Utrecht University

The impact of neighborhood location on crime

Abstract

The city of Amsterdam holds one of the highest crime rates in the Netherlands, with nearly 10% of all registered criminal offences in the country having taking place in its municipality in 2019. Scientific research has shown that there are many complex factors that influence where crime takes place within cities and that there are distinct differences between neighborhoods with respect to the types of crime that occur. This study aims to find out whether the geographical location of neighborhoods impacts crime rates, and specifically if the spatial distance from inner cities to other neighborhoods influences crime rates in those respective neighborhoods. Using data from the Nationale Veiligheidsmonitor (2017) and data provided by the municipality of Amsterdam and the Dutch Central Bureau for Statistics, three hypotheses were tested. Control variables focused on collective efficacy and resource proximity were added to examine whether any effects found for distance could have been influenced by underlying factors. The results provided no conclusive effect of spatial distance on crime, but rather the significant effects that were found were caused by the variables surrounding collective efficacy and resource proximity. Based on this, further research should take into account characteristics of neighborhood communities and resource proximity within neighborhoods to come to policy implications for communities in disadvantaged neighborhoods and efficient resource allocation to combat crime rates.

Keywords: *neighborhood location; crime; collective efficacy; resource proximity*

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Introduction

The Dutch city of Amsterdam ranks at number 309 out of 431 cities on the 2021 Crime Index (Numbeo, 2021); a low number that suggests Amsterdam to be one of the safer cities in the world. Nevertheless, nearly 10% of all registered criminal offences in The Netherlands in 2019 took place in the municipality of Amsterdam (CBS, 2020). This could be considered quite a large percentage attributed to only one municipality out of the 355 that existed in The Netherlands in 2019 (VNG, 2018). Moreover, about 5% of the Dutch population lives in the municipality of Amsterdam (CBS, 2020). Comparing this to the 10% of all registered criminal offences that occur in the city, there is a relatively high amount of crime in Amsterdam compared to the rest of the Netherlands, in terms of population.

Naturally, crime is not evenly distributed across any city; certain neighborhoods may be subjected to more crime than others. Research has shown that variations in levels of violent crime in certain neighborhoods are attributed to complex aspects such as disadvantage, segregation, land use, social control, social capital, social trust, and characteristics of other close-by neighborhoods (Sackett, 2016). A study by Schreck, McGloin & Kirk (2009) on Chicago neighborhoods found that neighborhoods are clearly distinguishable based on the types of crime that occur. The results revealed that certain neighborhoods showed higher violent crime rates that were unlikely to be fortuitous, whereas other neighborhoods showed higher rates of nonviolent crime which were just as unlikely to happen by chance. These findings were then connected to social disorganization theory, which suggests that a disorganized neighborhood may be subjected to more crime due to the combination of lack of social control and exposure to criminal cultural settings. The results suggested that social disorganization stimulates both violent and nonviolent offending, however more so in the case of violent offending. Ultimately, the study found that neighborhood disorganization more so influences the social control of violence than nonviolence.

A study in the light of spatial criminology by Bernasco (2008) has found that when looking at burglaries in the Dutch city of The Hague specifically, repeat burglaries and "near repeat" burglaries – meaning burglaries in the immediate environment of the first burglary – very often involve the same offenders. Thus, the offender is likely to return to an environment victimized by their own previous crime. This suggests that once one burglary has occurred in a certain neighborhood it is exponentially more likely to happen again, which would in turn increase the crime rate of that neighborhood.

While much research has been conducted on the spatial distribution of crime within neighborhoods, there is an aspect that is not included in the equation as much: distance, and

specifically neighborhood location within cities. Certain studies have focused on distance in the realm of offender mobility, concerning the distance from an offender's home to the locations where they commit their crimes; also known as geographic profiling (Rossmo & Rombouts, 2008). However, little research has been conducted on the aspect of distance in a more literal geographical sense. For instance, how cities are geographically divided into neighborhoods or districts, and how this affects crime rates across these divisions. With that, the purpose of this study is to identify in what ways the distance from inner cities to surrounding neighborhoods impacts crime rates in those respective neighborhoods. The results of this study will ideally shed light on the factors that contribute to crime distribution in cities, which can be utilized in policymaking surrounding crime prevention altogether. Ultimately, the following research question will be answered: *"What is the impact of the spatial distance from inner cities to other neighborhoods on the amount of crime in those neighborhoods?"*

