Industry and Housing:
Clash or Match?

A qualitative study into residents' experience of living close to industry
and how this affects their perception of nuisance and satisfaction.

TUDelft

Abstract

Due to both geographical and functional separation of port and city, urban planning of port cities has become a rather slow, costly and sometimes conflictual process. To work towards a more collaborative way of planning and to enhance the competitive edge of port cities, mixed-use developments that include both city -and industrial orientated functions could be an outcome.

A comprehensive literature study into the mixed-use concept reveals, besides a positive view, also a more critical view on mixed-use ideas. While mixing uses knows many benefits, in realized mixed-use developments higher goals, as sustainability, synergy and diversity are not always reached and residential satisfaction appears to be rather low. Furthermore, the combination of industry and housing is typically avoided and when attempted, this mix usually doesn't last long. It appears residential nuisance plays a pivotal role in this. Consequently, it is argued that when developing mixed-use areas, the potential incompatibilities between different uses should be acknowledged and residential nuisance should be managed.

By coining the terms actual and perceived nuisance, a distinction is made between the objective level of nuisance, exposed to the receiver, and the subjective level of nuisance, as perceived by the receiver. Commonly used measures in urban planning are focused on mitigating the observation of nuisance (actual nuisance). However, theory suggests that also the annoyance levels attached to these observations may not be overlooked (perceived nuisance) and that the relation between actual and perceived nuisance might not be as straight-forward as it seems.

In this study a deeper understanding of how residents perceive nuisance caused by industry is gained with help of a practical case: Hoek van Holland. This is a Dutch village located close to industry and part of the port city Rotterdam. Two focus groups with residents of Hoek van Holland are conducted and an urban planner who is involved with developments in the village is interviewed. The findings show that perceived nuisance is a very interrelated concept. It is influenced in several ways and depends on more than actual nuisance alone. It is theorized residential satisfaction has a mediating effect on feelings of annoyance and, therefore, urban planners should not underestimate the value of residential satisfaction for the (long-term) success of a mixed-use developments.

Executive Summary

Introduction

Brief problem statement

In modern urban planning, mixed-use is a commonly used concept. In both practice and in theory, relatively much attention is paid to fine-grained mixed-use areas, including functions as retail, offices and housing and relatively few attention is paid to gross-grained ones, including industrial or harbor functions. Some researchers, interested in the port city relationship, theorize this could be a seen as a missed opportunity. In port cities, port and city exist side by side, but contrary to the past, they have stopped relating to each other. To respond to external challenges and to reach a competitive edge, port and city are both growing. But having different ideas about how the space around waterfronts should be planned, the planning of port cities has become a rather slow, costly and (sometimes) conflictual process. As a result, port and city are functionally, as well as geographically, growing further apart. To deal with this separation, port city theorists argue that a more holistic and collaborative way of planning is desired, and that combining harbor and urban activities in one area, thus developing gross-grained mixed-use areas, could be an outcome. With these challenges and opportunities of port cities in mind, this study gained further understanding of the mixed-use principle in general, while having a special focus on the mix of industry and housing.

Literature study

A comprehensive literature study into the mixed-use concept reveals, besides a positive view, also a more critical view on mixed-use ideas, which could be summarized in two pivotal findings. Firstly, mixed-use developments are of uneven success. Secondly, financial, juridical and environmental complexities associated with industrial and harbor functions, makes attempts to develop gross-grained mixed-use areas remain limited. Moreover, when industry is included in a residential area, this mix usually doesn't last long.

The findings reveal that when aiming for a successful and durable mixed-use development, it is pivotal to consider the compatibility of the functions combined and to not underestimate the complexity it might entail. In line with this, they argue one should be aware of making oversimplified assumptions regarding residential nuisance in mixed-use areas and should take a critical stance on conventional wisdom regarding user satisfaction.

The second part of the literature study highlights residential nuisance entails a subjective component. A distinction was made between actual and perceived nuisance. The first is about the objective level of nuisance exposed to the receiver, while the latter is about the subjective level of nuisance, as perceived by the receiver. Naturally, perceived nuisance depends largely on the level of actual nuisance. Annoyance levels in realized mixed-use projects suggest perceived nuisance depends on more than actual nuisance alone. Multiple factors could play a role in this, which in study are named "perceived nuisance factors" (PNF).

Research Questions

Main Research Question

"How do residents, living in an area close to industry, experience their living environment regarding industrial nuisance, what personal and situational factors could influence their perceived nuisance caused by industry and what does this mean for the urban planning context?

Sub-Research Questions

1. What industry related nuisance do residents living in area close to industry perceive?
2. What factors could influence the perception of industry related nuisance?
3. What is the urban planning perspective on nuisance caused by industry?

Research Methods

Type of Study
In this research chosen for a qualitive approach. Such an approach is considered effective when deeper understanding of a topic is of interest and generalization of the findings is not considered necessary. Since this research aims to understand complex phenomena and aims to answer a "how"- question, qualitative type of study is appropriate.

Methods to Collect Data
For data collection three types of methods are employed; Focus-group, desk-top research and in-depth interviewing. This way, the data gathered in the three methods could complement one another and the validity of data could be assessed. Two focus groups have been held with residents of Hoek van Holland, a village in the Netherlands. Hoek van Holland is selected as case for this research because its location illustrates well how in modern urban planning variety of large-scale functions could come together and industry and housing could exist side by side. A combination of green housing, composting facilities, harbor activities and international transshipments are located around Hoek van Holland. In the first focus group five residents participated. Except their similar age and interest in the living environment, it could be considered as a diverse group of people, with different back-grounds, life experiences and interest. Three residents participated in the second focus group. Opposed to the first group the residents generally had a lot in common. The participant live in various parts of Hoek van Holland are represented in the focus groups. The main purpose of the focus groups is to gain a better understanding of how residents perceive nuisance caused by industry and what they think could have influenced their nuisance perception. After the focus groups, in-depth interviewing is employed as the second empirical method in this research. An urban planner involved with Hoek van Holland is interviewed to reflect on the findings of the focus groups and start a discussion about the urban planning context related to residential nuisance. The in-depth interview is conducted through a video-call.

Techniques to Collect Data
In both the focus groups and interview probing techniques are employed. In addition, generative techniques form an important part of focus groups. With help of these techniques residents are supported to make something to express themselves. It is believed in particular these make- techniques are valuable for qualitative research because they could bring deeper levels of information to the surface.

Data Analysis
During the data analysis a combination of verbal, written and visual data is gathered and compared. The different types of data complement one another and the discussion following from it provides further insights. However, in some cases findings resulting from different techniques were not entirely in correspondence and choices regarding the relative importance of data had to be made. The outcomes of the critical dialogue among residents were expected to be more explicit and thereby more reliable compared to the slightly ambiguous, sometimes difficult to understand, exercises. Therefore, in this study more weight was attached to verbal data opposed to visual data.

Data Analysis and Results Focus Groups

Collective Perceived Nuisance
During the focus group, various nuisance types and various nuisance sources came to light: composting smell, smell from Pernis, black-colored soot, orange-colored soot, industrial noise, shipping noise, shipping vibrations, light pollution and the view on ships and industry. Based on the focus groups, how residents perceive nuisance seems to depends on more than objective indicators alone. First of all, differences in observation could not always be explained by location of residence and explanations for differences in observations were sometimes not easily found. Furthermore, differences in annoyance could not always be clarified by differences in observations. In fact, even the conventional wisdom, the more nuisance observed, the more nuisance perceived was not always confirmed. What the findings reveal is that perceived nuisance is a complex phenomenon, that involves besides an objective, also a subjective component. Consequentially, it is rather hard to determine a collective perception of nuisance for all residents combined.

Collective Perceived Nuisance Factors

To understand why this is the case, the second part of the data analysis focusses on Perceived Nuisance Factors. The findings show perceived nuisance depends on actual nuisance, but is also influenced by multiple other factors. Underpinned with quotes derived from the focus groups, three types of factors were distinguished; (1) actual nuisance factors, (2) personal factors and (3) situational factors. The first cover characteristics related to nuisance source and to the actual occurrence of nuisance itself, the second relate to characteristics of the nuisance receiver, and the latter relates to characteristics of the receiver's living environment. All perceived nuisance factors combined show that residential nuisance is a very interrelated concept, which could be approached and mitigated from multiple perspectives.

Perceived Nuisance and Residential Satisfaction

Since residents mainly brought forward environmental characteristics to elaborate on their overall residential satisfaction, (and how this satisfaction, in turn, played a role in their nuisance feelings) this study pays attention to the interrelation between perceived nuisance and residential satisfaction. A dualistic relationship between residential satisfaction and perceived nuisance is theorized. Potentially, not only more nuisance leads to less satisfaction, but also more satisfaction leads to less nuisance.

Results Desk-top Research and In-depth Interview

Focus on Actual Nuisance and Objective Indicators

The findings show norms and zoning have a central place in nuisance management. In case the nuisance reaches an unacceptable level, they act by checking industries' compliance to environmental standards or regulations, and pose (temporary) restrictions when needed. Talking in terms of legislation, space and distances, objective indicators regarding environmental quality are seemingly leading in decision-making and determining potential health effects and respecting all the environmental standards are considered to be essential tasks in urban planning. Overall, it appears relatively much attention is paid to actual nuisance in urban planning, while seemingly limited attention is paid to perceived nuisance

Nuisance Management: A Balancing Act

What the top-down findings further reflect is that nuisance management is a balancing act between potentially conflicting interest. Projects that are beneficial from the urban planning point of view, might not always be best from the environmental perspective. For optimal quality of life one perspective is not necessarily better than the other, but a holistic approach balancing the two perspectives is preferred. Likewise, urban planning decisions are both based on objectively determined health and safety effects, as well as on the associated economic, financial, cultural or social benefits of the projects. Referring to the context of Hoek van Holland and the port of Rotterdam, the urban planner stresses it is a kind of battle between two major interests: the one of the villages and the one of the wider economy.

Residential Nuisance in Hoek van Holland: A Growing Challenge

In case of Hoek van Holland, this balancing act becomes harder and harder. The port and village both need to grow; The port to maintain the competitive edge and the village to become more livable from the social and economic perspective. This raises the question; How to safeguard the future of Hoek van Holland and keep the Dutch motor of the economy running at the same time? Responding to this urban planning challenge, policy makers balance both perspectives and support both the growth of the Rotterdam port as well as the growth of Hoek van Holland. To be more precise, the desk-top research indicates the political deal seems to be -a bit simply said- the following; In exchange for space and growth, the port companies have to invest in cleaner technologies, move potentially when needed and invest in the natural and recreational quality of villages around. Given that environmental norms are currently just met in Hoek van Holland, the growth of the port of Rotterdam is considerable and energy transitions typically include (temporary) externalities, whether this strategy would be effective enough to keep residential nuisance on an acceptable level could be questioned. How residential nuisance around the Rotterdam Port will evolve, will become clear along the way.

Conclusion

Research Findings

- The end-user experience of nuisance and satisfaction should not be overlooked in mixed-use developments and the port city context;
- Perceived nuisance is a very interrelated concept that is influenced in several ways and which depends on more than actual nuisance alone;
- And potentially, a higher overall residential satisfaction has a mediating effect on feelings of annoyance.

Research Transferability to Practice

How could these insights be used in practice and research? The general recommendation for the urban planning of port cities and the development of mixed-use areas is the following; Do not underestimate the value of residential satisfaction for the (long-term) success of a mixed-use development, minimize residential nuisance and benefit from all complexities involved. More specifically, nine recommendations for urban planning practice are proposed.

Reflection

Representativeness Hoek van Holland

Given that Hoek van Holland is not entirely representative for fine-grained mixed-use areas, is not entirely representative for gross-grained mixed-use areas, is not entirely representative for other villages near the Rotterdam port and that the Port of Rotterdam might not be representable for other industrial areas, makes the findings might not be extended beyond Hoek van Holland and the conclusions that suggest the contrary should be interpreted with diligence.

Research Validity

Some remarks regarding the validity of the research outcomes could be made. Firstly, relatively few attention is paid to the top-down perspective and the bottom-up insights gained from the focus group are probably stronger, while top-down findings might be less solid. Secondly, the data analysis of the focus groups showed, different methods could entail different outcomes. Visual data did not always correspond to the verbal data and the annoyance score was therefore harder to determine. Considering these differences, sometimes choices regarding the relative importance of data had to be made. The outcomes of the critical dialogue among residents were expected to be more reliable and more explicit compared to the slightly ambiguous, sometimes difficult to understand, exercises, which makes in this study more weight was attached to verbal data opposed to visual data. As a consequence, some outcomes respect to the perceived nuisance of residents might be considered less solid. Thirdly, the fact generative techniques serve as springboard for the discussion could include bias because the exercises might steer the residents in a certain direction. Fourthly, the residents participating in the focus group were less diverse as aspired. Yet, variety of perspectives was revealed and a critical dialogue was present. Therefore, it appears the validity of the outcomes are not limited by the limited diversity of residents. Lastly, the outcomes of the desk-top research should be treated with more care. The written data, derived from policy documents, research reports and websites could be undetailed or ambiguous, leaving much space for interpretation by the researcher.

Future Research

To create successful mixed-use areas and to develop new planning ideas for the port city context, more research is needed. This study, including its stronger and weaker sides, could serve as starting point for future research in several ways. Besides using the findings as knowledge basis to build further on, researchers could repeat this research, while using different practical case(s) or, the other way around, they could apply different methods while keeping Hoek van Holland as case. By either verifying or challenging current conclusions, future research could increase the understanding of residential nuisance and mixing uses in urban planning. In the report eight recommendations for future research are proposed.

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Introduction

1. Introduction

1.1 Brief Problem Statement

In the modern world, approximately 55% of the people live in urban regions and 37% of them live less than 100 km from the coast line. As urbanization in these coastal areas and port cities proceeds, natural environments and agriculture areas are making place for harbor and urban activities ("Port City Futures Conference 2018 | Centre for Global Heritage and Development," n.d.). Given the limited space available port and cities have to interact with their environment and with each other. In addition, societal trends such as increased globalization, the rise of network society and the transition towards a knowledge-based economy puts challenges on ports, cities and port cities as a whole. They have to adapt to new technologies, new climate ambitions and modern work conditions, while reaching a competitive edge. From the built environment point of view, it is interesting to explore what these trends mean for the urban development of port cities.

Historically, port cities have responded to external changes, separate or together, but always side by side. Port and city are always changing and interconnected and this will in the future be no different. Only this time, due to both geographical and functional separation, the spatial competition between port and city is not easily resolved. The port needs more space for their cargo, while the city needs more space for housing. Moreover, transformable green space is scarce and increasingly protected. As a result, urban planning of port cities has become a rather conflictual, slow and costly process. (Hall, 2016).It is argued a new collaborative way of planning is needed, whereby space is designed from a more holistic instead of dualistic perspective. Making places where multiple actors, both urban and industrial, co-exist, exchange knowledge and synergize (Hall, 2016; Merk, 2010; Wiegmans & Louw, 2011).

To achieve these objectives with help of the built environment, mixing different uses either on either building or area level is often put forward as a promising solution. Researchers and practitioners highlight mixed-use has many benefits regarding urban quality, livability and sustainability. That said, the actual success of mixed-use areas could be questioned (Freestone, 2008; Rowley, 1996). Higher goals are not are not always reached, cost-overruns commonly occur and incompatible functions are not always sufficiently managed. It could further be noticed, that combining industry and housing in one area remains a challenging task. This study looks deeper into this into these urban planning problems, by focusing on the combination of industry and housing.

1.2 Literature Study

In this chapter, the identified problem is further explored on the basis of literature research. From this it must become clear which knowledge is already available, where gaps occur and which questions deserve priority. Moreover, the initially still vague, broad and complex problem is defined in greater detail, which allows the formulation of a relevant main research question. First the concept of mixed-use is discussed from a positive stance, secondly this is done from a more critical perspective, thirdly, existing knowledge about residential nuisance and recent theories to mitigate this nuisance are described.

1.2.1 Mixed-Use: A Positive View

Many benefits are associated with mixed-use and to act on the new economic, environmental and social objectives applying mixed-use strategies became key in urban planning. In practice, urban area developments include frequently the combination of residential, office, educational, hospitality and retail functions. In theory, numerous research papers describe the success associated with these city-orientated, fine grained mixed-use areas. In coming sections, the rise and benefits of mixed-use are addressed.

The rise of mixed-use

More than a century ago uses were barely separated and this was part of the reason epidemics and diseases became a major problem in cities. This led to modern land-use planning, where the main focus was on keeping uses separate (Angotti & Hanhardt, 2001). The "functional city" conference by CIAM in 1933, enjoyed significant public support and separation of functions was since then one of the main principles in urban planning (Hoppenbrouwer & Louw, 2005; Korthals Altes & Tambach, 2008). In particular the combination of industry and housing, as characteristic for industrial cities in the 19th century, has been widely rejected. The high occupation densities, negative industry and traffic externalities and poor living circumstances in these cities reached unacceptable levels and policy makers were empowered to keep industrial functions and residential functions separated (Korthals Altes & Tambach, 2008).

However, global challenges as climate change and urbanization, gave rise to new visions on urban planning in last decades (Herndon, 2011; Hoppenbrouwer & Louw, 2005; Korthals Altes & Tambach, 2008). The separation of functions has been criticized in multiple studies: Separation might reduce nuisance, but it ultimately leads to unattractive and low-density urban structures with inefficient use of space and significant commuting times. To act on the new economic, environmental and social objectives applying mixed-use strategies became key in urban planning and potential conflicting functions are being brought closer together again (Herndon, 2011; Wheatley, 2014).

Benefits mixed-use

In mixed-use strategies, Jane Jacobs is frequently quoted as a source for inspiration. According to her the following conditions are indispensable for creating diverse and lively vibe on the streets. 1) preferably at least two functions should be present in an urban area, 2) it should be possible to switch street frequently, so urban blocks my not be too long. 3) a mix of older and newer building is desired 4) the population density must be sufficient (Rowley, 1996). Proceeding on the same train of thoughts, advocates argue mixing uses supports diversity and vitality, creates social interaction and community feeling ((Brewer & Grant, 2015; Freestone, 2008; Herndon, 2011). The Smart Growth Network ("Smart Growth Principles - Smart Growth Online," n.d.) for example, sees mixing as one of the leading urban planning principles to achieve place with a higher quality of life. They believe it enhances liveliness in public space, social encounters on the street and a community feeling in the area as a whole.

Many more benefits are associated with mixed-use developments. Firstly, they are conventionally promoted to meet sustainability goals (Rowley, 1996). The reasoning is that bringing multiple functions to one place reduces traffic flows, promotes use of public transport and increases sequential use of space (the use of space by multiple users after another). In that sense mixed-use is a sustainable way of planning whereby natural resources (Brewer & Grant, 2015; Freestone, 2008; Herndon, 2011; Hoppenbrouwer & Louw, 2005) and space (Addae-Dapaah, 2005) are efficiently used. Furthermore, it is believed to promote cultural vitality and attractive design of cities (Freestone, 2008; Herndon, 2011). From the developer's perspective, some benefits could be described as well. In mixed-use areas risks could be spread among the different uses (Freestone, 2008), increasing the financial feasibility of the development. In addition, in these areas different users might have different times they are active, increasing not only the liveliness or spatial efficiency, but also the financial support of facilities and the potential income generated in the area. Moreover, synergy effects might arise between the various uses, which potentially have positive effects on, again, livability of the area, but also financial benefits for the developer. To illustrate, when housing and offices are built near a bakery, this is convenient for the workers and residents because they can get fresh bread without much effort. At the same time,

this is beneficial for the bakery because customers flows are likely to rise as well. As a result, this so-called synergy could lead to higher rent levels and ultimately, higher financial return for the developer.

These benefits together make mixed-use is conventionally promoted, (Brewer & Grant, 2015; Hoppenbrouwer & Louw, 2005; Kim & Yang, 2017), starting in the 1960ies by among others Jane Jacobs and is still adapted in planning policies all over the world today. Importantly, mixed-use is not treated as separate planning idea, but is often combined with higher density and compactness. Together forming the key aspects of contemporary urbanism (Brewer & Grant, 2015; Herndon, 2011) and enrooting multiple urban planning movements, such as the compact city, the sustainable city and, more recently, the knowledge city (Freestone, 2008).

1.2.2 Mixed-Use: A Critical View

Looking at planning practice, several researchers question the success of mixed-use developments and pose a critical view on both the promotion, the application as well as the outcomes of this concept. To understand the main challenges regarding mixed-use, they are derived from literature and described below. First two process related challenges are described, then four product related challenges are described.

Process related mixed-use challenge: an ambiguous concept

Multiple researchers highlight the ambiguous character of mixed-use developments (Angotti & Hanhardt, 2001; Herndon, 2011; Hoppenbrouwer & Louw, 2005; Kim & Yang, 2017). Herndon (2011) argues it is seemingly a relatively understandable concept, however, beneath the simplistic terms, a vast amount of complexities is hidden. Rowley (1996) states in literature limited attention is paid to the definition of mixed-use that reflects the ambiguity around this concept. Kim and Yang (2017) support this statement and claims only one thing is sure: mixed-use is contrasting with single-use.

This is only partly confirmed by Herndon (2011), who compared and analyzed the various mixed-use definitions as formulated in theory. Although he sees some discrepancies; Urban Land Institute describes mixed-use developments as the integration of three or more functions (as cited in Hoppenbrouwer & Louw, 2005, p. 970), that produce revenue, while (Hoppenbrouwer & Louw, 2005) mentions the combination of only two uses can also be defined as mixed-use. They also reveal similarities in characteristics associated with mixed-use developments; it is generally agreed the area must be pedestrian friendly, functions need to be physically as well as functionally integrated, and the land must be used efficiently in both time and space. Regarding the process, an overarching, coherent plan that unites all project components is considered as one of the main characteristics of mixed-use developments.

Besides definitions, also mixed-use developments in practice reflect the ambiguity around this planning principle. Where CIAM focusses merely on housing, employment, recreation a transport in their urban planning ideas (Hoppenbrouwer & Louw, 2005), in current practice many more urban planning uses are distinguished, ranging from day care to universities and from start-ups to head offices. Likewise, mixed-use areas can differ enormously regarding the combination of uses and to what degree these uses are mixed (Angotti & Hanhardt, 2001; Kim & Yang, 2017).

The lack of clarity around mixed-use is for some researchers an important reason for concern, as this citation of Rowley (1996) illustrates: *"I worry that precisely because of the ambiguity of the term mixed-use development, it will rapidly degenerate into just another marketing slogan for a product that is a very pale imitation of the genuine article: this process has already started"* (p.95).

The fact policy makers are widely promoting benefits of mixed-use developments, without knowing precisely what the term mixed-use implies and without formulating a concrete plan of action, has led to some critical views in research. According to Rowley (1996), advocates of mixed-use developments seem to imply only minor changes in policy are needed and all future problems are resolved. He worries about the "simple-mindedness" of authorities, that barely seem to understand mixed-use issues. He stresses adopting a mixed-use strategy does not mean benefits are reached automatically. He further expresses critically that policy makers spend more time saying nostalgic and promising words about mixed-use benefits than that they investigate and analyze the situation at hand. Although formulated less strongly, this view is supported by Freestone (2008), who observes in Australian policy documents mixed-use is widely promoted, but actual information about how to develop successful mixed-use areas is barely available. Moreover, he observed that the urban masterplans of City of Sydney Council do not acknowledge that possible conflicts could arise between different functions and do not present any strategies to address them either.

Process related mixed-use challenge: organizational and financial complexities

From a cultural or economic perspective, separated functions are sometimes preferred over combined ones and risks related to mixed-use developments should not be underestimated (Grant, 2002). Firstly, mixed-use developments are relatively risky because existing constructional juridical, financial and management systems and various other processes in the built environment are still tailored to single-use developments (Herndon, 2011). Moreover, due to the increase risk associated with real estate and urban planning, developers have become increasingly specialized in a single type of development. As a result, the real estate market has become more complex and divided which increases the difficulty of realizing mixed-use projects even more (Rowley, 1996).

Besides this organizational challenge, also making a healthy investment plan remains challenging when combining different uses. Management cost are expected to be higher; schemes are too small and there is no existing proven development approach that can be used as reference (Rowley, 1996). Therefore, the complexity of multiple uses generally increases the uncertainty regarding financial return and increases the risk of cost overruns in development and operation (Kim & Yang, 2017). In the operation phase, another complicated issue arises: allocation of management and operation cost. Who pays for example for the maintenance of public space or other shared services? Maybe one user benefits more from a common good than other, should this be reflected in the cost allocations? But how do you measure this use of space? It could be concluded mixing uses entails numerous risks and difficulties for developers, both before and after completion (Schwanke as cited in, Herndon, 2011, p. 53).

Product related mixed-use challenge: paradox of the compact city

Some researchers question the success of mixed-use area and argue strong evidence mixed-use developments actually contribute to visual, functional and environmental quality of place is limited (Freestone, 2008; Rowley, 1996). Reasons for this uneven success could be related to so-called "paradox of the compact city". As explained earlier, mixing uses is often combined with densification policies and this is believed to minimize energy consumption and emissions related to car traffic (Sairinen & Kumpulainen, 2006). However, the idea that concentration positively changes travel behavior of residents is not widely supported in research (Korthals Altes & Tambach, 2008). De Roo (2000) suggests even the opposite; making more dense communities and adding numerous new houses does not decrease, but increase the amount of car traffic. And so, while initiated from sustainability ideas, compact city policies could have negative consequences for the environment, with higher noise-levels, lower air quality and more (toxic) dust. Importantly, this "paradox of the compact city" is not only limiting the success of mixed-use areas from a sustainability point of view, but also from a residential perspective. The noise caused by traffic is a significant, in the Netherlands even the most important, source for annoyance among residents (Franssen, van Dongen, Ruysbroek, Vos, & Stellato, 2004). And therefore, it could be argued mixed-use policies combined with density principles, do not create attractive cities as intended, but less attractive ones instead (Rowley, 1996).

Product related mixed-use challenge: understanding and satisfying residents

Contrary to the promised benefits of mixed-use developments, research indicates neighborhood satisfaction is typically low in mixed-use areas (Wheatley, 2014). In addition to this, Rowley (1996) concludes only few people prefer to live near amenities associated with center living, while these are typically combined with housing in mixed-use planning.

Contrary to expectations, seemingly gentle commercial activities could be a source for human health problems. Shops for dry cleaning or repairing shoes, for example can pollute the air and damage residents living close by. Cafés, restaurants and night club could be another source for annoyance with the noise they produce in evening and night. To continue, where the fresh-air produced by air-conditioning brings comfort inside offices, the noise it omits could be a source for discomfort for users outside the offices (Angotti & Hanhardt, 2001; Caniato, Bettarello, Schmid, & Fausti, 2016). These examples demonstrate satisfying all users in a mixed-use area is a complex matter and, importantly, indicates oversimplified assumptions regarding sources of nuisance and residential satisfaction are easily made.

Strickland (as cited in Angotti & Hanhardt, 2001, p.150), warned for the dubiety of assumptions regarding the compatibility of uses. By adopting zoning strategies, urban planners assumed that limiting industrial uses to light-manufacturing activities, such as workshops, would result in compatible mixed-use areas. With heavy industry excluded, the assumption was, no nuisance would be experienced in these areas. However, practice shows these assumptions are only partly true (Angotti & Hanhardt, 2001) and multiple studies provide evidence unwanted noise, especially when produced at night, is a pivotal source for dissatisfied residents (Caniato et al., 2016; Michaud et al.,

2016; Wheatley, 2014). For successful spatial planning it is recommended to take a critical stance on conventional wisdom regarding residential satisfaction and consider what actually affects the residential experience. Only then, resident-friendly environments can be established that responds to their values, needs and desires (Bratina Jurkovič, 2014).

Product related mixed-use challenge: achieving liveliness, community feeling and synergy

While mixed-use is commonly promoted in urban planning policies because of its positive effects on urban life and the community life, to what extend these effects are actually reached is not widely supported in research. Looking at the case study conducted by Hoppenbrouwer and Louw (2005)for example, they question whether the benefits associated with mixed-use developments, like liveliness, are reached in the Eastern Docklands in Amsterdam. The businesses that are located and interwoven in the residential area are rather small, they are not attractive for visitors and do not support social activity among the users of the area. This indicates merely having multiple uses present in one area is not a panacea for activated public life. Interestingly, something similar could be said about planning compact and dense. The interviews conducted by Brewer and Grant (2015), show finding the right balance between different uses and securing a certain density remains a challenging task. While, a certain population is needed for amenities to endure, some interviewees had the feeling too much focus is placed on housing and attracting residents. They warned building major apartment blocks does not make a lively neighborhood and generally a community feeling in these dense areas is missing (Brewer & Grant, 2015). It could therefore be argued quantity is not a goal in itself and is only desired when quality comes with it.

This might spark the question: if mixing uses and density is not effective enough, what else could be done in urban planning to reach liveliness, community feeling and synergy? Various recommendations could be found in research regarding creating successful mixed-use areas and are shortly described below:

- Design of public space: Schwanke (as cited in Herndon, 2011, p.40) stresses that connecting different users with visual connections in an urban area are of crucial importance. This means not only buildings themselves should be well-designed, but also the design of public space, ranging from small streets to wide parks, is important(Angotti & Hanhardt, 2001). The design of the public space and how people make use of it is vital for the experience of a mixed-use area (Rowley, 1996).
- User based design: To avoid potential conflicts between users Herndon (2011) recommends to *"Creating a harmonious relationship while placing different uses in close proximity to each other requires understanding the needs of each use and translating each of those needs in a coherent design scheme."* Rowley (1996)states planners generally tend to underestimate the significance of considering users values and wishes, while: *"Many of the virtues of mixed-use development in whatever setting, only exists to the extent that they affect, and are experienced from the public realm."*
- Positioning of uses: To create synergy between the various uses, Herndon, (2011) recommends to pay proper attention to the relative position of the various uses, and in particular the ones that complement one another. By placing them around a common area, for example, synergies could be supported. Both spatial design as well as the positioning of elements influence how uses perform separately and combined.
- Sufficient size: in addition to the position of uses, the size of the mixed-use project is an important determinant for synergy; in larger areas it is more likely for synergies to occur than in smaller, less populated areas. For a financially successful mixed-use development, strong relationships between uses, both inside as outside the area, are required (Rabianski, Gibler, Sherwood Clements & Gibler, 2009)
- Transactional quality: To what extent functions influence the way people act, or in scientific terms called the transactional quality of a functions, is often overlooked by urban planners. This is unfortunate since the way people act impacts the total experience of urban areas (Rowley, 1996).

Product related mixed-use challenge: combining industry and housing

To satisfy multiple stakeholders with each their own particular interests and needs, makes successful mixed-use development a challenging task. Users have very different needs and in case contradictory uses are combined in one area, these needs might differ even more. Following this theory, ensuring compatibility between the various functions is seen as a major mixed-use challenge. In particular the combination of industrial activities and residential activities is widely discussed in both theory and practice.

Since mixed-use responded to the modernist way of planning, where uses were separated, mixed-use could be seen as a counter-movement whereby seemingly incompatible uses could be placed closer together again. That said, in policies mostly a mix of functions that are seemingly compatible are encouraged (Wheatley, 2014). Mixed-use projects typically combine cultural, residential, educational and commercial functions in one area. Although, some

authors argue that new technologies allow industries to be cleaner and greener and therefore mixing housing with industry is not necessarily unfeasible (Angotti & Hanhardt, 2001) areas comprising both industries and housing remain limited (Korthals Altes & Tambach, 2008).

The reason for this could be found in literature. Despite the fact, multiple uses could be perceived incompatible with residential activities, typically the incompatibility with industrial activities is highlighted in research. Angotti & Hanhardt (2001) for example, states some industries have severe consequences for public health and in particular low-income groups, who often live in shorter distance to industrial areas, pay the price. Additionally, they argue that positive effects on the sustainability and livability of the area do not outweigh the negative health effects mixing uses could have on people. So, when there are no effective or affordable technologies available to protect people from nuisance, isolating industries might be the only solution left.

Like researchers, also authorities believe it is better to keep industries that place an eminent load on the environment at a safe distance from their residents. Not all combinations are believed to make sense and housing is in general believed to be incompatible with industry, in particular the ones classified as heavy (Angotti & Hanhardt, 2001). Besides health reasons, also financial reasons could play a role in separating industry and housing. Developers might find projects proximate to industries less attractive because they are expected to be more complex, risky and therefore less profitable. Moreover, juridical reasons could play a role. Environmental regulations that promote optimal protection of residents hinder the developments of mixed-use areas that include industry and housing. In the Netherlands the limiting effect of these regulations was recognized and a new approach, named "city-environment" approach, was developed to allow for more flexible application of the rules. In case of deviation of the norms, this must be compensated in environmental measures, preferably in the same environmental compartment (Korthals Altes & Tambach, 2008).

So, reasons above explain why industry and housing are typically separated. That said, it should be noted some historically and more recent attempts are made to combine these seemingly conflicting functions in one area. Take urban planning in Soho in New York for example, originally an industrial area, but in the 1980ies transformed to a mixed-use area including smaller scale manufacturing activities and housing (Angotti & Hanhardt, 2001). And also, in the Netherlands, some recent examples of mixed-use areas that include industry could be found. The heated housing market, among other reasons, have made more and more housing is added on existing industrial estates. In Plaspoelpolder for example, the municipality of Rijswijk aimed to transform the industrial area into one "flexible work city" with a rich mix of functions. Among other uses, housing was added to the area and at the same time the concrete plant that was already present could stay.

However, to what extend these attempts result in a successful mix of industry and housing could be questioned. Often the mix is rather limited or doesn't last long. Shortly after the transformation of Soho industries were due to gentrification forced to leave the area and to make place for other uses, such as commerce, office or housing. What happened was that residents living in Soho started to complain about noise and odor caused by truck traffic and industries. In combination with the increased rent levels and land values industries were strained to leave the area (Angotti & Hanhardt, 2001). In Plaspoelpolder, with exception of the concrete plant, other industries that were perceived to create high levels of pollution or other harmful externalities were excluded from the area and so, to what extent the mix of industry and other functions is in balance could be questioned. Similarly, in other Dutch mixed-use projects planned on existing industrial areas, such as Binckhorst and Buiksloterham, environmental considerations are still leading and ultimately all industrial activities are planned to be exchanged for either housing or small-scale "clean, labor-intensive and city oriented" businesses (Korthals Altes & Tambach, 2008).

Considering the above examples, it could be argued that despite the public ambitions and efforts to develop mixed-use areas, a combination of uses can rarely be found in recent urban projects. In the Netherlands there are residential developments that include commercial functions, but there are few examples that incorporate industrial activities as well (Angotti & Hanhardt, 2001).

So far, the compatibility of industry and housing is discussed from the environmental perspective, but in addition to environmental frictions, mixing housing and industry also involves spatial challenges. The activities are contrasting in nature and therefore the urban environments that support these activities are that as well. Residents generally prefer finer grained urban structures, shorter streets allow pedestrians to switch directions more frequently, take shorter routes and the shorter building blocks create a less monotone, more attractive street experience (Herndon, 2011). Industries, on the contrary, benefit from coarser urban structures, larger parcels could entail economies of scale, supports larger scale production processes and allow for spatial buffers to increase the industries' flexibility regarding future changes. The Eastern Docklands in Amsterdam, an existing mixed-use area in the Netherlands, illustrates this

well; Based on a typology-based analysis conducted by Hoppenbrouwer and Louw (2005), the urban grain of Eastern Docklands in Amsterdam could be described as sharp and fine. In the residential area some smaller, commercial service businesses are present and the interwovenness is considerably high. However, looking at the integration of the bigger industries in the area, the transition of residential to industrial is rather sharp instead of fluent. However, it should be mentioned that industries are changing and therefore their spatial needs change as well. As Angotti and Hanhardt (2001) explains that in the modern US, by adopting new technologies industry has become a less polluting and more flexible sector. They adopt new production activities, are less bounded to a specific location and it is not always necessary anymore to concentrate industry geographically. This way, also from the spatial perspective it might become easier to integrate housing and industrial activities in one area.

Yet, the environmental load associated with industries makes possible environmental conflicts between industry and housing are commonly resolved through avoidance or confrontation. Whereby the latter often leads to either industry or housing abandonment (Angotti & Hanhardt, 2001). It could be concluded that managing possible residential nuisance with help of local solutions has become indispensable in urban planning (Hoppenbrouwer & Louw, 2005) and therefore next section is concerned with this topic.

1.2.3 Residential Nuisance

Considering previous section, it could be noted applying mixed-use principles is not an automatic panacea for livability, sustainability and residential satisfaction. On the contrary, this satisfaction is typically low because residents experience nuisance from other types of uses. Furthermore, the questionable success of mixed-use developments illustrates the importance of managing residential satisfaction, environmental frictions and user experience in urban planning. The previous section also supports the problem statement drawn earlier in this report; combining industrial and residential functions in one area remains a challenging task. To understand better why this is the case, I continue the literature study by focusing on residential nuisance. First, general knowledge about nuisance is described. Secondly, the interrelation between nuisance and quality of life is discussed. Finally, the division between actual and perceived nuisance is explained based on three theories derived from literature.

Residential nuisance in general

Nuisance is a feeling of aversion, anger, discomfort, or dissatisfaction that occurs when an environmental factor adversely affects feelings or activities (Gezondheidsraad: Committee on the Health Impact of Large Airports, 1999). Environmental nuisance occurs in many ways. Albeit also odour caused by industry and livestock is one of the major sources for nuisance (Angotti & Hanhardt, 2001; Schauberger et al., 2012) and research on wind turbines indicates visual nuisance should not be underestimated, (in order of prevalence residents are most annoyed by seeing wind turbines, followed by "blinking lights", "shadow flicker", noise and vibrations) (Michaud et al., 2016) , most researchers highlight the importance of protecting people from noise. Basner et al., (2014) state noise could be seen as one of the most damaging pollutants in modern society, involving multiple physical and mental health risks for residents. Confirmedly, numerous researchers from all over the world have proved how exposure to noise has noticeable effects on human health and, in 2011, the World Health Organisation publicizes they view noise as one of the most pivotal type of environmental stress regarding its effect on population health. Urban planning directives follow this view and prescribe ways, like noise mapping, to protect people from harmful noise exposure (Morillas, Gozalo, González, Moraga, & Vílchez-Gómez, 2018). Rest and relaxation are believed to be essential activities to endure daily life and restoration should therefore be supported in the residential environment (Evans & Ferguson, 2011; Hartig, 2004). However, many people, especially in cities, are in and around their homes exposed to exceeding noise levels (Gidlöf-Gunnarsson & Öhrström, 2010). and last two decades a significant increase in noise nuisance is even noticed (Caniato et al., 2016). Besides traffic noise, which is generally perceived as the main reason for both annoyance and sleep disturbance, Caniato et al., (2016) identifies other important sources for nuisance: music of nearby pubs, people speaking or acting loud on the street and external HVAC (Heating, Ventilating, Air Conditioning). In line with this finding, severe annoyance is most likely to be reported when nuisance takes place in evening or nighttime (Caniato et al., 2016; Michaud et al., 2016). So while living close to hospitality and nigh-life amenities is generally considered as desired by residents, negative externalities should not be overlooked.

