovsky (1998) and Fietkau and Kessel (1981) (refer to Appendix 8.2), the framework has been subtly adjusted for more relevance to the Schoonschip case study. Kollmuss and Agyeman define PEB as "behaviour consciously aimed at minimizing the negative impact on the natural and built world, encompassing actions like reducing resource and energy consumption, using non-toxic substances, and minimizing waste production" (Kollmuss & Agyeman, 2002).

This framework serves as a crucial analytical tool for this thesis, providing valuable insights into the complex motivators of PEB and establishing links with the internal and external factors prominent at Schoonschip. In the top-left corner, the reader can find the internal factors which include personal traits, goals, childhood experiences, demographic factors, and environmental consciousness. The latter is subdivided into three main areas since it is a crucial element of this study: knowledge and education; affect, place and attachment; and values, attitudes, norms, worldviews, and moral commitment. These factors align with the original framework and resonate with the environmental consciousness evident among Schoonschip residents. On the bottom-left corner, the reader can find the external factors relevant to the case study, comprising of social and community dynamics, cultural factors, geographic conditions, economic situation, political environment, and infrastructure and built environment. Notably, the infrastructure and built environment are intricately developed, emphasizing the focus on the influence of green design in Schoonschip. Green urban design, representing the infrastructure and built environment, is further developed into three categories: visual design, green technology, and user behaviour. The interplay between external and internal factors becomes evident, with external factors fostering direct and indirect green incentives (e.g., recycling bins, shared mobility services), while internal factors induce intrinsic environmental actions (e.g., consuming local and organic produce, opting for bicycles and shared mobility services over personal cars). The framework posits that these factors collaboratively contribute to transformative and enduring PEB. Complementing this, Richard Gifford's 'big 5' elements were added to the initial framework to provide a set of tangible

actions against which to measure the influence of internal and external factors of PEB. According to Robert Gifford, these five forms of PEB are representative of the overall environmental engagement of an individual. These are: energy conservation, mode of transportation, food consumption, dietary choices, waste disposal, and material purchase, were integrated.

This comprehensive analytical framework serves as the foundation for developing interview questionnaires (refer to Appendix 8.1.3) and analysing data, facilitating an exploration of the impact of green design on sustainable behaviour within Schoonschip homes (RQ1.). Moreover, it aids in identifying the influential features of Schoonschip's green design, whether internal or external, in shaping residents' pro-environmental behaviour (RQ2.).

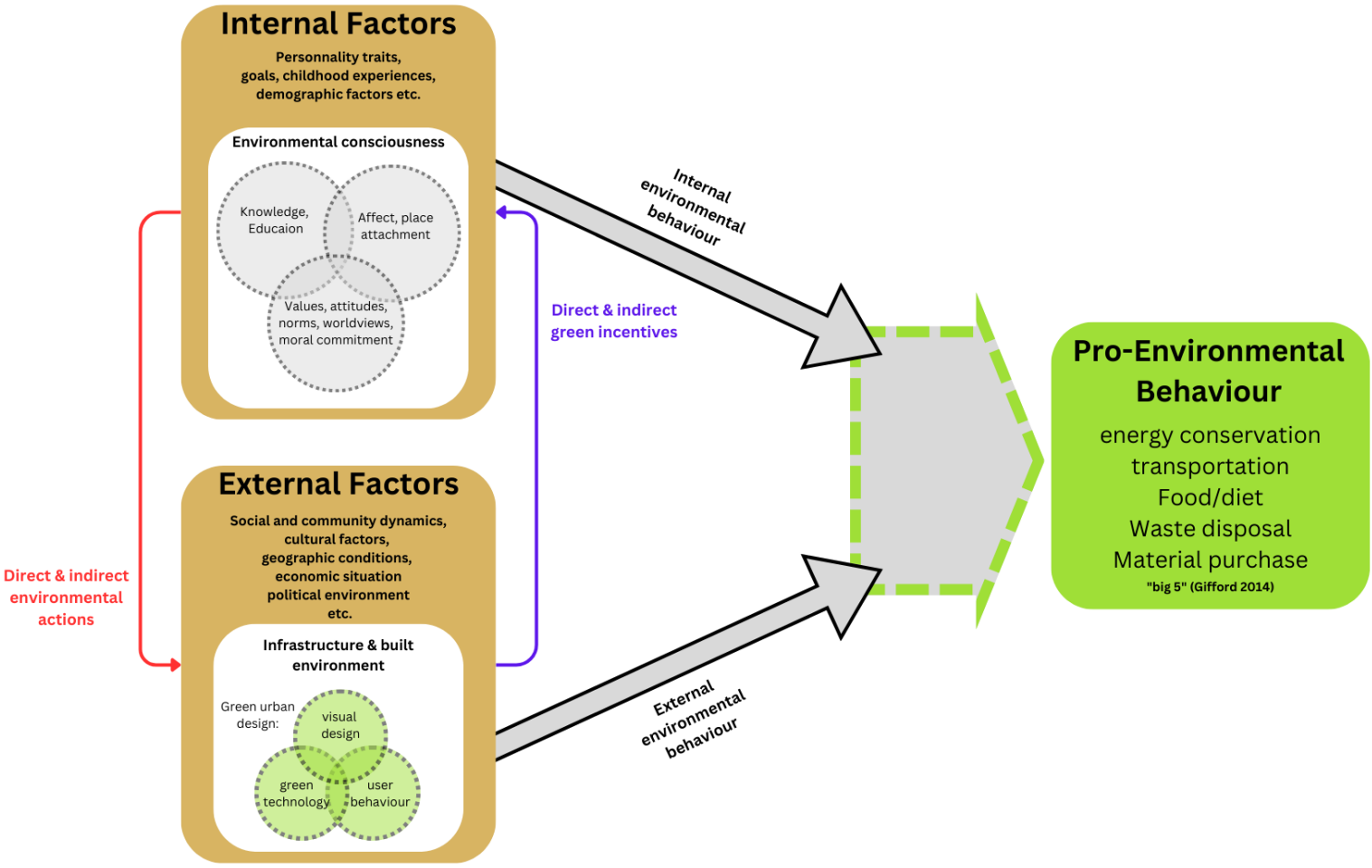

Figure 7: Author's adaptation of the Pro-Environmental Behaviour framework from Kollmuss and Agyeman, 2002

Methodology

This chapter elaborates upon the research design and its timeline, and the methodology used for this thesis. It describes the steps taken to build the structure and analysis of this study to answer the Research Questions.

Research design

The research design follows an exploratory approach to investigate the intersection of green urban design and pro-environmental behaviour in the home of sustainable individuals. Below is the timeline of the research design (see Figure 10).

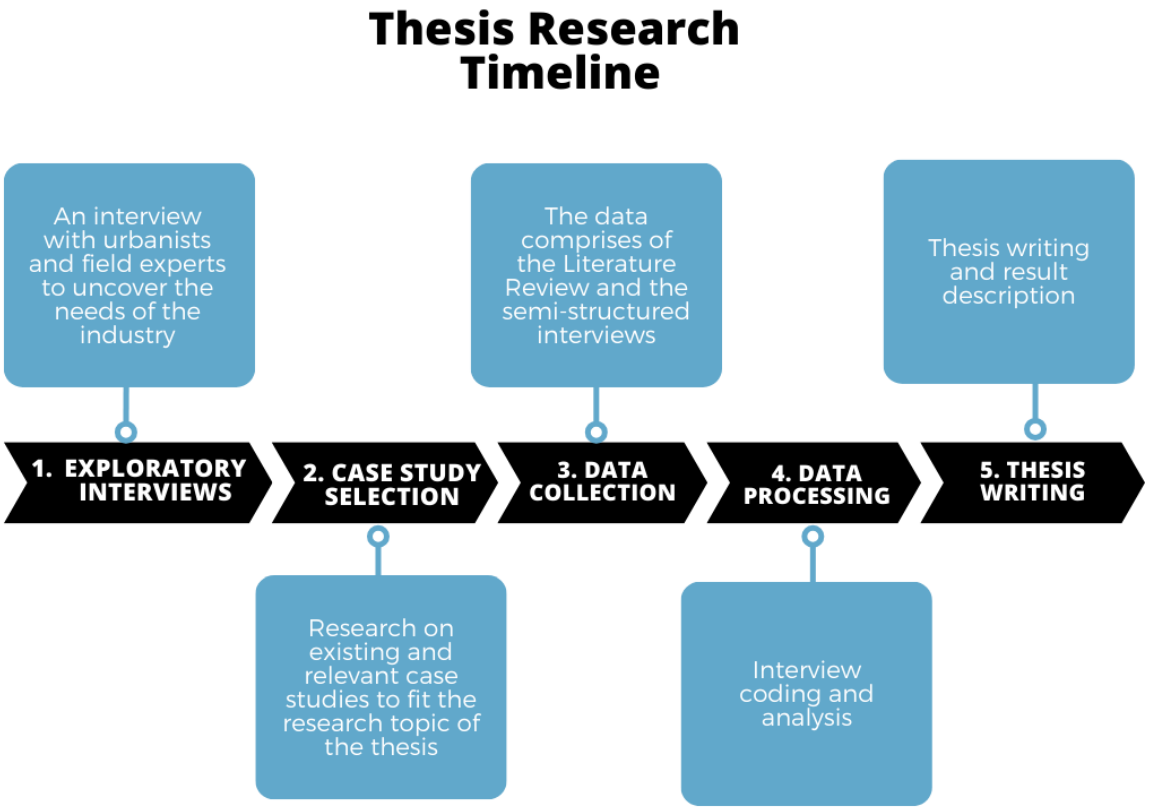

Figure 8: Research design timeline, a description of the steps of this research thesis

The research timeline:

1. Exploratory interviews:

Field experts and practitioners were interviewed to better understand the issues around urban sustainability, and to reveal a gap in knowledge from the practitioner's perspective. This assured that the thesis would investigate a valuable problem and provide looked after knowledge. Three exploratory interviews were conducted during the initial process of the thesis, each providing a different perspective and approach to urban sustainability and the role of urban design. The first interview was with a Social Urbanist at the European Commission, the second with a Circular City Officer at ICLEI and the third with an Architect/urbanist at

the French Development Agency (AFD). The combination of these interviews allowed the author to gain insight into the discussions and issues identified by the experts working with urban sustainability daily, which provided great inspiration in finding the gap this thesis will aim at researching.