To answer this question, this study will specifically focus on the city of Amsterdam, using data provided by the Municipality of Amsterdam and the Dutch Central Bureau for Statistics. The element of crime is represented within the dataset with a crime index variable. Both criminal offenses registered by the police and victimization numbers based off of questionnaires are included in this variable to give an accurate representation of the amount of crime in the neighborhoods that will be analyzed. The element of distance will be incorporated by dividing the city of Amsterdam into categorical rings partially based on the concentric zone theory, which will be elaborated on in the theoretical chapter of this study.

Theory

To answer the research question "What is the impact of the spatial distance from inner cities to other neighborhoods on the amount of crime in those neighborhoods?" it is vital to incorporate general theories of crime in neighborhoods and why it takes place. In addition to that, the aspect of spatial distance and geography needs to be included as well.
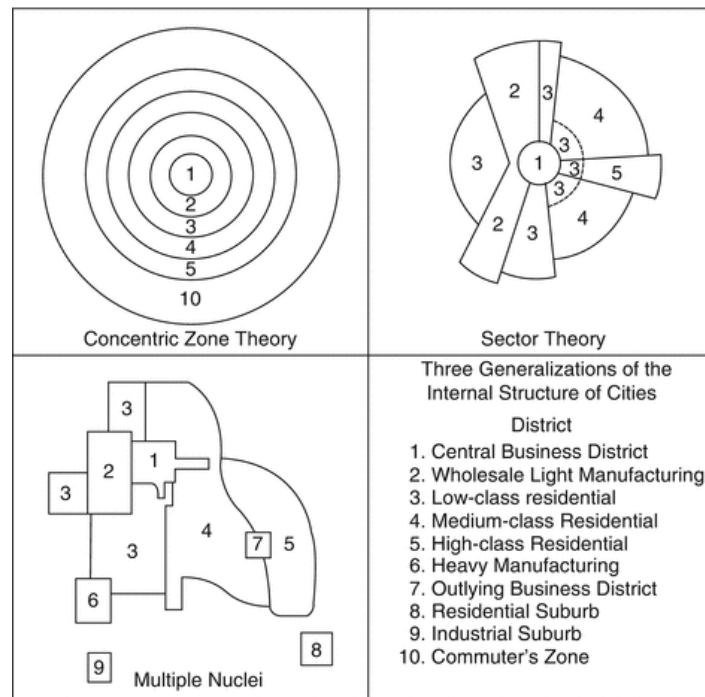
Concentric zone theory

Created by sociologist Ernest Burgess in 1925, the concentric zone model is an influential theoretical model that explains urban social structures. The main premise is that urban growth has the tendency to expand from its central business district through multiple concentric circles, or zones. Burgess' model identified five zones: (1) the central business district, (2) the transition zone, (3) the working-class zone, (4) the residential zone, (5) the commuters' zone (Park, Burgess, & McKenzie, 1925). According to Lersch (2011), the transition zone is

considered the least desirable city zone to live. Burgess described it as a melting pot of poor, immigrant, destitute, and criminal. The outermost zones on the model generally adapt to conventional norms, respect for law enforcement, and community maintenance (Siegel, 2009). The commuters' zone especially is considered to have "the highest standard of living and better quality of life" (Planning Tank, 2021). In contrast to this, the zones on the inner parts of the city do not seem to connect to these aspects in the same way as the outermost zones due to factors out of their control, such as being ignored and disenfranchised (Lersch, 2011). Based on this theory, one could argue that crime occurs more often in the inner parts of a city, closer to the center. However, the concentric zone theory has faced a great deal of criticism since its development.