By employing civil engineering, architectural or landscape measures policies aim to improve the residential environment. They typically have a special focus on limiting the noise levels caused by traffic. Based on data about the noise load in a given area, the percentage of (seriously) hindered people is calculated with exposure-response relationships. These relationships are based on a large one number of questionnaire investigations in various

countries, in the period 1971-1994 (Dusseldorp et al., 2011). Given the calculated environmental load, policy makers adopted at-source interventions aimed at minimizing the actual nuisance level of the source or taking protective measures to minimize the actual nuisance level exposed to the receiver (Dzhambov & Dimitrova, 2015). Noise barriers, low-noise asphalt, increased insulation value for facades are examples of commonly used measures. For visual nuisance, placement of green borders is a method, and to manage odour annoyance, employing a separation distance between the livestock or industry and the residential areas is one of the standard strategies (Schauberger et al., 2012). However it is argued these interventions, albeit effective in minimizing actual nuisance, do not always improve resident's quality of life (Bento Coelho et al. as cited in Dzhambov & Dimitrova, 2015, p. 1000). Additionally, their effectivity in protecting residents from negative health effects is rarely evaluated (Gidlöf-Gunnarsson & Öhrström, 2010).

Residential nuisance and quality of life

In recent policy documents and research papers more and more attention is paid to the concept of quality of life in relation to nuisance, using a high variety of strongly related terms like: quality of life, livability, environmental, living quality, quality of place or residential satisfaction, perception and experience"(Van Kamp, Leidelmeijer, Marsman, & De Hollander, 2003). Likewise, the environmental policy of the Netherlands doesn't look at disturbing environmental factors alone, but the subject is treated much broader. It is about the total quality of the environment, of which disturbing environmental factors are a part. The living environment quality is in this policy examined on the basis of a number of indicators, of which the most important are: quality of the home, appearance of the neighborhood (clean, whole), neighbors and social connection, safety, environmental nuisance (noise, odor), level and facilities (air, soil) (Franssen et al., 2004).

The difficulty of taking a wider approach is that the relevant interconnections as well as the relevant indicators seem infinite. Likewise, the thorough literature review of Van Kamp et al., (2003) uncovers both richness as well as the diversity of the existing conceptual models related to quality of life. Also, the meanings given to concept vary greatly which makes it difficult to distinguish one concept from the other and know the exact conceptual characteristics.

Despite of the great overlap, all concepts mention the person-environmental relationship. The environment and the users inside the environment interact and influence each other, either physically, socially economically and culturally. In addition, researchers seem to agree that objectivity and subjectivity play a role in this relationship and they generally recommend to apply both objective and subjective indicators in research(Van Kamp et al., 2003). In line with this theory, in the next section, the objective and subjective side of nuisance is described in terms of actual and perceived nuisance.

The role of mediation effects: Actual and Perceived nuisance

We can make a distinction between two types of nuisance: actual and perceived nuisance. The first is about the objective level of nuisance exposed to the receiver, for example the amount of decibel traffic noise meeting the façade of a house, while the latter is about the subjective level of nuisance perceived by the receiver, for example to what extend a resident is annoyed by the traffic noise in and around its home. Perceived nuisance could be measured with help of surveys and is also partly reflected in the record of nuisance complaints by residents. Partly, because research shows a certain degree of nuisance does not always result in public action or residential complaints (Fields, 1993). In practice, the perceived nuisance generally turns out to be different as expected, given the actual nuisance. This initiated a new wave of research into nuisance and the complexities it might involve. In following sections three interrelated theories are discussed. The first theory is about the interplay of satisfaction and perceived nuisance, the second theory describes the importance of supporting relaxation and related mental processes to mitigate perceived nuisance and the third focusses on "perceived nuisance factors" that could explain the differences between actual and perceived nuisance.

The mediating effect of satisfaction

Studies related to residential preferences often focus on elements that increase satisfaction, such as accessibility, or decrease satisfaction, such as nuisance. Only few researchers acknowledge the interplay between these elements and how they together add up to a level of overall satisfaction. One example of such a study is conducted by (Hamersma, Heinen, Tillema, & Arts, 2015). They explain some elements of the environment influence residents positively, and others influence them negatively and, as such, they argue that the first could at least slightly compensate for the latter. Focusing on high-way locations, they determined how environmental nuisance and increased accessibility (both associated with high-ways), alongside other characteristics of the living environment impact moving behavior (reflecting residential satisfaction). In addition, they studied the direct effect of accessibility gains and other residential

characteristics on the level of annoyance related to the high-way. The results of their research are summarized in figure 1.
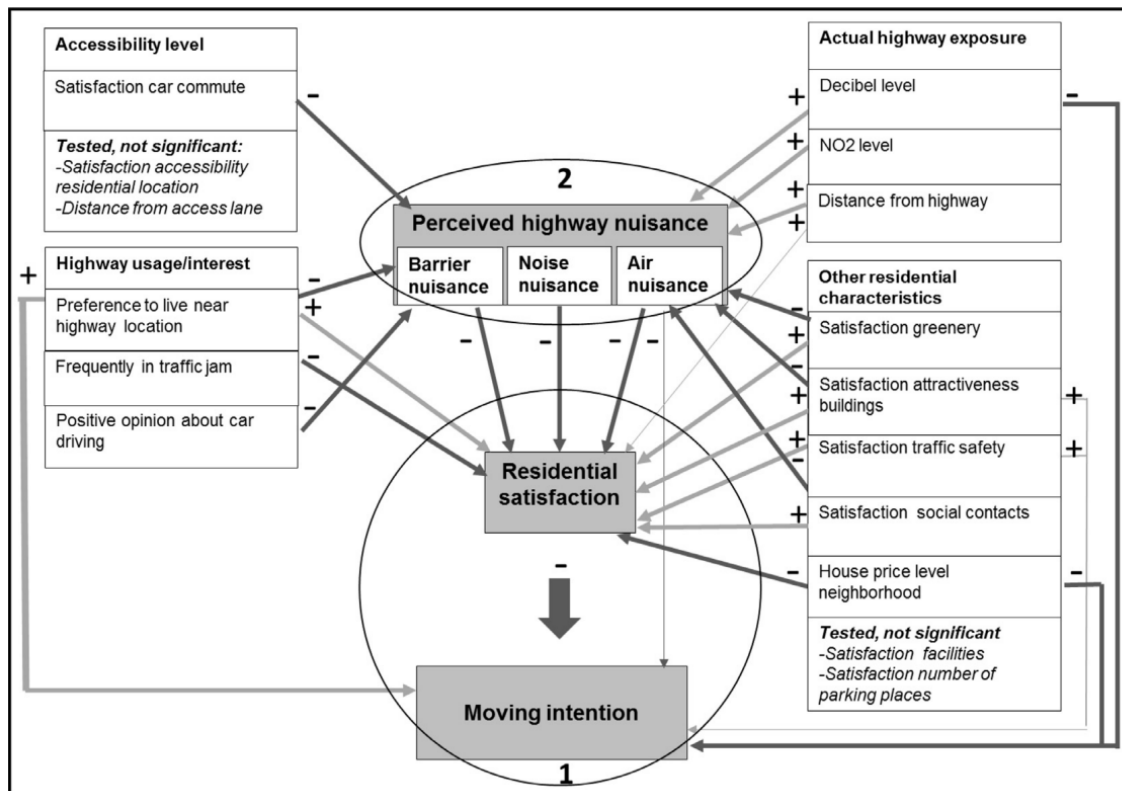

Fig 1. Supporting and mitigating effects of accessibility level, highway usage/interest, actual highway exposure and other residential characteristics on perceived highway nuisance, residential satisfaction and (indirectly) moving intention (Hamersma et al., 2015, p.139)

Important to note is that they didn't draw the relation between satisfaction and actual nuisance, that is based on objective noise and odor measurements, but instead used perceived nuisance, that is based on the self-reported annoyance. The reasoning behind is that existing research shows that where perceived nuisance is strongly related to reported satisfaction with the general living quality (Timothy Van Renterghem & Botteldooren, 2016), research that employs actual nuisance tend to show a much weaker relationship with residential satisfaction (Morris as cited in Hamersma et al., 2015, p.132).

To support residential satisfaction with help of the built environment is a commonly mentioned objective in research. But like research into quality of life, an agreement on proper assessment approaches and general consensus about what indicators are of relevance to planners and policy makers is missing. However, it is agreed on that overall satisfaction is mainly related to space outside the house (Kim & Yang, 2017) and that in particular green open spaces could increase the quality of life in cities (Bratina Jurkovič, 2014). Furthermore, more qualitative research approaches have shown spatial details should not be underestimated: the amount of noise, orientation, sunlight, exposure wind are determinant for satisfaction (Kim & Yang, 2017) and some urban design features are considered essential as well: green areas proximate to their home, multifunctional parks planted with trees, streets with trees on the side, a green routing system connecting the different green areas, opportunity for recreation and sport, and furniture for relaxing and playing (Bratina Jurkovič, 2014).

The mediating effect of relaxation

The second theory takes a more psychological perspective and hypothesize we can compensate the stress caused by environmental noise with "pathophysiological stress response in the body" (Stansfield, 1992; (Heinonen-Guzejev et al., 2011)Heinonen-Guzejev et al., 2011). What is meant here is that because of emotional processes in human beings, supporting feelings of tranquility with help of the environment could have a mitigating effect on feelings of stress (Aylor, 1977; Aylor & Marks, 1976; Yang, Bao, & Zhu, 2011). To create a living environment that supports this mediating effect, a new wave of research has investigated alternative methods regarding noise nuisance. Underlying ideas are

that naturalness and quietness benefit human health because it allows people to direct their thoughts away from daily life issues and restore their minds. Green and beautiful scenes are believed to activate stress reducing mental processes, so called micro-restorative experiences, encouraging people's general well- being (Kaplan, 2001). It is also theorized that especially when natural sounds, like bird songs, are present, a natural environment could have a relaxing effect on people (van Kempen et al., as cited in Dzhambov & Dimitrova, 2015, p.1000) and they are therefore less sensitive for getting stressed or annoyed. Thus, this theory suggests a complex interplay between perceived nuisance, (green) space and health.

Following the same train of thoughts, some researchers have investigated the mediating effect of green on perceived (noise) nuisance and formulated the following recommendations to reduce stress and feelings of annoyance with help of the built environment:

- Provide quiet areas in urban space (Dzhambov & Dimitrova, 2015; European Environmental Agency, 2014; Kluizenaar et al., 2011; Öhrström, 1991)
- Support interaction with green (Dzhambov, Dimitrova, & Dimitrakova, 2014)
- Create green areas or parks nearby housing, both visual attractive as well as usable for outdoor activities. A place that is found attractive is likely to be used more, aesthetical and usability aspects are therefore related and together influence the experience of nuisance (Gidlöf-Gunnarsson & Öhrström, 2010).
- Encourage presence of vegetation (Sullivan, Kuo, & DePooter, 2004), although the effectiveness of this measure appears to be strongly dependent on the vegetation's location. According to the study of Van Renterghem and Botteldooren (2016), vegetation in front of the house was effective, but the effect of vegetation in the neighborhood and presence of indoor plants was neglectable.
- Design housing and urban structure in a way, one side of the dwelling is quieter, so people have access to quietness as compensation for the noise on the other side (Gidlöf-Gunnarsson, Öhrström, & Forssén, 2012).
- Create more greener views instead of urban views (Li, Chau, & Tang, 2010; Viollon, Lavandier, & Drake, 2002).
- Reduce the visibility of the nuisance source (Aylor, 1977; Aylor & Marks, 1976). However, when green limits the view on the source too much, people tend to be more annoyed by noise, because they expect less of it in natural surroundings (Anderson, Mulligan, & Goodman, 1984).
- Ensure view on vegetation through the living room window. This proves to be very sufficient in minimizing annoyance among residents. When no green could be seen through the window, 34% of the residents reported to be annoyed, when this view was extremely green, with the same level of actual nuisance (same decibel, same street, same traffic) only 8% felt annoyed (Timothy Van Renterghem & Botteldooren, 2016).
- Increase the overall aesthetic quality of the neighborhood (Langdon as cited in Gidlöf-Gunnarsson & Öhrström, 2010, p.3360).
- Design streets in a way they offer a cozy and stress relieving atmosphere (Kastka and Noack as cited in Gidlöf-Gunnarsson & Öhrström, 2010, p.3360).
- Design urban space and building blocks according to what users find beautiful (Klæboe, Amundsen, Fyhri, & Solberg, 2004).
- Create urban courtyards (Öhrström, 1991; T. Van Renterghem, Salomons, & Botteldooren, 2006) The research of Gidlöf-Gunnarsson and Öhrström (2010) shows the quality of these courtyards (degree of naturalness and usefulness) matters as well. Residents perceive less nuisance when they live adjacent to a courtyard of high quality compared to one of lower quality (see figure 2,3). To create this quality the usefulness of space is important and so they recommend to consider sunlight and to provide play grounds or other out-door furniture.
- Contrary to previous findings, Dzhambov and Dimitrova (2015) uncovered that the influence of green on annoyance is rather limited. Again, the fact people expect less noise in a natural surrounding could be a possible explanation for this, since they take in such cases a more critical stance against their environment (Anderson et al., 1984).
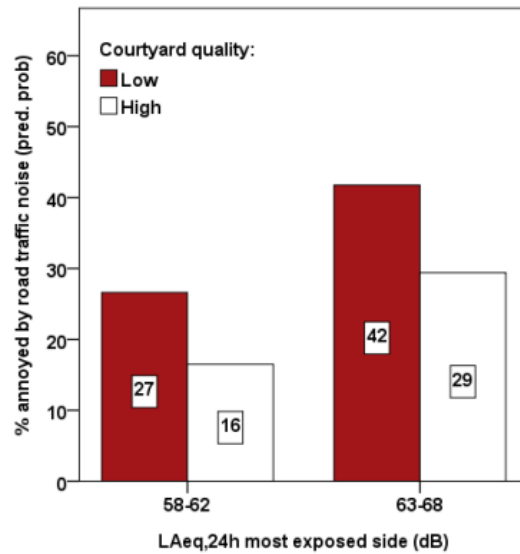
Figure 2. Percentage of noise annoyed residents due to road traffic when being at home in relation to courtyard quality and sound levels (source: Gidlöf-Gunnarsson & Öhrström, 2010, p.3368).
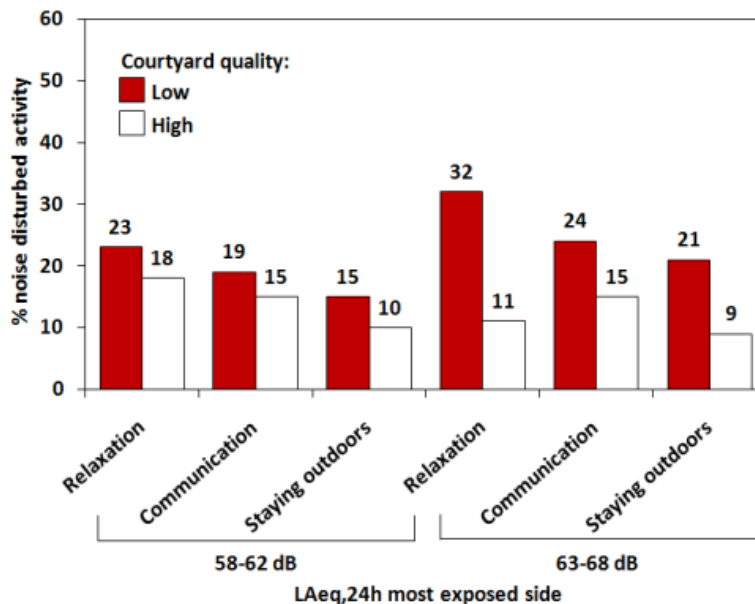

Figure 3. Percentage of noise outdoor activities in relation to courtyard quality and sound levels (source: Gidlöf-Gunnarsson & Öhrström, 2010, p. 3369).

Perceived nuisance factors

Taking a more coherent approach, the third theory described a variety of factors that could impact the perception of nuisance, likewise I name them "perceived nuisance factors". Like in other nuisance literature, in theories regarding these factors merely (air) traffic noise is mentioned as nuisance source. The subjective character of noise nuisance is underlined; it differs from person to person whether someone finds a noise annoying and to what extent noise is negatively experienced depends on a multitude of factors (Dusseldorp et al., 2011). Nurzynski (2013) (as cited in Szopińska & Krajewska, 2016, p.20): divides these factors in three groups; The first group includes sound related factors (volume, frequency etc.). The second group consists of factors related to the functional aspects of the environment (type, duration and moment of activities). In the third group he described cultural factors (user expectations and perceptions).

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Another division of factors is presented by (Dusseldorp et al., 2011). They highlight the importance of approaching nuisance in its full scope, including both the objective and subjective assessments. They explain noise nuisance is not only related to the sound level but also to other factors, summarized as "Nuisance is more than decibels." They distinguish the following categories: 1) demographic and (socio) economic factors (age, gender, income); 2) personal factors (fear of the sound source, sound sensitivity, economic connection with the sound source);3) social factors (expectations about future noise, attitude towards the sound source); 4) situational factors (attractiveness from the neighborhood, amount of greenery, distance to facilities).

The influence of these factors on the occurrence of noise pollution is complex and hard to predict. Most studies show that situational, social and personal factors have more influence on nuisance than demographic factors (Fields, 1993; Klæboe et al., 2004; Miedema & Vos, 1999, 2004; Schultz, 1978). It should be noted some research suggests demographical factors are of importance, but findings regularly contradict: Where Hamersma et al., (2015) identified elderly are easier annoyed than other age groups, Miedema & Vos, (1999) revealed this was the middle-aged group, while Klæboe et al., (2004) showed it were the younger people that report higher annoyance. Similarly, the influence of gender on reported nuisance is inconsistent and possibly depending on the number of hours that one is at home. One socio-economic factor that could be of influence is level of education and income, according to databases of Amsterdam and Rotterdam people with a high education (HBO, WO) are more often hindered compared to people with lower education (Dusseldorp et al., 2011).

Dusseldorp et al., (2011) further indicate the relative influence of each type of factor on perceived nuisance caused by noise (see table 1). This table is intended as order of magnitude, because the classification from small to large is relatively arbitrary and insights might change over time. Moreover, important to note is that the influence of a certain factor on the perceived nuisance is highly source dependent. It could for example be plausible that the fear of airplanes is higher than the fear of outdoor air-conditioning and therefore this aspect plays a more important role in nuisance cause by air traffic than in the one related to air-conditioning. In addition, it could be assumed that the in fluence of a factor is dependent on the type of nuisance considered, a similar table coined at nuisance caused by odour or dust might show different results. Some of the factors, such as the personal characteristics, are not easily changed. Other factors, such as expectations and attitudes towards the source, could be steered on by policy. Situational factors could be supported with help of urban, architectural and landscape planning and could therefore provide starting points for managing residential nuisance in the living environment.

PERCEIVED NUISANCE FACTORS	DEGREE OF INFLUENCE ON PERCEIVED NUISANCE			
	None	Small	Medium	Large
DEMOGRAPHIC AND SOCIO- ECONOMIC FACTORS				
Gender	X			
Age		Factors		
Family size		X		
Home ownership		X		
Duration of residence		X		
Time spend at home		X		
Economic relation with noise source			X	
Own use of noise source			X	
PERSONAL FACTORS				
Noise sensitivity				x
Negative attitude towards noise source			X	
Ability to cope			X	
Fear for noise source				X
Perceived economic importance of noise source			X	
Image of noise source		X		
Belief that noise source could avoid noise nuisance				X
SOCIAL FACTORS				
Controllability-predictableness			X	
Controllability-access to information			X	
Controllability-Trust government is able to solve problem				X
Controllability-Ability to express complaints or preferences				X
Procedural justice			X	
Concern about external effects of source				X
SITUATIONAL FACTORS				
Insulation against sounds				X
Presence quiet side				X
Presence of other noise sources			X	
Historical noise levels and expectations regarding future noise levels			X	
Satisfaction with living environment (dwelling itself, access to local amenities and quality of social relations)			X	

Table 1. Estimated degree of influence on perceived nuisance of each type of factor (based on table in Dusseldorp et al., 2011, p.27)

1.3 Conceptual Model

To formulate theories and test hypothesis developing a conceptual model is of crucial importance in research. This model could be seen as a preliminary answer to the problem statement, representing the important variables schematically and showing the possible interrelations. In the first section, the main literature findings are briefly described, this forms the basis for the conceptual model, which is explained in the second section.

1.3.1 Main Literature Findings

The literature study was divided in two parts. The first part, concerning mixed-use developments, reveals applying mixed-use principles is not an automatic panacea for livability, sustainability and residential satisfaction. On the contrary, this satisfaction is typically low because residents experience nuisance from other types of uses. Furthermore, the questionable success of mixed-use developments illustrates the importance of managing residential satisfaction, environmental frictions and user experience in urban planning. The previous section also supports the problem statement drawn earlier in this report; combining industrial and residential functions in one area remains a challenging task. In particular residential nuisance plays a role in this and therefore this topic formed the topic of the second part of the literature study.

The study showed, albeit multiple types of nuisance could occur, like odour, dust or visual nuisance, most research pays attention to the issue of noise and the adverse health effects that may entail. Similarly, multiple potential nuisance sources could be studied, such as windmills, livestock and industry, but the majority of researchers focus on the one caused by traffic. Traffic is seen as one of the main reasons that many people, especially in cities, are in and around their homes exposed to exceeding noise levels. And this considered problematic because rest and relaxation are believed to be essential activities to endure daily life and the residential environment should support these restoring activities. Many studies mention the person-environmental relationship and explain that the environment and the users inside the environment interact and influence each other, either physically, socially economically and culturally. In addition, researchers seem to agree that objectivity and subjectivity play a role in this relationship and they generally recommend to apply both objective and subjective indicators in research.

Following this recommendation, the objective and subjective character of nuisance was investigated and a distinction was made between two types of nuisance: actual and perceived nuisance. The first is about the objective level of nuisance exposed to the receiver, while the latter is about the subjective level of nuisance perceived by the receiver. To elaborate on this division, three theories are discussed. The first theory is about the interplay of satisfaction and perceived nuisance and how they together add up to a level of overall satisfaction. The second theory describes the importance of supporting relaxation and related mental processes to mitigate perceived nuisance. In particular the role of visual attractiveness, naturalness and usability for restoring activities of the environment is considered important in this respect. The third theory described a variety of factors that could impact the perception of nuisance, likewise named "perceived nuisance factors". The factors could be divided in four groups; demographic and socio-economic factors, personal factors, social factors and situational factors. The last group could be influenced by the urban planning field and is therefore the most relevant for this research.

1.3.2 Conceptual Model

The conceptual model (figure 4) presents main themes in literature and the important interrelations. Two main themes are actual and perceived nuisance. Thus, the model shows there is a distinction between the objective measurable amount of nuisance exposed to the receiver and the subjective determined amount of nuisance as perceived by the receivers. It is proven in theory and experienced in practice that the higher the actual nuisance, the perceived nuisance is likely to be higher as well. Literature and practice-based research indicate more factors are of importance for the perception of nuisance. Demographic, socio-economic, personal, social and situational factors impact to what extend the actual nuisance leads to annoyance among receivers (perceived nuisance). These factors are named "perceived nuisance factors" and form the third theme of the conceptual model. Finally, the fourth theme in the conceptual model is residential satisfaction. The interplay between actual nuisance, perceived nuisance and "Perceived Nuisance Factors" together add up to an overall level of satisfaction among residents.
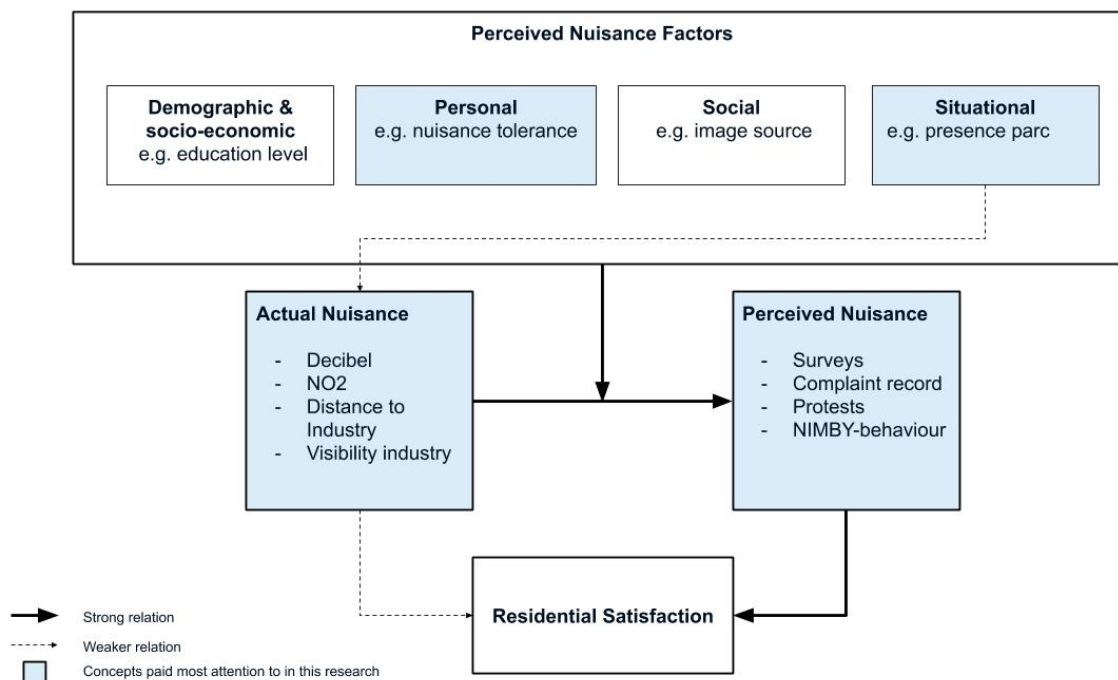
Figure 4. Conceptual model (own figure)

For reasons of conciseness, not all themes fall inside the scope of this research. Instead, most attention is paid to the themes inside the blue-colored boxes: personal factors, situational factors, actual nuisance and perceived nuisance. Situational factors are included because it is possible to steer directly on them with help of urban planning and this graduation project is conducted in context of this field. Since the literature study suggested it is crucial to take into account the end user perspective when mixing uses, also factors most related to this end-user are included in this research: the personal factors.

1.4 Scientific and Societal Relevance

One of the criteria of scientific research is that it is relevant from both the scientific as well as the societal perspective. In this regard, current research must contribute to the development and deepening of the urban planning discipline. First, is explained how this research contributes to science. Second, the societal relevance is described.

1.4.1 Scientific Relevance

Reviewing existing studies on mixed-use and residential satisfaction some limitations could be observed. Firstly, there is a lack of local solutions to deal with conflicting functions in mixed-use areas. Among existing studies general statements are made, like "public space is critical", but specific recommendations related to the urban planning are omitted. Secondly, to my knowledge, no qualitative research effort has been made to investigate the residential experience of residents living close to industry, considering both aspects of the living environment and characteristics of residents themselves. Thirdly, in existing research relatively much attention is paid to smaller scale and fine-grained mixed-use areas, the issues related to larger scale areas including industrial and residential areas are seemingly unexposed. Finally, there is still rather limited knowledge about why people feel annoyed by industrial activities and the role urban planning could play in mitigating this annoyance. This research aims to fill this knowledge gap.

1.4.2 Societal Relevance

According to van der Voordt (1998), societal relevance is high when a research contributes to the improvement of quality of life. On the neighborhood level, this research aims to formulate planning recommendations that maximize residential satisfaction and minimize related environmental nuisance in industrial mixed-use areas. Since these are important determinants for quality of life, it could be stated this research is of considerable relevance for society.

Furthermore, also on a higher level, it could be argued this research contributes to quality of life. Giving insight in how residents experience living near industry and how their perception of nuisance could be mitigated with help of urban planning, support planning decisions that could relieve environmental frictions between harbor and residential activities, prevent residential complaints or NIMBY- behavior, undesired relocations of harbor companies or industries and the time and cost overruns currently associated with unforeseen incompatibilities of functions. Moreover, it could give rise to a more collaborative way of urban planning: harbor and urban actors that work together, exchange knowledge and grow together as one knowledgeable port-city culture. Such a culture affects everyone and is likely to increase overall quality of life.

Research Questions

2. Research Questions

To conduct the research in a structured way, questions have been formulated that serve as guidance throughout the process. Based on the conceptual model a main research question is formulated. Derived from this main question, sub research questions are described. In the end, the answers to these questions together have led to an answer to the main research question and have resulted in the final research outcome.

2.1 Main Research Question

"How do residents, living in an area close to industry, experience their living environment regarding industrial nuisance, what personal and situational factors could influence the perceived nuisance caused by industry and what does this mean for the urban planning context?"

2.2 Research Sub-Questions

In order to answer the main research question, a set of sub-questions are answered. Taking the conceptual model as basis, three sub-questions are formulated:

2. What industry related nuisance do residents living in area close to industry perceive?
    a. What types of nuisance do residents perceive?
    b. Where do residents observe a type of nuisance?
    c. To what extent are residents annoyed a type of nuisance?
4. What factors could influence the perception of industry related nuisance?
    a. What makes some types and sources of nuisance more annoying than others?
    b. What personal factors could influence the perception of nuisance caused by industry?
    c. What situational factors could influence the perception of nuisance caused by industry?
5. What is the urban planning perspective on nuisance caused by industry?

3

Research Methods

3. Research Methods

This chapter explains the method that are used to conduct this research, including the different techniques that are used to gather and analyze data. The research method is based on the research questions described in previous chapter. Additionally, with selecting a method the available time and resources for this report are taken into account. First the type of study is described, followed by the used methods and techniques and finishing with more detailed information regarding data collection, data analysis and ethical considerations.

3.1 Type of Study

In this research is chosen for a qualitive approach. Such an approach is considered effective when deeper understanding of a topic is of interest and generalization of the findings is not considered necessary. Since this research aims to understand complex phenomena and aims to answer a "how"- question, qualitative type of study is appropriate. Furthermore, this research is focused on "perception" related issues, in which also a qualitative research method is preferred over a quantitative research method (Rodica Milena, 2008; Sayer, 2010). With help of qualitative methods, the perception of nuisance by residents could be explained in more detail; besides knowing when, why and where they experience nuisance, what type of nuisance they relate to industry, thus, in other words, understanding the residential experiences in a comprehensive way, also underlying values and needs could be uncovered. The findings together from a grounded basis for formulating urban planning recommendations. Important to note is that findings gained with qualitative type of studies are not suitable for generalization (Rodica Milena, 2008). This is kept in mind with data analysis and conclusion drawing of this research.

3.2 Methods to Collect Data

In qualitative research multiple methods are available to collect data. Robert Yin, a prominent methodologist in the social sciences field, stresses research should rest upon more than one source of evidence only and that the used methods should not be treated separately, but as an interconnected whole (as cited in Yazan, 2015, p.142). Likewise, in this study three types of methods are employed; Focus-group, desk-top research and in-depth interviewing. This way, the data gathered in the three methods could complement one another and the validity of data could be assessed. First, the general research design and the three used methods are described briefly. Secondly, the appropriateness of the empirical methods are explained. Thirdly, I will elaborate on the execution of the focus groups, and finally, I will describe the in-depth interviewing method in greater detail.

3.2.1 Research Design and Methods Used to Collect Data

Corresponding to the type of study, a qualitative research design is chosen for this study (see table 2). Two Dutch villages located close to industry of the biggest port of the Netherlands (Rotterdam Port) are taken as practical case: Pernis and Hoek van Holland. The three sub-questions formulated earlier form the basis of the research process. Each question is answered by collecting data with help of three methods: focus groups, desk-top research and an in-depth interview. The main purpose of the focus groups is to gain a better understanding of how residents perceive nuisance caused by industry and what they think could have influenced their nuisance perception. The data collected with focus groups is subjective and reflects the bottom-up perspective of urban planning. As complementation, desk-top research and in-depth interviewing are employed to answer the questions from the opposite perspective. To gain objective measurements and principles around the topic of residential nuisance caused by industry, online sources and publications are reviewed. Notably, location-specific information is gathered as much as possible, concerning the urban area similar to the area the residents of the focus group live in. Following the same train of thoughts, the interviewee of the in-depth interview is selected with care: an urban planner involved with the same urban area. The desk-top research and in-depth interview combined represent the top-down perspective of this research and bring, besides subjective data, also objective data into the study. Overall, the main idea behind this research design is that by cross-analysis of different types of data and different perspectives, a comprehensive understanding regarding residential nuisance could be gained.

To illustrate, it is likely not all data regarding nuisance is publicly available and could be gathered from the desk. Thus, the interview could fill this gap of knowledge. Furthermore, online data could be shallow or hard to interpret. The interviewee could provide deeper insights or explanations to make other data easier to understand. Referring back to the literature findings, this cross analysis of bottom-up and top-down data might also reveal the essential difference between actual nuisance and perceived nuisance. On the basis of all collected data lessons could be drawn for the mitigation of residential nuisance caused by industry in the urban area, studied in this research.

RQ	TOPIC	METHOD	DATA SOURCE	DATA TYPE	PERSPECTIVE
1	Perceived nuisance	Focus group	Residents	Subjective	Bottom-up
		Desk-top Research	Policy documents Research documents Online monitoring websites	Objective	Top-down
		In-depth Interview	Urban planner	Subjective/Objective	Top-down
2	Perceived nuisance factors (personal and situational)	Focus group	Residents	Subjective	Bottom-up
		Desk-top Research	Policy document	Objective	Top-down
		In-depth Interview	Urban planner	Subjective/Objective	Top-down
3	Residential nuisance from the urban planning perspective	Desk-top Research	Policy documents Research documents Online monitoring websites	Objective	Top-down
		In-depth Interview	Urban planner	Subjective/Objective	Top-down

Table 2. Research Design (own figure)

Focus groups

A focus group is a qualitative form of research in which a group of people are asked to join a discussion group to express their opinion, experience or feelings on certain topic. That way the perceptions of a group of people on a particular research topic become clear (Kairuz, Crump & O'Brien, 2007).

Desk-top research

One of the methods used to collect data is desk-top research. By reading and analyzing information available on websites or in documents, a better understanding regarding a topic could be gained. Since in desk-top research, a researcher doesn't collect the information him or herself, this is considered as a secondary data collection method. The advantage is that there is no need to go into the field, the internet forms a major source of information and it is accessible for no or very low cost (Hofferth, 2005). The method is often used in combination with other methods, as starting point, complementation or validation.

In-depth interviewing

Another qualitative method is in-depth interviewing. During such interviews, the interviewee is seen as an expert on a certain topic and the interviewer aims to learn from this expertise (Rodica Milena, 2008). Typically, interviewees are approached and conducted individually and probing techniques are applied to dive deeper into a topic (Carolyn Boyce, 2006). The aspired outcome is a vivid and detailed picture of the interviewee's perception, viewpoints and/or experiences (Rodica Milena, 2008).

3.2.2 Method Appropriateness Empirical Methods

Comparing the focus groups and in-depth interviewing as research methods reveals similarities and differences. A similarity is that both methods help to discover how people think about a certain topic, what words they commonly use when discussing it and which related aspects they find important. The main advantages of focus groups relate to the group process characteristic for this method. Firstly. the group process allows people with different opinions to respond to each other (Stokes & Bergin, 2006; Right Marktonderzoek, n.d.). This is useful because during focus groups a researcher could observe how arguments develop in a discussion and after the focus groups, he or she could identify the judgment of different type of respondents, or in marketing terms, different user-profiles (Schwab, 2016). Secondly, the group process makes that participants ask each other questions, which encourages them to substantiate their views and challenges them to reflect on their own perspective. This way personal views could be further defined and deeper insights could be gained (Poortinga. n.d.). Thirdly, referring to terms as synergy, snowballing and serendipity, Zikmund (as cited in Bergin, 2006, p.27) states a group process generally generates a wider range of information than a comparable number of individual interviews. The interaction of respondents starts a train of thoughts among them and that way new (spontaneous) ideas are likely to be created and/or deeper-rooted personal views could be

discovered. Finally, the group process makes respondents pay less attention to the interviewer and therefore the probability for interviewer bias remains limited in focus groups. Interviewer bias appears when an interviewer adopts probing techniques that steer answers into a certain direction, the interviewers are influenced and the given answers could be biased.

Acknowledging these advantages of group processes, over the years the popularity of focus groups in research has grown. However, these group processes also include disadvantages (as explained in more thoroughly section 3.2.2). What is questioned most is to what extent focus groups could provide deeper insights and higher quality outcomes than in-depth interviews. Stokes and Bergin (2006) conducted a parallel study whereby both focus groups and individual interviews were undertaken as part of a marketing research. By comparing the outcomes of both methods, they could asses the validity of the data collected during the focus groups and could understand better how group processes impact research outcomes. They found evidence that:

- Due to processes of consensus between individuals, findings of focus groups only limitedly reflect individual views;
- Both methods are effective in uncovering main marketing issues, such as buyer motivations;
- Data created in individual interviews is generally more detailed and in-depth than the one generated in focus groups;
- Compared to individual interviews, in focus groups wider, breath data is created and more contextual information is gathered.
- In-depth interviewing proves to be very effective in uncovering people's underlying thoughts or reasoning behind a certain view or opinion.

In the end they conclude that each method has particular advantages and disadvantages and that they are appropriate in different type of studies (see table 3). Rodica Milena (2008) conducted a similar, parallel study, applying and comparing both methods, and agrees that it remains dependent on the context what qualitative method suits best. In a research that investigates a specific, well-defined issue in -depth interviewing is likely to be applicable (Stokes & Bergin, 2006). The same is true for studies that address more private or sensitive issues. People might feel uncomfortable to share their thoughts in a group and therefore in-depth interviewing is recommended. In general, interviewees feel more relax and comfortable in a private setting, which allows them to share their deepest thoughts (Rodica Milena, 2008). Contrarily, when a research is concerned with a wider topic and is more exploratory in nature, conducting focus groups could be useful (Stokes & Bergin, 2006). Similarly, when the research is focused on a topic people not commonly discuss or think about, a topic that enjoys relatively low public awareness or a topic that is not yet adequately covered in research before, focus groups could be a suitable research method (Zikmund in Stokes & Bergin, 2006, p. 27).

POTENTIAL OF EACH RESEARCH METHOD TO	FOCUS GROUP	IN-DEPTH INTERVIEW
Identify spread and extent of opinions	Incomplete	Yes
Provide a consensus view	Yes	No
Offer depth and clarity of data	Incomplete	Yes
Offer breath of data and contextual information	Yes	Incomplete
Uncover subtleties in attitudes	Incomplete	Yes

Table 3. Comparison of the research potential of focus groups and individual interviews (based on table 1, Stokes & Bergin, 2006, p. 34)

Why focus groups are a suitable method for this research

The first reason a focus group is seen as a suitable method for this research is because this method could help people to structure and develop thoughts and opinions. This research requires residents to think about their personal experience and perception of nuisance in great detail. This might be difficult for residents who are not familiar with the topic or have never thought about it in this conscious and detailed way. Therefore, this research requires a method that helps respondents to express themselves better, such as focus groups.

