

Urban Green Space Accessibility: An Environmental Justice based Research

BSc Spatial Planning and design

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Summary

The importance of urban green spaces has become ever more clear during the Covid-19 pandemic. In times during which there is not much which can be done, urban green spaces have been a solution to relieve stress and offer the possibility of meeting up with other people.

It is not self-evident, however, that everyone experiences the same accessibility to such important spaces. The present study seeks to explain how urban green space accessibility is perceived from an environmental justice perspective.

By utilizing a case-study and qualitative statistical means, an inquiry has been made in order to find out if relevant socio-demographic groups have equal opportunity to access urban green spaces.

Results show no significant differences among socio-demographic groups regarding their accessibility to urban green spaces. Therefore, the urban green space accessibility can be regarded as just.

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1. Introduction

1.1 Background

Urban green spaces are important places for enhancing the quality of life (Maas et al., 2009). This is most likely due to the possibility to have meaningful social interactions and interactions with nature, causing positive externalities such as having a sense of space and social capital (Maas et al., 2009), as well as stress-relief and relaxation (Konijnendijk et al., 2013).

The societal relevance surrounding the topic of environmental justice in relation to the accessibility of urban green spaces is more evident nowadays than ever, since the use of urban green spaces as places for psychosocial interactions and stress-relief has increased during the COVID-19 pandemic: A time in which people have been in- and out of quarantine and have been tied to their homes, with face-to-face social contact being cut down to a minimum due to the restricting corona measurements imposed by national government (Rijksoverheid, 2021). Such lack of social interaction because of home confinement has been known to increase stress-levels and can become decremental to people's mental health (Kawachi et al., 2001).

The use of urban green spaces has seemingly offered a solution for such problems during the COVID-19 pandemic, considering that the use of urban parks and forests has increased to an extent that such green spaces were even temporarily closed down in some cities in the Netherlands due to overcrowding (Junte, 2021). It is not self-evident, however, that everybody has equal accessibility to urban green spaces in order to enjoy their related benefits (Davis et al., 2012).

1.2 Research problem

In the current academic literature regarding proximity planning, the importance and benefits of green space have been widely discussed and acknowledged (Gil Solá & Vilhelmson, 2019; Dempsey & Jenks, 2010). Health benefits can be experienced psychologically, sociologically and can increase physical and mental health (Davis et al., 2012); Urban green spaces provide opportunities to meet up with friends or family, which can increase strength of existing social ties or even create new ones (Davis et al., 2012). People might also be motivated to visit urban green spaces to engage with rather subjective experiences, like enjoying nature, getting lost from the city or to feel peace & quite (Couterier, 2000). Furthermore, urban parks and forests are spaces which enable one to relief stress and feel relaxed (Konijnendijk et al., 2013). The advantages of green spaces in cities has been recognized by the Dutch national government as well. They noted the importance of health fostering living environments consisting of more (urban) green spaces and aim to have established more healthy neighborhoods by 2050 (Rijksoverheid, 2020).

An urban green space should be an accessible space in order to make use of its related benefits (Davis et al., 2012). Accessibility of urban green spaces is often discussed in terms of physical accessibility, which is primarily concerned with the proximity and distance to urban green spaces (Park, 2017; Van Herzele & Wiedemann, 2003). According to Park (2017) and Suarez et al. (2020), accessibility is not merely concerned with distance. In order to argue that accessibility of urban green space is considered equal, individual preferences of urban green space aspects should also be taken into account (Park, 2017; Suarez et al., 2020). These individual preferences are, of course, subjective, but when such preferences are not perceived as being incorporated into an urban green space, people might not visit that urban green space as often as compared to when people do feel like their preferred aspects are incorporated into the urban green space (Fongar et al., 2019; Park, 2017; Suarez et al., 2020). Furthermore, Van Herzele and Wiedemann (2003) added that the distance to an urban green space, as well as perceptions of safety of an urban green space, should be considered as the pre-condition for

accessibility; If this pre-condition is not met, people will not even consider to visit an urban green space.

Dutch regional and national policies do not promise a direct improvement of accessibility to green spaces, but they do mention that accessibility to green spaces, meeting spots and other community amenities are crucial to foster physical and mental health (Rijksoverheid, 2020). Furthermore, the Dutch environmental vision (Rijksoverheid, 2020) does acknowledge that, especially in Neighborhoods where relatively more elderly and people with a lower income live, there should be more emphasis on the utilization and fair accessibility of urban green spaces (Rijksoverheid, 2020). Lastly, generally speaking, every citizen of the Netherlands should feel included and should feel able to participate in the Dutch society; Inclusion is a must (Rijksoverheid, 2020)

Whenever the accessibility to an urban green space is not equal among people, it might be considered an environmental justice issue (Davis et al., 2012). Several academics have argued that accessibility, whether related to the pre-condition or preferences, might be unequal between people based on their socio-demographic group, such as ethnicity, gender, age or income (Davis et al., 2012; Park, 2017; Suarez et al., 2020). Previous academic research, however, has not yet pointed out a clear distinction in regard to urban green space accessibility based on socio-demographic characteristics. Some academics conclude that some ethnic groups and people with lower income, actually have less access to urban green space, or only access to urban green space of bad quality (Dai, 2011; Davis et al., 2012). Other academics conclude that minorities and people with lower income have more access to urban green space (Barbosa et al., 2007; Kessel et al., 2009). A further elaboration on possible accessibility differences based on socio-demographic groups is therefore necessary in order to strengthen the focus of environmental justice practice in relation to urban green space accessibility.

Usually in urban green space accessibility and environmental justice research multiple neighborhoods or multiple cities are studied. There is, however a need for more research on the local/neighborhood level (Schipperijn et al., 2010). Also, neighborhoods are often categorized on the basis of characteristics of the majority of the people living there (e.g. income or race), which neglects variation in socio-demographic characteristics within a neighborhood and, thus, possible accessibility differences. Taking into account that cities, especially city neighborhoods, are becoming more diverse and are currently more diverse than ever before (Visser & Ter Steeg, 2019), it is of theoretical relevance to increase the literature on neighborhood-level studies in relation to environmental justice and urban green space accessibility.

The aim of this research is to, ultimately, find out if accessibility to urban green space is different among people based on their socio-demographic group. Therefore, it is important to know if the pre-condition for accessibility and recognition of preferences of urban green space aspects differ based on socio-demographic groups and, if so, whether local urban green spaces are already designed in a way which enable all inhabitants of the neighborhood to access an urban green space. This is crucial in finding out whether there are environmental injustices between people based on their socio-demographic characteristics.

From this research aim the main research question follows:

To what extent is there a difference in urban green space accessibility, from an environmental justice perspective, based on socio-demographic group (ethnicity, gender, age or income) ?

In order to make it possible to answer the main question in full, the following sub-questions should receive an answer first:

1. Is there a difference in the pre-condition of urban green space accessibility based on socio-demographic group?
2. How do people's preferences, and primarily the recognition of such preferences, of urban green space aspects relate to the accessibility of urban green space?

1.3 Structure of the thesis

The research problem and theoretical framework address why unequal urban green space accessibility may constitute an environmental justice issue, and which aspects should be researched in order to come to a fitting answer for the research questions. The next section, chapter three, will explain the methodologies that will be utilized in order to address urban green space accessibility from an environmental justice perspective. Subsequently, chapter four will show the findings from the neighborhood-level case-study. Chapter five will aim to provide a concluding answer to the main research question and, finally, chapter six will provide a reflection of the whole research process.

2. Theoretical framework

2.1 Environmental justice introduction

Environmental justice is a broad concept which is interpretable in multiple ways. It was initially defined by Robert Bullard as a principle according to which “all people and communities are entitled to equal protection of environmental and public health laws and regulations.” (Mohai et al., 2009, p. 407). The principle of environmental justice also holds that the physical and cultural environments are inextricably linked; Everybody should be able to live their lives and do the things they would like to do, wherever they would like without being discriminated (Mohai et al., 2009). Important in this relation between the cultural and physical world is the recognition of all socio-demographic groups and their different needs based on cultural differences (Schlosberg, 2009). Without recognition of these aspects, provision of people’s needs might be skewed towards a certain social group (Schlosberg, 2009).

Davis et al. (2012) linked this concept of environmental justice to the accessibility of urban green spaces. Davis et al. (2012) explain how the use of green spaces can benefit people in multiple ways (social ties, physical and mental health), a relative unequal access to these spaces could thus cause people who experience a low level of accessibility to not be able to exercise the possible benefits of an urban green space (Davis et al., 2012).

This study will follow the definition of urban green space as defined by (Schipperijn et al., 2010, p. 26):

“*Urban green space* (UGS) is in this paper defined as all publicly owned and publicly accessible open space with a high degree of cover by vegetation, e.g. parks, woodlands, nature areas and other green space. It can have a designed or planned character as well as a more natural character. Only areas that can be entered and used from ‘within’ are included.”

Following work conducted by Schlosberg (2009), Low (2013) and Kronenberg et al. (2020), this study will adopt the aspects of distributive- and recognition related justice in order to research urban green space accessibility. A similar approach, focused on the distributive justice and recognition related justice, was adopted by Suarez et al. (2020) as well, who argued that an environmental injustice might be created through an interrelation of unequal, physical accessibility (distance) and a kind of subjective accessibility related to the misrecognition of preferences from relevant socio-demographic groups.