For example, it is almost exclusively applicable to cities in the United States, as the pattern was based on the typical growth of American cities. After attempting to apply the concentric model to pre-industrial European cities, it was found that they did not follow the model and thus rendered ineffective. Due to changes in transportation and ways of commuting, its relevance has decreased largely. However, this last point of criticism could actually be applied to the city of Amsterdam. The theory focuses more so on public transit than on motorized transportation (Rodrigue et al., 2020). While this may cause for it to be an exemplary product of its own time in the United States, it makes it all the more applicable to Amsterdam where public transport is one of the most popular and efficient forms of transportation.

As mentioned previously, the concentric zone model divides cities in several concentric circles that surround the central business district. Other models that have been built upon the idea of the concentric zone theory, such as the sector model (Hoyt, 1939) and the multiple nuclei model (Harris & Ullman, 1945) take a less structured and more particularly divisive approach to the theory of urban social structures, as seen in figure 1.0. The sector model shows the city as a series of "wedges" that extend outwards from the central business district. The multiple nuclei model shows the city as multiple individual centers that each have their own surrounding clusters.

Figure 1.0: Classic models of urban land use (Harris & Ullman, 1945).

Neither of these models is particularly applicable to the city of Amsterdam. Therefore, the concentric zone model will be used as a starting point for this study, as it correlates with the element of spatial distance from the city center more so than other similar theoretical models. While the concentric zone model builds its circles upon the central business district, the center of the city of Amsterdam can be classified as a commercial city center. It is focused on shopping, tourism, and nightlife, rather than business. Despite the difference between these two types of city centers, the distance from a commercial city center to outer neighborhoods could still have implications for the amount of crime. Neighborhoods close to the commercial city center may be busier, for example due to tourism; this could result in more opportunity for crime. However, there are many other factors that affect crime, and neighborhoods far from the inner city have been proven to experience many crime related problems as well. Therefore, the districts of Amsterdam will be divided into categories around the city center, similar to the circular division of the concentric zone model. Each category will represent a new element of distance, which will be discussed further in the method section of this research project.

Routine Activity Theory

The routine activity theory was first developed by Cohen & Felson in 1979. This theory attempts to explain opportunity of crime and identify the patterns that go along with it. It is defined by three essential components: a motivated offender, a suitable target, and the absence

of capable guardianship. As the name suggests, this theory focuses on routine activities of both offenders and victims, taking into account situational aspects and travelling movements to gain insight into patterns of crime (Cohen & Felson, 1979). For example, an offender may regularly go to the same neighborhoods and be able to identify suitable targets for crime. A family house that is left unoccupied could be at risk for burglary. This brings up the combination of the burglar's routine locations and the occupants' movement away from their home, leading to opportunities for crime (Purpura, 2013).

In contrast to a place being left unattended, large crowds of people and busy streets bring about suitable crime targets as well: especially in the realm of pickpocketing and theft. The center of a city generally accounts for the busiest part of a city, due to the combination of tourism, shopping, restaurants, nightlife, and so on. Therefore, city centers and adjacent neighborhoods could potentially attract crime as well. Focusing on the theoretical element of guardianship, it is safe to assume that while capable guardians may be present in the city center, busy areas containing large crowds can make it complicated to detect suspicious situations.

Based on the theory behind the concentric zone model and the elements of the routine activity theory, the following hypothesis will be tested:

H1: More crime occurs in neighborhoods close to the city center than in neighborhoods further away from the city center.

Collective efficacy theory & social disorganization theory

The collective efficacy theory was first introduced by Sampson, Raudenbush, & Earls in 1997. Sampson, Raudenbush, & Earl defined collective efficacy as "social cohesion among neighbors combined with their willingness to intervene on behalf of the common good" (Sampson, Raudenbush & Earls, 1997, p. 918). The theory encompasses the idea that members of a community possess the ability to control the behavior of other members in that community. It specifically focuses on informal social control executed by community members, as opposed to formal control, which would for example be executed by institutions such as the police. Informal social control leads to members of a community achieving public order by themselves.

In 2016, Gerell & Kronkvist conducted a study on collective efficacy and police recorded public environment violent crime. After studying these components across 96 neighborhoods in the Swedish city of Malmö, results showed that low rates of collective efficacy were highly associated with violent crime in public environments (Gerrel & Kronkvist, 2016).