This could be further be explained with the special feature of a focus groups; It is not a form of interviewing that involves respondents answering a question one by one, but that people are encouraged to talk to each other. Participants ask each other questions, exchange anecdotes and give reactions to each other's experiences and opinions. The interaction between people that takes place in a group discussion facilitates the expression of ideas that would not have developed in an individual interview. People are encouraged to formulate questions themselves and to investigate both their own ideas and the ideas of others (Poortinga, n.d.). That way, also residents with limited experience with the topic could generate valuable information.

A second reason why focus groups are suitable for this research relates to the subjectivity of the topic. It is assumed how residents experience nuisance inside the living environment differs from person to person. With help of focus groups similarities and differences in residential experience could easily be uncovered because respondents can respond directly to each other and show whether they are in agreement or not. That way, it could be determined

to what extent experience of nuisance is a subjective matter and it could be discussed to what extent the distinction between actual and perceived nuisance is justified and is of relevance for urban planning.

As shown in the conceptual model, residential nuisance could be considered as a wide research topic because it is related to multiple factors. The fact focus groups generally generate breath and contextual data, forms the third reason why this is a suitable method for this research. Although maybe not in-depth, it becomes more likely all necessary data and factors are uncovered with help of this method.

Why in-depth interviewing is a suitable method for this research

Besides focus groups also in-depth interviewing is employed as research method. To explore the someone's perspective on a particular idea, program or situation in-depth interviewing could be an appropriate method. Due to its probing techniques, intensive questioning and personal attention data gained during such interviews is usually rather detailed. This makes it also a useful method to provide contextual information or find deeper explanations to given data (Carolyn Boyce, 2006). In that sense, in depth interviewing could be combined well with other methods to validate or complement data. Likewise, in-depth interviewing will in this research be applied after the focus groups. The data gained during the focus groups will serve as input for the in-depth interview and data will that way be validated and complemented if needed.

3.2.3 Focus Groups

Where previous sections explained the appropriateness of the focus group method in general, coming sections describe how the method is conducted in this study. The location, setting, amount, size of the focus groups is described. Furthermore, how residents are selected, approached prior to the focus group and how they are guided during the focus group is defined as well. Finally, potential drawbacks of the focus group method are addressed.

Focus groups in Hoek van Holland and Pernis

The focus groups are conducted with residents living close to industry as participant. For this, two residential areas in the Netherlands are selected: Pernis and Hoek van Holland. Both areas are located in proximity to industry, water and are as sub-municipalities, part of the bigger municipality Rotterdam. Interestingly, research of the municipality of Rotterdam shows the perceived nuisance in Hoek van Holland is compared to Pernis relatively high, while the actual nuisance is higher in Pernis (Gemeente Rotterdam, 2020). By conducting focus groups in both residential areas, collected data could be compared and could reveal interesting reasons for the difference in perceived nuisance between these places.

Amount and size of focus groups

The more focus groups are conducted, the better the consistency and reliability of the results could be checked. However, considering the given time for this graduation research, the aim was to conduct two focus groups in Pernis and two focus groups in Hoek van Holland. Typically, the group consists of approximately 8-12 persons and is led by one or more moderators. In this case however, only four to five residents are invited per focus group, this allows the moderator to create a more intimate environment for discussion appropriate for in-depth topics such as the living experience and nuisance perception. Moreover, another advantage of a smaller group is that this one is generally easier to guide than a larger one.

The role of moderator

The role of a proper moderator is attempted by me. It is the moderator's task to guide the discussion, support active and respectful participation and make sure the necessary information is gathered as much as possible. As preparation, the moderator defines questions and prepares other potential data collection techniques that are addressed during the focus group (see section 3.3). In this research the moderator takes care of organizational issues as well. Finding participants, maintaining contact with them, finding a suitable setting to organize the focus group, prepare a schedule, make nametags, bring drinks and bites, give a short presentation to explain the purpose of the focus groups and related research and, importantly, arrange forms for informed consent are all the responsibility of the moderator.

Participant selection criteria

Since this is a qualitative study, it is not the objective to generalize findings and, likewise, it is not necessary for the participants of the focus group to be representative for the total population of the selected locations. For selecting residents for the focus group only a limited number of criteria are formulated:
- They have to be able to speak Dutch language
- They have to be 18 years or older
- They have to live for at least 6 months in Pernis/Hoek van Holland

- They should not be part of the same household as other participants*

*Some scientists believe that people who know each other well are likely to agree with statements made by others. In addition, the fact they understand each other easily, without spending too many words could be a disadvantage as well. They are not encouraged to explain their viewpoints in detail, which could limit deeper insights to arise (Poortinga, n.d.).

On the balance, a rich variety of residents is preferred. This could be interpreted broadly: different in age, interest, personal interests. Different in their perspectives on industrial nuisance and/or harbor activities in general. Different in how long they already live in Hoek van Holland or Pernis and their satisfaction of living there. Different in the job they do and in which street they live, et cetera. That way a critical discussion between residents is more likely to arise and deeper insight regarding the subjectivity of nuisance could be gained. That said, since the amount of response is expected to be low and also the resident's availability for certain dates have to be respected, it is possibly hard to steer on focus groups consisting of a rich variety of residents.

Approaching potential participants

To increase the chance residents participate actively during the focus groups, they are selected with help of "convenience sampling". In this type of sampling residents who are available and willing to be present are selected. For both Pernis and Hoek van Holland I designed and ordered 1000 flyers to invite people for the focus groups (see appendix 2.8). They are spread in a variety of places, private, public and off-line and online. Residents interested in joining the focus group could send an e-mail to my TU Delft e-mail address, as indicated on the flyer or online messages (see appendix 2.6).

If this approach appears to be insufficient, I will turn to another type of sampling "Snowball-Sampling". This sampling method is commonly used when the groups of subjects are hard-to-reach. Existing participants are asked to look for relatives who might be interested in joining the focus groups. That way, the group of participants could grow like a snowball. Important to note is that there is a risk for bias in this type of sampling because relatives are more likely to have similarities and have shared opinions about issues. In addition, the anonymity decreases after snowball-sampling, which could influence the way residents participate in the focus group as well.

Focus group setting

Not all locations are suitable for a focus group. The following criteria are applied for selection of a location:

- It should be accessible for participants/ at acceptable distance to the participant's homes.
- It should be available at the moment of the focus groups
- It should have enough spatial capacity (for at least six persons)
- It should be a place people feel comfortable to be for two hours
- Preferably, it should be a place that entails a feeling of trust and informality.
- A table and chairs should be present
- Power plugs should be in place to charge my phone/lap top when necessary.

In search for a location I contacted neighborhood committees and asked them whether they could help me finding a suitable place to organize the focus groups. In addition, on the flyer I placed the friendly request; "If anyone likes to organize the focus group at his or her home, this would be highly appreciated. It goes without saying that I will provide the necessary drinks and bites."

Disadvantages focus groups and their research implications

Some important disadvantages are related to focus groups. It is pivotal to be aware of them and acknowledge their impact on the further research. Based on a combination of sources, disadvantages of focus groups are identified and listed in table 4. How to deal with the disadvantages is explained in table as well, mostly based on general knowledge and personal insights.

DISADVANTAGE FOCUS GROUPS	RESEARCH IMPLICATIONS
To a lesser extent possible to go deeper into subject with individual in group because they have less time to give individual answers (Poortinga, n.d.; Rodica Milena, 2008; Stokes & Bergin, 2006).	To mitigate this effect individual exercises could help, both during and as preparation of the focus groups. That way every participant has automatically an occasion to dive deeper into the topic and time to gain a more detailed understanding. A moderator could use disagreements to motivate people to clarify their point of view and to further investigate their opinion.
Chance of competitive behavior between respondents. Fewer answers might be obtained from less eloquent people (Poortinga, n.d.).	It is the task of the moderator to guide who is having the word and should try to divide the attention equally among the participants.

	The moderator could encourage respondents who say little to make a contribution or should make it clear to dominant respondents that they need to give others more room. A special tool could be using a sandglass and turn it around every time someone starts talking. This way someone feels urged to speak concisely. Also, individual exercises could help to divide the attention equally among the participants. When respondents are asked to first put something on paper themselves, after which the "answers" are discussed in the group this increases the chance that everyone can contribute to the conversation.
Setting a date, finding a suitable location and finding enough people interested to participate in the focus group might take time (Right marktonderzoek, n.d; Schwab, 2016).	Start in time with inviting residents for the focus groups and contacting neighborhood committees to ask for availability of rentable locations. Make use of multiple media channels, online ones such as websites and e-mail and physical ones such as flyers and newspapers. Set go-no-go moments to assess whether the focus groups could be organized in time and also include already a selection of dates in the invites of the focus groups.
The role of the moderator is a key factor in the success of a focus group and therefore also an important disadvantage. The risk of failure is considerably higher than when following a well-prepared interview guide. With a focus group, the interviewer has less control over the course of the group discussion than with individual interviews (Poortinga, n.d.; Schwab, 2016).	I will delve into the role of moderator in advance. I will ask tips from a colleague of Brink of how to be a good moderator. Optionally, ask someone from Brink or a friend or relative to assist me with guiding the focus groups, particularly focusing on the process. Prepare for multiple scenario's and make a detailed planning, which could be followed during the session. I will prepare what I am going to say when people have too much or too little input and what to do when disagreements run high. If necessary, I write a script where I can fall back on and practice with friends or housemates.
The data produced by a focus group study is more difficult to analyze than data from individual interviews. Working out the recordings of a group discussion is very time-consuming. Working out recordings is sometimes not possible because you can rarely completely prevent people from talking at the same time (Poortinga, n.d.).	Since the goal of this research is not to compare individual viewpoints, but get an overall picture of how residents experience the neighborhood, it is not of relevance to know exactly who says what. That said, for some sub-questions like 3, 4 it could be useful to gather and analyze individual data. Again, individual exercises could be useful in this regard. Also giving each residents their own color, so stickers and pencils all in the same color, that way their answers could be derived from the products we make during the focus groups. Moreover, a delicate working microphone, designed for group discussions might be useful to ensure audio recording is as precise as possible.
Group effects represent a risk. Divergent opinions, for example, are suppressed and not expressed when a certain perspective appears dominant or accepted by the group (Poortinga, n.d.; Rodica Milena, 2008; Stokes & Bergin, 2006).	To deal with this disadvantage the moderator should create a safe, positive atmosphere wherein participants respect each other views. This could be done by providing some occasion for small-talk in advance of the focus group and also during the break. In addition, it is pivotal that the moderator keeps a close eye on the group dynamic processes and prevent polarization or dominant behavior. The moderator could set an example by having a positive and tolerant attitude him/herself.
In a group discussion, people are more inclined to take culturally accepted positions than in individual interviews (Poortinga, n.d.).	The cultural bias in this research is expected to be low. Regarding living experience a wide range of viewpoints are culturally accepted.
A focus group may be less suitable if people experience the subject as uncomfortable or very personal, which might form a barrier for the discussion flow and idea sharing (Poortinga, n.d.; Rodica Milena, 2008).	The research topic is not very personal or private, therefore it is expected people do not experience it as uncomfortable to share their views or ideas. It is pivotal that the moderator keeps a close eye on the group dynamic processes and prevent uncomfortable feelings.

Table 4. Disadvantages of focus group as research method and related research implications (own figure).

3.2.4 In-depth Interviewing

After the focus groups, in-depth interviewing is employed as the second empirical method in this research. The data gained during the focus groups and desk-top research will serve as input for the in-depth interview and data will that way be validated and complemented if needed. An urban planner involved with Hoek van Holland and Pernis were planned to be interviewed to reflect on the findings of the focus groups and start a discussion about managing residential nuisance as urban planner in general. By addressing a top-down perspective, more contextual data could be gathered regarding the combination of industrial and residential uses, and the potential nuisance arising from it. An urban planner, working for the municipality of Rotterdam (the central municipality of Hoek van Holland and Pernis), is selected for this purpose. The selection is based on his current involvement with urban planning of Hoek van Holland and Pernis, his personal fascination for the urban planning challenges of the Port of Rotterdam and surrounding and his deep-rooted passion for making residents happy (Spelt, 2019). Moreover, the in-depth interview was planned to be conducted face-to face.

Preparation in-depth interview

Since this is a qualitative research that requires a sufficient amount of flexibility to react on and profit from serendipities, the interview is organized in a semi-structured way. This means that upfront decisions are made regarding the formulation of questions, sequence of questions and interviewer behavior, but that during the interview some deviations regarding these decisions might be made. The topics to be covered during the interview usually remain rather fixed in semi-structured interviews. (Research Methods and Statistics, 2016a, September, 11). Since the findings of this interview are compared with the findings of the focus groups, this interview requires a well-prepared structure. It is a balance between comparability and flexibility; the interviewer aims to follow this structure, but could deviate from it when needed. The structure drawn up is based on the main three topics of this research. Additionally, some context related questions are included. Albeit they are not derived from previous defined research topics, they are useful because they allow the researcher to gather more contextual information around the topic of residential nuisance caused by industry. How the in-depth interview is structured is shown in table 5.

RESEARCH TOPIC	INTERVIEW TOPIC	INTERVIEW TOPIC (in Dutch)
Contextual question	1. Importance of industrial nuisance	1. Belang van overlast door industrie
Perceived Nuisance	2. Degree of industrial nuisance in Hoek van Holland	2. Mate van overlast door industrie in Hoek van Holland
Perceived Nuisance Factors (personal and situational)	3. Factors influencing the perceived nuisance of industry	3. Factoren van invloed op ervaren overlast door industrie
Residential nuisance from the urban planning perspective	4. Accepted levels of industrial nuisance	4. Geaccepteerde niveaus van overlast door industrie
	5. Dealing with industrial nuisance	5. Omgaan met overlast door industrie
	6. Validation findings focus groups with residents	6. Validatie eerdere uitkomsten van bewonersbijeenkomsten
Contextual question	7. Challenge port city of Rotterdam	7. Uitdaging havenstad Rotterdam

Table 5. Structure in- depth interview and interview topics (own figure).

Based on this structure an interview protocol is drawn up, which could be found in Dutch in appendix 6.1. Besides drawing up this protocol, deciding on how the interviewer will behave is also part of the preparation. The relationship between the interviewer and interviewee is essential for a successful interview. The more trust is generated, the more likely an interviewee feels comfortable to share information. There are two styles of interviewing: person-orientated or task-orientated. A skillful interviewer adopts both styles at once and understands some topics require a "warmer" (more person-orientated) way of interviewing than others (Research Methods and Statistics, 2016b, September, 11).

In this case, a task-orientated style has been most prominent. Since the interviewee participates in the interview from the role as urban planner, topics discussed are rather professional in nature. Questions are not necessarily personal or sensitive, so it is therefore likely the interviewee feels at ease to answer all the questions. In this task-orientated style much attention is paid to the relevance, completeness and clarity of the data provided by the urban planner. That said, person-orientated behaviors cannot be neglected completely. At the start of the interview, some small-talk could nurture the relationship between interviewer and interviewee. Later, during the interview, the interviewer should show interest and empathy to encourage a free and trustworthy conversation.

Disadvantages in-depth interviewing and their research implications

Like focus groups, also some disadvantages are attached to in-depth interviewing. It is pivotal to be aware of them and acknowledge their impact on the further research. Based on a combination of sources, disadvantages of in-depth interviews are identified and listed in table 6. How to deal with the disadvantages is explained in the table as well, mostly based on general knowledge and personal insights.

DISADVANTAGES IN-DEPTH INTERVIEWING	RESEARCH IMPLICATIONS
Responses might be prone to bias, because interviewees might have certain stakes or interest in the research topic (Carolyn Boyce, 2006).	In this research it is expected personal interest are not really at stake. Moreover, the personal information of the interviewee is anonymized, which supports him or her to speak freely, respecting their privacy.
It could be a time intensive method. Planning, conducting, transcribing and analyzing the interview are time-consuming activities. (Carolyn Boyce, 2006).	In the overall research planning, a sufficient amount of time should be included for each activity related to interviewing.
It is not always possible for interviewees to find the rights words to express themselves (Verhulst & Lamberts, 2015).	By applying the right probing techniques, the interviewer could help the interviewee to formulate answers. A relaxed attitude showing understanding and patience could also make the interviewee comfortable to talk and think freely. Furthermore,

	the interviewer should try to avoid complicated language (Kairuz, Crump, & O'Brien, 2007).
Interviewer bias. The voice, intonation, body language and other social cues of the interviewer could steer the interviewee in a particular direction and that way bias the answers (Opdenakker, 2006).	By defining the questions in advance of the interview and be aware of steering effects during the interview, this interview bias could be diminished.
The face to face aspect of in-depth interviewing makes double attention is needed by the interviewer; besides listening to the answer given and understanding it, the interviewer also needs to remember what questions are already treated and what questions still need to be answered in the required level of depth and detail within the given time (Opdenakker, 2006).	The interviewer could take notes to ensure all questions are treated during the interview (Opdenakker, 2006). Also, an interview protocol could serve as checklist.
Depending on the location of the interview, travel cost could make this method a costly one (Schwab, 2016).	Since Hoek van Holland and Pernis are near Delft, this disadvantage is not applicable for this research.
The information provided in interviews is scattered in nature (Kairuz, Crump, & O'Brien, 2007).	Information gathered during the interview does not have to be structured right away, but this could be done afterwards by recording the interview with a microphone, transcribe this audio information and analyze this transcript with help of analysis software, such as Atlas Ti. That way information could be organized according to different concepts or topics, relevant for the research.

Table 6. Disadvantages of interview as research method and related research implications (own figure).

3.3 Techniques to Collect Data

Besides asking questions and making people feel at ease to speak freely, it is a pivotal task of moderator or interviewer to guide the respondents in a way they give complete, clear and relevant answers during the data collection. Therefore, two types of techniques are adopted during this research; probing techniques and generative techniques. The first is commonly used in qualitative research and is used during both the focus groups as well as the in-depth interview. The second is often used in design research. Albeit this is not a study where respondents actually design something, to stimulate proper data collection during the focus groups generative techniques are employed. This section includes a general description of both techniques and a precise explanation of how these techniques are applied during the study.

3.3.1 Probing Techniques

Providing more freedom to the respondents is one of the main aspects of qualitative methods. However, this freedom entails some challenges for the researcher as well. There is fewer control on what a respondent is saying and answers could easily end up off topic. In addition, respondent might not explain clearly or completely what they are meaning to say, speak ambiguously, are too specific or too broad. With help of probing techniques an interviewer or moderator could steer on qualitative answers and likewise, qualitative data. The purpose of probing is to get information you need, in the right level of detail and completeness.

How does this work? Basically, the interviewer responds to replies with probes. There are directive, non-directive and suggestive probes. As the name suggests, directive probes are used to give direction to respondents, asking about more specific information, an example or an explanation. Contrarily, non-directive probes do not give direction, but space. Space to wonder more about the topic, more time to formulate an answer. An example of non-directive probing is simply humming (hmm, hmm). Suggestive probing is a directive way of probing, that focusses not only on the scope, detail, completeness and relevance of the answer, but also on the content of the answer itself. Although, sometimes useful when respondents seem to struggle with the topic at hand, interviewers should be wary about using this type of probing, because of the related interviewer bias it might include. Examples of probes are the following (Research Methods and Statistics, 2016c, September, 11):

- Active silence
- Humming
- Echoing
- Comment
- Unfinished question/sentence

- Question
- Repetition
- Reformulation
- Follow-up question
- Expression of doubt
- Expression of (in)comprehension
- Expression of perceived inconsistency
- Paraphrasing
- Summarizing
- Reflection
- Request for elaboration
- Request for specification
- Request for example
- Request for contrast
- Request for own opinion
- Request for reasoning
- Request for experiences
- Request for feelings

3.3.2 Application of Probing Techniques in this Study

In both the focus groups and interview probing techniques are employed. It should be noted however, there are some slight differences in the exact execution of them. In focus groups, the conversation takes place in a group of people, and the group dynamics that this involves makes fewer probing of the moderator is needed. The respondents reply to each other, ask each other questions (directive probing), give spontaneous reactions, like "Oh really? (non- directive probing) or add content to the answer themselves. The moderator will still apply probing techniques, but not as much as an interviewer would do in an in-depth interview. Another possible side-effect of group dynamics is that everyone wants to be heard and topics are automatically discussed more extensively. This is positive when the topic is relevant for the research, but when it is not, it could also result in "wasted" time. Therefore, it becomes extra important for moderators, while at the background, to keep a close eye on the topics discussed and steer respondents when needed with help of probing.

In interviews, probing techniques are used in a slightly different way. Compared to moderators, interviewers play a more prominent role during the data collection. The interviewer is continuously involved in the conversation and steers the interviewee along the way with help of probing techniques. Furthermore, it could be theorized less non-directive probes are used during in-depth interviews. Interviewees do not have to compete with other respondents like in focus groups, and thus probes that give more space to formulate answer might be less necessary.

3.3.3 Generative Techniques

Poortinga (n.d.) mentions that assignments and exercises could besides questions form an important part of focus group studies. Such assignments help people to focus on the exercises and each other rather than on the moderator. As a researcher, it's not necessarily about the final outcome, but it is about all the information that people reveal when they discuss with each other. Following this train of thought, generative techniques are applied during the focus groups of this research.

To elaborate on what generative techniques entail, theories described in the book "The Convivial Toolbox", written by Elizabeth Sanders and Pieter Jan Stappers (2018) are taken as basis. In this theory, people formerly known as end-users, such as residents, are seen as experts of their own experience. The book explains that over the past years a wide variety of techniques have been developed to learn from people, their perceptions and experiences. The underlying idea is that by looking at what people say, do or make data is revealed. By combining say-, do-, and make techniques rich data regarding someone's perception, experience and feelings could be gathered. Say- techniques aim at gathering verbal information by asking respondents questions. Examples are questionnaires and interviews. With Do- techniques, behavior, activities or places are observed and documented with for example self-reports or (hidden) inspections. Finally, make- techniques involves letting participants make something to express themselves. It is believed in particular these make- techniques are valuable for research because they could bring deeper levels of information to the surface (see figure 5). Likewise, in the book most attention is paid to these make- techniques, also called generative techniques.
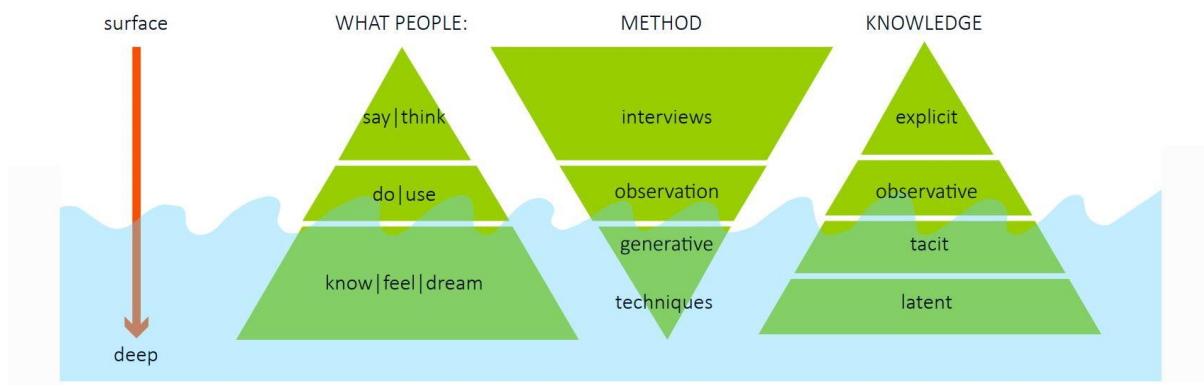
Figure 5. Methods that study what people say, do and make help to access different levels of knowledge (adapted from source: Sanders and Stappers , 2018, p. 67)

Something noteworthy are the toolkits for expression. Sanders and Stappers (2018) describe these toolkits are an essential part of every generative research, focused on people. A toolkit includes elements, such as photo's, words or maps that trigger emotions among people and helps them to formulate answers, verbally or visually. The toolkits could help participants to recall memories, uncover feelings or imagine experiences. In order to realy reveal deeper rooted knowledge, they recommend to follow "the path of expression" (see figure 6). Sanders and Stappers (2018) explain "the experience of the moment (now) is connected to the past and future through memories and dreams. The path of expression shows how a person's awareness could be guided in steps by thinking first of the present, then of the past, then looking for underlying layers, in order to move towards the future" (as cited in Sanders and Stappers, 2018, p. 55). Accordingly, the prepared questions and exercises support the residents to think about different times, and the relative sequence of these questions and exercises is based on the path of expression. Besides structuring the focus group deliberately, tailoring the toolkit to the research purpose is key.
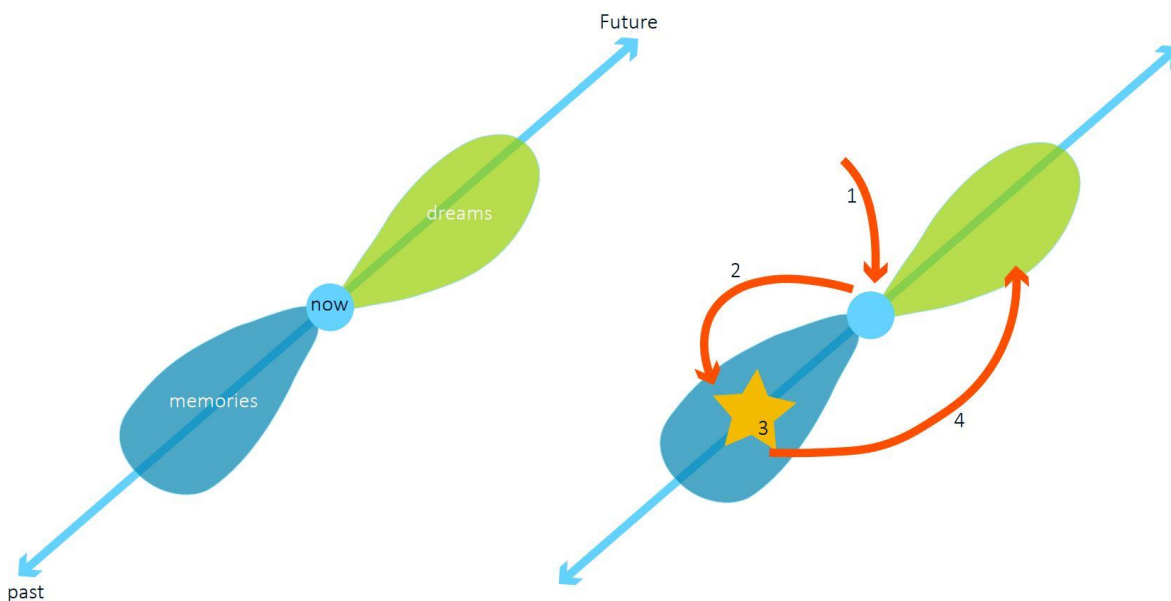

Figure 6. The path of expression (adapted from source: Sanders and Stappers , 2018, p. 55)

3.3.4 Application of Generative Techniques in this Study

In the focus groups, besides a discussion based on questions, also generative techniques are applied in the form of visual exercises (the toolbox for expression). That way, say and make techniques are combined in one method and they could complement and reinforce one another. As explained earlier, residential nuisance might be a topic people are not used to think about. So, when I for instance ask residents "Why do you think some people are more annoyed by nuisance that others?", it might result in silence because they cannot find the right words to answer this question. Therefore, for these "hard to discuss" topics visual exercises whereby residents make something are included in the

focus group. This allows them to express themselves visually and helps them to structure their individual thoughts and knowledge around the topic. When finished making, we reflect collectively on what everyone has made and develop a discussion based on the materials and creations we have in front of us. Thus, the purpose of the exercises during the focus groups is twofold; on the one hand, the outcome of the exercise entails visual data and, on the other hand, the activity of doing the exercise itself supports the collection of verbal data. Moreover, making such an exercise ensures individual information is documented, valuable for the later data analysis of the research.

RQ	RESEARCH TOPIC	FOCUS GROUP THEME	FOCUS GROUP THEME (Dutch)
1	Perceived nuisance	Industrial Nuisance as Experienced by Residents	Industriële Overlast zoals Ervaren door Bewoners
2	Perceived nuisance factors (personal and situational)	Comparison Perceived and Actual Nuisance	Vergelijking Ervaren Overlast Vergelijking van ervaren overlast met gemeten overlast
		The Past, Present and Future	Vroeger, nu en de toekomst
		Activities in Hoek van Holland	Ontspannen in Hoek van Holland
		The SIMS in Hoek van Holland	The SIMS in Hoek van Holland
3	Residential nuisance from the urban planning perspective	Not applicable	Not applicable

Table 7. Focus group themes per research topic and research questions (own figure).

Based on the research questions, as formulate earlier in section 2.2, the focus group is prepared. Firstly, all research questions and related topics, with exception the third, are translated into five focus group themes (see table 7). The third question is answered with help of desk-top research and in-depth interviewing. Based on these five themes, questions are formulated and exercises are prepared (see appendix 2.2). Despite this defined structure, it is expected topics would be brought up by the residents themselves during the conversation and will therefore lead to deviations in predefined order of data collection. Likely, the discussion will not follow a linear process.

These themes allow the discussion to be guided better and also supports structured data collection and analysis. Notably, since the themes and questions were communicated to the residents in advance of the focus groups, the themes are formulated in daily language. That way all residents could understand them properly and also their the thres-hold for joining the focus group remains low. For all themes, except for "The Past, Present and Future", visual material and or exercises were prepared to support a qualitative discussion. The exact generative techniques used during the focus group could be found in appendix 2.3 and the documents communicated to the residents prior to the focus group are shown in appendix 2.4 and 2.5.

3.4 Unplanned Method Deviations

As common for research projects, some empirical aspects developed differently as planned and, responding to them, some method deviations are made along the way. Section below elaborates on two deviations.

3.4.1 Cancellation Focus Groups Pernis
In advance of the empirical process, finding enough participants for the focus groups was already seen as a challenging task. In the end, this concern proved to be right. Albeit my effort; In both Hoek van Holland and Pernis I have spent approximately two days to post in total 2000 flyers. Posting them in people's post boxes and showcase them at public locations, that either people often visit, like supermarkets, or places people are not in a hurry, such as waiting rooms or medicine stores. Additionally, I approached local newspapers and online media, such as Facebook, to share my flyer and invite residents for the focus groups (see appendix 2.7). In the end, this approach proved to be insufficient, because not enough residents had shown their interest. In Hoek van Holland six residents responded to the flyer, of which five were available on the same date. In Pernis, the response was rather disappointing. To be precise, no resident had shown their interest. The poor prospect of finding an acceptable number of residents in Pernis, led to a pivotal decision; Objectives were down-sized and organizing two focus groups in Hoek van Holland became the main aim. Likewise, in search for more participants no further attention is paid to Pernis.

Once again, I visited Hoek van Holland and went from door to door to motivate people to join one of the focus groups. This time I did not only post a flyer, but handed it over personally by ringing the doorbells. It proved to be effective; Three additional residents verbally showed their interest in only two hours' time. Unfortunately, only one of them send an e-mail to officially apply. As final step, I turned to "snowball-sampling". Existing participants were asked to look for relatives who might be interested in joining the focus-group. In the end I managed to find a sufficient number of residents for two focus groups in Hoek van Holland. The first focus group took place on the 4th of March 2020, consisting of five residents. The second was conducted on the 12th of March 2020 and three residents joined this group. The latter supposed to be with four residents, however, one canceled due to illness, so eventually three residents were present.

3.4.2 Corona: From Face-to-Face to Video Call

Besides, the disappointing response of residents to join the focus group, another event lead to method deviations during this study; the international corona epidemic. Since the January 2020, a new human corona virus, called Severe Respiratory Syndrome (SARS-CoV-2), spread around the world and in the beginning of March 2020, it became a more serious problem in the Netherlands as well. The virus causes respiratory infections and has in some cases even a fatal end. With no vaccine available, the Dutch government posed strict measures in order to control the spreading of the corona virus; People may only go outside when necessary, (for example for groceries or a breath of fresh air), have to work at home as much as possible, keep 1,5 meters distance from one another and wash their hands with soap several times a day. Luckily, I had conducted the second focus group just in time: the 12th of March 2020, which is three days before the initiation of all these measures. The in-depth interview with the urban planner, however, was planned on the 2nd of April 2020 and would take place in person. Eventually, the in-depth interview proceeded through a video-call on the 3rd of April 2020 instead.

3.5 Data Analysis

During this research multiple types of data is collected, by analyzing them, new insights could be gained and an answer to the main research question could be formulated. This section describes the data analysis of this research. First, how each type of data is analyzed is explained. Second, a data analysis plan is presented to show how the various data, from the focus-groups, desk-top research and in-depth interview, is combined and analyzed.

3.5.1 Analysis per Data Type

Applying multiple methods and techniques makes also multiple types of data is collected. What the residents and urban planner say, will result in audio data, what they make will produce visual data, what they will write down or communicate through e-mail, leads to written data. Each type of data requires a particular data analysis approach, which are described in sections below.

Audio data (see appendix 3.2, 4.2, 6.2)

Under permission of the residents and urban planner, the focus group and interview have been recorded. After the focus groups and interview, the audio data was transcribed as soon as possible. This way, pivotal details, such as facial expressions or observed behavior, could easily be recalled and complete the data collection. A disadvantage of analyzing audio data of focus groups is that multiple participants might be speaking at the same time. To deal with this disadvantage two measures were taken. The first was to use a professional microphone to record the discussion, ensuring a high-quality record. The second measure was to be as moderator extra aware of people speaking simultaneously and act when needed. Since the total amount of transcripts was limited, it was not considered necessary to use an extra software tool, such as Atlas Ti. The principles behind Atlas Ti are, however, are adopted during the analysis of the transcripts. First, all relevant words and phrases are marked. They were considered relevant when a clear relation could be seen with a research topic or question. The marked phrases are then copied to a separate document where they are grouped according to the research topics. Printing these documents, provided a clear overview of the data, which could be processed in structured way.

Visual data (see appendix 2.3, 3.5, 4.5)

Besides audio data also visual data is collected during this research. Using generative techniques and supporting materials, such as maps, stickers and markers residents could express themselves in words and visuals. To tackle the same issue, how to distinguish individual data from the collective ones, every resident was assigned a different color.

So, one resident had red colored stickers and markers in the toolbox, while the other had green ones, the other blue and so on. The name tags had corresponding colors as well, which made putting names on the maps or drawings was not necessary and anonymity of the residents could also in the visual data be preserved. Since transparent foil was used as drawing material, individual drawings could be stacked and easily compared between the residents. Possibly, also patterns and common perceptions are this way revealed.

Written data (see appendix 2.4, 3.1, 4.1)

During the research also written data is collected. Policy documents, research reports and online knowledge centers are consulted. By reading carefully and marking phrases relevant to the research questions, similar to the analysis of transcripts, data could be categorized according to the research topics. This categorization of information is useful for structured data analysis. Beside this document review, some written data is also collected by e-mail. Some questions were sent by e-mail to residents in advance of the focus groups. Since they replied by adding answers to the original e-mail text and send an e-mail back individually, data was easily structured and analyzed.

3.5.2 Data Analysis Steps

Following the research Design, as described in section 3.2.1, three methods are used to collect different types of data, from different types of sources with different perspectives. To maintain an overview of all collected data and analyze it in a controlled and structured way, a converging process is followed, whereby data gained during the different methods is analyzed, compared and combined. The underlying idea is to fully employ and benefit from all data collected; It is pivotal to not jump directly to conclusion drawing, but first dive deeper and thoroughly into the data. With help of this data analysis plan every type of data on every level is considered. Step by step it becomes clear what the similarities and differences are between the perceptions and experiences of residents, on the one hand, and the knowledge and practice of urban planners on the other.

In line with this process, eight steps are defined to analyze the data in a structured way. Similar to the preparation of the focus groups and in-depth interview, the research questions and related topics (defined in section 2.2) serve as basis for the data analysis. The data needed in each step is not necessarily derived from one method or technique, but could also include an evaluation of multiple types of data, gathered during various types of methods. Moreover, during the final step all data collected during the research is considered. An overview of the data analysis steps is shown in figure 7.

Throughout the analysis both the data of residents as individual, as well as data of residents as group is considered. Whereby the first serves as basis for the latter. When translating this individual data to collective data, the degree of agreement between the residents has to be taken into account. When residents agree strongly about a topic, it could be one perception is representative for the group of residents as a whole. On the other hand, when residents disagree strongly about a topic, it would be better to accept a range of perspectives, since presenting a collective outcome would not be representative and would therefore be misleading. Focusing not only on the residents as group, but also as individuals allows me to gain a more in-depth understanding of perceived nuisance and to draw conclusions for residents as group in a more grounded way.