In a distributive justice perspective, accessibility is related to whether someone feels enabled to visit a certain green space. This is related to whether people meet minimal requirements in order to visit an urban green space, as is argued to constitute the pre-condition of accessibility in paragraph 2.2. following Van Herzele & Wiedemann (2003). In a recognition related justice perspective, accessibility is related to rate of visitation and how this is related to people’s perceptions of quality and preferences of cultural services. The importance of recognition of such preferences is discussed in paragraph 2.3. Paragraph 2.4 will then elaborate on possible accessibility differences between socio-demographic groups. In order to form a clear hypothesis for this study, it is necessary to find out which results can be expected. These expectations of possible accessibility differences based on people’s socio-demographic characteristics will be related to the distributive justice- and recognition related perspective, which are discussed in paragraph 2.2 and 2.3 respectively.

2.2 Distributive justice; The pre-condition

The distributive aspect of environmental justice within the topic of urban green space accessibility describes how an equal availability of green spaces is necessary in order to enable everyone to exercise its benefits (Low, 2013; Schlosberg, 2009). Therefore, everyone should be able to have at least some form of physical accessibility and live in proximate distance of an urban green space (Low, 2013). In this sense, as argued by Ernston (2013), the distributive aspect of environmental justice should be interpreted as a pre-condition for accessibility. The assessment of the pre-condition for accessibility in relation to urban green spaces has been addressed by Van Herzele & Wiedemann (2003), who argued that a pre-condition for accessibility is the minimal requirement for people to even consider going to an urban green space; It determines whether people will actually visit an urban green space. The factors driving the pre-condition of accessibility (distributive aspect) are distance and perceived safety as mentioned by Van Herzele & Wiedemann (2003). Therefore, when researching accessibility to urban green spaces, first the pre-condition (distance and safety perceptions) should be considered to be satisfied before analyzing people's preferences of urban green space aspects.

2.2.1 Perceived distance

There are certain thresholds which have to be exceeded in order for a person to decide to actually go to an urban green space. The most important factor constituting accessibility to an urban green space is the distance from the home location to the green space (Van Herzele & Wiedemann, 2003; Schipperijn et al., 2010). In this study no objective distances were measured. Instead, following Scott et al. (2007) and Schipperijn et al. (2010), this study utilized perceived distance as this is a better indicator for whether people visit an urban green space.

There is no definition in Dutch policies regarding a maximum/minimum distance within which every household should be able to find UGS. Therefore, a reasonable distance within which a UGS should be located from a household, is 400 meters. This distance has been used in multiple (non-Dutch) policies and academic articles as a threshold within which every household should be able to find an UGS (Van Herzele & Wiedemann, 2003; Barbosa et al., 2007).

2.2.2 Perceived safety

The second factor of the pre-condition for accessibility is perceived safety (Van Herzele & Wiedemann, 2003). As mentioned by the Barbosa et al. (2007), certain situational aspects of the environment such as the amount of trash on the ground, graffiti, etc. might make for a rather unsafe feeling in regard to that environment as a whole. This can cause people to decide to not visit an urban green space; How people experience the safety of an urban green space matters when deciding whether they are actually willing to visit that particular urban green space.

2.3 Recognition related justice

The recognition related justice, as explained by Schlosberg (2009), refers to the recognition of the different preferences based on socio-demographic groups. Kronenberg et al. (2020) adopted recognition related justice in order to make an environmental justice based inquiry in regard to urban green space accessibility. In connection with urban green space accessibility, the recognition related justice is primarily concerned with incorporation of people's preferences of urban green space aspects and desires in the urban green space. Such preferences have been widely discussed in different

settings (Giles-Corti et al., 2005; Davis et al., 2012; Kabisch & Haase, 2014; Bertram et al., 2015; Park, 2017; Biernacka & Kronenberg, 2019; Fongar et al., 2019; Kronenberg et al., 2020; Suarez et al., 2020).

What these preferences specifically are or how they are called, differs among academics. Kronenberg et al. (2020) referred to preferences as aspects of attractiveness, while Kabisch & Haase (2014) called them desired characteristics. Following Bertram et al. (2015) and Biernacka & Kronenberg (2019), who adopted the term cultural services, this study will address preferences as the preferences of cultural services. The cultural services entail aspects of an urban green space which motivate or make human beings more willing to visit an urban green space after the pre-condition for accessibility has been met.

Furthermore, the cultural services preferences can either be described by themselves (Kabisch & Haase, 2014) or in relation to certain preference of cultural services themes. For example, Fongar et al. (2019) addressed the cultural service preferences within themes, such as social interactions or physical activities. Compartmentalizing cultural service preferences within themes helps facilitating a clear structure. This study adopted 4 themes (Figure 1), which will help to analyze the possibly differing cultural service preferences based on socio-demographic group.

Cultural service preference themes					
Social activities		Physical activities		Experiences	Amenities
Family & friends		Running		Enjoy nature	Benches
Picknick or BBQ		Team sport		Stress relief	Trashcans

Figure 1: Preference themes and related examples of cultural services (based on Fongar et al., 2019) (Author, 2021).

Researching how such preferences of cultural services differ between socio-demographic groups matters since such preferences, as mentioned by Fongar et al. (2019), are associated with the perceived quality of an urban green space.

If then, preferences of cultural services would be different between social groups, and not all preferences of cultural services are recognized and incorporated into an urban green space, this could mean that the perceived quality can be different between socio-demographic groups.

It is important to know how people perceive the quality of the urban green space to, because this is crucial in determining whether a park is actually used and how frequently it is visited (Biernacka & Kronenberg, 2019; Fongar et al., 2019; Giles-Corti et al., 2005). This interrelation of preferences of cultural services, perceived quality and visitation rate is what constitutes urban green space accessibility in the context of recognition related justice.

2.4. Possible accessibility differences in relation to socio-demographic groups

Multiple Studies related to the use of green spaces in cities found that people have different usage patterns, interests and desires when visiting an urban green space based on their ethnicity (Kabisch & Haase, 2014; Peters et al., 2010), income (Daams et al., 2019; De Roo, 2011; Wendel et al., 2012), age (Chiesura, 2004; De Roo, 2011; Kabisch & Haase, 2014) and gender (Fongar et al., 2019; Wendel et al., 2012)

A research by Daams et al. (2019) showed that house prices are considerably higher near urban green space in Amsterdam. Considering that higher dwelling prices generally correlate with the inhabitants having higher incomes (Kestens et al., 2006), this might indicate a pre-condition and distributive injustice since distance to urban green space is possibly not equal among people based on income. De Roo (2011) found that people with lower incomes and elderly generally are more bound to their local urban green spaces and therefore should live within reasonable distance of the urban green space.

Studies by Chiesura (2004) and Kabisch & Haase (2014) found that seniors prefer to enjoy nature, get some fresh air and prefer the presence of park benches, whereas young people rather play sports, exercise and prefer more open, grassy terrain for physical activities and recreation. These results show how elderly lean towards preferring amenities and experiences, whereas more younger groups of people prefer physical activities.

Furthermore, there are also differences between men and women. For example, women view urban green spaces as unsafe more often than men do (Wendel et al., 2012). Therefore we can expect differences regarding the safety perceptions between men and women, which thus might indicate a distributive injustice. Also, men are more likely to engage in physical activities than women (Fongar et al., 2019). This could then possibly show an recognition related injustice if physical activities are better recognized within the case-study urban green space.

Lastly, there also seem to be differences in park usage based on ethnicity. According to Kabisch & Haase (2014) and Peters et al. (2010), non-western immigrants (e.g. people from Turkey and Marocco) prefer to use urban green spaces to come together with large groups of people and barbeque or picknick together. These usage patterns were different from the native citizens, who rather enjoy nature by themselves. These studies were conducted in Germany and the Netherlands respectively. These results imply that the non-western immigrants prefer social activities, whereas the Germans and the Dutch prefer experiences.

2.5 Hypothesis

On the basis of the information mentioned in this chapter, it is expected and hypothesized that there are differences in perceived distance based on age and income. If this is the case then the pre-condition for accessibility would be violated which would cause an distributive injustice. Secondly, we suspect there to be possible differences between men and women regarding their safety perceptions. If this is the case, then the pre-condition of accessibility could be violated, which would also cause an distributive injustice.

Furthermore, we suspect there to be differences regarding the cultural service preference themes based on ethnicity, age and gender. If, in the case-study area (Leeuwarder forest) certain cultural preferences are not recognized, this might cause people to perceive the case-study area to be of lower quality and , thus, choose to limit their visitations to this urban green space. This then constitutes a recognition related injustice and also a lower urban green space accessibility. Findings from the academic literature show that people with a non-western immigration background are more likely to use an urban green space for social activities, whereas the Dutch are expected to prefer experiences. Also, elderly and women are more likely to prefer amenities and experiences, whereas young people and men are more likely to engage in physical activities.

2.6 Conceptual model

The conceptual model below (Figure 2) shows how environmental justice is related to urban green space accessibility through the perspectives of distributive justice and recognition related justice. The dotted lines from the distributive justice, which is driven by perceived distance and perceived safety, towards the recognition related justice and urban green space accessibility depicts a pre-conditional relationship. If the pre-condition is met, the recognition related justice will be discussed through analysis of the cultural service preferences and preference themes in relation to perceived quality and visitation rate; A higher visitation and perceived quality is expected when more individual preferences of cultural services are recognized. In this case, a higher visitation rate would imply better overall urban green space accessibility. Since the cultural service preferences associate with the visitation rate, it is important to research if the cultural service preferences and amount of recognized cultural service preferences differ between socio-demographic groups. If this would be the case, then we could speak of an environmental injustice.