2. Case study selection:

A period of researching was dedicated to exploring the various projects that have been done relating to green urban design and sustainable urban solutions in Europe. During this time many initiatives and projects were discovered, amongst which the most relevant and suitable project was chosen. For this assignment instead of an initial three case studies, the focus was placed on only one project to provide a less varied but more profound analysis. This however also translates into a less comparable and more specific results of this thesis, which must be kept in mind. In the process of exploring various cases in Europe the most helpful tool was the Naturvation atlas, which is a comprehensive database of nature-based solutions for cities created to date (available at https://naturvation.eu/atlas.html) , and the review of urban design and architecture reports such as Arup's '50 city stories explored' design book. Schoonschip was found during online research on self-sustaining urban design case studies and appeared to be an intriguing case for a floating sustainable neighbourhood mainly designed by the residents themselves.

3. Data collection:

The data that informed the analysis of this paper came from two main sources: first a thorough review of previous urban design and pro-environmental behaviour literature, and secondly ten semi-structured onsite and online interviews with residents and project managers of Schoonschip. This process is further described in the following sections.

The literature review

The literature review was a lengthy process which unfolded in multiple steps. First an extensive literature review of more than 50 academic papers and additional grey literature led to the identification of key theories and gaps, and the conceptual framework that would then be used for the analysis of this thesis. Academic search engines such as Google Scholar and the Lund University Online Library research engine LubSearch were used to find relevant articles and map up the academic context for this research thesis. Initial keywords used during the research included: green urban design, sustainable urban living, sustainable urban design, sustainable lifestyle, pro-environmental behaviour, urbanism, and nudging. Then the keywords were refined to specifically look for information about the relationship between green design and behaviour patterns, using words such as 'green urban design nudging' while looking for qualitative studies. Throughout the search process, where feasible, individual keywords were combined into complex search statements, such as 'green urban design inducing pro environmental behaviour' or 'influence of green urban design on sustainable residents. The bulk of the processed literature comprised not only peer reviewed academic journal articles, but also books, news article and commissioned research reports. Since the case study used here can be representative of the North European context, the majority of processed sources stem from European and North American countries as well. In addition to the academic literature, some grey literature was reviewed, such as news articles, and the official project's website of Schoonschip and its open-source educational website.

Schoonschip's official website can be found here: (https://schoonschipamsterdam.org)

Schoonschip's open-source educational website can be found here: (https://greenprint.schoonschipamsterdam.org/).

The Interview collection

Ten semi-structured interviews followed an inductive and exploratory process. The interviews were conducted in English and person during the week of project visit when possible, and online (via Zoom) after the visit. The sample of the interviews comprised of 8 residents and 2 project managers (one from each main external partners of the project: Metabolic, a sustainability consultancy; and Space&Matter an architect studio). The choice of the residents was mainly following a random sampling and was very much tied to having an interview in person on the project during that week, meaning that it represents mainly residents that I was able to meet and that were willing to dedicate some time to the interview. Regarding the content, the interview design included questions that were slightly different according to the category of interviewees (see Appendix for interview designs). The interviewees either received the 'resident' or 'project manager[9]' questionnaire, which aimed at gaining insight into each category's perceptions on the possible influence of urban design on pro-environmental behaviour of the residents of Schoonschip. In both cases the interviews were recorded, transcribed, and then coded for data analysis. Most interviews lasted between 30 and 50 minutes. For the project managers, the questions aimed at assessing the PEB intention of the project, and whether from a professional perspective there is possibility to further develop the intersection of green urban design and PEB or not. The visit to the project site in person and having the opportunity to talk to the residents face to face, also allowed the authors to make observations and cross validate some findings, thus allowing for a comparative analysis which will prove to be useful in revealing some discrepancies.

Figure 9: Conducting the interviews in person in Schoonschip (the author and some residents of the project). Source: author.

[9] Project managers, here and throughout the thesis designate the professionals that were hired to work on the project externally representing one of the partner organisations on the project. These could be sustainability consultants, architects, legal advisors etc.

Interview demographics

The following table presents additional information on the interviewees (see Table).

Table 3: Interview demographics

Interviewee	Age group	Gender	Profession	Time lived on Schoonschip
Resident 1.	45-55	Male	Architect	8 years
Resident 2.	60+	Female	Retired	10 years
Resident 3.	35-45	Male	Actor	5 years
Resident 4.	45-55	Female	Life Coach/ Entrepreneur	3 years
Resident 5.	25-35	Male	Entrepreneur	4 months
Resident 6.	35-45	Male	Teacher	4 years
Resident 7.	45-55	Male	Sustainability Director at chemical firm	10 years
Resident 8.	35-45	Female	Teacher	4 years
Resident 9/ Project Manager 1. at Space&Matter	45-55	Male	Architect	7 years
Project Manager 2. at Metabolic	35-45	Male	Project Manager, sustainability consultant	0 years

4. Data processing:

On one hand the interviews were transcribed using an online open access AI transcription service and coded manually using Microsoft Word by identifying themes, patterns, and discrepancies. On the other hand, the literature review gave an interdisciplinary understanding of the main theories key for the topic of this thesis and allowed for the analysis of the recurring factors for PEB across disciplines (Table 2 in Chapter 3 on Literature Review). In addition, the site observations allowed for the author to maintain a critical eye and identify discrepancies between the perceived impact of green design on their behaviour and their actual behaviour (which will be further explained in the Discussion chapter).

5. Thesis writing:

Once all the data was gathered and processed, the last step was to piece the information together, structure and analyse the data in a way that is constructive and allows the reader to gain insights for further research.

To answer the first Research Question (RQ.1)*"To what extent can the green design of Schoonschip further induce pro-environmental behaviour in its sustainable residents?",* a theoretical analysis is given based on the Literature Review in chapter 3, and on a practical level in the results section in chapter 4.

To answer Research Question (RQ.2) *"Which features/factors have been perceived as most influential by the residents, and why?"* a narrative analysis of the interviews and observations was conducted. From the results of the analysis and coding a deduction was done to reveal the relationship between the green design elements present in the case of Schoonschip and the presence of pro-environmental behaviours. From there a discussion is opened relating back to the knowledge present in the literature.

Case boundaries

This study is bounded by a number of limitations due to the nature of the project and case study, the methods employed and the scope of this thesis. This means that the results brought to the attention of the reader come from a number of observations and considerations confined to this case but which the author urges to be expanded and further studied on other grounds. The results of this study are therefore an initial and exploratory undertaking on a topic still unexplored, which the author hope engender interest and stimulate additional scholarly inquiries into the subject matter.

The following are some of the limitations that must be addressed:

- The majority of Schoonschip's residents are actively committed to sustainability, reflecting strong ecological values and behaviours. In this context, the potential impact of Schoonschip's green design may not manifest as a radical shift in behaviour, as is often the case for individuals not already engaged in sustainable practices. Instead, the question is whether the green design of Schoonschip nudges the residents to go beyond their established pro-environmental behaviours. A recommended avenue for further research involves exploring the effects of green urban design on non-sustainably inclined individuals, especially within social housing projects where emphasis lies more on affordability than sustainable engagement. In such cases the impact of the green design might be more easily perceptible.

- The primary data of this study is based on semi-structured interviews conducted amongst the residents and projects managers of Schoonschip. Interviews can be a complex source of information for research since it can be subject to biases such as the social desirability bias, (where respondents tend to answer questions in a manner that will be viewed favourably by others); or recall bias (where the participants inaccurately remember or report past events or experiences). This is especially important to take into consideration since this thesis aims at analysing the perceived effects of green design on the residents' behaviour. To counter the risk of these biases, the interview design anticipated this by integrating cross-validation and consistency questions, however the risk of these to occur is still present.

- The sample size of the interview respondents is limited to ten, thus representing only about 20% of the households on Schoonschip. Within the timeframe of this thesis, it was difficult to engage with more residents, and the author acknowledges that this percentage is only a sample and cannot be completely representative of all the residents of Schoonschip.

- The complexity of variable. The physical environment is only one of the many influences that affect the behaviour of people. Even if this study tries to measure and analyse the various factors that influence the pro-environmental behaviour of the residents, these are too numerous and complex to discern exhaustively. The green urban design of Schoonschip is only one of the factors that influence the residents, and it is the aim of this thesis to provide as good as possible of an understanding on this influence. It must be considered that these factors are often intricately interconnected, making it challenging to study them in isolation.

- The temporal factors and contextual influences. The context in which the study is conducted plays a significant role in shaping user behaviour and perceptions. External factors, such as changes in policies, events, or the overall socio-economic environment, may impact the study results. Post-occupancy studies like this one are typically conducted at a specific point in time, and findings may not capture changes in behaviour or perceptions over the long term. A snapshot approach might miss seasonal variations, changes in occupancy patterns, or adaptations by users over time. This thesis thus provides an understanding of the influences of the green design of Schoonschip up to the date of this thesis.

Results & analysis

In this chapter, the findings are systematically presented and described in alignment with the logic of the analytical framework. The research data, encompassing codes and themes derived from interview transcripts, is organized into two sections based on the Pro-Environmental Behaviour (PEB) analytical framework—categorized as either 'internal' or 'external' factors, reflecting their predominant influence on residents' PEB. Table 4 offers a summarized overview of these factors, providing a precursor to the detailed descriptions that follow. At the end of this chapter, Table 5 compiles and categorizes the features of Schoonschip under Internal and External factors.

Table 4: External and Internal factors mentioned by the interviewees regarding PEB

EXTERNAL factors	Interviewees mentioning it	Nb of total mentions	INTERNAL factors	Interviewees mentioning it	Nb of total mentions
Green design (sustainability criteria of the houses, common jetty, green roofs, daylight orientation, materials etc.)	1, 2, PM2, PM1	7	**Knowledge transfer, learning, growth**	1, 2, 6, 7, 3, 8, PM2, PM1, 4, 5, 8	**45**
Green technology (solar panels, smart grid, batteries, closed loop showers,	6, 8, PM2, 1, 2, PM1, 7	12	Environmental consciousness & advocacy	1, PM1, 2, 3, 7, PM2	18
Community	1, 2, 3, 4, 5, 6, 7, 8, PM1, PM2	**95**	Resource efficient attitude, optimising consumption	1, PM2, 2	4
Being part of a participative project	1, 3, PM1, PM2	11	Environmental commitment	1, PM1, PM2, 3, 7, 8, 4, 5, 2	29
Financial Incentives and Cost-Effectiveness	1, 2, 3, 7, PM2	20	Ecological values	3, PM2, 1, 2, 7, PM1	18
Social sustainability	1, PM1, PM2, 3, 4, 5	15	Lifestyle	2, 3, 7, 8, 1, 4, 5, 6, PM1	20
Life phases (age, generation gap, demographics)	1, 4, 5, 6, 3, 2	25	Consumption habits, routines	1, 2, 7, PM1, PM2	13
Economic situation, financial ease	PM1, PM2, 4, 5, 7, 1, 3	25			

Geographical inequalities, gentrification, neighbourhood differences	PM2, PM1, 1, 3, 4, 5, 7	21			
Spillover effect, inspired others	1, 2, 7, PM2, PM1, 3, 6, 4, 5	33			
Shared services: mobility, online marketplace etc.)	2, PM2, PM1, 4, 5, 6, 7, 1	22			

The interview data analysis proceeded as follows: following coding and identification of key themes within the interview transcripts, these themes were then cross-referenced with the internal and external factors outlined in the Pro-Environmental Behaviour (PEB) framework. The significance of each factor was gauged based on the number of individuals mentioning it (with precise details of interviewees associating the factor with PEB) and the frequency of its recurrence throughout the interview sessions. It is important to note that for clarity and relevance, only the most frequently mentioned factors were included in the final table, providing a focused representation of the factors perceived as driving Pro-Environmental Behaviour by the interviewees.