3.6 Data Plan

Since this research makes use of human resources, residents and urban planner, information might be sensitive or private and therefore, needs to be handled with care. Data is treated with respect to the FAIR Guiding Principles - doi:10.1038/sdata.2016.18. FAIR stands for the four foundational principles of scientific data management: Findability, Accessibility, Interoperability, and, Reusability (Wilkinson et al., 2016). How data is collected, saved and respected in this research is described more extensively in the Data Plan in appendix 1.1.
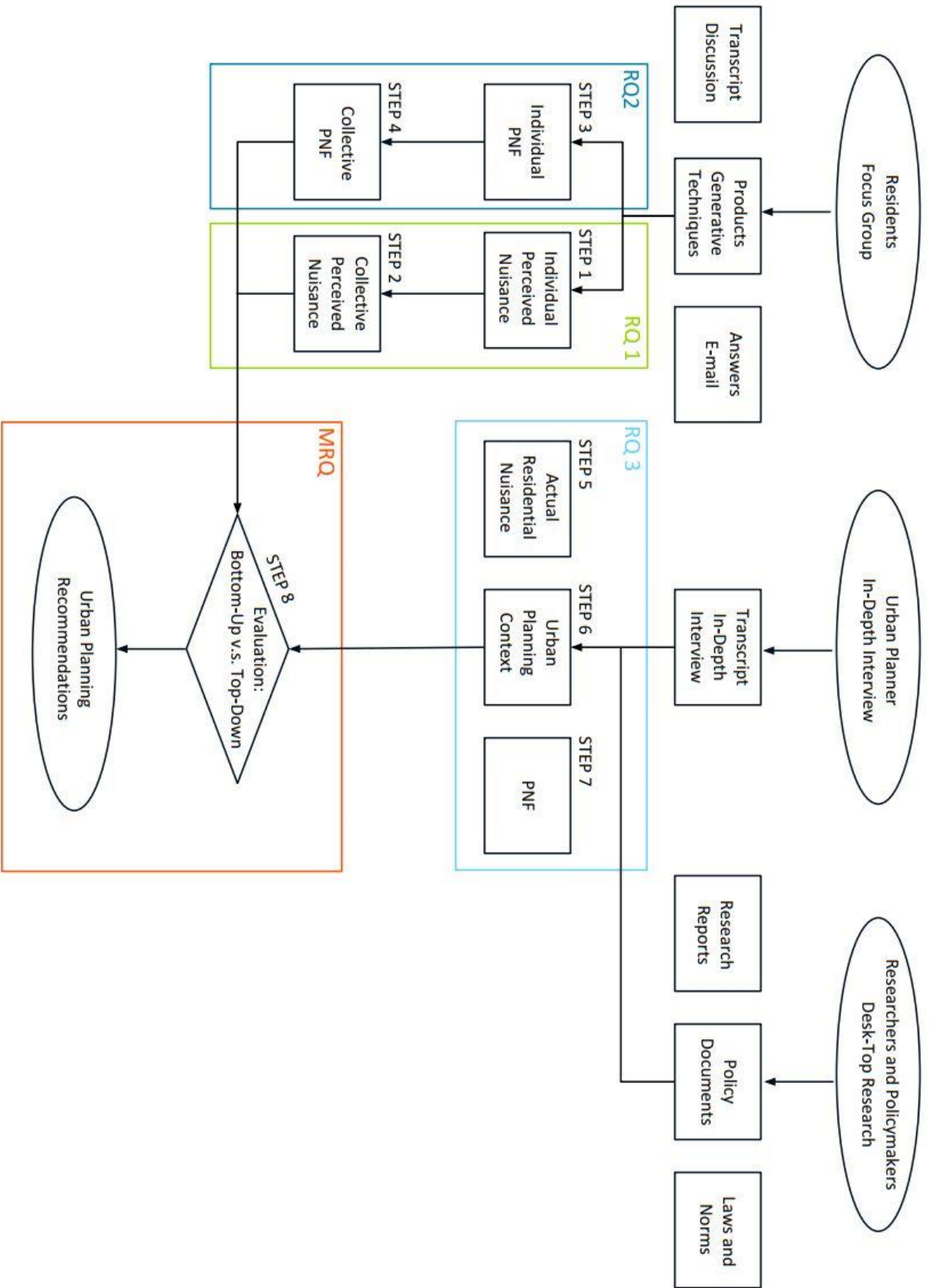
Figure 7. Data Analysis Steps (own figure)

3.7 Ethical Considerations

Next to the FAIR Guiding Principles, also the "regulations and guidelines for Human Research" provided by the TU Delft Human Research Ethics Committee are respected. In the science context, ethical considerations relate to values as anonymity, confidentiality and privacy. In this research these values are protected in multiple ways. Personal or sensitive information collected during the focus groups or in-depth interview are anonymized. Furthermore, before, during and after the focus group the participants are treated in a respectful manner. With help of an informed consent form, the researcher asks permission for the publication of data and is also transparent and honest about the further processing. Combined with an introduction letter, that explains the purpose of the research, this form is sent by e-mail to the interviewee and focus group participants in advance of the interview. At the start of the meeting, participants of the focus group have had the opportunity to read and sign the informed consent form (see appendix 1.2, 1.3) Moreover, the researcher has given the participants the opportunity to stop or leave the focus-group at any moment. At the end of the focus groups, the participants have received as appreciation for their participation some chocolates of the famous Delft chocolatery "de Lelie". Furthermore, the final report has been sent to the residents who participated during the focus groups. Prior to every method where human resources were consulted, permission has been requested for audio recording. Both residents and the urban planner agreed with this. In case of the focus groups also permission was asked for making pictures. One resident expressed the wish not to be on the picture. To respect the resident's privacy, the photos are merely shown shortly during the presentation, are not published online and are not included in this report.

4

Data Analysis and Results

4. Data Analysis and Results

After the execution of the focus groups, in-depth interviews and desk-top research, all data is gathered and analyzed. The results of this analysis are described in this chapter and important to note is that all data has been anonymized. This means addresses are presented globally instead of precisely, and fictional names are used for residents instead of their real names. Moreover, the results described in this chapter are based on a desk-top research, two focus groups in Hoek van Holland and one in-depth interview with an urban planner, working on Hoek van Holland. The focus groups in Pernis have due to circumstances been canceled, which has been explained in more detail in section 3.4.

First, general information regarding Hoek van Holland as practical case is provided. Second, how residential nuisance is determined is explained. Then, the individual and collective perceived nuisance of residents is determined and related lessons about residential nuisance in general are drawn. Next, a deeper understanding of perceived nuisance factors is gained, by looking at what factors could have played a role in the residents' nuisance perceptions, as individual and as group. Finally, the top down perspective of nuisance is addressed, whereby how residential nuisance is embedded in the Dutch urban planning context is briefly explained, the urban planner's view on nuisance in Hoek van Holland is described and wider urban planning challenges related to Hoek van Holland are discussed.

4.1 Case Description: The Focus Groups in Hoek van Holland

For data collection two focus groups have been held with residents of Hoek van Holland, a village in the Netherlands. Hoek van Holland is selected as case for this research because its location (figure 8) illustrates well how in modern urban planning variety of large-scale functions could come together and industry and housing could exist side by side; The north-east side of Hoek van Holland borders on green housing of the Westland, which is currently the most important horticultural area of the Netherlands. On the east side, one finds a mix of green, composting, industrial and residential functions. The Nieuwe Waterweg, a large-scale canal constructed for global trade shipments, is located south from Hoek van Holland and forms a "natural" border between the village and the harbor activities on the other side. The part of the harbor that is most close to Hoek van Holland, and thereby most likely to be experienced by the residents is called Tweede Maasvlakte. One bigger shipping company, Stenaline, is located in Hoek van Holland itself and is responsible for daily shipments to England to export Dutch vegetables. A green dike is constructed along the Nieuwe Waterweg, separating the village center, and thereby the residents, visually from the Stenaline and the Tweede Maasvlakte. Finally, Hoek van Holland is located at sea and one can find a beach at the north-west side of the village.

Figure 8. Satalite view Hoek van Holland, showing the large-scale mix of functions in the surrounding (based on Google Maps, 2020)

In the first focus group five residents participated: Kees, Yara, Anja, Jan and Marcel. What the residents had in common was their general interest in the living environment and their age, which varied between 45 and 65 years old. Despite these similarities, it could be considered as a diverse group of people, with different back-grounds, life experiences and interest. Moreover, they live in different parts of Hoek van Holland, as shown in map below. During the focus group there was a pleasant energy, the residents participated actively in the discussion and a critical dialogue aroused.

Three residents participated in the second focus group: Henk, Clarien and Fien. Opposed to the first group, these residents generally had a lot in common. They were between 60 and 70 years old, very satisfied to live in Hoek van Holland and all had no particular interest or relation with industry. Looking at the duration of residence, however, this was quite different, Clarien already lives for 50 years in Hoek van Holland, Fien almost 40 years and Henk only two years. Important to note is that Clarien and Fien knew each other personally, because they are living in the same street. Considering the locations of all residents combined, various parts of Hoek van Holland are represented in the focus groups, as shown in figure 9.

Figure 9. Map Hoek van Holland, showing approximately where residents of focus groups live (own figure)

4.2 Determining Perceived Nuisance

To determine what, how and where the residents of Hoek van Holland experience nuisance, the visual and verbal data resulting from the focus groups is analyzed. In addition, written data, obtained through e-mail with the residents prior to the focus groups is considered. It was expected that the different types of data would complement one another and would together give an idea about the nuisance perception per person. In retrospect, this expectation turned to be partly correct. Indeed, the exercises complemented one another and the discussion following from it provided further insights. However, in some cases findings resulting from different techniques were not entirely in correspondence and choices regarding the relative importance of data had to be made. How the perceived nuisance is eventually determined is elaborated in more detail below.

4.2.1 Initial Idea Data Analysis

Two focus group themes were prepared to gather data about the perceived nuisance in Hoek van Holland. The first theme was "Industriële overlast zoals ervaren door bewoners" (in English: industrial nuisance as experienced by residents) and included both generative techniques as well as probing techniques to collect data. The second theme is "Vroeger, nu en de toekomst" (in English: Past, present and future), for which merely questions were prepared. Initially the idea was to analyze both the verbal data as well as the visual data collected. By analyzing the visual data of the residents one can extract what types of nuisance they observe, where they observe it, how often they observe it and how annoyed they are because of it. More concretely, the generative techniques during the focus groups resulted in three types of drawings:

- The perceived nuisance map indicates the location of nuisance on higher scale with circles (see figure 10)
- The perceived nuisance section indicates the location of nuisance in and around the house with stickers (see figure 11)
- The perceived nuisance matrix indicates the frequency and annoyance of a certain nuisance with stickers (see figure 12)

Figure 10. Example of perceived nuisance map resulting from focus groups with residents (own figure)

Figure 11. Example of perceived nuisance section resulting from focus groups with residents (own figure)
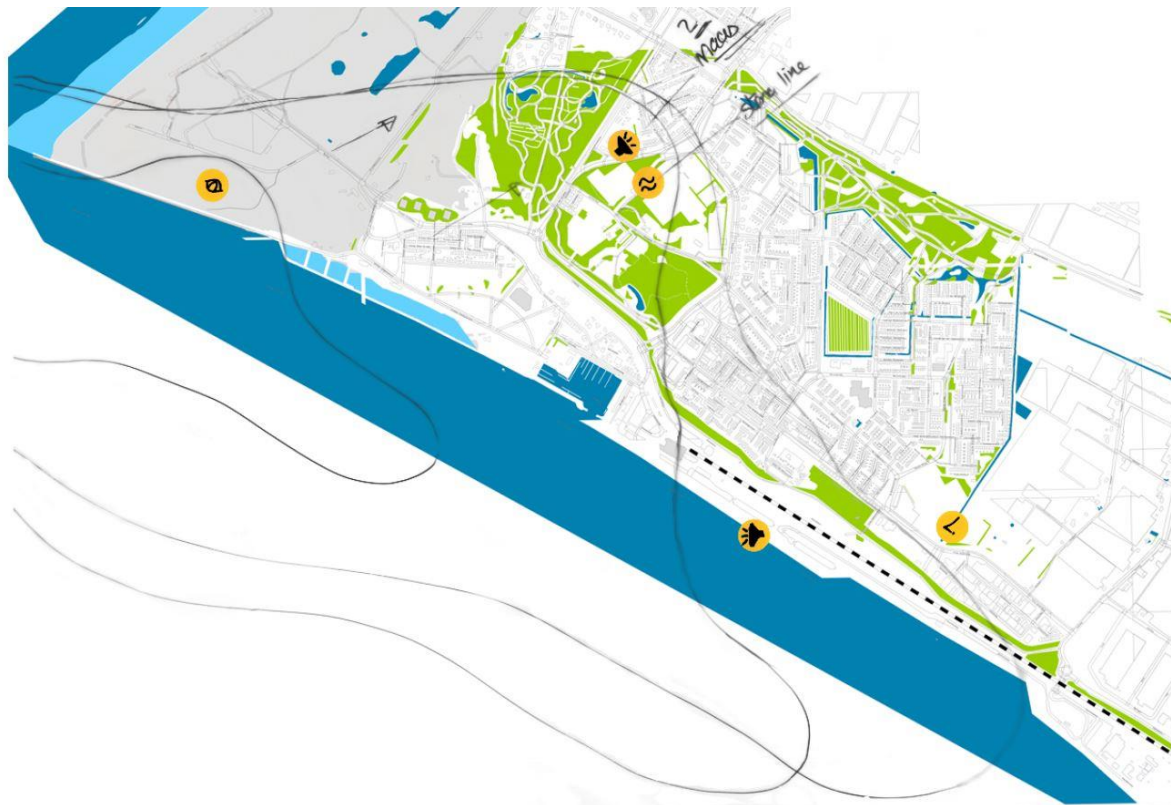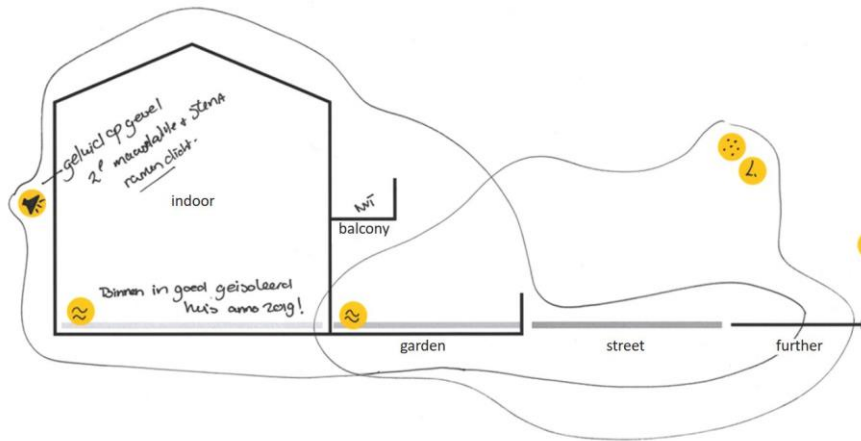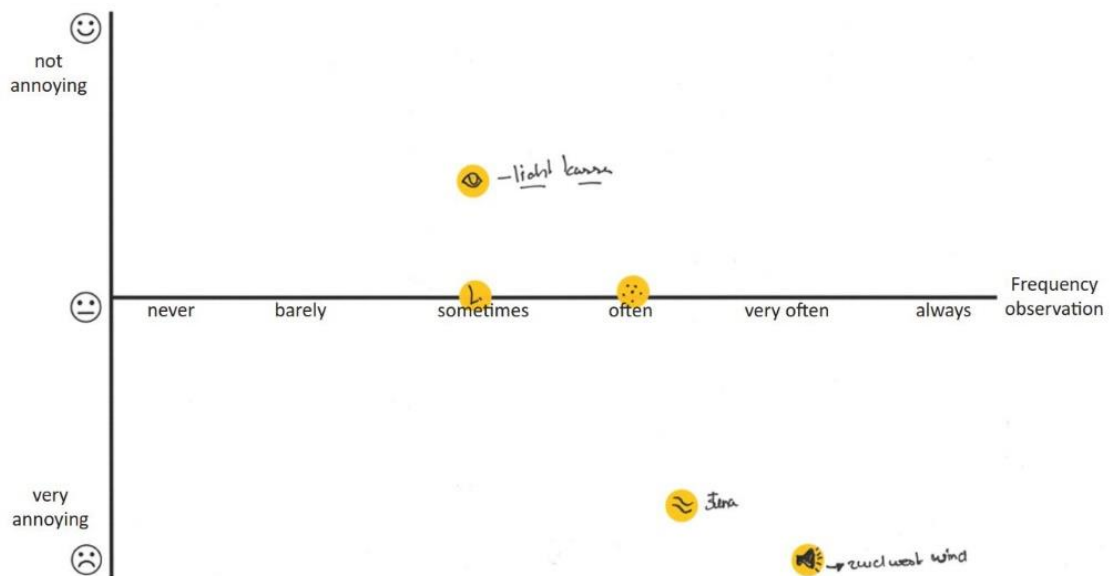

Figure 12. Example of perceived nuisance matrix resulting from focus groups with residents (own figure)
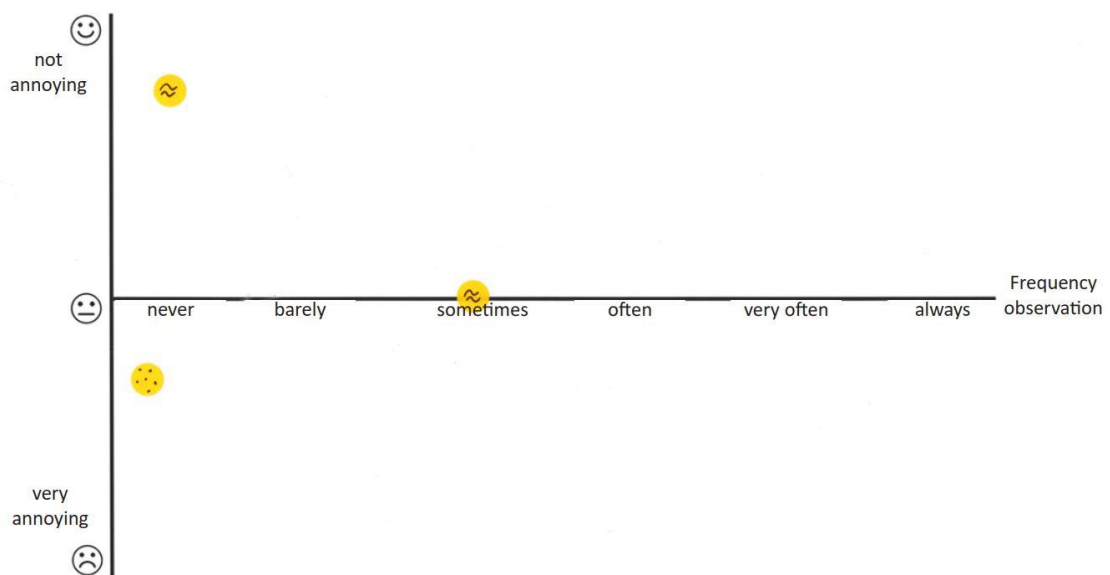

Figure 13. Example of perceived nuisance matrix, whereby the resident potentially has misunderstood the exercise (own figure)

Differences between map, section, matrix and discussion

Analyzing the drawings from the residents, it could be noted the assignments have been interpreted and conducted in several ways. As for the map, some residents draw circles indicating where they perceive the nuisance themselves, while others indicated the source of nuisance on it, and some seemed to combine the two. Regarding the exercise of the section there was less confusion, but the results were not always coherent with the map or the matrix. Indicating one type of nuisance was observed in and around the house, but not indicating it was observed in Hoek van Holland as a whole for example. As for the matrix, some residents had some difficulty using it and it could be questioned whether everyone understood it well. One resident indicated contradictory findings in the matrix; She placed the soot-sticker at the outer left, meaning she never observes soot, while she positioned it rater low, indicating she finds soot little annoying (see figure 13). Moreover, she placed a sticker for vibrations twice. Without any further explanation, her matrix was hard to interpret as researcher.

Complementing differences between map, section, matrix and discussion

When determining what types of nuisance are experienced by residents, the map, section and matrix complement one another and the different findings resulting from the three drawings could be added up. Typically, the section contained more types of nuisance than the map. The matrix, in turn, frequently included more types of nuisance than the section and seems to give the most complete overview of nuisance observations. Potentially residents cannot think about all their experiences at the same time or had to "warm-up" a bit and therefore added more information along the way. Another reason could be that the different drawings are associated with different scales. Residents started with the map, went on with the section, and by zooming in, new insights might arise. Anyway, the idea data complements one another is clearly supported, as illustrated by examples below:

- Fien seemed to interpret the map as a way to indicate nuisance you notice when you are walking through the village and being at home, while the section was meant for everything noticeable near home. Likewise, she indicated industrial view on the map, but not in the section and she indicated the positive view of the light house (which she can see from her garden) on the section, but not in the map;
- Yara, Clarien and Fien indicated soot in the section, but not in the map;
- Marcel indicated the positive view of shipping pipes in the section, but not in the map or matrix;
- Anja indicated in the map and section industrial view, but doesn't include this type of nuisance in the matrix.

By looking at the three drawings together, a rather complete picture of the types of nuisance observed by all residents could be drawn up. In the matrix how frequent a certain nuisance is observed became clear. As for the location of nuisance, the usability of the map and section could be questioned. Determining where in Hoek van holland nuisance could be perceived, the maps and sections show mainly where these eight specific residents perceive it, but no general statement about the observation of all residents in Hoek van Holland could be made. Yet, the map and section do show well what types of nuisance are more on top of people's mind in and around the house (soot and vibration) and what types of nuisance are noticeable in other places of the village (view an odor). Sound seems to be equally related to the house and the surrounding and is by some residents shown on the map, while others included it in the section or matrix.

Conflicting differences between map, section, matrix and discussion

When determining how annoying a certain type of nuisance is for a resident, correspondence between data becomes more important. It is namely unlikely resident find something little and very annoying at the same time. Thus, different data regarding annoyance is rather a sign of contradiction, then an opportunity for complementation. To determine the level of annoyance based on the matrix, four levels of annoyance are distinguished and two imaginary lines are drawn (see figure 14). This way, the location of the stickers gives an indication of the experienced annoyance per type of nuisance. The matrix formed a pivotal starting point for the discussion, and therefore it was expected verbal data regarding annoyance would correspond with the annoyance level indicated on the matrix. Analysis of the matrix and discussion combined, indeed show visual data and verbal data correspond greatly. However, in five cases some differences could be noticed:

- In the matrix, Yara doesn't place a sticker for light pollution, while in the discussion she mentions she is little annoyed by it.
- In the matrix, Yara places a sticker that indicates she always observes soot and is very annoyed by it, in the discussion she suggests the contrary by saying she barely notices soot and only knows it from others.

- In the matrix, Anja doesn't place a sticker for industrial view, while the things she said during the focus group and the things she wrote by e-mail suggest she is very annoyed by it.
- In the matrix, Jan places a sticker that indicates he is very annoyed by sound after eight a clock in the evening, during the discussion however, he barely elaborates on this and he explains in particular traffic noise is strongly present.
- In the matrix, Fien doesn't place a sticker for soot, while during the discussion it shines though she is a little bit annoyed by it.
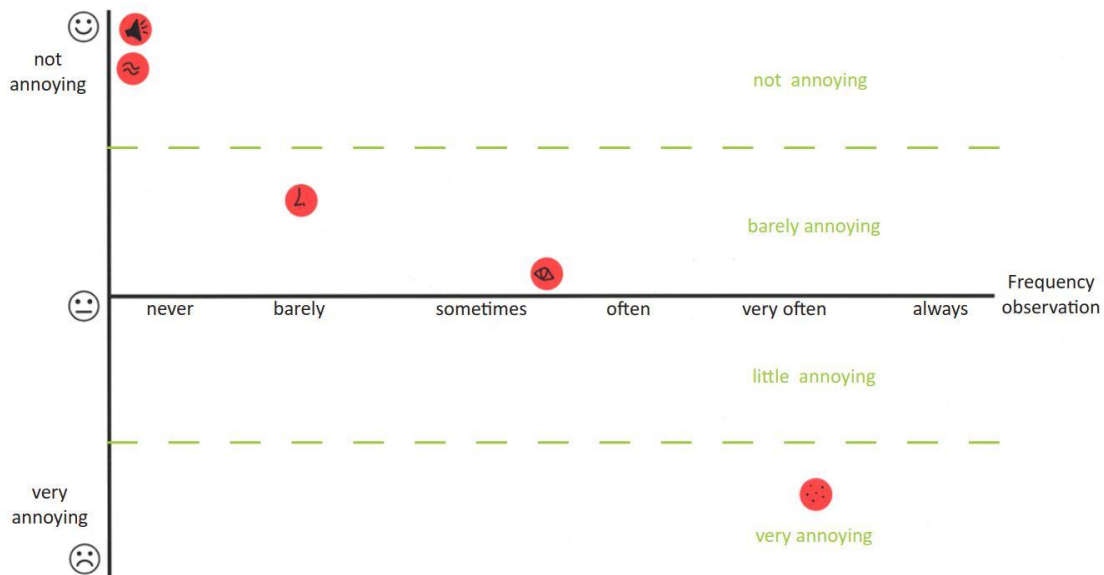

Figure 14. Data analysis perceived nuisance matrix, with help of imaginary lines and divisions (own figure)

4.2.2 Eventual Data Analysis

Considering these differences, sometimes choices regarding the relative importance of data had to be made. The outcomes of the critical dialogue among residents were expected to be more explicit and thereby more reliable compared to the slightly ambiguous, sometimes difficult to understand, exercises. Furthermore, data gained during the discussion could be considered to be more valid because the critical dialogue between residents encourage self-reflection and therefore given answers might be closer to resident's true perception than the initial answers shown visually by them. Theoretically, the groups process could also entail social pressure to give socially acceptable answers, however the overall atmosphere and respect among residents make me believe this type of bias was not strongly present during the focus groups. Reasons combined make in this study more weight was attached to verbal data opposed to visual data. As a consequence, some outcomes respect to the perceived nuisance of residents might be considered less solid.

4.3 Individual Perceived Nuisance

In coming sections, the nuisance perception of the residents that joined the focus groups are described. The perceptions are based on visual and verbal data combined and substantiated with quotes. Typically, names of respondents are exchanged for generic terms as "respondent n". However, taking the research conducted by Grandbom et al., (2014) as example, in this study the real names of the residents are exchanged for fictive ones. This way, the privacy of the residents is respected, while the data doesn't lose its personal character. Since the findings are based on personal experiences and perceptions, a more personal way of data analysis was considered suitable.

4.3.1 Perceived Nuisance Kees

Kees is one of the residents of the first focus group. By being an informal caregiver, joining committees and maintaining the "Zeeheldenroute", the popular walking route in Hoek van Holland, he could be considered as an active resident who cares about his personal and living environment. When I asked Kees about his perception of nuisance, he started to explain he and Hoek van Holland, including all the noise and vibrations that it might involve are in balance. He feels interwoven with his living environment and uses the words:

> KE: *"That sound is actually a kind of glove, that I fit, and then I actually feel pleasant."*

Actually, he hardly experiences vibrations. When he does, he knows it is the Stenaline which departs to England and he experiences it as something familiar. The same is true regarding the smell. Occasionally the composting facilitation Renewi gives a nasty smell, but since this is not so frequently it doesn't bother Kees too much. And again, he feels it is a fact that belongs to the Village, it is Hoek van Holland. As for the view, Kees referrers to light pollution caused by the assimilation lamps of the Westland (the area around Hoek van Holland known for its expertise in vegetable production inside greenhouses). He experiences that indoors, in the garden, on the street and elsewhere. He perceives this as a little downside:

> KE: *"It is not that I get a sad face, but I still think; "Aren't there any regulations for this? They should cover this, right?"*

The biggest minus according to Kees is the soot caused by industry. Fairly frequently he notices it on furniture in the garden. When he goes with his hand over the jacuzzi, for example, he always sees black colored dust. He expects this dust could also end up inside his own body and considers this as the price he pays for living in Hoek van Holland.

4.3.2 Perceived Nuisance Yara

Yara participated enthusiastically during the first focus group. She enjoys Hoek van Holland a lot and in particular she values the moments on the beach, where she has some drinks with friends. Furthermore, Yara likes to be involved with her living environment and believes it is important to take action when needed. She could be seen as an active and positive resident, who believes actions are stronger than words. Accordingly, describing her perception of nuisance, she keeps it short.

Sometimes Yara smells something from the composting facility, but this is barely annoying for her. Also light pollution is an issue for her because she hoped they would limit it more for the sake of animal well-being. However, since she only mentioned it briefly during the discussion it is assumed Yara is only very little annoyed by it. Something Yara does find very annoying is the view on the industry south-west from Hoek van Holland, better known as De Tweede Maasvlakte. When she is on the beach at day time, she always turns her back to it because it is really unpleasant for her to see it. However, in the evening the opposite is true, then the view is suddenly very interesting to see and she likes to take guests there. She says:

> Y: "But I'll take you out in the evening, then it's like one fairytale world, it is chock-full of lights across the street, then it has something very magical. A secret atmosphere."

Regarding black-colored soot, something contradictory could be seen. In the discussion Yara refers to it as something she always hears from others but doesn't notice herself. In the matrix, however, she indicates soot is always present and like, the industrial view, very annoying. Since verbal data is leading it is concluded she is barely annoyed by soot. As for the vibration, she doesn't experience it at all. Noise, on the other hand, she does experience, but interestingly this gives her more positive feelings than negative ones:

> Y: *"I hear "Kedenkedenk", nothing more, but I like it. I love these sounds."*

Moreover, she feels proud and warm when hearing the ships ragging:

> Y: *"I like that ships are ragging: "Yes, I live here!", so it gives me a warm feeling"*

4.3.3 Perceived Nuisance Anja

Another enthusiastic participant of the first focus group is Anja, a resident who loves nature and enjoys walking with her dog in Hoek van Holland. Since she strongly believes residents should be heard she always has always been very

actively involved with her living environment. Based on her past experiences, she currently decided to take a step back. She still likes to do her contribution for the surrounding, but in a way that takes less energy than before. The impression of Anja is that many Hoekenezen entered in a certain acceptance mode regarding the industry across the water, De Tweede Maasvlakte, and she regards this as a pity because the industry continues growing and the related pollution might do too. She is worried Hoek van Holland will be "snowed under" by future industrial developments and this was an important reason for her to join the focus group.

From time to time Anja perceives nuisance from a bad smell, this is a little annoying. Similarly, light pollution is noticed sometimes and this is a little annoying too. Moral judgement seems to play a role here:

> A: *"Secretly. I find it super cool when you see that white reflecting gull against the black sky, but it is of course wrong."*

Notably, albeit light pollution is not annoying for herself and she even likes it in some way, still she perceives it as nuisance because of the potential negative externalities it might pose on nature or animals. As for soot, she notices its presence and is also aware of the fact it is a serious problem, but somehow it is not really on top of her mind. For Anja soot is therefore only little annoying. Differently, vibrations and noise are two major sources of nuisance for Anja. Vibrations are caused by the Stenaline, a large trade ship lying at the dock of Hoek van Holland and by De Tweede Maasvlakte. She indicates both in the morning as well as in the afternoon, vibrations are often present and Anja considers them as very annoying. They negatively affect her enjoyment of life and she heavily underestimated this when moving to Hoek van Holland. The behavior of her own pets suggests vibrations have a lot of influence on nature, and therefore, she wonders whether they also impact human health in a negative way:

> A: *"My cats run away every morning, so what a deep hum does with our system… our natural system recognizes that as danger. And if the cats run away from that deep resonant vibration…"*

Another serious issue for Anja is the noise she experiences caused by industry of De Tweede Maasvlakte. A south-west wind is the most dominant wind direction in the Netherlands and it seems this is for Anja rather unfortunate. As Anja explained to the other residents during the focus group:

> A: *"I live here* (pointing to her home on the map), *some southwest wind from here* (pointing to De Tweede Maasvlakte) *, well "tada", I hear it continuously."*

The sounds she hears are that loud, she can distinguish the different machines, cranes and lifts used and also who is operating them. When windows are closed, sound from industry could be kept outside, otherwise she also experiences it inside. Taken all previous together, it could be argued Anja's overall perception of nuisance in Hoek van Holland is rather high.

4.3.4 Perceived Nuisance Jan
Jan participated in the first focus group. As member of the area committee, he is one of the representatives of Hoek van Holland. Apart from being the eyes and ears of the municipality of Rotterdam, members could also advise policymaking on various topics. Currently, they are preparing an area vision and the outcome of the focus group could form a useful building block for this. Likewise, Jan joined the focus group because the outcome could be of significance for the developments in Hoek van Holland, and thereby also for his living environment and living experience.

On the map Jan indicated in and around his house he perceives nuisance from smell, soot and noise. In the discussion he explains soot is noticed on the balcony and on his windows, it is something permanent and therefore a type of nuisance that bothers him very much. Smell from the composting facility, on the contrary, is something temporary and Jan is only little annoyed by it. Like soot, nuisance caused by noise is experienced often. However, Jan points out he only hears industrial noise after eight a clock in the evening because around then, the rush hours are usually over; The background noise caused by cars disappears and industrial noise remains. Although Jan indicated with stickers noise is very annoying for him, during the discussion he puts more emphasis on traffic noise respect to industrial noise and how this impacts his daily life and satisfaction:

> J: *"I live in an apartment building, next to it there is a big road, well, the sound climbs up to the sixth floor, and yes… so if you have the window open, you can just stop watching television."*

Based on the outcomes of the discussion and assignments combined, I believe Jan is very annoyed by traffic noise and only little annoyed by industrial sounds. Interestingly enough, Jan doesn't hear shipping noise. He is used to it and he only hears it when something unusual is happening, then he walks on his balcony to have a look. Finally, Jan mentions nothing about light pollution or vibration during the focus group and also didn't refer to them in the assignments. It is assumed he doesn't perceive nuisance of that kind.

4.3.5 Perceived Nuisance Marcel

Marcel is a friendly resident who made his house available for the organisation of the first focus group and joined it as participant himself. His wife Josefien took care of the host related tasks, prepared soup and made sure everyone had something to drink throughout the evening. This way, Marcel didn't have to play a dual role as host and resident, but could pay fully attention to the discussion and exercises. Having studied himself too, he understands the sometimes-challenging aspects of doing empirical research and is therefore always willing to give students a helping hand. Regarding the perception of nuisance Marcel discussed the following:

Marcel first points out he likes the view of the chimney from the Stenaline chimney, the big ship lying at Hoek van Holland. He perceives it as a sign of economic growth and one of the reasons the Netherland is a prosperous country. Industrial noise he notices, but forms barely a source of annoyance. The same is true for the noise caused by Stenaline. A little bit more annoying are the vibrations caused by Stenaline and the poor view caused by De Tweede Maasvlakte, the industrial area south-west from Hoek van Holland. Although he acknowledges the economic benefits of industry, yet he doesn't like to see it. Especially when he is on the beach, he really feels a little bit bothered by the poor view. Sometimes marcel smells the composting facility, which is quite unpleasant, but fortunately temporary and from a safe source. Finally, soot is noticed on the windows, in the garden and on the balcony and this forms the most annoying type of nuisance for Marcel:

> M: *"What I find very annoying is the soot, or fine dust, also because I don't know what it is. That is important to know, whether it is harmful or not."*

4.3.6 Perceived Nuisance Henk

Kindly, Henk made his house available and actively participated during the focus group as well. Snacks were prepared and provided on the table prior to the focus group and we used the planned pause to refill our tea glasses if necessary. This way, Henk could pay his full attention to the discussion and the assignments instead of being a host. To broaden his horizon and just out of curiosity, Henk decided to join the focus group.

Opposed to many of the other residents, Henk doesn't experience vibrations from Stenaline or unpleasant smells from the composting company and only rarely notices black colored soot on the windows. Instead, he smells Pernis occasionally and notices orange-colored soot on the façade, of which the first annoys him a little and the latter annoys him barely. From his home, Henk has a direct view over the water, the so called Waterweg, and the industry across from it. He believes this view could be better, but doesn't perceive it as a major nuisance. The fact there is water in between him and the industry could play a role in this:

> H: *"I believe that that (pointing to industry) is really there and that this (pointing to the table) is really here. And there is a very nice boundary of water in between."*

Light pollution has not been discussed during the second focus group and thereby Henk didn't share his perspective on it. As for the view on ships, Henk is not annoyed at all, but rather fascinated. During the discussion he uses words as "insane", "fantastic" and "unbelievable". He explains it is also a certain source for entertainment in Hoek van Holland. In the local newspaper "*Hoekse Krant*" there is always a column about the ships that pass by, then people go indeed watch the ships. The shipper in turn goes honking and the people start cheering. Henk finds this interaction amazing and is fascinated by the ships themselves too. In particular the notable scale difference attracts his attention, as is illustrated well during the focus group, when a ship passed our view:

> H: *"If you check that ship* (pointing to a ship passing by)*, it is a mile away from here, when it comes by and you compare it with those flats here, then there are just five more floors on such a ship. That is transposed brazenly, how gigantic things are, now I just get chills. How big it all is!"*

4.3.7 Perceived Nuisance Clarien

Clarien participated in the second focus group. Already in the introduction she sums up family members important for her, and also later, the importance of social life shines through her answers. Clarien comes forward as a friendly and

caring person, who enjoys living in Hoek van Holland. Furthermore, the health and wellbeing of her personal surrounding is important for her, she is active in voluntary work and, in line with this, her life motto is: *"When you can take care of yourself, you can also take care of others."* Though not thinking about her living environment very frequently or mindfully, Clarien decided to join the focus group because she believes students should always receive help when doing research.

Clarien perceives relatively little nuisance from industry and when she does, she experiences it merely at home. She finds it hard to think of something that is annoying and related to industry, because for her living environment is not that industrial at all:

> C: *"Yes because for the rest* (besides Stenaline) *we do not have so much industry. Yes, on the other side maybe."* (on a tone that says it is not so relevant.)

In the individual part of the focus groups she only brings forward two types of nuisance: vibration and soot. However, during the discussion, she also responds to other residents regarding smell and view. For her the smell caused by the composting facility is definitely not pleasant, but since it is only temporary it doesn't annoy her at all. As for the view, from her home she sees her own garden and a green dike with sheep, Clarien loves it! When walking in other parts of Hoek van Holland the industrial is not bothering her at all. In fact, it appears the industry is barely visible for her. When another resident talks about the view on industry from the beach, Clarien wonders:

> C: *"But from there, the industry is visible then?"*

By far the most notable type of nuisance is vibration caused by the Stenaline. Every day around 16.00 the ship arrives to the harbor of Hoek van Holland and then all the windows in Clarien's living room are shaking heavily for around fifteen minutes. The fact she uses words as "*This* week the vibration was…" and "*Sometimes* it is…" suggests the intensity of the vibration differs day by day and Clarien wonders whether this has something to do with the shipper steering the ship. The vibrations could be very extreme:

> C: *"Then, the windows really go like this"* (makes wild waving back and forth movements with her arms)

Interesting enough, the Stenaline vibrations are only little annoying for Clarien, because she says she is simply used to it and it is also temporary. However, she indicates that if the vibration would hold for half an hour or longer, it would probably become very annoying for her. Thus, duration of externalities seems to strongly influence to what extent Clarien is bothered by them. Finally, black colored sticky soot is observed by Clarien, she notices it mainly in the garden and finds this a little bit more annoying respect to the other types of nuisance. Light pollution has not been discussed during the second focus group and thereby Clarien didn't share her perspective on it.

4.3.8 Perceived Nuisance Fien

Fien participated in the second focus group. She is not thinking mindfully or often about her living environment, but when friends or neighbors are asking her to join a committee concerning Hoek van Holland, she is always willing to help and fill up the empty spot. Fien comes forward as social and active resident, who likes to hop from activity to activity in her free time. That said, she also values to take rest and enjoys silence and nature. In Hoek van Holland a combination of natural environments could be found, such as beaches, woods and dikes. Fien loves that! During the focus group, Fien states a couple of times that she doesn't experience that much nuisance. She suggests an observation of a negative externality, does not necessarily lead to annoyance. Nuisance seems to be a phenomenon hard to get grip on, and she poses questions as:

> F: *"I do see some fine dust lying on the windows, but does it bother me? You know…"*

> F: *"But take for example the vibration, is that nuisance? Oke yes, I notice it. Yes uh, when the house later…"*

Though unfinished, the quotes above indicate an observation alone, is not in itself a source of annoyance for Fien. Only when actual negative consequences are clearly present, she could potentially get annoyed. Generally speaking, Fien's perception of nuisance is rather low. More specifically, she mentions the poor composting smell and some limited noise caused by Stenaline. She is barely annoyed by both of these externalities because they are temporary and she is used to it. Clearly noticeable are the shipping vibrations at the end of the afternoon. Fien is a little annoyed by them because almost every day they are present and the timing is sometimes inconvenient too. When working at

home for example, shaking doors are not really helpful in staying focused. Similar to vibrations, soot is something that is observed clearly. Likewise, she placed a great amount of soot stickers on the façade, indicating it could be found everywhere around her house. In words, she describes:

> F: *"Well I do have particulate matter, that it is not super bad, but I feel like I always have dirty windows. Sticky stuff. For example, during summer everything is slightly opened and everything that stands underneath gets kind of covered with sludge."*

However, the clear observation of soot, doesn't necessarily mean she is very annoyed by it. On the contrary, soot barely gives her feelings of annoyance. As for the view, Fien acknowledges positive and negative aspects of Hoek Holland. On the one hand, you have elements that are characteristics for the village, like ships and light houses. She likes to see them and also enjoys other people seem to be entertained by it as well. On the other hand, you have the industry south from Hoek van Holland (De Tweede Maasvlakte). The greener, the better for Fien. Thus, the industrial view is a bit too unnatural according to her. Especially when walking on the beach, she is a little bit annoyed by it and feels like the view could be better. "A few mountains would suit", she jokes.