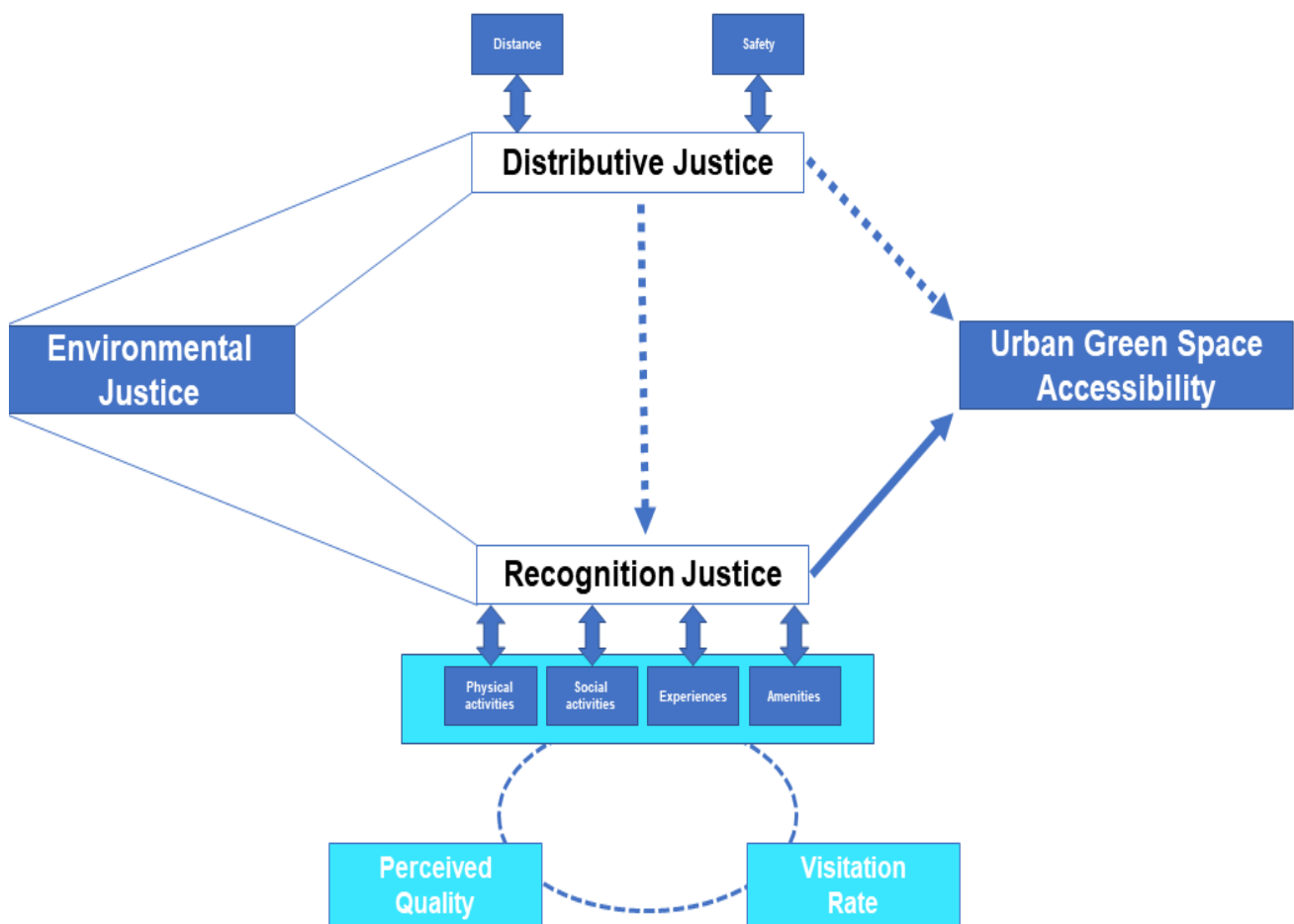


Figure 2: Conceptual model (Author, 2021)

3. Methodology

3.1 Case study method

In order to test the aim of this research, a case-study approach will be utilized. As mentioned by Schipperijn et al. (2010), multiple researches on several scales (local, regional, national) have been conducted to register the use and benefits of green spaces. However, there has been little research on the difference of accessibility and usage of urban green space based on socio-demographic characteristics within the context of environmental justice on a neighborhood case study level. It is especially important to utilize case-studies for this kind of research to gain an understanding how several aspects impact the accessibility and usage of urban green spaces on a certain geographical location (Schipperijn et al., 2010); A case-study allows you to obtain in-depth and comprehensive information about a particular object or procedure in reality (Clifford et al., 2016)

3.2 Case description

To analyze how urban green space accessibility and use differs across social groups within the context of environmental justice, an already socially diverse area is necessary. Therefore the neighborhood of Bilgaard was chosen as the case-study site.

Bilgaard is a large scale, post-war, mixed-use neighborhood in the north of Leeuwarden. The area is divided in four identical residential units in the south and another five identical residential units in the north of the neighborhood, consisting of high-rise, mid-rise and detached Houses (Bestemmingsplan, 2011) (Figure 3). A total of 6870 people spread across 3745 households live in Bilgaard.



Figure 3: Neighborhood of Bilgaard (Bestemmingsplan, 2011)

Bilgaard is a rather diverse neighborhood, which makes it suitable for environmental justice analysis; Around 30 percent of the inhabitants has a non-western immigration background (Bestemmingsplan, 2011). The distribution of gender is rather equal, with 45 percent being male & 55 percent being female (Bestemmingsplan, 2011). Furthermore, A relatively high percentage of the inhabitants are considered to have a low-income (71 percent) (Bestemmingsplan, 2011). Also, There is a relatively good mix of the different age groups, with the age group of older than 65 years being the largest group (24,1 percent) (Bestemmingsplan, 2011).

The elderly, as well as the percentage of people with a non-western immigration background has seen growth over the past 20 years (Bestemmingsplan, 2011). The relatively high percentages of elderly (> 65 years) and people with a non-western immigration background makes this area interesting for environmental justice research.

It should be noted that there is quite some green between residential units, however, the presence of garden green or having a private garden does not result in less frequent visitation of public urban green spaces (Maat & De Vries, 2006; Schipperijn et al., 2010). Therefore, it is still important to consider urban green space (park/forest) accessibility in the light of environmental justice in order to reach an equitable situation (Schlosberg, 2009)

The related urban green space to this area is the Leeuwarder forest. It touches the neighborhood at the north end and contains approximately 140 acres of nature (Bestemmingsplan, 2011) (Figure 4). This forest was placed there in the 1990's as a designated area for recreation, nature and to capture carbon dioxide emissions (Bestemmingsplan, 2011).



Figure 4: Aerial view of Leeuwarder Forest (Bing maps, 2021).

3.3 Data collection: Qualitative statistical survey

Since the purpose of this study is to test whether there is a difference in urban green space accessibility, and the utilized method is a case-study at the neighborhood level, the population is restricted to the inhabitants of the neighborhood of Bilgaard.

In order to capture subjective feelings and preferences, which are required in this research, qualitative data is necessary (McGuirk et al., 2016). Qualitative research is concerned with revealing complex experiences and relations which people are confronted with on a daily basis such as environmental perceptions, social ties and life in general (McGuirk et al., 2016). Qualitative research is usually conducted in a non-statistical manner via, for example, in-depth interviews, which are very useful in order to gain specific, personal insights (McGuirk et al., 2016). Downside to this kind of research, however, is a relatively low respondent group as opposed to surveys. Furthermore, when conducting interviews, respondents' can experience so called 'interviewer effects' that can cause the respondent to feel like they should answer in a way which would satisfy the interviewer most (McGuirk et al., 2016). Opting for a qualitatively based survey instead would avoid such effects and might cause respondents to give a more honest answer, especially when their identity remains private (McGuirk et al., 2016). Although, there are also downsides to a survey. Due to its relative compact form compared to interviews, the information gathered by a survey is not as specific and in-depth (McGuirk et al., 2016).

All in all, considering interviews would have had to be conducted online due to Covid-19, the unease people might experience when visiting their homes during these times and the practicality of survey distribution and its ability to capture attributes, attitudes and behaviors, this research opted for a qualitatively based survey.

Most of the questions were composed in a closed question setting in order to gather respondents' information about; Attributes such as their socio-demographic group; Their attitudes, as to find out things which the respondents' prefer, such as certain urban green space cultural services; Their behavior (e.g. whether respondent's visit the Leeuwarder forest). However, according to McGuirk et al. (2016), in order to enable respondents' to give new insights regarding their experiences and preferences (in this case about urban green spaces and particularly the Leeuwarder forest), it is necessary to add the option "other" to the closed questions. Furthermore, the questions were mostly designed as to fit the categorical (nominal and ordinal) variables (see appendix), which can be regarded as qualitative variables (Burt et al., 2009). Nominal variables capture the attributes and behaviors of the respondents', whereas ordinal questions are more concerned with attitudes and their ranking (Burt et al., 2009).

The survey was distributed throughout the neighborhood of Bilgaard by sticking papers, with a QR-code linked to the survey, to several walls and poles. The survey is therefore based on voluntariness, which means that people choose themselves (self-select) whether they fill in the questionnaire. The downside to this survey design is that, although rather convenient during these times, there is a bigger change of sampling bias. In this case, that would mean that only people who feel like they should answer will fill out the survey, and this might increase the change of having a non-representative sample (Burt et al., 2009).

3.4 Data Analysis

First the data was cleaned from non-serious answers (e.g. My couch is also a forest, right?) The data analysis process (see 3.4.1) for the distributive justice perspective aims to find out if the pre-condition for green space is met. Secondly, from a recognition related justice perspective, it is crucial to know whether cultural service preferences are recognized when visiting the Leeuwarder forest and how they relate to the perceived quality and visitation rate. Such interrelations are important to research as they might uncover an underlying environmental injustice when the amount of recognized preferences would be different amongst socio-demographic groups. For the statistical analysis a significance level of 5% ($\alpha = 0,05$) is adopted, meaning that any probability value (p) lower than the significance level ($\alpha = 0,05$) shows a significant result. A significant result would mean that there is a difference between groups or variables. If the probability value is higher than the significance level (so $p > \alpha = 0,05$), then the statistical result is regarded as being insignificant and thus not showing a difference between groups or variables.