Another theory that focuses on the effects of social control within neighborhoods is the social disorganization theory. Social disorganization theory was developed in 1942 by Shaw & McKay, members of the Chicago School of Sociology; a group that consisted of numerous sociologists at the University of Chicago in the early 1900s. Their vision on social relations was "heavily qualitative, rigorous in data analysis, and focused on the city as a social laboratory" (Lutters & Ackerman, 1996). The latter proved to be particularly relevant for social disorganization theory. This theory argues that a socially disorganized neighborhood will experience more crime due to the combination of lack of social control and exposure to criminal cultural settings. One of the main premises is that location matters in the process of predicting illegal activity, specifically that the residential location of an individual is more crucial than other characteristics.

To be able to form a clear hypothesis, these two theories on the effects of social control within neighborhoods will be combined to serve as a general element of collective efficacy. To gain insight into the amount of collective efficacy in Amsterdam neighborhoods, and if there is any correlation between the social control and amount of crime in these neighborhoods, the following hypothesis will be tested:

H2: The impact of distance from the city center to outer neighborhoods on crime is (partially) explained by collective efficacy.

Strain theory

Strain theory was developed by Robert K. Merton in 1938. It describes the stress that individuals experience when they are unable to achieve what society deems as success due to a discrepancy between the desired goals and the means available to them. Merton focused specifically on the concept of the American Dream, which encourages people to strive for success while claiming equal opportunities for all regardless of social class, or financial and racial background. He drew attention to the fact that success was actually not equally attainable for everyone and pointed out that people who cannot accomplish their goals experience strain. Merton argued that this is specifically relevant to people from lower social classes, for whom the American Dream had turned into an ideal. When not accomplished, it could be viewed as a lack of effort rather than a predisposed lack of legitimate means. As a result of this, the only way for these people to try and achieve their success is through crime (Merton, 1938). Material success could be achieved through theft, robbery, or virtually any other illegal way of obtaining financial means.

Living in the inner city is generally more expensive than living further away from the city center, therefore the mean level of income is lower in neighborhoods far away from the city center. This ties in with the level of social class in those neighborhoods. Based on strain theory, it is safe to assume that the people in these neighborhoods have less legitimate resources, such as money and education, to achieve their goals; thus, they are more likely to experience strain, and more likely to become involved in crime. Based on this, the following hypothesis will be tested:

H3: More crime occurs in neighborhoods further away from the city center than in neighborhoods close to the city center.

Method

Data

The dataset used for this research project was made available by the City of Amsterdam. The data was taken from the Landelijke Veiligheidsmonitor, or National Safety Monitor, along with data provided by the municipality of Amsterdam and data on registered crime provided by the police. The Landelijke Veiligheidsmonitor monitor is conducted every two years by the Dutch Central Bureau for Statistics [CBS]. It focuses on safety, quality of life, fear, crime prevention, victimization, attitudes towards police, and other themes surrounding the safety of the general population and their environment. The data is measured on national, regional and local levels (CBS, 2018). For this project, the 2017 data of the City of Amsterdam will be used.

The data was collected in 2017 from August until November through online questionnaires and paper questionnaires. A stratified sample was taken of over 380.000 Dutch citizens aged 15 years and older, who were then asked to participate in the study. To obtain reliable figures on police district level, an obligatory minimum of 65.000 respondents needed to be met. In the end, the response was 39.3%. This resulted in nearly 150.000 respondents nationwide, securing the reliability of the study (CBS, 2018). The results have been calculated for every neighborhood in Amsterdam. The mean results of the questions in the questionnaire have been assigned to the respective neighborhoods, resulting in operable variables.

In addition to the safety monitor dataset, some other variables will be added to the analysis. The additional data was collected by the municipality of Amsterdam and the Central Bureau for Statistics and will be discussed further along in this chapter.

Variables

This research project is focused on the influence of distance on the amount of crime in neighborhoods. In this research prompt, crime is the dependent variable, which will be measured with a crime index. The independent variable is distance. To measure this, the districts of the city have been divided into four different categories of distance from the city center, and then grouped together in the dataset to fit those categories.