4.4 Collective Perceived Nuisance

This section focuses on the residents as group and aims to draw an overarching picture of the perceived nuisance in Hoek van Holland. Firstly, the types and sources of nuisance in Hoek van Holland are identified. Secondly, based on the individual observation and annoyance scores, interrelations are studied. To what extent could differences in observation be explained by location of residence? To what extent could differences in annoyance be explained by the observations? This way, a critical stance regarding conventional wisdoms is taken and lessons regarding perceived nuisance could be drawn. Furthermore, the individual nuisance perceptions are presented in one collective nuisance map, giving an impression of the perceived nuisance in Hoek van Holland. Finally, main findings regarding perceived nuisance are summed up.

4.4.1 Types and Sources of Nuisance

During the focus group, various nuisance types and various nuisance sources came to light. Every resident observed composting smell and industrial view and elaborated on these observations during the discussion. The black-colored soot, view on ships and the vibrations they may cause are also described by most of them and often they do so in great length and detail. Residential annoyance regarding industrial noise and shipping noise are also mentioned by most of the residents, but then usually in few words only. Importantly, some types of nuisance have only been discussed in one of the two focus groups. Light pollution is treated in the first, but not in the second. While orange-colored soot and smell coming from Pernis are only discussed during the second focus group. Why is this the case? It could be some types of nuisance are not observed by the residents participating in a focus group and are therefore not brought up. Another reason could be that, an environmental externality is noticed, but not seen as a type of nuisance and therefore not mentioned during the discussion. A third reason could be that the externality is not on top of people's mind, (which could also be an indication of low annoyance), and they therefore forgot to discuss it during the focus group. Given the nature of light pollution, it is expected that all residents do observe it, but that residents of the second focus group do not associate it with industrial nuisance. Orange-colored soot and smell from Pernis is only discussed in the second focus group whereby only Henk indicated to observe it. It is therefore possible these types of nuisance are not discussed in the first focus group because resident joining it do not observe them. In tables 8 and 9 all industrial types and sources of nuisance that came forward during the research are listed.

Besides industrial sources, residents put forward non-industrial sources for nuisance as well. Jan experiences much noise from the car way next to his apartment, and this is also the type of nuisance that impacts his residential satisfaction the most. Similarly, Henk mentioned his previous home was located near a busy road and this was not pleasant. Clarien finds the noise produced by construction works very annoying. Marcel and Henk complained about the holiday homes. They cannot understand why these should be built on a beautiful beach; They prefer to have industry across the water than holiday homes on the beach. In line with this, Yara complained about new apartments built in Hoek van Holland, the architecture is, to put it mildly, not her taste. To conclude, Fien stressed multiple times during the discussion, that industrial nuisance is not such a big deal for her, but the overall crowdedness and behaviour of fellow residents are. Especially, noisy neighbors bother her a lot.

NUISANCE TYPE	NUISANCE SOURCE	PRESENCE OBSERVATION PER RESIDENT (incl. frequency when known)							
		Kees	Yara	Anja	Jan	Marcel	Henk	Clarien	Flen
SOOT	Industry (black soot)	Yes Very often	No	Yes, often	Yes, very often	Yes, very often	No	Yes	Yes
	Industry (orange soot)	*unknown*	*unknown*	*unknown*	*unknown*	*unknown*	Yes, sometimes	No	No
SMELL	Composting facility	Yes, seldom	Yes, seldom	Yes, sometimes	Yes, sometime/ often	Yes, seldom	No	Yes	Yes, seldom
	Pernis	*unknown*	*unknown*	*unknown*	*unknown*	*unknown*	Yes, sometimes -often	No	No
VIBRATION	Stenaline	Yes	No	Yes, often	No	Yes, often	No	Yes, sometimes	Yes, often
	Industry	No	No	No	No	No	No	No	No
NOISE	Industry	Yes	Yes	Yes, very often	Yes, very often (only after 20.00)	No	No	No	No
	Stenaline	Yes	Yes	Yes, often	Yes,	Yes, sometimes	No	Yes,	Yes,
VIEW	Industry	Yes	Yes, always	Yes	Yes	Yes, sometimes	yes	yes	Yes, sometimes
	Ships	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Green houses (light pollution)	Yes, sometimes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8. Overview industrial types and sources of nuisance discussed during the focus groups and related individual observations. (own figure)

NUISANCE TYPE	NUISANCE SOURCE	LEVEL OF ANNOYANCE PER RESIDENT							
		Kees	Yara	Anja	Jan	Marcel	Henk	Clarien	Flen
SOOT	industry (black soot)	Very	Barely?	Little	Very?	Very	Not	Little	Barely
	industry (orange soot)	*unknown*	*unknown*	*unknown*	*unknown*	*unknown*	Barely	Not	Not
SMELL	Composting facility	Barely	Barely	Little	Little?	Little	Not	Not	Barely
	Pernis	*unknown*	*unknown*	*unknown*	*unknown*	*unknown*	Little	Not	Not
VIBRATION	stenaline	Not	Not	Very	Not?	Little	Not	Little	Little
	Industry	Not	Not	Not	Not?	Not	Not	Not	Not
NOISE	industry	Not	Not	Very	Little?	not	Not	Not	Not
	stenaline	Not	Not	Not	Not?	Barely	Not	Not	Barely
VIEW	industry	Not	Very	Little	Not?	Little	Barely	Not	Little
	ships	Not	Not	Barely	Not?	Not	Not	Not	Not
	light pollution Green houses	Barely	Barely	Barely	Not?	Not	*unknown*	*unknown*	*unknown*

Table 9. Overview industrial types and sources of nuisance discussed during the focus groups and related individual annoyance scores. (own figure)

4.4.2 Comparison Observation of Nuisance

In table 8, all industrial types and sources of nuisance mentioned during the focus groups are listed. Based on section 4.3, whether residents observed them and in what frequency (if known) is shown in table 8 as well. In this section the individual observations of nuisance are compared. Looking at levels of agreement between residents, outliers, or other discrepancies, results in the following findings:

Similar observations

For some types of nuisance, the residential observations are more similar, while for others they are more diverse. View related nuisance is rather similar among residents, they all can see industry and ships near the waterfront of the village. Jan, living on the sixth floor, and Henk, living at the water could also see them clearly from their home. The same is true for noise caused by the Stenaline, except Henk, all residents hear claxons or shipments from time to time. The residents who experience vibrations from the ship, also hear these vibrations because doors and windows are shaking. Composting smell, again with exception of Henk, is noticed by all residents too.

Varying observations

Types of nuisance that give more varying results are industrial noise, black-colored soot and vibrations by Stenaline. Industrial noise is heard by Kees, Yara, Anja and Jan. Remarkably enough, their locations of residence are quite spread over the village. In addition, it is interesting to see that residents living geographically most close to the source, Henk, Clarien and Fien do not observe this type of noise. The conventional wisdom the closer to the source, the more nuisance is seemingly not applicable in this case.

Black-colored soot, is not noticed by Yara and Henk, but very often by the others. For Henk, his location of residence could potentially be the reason (see figure 9). He lives a little bit more west compared to the other residents, when the source of soot is relatively more eat and with the wind typically coming from the south-west in the Netherlands, it could be Henk therefore doesn't notice the soot. For Yara, however, this is less likely. She lives very close to other residents of the focus group in an apartment building (see figure 9). Maybe the orientation of her apartment is on the North-East and with the Dutch wind typically coming from the South-West, it could be her façade is less exposed to soot. But this has not been investigated.

Vibrations caused by Stenaline are observed by Kees, Anja, Marcel, Clarien and Fien and are not observed by the others. Given the various places of residence, this could either mean that vibrations have a wide reach or that more factors than distance are playing a role here. Yet, to what extent residents are talking about the same vibrations could be questioned. Clarien and Fien live very close to the ship and indicate vibrations occur usually in the afternoon for about 15 minutes. Anja, however, indicated to notice vibrations in the morning too and frequently wakes up from it. Multiple sources of vibrations seem to be present around Hoek van Holland and potentially, the vibrations felt by Anja are not coming from Stenaline, but the industry instead. But, again, this is not investigated.

Deviating observations from Henk

It could be noticed that Henk's observations are less often shared with others. He is the only one who indicates to smell odour from Pernis and orange-colored soot on the façade. In addition, opposed to the others, he doesn't smell the composting facility and doesn't hear noise from Stenaline. The fact the composting facility is in the East, Henk lives in the western part of Hoek van Holland and Dutch wind typically comes from the south-west could explain why Henk doesn't notice composting smells. Also, the other observations could maybe be explained with Henk's location of residence, but since no other resident lived in the same area as Henk, no strong statement could be made in this respect.

Relatively high observation by Anja

Apart from Henk's, also the observations of Anja are interesting. It seems she notices almost every type of nuisance and she also seems to notice them more often than the other residents. Since she lives relatively far away from the nuisance sources: she lives in the north-west, while composting activities are in the east, Stenaline in the south and industry in the south-west. Other factors as location of residence seem to play a role here.

Validity of frequency

To what extent the indicated frequency of residents, reflect the actual frequency of nuisance well could be questioned. Firstly, because residents expressed to have some difficulty with making the matrix-exercise. During the focus group they asked me for clarification but still some misunderstanding could be seen. Clarien placed for example a soot-sticker on the left bottom side, indicating the contradictory idea that she never notices soot, but is a little annoyed by

it. Secondly, ranges of frequency are a subjective matter. Fien and Clarien, in words agreed that every day around 16.00 vibrations from Stenaline could be felt for around 15 minutes. However, in the matrix Clarien indicates to feel vibrations sometimes, while Fien indicates to feel them often.

4.4.3 Comparison Annoyance of Nuisance

To learn something about perceived nuisance it is interesting to compare not only what environmental externalities residents observe, but also what feelings of annoyance are attached to these observations. In table 9, all industrial types and sources of nuisance that came forward during the research are listed. Based on section 4.3, to what extent the residents individually are annoyed by them is shown in table 9 as well. This table is intended as order of magnitude, because the classification from "not annoying" to "very annoying" is relatively arbitrary. In addition, the levels of annoyance are based on explicit verbal data as well as more indicative visual data, potential misinterpretations could have occurred and in few cases choices regarding the weight of importance respect to data are made. Therefore, the determined annoyance levels should not be understood literally. Anyway, the table gives a plausible indication if the residential nuisance perception in Hoek van Holland. In this section, the individual feelings of annoyance are compared. Looking at levels of agreement between residents, outliers, or other discrepancies, results in the following findings:

Uncertain annoyance levels

Before going deeper into feelings of annoyance among residents, it is pivotal to point out that for two residents, Yara and Jan, some outcomes might be less certain. In case of Yara, the feelings she has respect to soot remain questionable. Her matrix indicates she observes soot always and she is also very annoyed by it. During the discussion however, she mentions soot is something others point out to her, which could mean she herself doesn't observe it that much herself or is not very annoyed by it. Also, when she elaborated on the stickers in her matrix, she didn't pay attention to the soot-sticker. The contrast between visual data and verbal data is significant and choosing one or the other could reflect an untrue annoyance level. Potentially, she was influenced by the others residents, either during the generative techniques or during the discussion. As was explained in section 4.3, verbal data is leading in this data analysis and therefore, it is determined Yara is barely annoyed by soot.

In case of Jan, it is argued all his perceived annoyances could be questioned. During the focus group, Jan seemed to describe his living environment in an impersonal way and minimally expressed his own feelings or perceptions. As member of the area committee, he is involved with the urban planning of Hoek van Holland and potentially, this involvement with urban planning biased his behavior and answers during the focus group. The annoyance scores in the table are merely based on visual data. In words, Jan didn't express any annoyances towards industrial types of nuisance, but gave objective explanations for the occurrence of the environmental externalities instead. Thus, the findings respect to Jan's annoyance remain relatively uncertain.

Relatively high annoyance by Anja

Looking at the degree of annoyance among residents, it could be noted Anja's perceived nuisance is relatively high. She is not necessarily very annoyed by everything, but she generally gives a slightly higher annoyance score to observations than the others. An exception is seen for black-colored soot, where Kees and Marcel are more annoyed than her. Anja's feelings of annoyance correspond to the fact she observes many types of nuisance. However, for quite some types of nuisance her observation is similar to the ones of fellow residents and seems to be only part of the explanation for her perceived nuisance. She notices, like Fien and Carien, frequently vibrations, but for her this is very annoying, while Fien and Clarien give a "little annoying" score. Other factors as location of residence, residential observation or actual nuisance seem to play a role here.

Annoyance and observation

By linking the findings of table 9 to table 8, the correspondence between annoyance and observations could be checked. Conventionally, it is expected annoyance levels towards a certain environmental externality are strongly linked to the observation of this externality. Or in other words, the higher the actual nuisance, the higher the perceived nuisance is expected to be. Looking at the findings of these focus groups, this expectation is partly confirmed. Some annoyance scores are like you would expect, given the observations of the residents, but for some this correspondence is less visible.

Annoyance not contradictory to observation

Residents have similar observations, as well as similar annoyance scores for industrial vibration, composting smell, shipping noise and shipping view. Industrial vibration is according to the residents not observed in Hoek van Holland and likewise, no one indicated this is an annoying type of nuisance for them. Light pollution is, following common sense, observed by everyone, however it only discussed during the first focus group. The residents joining this focus group, expressed a slight annoyance for light pollution, because they believe it is not ethically correct to pollute the sky in this way and cause potential problems for animals or nature. Composting smell is also barely observed in Hoek van Holland and residents are generally not so annoyed by it. They mention reasons as it occurs not so frequent, is not permanent and no health risks are associated with it. Kees added an extra reason; "This smell is part of Hoek van Holland." Diversely, most residents hear some shipping noise and see the Stenaline or other ships coming by, but the shipping related externalities are not considered very annoying. A potential reason could be that ships are characteristic for Hoek van Holland and residents might therefore be used to them or believe the related sounds and views belong to the area and their living environment. In fact, Kees, Yara, Henk, Clarien and Fien explained that ships even arouse positive feelings for them, rooted in familiarity, fascination and entertainment. Moreover, some residents highlighted shipments are pivotal for international trade and thereby less annoying to see or hear. The noise resulting from the shipping vibrations, however, is potentially more annoying. Fien indicated her door is shaking due to the Stenaline and sometimes, when she needs some concentration for work for example, she finds this a little annoying. A more straightforward finding is that orange colored soot and smell from Pernis is only found slightly annoying by Henk, as he is also the only resident who observed these types of nuisance, this is according to expectation.

Annoyance, not entirely explainable by observation

Regarding the annoyance scores for black-colored soot, industrial view and vibrations from Stenaline residents are less in agreement and the different scores are not always explainable by the resident's observations. For black-colored soot, the scores are significantly different. Without focusing on the more uncertain scores of Jan and Yara, it could be seen Kees and Marcel are very annoyed by soot and Anja, Clarien and Fien are only little annoyed by it, while Henk is not annoyed at all. Henk's score could be explained by the fact he doesn't notice it. However, explaining the other scores is less-straight forward, because the observation of the other residents is relatively the same. They all notice black-colored soot on the windows, façade and garden, it is sticky and almost permanent. How come Kees and Marcel are very annoyed by it? Looking at their reasoning, contrary to the other residents, they indicate they do not know exactly where the soot comes from and are therefore not sure whether it contains negative side effects or not. Following the logic, "If it can end up in here, it could also end up in my lungs", they associate increased health risks with soot and are therefore more annoyed by this type of nuisance. Anja cares about a healthy environment too, but other types of nuisance have a higher impact on her and she says "Soot is somehow not so much on top of my mind". Fien and Clarien are generally not quickly annoyed, but prefer to look at the positive aspects of their environment and are despite nuisance, happy to live in Hoek van Holland.

Similar to soot, the vibrations caused by Stenaline lead to different levels of annoyance among the residents that notice them. Kees notices vibrations when the motor is running, but is not annoyed by it. Again, his interwovenness with the area plays a role, for him vibrations are part of the village. Anja, on the contrary is very annoyed by it and she gives several reasons for this. She explained the vibrations have a serious impact on daily needs, such as sleep, and therefore also affect her overall residential satisfaction in a negative way. When moving to Hoek van Holland, she did not expect them to be so noticeable and, moreover, she believes vibrations could involve health risks as well. Marcel, Clarien and Fien' find vibrations of Stenaline more annoying than Kees, but less annoying than Anja. This is interesting because the observation of Clarien and Fien are just as evident as Anja's, if not more. Detailed descriptions of shaking doors and windows suggest Fien and Clarien observe vibrations on a daily basis and sometimes in a very extreme way. Yet, they are only little annoyed by them. Like with soot, the fact Fien and Clarien are generally not quickly annoyed, but prefer to look at the positive aspects of their environment could play a role here. Despite of vibrations, they are happy to live in Hoek van Holland. Moreover, they explain vibrations are not that much of a problem because they are temporary and stop after 15 minutes. Fien says she would tolerate vibrations for maximum one hour before it will become annoying, for Clarien half an hour would already be enough. What they further point out is that they are simply used to them and thereby less annoyed too.

As for industrial noise, the annoyance associated with this type of nuisance differs among residents too. Kees and Yara mention to hear sometimes ragging sounds from industrial activities, but they are not bothered by them. On the contrary, they even enjoy them a bit because it reminds them of living in Hoek van Holland. This is different for Anja, who is very annoyed by the sounds she hears. They are loud, almost always present and sleeping with the window open is not an option. On the one hand, her observation could be an evident explanation for why Anja is so annoyed by industrial noise. On the other hand, whether her observation is significantly different than Kees or Yara's is not sure and is hard to determine based on the data at hand.

Another type of nuisance that gives interesting annoyance scores, given the observation, is industrial view. While all being able to see it when walking near the waterfront of Hoek van Holland, seeing the industry seems to

have variating effects on residents. Kees, Jan and Clarien are not at all bothered by it. Yara, on the contrary, is very much annoyed by it. Remarkably, when one would determine the average score, it would indicate residents are barely annoyed by industrial view, which represents only how one of the residents (Henk) actually feels. During the focus groups multiple aspects determinant for the feelings of annoyance towards industrial view were revealed. Clarien indicated maintenance to be very important, especially when it is an industrial building close by and therefore, clearly visible. It further became clear that view related annoyance could be very moment dependent. Multiple residents indicated that the view on industry in Hoek van Holland annoys them during the day, but when the night falls, it is suddenly very fascinating to see and considered to be beautiful in its own mysterious way. Apart from the moment of observation, also the location of observation seems to matter. When residents are at a place functioning as destination, like a square or park, they seem to assess the view through a more critical lens, then would be the case in transition places, like a road. Accordingly, Marcel, Henk, Fien, Yara all mentioned to be particularly annoyed by the view when walking on the beach. Furthermore, the perceived distance seems to influence the annoyance of industrial view too. For Henk, Clarien and Fien it feels like there is a large distance between the industry and them. De Nieuwe Waterweg forms a natural border between Hoek van Holland and de Tweede Maasvlakte, which increases the perceived distance and thereby diminishes observation and feelings of annoyance.

4.4.4 Collective Perceived Nuisance

Considering the perceived nuisance of all residents combined, the collective perceived nuisance could be visualized in a map (see figure 15). In the map circles indicate where a certain type of nuisance is observed and the size of the symbol attached to it indicates the annoyance scores regarding this type of nuisance. Only when residents agree completely on the annoyance level of a type of nuisance, it is possible to determine one collective annoyance score. However, since residents showed merely different feelings of annoyance, no collective annoyance score could be determined and for each type of nuisance multiple scores are presented. Regarding the observation of nuisance residents appear to be more in agreement. When residents all observe a type of nuisance, a circle is drawn, which includes all these residents' homes. When a type of nuisance is experienced by one resident, but not by the residents around, this is indicated with a smaller circle, which includes merely the home of the resident who observes the nuisance. Notably, it was difficult to determine precisely where in Hoek van Holland is observed because the findings of the focus group give merely an indication of this; The maps and sections tell us mostly where these eight residents perceive it, instead of where it could be perceived by residents in general. Considering these uncertainties, the collective nuisance map should not be interpreted literally, but should merely be seen as a visual impression of the focus group findings.

4.4.5 Summary Findings

Based on the focus groups, how residents perceive nuisance seems to depends on more than objective indicators alone. First of all, differences in observation could not always be explained by location of residence. Sometimes other objective factors could have played a role, such as the wind or housing orientation, but in some cases explanations for differences in observations were not easily found. Furthermore, findings indicate that differences in annoyance could not always be clarified by differences in observations. In fact, even the conventional wisdom, the more nuisance observed, the more nuisance perceived was not always confirmed. What the findings reveal is that perceived nuisance is a complex phenomenon, that involves besides an objective, also a subjective component. This subjectivity makes it is rather hard to determine a collective perception of nuisance for all residents combined. Observations and annoyance levels seem to be highly source, receiver, location and moment dependent. Considering all the above, might spark the question: How is it possible that residents who live, in a relatively small village, observe and perceive nuisance in so many different ways? What makes some types or sources of nuisance more annoying than others and factors could play a role in this? To find answers and gain a deeper understanding of perceived nuisance, the next section addresses Perceived Nuisance Factors (PNF).
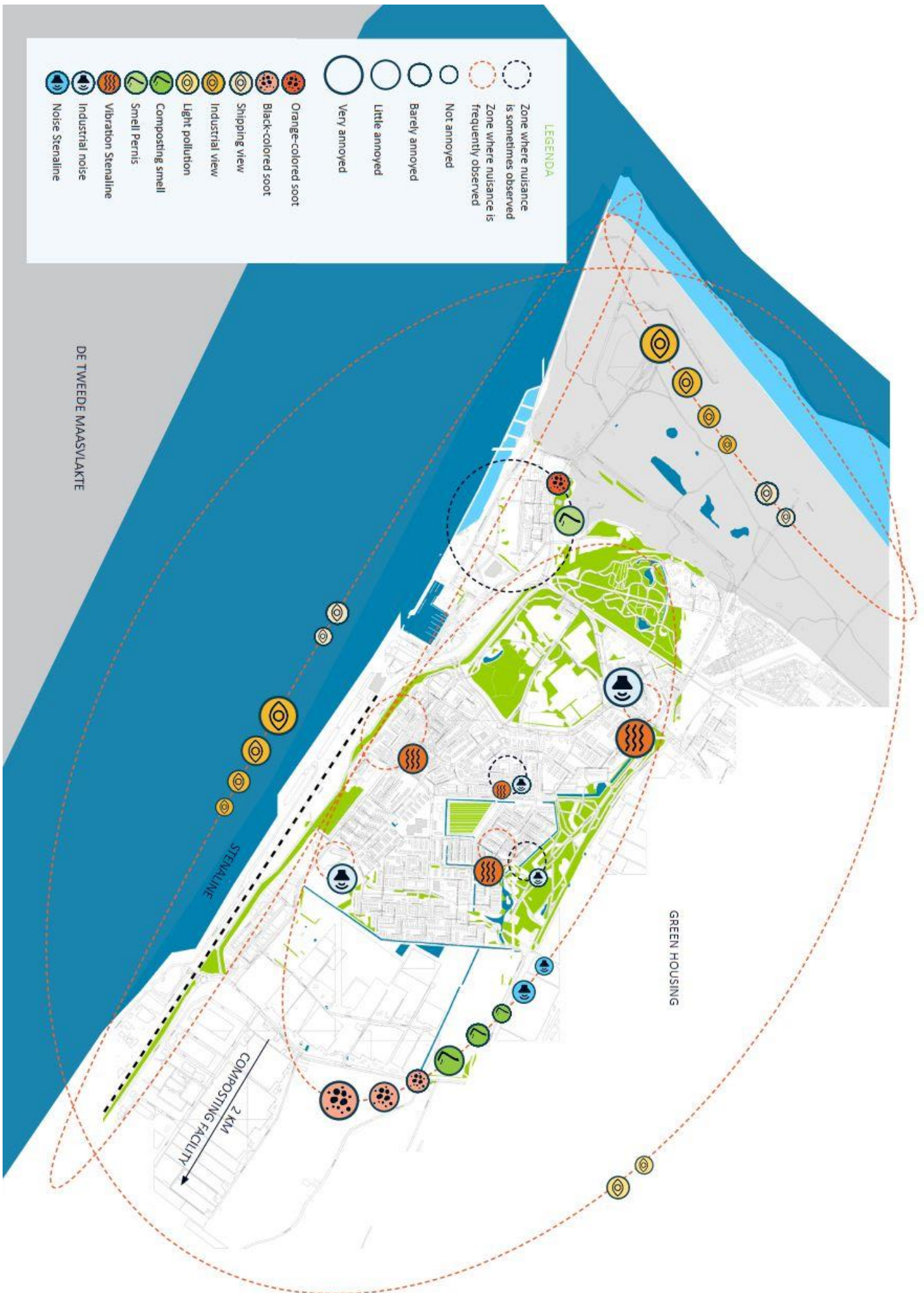
Figure 15. Collective Perceived Nuisance Map (own figure)

4.5 Determining Perceived Nuisance Factors

To determine what factors could have influenced the nuisance perception of residents in Hoek van Holland, the visual and verbal data resulting from the focus groups is analyzed. Three focus group themes, with related visual exercises and questions, were tailored at PNF, but in retrospect, merely two themes resulted in a useful discussion and findings. How the perceived nuisance factors are eventually determined is elaborated in more detail below.

4.5.1 Initial Idea Data Analysis

Initially three focus group themes were prepared to encourage a discussion about perceived nuisance factors. The first is called "Vergelijking van ervaren overlast met gemeten overlast" (in English: Comparison perceived and measured nuisance). For this theme I referred to research outcomes, to create a starting point for further discussion. The research I described was conducted by the municipality of Rotterdam (Gemeente Rotterdam, 2020) and determined the actual and perceived nuisance of villages near Rotterdam. I highlighted the outcomes of Pernis and Hoek van Holland; where the perceived nuisance in Hoek van Holland is relatively high, given the actual nuisance, the perceived nuisance in Pernis is relatively low, given the actual nuisance. During the focus groups, I asked the residents how they would explain these differences in perceived nuisance between the two villages. Based on the theorization that followed, several potential perceived nuisance factors came to light.

The second theme prepared to determine PNF, is called "Ontspannen in Hoek van Holland" (in English: Relaxation in Hoek van Holland). The theme is based on the theory of Öhrström (2010) that the more activities residents are able to do in their environment, the higher the quality of this environment, and the lower the perceived nuisance is likely to be. To indicate the degree the environment could be used for activities, the term "usability" is coined. The initial idea of this theme was to determine characteristics in the environment that support usability and thereby situational PNF. Two generative techniques were prepared. The first consisted of a section (see figure 16), wherein residents could indicate what activities they like to do where. Following the theory relaxation and distraction makes people less sensitive for feelings of stress or annoyance (as theorized by Yang, Boa, &Zhu, 2011 for example), a distinction was made between relaxing and distracting activities, whereby the first could be indicated with help of a ying-yang sticker and the latter with a smiley-sticker. For the second generative technique a matrix was prepared. By placing smiley stickers, standing for activities that are distracting to do, or ying-yang stickers, standing for activities that are relaxing to do, residents could asses the usability of their living environment and indicate to what extent they believe doing an activity has a mediating effect in their nuisance perception (see figure 17).

Both the section and matrix were intended as bridge towards the more pivotal issue; the relation between their satisfaction with their living environments (including its usability) and the perception of nuisance. However, in the end residents tended to stick on this "bridge" and were mostly talking about how Hoek van Holland could be improved regarding its activities. My attempts to steer them back to the topic of nuisance remained difficult, thus the exercises were less useful as initially intended. Apart from this limited usefulness, also the correctness of the visual data resulting from the matrix could be questioned. During the focus group there was much confusion around the exercise, residents had to ask for clarification multiple times and looking at the resulting matrixes (see for example figure 18), it could be seen most residents barely placed stickers inside the matrix. Thus, whether they eventually understood it correctly remains uncertain.

The third theme was a little bit contextual in nature and was called "The Sims in Hoek van Holland." (idem name in English). The aim of this final theme was to start a discussion about feelings of compensation and to dive deeper into residential values. By dangling a future where more industry was built inside Hoek van Holland, I presented the residents a fictive urban planning contract, which they had to (fictively) sign in 15 minutes. I said; "Oke, it is going to happen. Within five years a new industrial building (size of two soccer fields) will be built in your street, and there is nothing you can do about it. But there are possibilities for compensation, I am here now as representative of the of the municipality of Rotterdam and I have a contract for you to sign. You will not be compensated in money, but for the rest all the options are still open. In this contract you may write down exactly how you would like to be compensated. It could be something physical, like a garden, or a service, like a fitness membership, anything you want in return for accepting the industry in your street. Really imagine this would happen and create a contract you would actually sign in case this imaginary future would have been real." In addition to this instruction, a booklet showing numerous compensation possibilities was handed out to inspire the residents. The contracts and discussion resulting from this exercise are important sources for determining situational PNF (see appendix 3.5 and 4.5).
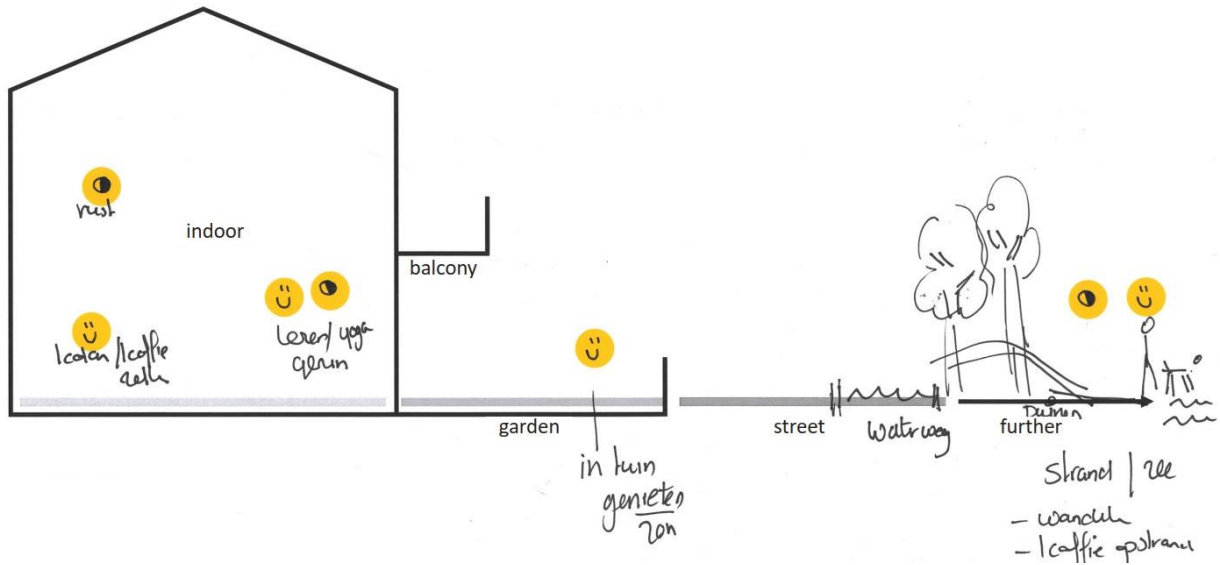
Figure 16. Example usability section, created during focus groups with residents (own figure)
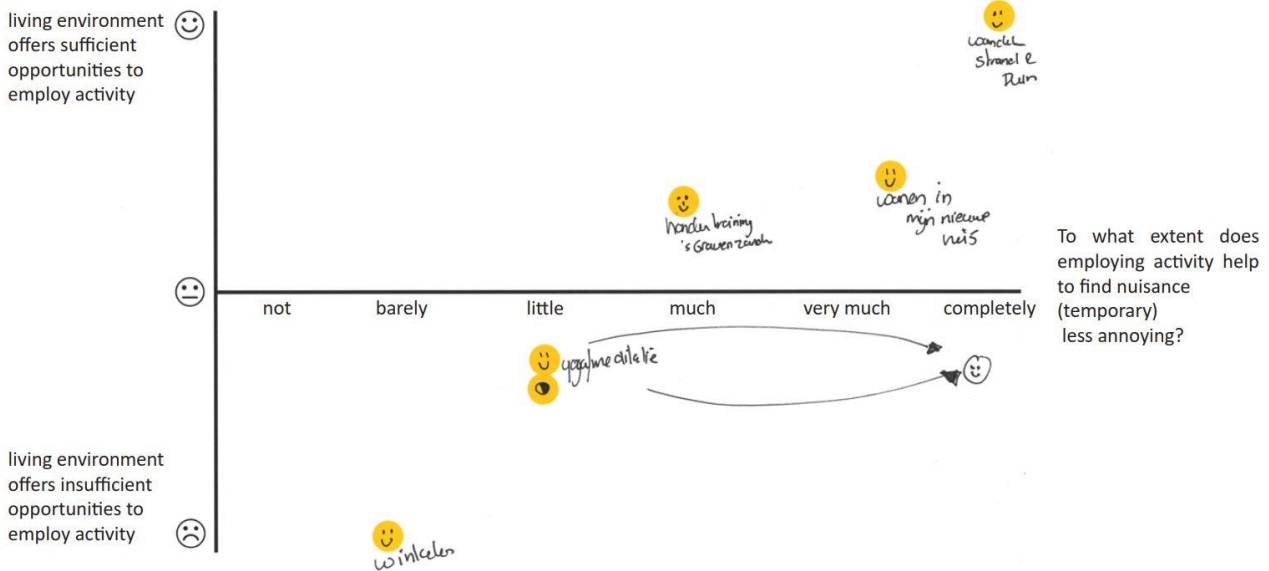

Figure 17. Example usability and perceived nuisance matrix, created during focus groups with residents (own figure)
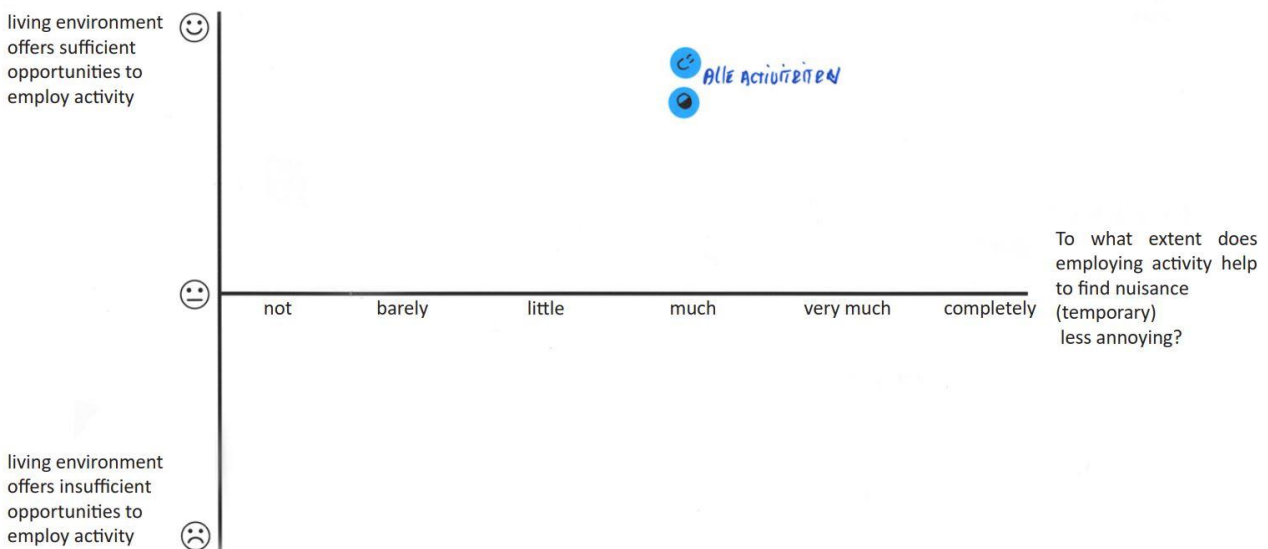

Figure 18. Example usability and perceived nuisance matrix, created during focus groups with residents (own figure)

4.5.2 Eventual Data Analysis

Considering the above, it is decided to leave out visual data produced during theme "Ontspannen in Hoek van Holland" and to merely focus on verbal and written data gathered during the other two themes. Notably, relevant information for determining PNF could be found in other parts of the discussion as well. Based on personal explanations regarding their annoyance, for instance, residents could intentionally or accidently reveal PNF. Eventually, all verbal data gathered throughout the focus group is used to determine PNF.

Besides a deviation in data analysis, also a shift in focus regarding the outcome is made. As explained in section 1.3, this research intended to focus mainly on Personal and Situational Factors. However, during the discussion residents did not only refer to characteristics, related to themselves or their environment, but assigned also characteristics to the nuisance observation itself, indicating for example that duration of nuisance influences the annoyance resulting from it. To acknowledge also the importance of these characteristics, an additional type of factors is included in the study: Actual Nuisance Factors.

Furthermore, by e-mail written data is gathered as well, which is employed to understand the resident better and place findings of the focus group in a broader context. Prior to the focus groups, residents were asked about their motivations to live in Hoek van Holland, their duration of residence and also their relation to industrial activities in general. This way, more contextual information and personal data is gathered about the residents is gathered, usefull to determine personal PNF.

Thus, by analyzing the focus group transcripts and e-mail messages, quotes implying relevant factors are extracted and categorized according to the three types of factors. This resulted in three groups: Actual Nuisance factors, Personal Factors and Situational Factors. The analysis steps of extraction and categorization are displayed in appendix 5.2 and 5.3. In coming sections, first the individual perceived nuisance factors are determined and then, based on the collective findings new insights regarding PNF are gained.

4.6 Individual Perceived Nuisance Factors (PNF)

Having determined the perceived nuisance, this section looks deeper into the factors that influence this perception: Perceived Nuisance Factors (PNF). In coming sections, the individual perceived nuisance factors of the residents that joined the focus groups are described. By looking more closely to what residents said or theorized during the focus groups, a deeper understanding is gained of what PNF could be and how they could influence a resident's nuisance perception. The factors are based on verbal data and substantiated with quotes. The real names of the residents are exchanged for fictive ones, similar to the ones in section 4.3 and 4.4. This way, the privacy of the residents is respected, while the data doesn't lose its personal character. Since the findings are based on personal experiences and perceptions, a more personal way of data analysis was considered suitable. The next section builds on this section and pays attention to the PNF from the collective perspective and combines all individual factors in one list.