External factors:

The following section presents the external factors most mentioned by the interviewees during the data collection process. The term 'external factor' here refers to any factor that is beyond the direct control or influence of the individual, in line with Kollmuss and Agyeman's definition.

- *Green design*

Green design was only mentioned explicitly or identified as a nudging factor by the residents or project managers of Schoonschip a few times (only 7 mentions of the term 'green design'). Resident 2 noted however, that the visually appealing green design of the project worked in favour of the reputation of Schoonschip and inspired neighbours/visitors, raising their curiosity and awareness about green urbanism and sustainable development solutions: "What I like about this place is that we live in such an attractive way that already by the spot and the design, many people say, 'oh, wow, that's really interesting. I want this too. I would live here.'" (Resident 2).

There seems to be a dichotomy regarding the role and influence of green design on PEB. Some residents argue that the point of a great and effective green design is to avoid behaviour change. In fact, green design should allow behaviour consistency: "My idea with sustainable design, if you do it right, it does not change your behaviour a lot. Because it should just work. And I'm inclined to think that most people don't want to be bothered with the stuff too much" (Resident 1). This raises the question of what the aim of green design really is. If indeed, it is implemented to replace PEB and individual's efforts by the design itself, it can be seen as a short-term solution that doesn't increase environmental awareness and knowledge, but achieves sustainable results nonetheless. If, however, it is used to promote PEB, it appears to

fail at doing so, at least in the perception of these individuals. On the opposite other residents and project managers (Residents 3 & 8, Project Manager 1) seem to indicate that green design is actually a powerful and seamless nudge for PEB: "By seamlessly integrating green spaces, eco-friendly technologies, and visually appealing design, the community fosters a strong connection with nature while promoting eco-conscious behaviours." (PM1). Green design indicating the display of waste facilities, floating garden and green roofs etc. for example, it was mentioned by project Manager 1 that the easy access to these facilities and clear instructions particularly motivated residents to engage in PEB (PM1). Resident 3 mentioned that the design of the houses (light orientation, materials, green roofs, sustainable heating, and water systems etc.) influenced their every day: "having a house like that is in so many ways, forming your behaviour".

Generally speaking, the residents showed more awareness about the specific green technologies and features (shared mobility, apps, solar panels) and social aspects of the project (common spaces, sense of belonging, etc.) than the design of the project itself. The conscious or subconscious influence of this is not measurable therefore, not meaning that it is non-existent, however.

- *Green technology*

The role and impact of the chosen green technologies on Schoonschip was more mentioned than the green design (about 12 mentions of the term 'green technology'), showing more awareness and preoccupation over these. Most green technology features mentions were regarding the solar panels, the smart grid, the closed-loop shower system, the apps (online marketplace) and shared services such as the mobility hub (electric cars and bikes at disposition).

According to some residents, green technology provides more comfort and convenience allowing for their behaviours to remain unchanged: "the green technology hasn't caused major shifts in my behaviour. The convenient access to resources and the self-sustaining features of the community maintains a comfortable living standard", "the efficiency and automation of the sustainable systems within the houses reduce the need for significant behavioural changes" (Resident 8); "mmm maybe not? I'm not sure whether the green technology or the architecture changed our behaviour" (Resident 6), "it's great that we live here, that we can be so energy friendly. But you really need a system for that. I mean, I don't have to put effort into it to make it work." (Resident 2). In addition, according to Resident 2 green technology is a great tool for providing more comfort and reducing the impact of the households at the same time: "because on a systematic level, if it can really help you to live in a comfortable way and use less energy... Why wouldn't it? it's really an attractive way to do that.". Importantly, Project Manager 1 noted that if the green technology is well done, it should provide sufficient efficiency gains that it cancels out the possibility of the Jevon's paradox (or rebound effect), showing an awareness from the project manager's side and an intentional decision to counter that: "The efficiency of these showers underscores the success of implementing sustainable technologies that have a minimal boomerang effect on energy consumption. It exemplifies how technological choices can lead to lasting positive outcomes".

However, an even greater number of residents and project managers perceived green technologies as transformative and behaviour changing agents. Project manager 1 notes that green technology makes PEB more convenient and encouraged: "with easily accessible waste collection facilities and clear instructions, residents are motivated to sort and recycle waste effectively, reducing environmental impact." (PM1). Residents 4 and 5 mentioned that due to

the apps and shared services they consume less and more consciously than before (second hand clothes, dietary changes, flying less etc.). In addition, Resident 2 stated that the share mobility services changed their habits: "now that we live here, we only use the shared mobility hub, so we rent cars when we need that. We sold our car". Resident 2 continued by saying that the shared services really changed his view on individual ownership: "living in this community has led us to embrace collaborative consumption, such as sharing resources like cars with others, reducing the overall demand for individual ownership". Moreover, the special care and awareness needed for the green technologies have forced the residents to modify their habits and learn about the sustainability of the technologies used: "you cannot put detergents like chloride in the green toilet system. You should also not put synthetic stuff" (Resident 1).

Finally, the green technology installed at Schoonschip has not only reduced the carbon footprint of the households but also inspired others and worked as an exemplary project for many state-of-the-art green technologies: "the integration of advanced technologies in our home has not only improved sustainability but also inspired others to explore similar solutions"(Resident 7).

- *Community*

The one feature of Schoonschip that came out as the most impactful from the interviewees perspective, was undoubtedly the community living (the term 'community' mentioned more than 95 times during the interview process).

The community of Schoonschip acted as a real catalyst for pro-environmental behaviour, and fostered a strong sense of community engagement where residents actively share resources, knowledge, and experiences through various app groups and activities (Resident 1, 2). Resident 4 even stated that talking about sustainability is not enough and one must show action: "I started living here and then I decided okay I can have a big mouth and talk about what I think people should do, or I should bring my own offering. So not flying is my offering." (Resident 4). Being surrounded by sustainable individuals incited most residents to take up new habits such as vegetarianism to be more in line with their sustainable values: "living here we really tried to eat as much vegetarian, some vegetarian stuff we really like but most of them we really don't like. But we got more conscious. There are a lot of vegetarians and veganistic people here. And we're on the right path" (Resident 6). Living in such a close-knit community has allowed the residents to learn from each other and get inspired. By sharing successes and supporting each other's green initiatives, residents reinforce a culture of sustainability and inspire one another to strive for even higher environmental standards (Resident 7, PM1): "observing the positive changes in my own lifestyle and the collective efforts of the community has shown the potential of such projects to influence broader societal change". The success of the project is attributable to various elements, but the commitment of the community to sustainability was an important one: "the experience of being part of a sustainable community has instilled a commitment to eco-conscious living, driving continuous lifestyle changes" (Resident 8).

However, the community served not only as inspiration but also as a positive self-reinforcing social mechanism that pressured residents into being better sustainable community members. For example, individuals wouldn't feel comfortable having unsustainable behaviours by fear of being judged by other residents: "personally, let's say if I were to go on a holiday to the Bahamas for a week, I would feel a little bit uncomfortable telling everybody about it."(Resident 1). Another pressure point is the fact that the project was done very publicly, and with the aim of becoming 'the most sustainable floating neighbourhood of Europe', creating

a pressure on the residents to behave in an exemplary manner: "being part of this sustainable community has fostered a social and internal commitment to sustainable living. Knowing that I am surrounded by like-minded individuals and living in an exemplary project encourages me to maintain sustainable practices and serve as an advocate for sustainability." (Resident 3)/ "other people know that you live in a sustainable project, and they're like, 'oh, I thought you don't eat meat' or not that I eat a lot of meat, but I guess you also feel still sort of the pressure not to"/ "As residents of Schoonschip, we are not only committed to living sustainably for ourselves but also strive to be living examples of sustainable practices to inspire others. Our conscious choices have an impact on how others perceive sustainability and consider their own actions" (Resident 3).

Nonetheless, the strong community of Schoonschip also meant being surrounded by likeminded people and belonging to a strong and supportive group (Resident 2). The shared motivation to address environmental issues and desire to be part of a like-minded community brought together innovative and enthusiastic individuals, ready to "build a project fundamentally fit for the future" (Resident 7). Multiple residents mentioned the unexpected importance and value of living in a supportive community, where people know exactly who you are: "I guess it's also a form of sustainability to be grounded within a community and you help each other out. And you feel like you are part of something. I value that more than that, I know that my energy bill is lower" (Resident 3).

Moreover, according to the residents, such a community is a great space for being challenged. From questioning the importance of individual ownership, rather than shared services, or trying out different diets, the residents mention being challenged by other members and admit having grown from it. Residents 2 and 7 admit having been challenged in their habits: "living in this community has led us to embrace collaborative consumption, such as sharing resources like cars with others, reducing the overall demand for individual ownership" (Resident 2), "participating in this project has empowered me and the community to challenge conventional norms and strive for a more sustainable way of living" (Resident 7).

In addition, when the focus is often on the green design or the green technology used, in the case of Schoonschip it is interesting to note that the maintenance and upkeep of these design elements is just as important. Resident 2 has noted that this work is crucial for the success of the project and is done by residents voluntarily: "The focus on energy management has been significant in our sustainable community, and it has required substantial efforts from volunteers to maintain the functioning of the smart energy grid."(R..2). The growth of some individuals into the role of monitoring and maintenance also allowed the community to continuously learn and grow towards lessening their carbon footprint and environmental impact.

Finally, such a strong environmental community can often be the source of conflict and various power dynamics. It is interesting to see that multiple resident (3, 4&5, 7) noted some conflict and disagreement around some behaviours (flying, owning a car etc.) but still generally agreed on having to go beyond politicising environmental behaviour and censorship, to remain a supportive and inspiring environment for all to grow. Resident 3 for example highlight the multiplicity of meaning behind sustainability and the importance of finding it's individual meaning according to their own values: "you could have a diesel car and focus on animal welfare, and that can also be 'sustainable'. And you don't have to judge that, or you can just think for yourself what you find important.". Residents 4 and 5 note that Schoonschip mirrors society: "I think it's a beautiful reflection of society, living here. Also, the little hiccups between neighbours, and then talking about it, and bringing people together, getting over their own

issues" (Resident 4&5). Project manager 1 also mentioned that a project should ultimately not only be measured in its technological success but also by the quality of the community cohesion and well-being of the residents.