3.4.1 Distributive Justice

According to the academic literature, as mentioned in the theoretical framework, distributive justice is considered as the pre-condition; In order for people to be able to make use of urban green space benefits, people should live within a certain distance of the related urban green space (within 400 meters) and have a perceived sense of safety of that same urban green space in order to even consider going to such a space; distributive justice, at the neighborhood-level with one identified urban green space, is therefore concerned with the visitation of urban green space. We want to find out if people decide to visit or not to visit the Leeuwarder forest based on distance and perceived safety. It is, however, possible that distance or safety does not indicate visitation. Therefore, we should first validate if this is the case; If the indicator does not indicate visitation it will be excluded from further study (see appendix 2). lastly, the concept of distributive justice,

based on its indicators, will be tested against the relevant socio-demographic groups to find out whether there is a difference. The figure below (Figure 5) shows the analysis procedure.

This study opted for a Kruskal-Wallis test on the basis of its ability to compare results between groups consisting of either nominal or ordinal data.

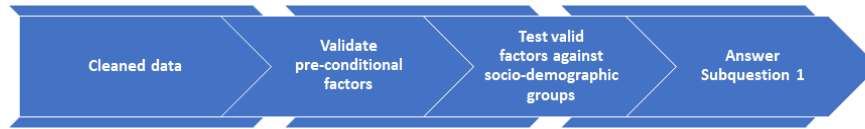


Figure 5: Data Analysis procedure for distributive justice (Author, 2021)

3.4.2 Recognition related Justice

As mentioned in the theoretical framework, recognition related justice is concerned with people's preferences of cultural services in an urban green space, and such preferences interrelate with the perceived quality and visitation rate of an urban green space according to Fongar et al. (2019) and Giles-Corti et al. (2005). The assessment procedure related to perceived quality is rather diverse and there seems to be no one best way to test this variable (Zhang et al., 2017). Therefore, in order to test the relation between perceived quality, visitation rate and people's preferences for green spaces, the following method based on Fongar et al. (2019) and Giles-Corti (2005) is proposed.

First, a Spearman's rho test, due to its ability to show a correlation between two ordinal variables, will be utilized to see whether perceived quality corresponds with the rate of visitation. Secondly, a count of recognized preferences of cultural services according to the preference themes will be tested against perceived quality and rate of visitation in order to find out whether recognized preferences within this case-study do actually predict perceived quality and rate of visitation. If this is the case, then it is clear that the preferences for cultural services are a good predictor of perceived quality (and visitation if there would be a correlation between rate of visitation and perceived quality). The count of recognized preferences is established by assessing whether each aspect as chosen in question 6 by a respondent is also confirmed by question 7. If that is the case, then this counts as 1 (see figure 6 and appendix 1).

Secondly, if all relations are established, a Kruskal-Wallis test will be adopted to see whether the count of recognized preferences differs among socio-demographic groups. If there would be a difference, then we might have an recognition related environmental injustice (see figure 7)

Example: Question 6: Nature (yes) AND Question 7: Nature (yes), then the general UGS preferences is actually experienced in the Leeuwarder forest. So this counts as 1 recognized, experience related, preference.

Figure 6: Example count (Author, 2021)

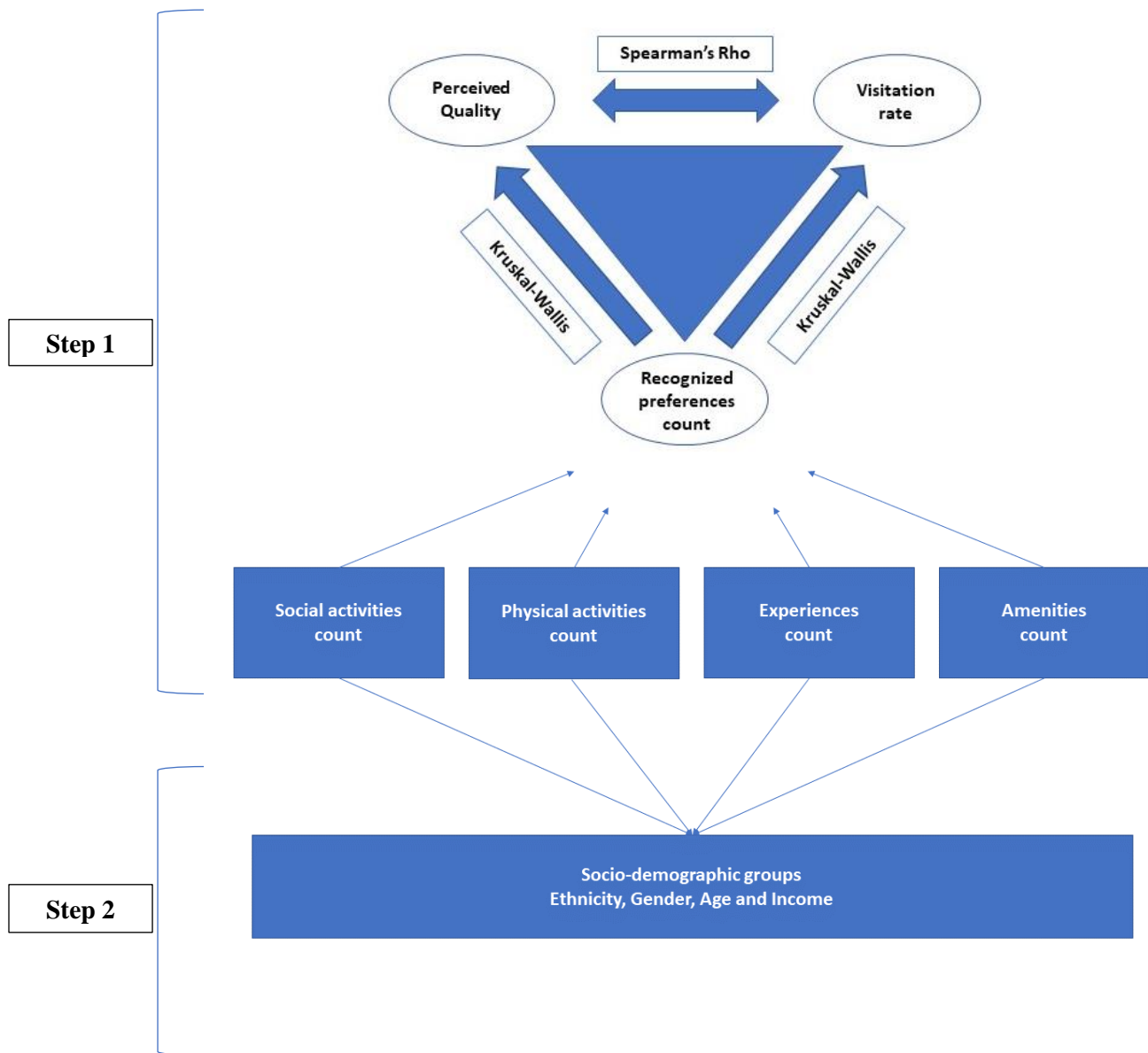


Figure 7: Data Analysis procedure for recognition related justice (Author, 2021)

4. Results

4.1 Socio-demographic group distribution

The survey received 49 total responses, consisting of 3 visitors and 11 non-visitors, 1 respondent did not fill out the questions related to the preferences of cultural services which caused one less case in the analysis part of the recognition related justice (4.3). The distribution of the respondents based on socio-demographic group is shown below (Figure 7).