4.6.1 Perceived Nuisance Factors Kees

Kees has lived for almost 40 years in Hoek van Holland. Assessing the village, the only thing he is missing a little are cultural facilities, but he believes this is unrelated to his nuisance perception. He is satisfied with his living environment, not despite the industry, but including the industry. The fact he is used to externalities is only mentioned shortly, instead Kees stresses multiple times he feels like he is in harmony with the environment and all the industrial characteristics that might include. He says:

> KE: *"I am not so annoyed (pointing at the speaker on the map). Actually, this counts for all the sounds I hear in Hoek van Holland. We are in balance. The sounds of Hoek van Holland and I are in balance. I'm bothered by nothing, during those 40 years that I have lived here. Only the first Monday of the month I still startle: the fire alarm."*
>
> K: *"So you actually got used to it?"*

> KE: *"The period in Rotterdam was different then, but in Rozenburg we also had it, and here you experience it too. That sound is actually a kind of glove that I fit and then I actually feel pleasant."*

PNF KEES

Personal factors
- Interwovenness living environment
- Previous place of residence
- The "busy bee" degree
- Applied coping mechanism

Situational factors
- Co-housing
- Age friendly house
- A house that supports to do activities he likes
- Hidden industry
- Provided earplugs and eye masks industry
- Holiday assurance, being able to go months away

Something not stressed by Kees himself, but derived from his contextual information, kees is someone who enjoys doing a lot of things and likes to keep himself busy. He joins several committees, is initiator of multiple small-scale associations, and is personal care giver of two elderly. In line with the above, Kees copes with industrial nuisance by contributing to the quality of the living environment himself, by joining committees and employing maintenance tasks. Potentially, he also adopted (unconsciously) cognitive dissonance; This is an internal process whereby your own attitudes, beliefs or behaviors are altered to reduce feelings of discomfort. Following this coping theory, by telling himself positive feelings are attached to industry, he also experiences it this way. While there is no strong evidence Kees actually applied cognitive dissonance, he does speak about internal processes whereby you kind of give an externality a place and doing so, you are observing it less or accepting it more:

> KE: *"(…) But in your subconscious they are sounds. (…)"*
> Y: *"Yes, I understand what you are saying"*
> KE: *"By subconscious I actually mean you give it a place and you and I (to Yara) do that clearly a bit easier."*

While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 3.5) situational factors are determined too.

4.6.2 Perceived Nuisance Factors Yara

Yara lives for 6 year in Hoek van Holland. Despite she misses a cozy, lively atmosphere in the center of the village, Yara is satisfied to live in Hoek van Holland. For Yara a combination of actual nuisance factors and personal factors seem to play a role. The fact she is very annoyed by seeing the industry and the modern architecture in the village indicates esthetical quality is important for her. In addition, she stresses seeing and hearing ships are not annoying, but fun:

> Y: *"I keep it short, I join these two, for me it is part of it, I even enjoy it a bit. I like that ships are ragging: "yes, I live here", so it gives me a warm feeling"*
> *(…)*
> Y: *"The sound of the Stenaline (the ship) doesn't vibrate with me, I don't feel it, I think it is a lovely little sound."*
> *(…)*
> KE: *"And that high tone as well, during departure, that whistle."*
> Y: *"Yes, but that's what you go for, that's why you live here."*
> J: *"Besides, he has to do that whistle, too."*
> KE: *"Yes, I agree with you, but enough residents are bothered by that."*
> Y: *"Would hate it, if it would go away!"*

PNF YARA

Actual nuisance factors
- Degree nuisance source offers entertainment

Personal factors
- Esthetical quality nuisance source
- Feelings of familiarity and proudness
- Observant or intuitive personality

Situational factors
- Hidden industry
- Parc-like, green natural environment
- No devaluation house
- A holiday home in the woods
- Optimal insulation
- Spatial house
- Age friendly house
- Facilities and activities in the neighborhood

Besides "Degree source offers entertainment" and "feelings of familiarity and proudness", a factor clearly noticeable in Yara's words is "observant/intuitive orientated". Multiple times Yara shares perspectives, typical for an observant mind. According to social sciences, observant minds live in the moment and are interested in the practical side of life; not thinking, but doing. Contrary to intuitive minds, they are not interested in hidden layers or future potentials behind an observation, but perceive the world as it is presented to them (NERIS Analytics Limited, 2011- 2020). First of all, when introducing herself, Yara shared she believed when you are bothered by something, you should take action and do something about it. In addition, her life motto "new day, new chances" underlines yara is focused on the present and lives day by day. Finally, during the discussion she responds to residents in a way that reflects worrying about potential health risks (related to soot), dangerous explosives (related to shipments) or an untrustworthy government are not very useful according to her:

> KE: *"Well I don't know if mysterious is the right word… it's more of a latent confidence in the government. At least I think so…"*
> Y: *"Well, if you don't have that anymore, you live like a pariah. And certainly not everything is communicated. (…) you shouldn't want to know everything."*

While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 3.5) situational factors are determined too.

4.6.3 Perceived Nuisance Factors Anja

Anja lives for six years in Hoek van Holland and her answers to the questions by e-mail suggest she is compared to the other residents less satisfied to do so. Besides the considerable amount of nuisance, she perceives, she is also not super satisfied with the center of the village, which lacks activities and atmosphere, especially in winter time. That said, the sea side is still a major plus for Anja. The idea industrial nuisance will increase coming years, frightens her a little. In an e-mail she expresses her sincere concerns:

> A: *"De Tweede Maasvlakte will still cause a lot of inconvenience. Much more than one now is thinking about. This because it is now filled for only 1/5ᵗʰ (of the space made available for it). Much has already been written about it. This will increase extremely in the coming years. So far, Hoek van Holland is silently "waiting". The (industrial) land that will be added, will be larger than the entire Westland combined. No variety in functions: destination is industry. While the most common Dutch wind is south-west wind ...the future will tell ...and the question is ...what measures are available?"*

PNF ANJA

Actual nuisance factors
- Potential health risks

Personal factors
- Previous experience government
- (mis) Trust government
- Observant or intuitive personality
- Personal sensitivity
- Personal expectation regarding nuisance in a particular place

Situational factors
- Hidden industry
- Age friendly house
- Optimal insulation
- Green areas nearby
- No devaluation house
- Spatial and luxurious house
- Environmental friendly house
- Investment of industry in living environment
- Holiday assurance
- Facilities and activities in the neighborhood

Above citation illustrates Anja has an intuitive way of thinking about her living environment and thereby suggests factor "observant/intuitive orientated" could have influenced her perception of nuisance. Similarly, her long-term orientation, as is typical for intuitive minds, is reflected in the fact she underlines there are potential health risk attached to nuisance. To continue, another e-mail indicates also "personal expectations" seemed to have played a role:

> A: *"We moved away because of the construction of a highway 50 meters from our house. (...). The house where we now live is near the beach, we went here for peace, but the environmental noise here is more than where we used to live. I had hoped for "empty" air: I was wrong. (however) The murmur of the sea is great. (…) But I find the noise at night from the De Tweede Maasvlakte very disturbing. Opening the window does not produce silence, but noise up to 60dB."*

The fact Anja had to move because of a planned highway could have harmed her trust in the government as a whole. During the discussion, she says:

> A: *"Also with such a project, a highway or De Tweede Maasvlakte, when planning such a project they take into account that people will get used to it. So, they start small, with ten containers, there will be 50 containers in the next five years. So, there is also speculation on the habituation where we are talking about and then, the nuisance is systematically increased. Because measures only come after it."*

Thus, also "previous experience government" and "trust in government" could be relevant factors for Anja. Lastly, the factor "personal sensitivity" could be related to Anja' nuisance perception. During the focus group herself she shared that due to a medical issue in the past, she has become extra sensitive for externalities, such as light and sound. While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 3.5) situational factors are determined too.

4.6.4 Perceived Nuisance Factors Jan

Jan has lived his whole life in Hoek van Holland and lives already 66 years in this village. In the past he worked for Rijkswaterstaat, in which he focused on doing water measurements and maintaining the water quality. During this work Jan was involved with industry and shipping companies to check whether they were not discharging pollutants in the water and also to check whether they followed the regulations regarding safe work environments. Outside the working hours, Jan was main director of a shipper magazine and board member of the environmental association of Hoek van Holland. After retirement, Jan continued with shipment and environmental related activities. Currently, he is maritime journalist, part of the area committee (focused on urban planning) and board member of a tenant's association. All these life experiences together, makes Jan is a resident who is very knowledgeable regarding the present, past and future environment in Hoek van Holland and who has a strong relation to the industrial surrounding. The factors "general interest in living environment" and "experience past nuisance in current living environment" are therefore clearly reflected:

PNF JAN
Actual nuisance factors
• Presence other types of nuisance
Personal factors
• General interest in living environment
• Experience past nuisance in current place of residence
• Personal criticalness regarding own living environment
• Knowledge regarding nuisance source
• Personal interest regarding nuisance source
Situational factors
• Hidden industry
• Mediterranean public space
• Energy neutral environment
• Investment of industry in living environment

> J: *"(…) That soot is a completely different story. That is a permanent thing here. It is clean compared to 10 years ago. We suffered a lot from that tapoioca stuff, regularly all cars had to be cleaned again. With the environmental association we also fought against it, up to the council of state. He judged that the reports of measures did have peculiarities, and since then it became less."*

Interestingly, looking at Jan's answers regarding nuisance, his stance against the environment is relatively uncritical. The fact Jan doesn't do a lot of activities in his free time, could be a reason Jan is easily satisfied with his living environment and thereby less critical, reflecting the factor "Personal criticalness regarding own living environment". When asking him about his satisfaction regarding Hoek van Holland and the degree the village offers enough opportunities to do his favorite activities, Jan answered in third person:

> J: *"(…) And I'm telling you people in there come to live outside the area, they go to s'Gravenzande or Maassluis for entertainment. I have an entrepreneur who runs a restaurant and who is very satisfied with the Landal holiday homes because people sometimes come to him. (…)."*
> K: *"And about yourself, are you satisfied or are there things you miss?"*
> J: *"Well I miss very little because I don't do much. But uh, so you can do all kinds of sports here, bowling, rugby…"*

Potentially the factors "personal interest in nuisance source" and "knowledge regarding nuisance source" play a role in Jan's nuisance perception as well. Due to his past and current experiences Jan has much understanding regarding industry and ships and the potential nuisance it might involve:

> KE: *"And that high tone as well as that departure, that whistle."*
> Y: *"Yes, but that's what you go for, that's why you live here."*
> J: *"Besides, he has to do that whistle too, you know."*

This makes he knows the reason behind negative externalities and it could be he is therefore less annoyed by them. Jan also explains that due to his interest in shipping, he knows when something unusual is happening, which could impact his observation of nuisance too. When all shipping activities go according to plan, he doesn't hear the ships at all. But when something goes wrong, he hears it immediately and goes to the balcony to have a look. Finally, Jan's apartment is surrounded by busy traffic, makes traffic noise is the most prominent type of nuisance for him, which could have affected his perception of nuisance caused by industry. While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 3.5) situational factors are determined too.

4.6.5 Perceived Nuisance Factors Marcel

Marcel lives for almost four years in Hoek van Holland and is a very satisfied resident. He deliberately chose for Hoek van Holland as new living environment and therefore was mentally prepared for the potential negative sides related to the village, such as industrial nuisance and the poorly developed center. The following quote supports this and explains "expectations regarding nuisance in particular place" are likely to have influenced Marcel's perception of nuisance:

> M: *"Well in my case, we have been looking for a long time to live here, we looked closely at location and we are very satisfied with that. Other things are less desirable, but this location makes they are more than compensated for. I can live here.* (points around to his house and garden) *Nice and quiet, sit outside, I can do my things etc. And already in advance I knew that center was nothing. So yes, I knew where I was living and where I was going to, so I knew where I went. But yes, we looked carefully where we went, so we are not surprised by what we come across here, I knew about the Stenaline and stuff and I don't mind. I am happy here and can do my things."*

As economic researcher in the green housing sector, Marcel is in some way involved with industry in his daily life and is in this respect a relatively knowledgeable resident. Like Jan, knowing more about the nuisance source could have impacted his feelings of annoyance. As for light pollution, for example, he points out:

> M: *"You often read comments that if you don't know something, then it gives extra fear and anxiety. If you know what is happening somewhere, inside building or behind the scenes, then this affects your perception. Take the greenhouses for example, because I also have horticultural work, I know what development are taking place. We now have yellow light, but we go to purple light. I know what changes and progress is coming. Because you know why, you give it a less negative score. Yet, I also don't find it nice to see, that's another story."*

This way, Marcel refers literally to the factor "knowledge regarding nuisance source" and shows he believes strongly there is a relation between someone's knowledge and nuisance perception. Contrarily, he points out the "habituation" is probably a less relevant perceived nuisance factor. For him personally, but also in general:

> K: *"To what extent do you think, how long you have lived here, how much it affects the nuisance you experience?"*
> Y: *"Well not."*
> M: *"Well for a short period. At the beginning they are new, but now I live here longer, you can place it."*
> KE: *"It's more the anomaly you hear now."*

As for actual nuisance factors, it is likely "potential health risks nuisance" and "degree source nuisance supports economic growth" are of relevance in Marcel's case. The first because he is worried about potential health risks related to the black-colored soot he notices. Notably, the fact his question towards the municipality about this remains unanswered exacerbates his worries and thereby his annoyance of soot as well. The latter because Marcel multiple times brings forward arguments relating to this factor:

> M: *"I like the view of the Stenaline chimney, also a bit of progress. Why do we have it oke here? Also because of De Tweede Maasvlakte."*

However, later in the discussion Marcel nuances this statement a bit:

> M: *"A negative view is De Tweede Maasvlakte. I know, well...I'm an economist, it's progress. But I don't like to see it. So then when I get there on the real beach, I am a bit bothered by that."*

While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 3.5) situational factors are determined too.

4.6.6 Perceived Nuisance Factors Henk

Henk lives for around two year in Hoek van Holland in a satisfied way. Looking at Henk's words during the focus groups from the person-environment point of view, much attention is paid to the personal side of the relationship. Meaning that opposed to characteristics of the living environment, mainly Henk's characteristics and the way he assesses its surrounding seems to have influenced his perception of nuisance. Firstly, he explains comprehensively that in his life it has been a deliberate choice to always try to make the best of it, to not worry about the future and to never fall into a victim role. This could be seen as a certain coping mechanism to deal with nuisance, but also other negative experiences in life.

H: *"At work they ask "How long do you have to go Henk?"*
"Well until a quarter past three. And you shouldn't nag at me, because I have to enjoy myself right now." I am also not like there or then, or it will be better later. No, I have to enjoy myself, here and now. That's my assignment."
C: *"Indeed"*
H: *"I also see that as my assignment. And not that it would be better elsewhere. No, here, you have to make it good."*
K: *"(…) and would you rather adapt yourself than adapt your environment?"*
H: *"Yes, and I just said that too, because I don't want to be a victim. I don't want to blame the other person either. And I'm in a society where things like that can happen and then I'm still always happy that I can live in the Netherlands. So that's how I see it. (…)"*

PNF HENK

Actual nuisance factors
- Degree nuisance source offers entertainment
- Degree source nuisance supports economic growth

Personal factors
- Applied coping mechanism
- Observant or intuitive personality
- Presence (emotional) distraction
- Places visited (during holidays)
- (mis) Trust government

Situational factors
- Good relation with neighbors

Apart from the factor "applied coping mechanism", quotes above suggest that the factor "observant or intuitive personality" could be applicable for Henk as well. When I asked Henk about his feelings regarding compensation in case the industry in his environment would grow, he explained for him thinking about something fictional is rather useless: As typical for an observant mind, he says:

H: *"(…) So it is an image of something and it just always has to be seen whether it turns out like that. You have to be in that situation. So, I have stairs here now, and if I miss a leg, I'm going to see how I get up those stairs. But maybe not at all, maybe I'm so negative that I just sit and moan. You don't know, you only know when it happens. So, if I get lung cancer, I don't know if I'm going to get mad at that (pointing to industry), and if I'm going to be a victim. Because in my whole life I don't want to be a victim, in any way."*
(…)
H: *"I don't want to allow that. That is also what I see in contemporary art, for example, performers all make doomsday scenarios, black paintings, "Everything is broken, everything goes to the ***", but I find that a bit too easy. Of course, if it continues like this, sure there are more bigger problems, but I can't help it. I can only pick up a piece of plastic, I cannot change the world. (…)"*

Throughout the discussion Henk emphasizes that if you would know everything and think about everything, you would perceive things differently, but he personally prefers to mind his own business, his own environment and care for it to his best ability. Planting trees in front of the house that could clean the air and picking up trash in his street are for example actions Henk undertakes himself. For him this is more than just improving the environment, but it is also positively affecting his own mood; By picking up trash he experiences kind of romantic feelings, happy to make a modest contribution to the world around. Other factors that came forward in Henk's answers are "places visited (during holidays)", "presence (emotional) distraction", "degree nuisance source offers entertainment", "personal interest in nuisance source", "(mis) Trust government" and "degree nuisance source supports economic growth". The latter, is illustrate in quote below when Henk explains seeing the holiday houses is more annoying for him respect to seeing the industry:

H: *"Well, I find that really annoying, that I am picking trash there, that I can look at those blocks."*

K: *"And you don't really have that same feeling with industry?"*
H: *"No, that was also what I fantasized, if you live in Maastricht, you will not see this, but this will be also produced for you in Maastricht." (…) You know, (…) we live here, but it is this for all of us. There is gas for three months, that's for me too…"*

Where for the other residents several situational factors could be derived from the written data provided on the fictive contracts (appendix 4.5), in case of Henk, situational factors are determined differently because he decided not to sign it. He stresses again that he doesn't want to be a victim, he prefers to accept the situation at hand and deal with environmental changes by himself. Furthermore, he states to have no trust in the government or unequal agreements in general, and believes signing or not would not make any difference. However, the discussion that followed during the exercise revealed one situational factor anyway:

H: *"So who cares if I sign or not? ... I do want to stay on good terms with my neighbors.
(…) I don't want to argue because of one factory that comes. So, I have very nice neighbors, which I think is an incredibly important aspect."*

4.6.7 Perceived Nuisance Factors Clarien

Clarien has lived in Hoek van Holland for almost fifty years. Her previous places of residence were also in the same region, namely Naaldwijk and s'Gravenzande. During the focus group Clarien often refers back to these places, and therefore it could be "previous place of residence" is an important factor for her. To illustrate:

C: *"I live very pleasant here, and I think everywhere there is something wrong. We lived in 's-Gravenzande, well there we had an iron factory at the end of the street. Well, it was always noisy, crowded and smelly (…) so ... it was just in our street, so yes no, I will not go back to 's-Gravenzande."*

PNF CLARIEN
Actual nuisance factors
• Duration nuisance
• Permanence nuisance
Personal factors
• Previous place of residence
• Experience past nuisance current place of residence
• Interwovenness with living environment
• Coping mechanism
• Habituation
Situational factors
• Safety teams or services
• A garage to park the car
• Facilities and activities in the neighborhood
• Good contact with neighbors
• Beautiful industry
• Holiday assurance

When she arrived in Hoek van Holland, she was negatively surprised by the boat that caused a very intense smell. In the past it used to smell way worse than it currently does, explains Clarien. And the same is true for Synres, the composting facility, which's odor was more dominantly present as well. She is aware of the past nuisance situation in the village and it is likely this impacts her current perception of nuisance.

Albeit not emphasizing it strongly, some comments of Clarien suggest she has become interwoven with the area. She explains she has some friends who move away to live closer to their children. Though Clarien is very fond of family, she states that this would not be a reason for her to leave Hoek van Holland, which suggest "Interwovenness with living environment" could be play a role in Clarien's nuisance perception. She says:

C: *"(…) It's also because you're just happy and there are all kinds of things you can do. It is not the case that, I have children who live a little but further away, well The Hague and Leiden, not so far away, but it is not that I say, I am moving to Leiden because our children live there. I don't have that. What you sometimes hear: "Yes I want to be closer to my children. Well, that really doesn't apply to me."*

Above quote also indicates Clarien is just very happy to live in Hoek van Holland and all the activities she is able to do there. Multiple times during the discussion she explains the village has much to offer and she really enjoys the many walking-and-cycling routes around. "Facilities to do activities in the neighborhood" is therefore added to Clarien's list of perceived nuisance factors.

Throughout the discussion, Clarien generally agreed with Henk that someone's perceived nuisance depends largely on someone's mindset, she believes that residents also have a certain responsibility themselves to make a

place they enjoy to live in. Likewise, when nuisance is really affecting her daily comfort and nuisance is very extreme, she will make some phone calls to improve the situation:

C: *"Well not with the catamaran, it smelled really bad. Even if you were a little bit further inside the village, when he was operating, the whole village noticed. (…) It was really gross. We also called a number then. Yes, and if you then keep calling regularly, then there are council meetings and stuff, and then, it was taken out of service."*

As for the actual nuisance factors, time related factors seem to have a considerable effect on Clarien's nuisance perception. Although the vibrations caused by the Stenaline could sometimes be very extreme, she is not that much bothered by it because it is only temporary and it doesn't last long. To conclude, the factor she stresses herself the most is "habituation", as quote below indicates:

C: *It is also often a matter of getting used to it. Because when we have people visiting, they ask wonderingly; "What do we hear now?" and then I say "Yes that's the boat, I can't help it now." But we are used to it and that is actually also a dangerous thing."*

While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 4.5) situational factors are determined too.

4.6.8 Perceived Nuisance Factors Fien

Fien lives already for 37 years in Hoek van Holland and is a very satisfied resident. During the focus group she explains with help of lively anecdotes how much she enjoys living there. Moreover, she draws links between her satisfaction and perception of nuisance:

K: *"(…) But I just find it interesting... how do you think that this is so different from resident to resident?"*
(…)
F: *"Yes, I think it is a balance of what you see, and furthermore you look at the whole picture of where you live, what is very positive about it. You are in one step in the shopping street, it has a central location, you easily walk into the woods."*

From this regard, being satisfied is also a kind of coping mechanism for Fien, "applied coping mechanism" is therefore seen as influential factors for her. Notably, Fien's second way of coping is calling to the phone number intended for nuisance related complaints, which she only does when something is causing discomfort in her daily life and is thereby very annoying:

> **PNF FIEN**
>
> Actual nuisance factors
> - Presence other types of nuisance
>
> Personal factors
> - Applied coping mechanism
> - Experience past nuisance current place of residence
> - Observant or intuitive personality
> - General interest in living environment
>
> Situational factors
> - Greener neighborhood
> - Hidden industry
> - Beautiful industry
> - Camper, to go away from time to time
> - Facilities in the neighborhood
> - Good contact with neighbors
> - Environmentally friendly house/neighborhood
> - More parking facilities
> - Crowdedness

F: *"But yes, at the beginning it (the boat) would play such a tape when it left. Where the life jackets are stored, in German and in French. And then you lie in bed and you thought; "Ah yes of course, they are on the left side, below." About that I also made a phone call. And then they started playing it later, when they are a bit further away from the dock. Yes, that really helped."*

Like Clarien, she has knowledge regarding the past situation of her living environment and it seems to influence her nuisance perception:

H: *"And I don't like the fish palace either."*
F: *"Well what stood there first was even worse."*
H: *"Yeah? So, at the fish palace, so it has improved?"* (surprised tone)
F: *"Yes, a huge progress, 400% percent or so I think* (looking for confirmation to Clarien)
F: (…) *"But yes it has been improved enormously."*

Looking at other statements, it seems Fien is a busy bee with an observant mind, who is simply not continuously thinking about her place of residence and potential nuisance too much:

> F: *"Yes, I agree, and you have nice things and less nice things. And that works out well, (…) I now have a house that I can afford, so the choice is easy, and you have to live somewhere, right? There is plenty in the village which is just fine and I am also not always very busy with my living environment; You also have your work, your friends and your children. You are not always reflecting or thinking about it, you just want to live your life."*

Besides the factor "observant or intuitive personality", quote above also shows Fien's general interest in the living environment is relatively low, which relates to the factor "general interest in living environment". As for actual nuisance factors, one that is clearly put forward by Fien is "presence other type of nuisance". Throughout the discussion, she mentions her annoyance regarding the neighbors around and that she also doesn't like that Hoek van Holland is becoming more and more filled with buildings and people over the years. While the discussion reveals mainly personal factors, based on the written data provided in the fictive contracts (appendix 4.5) situational factors are determined too.

4.7 Collective Perceived Nuisance Factors (PNF)

In section 4.6 individual perceived nuisance factors (PNF), likely to be of influence for residents individually, are determined. With help of lively descriptions and quotes a deeper understanding of PNF is gained. This section complements to this understanding by focusing on the residents as group. For a complete overview, a list of potential PNF is drawn up, and for a deeper understanding, some characteristics of the PNF are described.

4.7.1 Potential Perceived Nuisance Factors

To have an overview of what factors could in fluence perceived nuisance, all individual PNF determined in previous section are added up and combined in table 10. For a healthy, safe and thereby satisfied residents, urban planners and policy makers could steer on actual nuisance. To support residential satisfaction even more, they could steer on perceived nuisance as well. The perceived nuisance depends on actual nuisance, but is also influenced by multiple factors. In this study we focused on two types of factors: personal factors, relating characteristics of the nuisance receiver, and situational factors, relating to the living environment of the receiver. Asking the residents to elaborate on their nuisance perception revealed many characteristics related to nuisance source and to the actual occurrence of nuisance itself. To give these findings an explicit place too, a new type of factors is distinguished: Actual Nuisance Factors. Since these factors relate to actual nuisance opposed to perceived nuisance, it could be argued they have contrary to the other PNF an indirect effect on perceived nuisance. Anyway, directly or indirectly, they seemingly play a role in feelings of annoyance and could therefore be seen as important characteristics to consider when aiming for a lower perceived nuisance among residents. Sections below elaborate on the three types of PNF and on the dualistic character of PNF in general.

4.7.2 Actual Nuisance Factors

Considering the actual nuisance factors presented in table 10, it could be seen the list goes beyond location of residence and separation distances. More characteristics related to actual nuisance appear to be important, which creates more opportunities for urban planners and policy makers to steer on actual nuisance and thereby, perceived nuisance. What the factors further show is that one cannot only affect actual nuisance by mitigating the negative characteristics, but one can also recognize positive aspects and enhance them. Take the factor "degree nuisance source supports economic growth" for instance. Maybe industries could present their economic benefits more explicitly or policy makers should communicate these benefits more to the population. Three actual nuisance factors are highlighted below.

Presence of other types of nuisance
This factor indicates residents perceive the environment as a whole and do not asses nuisance separately, but rather in comparison to other types of nuisance. Fien stressed multiple times during the focus group, industrial externalities

ACTUAL NUISANCE FACTORS	PERSONAL FACTORS	SITUATIONAL FACTORS
Observability nuisance in daily life	Habituation	Co-housing
Moment of time nuisance*	Feelings of familiarity, proudness	Age friendly house
Duration nuisance	Interwovenness with living environment	A house that supports to do hobby's
Permanence nuisance**	Experience past nuisance in current place of residence*	Hidden industry
Potential health risks nuisance	Previous place of residence*	Provided earplugs and eye masks industry
Potential safety risks	Places visited (during holidays) *	Holiday assurance
Operator of nuisance source*	Knowledge regarding nuisance source*	Parc-like, green natural environment
Esthetical quality nuisance source	Personal interest in nuisance source	No devaluation house
Controllability nuisance	Economic dependence on nuisance source	A holiday home in the woods
Predictability nuisance	The "busy bee" degree: Degree of enjoyment to do a lot of things and keep yourself busy	Optimal noise insulation
Presence of other types of nuisance*	Observant or intuitive personality: observant or intuitive way of processing the environment*	Optimal energy insulation
Degree nuisance source offers entertainment	Personal sensitivity	Spatial house
Degree nuisance source supports economic growth	Presence (emotional) distraction*	Facilities and activities in the neighborhood
	Trust government	Age friendly house
	Previous experience government*	Green areas nearby
	Personal expectations regarding nuisance in a particular place*	Luxurious house
	Applied Coping Mechanism*	Environmentally friendly house
	General interest in living environment	Living environment supported by industry
	Personal criticalness regarding own living environment	Mediterranean public space
		Energy neutral environment
		Green facades industry
		Solar panels on flat roof of industry
		Social cohesion in the neighborhood
		Neighborhood bus
		Beautiful garden
		Good contact with neighbors
		Safety teams or services
		A garage to park the car
		Beautiful industry
		Greener neighborhood
		Camper, to go away from time to time
		More parking facilities

* The findings suggest this PNF could, dependent on the value, both have an increasing as well as mitigating effect on perceived nuisance.
**The findings suggest this PNF could, while having the same value, both have an increasing as well as mitigating effect on perceived nuisance.

Table 10. Actual Nuisance Factors, Personal Factors and Situational Factors that could influence perceived nuisance. (own figure)

are not so annoying compared to other types of nuisance; her neighbors are way worse. Similarly, Jan explained he notices industrial noise only in the evening because during the day the noise caused by traffic near his house is more prevailing. The findings suggest management of residential nuisance requires a holistic approach that considers multiple types of nuisance simultaneously.

Potential health risks

When speaking about nuisance, most residents mentioned health-related topics too. To what extent there are worries about potential health risks differs from resident to resident. Based on quotes, it could be noticed Kees, Marcel and Anja are most concerned about short and long-term health risks. The general concern regarding health, seems a plausible reason why Kees and Marcel are more annoyed by soot and Anja is more annoyed by industrial noise and shipping vibrations. From the residential perspective, it is more a matter of association than measurement; it is about the health risks associated with a certain type of nuisance, rather than the actual health risks according to measurements or research. Notably, that soot is harmful is not proven, but Marcel and Kees do experience it this way. Education and communication are therefore pivotal aspects of nuisance management.

Permanence, duration, moment nuisance

All residents used time related terms in their argumentation to explain their annoyance scores attached to observations. They all agreed composting smells were due to, among other reasons, their temporariness not a big problem. In addition, Anja hears industrial noise permanently, while Jan only hears it in the evening hours, which could explain why Anja is very annoyed by it and Jan is only little. Furthermore, a potential reason why vibrations are for Anja more annoying than for Clarien and Fien could be related to the moment these vibrations occur. Clarien and Fien feel them only in the afternoon, while Anja feels them in the morning too. This way her sleep is disturbed and it is understandable this leads to more feelings of annoyance. Another interesting finding a that seeing industry in the dark was found quite fascinating, and therefore less annoying than in day-time.

4.7.3 Personal Factors

With help of the focus group a comprehensive list of personal factors could be drawn up (see table 10). Like, the actual nuisance factors, the length of the list illustrates urban planners and policy makers could steer on perceived nuisance in numerous ways. The personal factors form the link between the spatial research fields and more socially related ones. Some examples; "personal sensitivity" links to health, "observant intuitive personality" links to psychology, "busy bee degree" links to leisure studies and "feelings of familiarity, proudness" and "interwovenness in living environment" link to culture and demographics. The personal factors combined suggest the personal side of the person-environmental relationship should not be underestimated. Possibly, residents coming from Rotterdam to Hoek van Holland react differently to externalities, compared to the ones who have lived in Hoek van Holland their entire life. It is theorized managing residential nuisance could become more effective when acknowledging all the personal characteristic of residents instead of treating them as a generic identity. Five personal factors are highlighted below.

Applied coping mechanism

Though not asked about coping directly, during the focus groups several coping mechanisms to deal with nuisance came to light. Residents of the first group all like to be involved with developments in Hoek van Holland and join now and then participation sessions to obtain information and ask questions. Clarien and Fien express their problems to parties responsible for it and make a phone call to report nuisance when needed. Kees and Henk undertake maintenance activities to make a positive impact on the environment themselves. Anja did not describe precisely what coping mechanism she applies, but did mention she always has been a very active resident, but this exhausted her enormously, which is why she now tries to take a step back. Henk, Clarien and Fien underline to focus on the positive sides of the neighborhood and that way negative feelings of annoyance could be avoided. Taken all together, it is not necessarily pivotal that you apply a coping mechanism, but it is potentially more important what coping mechanism you apply.

Observant intuitive/personality

By formulating this factor, I suggest a resident's personality could also play a role in nuisance perception. Based on the statements made, Kees, Anja, Jan's and Marcel's personality seems to be more on the intuitive side of the spectrum, while Yara, Henk, Clarien and Fien seem to be more on the observative side. Since a difference in perceived nuisance could be seen between these two groups, it could be this factor is one of the more influential PNF.

Personal expectation

Except for Jan, who lives already his whole life in Hoek van Holland, all residents mention or stress that expectations play a role in perceived nuisance. Marcel and Henk stress that moving to Hoek van Holland was a deliberate choice, they are less annoyed by the negative sides of the village, because they expected it. Anja, on the contrary, associated Hoek van Holland with the beach, fresh air and expected a silent, relaxed place to live. Once there, for her the opposite is true, she hears industrial noise permanently. Since compared to the other residents Anja's perceived nuisance is relatively high, it could be "personal expectation" is one of the more influential PNF.

Experience past nuisance in current place of residence
This factor seems to depend greatly on the duration of residence. Residents who have been living for many years in Hoek van Holland, Jan, Clarien and Fien, frequently referred to the past nuisance, while residents who are relatively new in Hoek van Holland, like Henk and Marcel, did not mention it at all.

Personal sensitivity
Lastly, the factor "personal sensitivity" could be one of the more influential PNF. Due to health issues, Anja is the only resident who indicated to be highly sensitive for negative externalities, such as noise, light and vibrations. This could have affected her observation of environmental externalities; she might notice them sooner than less sensitive residents. Additionally, it could have impacted her annoyance score attached to observations as well. Her body might react more extremely to observations, including side effects, such as headache or light flashes. Therefore, even with a similar observation as others, nuisance might affect her quality of life more easily compared to other residents. Given the relatively high perceived nuisance of Anja, it could be "personal sensitivity" is one of the more influential PNF.

4.7.4 Situational Factors
Similar to the actual nuisance factors and personal factors, a long list of situational factors could be drawn up. The factors relate to all kinds of aspects of the living environment and it seems the list of situational factors could be extended to an even longer list. However, the factors partly overlap and some are rooted in similar residential values. To steer on perceived nuisance from the situational perspective, urban planners could focus on factors or on the values underneath. Based on the situational factors, the following residential values could be distinguished:

- Social living
- Green living
- Long-life living
- Usable living
- Safe living
- Accessible living
- Environmentally friendly living
- Esthetical living
- Nuisance free living
- Compensated living
- Escapable living
- Value- stable living

Most of above values are quite straight-forward and are probably applicable to any living environment. Some might need some further explanation and are more particular for an environment where nuisance sources are present. "Compensated living" relates to the fact that residents want to feel compensated for negative changes in their environment. Dangling the (fictive) future event that new industry would be added to Hoek van Holland, many residents expressed the wish to be compensated by both the municipality as well as the industrial companies. This compensation could take many forms; ranging from simple earplugs and eye masks to an improved garden and a luxurious house. The value "escapable living" reflects the wish to be able to leave the living environment from time to time and therefore some residents demanded a holiday home or camper as compensation. It seemed most of them wrote these wishes down as "nice to have", thus a way to increase quality of life even more. But Anja expressed being able to escape is really a necessity for her. With industry in her street, she would like to go away as much as possible. Furthermore, newly built industry could have negative consequences for the value of homes. Acknowledging this, residents do not want their house to devaluate and desire "value-stable living". They expressed that urban planners or companies should invest in the neighborhood to such an extent, devaluation of their homes is avoided. The value "nuisance free living" relates directly to nuisance perception and involves the wish for architectural measures, like insulation. Finally, it is important to note "esthetical living" refers in this case mainly to industrial view. All residents, with exception of Henk, expressed they would like the industry to be designed in a way the esthetical quality of the neighborhood is protected. They thought about better architecture, green facades or natural dividers.

Though some values are more clearly linked to nuisance than others, the fact residents express all of them in the contracts suggests they are all important for nuisance perception. In fact, the situational factors go beyond architectural measures or technical solutions and include all aspects that could support their residential satisfaction. Some factors are rooted in the wish for health and safety, like high-quality noise insulation or presence of safety teams,

other reflect a wish for having an active social life and good neighborhood relations, like the wish for co-housing and neighborhood activities. The underlying values of the situational factors show that residents think about the present and the future (long-life living), wanting the best for themselves (usable living) and the other living beings around (Environmental-friendly living). From this regard, it appears that residents look at the total quality of their living environment and view potential environmental disturbances as a part of it. Walking opportunities, accessibility to green and friendly neighbors all play a role in their overall satisfaction and could thereby mediate their feelings of annoyance.

Perceived nuisance and residential satisfaction

Based on the above a dualistic relationship between residential satisfaction and perceived nuisance is theorized. Potentially, not only more nuisance leads to less satisfaction, but also more satisfaction leads to less nuisance. How does this hypothetically work? By respecting the residential values in urban planning, the positive aspects in the living environment are more likely to outweigh the negative ones, residents are probably more satisfied, more tolerant, and, eventually they are less likely to feel annoyed and less likely to perceive nuisance. This theory is rooted in the findings of the focus group. Resident who are satisfied with everything in Hoek van Holland are Clarien and Henk, they have a rather low perception of nuisance, while Clarien notices clear shipping vibrations, black-colored soot and sometimes smell. Kees, Yara, Marcel and Fien have some small point of critic regarding their living environment, but are overall very happy to live in Hoek van Holland. As for their perceived nuisance, they have maybe one type of nuisance they find very annoying, but overall, their perceived nuisance is relatively low. Anja, on the contrary, has besides nuisance, more aspects she is dissatisfied about in Hoek van Holland. She has an annoying neighbor, would have liked more shopping facilities, a more lively center and more cultural events that are actually fun to visit. Anja's perceived nuisance is relatively high. These findings are not revealing a proven theory, but are merely suggesting an interesting hypothesis. All PNF combined show perceived nuisance is a very interrelated concept, which could be approached and mitigated from multiple perspectives.

4.7.5 Dualistic Effect PNF

Looking at the effect of the factors, it could be noticed some factors have a straight-forward and consistent effect on perceived nuisance, while others are more ambiguous and could affect perceived nuisance in multiple ways (marked with * in the table). Take "Controllability nuisance" for instance, it could be assumed the effect has one direction: the more controllable the actual nuisance, the lower the perceived nuisance. While for "knowledge regarding nuisance source" the effect could be twofold: Yara stated it is better not to know everything, because it will increase your worries, while marcel stressed when you are more knowledgeable, it is likely this mitigates your annoyance. For this factor, it depends largely about what you get to know; when something illegal is happening behind the scenes and you find out, it will increase worries, while when you find out innovative improvements are in development, this is likely to decrease your feelings of annoyance. The findings suggest there could also be PNF with a dualistic effect on perceived nuisance, also when the value of the factors is the same (marked with ** in the table). The PNF "permanence nuisance" forms an example in this respect. Residents assigned both an increase as well as decrease of annoyance to permanent types of nuisance. On the one hand, they argue soot is very annoying because of its permanence. At the same time, they hypothesize; When something is permanently there, you get used to it and this mitigates feelings of annoyance. Accordingly, they theorize residents of Pernis perceive relatively less nuisance residents of Hoek van Holland, because Pernis is literally surrounded by industrial activities and people are probably experiencing nuisance all the time, which is less notable than nuisance that comes in waves.