- *Participative project*

From the very start of the project, the participation of diverse groups and experts was important (11 mentions of the term 'participative'). This quickly became the core of the project itself, aiming to become the most sustainable neighbourhood built by the people for the people, cutting out "intermediaries and ensuring that margins benefit the community" (PM2), Thus bringing attention to the extractive model prevailing in the industry and encouraging developers to adopt more responsible and sustainable approaches.

The participative approach of the project allowed the residents to really dive deep into the topics of sustainability and be transformed by the process of building the project themselves. Residents mentioned multiple times just how transformative this process was for them, as they entered the project with certain values and behaviours and came out more environmentally aware and engaged: "The process was really what changed people" (Resident 1). Resident 3 shares that "living in this sustainable community has been a transformative learning journey, where active participation and engagement have been instrumental in personal growth and awareness.". He further explains that in is the number of decisions to be made and the necessary knowledge that changed them: "because you have to go through so many choices building Schoonschip, like what kind of materials do I use? What is affordable, what is good?". It was truly the experience of learning by doing that change their behaviours as well: "Our involvement in the project not only taught us about sustainability but also brought about changes in our behaviour and decision-making."(Resident 6).

As a matter of fact, the project stands out for its participative process as well, which is still novel in the building industry. The residents highlight that the success of the project has to be measure not only in it reaching its sustainable ambitions but also for its participative process: "While aiming to be the most sustainable project in Europe, success was not solely measured by predefined metrics but by the transformative journey undertaken." (PM1).

Another important aspect highlighted by Project Manager 1, is the sense of ownership and willingness to change that came from the participative process. Indeed, the community member were much more likely to change their behaviour and try out new habits as the motivation to do so came intrinsically and from them as a community, and force upon them from an external or top-down manner: "The community aimed to involve all members in important decisions about communal spaces, activities, and events."(PM1). Hence the behaviour change was easier the more inclusive and participative the process was, which the expert consultants and consultants the project partnered with quickly realised and facilitated as well: "Space&Matter facilitated opportunities for residents to voice their preferences and ideas, giving them a sense of ownership and agency in the project."(PM1).

The residents shared that having their voices heard and counted on for the development of the project, induced a sense of responsibility and commitment to the project and thus sustainability as well. PM2 stated that "the community's commitment to sustainable decision-making, including the choice of technologies and layout, reflects a sense of responsibility for creating a sustainable and cohesive living space". Moreover, the project took more than 10 years to be fully completed, requiring an important time and financial investment from the residents, only possible through their great commitment to the process and goals of

Schoonschip: "One thing that keeps on inspiring me is that this project took rather long... in the end it was 10-12 years. Having gone through this and how I've changed my behaviour in the last ten years, it has also taught me that actually if you need to change 180 degrees it seems like too much but if you just start and every time you turn a little bit and you do it in small steps... it goes surprisingly fast, and you can achieve amazing things." (Resident 7). Resident 7 also shared that such participative processes really have the potential to transform nit only individuals but collective behaviour patterns: "Observing the positive changes in my own lifestyle and the collective efforts of the community has shown the potential of such projects to influence broader societal change."(Resident 7).

Finally, it was interesting to hear that that project worked as a rallying point for sustainability enthusiasts, keen to be part of a pioneering environmental venture. It was truly an opportunity for collaboration and participation from many various experts and non-experts to further research and development in sustainable urban solutions: "Schoonschip project brought together a diverse group of architects, consultants, and experts, creating a collaborative think tank with a wealth of sustainability-related knowledge and skills", "This open research and development (R&D) process fostered extensive discussions and brainstorming sessions on sustainable practices, allowing for the integration of multiple perspectives and innovative solutions", "Schoonschip project acted as a catalyst that brought together like-minded individuals with a shared passion for sustainability. It provided them with an opportunity to collaborate and work towards realizing a truly sustainable and eco-conscious community" (PM2).

- *Financial incentives & cost-effectiveness*

Along the prominent environmental and social values of the community, the financial and economic incentives can't be neglected when it comes to nudges for PEB (20 mentions of the terms 'financial' and 'cost-effective').

Indeed, the green technologies and design of the project promised great energy and water efficiencies, thus reducing the bills of the residents' long term: "reduced energy costs, play a crucial role in incentivizing sustainable actions" (PM2). This appeared to be true especially in times of geopolitical instability and inflation, which didn't impact the residents of Schoonschip, who's energy bills were sometimes even negative (excess production of energy via the solar panels): "The transition towards renewable energy and reduced dependence on fossil fuels has made our energy bills net zero or below zero, rewarding our investment.", "The shift towards renewable energy has not only had environmental benefits but has also made us less vulnerable to the fluctuations of fossil fuel markets." (Resident 7).

The various green technologies such as the solar panel and smart grid system also incentivised behaviour changes in order to reduce costs and consumption: "We try to run the washing machine during the day... because electricity is cheaper." (Resident 1). Importantly, the project provided the opportunity of owning a house, a true privilege in centre Amsterdam, especially at a young age, according to Resident 3: "My reasons to join the project were like 'Wow, I get to buy a house', especially in Amsterdam, the housing market is crazy". For the various partner organisations, this project presented a great financial opportunity as well as they could gain publicity and credibility in the green urban design market: "The thing about all the external parties is that this was a prestige project, they got paid less and they could make some promotion for themselves." (Resident 3).

- *Social sustainability*

Social sustainability was mentioned by the residents and project managers as ultimately the most important aspect of the project (15 mentions of the term 'Social sustainability'). The importance and value in social sustainability was just as surprising to the residents as it was for the project managers, that quickly realised that environmental sustainability isn't complete without the social sustainability. Resident 3 explains that "in the build-up of the project, you're only busy with designing the houses and the technology. But I guess the social part, that's so much more important than living on a boathouse, that's something I hadn't realized before living there that it's also 'sustainability'". Many of the residents even mentioned social sustainability to be more important than the green technology, the design of the project or environmental sustainability: "This social support system in Schoonschip is almost more important than that we have solar panels."(Resident 3). It could be argued that environmental sustainability provides space and a tangible structure for social sustainability to flourish: "Using environmental sustainability to build a very social, sustainable community is a real win-win" (Resident 1), "integrating communal spaces into the design played a role in the social sustainability of the project" (PM1), "Residents actively collaborated, fostering a tight-knit community that transcended the project's environmental achievements " (PM2).

From the very first feasibility master plan, (PM2) Schoonschip wanted to integrate diversity and inclusivity into its community. Resident 4 shared that "in the process of choosing who could join the project, they called it the 'horizontal waiting list' so that it's not just the white, wealthy people who get in. It's less to do about wealth and looks for more different backgrounds". However, the project didn't go according to plan regarding social inclusivity: "we didn't want to spread the message that you can only be sustainable when you're rich. So, we tried to have a social housing within the project, but that was really hard. It was a big hassle to make it work because it's a private project and then we have this municipality and the corporation who wanted to finance the houses, but they wanted to have a say in the whole thing, and it became a big struggle" (Resident 5). In its current form, the project raises questions of social and environmental injustice, of which the residents are aware and acknowledge concerns of gentrification and strive for socially inclusive practices: "Residents actively discuss and address issues related to affordability and access, aiming to ensure that sustainable living is accessible to diverse socioeconomic backgrounds." (PM1), "The team recognized that achieving sustainability goals required addressing not only environmental concerns but also social equity and inclusivity" (PM2).

What the project has achieved nonetheless, is a strong support system and social net, which has been unvaluable to various community members: "The moment that I came to live here, I had Corona. It was like the first week of Corona. And then all these neighbours came to take care of me and bring me food and cook for me and ask me if I was okay. And it moved me to tears. It made me feel really cared for. And I haven't had that experience so much in living in a city" (Resident 4). Other residents struggling with single parenting or illness, have also shared positive experiences within the Schoonschip community: "Co-parenting in this community is incredible. We support each other in raising our children, and it's heartwarming to see how we come together as a family." (Resident 4), "just normal daily friendly interactions that give me sort of a... I guess it's also a form of sustainability to be grounded within a community and you help each other out. And you feel like you're part of something. I value that more than that, I know that my energy bill is lower."(Resident 3).

- *Life phases & demographics*

According to the authors of the PEB framework, Kollmuss and Agyeman, "two demographic factors have been found to influence environmental attitude and pro-environmental behaviour which are gender and years of education." (Kollmuss & Agyeman, 2002). Indeed, according to the data collected, age (and life phases such as children, teenagers, young adults etc.) have been mentioned multiple times by the interviewees (25 mentions of the terms 'age', 'generation', 'demographics').

There seems to be a notable difference in environmental concern across generations, with children that see recycling and waste fishing from the canal as a game (Resident 6): "there's a lot of plastics passing by through the water, and we do a lot of cleanups, we just grab it out of the water. And the kids start to do it as well, that's quite funny, you see there's a game". To teenagers that refuse to contribute to sustainable behaviours and call out the project as a 'sect'(Resident 2, 4): "We live with our youngest son. He still lives at home. And he's not so much concerned. I mean, he takes long showers, and we have discussions about that." (2), "My kids are not into it, but my kids are teenagers they call this a 'Sect' or 'cult'. To them we are the green Nazis. You can't do this, you can't make a fire, you can't do this... Those are the worst things. But yeah, they don't know yet. But they understand." (4). To young adults that engage in PEB without hesitation (Resident 3) and elderly that worry much about the sustainable future (Resident 2).

It has also been mentioned a number of times that the Schoonschip community gathers an upper-class educated group of individuals, that have been educated about environmental concerns, and this indeed makes a considerable difference (Project managers 1, 2).

- *Economic situation, financial ease*

As mentioned before, the participative project required from the residents a consequent investment in time, money and energy to accomplish what it has. This already isn't possible for most people and therefore preconditions a certain economic and financial ease necessary to be part of the project (the term 'economic' and 'financial ease' were mentioned 25 times).

The project has been called 'elite' by Resident 4 and 5, and Project Manager 2, acknowledging the exclusivity of the project. There is also a concern of the public image of the project: "There's also articles written about this place, saying it's all design inside, and it's just for the rich. So, we get a lot of critique and I think it's also very important that we take the critique and look at ourselves because it's true." (Resident 4). In addition, the high technological green solution that Schoonschip chose to install represented an important financial investment (such as the toilet system, the closed-loop showers, smart grid, ventilation system etc.), of which some allowed for cost efficiencies and reduced environmental impact, and others created problems: "The Blackwater system in the toilets is working... it produces very little water, so I think it's only like one or one and a half liter per flush. So definitely on water consumption, it's super-efficient." (Resident 1), "no there were upfall showers (closed loop showers) showers which recycle the whole water, but we were happy that we didn't have one because it gave a lot of problems to people."(Resident 6).