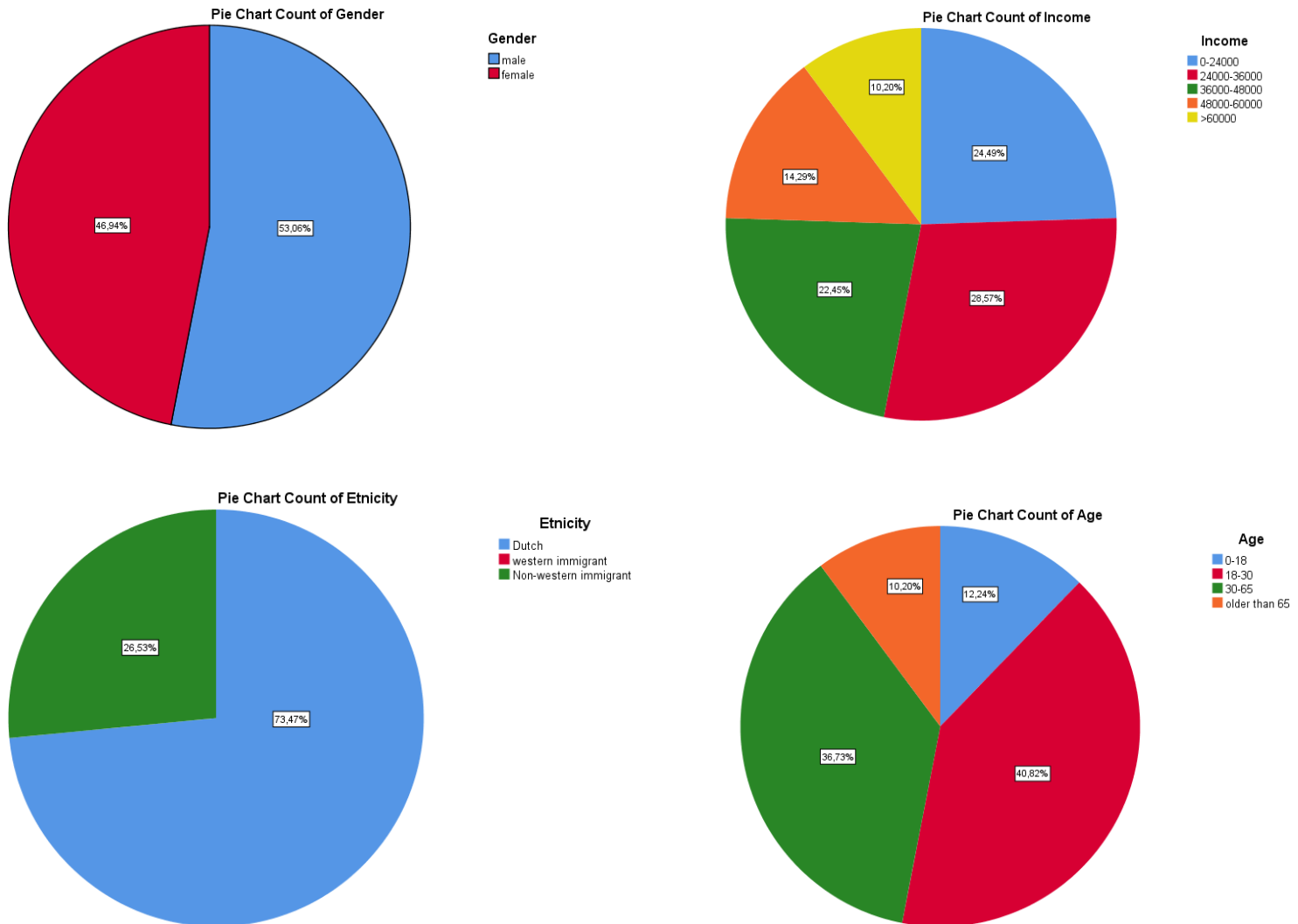


Figure 8: Socio-demographic group distribution

4.2.1 Distributive Justice; Indicator assessment for pre-condition for accessibility

First, this study tested whether perceived distance and perceived safety actually indicate whether someone would visit the Leeuwarder Forest. This was assessed by utilizing an Kruskal-Wallis test (see appendix 3). It turned out that perceived safety did not indicate whether someone would visit the Leeuwarder forest or not ($p = 0,270 > \alpha = 0,05$) (Figure 8). As one might tell by looking at the bar chart, the distribution of perceived safety does not vary significantly based on visitation, although there were 3 non-visitors who found the forest to be unsafe whereas no visitors viewed the forest as unsafe.

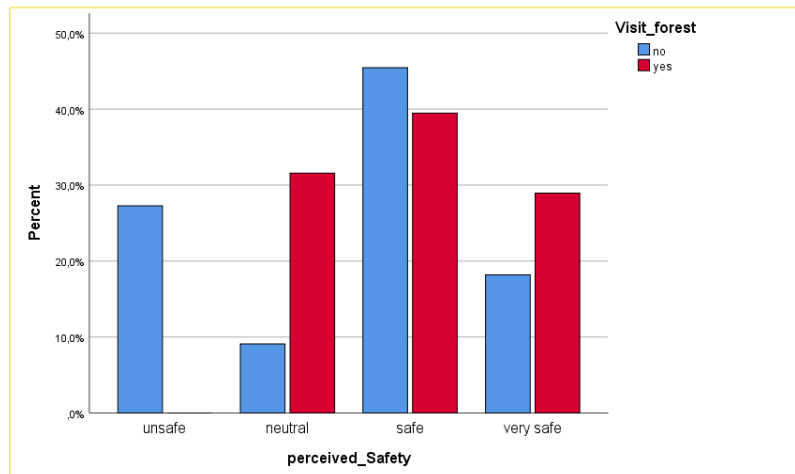


Figure 9: Bar chart: perceived safety based on visitation

The other indicator, perceived distance, did turn out to predict whether people would visit the Leeuwarder forest ($p = 0,000 < \alpha = 0,05$). As shown in the bar chart below (Figure 9), non-visitors primarily live more than 800 meters away and the main group of visitors actually lived within 400 meters of the Leeuwarder forest.

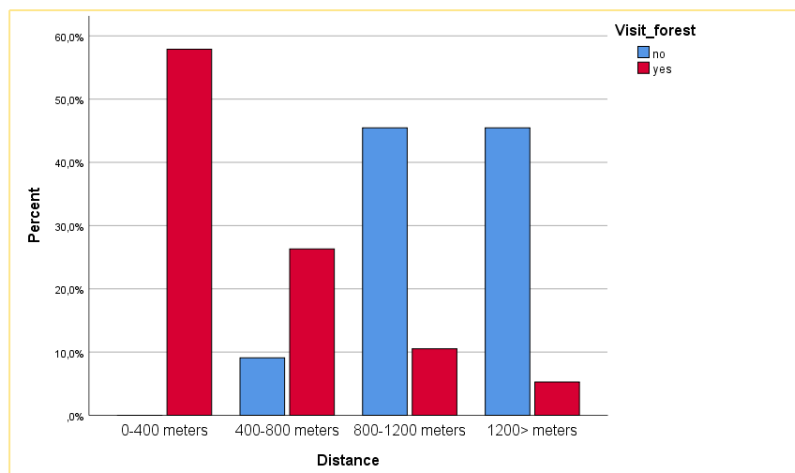


Figure 10: Bar chart: Perceived distance based on visitation

4.2.2 Distributive Justice; Distance distributed across socio-demographic groups

Now it is established that distance indicates whether someone would visit the Leeuwarder forest, it is necessary to know whether the distance from the respondents' home location to the Leeuwarder forest is equal across socio-demographic groups.

All results turned out to be insignificant ($p = 0,711$; $p = 0,418$; $p = 0,516$; $p = 0,388 > \alpha = 0,05$), thus the distribution of distance can be considered to be equal amongst socio-demographic groups (Figure 10).

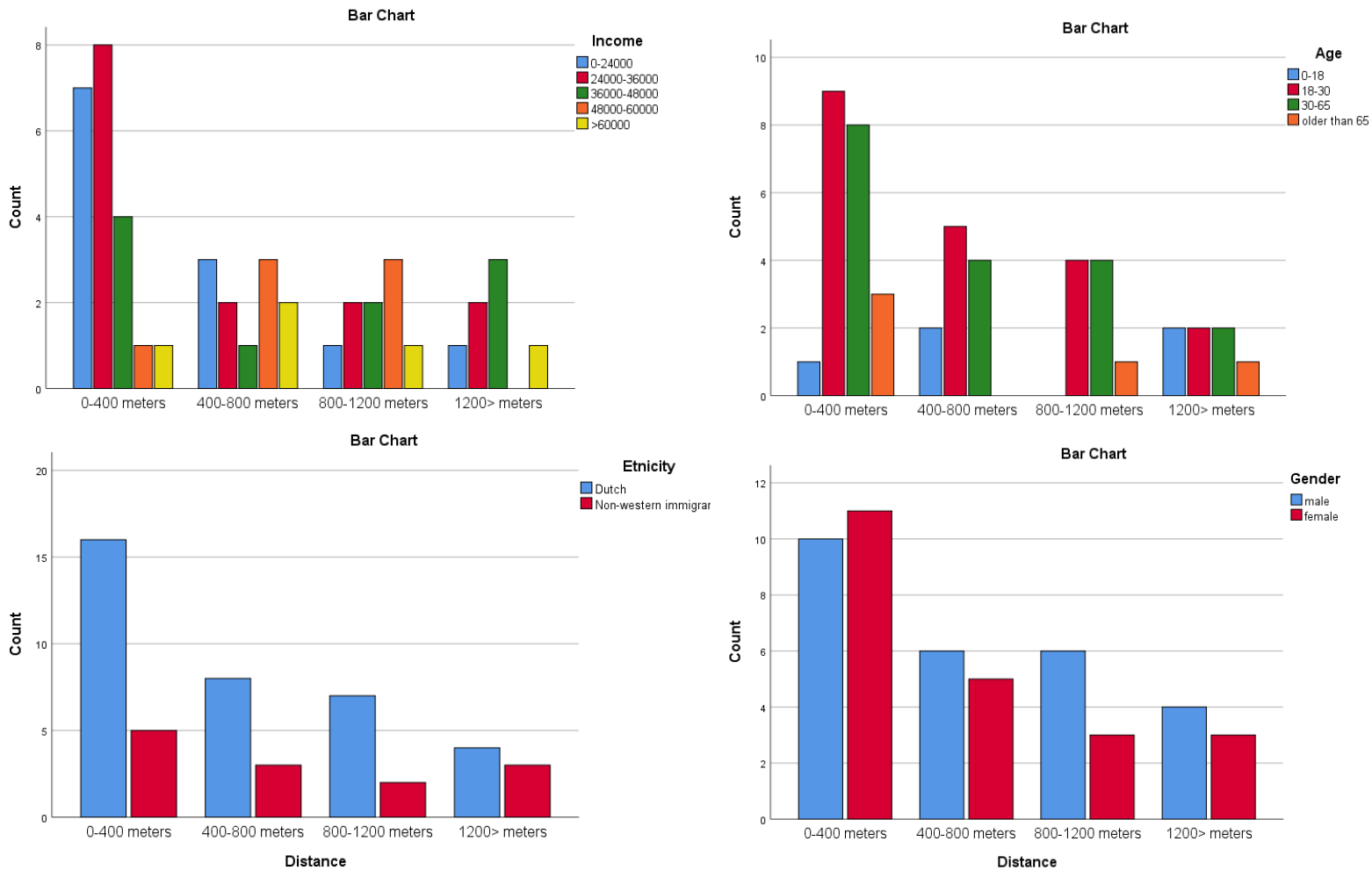


Figure 11: Bar charts: distance distributed across socio-demographic groups

4.3.1 Recognition related justice: Correlation perceived quality and visitation rate

First, this study researches whether there is actually a correlation between perceived quality and visitation rate; Do people visit the Leeuwarder forest more often if the perceived quality of this particular space is better?