4.8 Residential Nuisance and Urban Planning

Previous sections focused on data gathered from residents and thereby reflected the bottom-up perspective. To validate and complement on previous findings, in this section the top-down perspective will be addressed. Based on the data gathered during desk-top research and the in-depth interview, the way nuisance is approached in Dutch urban planning context is described, what the urban planner knows about nuisance in Hoek van Holland, how is dealt with nuisance in the port city Rotterdam is described and finally, potential perceived nuisance factors are derived from the interview are discussed.

4.8.1 Residential Nuisance and Urban Planning in General

To gain a better understanding of how residential nuisance is managed in urban planning practice, Knowledge Center InfoMil forms an important source of information. The Knowledge Center InfoMil is part of Rijkswaterstaat (directorate general of part of the Ministry of Infrastructure and Water Management of the Netherlands), and encourages the implementation of knowledge-based environmental policies. All information about Dutch environmental legislation and regulations is bundled on the website of InfoMil (Kenniscentrum InfoMil, n.d.) and likewise, this website formed the basis for coming section.

Area development always starts with a reason that can vary from the desire to convert a company into a home to an urban renewal project. Rijkswaterstaat distinguishes the following phases in an area development process:

- Pre-discovery
- Exploration
- Plan study
- Realization
- Management

It comes down to the development of a vision, then, the creation of more concrete plans, such as the land-use plan and finally, the actual realization of the area developments. The further in the process, the harder it becomes to make adjustments. Therefore, it is argued to include environmental aspects, like noise, as early as possible in the development process. In practical terms, including aspects means the consideration of environmental norms, standards and rules, set up to determine whether the realization of a certain project is desirable.

Rijkswaterstaat argues that in good spatial planning, rules are respected, standards are not exceeded and potential health effects are avoided. In this sense, striving for good spatial planning could mean some plans may not be allowed. An important note they make is that even if limit values are met, there may be health effects, and projects could be rejected. Especially more sensitive groups of people like elderly of children might not be protected by norms alone and can be taken into account in decision making. In addition, Rijkswaterstaat supports collaboration between fields and mentions for example, the GGD (health care institution) could be asked for advice on health issues in urban planning. Working on good spatial planning, the competent authority must therefore weigh up the various interests for the local situation at hand. And for environmental quality, this is more than simply complying to the rules. In line with this statement, Rijkswaterstaat describes six environmental principles;

- Consider the exposure of externalities on people;
- Separate nuisance sources from nuisance perceivers;
- Prevent foreseeable nuisance or health damage;
- Protect against pollution, whereby the most vulnerable group is in the least polluted place;
- Weigh important interest in a balanced way;
- And, explain decisions substantially.

Besides rejection of plans, also buffer zones or technical measures could help to respect these principles. However, Rijkswaterstaat describes it cannot always be prevented that certain places are assigned a destination where groups of people are exposed to exceeding environmental externalities. In those situations, realization of the project entails many (non-environmental) urban planning benefits and therefore deviations to the environmental principles or the land use plan are allowed. A substantial motivation should be present in this case and might for example include:

- Based on a location analysis, it is shown no other locations are available for the project;
- There are urban planning reasons that explain the preference for the location;
- Project measures will lower the nuisance present on the back-ground of the location, which makes a certain destination inside the project may exceed environmental standard;
- Or, choosing this location involves financial benefits.

To formalize this decision process, the consideration of spatial permissions is based on assessment frameworks. Only frameworks for noise, air quality and external safety are addressed on the website, as only for these types of nuisance legal obligations apply. To mitigate nuisance caused by odour for example, separation distances between the source and receiver are applied and certain contours are associated with acceptable odour levels. However, this contour is not necessarily a hard boundary within which construction is not permitted. Potentially, the fact noise, air quality and external safety are strongly related to residential health and safety, is the reason why these types of nuisance gain seemingly more attention from Rijkswaterstaat and are more strictly managed in urban planning.

Considering all the above, it could be seen Rijkswaterstaat aims for good spatial planning, whereby the environmental perspective is, preferably as early as possible, included in the area development process. Furthermore, considering potential health effects, respecting all the environmental principles and standards are considered to be essential tasks in urban planning. Rijkswaterstaat acknowledges striving for a clean and healthy environment, while balancing other economic or planning interest might be complex and likewise, many tools and guides in relation to area development are bundled on the website. Discussing them all would fall outside the scope of this research, but three instruments are highlighted by the Knowledge Center InfoMil, are thereby potentially seen as more important, and are briefly described below:

1. Legal instrument City and Environment
Aiming for a better integration between nuisance management and urban planning, this instrument defines three steps to be followed in the development process:
- Step 1: Collaboration between environmental experts and urban planners starts already at the beginning of a project and environmental externalities caused by the nuisance source should be limited as much as possible.
- Step 2: Customize within the environmental laws by seeing opportunities and being creative.
- Step 3: When previous steps proved to be insufficient to enhance or protect the quality of life, deviations to environmental legislations could be made.

2. Statutory instrument PlanMER
To determine the environmental impact of projects in a systematic, transparent and objective way, the environmental impact report forms a useful instrument. Environmental impact assessment (EIA) is legally anchored in the Environmental Management Act and is legally required in the realization of land-use plans or permits. The aim of Plan MER is to fully embed the environmental perspective in the plan making process of spatial projects and to ensure location choices are made deliberately, while others users beyond the planning area are taken into account.

3. GES (Health Effect Screening)
It is stated environmental norms and regulations are not always sufficient to guarantee a healthy environment. GES is a spatial screening instrument that helps to determine the actual health risks associated with urban planning developments. With GES nuisance sources are assessed in a structured way, potential health risks (also the ones below the norms) are revealed and are made comparable. This way, project alternatives could be scored based on the health effects (GES score) and the number of people who are likely to suffer from the health effects are estimated too (home score). The GES is a screening instrument, not a legal assessment instrument.

What the three instruments illustrate well is that on the one hand environmental legislations are well integrated in the legal and planning process of urban developments, but at the same time are not always found effective enough to avoid health risks or protect quality of life. What the instruments further suggest is that projects beneficial from the urban planning point of view, might not always be best from the environmental perspective. Confusingly enough, quality of life is supported by both planning and environmental perspectives, but through what values this quality is reached might differ. An urban planner could realize quality of life by focusing on health and safety, respect all environmental legislation and adopt ambitious norms if possible. Contrarily, an urban planner could also realize quality

of life by focusing on economic, financial, cultural and social values, customize environmental legislation and make deviations from norms when needed. For optimal quality of life one perspective is not necessarily better than the other, but a holistic approach balancing the two perspectives is preferred.

In sum,

Based on consultation of the Knowledge Center InfoMil, in urban planning practice the main course of actions of nuisance management seem to be; The first decision seems to be rejection or acceptance of nuisance sources on certain locations. When accepted, how environmental legislation and norms could be reached is investigated. If impossible, customization or deviation from these norms is explored. Which environmental norms eventually are applied and what functions eventually are allowed at certain locations are laid down in land use-plans. When projects are realized in correspondence to these land-use plan, it is during the operational phase checked and monitored whether nuisance sources comply to the environmental norms and rules.

The choices made in nuisance management depend partly on the objectively determined health and safety effects of the nuisance sources on people inside or beyond the planning area. On the other hand, these choices depend on the economic, financial, cultural or social benefits associated with allowing certain uses at certain places. What arguments weight stronger depends on political preferences and the type of nuisance managed, stricter norms and procedures apply for the management of noise, air quality and external safety than for other types of nuisance, such as soot, odour or vibrations.

The instruments available for urban planners reflect nuisance management is a balancing act between potentially conflicting interest. It is implied that choosing for an economically, financially, culturally, socially valuable development could lead to a relaxation of environmental norms and that such a development might include more nuisance for the users inside and around. This way, the idea residential satisfaction (resulting from an economically, financially, culturally, socially valuable environment) could have a mediating effect on residential nuisance seems to be overlooked. The findings further suggest nuisance issues are in practice strongly associated with environmental health and safety and seemingly less linked to feelings of annoyance or feelings of satisfaction with the living environment as a whole. Thus, relatively much attention is paid to the objective indicators and mitigating actual nuisance, opposed to subjective indicators and perceived nuisance. Finally, findings indicate although formalized and embedded in objective instruments and legislation, managing residential nuisance in urban planning remains partly a political and thereby subjective, issue.

4.8.2 Residential Nuisance and Urban Planning of Hoek van Holland

To validate and complement on the findings provided by the desk-top research and focus groups, an urban planner involved with the area developments in and around Hoek van Holland is interviewed about residential nuisance in urban planning practice. While having a special focus on the findings of this interview, also some findings of the other methods are employed in coming sections. Notably, although the interview was partly intended to find out what the urban planner knows about the perceived nuisance in Hoek van Holland, the findings show the urban planner is not directly working on residential nuisance himself. Instead, he is more focused on the wider urban planning context in relation to nuisance. In the end only little knowledge regarding the nuisance situation in Hoek van Holland was gained during the interview. Yet, the interview was useful because actors, processes and perspectives relevant for nuisance management were uncovered. First, the main activity of nuisance management is described, second, the objective and subjective component are addressed, then related urban planning challenges are discussed.

Residential nuisance management: a continuous conversation about legal boundaries

The urban planner explains for the management of nuisance in Hoek van Holland, a continuous conversation takes place between the municipality, the Port of Rotterdam Authority, and DCMR to make agreements regarding nuisance. The Rotterdam Port of Rotterdam Authority could actually be seen as a major landlord of many harbor companies. The authority manages, operates and develops the Rotterdam port and the industrial area around (Rotterdam Havenbedrijf, 2020). DCMR is the joint environmental service of South Holland (province in the Netherlands), which works on a safe and clean-living environment for its inhabitants. They are responsible for monitoring the environmental quality, for making permits and enforcing environmental and safety rules (DCMR Milieudienst Rijnmond, n.d.).

During such conversations, they discuss on what locations may be built, where the noise contours will be and what façade measures need to be applied, whereby the business operations of the port are never obstructed. According to the urban planner, pushing back zoning towards the industry of the port is not preferred in the area

around Rotterdam, and thus in Hoek van Holland. To assess the desirability of a project, coherence with existing industrial activities is therefore an important determinant for the municipality of Rotterdam. Early in the plan making process, the municipality starts a conversation with the Port of Rotterdam, saying something like: "I would like to have 20 homes here and 60 homes there." The urban planner explains, to put it simplistic, the harbor companies are typically against growth of the residential areas in the region. They see housing construction as a considerable risk; The more residents, the more potential objectors. Throughout the interview, the urban planner stresses it is a kind of battle between two major interests: the one of the villages and the one of the wider economy. For villages more inhabitants, mean more support for facilities and local employment, while for the port more inhabitants mean more potential objectors, less freedom to operate their trading processes and a risk for the national economy. Based on this conversation urban planning decisions are made. The municipality aims to balance all the interest and respect all perspectives. That said, the municipality is a pivotal shareholder of the Port of Rotterdam, holds 70% of the shares to be precise (Rotterdam Havenbedrijf, 2020), and could potentially be biased in favor of the harbor companies. The urban planner explains the village perspective is considered in urban planning by respecting the legal lines, such as noise contouring or other environmental restrictions on hazardous or polluting companies. In that sense, there is some attention for the villages from the port he says. The port perspective is taken into account in urban planning by providing sufficient space for the port.

Residential nuisance management: acknowledging objectivity and subjectivity

Talking in terms of legislation, space and distances, objective indicators regarding environmental quality are seemingly leading in the continuous conversation between The Municipality of Rotterdam, The Port of Rotterdam Authority and DCMR. However, during the interview it shines through the urban planner believes nuisance consists of an objective as well as a subjective component and is something that could be managed by steering on objective a well as subjective indicators.

Asking about his view on nuisance in Hoek van Holland, he had to recall his memory a bit and explained that, if he remembers well, mainly noise and smell is an issue in Hoek van Holland. Whereby noise could mainly be observed on the south side of Hoek van Holland (following the maximum noise contour) and smell could be noticed in the entire village. He explains this are considered the continuous types of nuisance and they (DCMR) deal with them by checking the compliance to agreements that are laid down in permits and land-use plans. In addition, they monitor the complaints and experiences of residents themselves by online-reporting and yearly participation sessions. Apart from this, they also deal with more incidental types of nuisance, like temporary pollution from companies for example. In that case, the aim is to minimize the subjective experience of nuisance through communication. By making announcements, companies indicate some irregular activities, necessary maintenance works for example, are coming up. This way, residents are mentally prepared for nuisance and more likely to accept it, explains the urban planner. The fact DCMR considers the residential perception through bottom-up initiatives and steers on acceptance through communication suggests the subjective component of nuisance is somewhat acknowledged.

Nonetheless, to what extent the residential perspective has really gained a place in the decision process of urban planning could be questioned. First, keeping residents satisfied is not specifically mentioned as objective of nuisance management. Furthermore, looking at the website of DCMR, the perceived nuisance of residents of Hoek van Holland, as determined earlier in this study, is not strongly reflected. Only for some types of nuisance, the approach and related norms are explained on the website (see figure 19). Seemingly no attention is paid to vibrations and soot, while these are from the resident's point of view important sources of annoyance. Information regarding these types of nuisance, relevant for the residents living in Hoek van Holland, remains hidden this way. Moreover, measurements, permits and norms are returning elements in the nuisance management of DCMR. More "soft" approaches such as communication, participation or mental support are unexposed. That said, not highlighted, does not necessarily mean they are not applied. In addition, the perceived nuisance of residents in Hoek van Holland is not strongly reflected in the urban planner's description of nuisance in the village either. Nuisance related to black-colored soot, vibrations and industrial view are missing in his description. This is quite remarkable, because for some residents these are pivotal sources of annoyance.

Potentially, the urban planner is most aware of nuisance types that are included in the decision frameworks, which are noise, air quality and external safety. The decision frameworks are used to make environmental agreements, and these agreements in turn form the basis for urban planning decisions. A potential drawback of this approach is that the types of nuisance that are not included in the frameworks might be easily overlooked. Another explanation could be that the problem of a type of nuisance is underestimated. This could be the case with industrial view. The

urban planner believes people accepted the view on industry in Hoek van Holland, because it is so particular, so contrasting and interesting in a way. He further believes people expect an industrial view there, it is just part of the village's identity and therefore it is more likely to be accepted. Since the focus groups indicate this is not entirely true, some residents feel even extremely annoyed when seeing the industry, the assumption industrial view is accepted in Hoek van Holland could be questioned. A third explanation could be that types of nuisance that are more qualitative in nature, like view, are limited addressed because objective methods to manage them are missing. Potentially uncertainties are associated with subjective approaches and they are therefore avoided. However, working with subjective indicators might include uncertainty, but as the misunderstanding regarding view illustrates, leaving it to observations and assumptions might be even more risky and might result in incorrect outcomes.

Smell caused by industry
"In certain weather conditions, for example a long period with little wind, substances in the air do not spread as quickly as usual. In such a situation, DCMR can issue a warning code for the industry. On the basis of the relevant 'stench code', companies must take measures to prevent air pollution." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Smell caused by shipping
"Ships that are moored in the port of Rotterdam can, for example, cause bad odors through ventilation or through their generators. We pass on reports to the Port Coordination Center." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Noise caused by shipping
"When reporting noise nuisance, we investigate the cause and act if a company does not comply with the permit regulations." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Low frequency noise by industry or shipping
"DCMR also accepts reports from residents about low-frequency noise. Low-frequency noise can be caused by companies, (rail) road traffic and shipping traffic. If the low-frequency sound comes from a company or industry, DCMR will conduct an investigation. If it turns out that the noise standards are exceeded, we will ensure that the company takes measures. If the company meets the standards, a solution is only possible if the company sees opportunities for this. Even if the standard is met, the sound can still be audible and annoying." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Dust caused by industry or shipping
"Fine dust (PM10) is a collective name for floating, inhalable particles with a diameter of less than 0.01 millimeter. Fine dust is not visible to the naked eye. The DCMR shows the concentration of PM10 in the air via the air measuring network. The legal standard is an annual average of 40 µg / m3 (micrograms per cubic meter). In addition, the daily average mg will be 35 times higher than 50 µg / m3 annually. The DCMR also measures the smaller component PM2.5 and displays it via the air measurement network. PM2.5 is a collective name for floating, inhalable particles with a maximum diameter of 0.0025 millimeters. There is no legal standard for an annual average yet. Because PM2.5 is even smaller than PM10, these particles can penetrate even deeper into the lungs and are therefore more harmful to health." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Hazardous substances by industry
"In industry, companies regularly use hazardous substances during the production process. The risks of using hazardous substances are limited by setting safety requirements for companies. Companies where many hazardous substances are present fall under the scope of the Decree on Major Accident Risks (Brzo). These companies must meet strict safety requirements to prevent major accidents and to limit their consequences for human health and the environment." (as cited in DCMR Milieudienst Rijnmond, n.d.)

Figure 19. Nuisance Management Approaches by DCMR per type of nuisance (source: DCMR Milieudienst Rijnmond, n.d).

4.8.3 Residential Nuisance Management: A Growing Challenge

According to the urban planner, area development in port cities is a continuous balancing act between conflictual interest. Moreover, in case of Hoek van Holland, he believes this is a rather challenging task. On the one hand, the port of Rotterdam is still growing. A large part of the harbor activities planned to be operational in De Tweede Maasvlakte are not present yet. As a result, coming years, more harbor and industrial companies are expected to locate there and it will become harder to uphold the existing contouring and norms. At the same time, Hoek van Holland is growing too. The municipality of Rotterdam observed the village is aging, its population is shrinking and employment and cultural facilities are diminishing. To backpedal these developments, the municipality believes Hoek van Holland needs to attract new people and therefore new housing needs to be built.

This arouses two interrelated urban challenges:
- How to support the growth of both the Rotterdam Port, while respecting the legal lines that safeguard a safe and healthy living environment in Hoek van Holland? And;
- How to safeguard the future of Hoek van holland, while keeping the Dutch motor of the economy running at the same time?

Asking the urban planner how to deal with these challenges, there was no concrete strategy on top of his mind, but he stressed that a qualitative conversation between the port and villages forms the basis and that multiple positive developments, like new technologies and stricter construction rules, give hope. A desk-top research into policy documents about the urban planning of the Rotterdam Port and Hoek van Holland provided more detailed information in this respect. The consulted documents indeed show both the village as well as the port are planned to grow.

Growth Hoek van Holland

Besides, regular housing construction in Hoek van Holland, the municipality envisions the village as the "beach resort" of Rotterdam and want to invest in luxurious, recreational housing to attract tourist from afar. Next to these touristic and residential activities, also cultural and industrial facilities will be supported in Hoek van Holland. By facilitating the industrial clusters East from the village, green-tech innovation and the local economy is encouraged. South from the village, a new transshipment terminal for Stenaline is planned (Gemeente Rotterdam, 2015).

Growth port of Rotterdam

As for the future development of the port of Rotterdam, the policy document "*Havenplan 2020: Ruimte voor Kwaliteit*" (in English: Port Plan 2020: Place for Quality) drawn up by the municipality of Rotterdam (2004) formed an important source of information. The document covers an urban planning strategy to respond to current and future challenges in and around the port. The starting point is that a flourishing port, that enjoys an international competitive position, should not only entail benefits for the companies inside it, but should also share these benefits with the urban and residential areas around. Likewise, an important goal is to contribute to a better spatial quality in the region around.

To create these benefits in the first place, the port has to respond to external trends, like the energy transition and circular economy movements by renewing production processes and improve the overall accessibility, within the port and beyond. These developments require space and therefore the port needs to grow. However, a growing port might entail negative consequences for the areas around. More harbor activities and increased transport (that comes with it), put pressure on the environment and leaves fewer space for green and recreation and could thereby diminish the attractiveness of the living environment as a whole.

Acknowledging these challenges, the municipality of Rotterdam adopts a rather optimistic view and focusses on the opportunities instead. They argue further development of technology, creativity and regulations and a growing commitment to corporate social responsibility in the business sector, offer many opportunities for a harmonious combination of port and a densely populated environment. The Rotterdam port has become cleaner, greener and safer over the years and the municipality expects this progress will continue in the future.

More concretely, the port acts in three ways. Firstly, within the port environmentally friendly production processes are developed and higher environmental standards are aspired. Secondly, the Port of Rotterdam is expanding towards the sea to create more space. Moving the port slowly to the west, provides more space for the city in the east is the idea. Finally, to increase the attractiveness of the region and safeguard the quality of life of villages around, the port will invest in a greener, a more natural and a more recreational region.

future residential nuisance in Hoek van Holland

Considering this strategy for the port, the political deal seems to be that in exchange for space and growth, the harbor companies have to invest in cleaner technologies, move potentially when needed and invest in the natural and recreational quality of villages around. At first sight this strategy seems like a promising solution for the challenge at hand; the port could grow, while safeguarding the health, safety and even attractiveness of surrounding villages, like Hoek van Holland. However, whether this strategy would be effective enough to keep residential nuisance on an acceptable level could be questioned. Given the fact current environmental norms are, at least in case of Hoek van Holland, just met, meeting more ambitious standards might be hard. Take the noise levels for example, in Hoek van Holland the measured noise levels are around 59 dB, which is just one decibel lower than the legal maximum (Arcadis, 2017). In addition, air quality measurements show also the NO2, CO2 and fine dust levels are close to exceeding the European standards in the village (Arcadis, 2017; Rijksinstituut voor Volksgezondheid en Milieu, 2019). Safeguarding the environmental quality in Hoek van Holland is already a challenge in the present, let alone when the port has grown.

Another reason why the strategy of the port might be less promising as expected relates to its eventual effect on residential nuisance. Some aspects of the strategy are likely to minimize residential nuisance, like technologies, while other are likely to increase them, like growth. What aspects weigh stronger is hard to tell and thus, how residential nuisance around the Rotterdam Port will evolve, will become clear along the way. Moreover, the nuisance levels do not depend on port strategies alone, but are influenced by external developments too. In practice many actors are involved with urban planning, which makes multiple developments might be happening and interacting at the same time. Consequentially, residential nuisance is approached from multiple angles (economic, legal, spatial, political etc.) and affected in several, sometimes conflicting, ways. Thus, considering all these different developments combined, it remains hard to predict how residential nuisance around the Port of Rotterdam will evolve.

Moreover, the urban planner expects residential nuisance to temporary grow in Hoek van Holland too. He explains the energy transition is a slow process, which makes at some moments both existing as well as new production processes are active. This transition phase makes temporary more pollution or noise could be produced and nuisance could rise. In short, the nuisance challenges in port cities, like Rotterdam, or port villages, like Hoek van Holland, are not easily resolved.

4.8.4 Perceived Nuisance Factors

Based on the interview, additional perceived nuisance factors, as complementation to the ones derived from the focus groups, could be determined. Research conducted by the municipality of Rotterdam (Gemeente Rotterdam, 2020) indicates the perception of nuisance in Hoek van Holland is relatively high, given the actual nuisance, when comparing it to another village near Rotterdam, Pernis, where the perceived nuisance is relatively low, given the actual nuisance. During the interview, I referred to these research outcomes and asked the urban planner how he would explain these apparent differences in perceived nuisance between the two villages. Based on the theorization that followed, three potential perceived nuisance factors (PNF) came to light, as discussed below.

Economic dependency

Asking the urban planner how he would explain that residents in Hoek van Holland experience relatively more nuisance in Hoek van Holland, compared to the ones in Pernis, he refers mainly to economic dependency:

> F: *"Well, that's my opinion, well, I think there is a great work-relatedness, so when you also work in the port…it is also your bread (income). That is a little bit less in Hoek van Holland, compared to Pernis and Rozenburg, There, they are still strongly related to the port."*

He explains that in the past this economic dependency was not only manifested in the form of employment an income, but also on a higher-level port and nearby villages were economically connected. He explains that all villages around the Nieuwe Waterweg were ones raised in the 1970s to support the port. But this port relatedness is decreasing more and more. There used to be large port pension funds, that also invested in villages as Pernis or in Rozenburg. But currently, those pension funds prefer to do investments abroad and do not invest in the surrounding areas anymore. What also could be seen is that fewer and fewer employees working in harbor companies are coming from villages nearby. As a consequence, residents living in these villages feel less related to the port. The urban planner theorizes they previously thought "*It's my employer too, so I can still balance it somewhat*", but they currently are less work related and thereby probably less tolerant respect to nuisance too.

Hypochondic behaviour

Furthermore, the urban planner stresses a behavioral factor that could impact the perception of nuisance. Not only in Hoek van Holland, but in any residential area, residents influence one another, he says. Looking for confirmation, people share their annoyance and thereby they could trigger others to feel the same. The urban planner refers to this phenomenon as hypochondic behavior:

> F: *"If someone is over-stimulated and you have not informed this properly, you will get that hypochondic behavior too: "Doesn't it bother you too? You know, that's often the first question you ask the other, you try to share this problem with someone else. And that goes like wildfire (very quick) in these villages. Suddenly everyone is bothered by that one windmill, or suddenly I can't sleep well anymore. And that does something with your mental state, I belief."*

> K: *"Ah yes, so people actually influence each other? So if the neighbors are all complaining, you are also inclined to notice it more."*

> F: *"Yes, because it also bothers you, that must be."* (joking tone)

To avoid this from happening, communication is key according to the urban planner. It is pivotal that companies communicate to the residents that polluting, noisy or smelling activities will take place and potentially more nuisance could be experienced because of it. By providing information up-front, nuisance will not come by surprise and wrong assumptions, about for example the health risks, could be mitigated. It is better to inform residents and avoid annoyance, before they inform one another in a more emotionally triggered state.

To what extent "hypochondic behavior" indeed appears in practice and could be seen as a relevant PNF, could be based on observations of residential behaviors. Since this study did not capture the behavior during the focus groups precisely, hard statements regarding residential behavior and the related relevance of "hypochondic behavior" as PNF cannot be made. However, the overall impression of how people acted during the focus groups suggest "hypochondic behavior", is not clearly observed. Looking at what the residents said, suggests hypochondic behavior appears in practice, but is potentially less impactful than suggested by the urban planner. Indeed, residents indicated changes in the living environment could be a topic of conversation between friends or neighbors. They point out talking about changes in the environment and appointing polluting companies as common "enemies", works connecting and creates a certain feeling of cohesion. However, whether this conversation changes their nuisance perception has not been discussed during the focus group.

Quality living environment

The urban planner explains he could imagine that the way residents maintain their own living environment could impact their nuisance perception. People with a more active and positive mind-set, might compensate negative aspects of their environment, like nuisance, with positive aspects, like beautiful flowers. That way their overall living quality will improve and it might be easier to accept nuisance. Positive and negative aspects are more in balance. This factor corresponds to the idea posed by some of the residents during the focus groups. They explain to look at their living environment as a whole. Most of them experience many positive aspects in Hoek van Holland, like the beach and the wood, and as a consequence, they are not so bothered by negative ones, like smell or noise.

Conclusion and Discussion

5. Conclusion and Discussion

This study starts from the observation that urban actors and harbor actors have different ideas about how the space around waterfronts should be planned. Consequently, the planning of port cities has become a rather slow, costly and (sometimes) conflictual process. Arguing that a more holistic and collaborative way of planning is desired, and that more attention should be paid to planning of larger scale and gross-grained functions, such as industries, this study gains further understanding of the mixed-use principle in general, while having a special focus on the mix of industry and housing. The literature findings reveal that when developing (gross-grained) mixed-use areas potential incompatibilities between different uses should be acknowledged and addressed, while considerable attention should be paid to the end-user experience and residential nuisance. In turn, management of residential nuisance requires a holistic, critical and comprehensive approach, whereby both the objective indicators, derived from measurements, as well as the subjective indicators based on the user experience, are considered.

Based on the literature study, a conceptual model is developed and tested with help of a practical case: Hoek van Holland; A village in the Netherlands, that illustrates well how in modern urban planning variety of large-scale functions could come together and how industry and housing could exist side by side. To gain a better understanding of residential nuisance, as perceived by the resident on the one hand and as managed by the urban planner on the other hand, the following research question forms the basis of this research:

> RQ: *"How do residents, living in an area close to industry, experience their living environment regarding industrial nuisance, what personal and situational factors could influence the perceived nuisance caused by industry and what does this mean for the urban planning context?"*

By employing three empirical methods, focus groups, desk-top research and an in-depth interview, the research question is answered and both the bottom-up as well as the top-down view regarding residential nuisance is addressed. In coming sections these empirical findings are described in relation to theory, each other and the broader societal context.

5.1 Empirical Findings and Correspondence to Theory

5.1.1 Findings Focus Groups

To gain a better understanding of the perception of nuisance in residential areas close to industry, two focus groups are conducted with residents living in Hoek van Holland. Individual exercises served as springboard for an open discussion among the participants and provided the opportunity to share residential experiences.

Actual nuisance and perceived Nuisance

The findings reveal that perceived nuisance is a complex phenomenon that besides an objective, also involves a subjective component. First of all, observational differences could not always be explained by location of residence. Similar observations of industrial noise are found from residents living in different parts of Hoek van Holland and with varying distances from the industry. Moreover, the resident who experiences most noise nuisance, lives relatively far away from the source.

The findings further indicate that differences in annoyance could not always be clarified by differences in observations. Five residents had a similar observation of black-colored soot, but for two of the residents this resulted in considerable feelings of annoyance, while the other three were only little annoyed by it. In fact, even the conventional wisdom, "the more nuisance observed, the more nuisance perceived" is not always reflected. Two residents experience extreme vibrations and are little annoyed by them, while another resident experiences the same, (or potentially even less), extreme vibrations and is very annoyed by this.

Commonly used measures are focused on mitigating the observation of nuisance. However, these findings suggest that also the annoyance attached to this observation may not be overlooked. Measures such as isolating facades and employing separation distances, might minimize actual nuisance, yet are not always effective enough to mitigate a resident's perception of nuisance. It is not implied that location of residence or positioning of seemingly conflictual functions is not relevant, but findings do indicate that nuisance is more than objective values.

Corresponding to existing research (Dzhambov & Dimitrova, 2015; Gidlöf-Gunnarsson & Öhrström, 2010) these findings suggest it requires both an observation of a negative externality, as well as a certain level of annoyance attached to this observation for nuisance to be perceived, and interestingly, whether an observation triggers annoyance differs from resident to resident.

Perceived nuisance factors

To understand why this is the case, the second part of the data analysis focusses on Perceived Nuisance Factors. The findings show perceived nuisance depends on actual nuisance, but is also influenced by multiple other factors. Underpinned with quotes derived from the focus groups, three types of factors were distinguished; (1) actual nuisance factors, (2) personal factors and (3) situational factors. The first cover characteristics related to nuisance source and to the actual occurrence of nuisance itself, the second relate to characteristics of the nuisance receiver, and the latter relates to characteristics of the receiver's living environment.

The actual nuisance factors show that for residents many characteristics of the nuisance source, and of the externalities that come with it, are of relevance for their feelings of annoyance. They show actual nuisance goes beyond the location of residence and separation distances. It is not only of relevance where the source of nuisance is located and what externalities are produced, yet it matters also when, how often, and at what moment the nuisance is present. Besides these time- related aspects, more qualitative aspects, like its controllability and associated economic benefits, are potentially playing a role in nuisance perception.

A similar complexity is reflected in the list of personal factors. Someone's interwovenness with the living environment, personal expectations, knowledge, previous experiences and health could all impact someone's nuisance perception. Acknowledging all these factors, managing nuisance in a more tailor-made way, opposed to treating "residents" as one generic identity, could be useful. Notably, personal factors touch upon social, cultural, demographic and health science fields, which suggests one could steer on perceived nuisance from several perspectives, other than the spatial perspective alone.

The relevance of the wider context is reflected in the situational factors as well. Some factors are rooted in the wish for health and safety, like high-quality noise insulation or presence of safety teams, other reflect a wish for having an active social life and good neighborhood relations, like the wish for co-housing and neighborhood activities. The underlying values of the situational factors show that residents think about the present and the future (long-life living), wanting the best for themselves (usable living) and the other living beings around (Environmental-friendly living). From this regard, it appears that residents look at the total quality of their living environment and view potential environmental disturbances as a part of it.

All perceived nuisance factors combined show that residential nuisance is a very interrelated concept, which could be approached and mitigated from multiple perspectives. Like Van Kamp et al., (2003) learned about the concept of quality of life in relation to nuisance, the relevant interconnections and indicators seem to be infinite. The perceived nuisance factors support the theoretical relevance of the person-environmental relationship as well and indicate that the environment and the users inside the environment interact and influence each other. Moreover, the findings are in line with existing studies Dusseldorp et al., (2011) and Szopinska and Krajewska (2016), who describe the general existence of these kinds of factors. Considering the comprehensive list of perceived nuisance factors, conducting focus groups seems to be an effective method to uncover contextual information and to look at issues in its full scope.

Perceived nuisance and residential satisfaction

Since residents mainly brought forward environmental characteristics to elaborate on their overall residential satisfaction, (and how this satisfaction, in turn, played a role in their nuisance feelings) this study pays attention to the interrelation between perceived nuisance and residential satisfaction. Studies often focus on elements that increase satisfaction such as accessibility, or decrease satisfaction such as nuisance. Only a few researchers acknowledge the interplay between these elements and how they together add up to a level of overall satisfaction.

In this study, a dualistic relationship between residential satisfaction and perceived nuisance is theorized. Potentially, not only more nuisance leads to less satisfaction, but also more satisfaction leads to less nuisance. How does this hypothetically work? By respecting the residential values in urban planning, the positive aspects in the living environment are more likely to outweigh the negative ones. This means that, residents are probably more satisfied, more tolerant, and eventually less likely to feel annoyed and perceive nuisance.

This theory is rooted in the findings of the focus groups; as explanation for limited feelings of annoyance, some residents in Hoek van Holland indicated to look at their living environment as a whole, including all the positive and negatives aspects it includes. Walking opportunities, accessibility to green and friendly neighbors all play a role in their overall satisfaction and could thereby mediate their feelings of annoyance. Moreover, the residents who highlighted mainly the positive points of Hoek van Holland during the focus group perceived relatively less nuisance. While the resident who emphasized the negative sides of the living environment, such as an annoying neighbor or the limited facilities in the village, had a relatively high perceived nuisance.

Although the findings are not solid evidence for this theory to be true, three studies that suggest interplays between satisfaction and nuisance may not be overlooked. Firstly, the research of Hamersma et al., (2015), focusing on high-way locations, studied the direct effect of accessibility gains and other residential characteristics on the level of annoyance related to the high-way. The findings show increased satisfaction with greenery, traffic safety and attractiveness of the buildings has a mediating effect on the nuisance perceived by the highway. Another study, conducted by Gidlöf-Gunnarsson and Öhrström (2010) shows residents perceive less nuisance when they live adjacent to a courtyard of high quality compared to one of lower quality. Assuming residents are more satisfied with high-quality courtyards, their findings could also underpin the validity of the theory drawn up in this research. Finally, qualitative research, by Timothy Van Renterghem and Botteldooren (2016), implies view on vegetation through the living room window could be very sufficient in minimizing annoyance among residents. When no green could be seen through the window, 34% of the residents reported being annoyed. When this view was extremely green, with the same level of actual nuisance (same decibel, same street, same traffic) only 8% felt annoyed. These three studies may not be solid proof for the dualistic relation between residential satisfaction and perceived nuisance, but do make the validity of this relation theory more likely.

The visualization on how the findings of the focus groups could complement to existing theory, is shown in figure 20 by making modifications to the conceptual model drawn up earlier in this research.
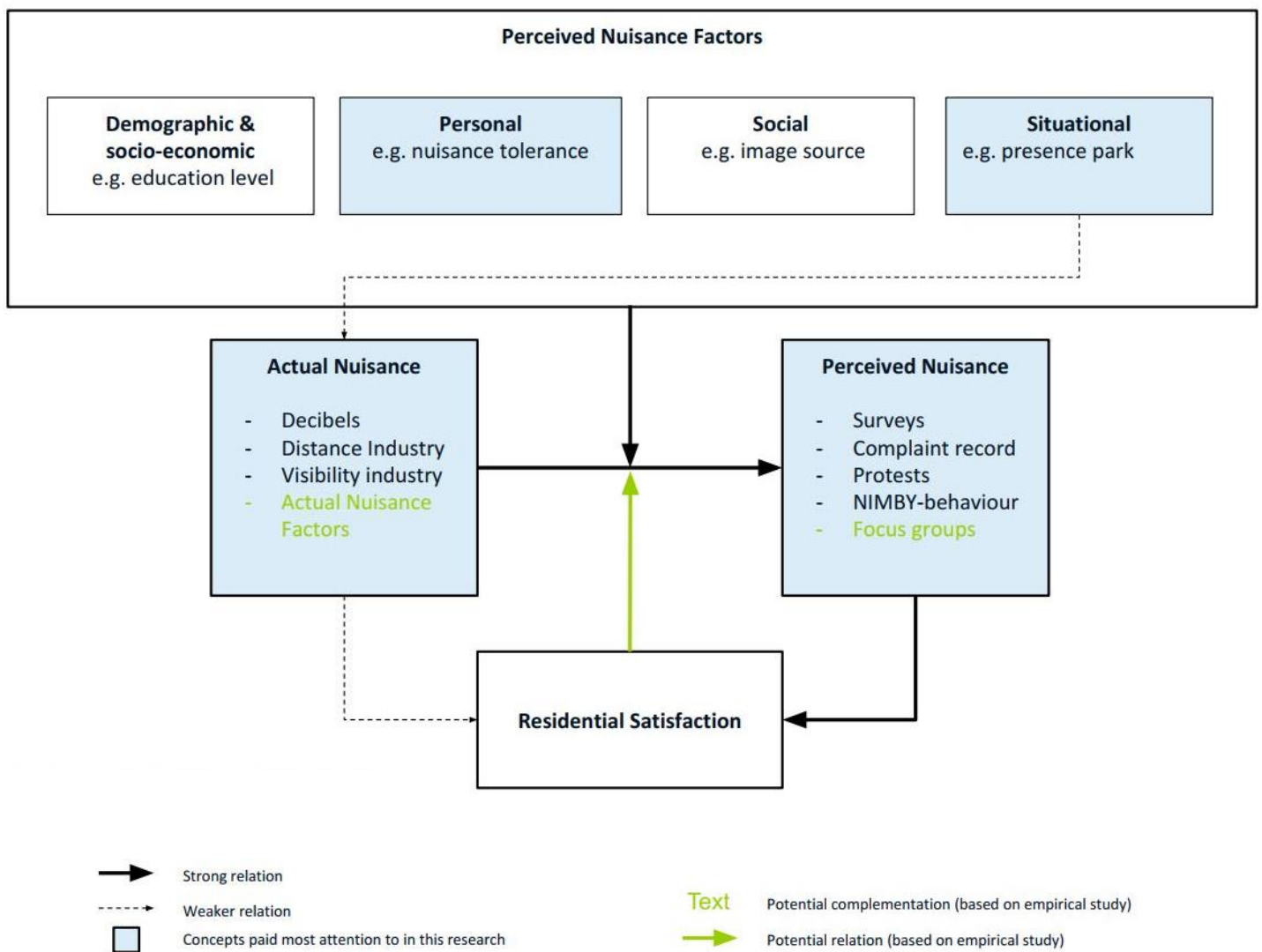

Figure 20. Conceptual model, adjusted according to empirical findings (own figure).