- *Gentrification and inequalities within the neighbourhood (geographic conditions)*

The geographic location itself of the project is key in understanding the social conflicts and pressures around the project. Situated in the Noth of Amsterdam in a post-industrial, working-class neighbourhood Schoonschip raises important questions of gentrification and social inequalities (PM1). These inequalities influence the behaviour and values of the residents, concerning their consumption habits for example. Resident 4 shared about the voluntary work with paperless immigrants just a few blocks away and her awareness about the critical situation of people living around the project: "there's kids that have no food at the end of the month. They go to school without food, they don't have a sandwich, and we're sitting here, you know?" (Resident 4). The entire neighbourhood and city of Amsterdam is going through important changes and gentrification: "the project stands as an island of sustainability amidst ongoing construction." (PM2), "The prices were rising in the cities, and we also couldn't afford it anymore." (Resident 1). Resident 3 describes the North of Amsterdam as the Brooklyn, New York: "Pricing is a thing, especially in the north of Amsterdam, because it was always like the Brooklyn of Amsterdam. It was a working-class neighbourhood and now all these rich people, which I guess I'm part of as well, moved in but this was already starting before Schoonschip."(Resident 3). What we can see here is that the residents of the project are well aware of these inequalities and eco-injustices, gentrification seems to be bigger than the project itself, which appears nonetheless to only reinforce this phenomenon (the term 'gentrification' was mentioned 21 times).

- *Spillover effect, inspiring others*

The notoriety and success of the project has created some spillover effects, inspiring similar projects internationally. The residents are mostly conscious of the visibility of the project and tend to behave more sustainably to be in line with the image of the project and lead an exemplary sustainable life (the term 'spill-over' and 'inspiring' was mentioned 33 times during the interview process). According to Resident 1, the project gets recognised around the world: "The city of Amsterdam is super proud of this community. So, wherever they go in the world, and they do a presentation, and we are always in it". Schoonschip has also influence greatly the green urban design landscape of Amsterdam and served a s a blueprint for suture sustainable community initiatives (PM1): "Schoonschip's pioneering model and positive outcomes have had a noticeable influence on municipal policies and regulations related to sustainable development. The project's success has prompted the city to reassess its approaches to green building codes and energy management".

The increasing number of visitors, however, presents a fine line between fame and lack of privacy. Residents have expressed that the number of visitors and tourists is starting to be irritating and pushes them to retract to the safety of their homes, thus spoiling the unique social sustainability of the community: "you get all sorts of media attention. But that's partly also a spillover effect you don't want too much after a while. You think, oh, that's another journalist" (Resident 2).

The residents have also expressed that the thorough green design of the project has created spillover effects from one behaviour and habit to another: "Living in this community has led to spillover effects in my behaviour, such as a heightened consciousness of energy consumption and waste reduction." (Resident 7).

Another interesting effect has been noticed by Project Manager 2, as Schoonschip has created positive spillovers for the partner organisations as well, as the number and size of green urban

design projects has increased soon after the release of Schoonschip: "Schoonschip's emphasis on education and research had unforeseen spillover effects that extended beyond individual behavioural changes. The open development process encouraged collaboration, knowledge-sharing, and the adoption of sustainable practices among builders and neighbouring communities." (PM2).

- *Shared services*

One of the notable green technologies on the project that has changed the behaviour of the residents are the various shared services such as the apps for the community's online marketplace for used clothes and furniture, the mobility hub consisting of electric cars and bikes/cargo bikes, and the shared house that serves as community space and event venue. The shared services account for a good part of the influence on the daily habits of the residents of Schoonschip (term 'shared' used 22 times in the interviews). Resident 4, for example has mentioned just how much the online marketplace has changed their purchasing habits: "when I moved here I had so much stuff, so we just put it on the marketplace and then when I look in houses, everyone has something from us, it's really funny.". The other important feature has been the mobility hub, which nudged the residents to give up their own cars to use a shares system instead: "Now that we live here, we only use the shared mobility hub", "Living in this community has led us to embrace collaborative consumption, such as sharing resources like cars with others, reducing the overall demand for individual ownership." (Resident 2). For some residents this process wasn't necessarily easy either, but still seem to have proven more efficient: "Having to put away my car and embracing car sharing initially seemed like a big barrier, but it has proven to be a positive change in my lifestyle.", "The shared car use and electric mobility have significantly influenced my daily choices and provided a more sustainable approach to transportation." (Resident 7). Lastly the shared house, used as a common space has been a tool for strengthening the social bonds of the community (Resident 5) and improve on the social sustainability of the project as the community hosted a Ukrainian family in their common house over 2022 (PM2).

Internal factors:

This section highlights the predominant internal factors, those most frequently mentioned by interviewees during data collection. The emphasis on internal factors aligns with the thesis's objective, which is to evaluate the impact of external factors on the Pro-Environmental Behaviour (PEB) of Schoonschip residents. Internal factors, as defined by Kollmuss & Agyeman in their PEB framework, refer to elements intrinsic to an individual, independent of external influences.

- *Knowledge, learning & growth*

The residents of Schoonschip are known to be well educated (amongst the residents there were actors, architects, engineers etc.) and particularly environmentally aware. It has been noted however that the degrees of environmentalism and knowledge of green technologies varied greatly between residents. Their level of environmental knowledge however has grown immensely through the participatory process of building the project: "During the building process, we spent a lot of time talking about the environment and how to build sustainably" (Resident 1), "Throughout the process of constructing the house, we gained valuable insights and acquired significant knowledge" (Resident 6). And from the everyday interactions between them since its completion, which pushes them towards continuous learning and growth: "I must say the drawback of that is being a bit of a bubble but on the other hand learning and

understanding from each other and that is what has surprised me the most and also that's kind of inspiring." (Resident 7), "Living in this sustainable community has been a journey of continuous learning and personal growth, where accumulated knowledge and experience have made me more adept at sustainable living, including insights into sustainable house construction and the complexities it entails." (Resident 3). In addition, the participatory aspect of the project also means that the residents got to interact and learn from the expert project managers and partners (Space&Matter, Metabolic), and learn from each other about best practices and innovative sustainability solutions.

- *Environmental commitment*

The environmental commitment of the residents of Schoonschip was strongly highlighted during the interviews (the term 'commitment' was mentioned 29 times in the interviews). This commitment was reflected in the amount of time and energy the residents dedicated to Schoonschip, which took about 10 years to be accomplished: "This group of people is quite aware; otherwise, you would not put 10 years into building your own environmentally sustainable house" (Resident 1). The environmental commitment of the residents can also be seen in the various innovative and daring green technologies and design solutions that were tested and used: "the project was a trailblazer for sustainable innovations, showcasing state-of-the-art technologies and design principles. Its success as a pilot project has become an influential model for inspiring future sustainable developments" (PM2). And in the continuous dedication of the residents to lessen their environmental and social impact, and always reduce their carbon footprint (Resident 8), which most of the time surpassed mere convenience and asked for additional effort (PM2). The engagement of the project members to build the project in the most participative way possible allowed the residents to make informed choices about sustainable features and technologies and "developed a sense of ownership and commitment to the project's overarching sustainability goals" (PM2). Finally, the project reflects a clear commitment to a holistic understanding of the sustainability values, that are just as social as they are environmental: "Their commitment to aligning with the Sustainable Development Goals (SDGs) showcased a broader commitment to environmental and social well-being" (PM1).

Table 5: Features of Schoonschip by category, PEB and type of factor

Schoonschip green design & technology features			
Green technology	**Green architecture**	**Green community**	**Green mobility**
isolation energy efficiency rating EPC=max 0; thermal energy heat pumps from surface water in collaboration with Aquathermia to heat and cool buildings sustainably; passive solar energy (building orientation, insulation, heat generation from ventilation system); solar water heaters; heat recovery system in showers for heating of buildings (Aquathermia); photovoltaic solar panels for electricity and individual battery per household; smart grid within the community; separated grey (i.e. washing machine) and black water (i.e. toilet) for the Waternet's (tap water supplier for Amsterdam and area) pilot project for biomass creation; smart grid for trading energy efficiently amongst the households	sustainable materials & installations (recycled plastic, local FSC certified wood, hempcrete insultation, timber framing); floating garden & green roofs; unique designs creating with Space&Matter integrating common ambitions and frameworks	joint food purchasing: fresh produce with direct contract with local farmers and restaurant leftovers; jetties & collective spaces: these favour social cohesion and engagement to the project's development; owners' association & foundation 'Pioneer Vessel' for knowledge transfer between sustainable projects own website (schoonschipamsterdam.org) & interactive opensource educational website (Greenprint), a committee for meetings and events: events such as clothes swaps, workshops, celebrations	shared cars, electrical bikes/cargo-bikes
EXTERNAL PEB factor	EXTERNAL PEB factor	EXTERNAL and INTERNAL PEB factor	EXTERNAL PEB factor

Discussion

RQ1.

To what extent can green design induce pro-environmental behaviour in the home of sustainable individuals?

The body of research and the involvement of urban planning practitioners in adopting green urban solutions to address unsustainable consumption patterns in cities have significantly expanded. Furthermore, the potent nudging impact of urban infrastructure, including housing, has proven to be a robust mechanism for influencing people's behaviour. If strategically implemented, green urban design holds the potential to propel city dwellers towards achieving the Sustainable Development Goals, thereby fostering a more habitable urban environment. The examination of Schoonschip provides a nuanced exploration of the intricate dynamics between green urban design and pro-environmental behaviour within the residences of environmentally conscious individuals in North Amsterdam.

This study demonstrates that the built environment can indeed sway and encourage individuals to adopt more sustainable practices. However, it is essential to acknowledge that this relationship is intricately linked to various other influencing factors.

The relationship between green design and Pro-Environmental Behaviour (PEB) manifests in various forms—direct, indirect, conscious, and subconscious. Through ten interviews conducted with project members, including residents and project managers, the diverse effects of green design emerged, perceived in multifaceted ways. Despite the terms 'green design' and 'green technology' being mentioned only 19 times, as compared to more frequently discussed factors like 'community' (95 mentions), 'life phases/age' (25 mentions), and 'economic' situation (25 mentions), it is crucial to delve deeper into the nuanced impact. A quick interpretation might suggest that green design and technology are not predominant concerns for residents, but this is only partially accurate.