In order to test this, a spearman's rho test was utilized. The test turned out significant ($p = 0,007 < \alpha = 0,05$), which means there is a correlation between visitation rate and perceived quality; A higher perceived quality means a higher rate of visitation (also see figure 11). The strength of the relationship is however considered to be "moderate" (0,433).



Figure 12: Bar chart: Correlation perceived quality and visitation rate

4.3.2 Recognition related justice: Recognized preferences, perceived quality and visitation rate

The amount of recognized preferences was tested against the perceived quality and visitation rate separately by utilizing a Kruskal-Wallis test. The results of this test turned out insignificant for all perception themes, as well as the total satisfied preferences; all probability (sig) levels turned out to be higher than the significance level of $\alpha = 0,05$ (5%) (see appendix 5).

Furthermore, this entails that perceived quality and visitation rate cannot be predicted by the amount of recognized preferences; In this particular case-study and sample, people who visit the Leeuwarder forest are seemingly not motivated by the amount of recognized preferences to visit the Leeuwarder forest less or more often.

4.3.3 Recognition related justice: Perceived quality distributed across socio-demographic groups

Although, there is no significant relation between the recognized perceptions, perceived quality and visitation rate, it is still important to know whether the perceived quality is equal among the socio-demographic groups since the perceived quality does correlate with visitation rate. In other words, if the perceived quality is not equal among the socio-demographic groups the visitation rate could also differ, which might constitute an environmental injustice. The results of the Kruskal-Wallis tests turned out to be insignificant ($p = 0,063$; $p = 0,914$; $p = 0,974$; $p = 0,215 > \alpha = 0.05$), which means that perceived quality is equally distributed among the socio-demographic groups (also see figure 12).

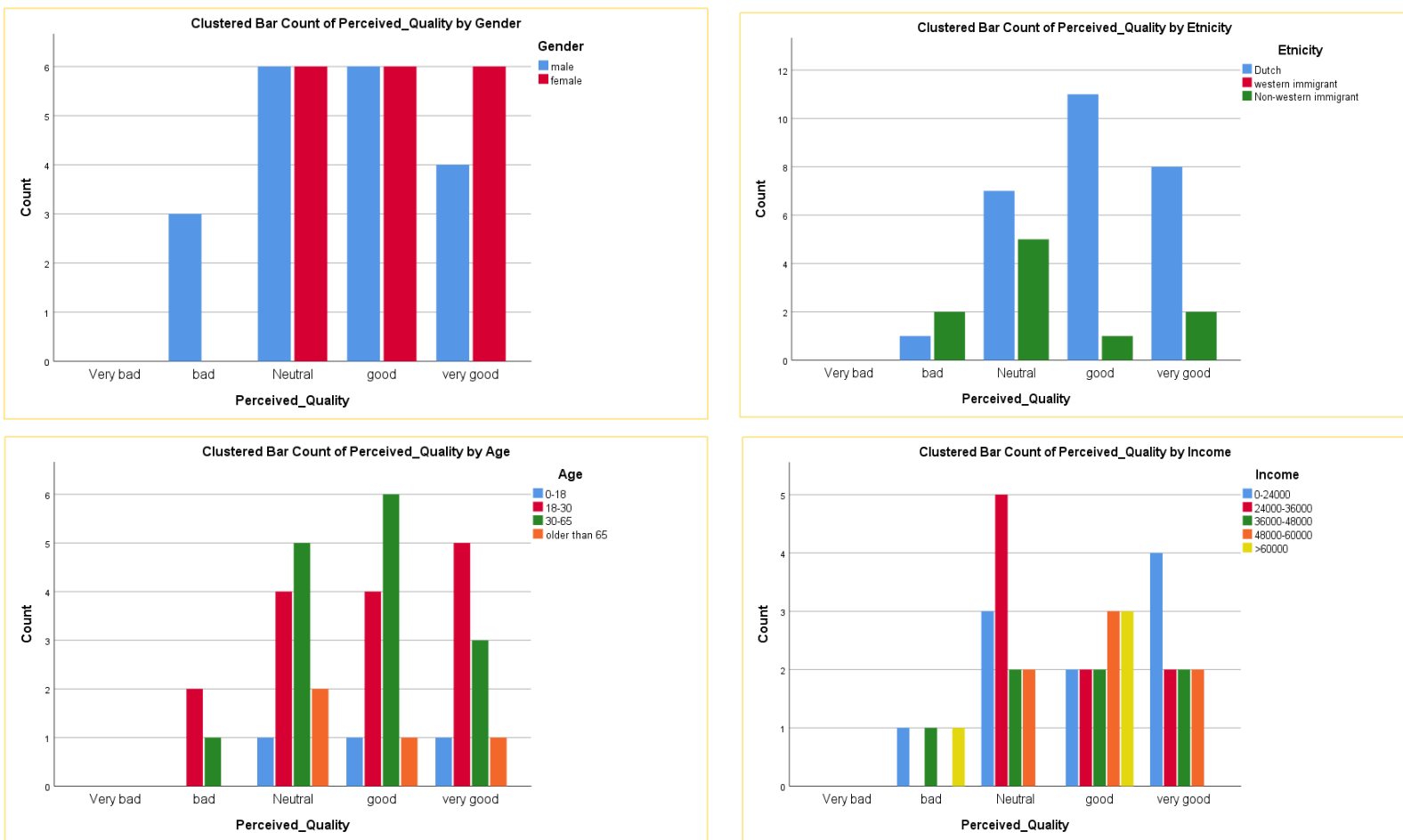


Figure 13: Bar chart: distance based on visitation across socio-demographic groups

5. Discussion

5.1 Distributive justice; Pre-condition for accessibility

The analysis of the pre-condition for accessibility showed some surprising results. First of all, the perceived safety of the Leeuwarder Forest did not indicate whether someone would visit the Leeuwarder forest. This finding is contradictory to Van Herzele & Wiedemann (2003) who mentioned perceived safety to be indicative of whether people would actually be willing to visit an urban green space or not. Since perceived safety turned out to be insignificant, it was excluded from further study.

Furthermore, the perceived distance turned out to be significant in indicating whether someone would visit the Leeuwarder forest. This finding was actually expected and is in line with Van Herzele & Wiedemann (2003). Although, the results show that most people tend to visit the Leeuwarder forest when they live within 400 meters, the results do also show that people still visit the Leeuwarder forest even if they live further away than 400 meters, especially if they still live within 800 meters of the Leeuwarder forest (Figure 9). Therefore, it is debatable whether perceived distance can be considered to be a pre-condition for accessibility. These results are comparable to results by Schipperijn et al. (2010) who found that distance was not an issue for the Danish population in deciding to visit an urban green space.

In order to notice a distributive injustice the, perceived distance should have been unequal among the socio-demographic groups. The results turned out to be significant and thus the distance was considered to be equally distributed across socio-demographic groups, which means that there is not one particular group whose perceived distance is more, or less, compared to the other groups. Therefore no distributive injustice was found.

These findings also show that elderly and people with lower incomes do not have less access to the Leeuwarder forest based on perceived distance compared to other groups, which is desirable according to De Roo (2011). Furthermore, this finding contradicts previous findings by Dai (2011), who mentioned that minorities and lower income classes lived further away from available green space than native inhabitants and people with a relatively higher income. Although, Engelberg et al. (2017) also found that there are no differences in green space accessibility among socio-demographic groups. The different results can possibly be explained by the different cultural and geographic dimensions of the studies; These dimensions might reflect different local norms and values, which thus could cause different outcomes of urban green space research in different locations (Wendel et al., 2012).

5.2 Recognition related justice:

Following on the pre-condition of accessibility, which was met for every socio-demographic group as the perceived distance to the Leeuwarder forest is considered to be equal across groups. The recognized cultural preference themes were analyzed in relation to perceived quality and visitation rate. It was assumed on the basis of the academic literature that the cultural service preference themes were able to predict the perceived quality of an urban green space, in this case the Leeuwarder forest, and that the perceived quality would be associated with visitation rate. As mentioned in 4.3.1, there is a significant relation between the perceived quality and visitation rate of the green space. This finding corresponds with Fongar et al. (2019) who also found an association between perceived quality and frequency of visitation. The strength of the result turned out to be “moderate” (Venhorst, 2020). Therefore however the recognized cultural service preference count and cultural preference themes were tested against both the perceived quality and visitation rate.

When testing the recognized cultural service preferences against the perceived quality and visitation rate, all results turned out insignificant. Therefore, the cultural service preferences do actually not indicate whether people visit the Leeuwarder forest or not. These findings are rather contrary to findings by Fongar et al. (2019) and Giles-Corti et al. (2005), who did find a relation between preferences of cultural services and perceived quality. Furthermore, the results of this study also contradict assumptions by Park (2017), who mentioned that individual preferences and perceptions matter in relation to park visitation and accessibility.

Since the count of cultural service preferences did not actually indicate whether people would visit the Leeuwarder forest more often, no further study was conducted on how they differ across socio-demographic groups, as they do not indicate the rate of visitation. Therefore, as an alternative, this study analyzed whether the perception of quality of the Leeuwarder forest was different across socio demographic groups; If this would be the case, then it could still entail an environmental injustice.