Crime

To measure the amount of crime in the neighborhood analysis, the dependent variable "criminaliteitsindex" will be used. This translates to crime index. The crime index is a combination of the variables High Impact Crime index (HICindex) and High Volume Crime index (HVCindex). The distinction made between these two types of crime involves the impact the crime in question has on the victim involved. A crime that impacts the victim personally, such as violence, would be classified as High Impact crime. Crimes that happen at much higher rates that do not affect the victim as personally or directly, such as car theft, are classified as High Volume Crime. Both of these variables include police data and victimization numbers (Gemeente Amsterdam, 2015). In the dataset, the values of these variables are added up together and then divided by two which leads to the mean that is then used as the crime index number. The numbers that make up this variable are partially based on questions from the questionnaire and on registered crime numbers provided by the police. The crime index scores are calculated based on the difference in crime per a certain population compared to the average scores from 2014. Thus, a score below 100 would mean that there is more crime compared to 2014, and a score above 100 would mean that there is more crime.

Neighborhoods of Amsterdam

As explained in the theoretical framework, the neighborhoods will be divided into categories, inspired by the ideas behind Burgess' concentric zone theory (Park, Burgess, & McKenzie, 1925). Another reason for the categorization is that measuring literal physical distance in kilometers would bring certain limitations, as this would not account for factors such as public transport stations or tracks, bodies of water, public parks, and so on. Furthermore, the center of a neighborhood might differ greatly from the outer borders of that neighborhood and thus only measuring the distance to that center could be a false representation when combining it with the data from the safety monitor. To incorporate the concept of distance into the analysis,

a categorical variable "distance" will be created based on the division of the neighborhoods of Amsterdam.

To illustrate the division, the neighborhoods have been color-coded to display their respective categories in figure 2.0. The city of Amsterdam officially contains 99 districts; however, some districts have been grouped together in the dataset. These districts have been visually connected to each other in the map. The dataset also contains districts around Diemen, Duivendrecht, and some in Amstelveen. These will not be incorporated in the analysis.

The darkest green represents the city center. The neighborhoods in this category will not be incorporated in the analysis, as this would go against the research question: after all, the point of this project is to find out if the distance from the city center matters for the amount of crime in the neighborhoods outside of the city center. Moreover, the districts that make up the city center differ greatly from surrounding neighborhoods, considering they are more so focused tourism, shopping, restaurants and nightlife rather than residency.

The remaining categories have been divided into four rings in the dataset. The first ring is represented by the slightly lighter green color around the city center, where neighborhoods are directly connected or very close to the city center. The next color represents the ring 2, and the next color represents the connected ring 3. The districts of the Bijlmer will be analyzed separately as ring 4, as they are not directly connected to the city itself, due to the village Duivendrecht and part of the municipality of Diemen being located between the city region and the Bijlmer. This accounts for an even larger concept of distance which could enrich the grasp of the analysis. While the Bijlmer is not directly connected to the city, there is a direct metro line between the Bijlmer and Amsterdam Central Station.