Green design and technology exert a profound nudging effect, even if not overtly acknowledged by residents. Further analysis reveals that community-led nudges are made feasible by the prioritization of green technologies and common spaces within the built and designed green infrastructure. Notably, 50% of respondents explicitly claimed that green design or technology did not influence their behaviour (Residents 1, 2, 8, Project managers 1 & 2). However, when probed about specific behaviour changes, instances emerged, such as adapting laundry schedules to utilize solar power, relying solely on shared mobility hubs instead of personal cars, and opting for second-hand purchases through community platforms. Despite initial denials, tangible behavioural shifts were evident due to various green designs and technologies, often operating at a subconscious level.

Moreover, project observations and relevant literature complement the interviewees' perceptions, highlighting a discrepancy between what they say or perceive affects their behaviour and the actual impact. This underscores the complex interplay between green design, technology, and behavioural change within the context of the Schoonschip project.

Secondly, green design and green technologies can be powerful tools, however they can also represent the risk of rebound effects. Indeed, unless the green technology such as the closed-loop showers installed in some of the houses, don't provide sufficient efficiency gains to cancel out the potential rise in use, the Jevon's paradox as seen in the literature review indeed may

apply. This reinforces the literature on the need to accompany green technologies such as design with pro-environmental behaviours too (Stegall et al.). Some of the residents and mostly the project managers seem to be aware of this risk and confirm that green technologies tend to promote comfort above PEB and thus can create dependencies on these technologies. Project manager 2 for example, explained that Schoonschip is a trailblazer project with regards to the design features and technologies in place, however it doesn't promote such transformation of habits and behaviour patterns as more low-tech projects, such as 'the Ceuvel' (a sister project done by the same architect studio). In fact, such high-tech green projects like Schoonschip can be questioned for their sustainability regarding the reliance on experts and maintenance of these specialised green technologies and their overall impact and Life Cycle Assessment (LCA). It is important to remain critical of the overall environmental and social impact of the project throughout its life cycle and not just the user phase. In the case of Schoonschip, the environmental cost of the high technology features and equipment of the houses is very high and will most likely be out of date within ten years, since the technologies are evolving very fast, and the pieces needed to keep the green features working could be hard to find.

Thirdly, the green design is most transformative of behaviours when created in a participative way. In the case of Schoonschip, it is evident that the process of knowledge transfer and collaboration between experts and non-experts has allowed the residents to truly understand the impact of PEB and the potential of green design. Most members of the Schoonschip community mentioned the power of impactful discussions they have with other residents and how they encourage each other to improve on their consumption habits, or even feel pressured to align with the image of the project. By living in a sustainably minded community, it is the continuous improvements and resource-efficiency that allows the community to go beyond the convenience the green technologies offer them, and thus engage with sustainability in a proactive way. This also makes sure that the Attitude-behaviour gap doesn't widen, by encouraging the residents to put all their environmental knowledge to use and 'walk the talk'. The participation of the residents in the creation of the project also created a sense of attachment in line with the theory, meaning that the residents developed a sense of attachment to the success of the project and thus also a sense of commitment to the environmental and social values carried through the project. This confirms the initial hypothesis that there can be a risk of rebound effect, and this especially in that case that the residents are excluded from the decision-making process of the project.

In conclusion, this study substantiates the notion that initial Pro-Environmental Behaviours (PEBs) possess the potential to trigger spillover effects onto other behavioural domains. Green design, particularly facilitated by specific technologies requiring habit adaptations, such as embracing a vegetarian diet, can serve as a catalyst for residents to adopt a spectrum of PEBs. For instance, the initial shift towards a shared mobility service prompts environmental awareness, leading individuals to reevaluate ownership practices in various realms, such as clothing and food choices within the context of Schoonschip. This sets in motion a positive cycle of environmentally conscious initiatives originating organically from the residents themselves. The implication is that green design and technologies can unleash a ripple effect of PEBs, progressively influencing all facets of an individual's lifestyle.

However, a critical perspective emerges, suggesting that while green design can spark positive behavioural cycles, it is equally capable of fostering resource-intensive lifestyles. Policymakers, developers, and housing corporations need to be mindful of the far-reaching impact of their designs on the lifestyle choices and behaviour patterns of citizens. The deliberate setting of features such as infrastructure and built environment, the cultivation of a sense of community,

and the provision of economic incentives for PEB—all elements that can be intentionally crafted—should complement less influenceable internal factors like environmental values or demographic aspects. This calls for a nuanced approach in urban planning and policy formulation to ensure the promotion of sustainable behaviours without inadvertently fostering resource-intensive alternatives. External factors, being more frequently cited than internal ones in the interview process, underscore the need for intentional interventions in the design and planning process to align with broader sustainability goals.

RQ2.

Which green design features have been perceived to be influencing sustainably minded individuals' behaviour in the Schoonschip neighbourhood, and why?

Ultimately, the factors deemed most impactful by Schoonschip residents were the 'community' (external) and 'Knowledge transfer, learning, growth' (internal). The project's true value, according to residents, lies in the robust bonds they've forged—a sense of belonging, mutual support, and encouragement in their collective pursuit of sustainable living. The surge in community-led sustainable initiatives underscores the paramount importance of fostering a strong sense of 'community,' particularly in urban landscapes. The significance of community bonds has become especially pronounced in the wake of the Coronavirus pandemic, laying bare the prevalent alienation felt by citizens in their own cities.

Firstly, the Schoonschip community exemplifies the power of idea-sharing and mutual learning. Interviewees frequently cited fellow project members as influencers, noting that the communal responsibility of representing the project spurred them to continually enhance their Pro-Environmental Behaviours (PEBs). However, it's essential to acknowledge that the Schoonschip community, while tightly-knit, represents a relatively homogenous group of "like-minded and well-educated individuals" (Resident 4, 7, PM1, PM2), lacking diversity in ethnicity, economic status, and worldview. This privileged enclave contrasts starkly with some of Amsterdam's poorest working-class and immigrant neighbourhoods, raising a critical concern inherent in many green urban projects—eco-gentrification. Despite emphasizing the importance of social sustainability over technological or design aspects, Schoonschip has struggled to create inclusive opportunities for marginalized groups within its confines. The project's commitment to social sustainability, evident in its supportive and community-focused ethos, serves as a pioneering model for alternative sustainable urban living.

Secondly, the emphasis on knowledge transfer and continuous learning proved pivotal in adopting PEBs. The participatory nature of the project enabled residents to grasp the rationale behind green solutions firsthand. This learning process extended beyond the project's development phase, with residents continually improving their impact through open-source documentation, regular meetings, and feedback loops, notably facilitated by smart meters that inform energy and water consumption patterns.

Notably, despite Schoonschip's acclaim for its remarkable green design and innovative technologies, residents perceive social sustainability as a more enduring and profound marker of sustainability. This underscores the importance of complementing technical and social solutions in urban green design projects, emphasizing the significant nudging effect of social interactions. It becomes evident that fostering a cohesive and supportive community, coupled with ongoing education and shared learning, is foundational for the sustained success of green urban initiatives.

Looking forward, these insights shed light on the need for urban planners and policymakers to address issues of social equity and inclusivity in green urban projects. The unintended consequences of eco-gentrification pose challenges to the overarching goal of creating sustainable urban environments. Additionally, the study emphasizes the importance of integrating social sustainability metrics alongside technical assessments in evaluating the success of green design initiatives. Adopting a holistic approach that considers the social dynamics within and beyond a project's borders will be crucial for steering urban sustainability efforts towards truly equitable and lasting outcomes. The study also revealed that some of the barriers to PEB identified in the literature review, such as the level of education of the residents, their habits, and place attachment, notably played a role in the case study of this thesis. This underscores the complexity of influencing behaviour in urban settings and highlights the importance of considering diverse factors in designing effective interventions.

Reflecting on the methods

The predominant factors cited by interviewees as influencing their behaviour on Schoonschip were 'community' and 'Knowledge transfer, learning, growth.' This emphasis on communal and knowledge-sharing aspects, rather than the expected focus on green design and innovative technologies, provided a humbling perspective. Initial interview questions, centering on behaviour changes 'before' and 'after' residing in Schoonschip, fell short, with many respondents claiming no change or minimal influence from green design and technologies. This underscored the transformative impact of the participatory construction of the built environment, prompting a reassessment of the study's scope.

In the preliminary study phase, the research focus narrowed to consider residents as inherently sustainably minded individuals. The investigation then explored how the green built environment of Schoonschip, encompassing green design and technology, furthered their engagement. Kollmuss and Agyeman's pro-environmental behaviour (PEB) framework facilitated the identification of internal and external factors influencing residents' PEB and assessed the role of green design and technology in shaping their behaviour.

As the number of green urban projects increases and cities face mounting pressure to align with the Sustainable Development Goals (SDGs), understanding the impact of green design and technologies on sustainable individuals becomes imperative. Investigating the influence of specific design features provides urbanists, policymakers, and developers valuable insights into the behavioural consequences of their initiatives, facilitating intentional project development. The inquiry into 'to what extent' green design influences PEB delves into the mechanisms of this influence, examining the degree to which behavioural changes occur due to green design and considering the potential role of other factors.

However, it is crucial to acknowledge the study's limitations. The findings are context-specific, tied to Schoonschip's unique demographic, cultural values, and geographic conditions. While the project's features are not easily replicable, it stands as a valuable lesson for future endeavours. Schoonschip's unique characteristics notwithstanding, its aim is to inspire and guide upcoming projects, integrating lessons from its shortcomings. However, the limited representation in the interview sample size calls for cautious interpretation of community perceptions.

Conclusions

Practical implications and recommendations for non-academic audiences

In conclusion, the exploration of the potential influence of green urban design on pro-environmental behaviour, as investigated through the lens of the Schoonschip case study, has uncovered nuanced and multifaceted dynamics. The study has underscored the intricate interplay between internal and external factors, shedding light on the pivotal role of 'community' and 'Knowledge transfer, learning, growth' as the most influential determinants of Pro-Environmental Behaviours (PEBs) among Schoonschip residents. The significance of community bonds in fostering sustainable practices within urban environments has been accentuated, with the Schoonschip community serving as a compelling example of the power of shared ideas and mutual learning. However, it is crucial to acknowledge that this community, while exemplifying a supportive and collaborative ethos, exists within a relatively homogeneous demographic, raising concerns about potential eco-gentrification and the need for inclusivity in green urban projects.