That being said, the extensive literature review of Van Kamp et al., (2003), conducted in assignment of the National Institute for Public Health and the Environment in the Netherlands (RIVM), shows the relationships between environmental quality and residential satisfaction typically follow one causal direction; Nuisance is viewed as a source for dissatisfaction and overall satisfaction is seen as the sum of satisfactions and dissatisfactions combined. A causal relationship in the opposite direction is typically not seen, which could mean the validity of the theory is poorly supported in existing research. Nevertheless, in research on the quality of life and residential satisfaction, a variety of terms is used, and due to this lack of uniformity is it hard to compare findings and models on this concept. It is therefore hard to determine the correspondence to the theory of this potential dualistic relationship between satisfaction and nuisance. More comprehensive literature research is needed to draw valid conclusions in this respect.

5.1.2 Findings In-Depth Interview and Desk-top Research and Correspondence to Theory

Where above sections, reflect mainly upon bottom-up findings gained during the focus groups, also the findings gained during the desk-top research and in dept interview deserve a closer look. During the study a continuous desk-top research was conducted. Based on research reports, policy documents and online measuring networks, objective data regarding residential nuisance in Hoek van Holland is gathered and strategies to manage residential nuisance in Hoek van Holland were retrieved. In addition, an urban planner was interviewed about the current situation of residential nuisance in Hoek van Holland and about the wider urban planning context of port city Rotterdam.

Focus on actual nuisance and objective indicators

The findings show norms and zoning have a central place in nuisance management. Firstly, Rijkswaterstaat, (directorate general of part of the Ministry of Infrastructure and Water Management of the Netherlands), considers determining potential health effects and respecting all the environmental standards as essential tasks in urban planning. Likewise, they state urban planners have to take potential externalities of projects on their surrounding into account, before accepting them to be developed. In addition, they have to take a position regarding the norms and zoning in place, which they could customize, deviate from, or apply strictly.

Secondly, the urban planner explains for the management of nuisance in Hoek van Holland, a continuous conversation takes place between the municipality, the Port of Rotterdam Authority, and DCMR to make agreements regarding nuisance. During such conversations, they discuss on what locations may be built, where the noise contours will be and what façade measures need to be applied. Talking in terms of legislation, space and distances, objective indicators regarding environmental quality are seemingly leading in this conversation. However, the urban planner is aware of the subjective component of nuisance too; He believes work-relatedness and hypochondic behavior of residents could play a role in their nuisance perception and he stresses the importance of communication between companies and residents to mitigate feelings of annoyance.

Thirdly, the focus on objective indicators is confirmed when looking at the actual nuisance management of DCMR, the collective environmental service of the province; based on environmental measurements, online-reporting and yearly participation sessions they monitor the environmental quality. In case the nuisance reaches an unacceptable level, they act by checking industries' compliance to environmental standards or regulations, and pose (temporary) restrictions when needed. As was already argued by Dzambov and Dimitrova (2015) and Gidlöf-Gunnarsson & Öhrström (2010), the findings suggest relatively much attention is paid to actual nuisance in urban planning, while seemingly limited attention is paid to perceived nuisance.

Nuisance management: a balancing act

What the top-down findings further reflect is that nuisance management is a balancing act between potentially conflicting interest. Rijkswaterstaat acknowledges striving for a clean and healthy environment, while balancing other economic or planning interest might be complex. Projects that are beneficial from the urban planning point of view, might not always be best from the environmental perspective. Confusingly enough, quality of life is supported by both planning and environmental perspectives, but through what values this quality is reached might differ. An urban planner could realize quality of life by focusing on health and safety, respect all environmental legislation and adopt ambitious norms if possible. Contrarily, an urban planner could also realize quality of life by focusing on economic, financial, cultural and social values, customize environmental legislation and make deviations from norms when needed. For optimal quality of life one perspective is not necessarily better than the other, but a holistic approach balancing the two perspectives is preferred.

Likewise, data provided by Rijkwaterstaat suggests urban planning decisions are both based on objectively determined health and safety effects, as well as on the associated economic, financial, cultural or social benefits of the projects. What arguments weight stronger depends on political preferences, because some urban planners might value health and safety more than others, and depends on the type of nuisance managed, because stricter norms and procedures apply for the management of noise, air quality and external safety than for other types of nuisance, such as soot, odour or vibrations.

The urban planner interviewed confirms the above, and stresses it is a kind of battle between two major interests: the one of the villages and the one of the wider economy. For villages more inhabitants, mean more support for facilities and local employment, while for the port more inhabitants mean more potential objectors and less freedom to operate their trading processes. The municipality aims to balance all the interest and respect all perspectives. The village perspective is considered by respecting the legal lines, with a special focus on air quality, safety and noise contouring, and the port perspective is taken into account by avoiding these legal lines to move towards the port and placing the legal lines in a way the business operations of the port are never obstructed.

Residential nuisance in Hoek van Holland: a growing Challenge

In case of Hoek van Holland, this balancing act becomes harder and harder. The port and village both need to grow; The port to maintain the competitive edge and the village to become more livable from the social and economic perspective. This raises the question; How to safeguard the future of Hoek van Holland and keep the Dutch motor of the economy running at the same time? Responding to this urban planning challenge, policy makers balance both perspectives and support both the growth of the Rotterdam port as well as the growth of Hoek van Holland.

To be more precise, the desk-top research indicates the political deal seems to be, a bit simply said, the following; In exchange for space and growth, the port companies have to invest in cleaner technologies, move potentially when needed and invest in the natural and recreational quality of villages around. At first sight this strategy seems like a promising solution for the challenge at hand; the port could grow, while safeguarding the health, safety and even attractiveness of surrounding villages, like Hoek van Holland. However, whether this strategy would be effective enough to keep residential nuisance on an acceptable level could be questioned. Current environmental norms are, at least in case of Hoek van Holland, just met, and meeting more ambitious standards (needed to avoid increased nuisance due to growth) might therefore be hard. Furthermore, with all technical, societal and legal developments happening at the same time, the eventual effect on residential nuisance is hard to predict. New technologies and investment in green living environments, are likely to minimize residential nuisance, but the growth of the port and transition of production processes are likely to increase it. What aspects weigh stronger is hard to tell and thus, how residential nuisance around the Rotterdam Port will evolve, will become clear along the way. During the interview, the urban planner expresses some worries in this regard and due to the transition towards new technologies in the port, he expects residential nuisance in Hoek van Holland is to grow.

5.2 Findings Placed in the Wider Societal Context

Many benefits are associated with combining different uses in one area, and likewise, the mixed-use concept enjoys a considerable popularity in modern urban planning. However, it is noted mixed-use developments are of uneven success and bringing multiple users in one area requires a certain understanding of each of them. What do they do, what do they need, how do they act, and importantly, how do they impact one another? Only by considering all these aspects in a holistic but detailed way, the compatibility of users and thereby, the right mix of functions could be determined. Moreover, realizing successful mixed-use areas requires a critical stance on conventional wisdom regarding the compatibility of functions and a decent understanding of end-user's experience, including all complexities involved.

One of the conventional wisdoms concerns the separation of housing and industry. Industrial activities are typically associated with negative externalities of industry and traffic and thereby entailing a poor living environment for residents. That the functions are seemingly conflictual is understandable, but, taking a critical view, whether this means they could not be combined at all and should be placed at large distance from one another could be questioned. Over the years, new technological developments have supported industries to become greener and cleaner, which could mean they could be brought closer to urban activities again without limiting people's health or safety. From both the economic, environmental and as well as social perspective, avoiding gross-grained mixed-use areas, whereby

industrial and residential uses are combined, could even be seen as a missed opportunity. Having a dense diversity of functions, could reduce travel times, support green ways of transport, encourage synergy, knowledge exchange, innovation and overall livability. By combining finer-grained functions, like housing, with gross-grained functions, such as industry, it is theorized these benefits could arise on a higher scale as well.

Applying these theories to port cities, it could be argued the strict separation of port and city should be reconsidered and new ways of planning might be needed around waterfront areas. Societal trends such as increased globalization, the rise of network society and the transition towards a knowledge-based economy puts challenges on ports, cities and port cities as a whole. They have to adapt to new technologies, new climate ambitions and modern work conditions, while reaching a competitive edge. Though port and city have grown further apart over the years, acknowledging the interconnectedness of port cities, it is argued they have to adapt to these external changes together. A new collaborative way of planning is needed, whereby space is designed from a more holistic instead of dualistic perspective. That way, port cities could become places where multiple actors, both urban and industrial, co-exist, exchange knowledge and synergize. Similar to realizing successful mixed-use areas, realizing united port cities requires a critical stance on conventional wisdom regarding the compatibility of functions and a decent understanding of end-user's experience, including all complexities involved. Moreover, a more openminded view regarding the combination of harbor and urban functions is needed and new ways of mixing seemingly incompatible uses should be explored.

Following this train of thoughts, in practice some attempts are made to combine industry and housing in one area. However, for a holistic way of urban planning, there is still a long way to go. Why? Firstly, because attempts are limited; In policies mostly a mix of functions that are seemingly compatible are encouraged, while areas comprising both industry and housing remain limited. Secondly, in mixed-use areas the transition from urban structures to industrial ones remains rather sharp. The integration of functions is relatively poor and higher goals are not always reached. Thirdly, despite efforts to create a mix of industry and housing, this mix usually doesn't last long. The typical course of actions is the following; Residents experience nuisance, start complaining and ultimately, in combination with the increased land values, industries feel constrained to leave the area.

Albeit many benefits are associated with mixed-use, when it concerns gross-grained functions, it seems environmental considerations are still leading. Furthermore, it could be argued fine grained and gross grained mixed-use areas are weighted with different standards; where respect to the first much attention if paid to the potential benefits, and limited attention is paid to the incompatibility of uses, for the latter the opposite seems to be true. It is a striking contradiction, which raises the question: to what extend is the unconditional trust in mixing smaller-scale, fine grained and city orientated functions, opposed to a persistent mistrust in combining larger scale, gross- grained and industrial orientated ones, in urban planning justified?

To answer this question a deeper understanding of the compatibility of users should be gained and more research should be done. It Is pivotal to know how users experience the world around them and perceive potential nuisance in their living or working environment. This study is a (modest) contribution in this respect, and dives deeper into the experience of residents living close to industry. Having a special focus on perceived nuisance, the study findings helped to gain a better understanding of how residents experience their living environment respect to nuisance. They showed the importance of considering the subjective side of nuisance, how different levels of acceptation and annoyance are attached to the observations of negative externalities and how various factors could influence the resident's perception. Perceived nuisance proved to be a very intertwined concept that relates strongly to other concepts such as personal characteristics, environmental characteristics and overall residential satisfaction. Due to its interrelatedness perceived nuisance could, on the one hand, be seen as a complex issue to deal with or steer on, on the other hand, this same interrelatedness also has a positive side; perceived nuisance could be addressed from many angles, scientific fields and in both objective as well as subjective ways.

Placing these findings in the scientific and societal context, the main bottom-line becomes clear; Urban planning in general, and of port cities in particular, includes many complexities, which are not easily resolved by simply coining the term mixed-use. It seems policy makers are widely promoting the mixed-use concept, without knowing precisely what the term mixed-use implies and without formulating a concrete plan of action. The study findings suggest a different approach is needed. To create successful mixed-use areas and develop new urban planning forms to unite industry and housing, or on a larger scale, port and city, a more holistic and detailed way of urban planning is needed, whereby:

- Potential incompatibilities between users are acknowledged
- Personal and situational factors impacting the end-user experience are considered
- A striking balance between measuring and determining, between numbers and experiences, between the environment and the perceiver and thus, between objectivity and subjectivity is found.

This boils down to the fact that interrelated complexities of urban planning should be acknowledged and addressed with help of concrete strategies.

While the above poses mainly a critical view on modern urban planning, also some positive trends could be noted. In the Netherlands, the environmental law system for spatial projects is currently shifting from a fragmented collection of laws to one integrated one; The Environmental Act. The act bundles and modernizes the laws for the living environment. It provides a coherent approach to the living environment, creates room for local customization and supports better and faster decision-making. In addition, participation is promoted. For example, by involving citizens and entrepreneurs as much as possible in the development of the living environment. The Environmental Act offers opportunities for urban planners to approach residential nuisance in a more subjective way, to deviate from standards when needed and benefit from mediating effects between residential satisfaction and residential nuisance.

Nonetheless, whether the act will actually result in a better integration of the end-user perspective could be questioned. This depends strongly on to what extent input from end-users is actually implied in the further plan making and also on how the participation sessions are monitored and evaluated. Notably, to say something about the end-user integration, it is pivotal to know how this end-user is defined. Only the users involved in the process and actually spoken to have an opportunity to be heard and have an influence. Furthermore, whether The New Environmental Act will lead to a faster decision making is debatable as well. This depends strongly on the decision-making process among the policy makers involved and how they deal with the increased freedom given to them. Softening the strictness of regulations and standards, makes the solutions for urban issues will become wider, but also more political in nature. Therefore, when the new act is in place, increased creativity and strong leadership among policy makers will be needed, to solve spatial issues in a more integrative way, without delaying the decision-making process as a whole.

The Environmental Act illustrates well that acknowledging complexities, at first, is not an automatic panacea for resolving them. In fact, more latent complexities could be brought to the surface this way or even new challenges could arise. But the point is, when ambitious dreams are formulated, innovative, green and lively places are pursued and even united port cities are aspired for the future, why would the path towards it be easy? Like risk management, complexity management is inevitable in urban planning; One might not always be able to mitigate the probability or impact of complexities, but one can at least acknowledge and address them.

So, imagine; A park on the doorstep, the primary school within walking distance, a safe infrastructure, and enough (industrial) activity and therefore employment in the area. Sounds good? Mixing uses could help to create such lively areas. However, to realize success full mixed-use developments, whereby the associated benefits and higher goals are actually reached, complexities, such as user incompatibility and residential nuisance may not be overlooked. On the contrary, residential nuisance should be approached in its full scope, including the subjective component it entails. Importantly, it is not suggested this will make urban planning any easier. Working with objective and subjective indicators at the same time and steering on them might be hard, like comparing apples and pears. However, this may not be a reason to pay limited attention to the subjective side of things and focus mainly on seemingly less conflictual fine-grained uses, opposed to gross-grained ones. Considering all the global challenges at hand, more than ever, we see the urgency of tackling them together and see the importance of pleasant environments, where dualistic perspectives both get a place. Let's investigate whether we could create places where seemingly conflictual uses exist side by side. Let's investigate whether we could create places including both finer/smaller as well as grosser/ larger functions. Let's investigate whether we could create places that combine shipping, industrial, retail, hospitality, educational and residential uses or more. Creating such places starts with acceptance. Accepting the qualitative consideration required to give subjectivity a place and accepting the uncertainty and variability required to give the combination of industry and housing a chance. If this acceptation succeeds, functions could be mixed in more creative and at the same time more compatible ways. If this acceptation succeeds, we are one step closer to a united port city.

5.3 Research Transferability to Practice

The research shows:
- The end-user experience of nuisance and satisfaction should not be overlooked in mixed-use developments and the port city context;
- perceived nuisance is a very interrelated concept that is influenced in several ways and which depends on more than actual nuisance alone;
- And potentially, a higher overall residential satisfaction has a mediating effect on feelings of annoyance.

How could these insights be used in practice? The general recommendation for the urban planning of port cities and the development of mixed-use areas is the following; Do not underestimate the value of residential satisfaction for the (long-term) success of a mixed-use development, minimize residential nuisance and benefit from all complexities involved. More specifically, nine recommendations are proposed below.

1 Take a critical stance against conventional wisdom regarding the compatibility of functions

When weighing alternatives, also acknowledge positive effects of the combination of industrial and residential activities, do not overestimate annoyance levels in gross-grained mixed-use areas and do not underestimate the potential nuisance present in smaller-grained mixed-use areas. During the focus group some residents indicated traffic, annoying neighbors and unaesthetic architecture are just as important sources for nuisance, as industry and shipping activities. Some examples of how this recommendation could be applied in mixed-use practice: set higher standards for the beauty of architecture, invest more in noise insulation between neighbors and develop car-free streets in mixed-use areas.

2 Managing actual nuisance is not the same as managing perceived nuisance

In current urban planning of Hoek van Holland environmental norms, legal lines and decibels are leading. However, the fact residents showed sometimes different feelings of annoyance respect to a similar observation indicates for a lower perceived nuisance, other indicators should not be overlooked. Residential nuisance goes beyond the location of residence and separation distances. To avoid perceived nuisance more attention to subjective indicators should be paid. Some examples of how this recommendation could be applied in mixed-use practice: organize participation sessions with users in different parts of a village, map the perceived nuisance of a village, communicate potential health or safety risks in daily language on commonly used channels.

3 Be aware of the fact that a healthy and safe environment is not the same as a nuisance free environment

Resident's worship a wide range of residential values, a healthy and safe living environment is just one of them. Likewise, not all types of nuisance that are most important from the health perspective, like noise, air pollution and hazardous substances, are most important from the resident's perspective. Some examples of how this recommendation could be applied in mixed-use practice: set legal standards for types of nuisance that are considered most annoying, test plans on expected annoyance caused by industrial and non-industrial sources and maybe, (like the energy labels for a sustainable living environment) nuisance labels for a satisfactory living environment should be created.

4 Benefit from the interrelatedness of residential nuisance and the steering opportunities it offers

The fact residential nuisance is a very interrelated concept, which could be approached and mitigated from multiple perspectives, is not clearly reflected in urban planning of the port of Rotterdam and Hoek van Holland. Respecting environmental norms might be the basis, but it could also be useful to approach the nuisance issues from another angle and employ urban planning measures that benefit from all factors in place. Furthermore, also the interrelations between perceived nuisance factors offer opportunities for mediation effects. Some factors increase feelings of annoyance, like a high intensity of vibrations, and other aspects mitigate feelings of annoyance, like a short duration of vibrations. As for feelings of annoyance, the first could partly be compensated with the latter. Some examples of how this recommendation could be applied in mixed-use practice: design housing and gardens in a way residents could control the amount of nuisance they perceive, divide polluting maintenance activities of industries over shorter periods of time and consider demographic, cultural and health data in the environmental risk assessment

5 Consider the users in the environment in greater detail

Although during the interview, the work- relatedness and behavior of residents is already acknowledged by the urban planner involved with Hoek van Holland, in the actual decision-making specific characteristics of residents seem to be unexposed. Much focus is placed on the number of residents living in Hoek van Holland and on where in the village residential functions should be allowed. The personal factors revealed in this research indicate perceived nuisance of residents does not depends on how many residents there are and where they live, but depends (among other things) also on who they are and where they are from.   In fact, threating the residents as one "generic" identity might be misleading, the findings of the focus group suggest some residents are more likely to be potential objectors than others. Some examples of how this recommendation could be applied in mixed-use practice: Identify residents' environmental DNA (what do they associate with home?) and create partnerships with online data bases of personality tests, like NERIS Analytics Limited (2011-2020) for instance.

6 Steer on overall satisfaction to mitigate nuisance

In nuisance management supposedly few attention is paid to the interrelation between perceived nuisance and residential satisfaction. The fact the port of Rotterdam, invests, as compensation for its growth, in green and recreational uses around reflects they are somehow aware of the fact residents could have feelings of compensation and asses the multiple domains of the living environment in relation to one another. However, besides adding green, there are many more ways to support residential satisfaction in urban planning and thereby, there are potentially many more ways to mitigate perceived nuisance. Some examples of how this recommendation could be applied in mixed-use practice: develop age friendly co-housing, organize neighborhood activities and support cultural facilities.

7 Apply bottom-up and qualitative approaches

In this study residents brought forward multiple types and sources of nuisance, and described related observations in a detailed way. Similarly, they (inexplicitly) related a wide range of residential values to nuisance and came up with specific ideas of how they would want to be compensated for increased industrial nuisance in their neighborhood. From this respect, to gather broad and detailed data about the residential experience, conducting focus groups and employing generative techniques has proven to be useful. Residents' personal stories gave a deeper insight in how they perceive the world around them and how they balance the positive and negative externalities exposed to them. Wherewith quantitative techniques, respondents cannot deviate from the prepared research topics, in qualitative techniques they have more room to wander around and to reveal interrelated topics. Moreover, with generative techniques deeper knowledge could be brought to the surface and underlying values and expectations could be revealed. Residents could be seen as the experts of their past, present and future experience and could help to create specific measures and ideas that actually match with their values and desires. To fully benefit from this expertise and creativity, it is recommended to employ besides quantitative, also qualitative approaches in nuisance management.

8 Employ holistic financial and compensation constructions

From the financial perspective a holistic approach is recommended as well. Decisions in the port city context impact many actors and it is pivotal the benefits and cost of each actor are kept in balance. The growth of the port is beneficial for harbor actors, but could involve negative externalities for the residents in villages around, like Hoek van Holland. Contrarily, when the heavy industries inside the port have to move further away from the residential areas, this is costly for the industrial actors, but this has probably positive effects for the health and safety environment of the residents. Growth of the port might mean the development of residential areas around might become more costly because developers have to invest in qualitative housing to mitigate actual and perceived nuisance. The municipality could support these developers by offering a lower land price. However, the municipality is potentially already having higher cost themselves to invest in a high-quality public space and organize participation sessions with residents. That said, the municipality also benefits from the growth of the port, in the form of shares, employment and a strengthened economy. And what about the residents, they pay taxes too and this money is thus partly used for the construction of new infrastructure and harbor space? In short, respecting the balance of all actors might be difficult, but in collaborative urban planning, like is aspired in port cities, cost and benefits should be as equally divided over the actors as much as possible. Some examples of how this recommendation could be applied in mixed-use practice: attach conditions to the growth of the port, attach conditions to the growth of the village, reward companies that invest in the residential areas around with increased marketing efforts from the municipality or with knowledge partnerships with universities.

9 Ambition, creativity and leadership

The urban planning of port cities and mixed-use areas is a challenging task. It involves many complexities and addressing them, asks for difficult decisions to be made. For successful developments, challenges should be accepted with ambition and should be approached with creativity. For smooth decision making and a continuous progress, leadership among urban planners and policy makers is needed. Some examples of how this recommendation could be applied in mixed-use practice: follow leadership workshops, map and monitor decision making and set deadlines for important decisions at the beginning of a project.

To conclude, the results of this study could be applied in multiple ways. They highlight the importance of acknowledging and addressing complexities in urban planning and of developing concrete strategies accordingly. With a special focus on residential nuisance, the research provides also more insight into the subjective side of urban planning and offers handles to steer on it in a more holistic and detailed way. All findings combined, show that reaching ambitious urban visions, such as a united port city, might not be easy and that it requires critical and creative minds to address problems at hand. Hopefully, through a more critical, holistic, creative and collaborative approach new ways of urban planning could be explored and, above all, more successful ways of urban planning could be reached.

Lastly, it is important to note that since this research concerns a qualitative study, the generalizability of the findings beyond Hoek van Holland remain uncertain and above recommendations for practice should, therefore, be treated with care. Next chapter reflects more extensively on the representability of the findings.

Reflection

6. Reflection

6.1 Reflection on Case

This section reflects on the representability of the practical case, by holdings it against urban concepts and the societal context. In this study Hoek van Holland was used as practical case to investigate the residential experience of living close to industry. However, what "close to industry" exactly means in distances or spatial configuration was not specified and also the gross-grained concept, as often referred to in the conclusion, is poorly defined. As a consequence, drawing analogies with Hoek van Holland and other gross-grained mixed-use areas might be open for interpretation. The fact that residents in Hoek van Holland are -despite the industrial nuisance- generally satisfied, does therefore not automatically mean mistrust in gross-grained mixed-use areas is unjustified. Yet, the findings do indicate living "close" to industry might not be as bad as generally expected and possibilities to combine industry and housing should be explored further in research and urban planning practice.

But to what extent could Hoek van Holland be representable for an urban concept in general? Evaluating the urban structure of the village, surrounding industry and port of Rotterdam combined, at first sight it concerns a rather large-scale urban area, whereby smaller-grained functions, as retail and housing, are separated from gross-grained functions, like the port of Rotterdam. Exceptions in this regard are the shipping company, Stenaline, and the green housing, which are both located adjacent to the village. A difference is that Stenaline is still visually divided from housing through a dike, while green housing and residential housing exist side by side, without spatial elements or separation distances in between. From this regard, actually three types of mixed-use could be distinguished in Hoek van Holland; A smaller scale and more fluent mix of fine-grained and gross-grained uses (green housing), a medium scale, sharp mix of fine-grained and gross-grained uses (Stenaline) and a larger scale, sharp mix of fine-grained and gross-grained uses (Port of Rotterdam). Whether the third, could still be called a type of mixed-use is questionable and once again, the ambiguity related to this concept becomes clear. However, having this insight in retrospect, the study focused on Hoek van Holland as a whole and conclusions are drawn accordingly. By looking at the perceived nuisance resulting from the three types of mixes, separately, more solid comparisons between the Hoek van Holland and urban concepts could have been drawn. In sum, the conclusions might be less representable for mixed-use areas in general, let alone the commonly used ones, consisting of smaller-grained and city orientated uses.

Comparing Hoek van Holland to other villages located proximate to the Rotterdam Port, another remark concerning the representability of the case could be made. With its location on the coast, its beach and greenery, Hoek van Holland differs greatly from some other port villages, such as Pernis, which lies adjacent to a busy high way and is directly surrounded by heavy industry. Hoek van Holland is spatially very particular and might therefore be less representable for other residential areas close to industry, as was initially aspired. The conclusions on perceived nuisance might therefore be less transmittable as intended.

Finally, the perceived nuisance caused by industry is studied by taking Hoek van Holland as practical case. However, it should be noted that some, if not most, of the nuisance in Hoek van Holland is caused by industry that is part of a bigger identity: The Port of Rotterdam. Because urban planners might approach harbor functions and industrial functions in different ways, the drawn analogy from port to industry could be questioned. Moreover, the Port of Rotterdam could be considered as a rather specific case, having the municipality of Rotterdam as pivotal shareholder and enjoying the image as driver of the Dutch economy could have caused bias among urban planners. Considering also its considerable size, the Port of Rotterdam might not be representable for other industrial areas and thus conclusions regarding urban planning practice and how urban planning deals with industry or residential nuisance might be less solid. Taken all remarks together, the findings might not be extended beyond Hoek van Holland and the conclusions that suggest the contrary should be interpreted with diligence.

6.2 Reflection on Methods

In this study was chosen for a combination of three empirical methods, focus groups with residents, an in-depth interview with an urban planner and a continuous desk-top research into the residential nuisance. The underlying idea was that both the bottom-up, as well as the top-down perspective was addressed in this study and that by comparing the two perspectives, new insights could be gained. Important to note here is that relatively few attention is paid to the top-down perspective. Where eight residents joined the focus groups, only one urban planner was interviewed. Moreover, verbal, written as well as visual data about the residents was gathered, while merely verbal data about urban planning resulted from the interview. From this regard, bottom-up insights gained from the focus group are probably stronger, while top-down findings might be less solid. Likewise, the result section concerning urban planning practice aimed to formulate the outcomes as potential indications, rather than sharp statements.

That said, some remarks respect to the validity of the focus group outcomes could be made as well. During the focus groups, data was gathered with help of individual exercises and a collective discussion and this way generative techniques as well as probing techniques were applied. Employing multiple techniques and methods gives opportunities for validation and complementation of findings. However, as the data analysis of the focus groups showed, different methods could entail different outcomes.

To be more precise, in five cases, the visual data did not correspond to the verbal data and the most correct annoyance score was harder to determine. Potentially, the group dynamics played a role in this. During the collective discussion residents might influence one another and verbal data might therefore deviate from the visual data provided earlier in the individual exercises. In this sense, some expected drawbacks of focus groups (as described in section 3.2.3) are confirmed; group effects indeed represent a risk and data produced is harder to analyze.

Considering these differences, sometimes choices regarding the relative importance of data had to be made. The outcomes of the critical dialogue among residents were expected to be more reliable and more explicit compared to the slightly ambiguous, sometimes difficult to understand, exercises, which resulted verbal data as valued more than visual data. As a consequence, some outcomes respect to the perceived nuisance of residents might be considered less solid.

Another drawback of employing generative techniques is the bias it might cause. The fact generative techniques serve as springboard for the discussion has a positive and negative effect; On the one hand, it is positive because it supports residents to formulate and structure their thought, on the other hand, it could steer the residents in a certain direction. All residents mentioned time-related factors in their arguments, but did they do it because they all believe frequency of an externality is important? Or did they do it because the matrix in front of them included different levels of frequency and they were steered to think about it? The same is true for the situational factors, the residents came up with a wide range of ideas. But did they do so, because the usually think about their living environment in a broad way? Or did they because I provided an inspiration booklet that encouraged them to think this way?

Besides contradicting findings and bias, also remarks about the composition and size of the focus groups could be made. Ideally, the focus groups would consist out of five residents, different in character, interests, demographic characteristics and living in various parts of Hoek van Holland. This way, more residential perspectives are brought to the table and a more complete, and potentially more representable, picture of perceived nuisance in Hoek van Holland could be drawn. Deviating from this ideal composition, the focus groups in this research were less diverse as aspired. The first focus group consisted of five residents, all interested in the living environment and between 50-65 years old. Apart from these similarities, the residents did differ respect to their relation with industry and specific location of residence in Hoek van Holland. The second focus group consisted of three residents, living all at the waterfront and being of similar age, between 60-70 years old. Important to note is that two of the residents in the second group are close neighbors, who frequently bump into one another on the street and therefore know each other personally. Both the size, diversity and personal relation in the second focus group, makes the outcomes of this group are less solid than the ones of the first.

Moreover, the fact both focus groups are less diverse as aspired, probably has consequences for the group dynamics too. Monotony could mean some perspectives on nuisance remain latent, and thereby, a potential useful disagreement of perspectives could be missed. Disagreement is one of the driving powers behind focus groups and the idea is that by sharing (potentially conflicting) thoughts, participants are supported to take a critical stance against their own viewpoints. This way, final answers are already self-evaluated and likely to be closer to the truth. In general processes of consensus are expected in focus groups (section 3.2.2), but in smaller groups this might be even more the case. In smaller groups, people might be less likely to disagree and it could therefore also be argued agreements

are less meaningful in smaller groups than in bigger ones. In sum, the composition of the conducted focus groups could have limited the strength of the outcomes related to perceived nuisance in Hoek van holland.

Nonetheless, looking at the eventual process of both focus groups, these theoretically expected limitations are not clearly seen in this research. During the discussion few encouragements from the moderator were needed, the conversation was flowing well and thereby several perspectives were revealed. Furthermore, residents treated each other with respect and in a tolerant way. Every resident had chance to give input, to elaborate on their individual view and, to my impression, less socially acceptable views were not suppressed. Moreover, by asking critical questions, asking for elaboration or expressing feelings of surprise or (mis)understanding a critical dialogue was, despite the limited diversity of the residents, created anyway. Based on these observations, the validity of the focus groups is strengthened and outcomes, especially relating to individual nuisance perceptions, are believed to be rather strong. With help of the focus groups, more insight in feelings of annoyance is acquired and a better understanding of how resident experience the world around them is gained.

Outcomes of the desk-top research, on the contrary, should be treated with more care. Desk-top research is typically a more secondary method, whereby merely written data is consulted. The drawback of this method is that information provided by documents and websites could be undetailed or ambiguous, leaving much space for interpretation by the researcher. Likewise, during the study some statements were based on missing information, opposed to given information. It was for example suggested that Rijkswaterstaat pays seemingly more attention to noise, air quality and external safety in urban planning, because merely frameworks for these types of nuisance are addressed on the website and only for these types of nuisance legal obligations apply. However, this is a rather short-sided argumentation and it might be, though not addressed specifically, that other types of nuisance are considered important as well. A similar doubt could be shed on the following statements:

- City and Environment, PlanMER and GES (Health Effect Screening) are instruments that play potentially a pivotal role in urban planning, because they are one of the few highlighted instruments on the InfoMil website;
- Objective indicators are leading in current urban planning, because the process, principles and instruments are all concerned with environmental norms and the choice between respecting, customizing or deviating from them;
- Talking in terms of legislation, space and distances, objective indicators regarding environmental quality are seemingly leading in the continuous conversation between The Municipality of Rotterdam, The Port of Rotterdam Authority and DCMR;
- To what extent the residential perspective has really gained a place in the decision process of urban planning could be questioned, because keeping residents satisfied is not specifically mentioned by the urban planner as objective of nuisance management;
- To what extent the residential perspective has really gained a place in the decision process of urban planning could be questioned, because seemingly no attention is paid to vibrations and soot, while these are from the resident's point of view important sources of annoyance.

Above statements are not strongly proven and several remarks regarding their validity could be made. Nonetheless, they are not (yet) scientifically challenged either and also less solid findings could be useful in science. The stronger and weaker findings combined, give holisticness and subjectivity a place in urban planning and could trigger more researchers to study these topics. By either verifying or challenging current conclusions, future research could increase the understanding of residential nuisance and mixing uses in urban planning. In next section some possible research recommendations are made in this regard.

6.3 Future Research

To create successful mixed-use areas and to develop new planning ideas for the port city context, more research is needed. This study, including its stronger and weaker sides, could serve as starting point for future research in several ways. Besides using the findings as knowledge basis to build further on, researchers could repeat this research, while using different practical case(s) or the other way around, they could apply different methodologies while keeping Hoek van Holland as case. Some examples of research possibilities are described below.

Perceived nuisance is receiver specific

Having revealed personal factors as "interwovenness with living environment" as potential PNF, it could be every resident has its own environmental identity, its environmental DNA, its ingredients that make them feel at home. Future research could look into the difference from residents coming from Hoek van Holland versus completely other places such as Rotterdam, and estimate what this could mean for their nuisance perception. A research question could be: *"To what extent is there a difference between perceived nuisance of residents living in a village and the ones from the city?"*

Economic value of nuisance source influences perceived nuisance

The Port of Rotterdam might not be representable for other industrial areas because it is seen as the driver of the Dutch economy. Nuisance is perceived differently when the source has a positive impact on the economic growth, this research could be repeated for a village close to (normal) industry, less important for the Dutch economy. A research question could be: *"To what extent is there a difference between perceived nuisance of residents experiencing nuisance form an economically important source and the ones experiencing it from an economically less important one?"*

Perceived nuisance and population size

The port of Rotterdam believes a bigger population means more objectors and a higher nuisance, future research could test this, by comparing the perceived nuisance in bigger and smaller populations. A research question could be: *"To what extent is there a difference between perceived nuisance of residents living in a bigger population and ones living in a smaller population?"*

Ranking perceived nuisance factors

Some Perceived Nuisance Factors might be more influential than others. In practice, where cost and efforts are weighted against impact, it might be useful to know what factors influence perceived nuisance the most. Quantitative research could be conducted to test the effect of perceived nuisance factors. A research question could be: *"What perceived nuisance factors influence perceived nuisance the most?"*

Perceived nuisance and residential satisfaction

In this study a dualistic relation between perceived nuisance and residential satisfaction is theorized. Quantitative research could be conducted to test the validity of his theory. A research question could be: *"To what extent has overall residential satisfaction a mediating effect on perceived nuisance?"*

Urban planners could be biased in favour of industry or residents, port or city

The Port of Rotterdam might not be representable for other industrial areas. In this case the urban planners were potentially a little biased in favor of the industry, future research could be repeated for a village close to (normal) industry, whereof the municipality is not a pivotal shareholder. A research question could be: *"To what extent is there a difference between nuisance management of industrial areas where municipalities hold shares and of areas where municipalities do not hold shares?"*

Residential perspective versus port perspective

New forms of urban planning are needed in port cities, and this requires a holistic approach. taking more a holistic perspective. This study focused mainly on the residential perspective on nuisance. To understand oher actors as well, future research could complement on this study, by diving deeper into the port perspective on nuisance. A research question could be: *"How do harbor companies experience urban planning in crowded residential areas and how do they deal with residential nuisance?"*

Fine-grained versus gross-grained functions

Three types of mixed-use could be distinguished in Hoek van Holland. However, having this insight in retrospect, the study focused on Hoek van Holland as a whole. Conclusions are drawn accordingly and might be less representable for one type of mixed-use area in particular. Having a better idea of how nuisance could be determined, this study could be repeated in future research, taking two mixed-use areas as case, whereby one includes gross-grained uses and has a more equal focus on urban and industrial interest, while the other includes merely fine-grained uses and has a more city-orientated focus. A research question could be: *"To what extent is there a difference between in nuisance perception in industry/port orientated mixed-use areas and city orientated mixed-use areas?"*

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Appendix Overview

What data is collected per method and where it is documented

DATA COLLECTION METHOD	COLLECTED DATA	APPENDIX NR
General		Appendix 1
	Data plan	Appendix 1.1
	Informed consent focus group	Appendix 1.2
	Informed consent interview	Appendix 1.3
Focus Group		Appendix 2
	Schedule	Appendix 2.1
	Questions and assignments	Appendix 2.2
	Materials and tools	Appendix 2.3
	Questions send prior to focus group	Appendix 2.4
	Information send prior to focus group	Appendix 2.5
	Flyers_ finding participants	Appendix 2.6
	Social Media_ finding participants	Appendix 2.7
	Excel_ finding participants	Appendix 2.8
First Focus Group		Appendix 3
	Answers to questions send prior to focus group	Appendix 3.1
	Transcript	Appendix 3.2
	Photo's personal objects	Appendix 3.3
	Photo's during focus group	Appendix 3.4
	Results generative techniques	Appendix 3.5
	Signed informed consent	Appendix 3.6
Second Focus Group		Appendix 4
	Answers to questions send prior to focus group	Appendix 4.1
	Transcript	Appendix 4.2
	Photo's personal objects	Appendix 4.3
	Photo's during focus group	Appendix 4.4
	Results generative techniques	Appendix 4.5
	Signed informed consent	Appendix 4.6
Data Analysis		Appendix 5
	Validation Verbal and Visual Data	Appendix 5.1
	Extracting Perceived Nuisance Factors I	Appendix 5.2
	Extracting Perceived Nuisance Factors II	Appendix 5.3
In-Depth Interview		Appendix 6
	Interview protocol	Appendix 6.1
	Transcript	Appendix 6.2
	Signed informed consent	Appendix 6.3