The result of the distribution of perceived quality was statistically equal. There was one interesting result, however. Ethnicity showed a probability value of $p = 0,063$. This result is still, taken the significance level to be $\alpha = 0.05$, considered insignificant, but it is an interesting result compared to the other outcomes. As shown below (Figure 13), the perceived quality, and thus the visitation rate seem to be lower for non-western immigrants, showing that proportionally they tend to visit the Leeuwarder forest less. This is possibly due to the fact that there are only 10 respondents with a non-western immigrant background, as opposed to 27 respondents being Dutch. Therefore, it is unclear what would have been the outcome if there would have been more respondents with a non-western immigrant background.

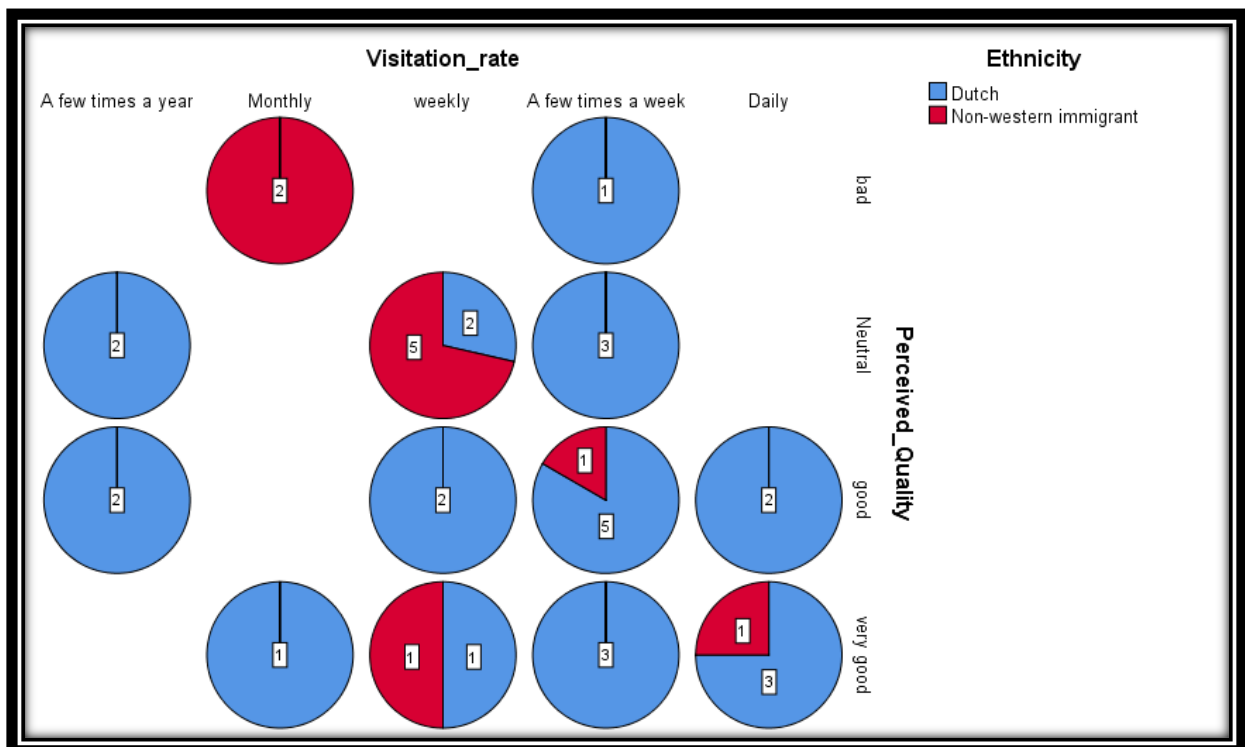


Figure 14: Perceived quality and visitation rate across ethnicity groups

Furthermore, the total recognized preferences and recognized cultural service preference themes failed to indicate the perceived quality and visitation rate. It is, therefore, unclear what the exact underlying cause is of this perceived quality difference.

Rigolon (2016) mentioned that the way of assessment can cause different quality perceptions of urban green spaces among socio-demographic groups. Therefore, an alternative way of assessment could for more distinctive and clear results in future studies on environmental justice in urban green space accessibility.

6. Conclusion

The present study aimed to answer to what extent a difference in urban green space accessibility, from an environmental justice perspective, based on socio-demographic group can be found on the local, neighborhood level. Distributive justice and recognition related justice were adopted as drivers for urban green space accessibility; If the distributive justice perspective, which is considered to be a pre-condition for accessibility, was considered to be unjust, this would directly mean an environmental injustice. After the pre-condition was met, the preferences of cultural services were analyzed in order to find an recognition related injustice; If people would visit the Leeuwarder forest more or less on the basis of the recognition and incorporation of their preferences this could constitute and recognition related injustice.

Distributive justice is about enabling people to visit an urban green space and to make use of its related benefits. It is important to know what constitutes people's decision-making process when they would consider to go to an urban green space. Distributive justice is, therefore, regarded as a pre-condition of accessibility. The pre-conditional factors of perceived distance and perceived safety as mentioned by Van Herzele & Wiedemann (2003) were adopted in order to predict visitation of the Leeuwarder forest.

It turned out that perceived safety did not associate with the visitation of the Leeuwarder forest and was therefore excluded from the study. Perceived distance, however, did associate with visitation, but was found to be equal among socio-demographic groups. In this sense, all socio-demographic groups were equally capable of visiting the Leeuwarder Forest and thus the pre-condition of accessibility was satisfied, meaning that no distributive injustice was found. The pre-condition of accessibility can therefore be considered to be equal for all socio-demographic groups.

Secondly, the recognition related justice was researched. Recognition related justice is about how in order for people to be able to enjoy the urban green space to the fullest they should be able to utilize an urban green space according to their preferences of cultural services. Such preferences were addressed within 4 adopted themes, namely physical activities, social activities, experiences and amenities.

A count was made, following Giles-Corti et al. (2005) and Fongar et al. (2019) of recognized preference of the Leeuwarder forest to see whether this associated with the perceived quality and visitation rate of the Leeuwarder forest. The perceived quality was expected to be indicated by the amount of recognized cultural service preferences, as well as being associated with the rate of visitation. These results turned out to be insignificant. Therefore we can only say that the amount of recognized preferences does not directly indicate whether people are more likely to visit, in this case, the Leeuwarder forest. The perceived quality and visitation rate did associate with each other and were equally distributed across socio-demographic groups, thus not causing a problem of injustice.

Concluding, the results of this study did not indicate either unequal pre-conditional accessibility or unequal accessibility on the basis of the recognition of cultural service preferences, meaning that the rate of visitation and perceived quality was equal among socio-demographic groups. Therefore, no injustices were found. It can therefore be said that there is no difference in accessibility among, socio-demographic groups, to the Leeuwarder forest on the basis of an environmental justice perspective.

No environmental injustices were found. Therefore no further advice for the planning or improvement of the Leeuwarder forest is proposed. It is advised, however, that future studies adopt a mixed-methods or more qualitative approach when assessing urban green space

accessibility from an environmental injustice perspective. Because the statistical approach of this study showed to be insufficient in finding possible cases and explanations of environmental injustices.

7. Reflection

This study was based on the assumption that benefits provided by urban green space, whether those are social, psychological or health related benefits, can be enjoyed equally by every visitor of the urban green space once they feel like they are enabled to visit the urban green space. Therefore, no research was done regarding the extent to which benefits are actually related to preferences of cultural services, perceived quality and/or visitation rate. In this sense, the benefits were regarded as implicitly linked to people's urban green space accessibility; One's ability to visit the urban green space and to use it according to their needs and preferences.

This research was conducted by utilizing statistical methods in a rather qualitative sense. It should be noted, however, that in order to fully capture people's experiences and perceptions a more in-depth qualitative approach would have been preferable. However, due to the current circumstances regarding the COVID-19 pandemic, a survey was utilized in order to gather data on urban green space accessibility. Unfortunately, The amount of respondents (49) was rather low to make an statistical inference on the gathered data. Furthermore, in the first distribution round of the survey the respondents were only from Dutch decent, which caused the sample to be non-representative of the larger population. Ultimately, only a total of 11 respondents with a non-western immigration background filled out the survey. These aspects could possibly explain the insignificant outcomes.

Finally, an own adoption of methodology used by Giles-Corti et al. (2005) and Fongar et al. (2019) was utilized. The amount of of recognized cultural services (either total or per preference theme) was not able to predict what it was supposed to, namely perceived quality and visitation rate. This meant that people did not base their perception of quality or visitation frequency of the Leeuwarder forest on the amount of their own preferred and recognized cultural services. This was a surprising finding since according to Fongar et al. (2019) such aspects could be utilized in order to predict visitation frequency and perceived quality, which was not the case in this study. This caused for rather inconclusive results and made for a big limitation of this study's outcomes.