Furthermore, the emphasis on knowledge transfer and continuous learning emerged as a pivotal aspect of adopting PEBs, facilitated by the participatory nature of the project. The residents' ongoing commitment to open-source documentation, regular meetings, and feedback loops highlights the role of continuous education in sustaining environmentally conscious behaviour beyond the project's development phase. Interestingly, despite the acclaim for Schoonschip's green design and innovative technologies, the residents perceive social sustainability, rooted in a strong sense of community, as a more enduring and profound marker of sustainability. This nuanced perspective underscores the importance of integrating social and technical solutions in urban green design projects, emphasizing the significant nudging effect of social interactions. Looking forward, the insights from this study hold valuable implications for urban planners and policymakers. The unintended consequences of eco-gentrification pose challenges to the goal of creating equitable and inclusive sustainable urban environments. The study emphasizes the need to integrate social sustainability metrics alongside technical assessments, adopting a holistic approach that considers the complex interplay of factors within and beyond a project's borders. Furthermore, the identified barriers to PEB, such as residents' education levels, habits, and place attachment, reinforce the complexity of influencing behaviour in urban settings, necessitating tailored and comprehensive interventions.

In essence, the Schoonschip case study serves not only as a unique and insightful exploration of the potential of green urban design but also as a source of valuable lessons for future projects. While the project's features and community characteristics may be unique, the recurring themes in green urban design projects, such as green design, technologies, common spaces, governance, affordability, and inclusivity, provide a foundation for broader applicability. This study contributes to the ongoing discourse on sustainable urban living by emphasizing the need for intentional, inclusive, and socially conscious approaches in shaping the cities of the future.

The following are some recommendations for the target audience:

For Researchers:

Further explore the social dimension of green design: Researchers should look further into the social aspects of green urban design projects as significant factors influencing pro-environmental behaviour. The case of Schoonschip underscores the importance of community and knowledge sharing in fostering sustainable practices. Oftentimes the emphasis is put on the environmental impact of sustainable projects rather than the social factors, it would be beneficial to deeper our understanding of social control.

For Policymakers:

Flexible regulations: regulatory frameworks that foster experimentation and innovation in sustainable urban design. These flexible regulations are instrumental in facilitating the realization of distinctive projects, exemplified by the success of Schoonschip. Moreover, the construction of Schoonschip not only expanded the spectrum of housing solutions available in the Netherlands but also demonstrated the viability and reliability of green housing alternatives, positioning them as feasible and attainable options alongside conventional solutions.

For Green Urbanists:

Promote the integration of sustainable infrastructure by actively promoting the adoption of green technologies and eco-friendly urban development. Emphasize the concrete advantages of these technologies in diminishing the ecological impact of urban communities. To make this recommendation more implementable and realistic, establish partnerships with local governments, urban planning authorities, and private developers. Collaborate on pilot projects such as Schoonschip, that showcase the positive environmental, economic, and social outcomes of incorporating green technologies into urban infrastructure. Engage in public awareness campaigns to educate citizens and garner support, emphasizing the long-term benefits and cost-effectiveness of sustainable infrastructure. Additionally, incentivize developers and businesses to invest in eco-friendly practices through tax breaks, subsidies, or other financial incentives. By creating a supportive ecosystem and highlighting the practical benefits, the transition to sustainable infrastructure becomes more feasible and likely to gain widespread adoption.

For Urban Developers:

Implement a robust community engagement strategy by involving future residents in the early planning and design stages of sustainable urban projects. To make this recommendation realistic and implementable, establish community workshops, focus groups, and online platforms that facilitate open communication and collaboration between developers, urban planners, and potential residents. Actively seek input on design preferences, sustainability features, and community amenities, allowing residents to contribute to the decision-making process. Create user-friendly channels for feedback and incorporate residents' ideas into the project's blueprint. Foster a sense of ownership and commitment by keeping residents informed about the project's progress and involving them in key decisions. Additionally, leverage digital tools and social media to reach a broader audience and ensure inclusivity in the participatory process. This approach not only enhances the overall sustainability of the project but also builds a stronger connection between residents and their environment.

In summary, the case study of Schoonschip in Amsterdam suggests that while green design and technologies are essential components of sustainable urban development, the social aspects, including community building and knowledge transfer, play a pivotal role in influencing pro-environmental behaviour. To promote sustainability in urban areas, it is crucial to embrace a holistic approach that encompasses both eco-friendly infrastructure and

community engagement. Researchers, policymakers, green urbanists, and urban developers should collaborate to create thriving, sustainable neighbourhoods that inspire residents to adopt pro-environmental behaviours.

Recommendations for future research

This thesis contributes to the body of literature on sustainable urban development by challenging prevailing assumptions about the drivers of pro-environmental behaviour. It offers a holistic perspective that goes beyond technological and architectural aspects, emphasizing the crucial role of community dynamics and knowledge sharing within sustainable housing projects like Schoonschip in Amsterdam. The research provides practical insights for urban planning and policymaking, with the case study offering concrete examples of how green design and community interaction influence residents' behaviours. Furthermore, the focus on knowledge transfer and learning experiences within the community adds a novel dimension to the literature, informing the design of educational programs and community-building initiatives in sustainable urban projects. This study enriches the understanding of sustainable urban development, providing valuable knowledge for researchers, urban planners, policymakers, and developers striving to create more environmentally conscious and socially connected cities.

The following are some theoretical and conceptual conclusions based on the findings of the thesis:

- Sustainability as a multifaceted construct: The findings highlight that sustainability extends beyond technological and architectural aspects to encompass social, psychological, and community-driven dimensions. This conclusion contributes to the evolving understanding of sustainability as a multifaceted and interconnected construct.
- Behavioural nudging through design: The findings suggest that green design can act as a subtle form of behavioural nudging, prompting residents to adopt pro-environmental behaviours without explicit awareness. This concept aligns with the notion that well-designed environments can shape human behaviour, emphasizing the significance of incorporating behavioural science principles into urban planning and design theories.
- Community-centred sustainability: The thesis emphasizes the pivotal role of community dynamics in promoting sustainability. This concept challenges the traditional focus on technological solutions in urban design and highlights the need for urban development theories to incorporate social sustainability elements, recognizing the influence of communal bonds and shared values on pro-environmental behaviours.
- Knowledge transfer and empowerment: The research underscores the concept of knowledge transfer as an empowerment tool within sustainable communities. It reveals that participatory processes and the acquisition of sustainable knowledge can enhance residents' sense of ownership and commitment to PEB. This concept suggests that educational initiatives should be an integral part of sustainable urban design.
- Re-evaluation of sustainability metrics: The findings invite for the re-evaluation of how sustainability is measured and assessed within urban planning frameworks. Traditional metrics may need to be expanded to account for the social and knowledge-sharing dimensions identified in this study, acknowledging their influence on residents' sustainable behaviours.

Future research should focus on strategies to mitigate eco-gentrification in sustainable urban development projects, building upon the insights gained from Schoonschip. Investigate

policies and interventions that can balance the benefits of sustainability with the potential for gentrification, ensuring that long-term residents and vulnerable populations are not displaced.

In addition, it should explore the differential impact of green design on individuals from less privileged and less environmentally conscious backgrounds. Research could examine whether tailored approaches are needed to encourage behaviour change among these populations, considering their unique challenges and motivations.

It should be particularly relevant to investigate effective methods to bridge the gap between individuals' desire to combat climate change and their reluctance to change their lifestyles. This research could delve into communication strategies, educational programs, and incentives that align sustainability goals with personal preferences and convenience.

Further research should be warranted on the concept of green social housing, particularly its design, affordability, and accessibility. Exploring how such projects can address the housing needs of economically disadvantaged communities while promoting sustainable living practices.

And finally, research should delve into the challenges and solutions related to inclusivity within sustainable communities and projects. This could encompass studies on social cohesion, community engagement, and the incorporation of diverse perspectives in the planning and decision-making processes of sustainable urban developments.

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Appendix

Interview design

Interview consent form:

- I, the undersigned, have read and understood the Study Information Sheet provided.
- I have been given the opportunity to ask questions about the Study.
- I understand that taking part in the Study will include being interviewed and audio recorded.
- I have been given adequate time to consider my decision and I agree to take part in the Study.
- I understand that my personal details such as name and employer address will not be revealed to people outside the project.
- I understand that my words may be quoted in publications, reports, Web pages and other research outputs but my name will not be used.
- I agree to assign the copyright I hold in any material related to this project to Boréa Malnoury-Erdös (researcher).
- I understand that I can withdraw from the Study at any time, and I will not be asked any questions about why I no longer want to take part.

Name of participant: _____ Date: _____

Researcher Signature: Boréa Malnoury-Erdös Date: _____

Study information sheet:

Thank you very much for agreeing to participate in this study. This Information Sheet explains what the study is about and how I would like you to take part in it.

The purpose of this study is to better understand the perceived effect of 'green' design features in residential buildings on Pro-Environmental Behaviour of residents. It is particularly interesting to see whether the environmental behaviour of residents was changed directly due to the green design features of the project.

In order to elicit your views, as the author of this master thesis at Lund University, I would like to conduct an interview with you. If you agree to this, the interview will be audio recorded and will last about 30 to 45mn.

The information provided by you in the interview will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses.

At the end of the study, anonymized research data will be archived at the IIIEE Thesis Archive in order to make it available to other researchers in line with current data-sharing practices.

Once again, I would like to thank you for agreeing to take part in this Study. If you have any questions about the research at any stage, please do not hesitate to contact me.

Boréa Malnoury-Erdös

Questionnaires

Pro-environmental Behaviour categories, adapted from "the big five" (Gifford, 2014) + 2 additional elements relevant for the case studies	**Green building related Pro-Environmental Behaviours:** fire questions for interview (cf. inspired by Xie et al. 2020)	**BEFORE** **YES/ NO**	**AFTER** **YES/NO**
Visual sustainability	- Use of private exterior space for gardening (terraces, rooftop)		
Diet/ Food	- Go to farmer's market - Buy local food - Vegetarian/vegan diet		
Mode of transportation	- Meet daily living needs within walking distance - Use public transportation - Shared transportation (car, bicycle, etc) - Promote use stairs instead of elevators - Encourage to travel using low carbon modes of transport		
Energy conservation	- Check if the power is off when you leave home - Purchase water-saving appliances - Remind family members to save energy - Shorten shower time		
Waste disposal	- Recycling - Sell second hand		
Material purchase	- Buy second hand - Buy local		

	- Buy quality products (material, carbon intensity, durability etc.)		
Sustainable community action	- Support environmental initiatives - Part of environmental activist groups		

Use this survey for the triangulation of information and backup!

Schoonschip 'Green' features (cf. categories from website)	Pro-Environmental Behaviours "big 5"+	Perceived effect on PEB
Green technology (isolation EPC=max 0, no gas system, heat pumps 'aquathermie', passive solar energy, solar water heaters, heat recovery system in showers, photovoltaic solar panels for electricity, individual battery per household, smartgrid within the community, biomass energy from black water (from toilets) in colaboration with Waternet, water efficiency, smart devices & ICT to optimize yield)	- Energy conservation - waste	Fill this out with + or – or #(for neutral) for each PEB identified according to the interview results
Green architecture (sustainable materials & installations, floating garden & green roofs, unique designs integrating common ambitions and frameworks)	- visual sustainability - energy conservation	
Green community & wellbeing initiatives (joint food purchasing, jetties & collective spaces, owners association & foundation 'Pioneer Vessel' for knowledge transfer, own website (@ schoonschipamsterdam.org) & interactive opensource educational website (@ Greenprint), a party committee for meetings and events	- food/diet - material purchase - sustainable community activism	
Green mobility (shared cars, electrical bikes/cargo-bikes)	- transportation	

Project Managers **(people involved with developing and creating the green residential project)**
Topics:
Warm up questions…
Initial aim of the project
What were the initial goals of the project?
Were these fulfilled?
What sustainability challenges did the project target?
In what ways is this project different in tackling urban sustainability?
Potential of influencing PEB & behaviour change via the project
Do you think green residential projects have the potential to influence EB & create PEB?
How could green residential projects create and influence PEB?
How did … influence the EB of its residents/ neighbors?
Have you measured a change in behaviour/ PEB before and after the project?
+ Potential spill-over effects of green residential projects
Were there any anticipated spill-over effects from this project?
Have there been any unforeseen positive spill-over effects from this project to your knowledge? (inspired similar projects elsewhere, initiated an innovative environment for more green projects etc.)
Have there been any unforeseen negative spill-over effect from this project? (eco-gentrification, rise of prices etc.)

Residents
Topics:
Warm up questions… (prononciation of Schoonschip? date of moving in, about me, etc.)
Green design & its influence:
Has the green design of Schoonschip had any effect on how you behave in your everyday life? (EB)
How have your behaviour changed?
Green design features of Schoonschip:
Have you noticed a change in your behaviour due to a specific … (*category*) feature? *For example: Do you think your consumption of electricity has changed due to the smart grid, if yes how?* If yes how has your behaviour changed? (less/more use, switched use/product etc.)
Perceived PEB BEFORE being a resident of the project:
Before living in Schoonschip, do you recall having any of the following *PEBs*? *Visual sustainability, diet/food, mode of transportation, energy conservation, waste disposal, material purchase, sustainable community action* (none, some, all)
Perceived PEB AFTER being a resident of the project:
Since you are living in Schoonschip, which of the following *PEBs* do you have ? *Visual sustainability, diet/food, mode of transportation, energy conservation, waste disposal, material purchase, sustainable community action* (none, some, all)
If more time…
Potential spill-over effects of green residential projects
Have you noticed any unforeseen positive spill-over effects from this project? (inspired similar projects elsewhere, initiated an innovative environment for more green projects in Amsterdam or elsewhere, etc.)
Any negative unforseen spill-over effects from this project? (eco-gentrification, rise of prices etc.)
Transformative capacity of green residential projects
In your opinion, are green residential projects such as Schoonschip capable of transforming the behaviour of its residents for more sustainable ones?
If you could change something in the project for a stronger positive impact on environmental behaviour, what would it be?

Conceptual framework of PEB

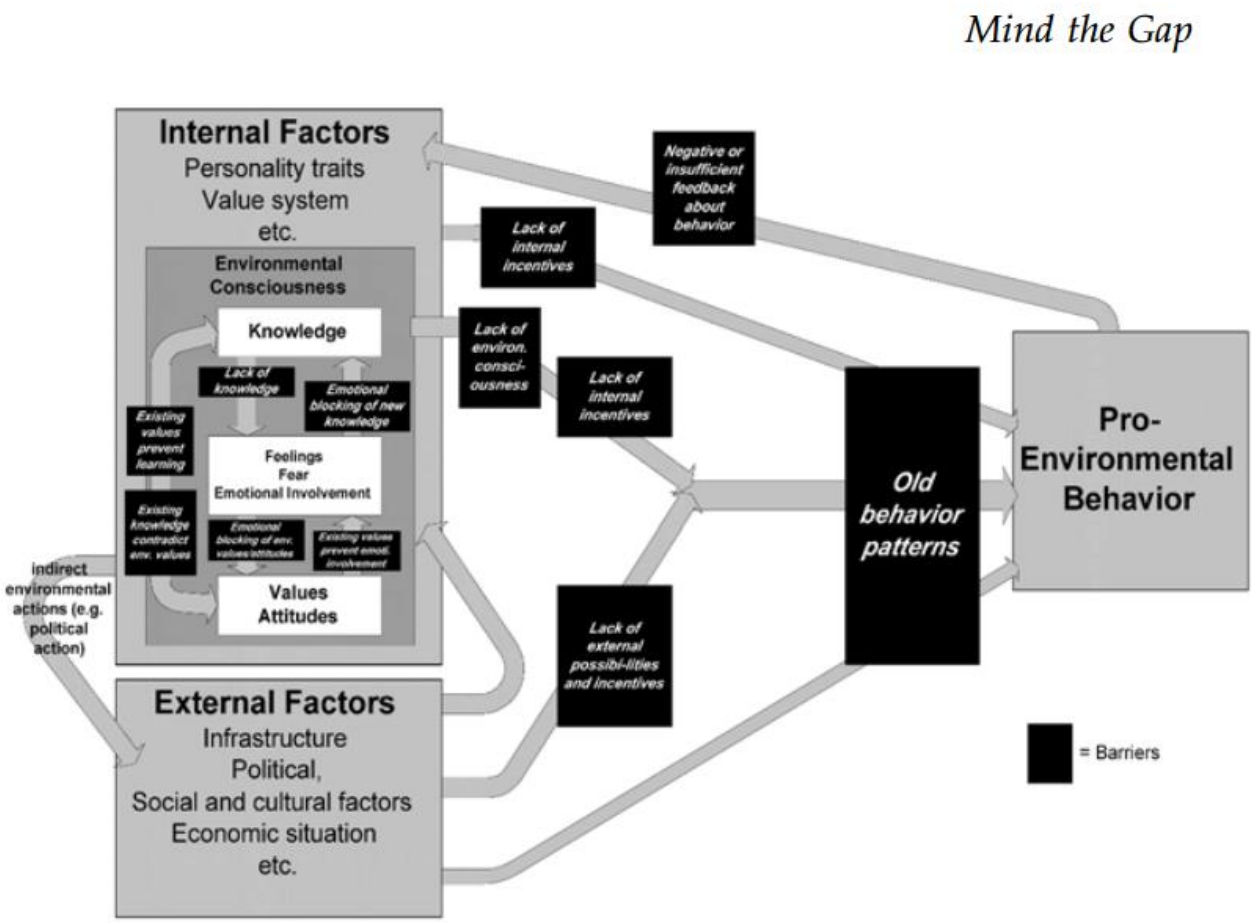

Figure 10: Original conceptual framework of Pro-Environmental Behaviour from Kollmuss and Agyeman (2002)

The final result of the Schoonschip project and its green design features:

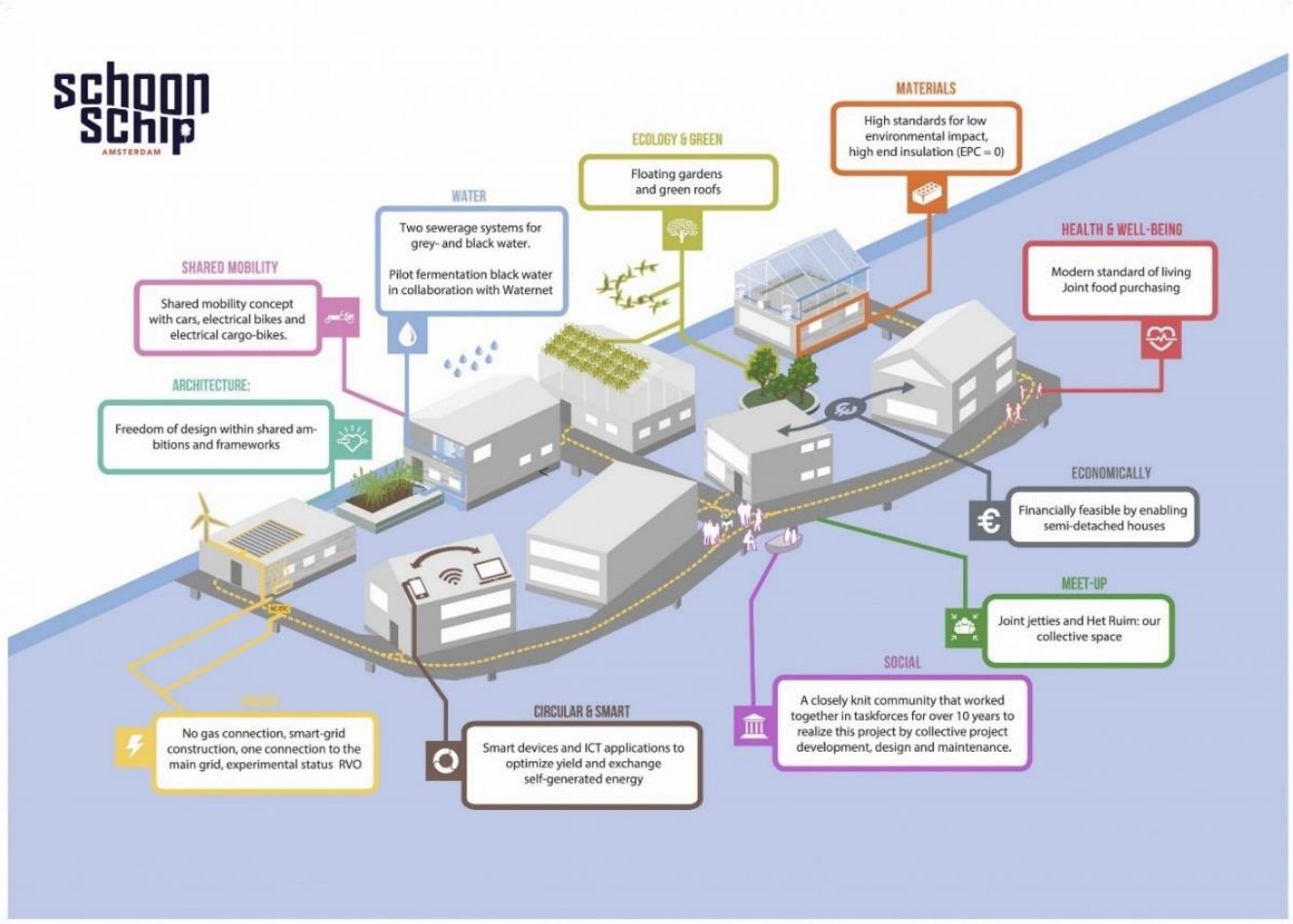

Figure 11: The participative process: one of the many meetings that created Schoonschip (photo: Space&Matter)