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9. Appendices

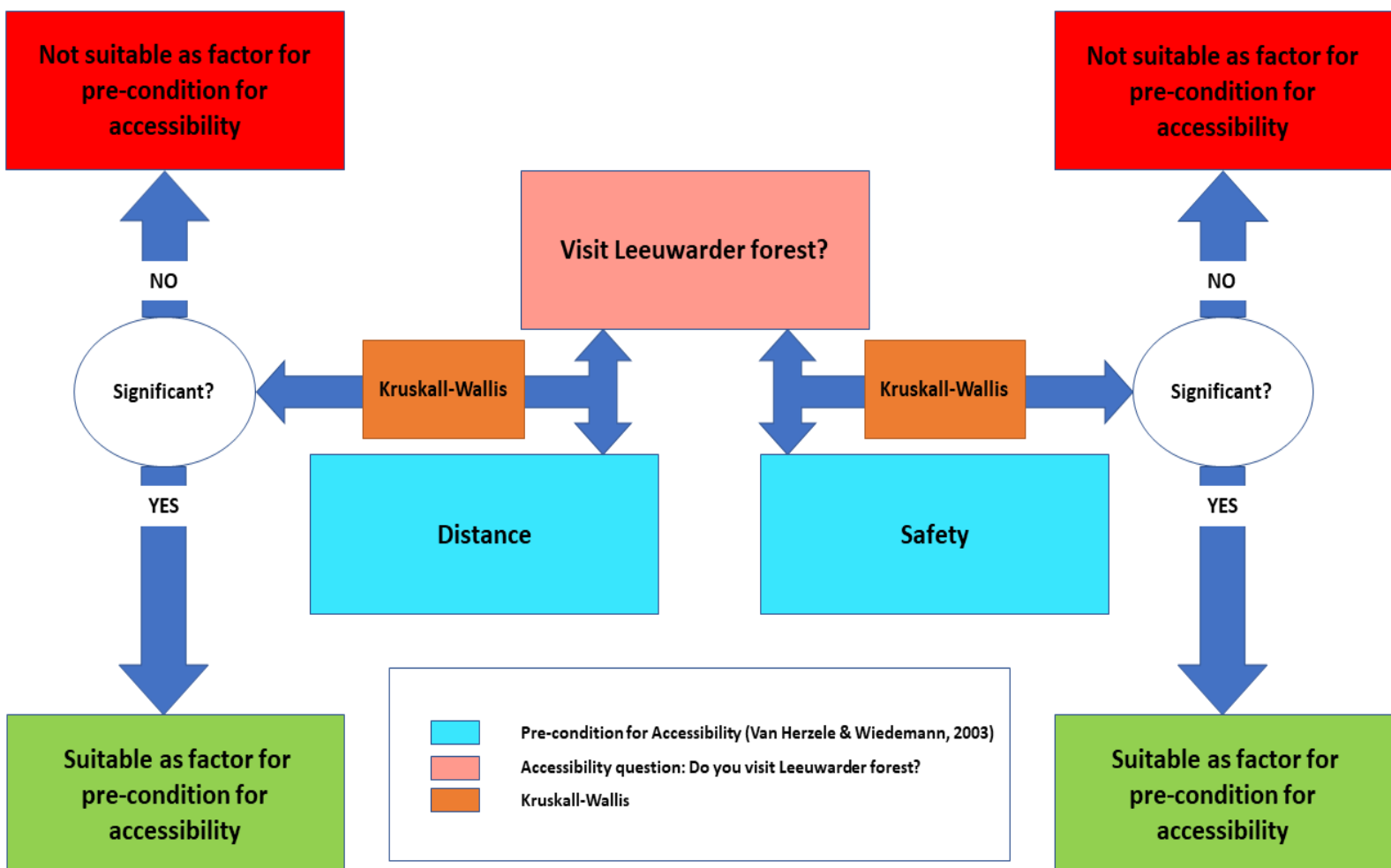
Appendix 1: Questionnaire table

Questions	Measurement level	Answer options	Aim of the question	Notes
1.. Consent question: Do you agree that your answers to this survey will be utilized for academic purposes only?		Yes No	Only respondents who answered “Yes” , will be concluded in this study.	
Questions concerned with Distributive justice			The following questions aims to find out if visitation of The Leeuwarden forest is based on indicators of pre-conditional accessibility, following Van Herzele & Wiedemann (2003)	
2.. Do you ever visit the Leeuwarder forest?	nominal	Yes No		If the answer is “No”, the respondent only has to answer question 3 and 4
3.. To what extend do you agree with the following statement: “The Leeuwarder forest is a safe environment”	ordinal	Strongly disagree Disagree Neutral Agree Strongly agree		
4. How far do you live from the Leeuwarder forest?	ordinal	0-400 meter 400-800 meter 800-1200 meter .> 1200 meter		
Questions concerned with recognition related justice			The following questions aim to find out whether preferences for cultural services are related to perceived quality and rate of visitation, following Fongar et al. (2019).	
5.. How often do you visit the Leeuwarder forest?	ordinal	A few times a year Monthly Weekly A few times a week Daily		

6. For which reasons, in general, would you visit an urban green space?	Nominal (Yes/No for each option)	<p>(Social activities)</p> <ul style="list-style-type: none"> • Spend time with family or friends • Picknick or BBQ • Other... <p>(Physical activities)</p> <ul style="list-style-type: none"> • Exercise/running • Team sport • Other... <p>(Experiences)</p> <ul style="list-style-type: none"> • Enjoy nature • Stress relief • Peace & quiet • Other... <p>(Amenities)</p> <ul style="list-style-type: none"> • Benches • Trashcans • Other... 	reveal the cultural service preferences of respondents	
7. Which of the above mentioned are satisfied when visiting the Leeuwarder forest?	nominal	Same as for question 6		
8. To what extent do you agree with the following statement: “I am satisfied with the quality of the Leeuwarder forest.”	ordinal	Strongly disagree Disagree Neutral Agree Strongly agree		
Socio-demographic Questions				
9. How old are you?	Ordinal	0-18 18-30 30-65 >65		
10. What is your gender?	nominal	Male Female		

		Other...		
11. What is your ethnicity?	nominal	Native Dutch Western-immigrant Non-Western immigrant		
12. How much do you approximately earn on a yearly basis?	ordinal	0-24000 euro 24000-36000 euro 36000-48000 euro 48000-60000 euro > 60000 euro		

Appendix 2: Assessment of perceived distance & safety against visitation (yes/no)



Appendix 3: Crosstabulation indicators (perceived_Safety & distance) of pre-condition (Visit_forest)

Count		Distance				Total
		0-400 meters	400-800 meters	800-1200 meters	1200> meters	
Visit_forest	no	0	1	5	5	11
	yes	22	10	4	2	38
Total		22	11	9	7	49

Count		perceived_Safety				Total
		unsafe	neutral	safe	very safe	
Visit_forest	no	3	1	5	2	11
	yes	0	12	15	11	38
Total		3	13	20	13	49

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of perceived_Safety is the same across categories of Visit_forest.	Independent-Samples Kruskal-Wallis Test	,270	Retain the null hypothesis.
2	The distribution of Distance is the same across categories of Visit_forest.	Independent-Samples Kruskal-Wallis Test	,000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Appendix 4: Distribution of distance across socio-demographic groups (Kruskal-Wallis)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Distance is the same across categories of Age.	Independent-Samples Kruskal-Wallis Test	,711	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Distance is the same across categories of Gender.	Independent-Samples Kruskal-Wallis Test	,418	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Distance is the same across categories of Ethnicity.	Independent-Samples Kruskal-Wallis Test	,516	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Distance is the same across categories of Income.	Independent-Samples Kruskal-Wallis Test	,388	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

**Appendix 5: Spearman Rho correlation and distribution of recognized preferences
(according to theme and total) utilizing Kruskal-Wallis**

Correlations			Perceived_Qu ality	Visitation_rat e
Spearman's rho	Perceived_Quality	Correlation Coefficient	1,000	,433**
		Sig. (2-tailed)	.	,007
		N	37	37
	Visitation_rate	Correlation Coefficient	,433**	1,000
		Sig. (2-tailed)	,007	.
		N	37	37

** . Correlation is significant at the 0.01 level (2-tailed).

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of PHYSICAL_ACTIVITIES is the same across categories of Perceived_Quality.	Independent-Samples Kruskal-Wallis Test	,171	Retain the null hypothesis.
2	The distribution of SOCIAL_ACTIVITIES is the same across categories of Perceived_Quality.	Independent-Samples Kruskal-Wallis Test	,210	Retain the null hypothesis.
3	The distribution of AMENITIES is the same across categories of Perceived_Quality.	Independent-Samples Kruskal-Wallis Test	,394	Retain the null hypothesis.
4	The distribution of EXPERIENCES is the same across categories of Perceived_Quality.	Independent-Samples Kruskal-Wallis Test	,766	Retain the null hypothesis.
5	The distribution of TOTAL_SATISFIED_PREFERENCES is the same across categories of Perceived_Quality.	Independent-Samples Kruskal-Wallis Test	,675	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of PHYSICAL_ACTIVITIES is the same across categories of Visitation_rate.	Independent-Samples Kruskal-Wallis Test	,826	Retain the null hypothesis.
2	The distribution of SOCIAL_ACTIVITIES is the same across categories of Visitation_rate.	Independent-Samples Kruskal-Wallis Test	,521	Retain the null hypothesis.
3	The distribution of AMENITIES is the same across categories of Visitation_rate.	Independent-Samples Kruskal-Wallis Test	,587	Retain the null hypothesis.
4	The distribution of EXPERIENCES is the same across categories of Visitation_rate.	Independent-Samples Kruskal-Wallis Test	,119	Retain the null hypothesis.
5	The distribution of TOTAL_SATISFIED_PREFERENCES is the same across categories of Visitation_rate.	Independent-Samples Kruskal-Wallis Test	,273	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Appendix 6: Distribution of perceived quality across socio-demographic groups (Kruskal-Wallis)

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Perceived_Quality is the same across categories of Ethnicity.	Independent-Samples Kruskal-Wallis Test	,063	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Perceived_Quality is the same across categories of Income.	Independent-Samples Kruskal-Wallis Test	,914	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Perceived_Quality is the same across categories of Age.	Independent-Samples Kruskal-Wallis Test	,974	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Perceived_Quality is the same across categories of Gender.	Independent-Samples Kruskal-Wallis Test	,215	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.