Figure 2.0: Map of all neighborhoods in Amsterdam divided into five categories.
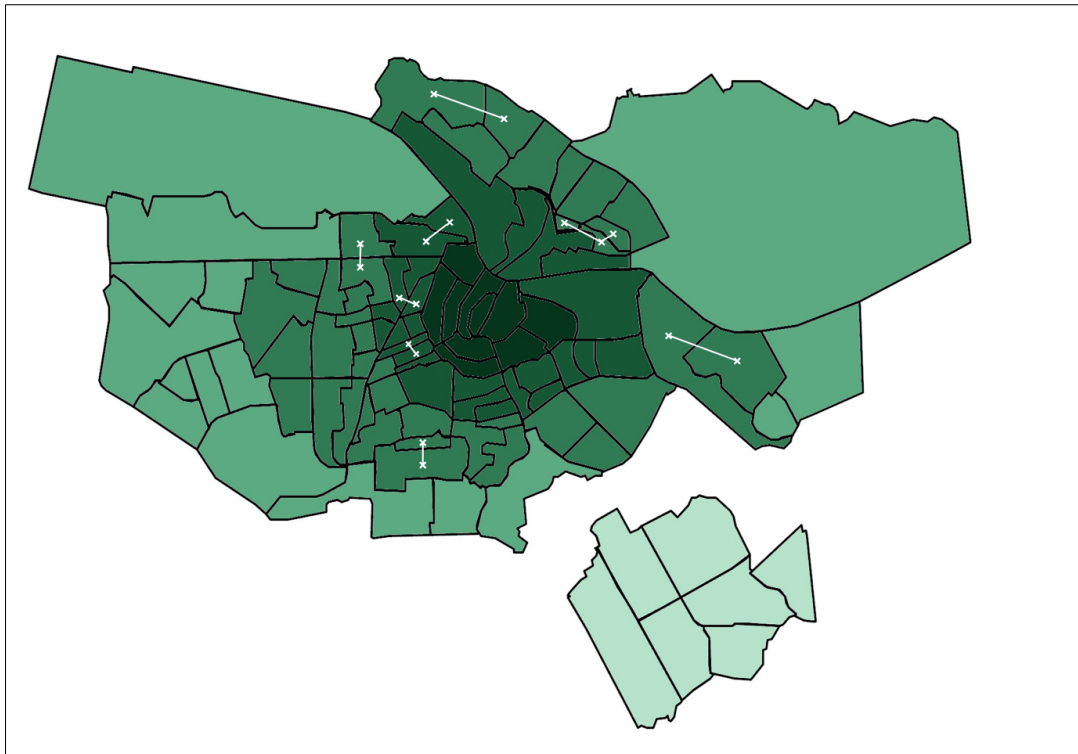
Note: Adapted from *Gebiedsindelingen* [Map], by Gemeente Amsterdam
(https://maps.amsterdam.nl/gebiedsindeling/)

Control variables

To find out whether the possible effect of distance on crime could be explained through other characteristics, several control variables will be added to the analysis. These control variables aim to ensure whether the effect of distance could be explained through either neighborhood community characteristics or through the number of resources that are available and whether this differs in neighborhoods close to and further away from the city center.

Proximity to resources

One of the control elements of this analysis is the proximity to different resources. In 2018, Tung, Boyd, Lindau & Peek (2018) conducted a study on neighborhood crime and access to health-enabling resources. The results led to the assumption that crime in neighborhoods could be associated with problems in accessing health-related resources. Moreover, the proximity to resources could also be connected to strain theory, as mentioned in the theoretical framework. A lack of desired and necessary resources in close proximity could inhibit individuals in their

daily functioning, leading to the strain and stress that come with not being able to achieve goals due to factors outside of their control.

Based on these findings, several variables surrounding the proximity to resources will be included in this analysis to further evaluate the effect of the spatial distance between inner cities and outer neighborhoods on the amount of crime, and if that effect holds up once these variables are included. The variables will include traditional healthcare resources as well as resources surrounding social care.

The CBS carries out annual research on the proximity to resources in all Dutch municipalities and neighborhoods. These numbers are published as proximity statistics (CBS, 2020). The dataset includes various resource themes such as healthcare, hospitality, education, and others. In this analysis, we will be using the 2017 proximity statistics of Amsterdam. The following variables will be included: the distance to a doctor's office, the distance to a large supermarket, the distance to a daycare facility, and the distance to an elementary school.

Duration of residence (residential mobility)

As mentioned in the theoretical framework of this project, the amount of collective efficacy influences crime rates within neighborhoods. One factor that contributes to the height of collective efficacy in a neighborhood is residential mobility. Residential mobility can be defined as "residence relocation regardless of the distance between the dwellings" (Le Roux, 2019). As explained by Sampson, Raudenbush & Earls (1997), one of the most important reasons that residential mobility influences collective efficacy is the fact that the development of social bonds takes time. Frequently moving around inhibits residents from making these social connections, thus resulting in lower collective efficacy rates.

To incorporate this element of residential mobility in the analysis, the variable "duration of residence" has been added to the dataset. Based on the aforementioned theory, we expect neighborhoods with a higher mean duration of residence to experience less crime than those with a lower mean duration of residence. The variable will be incorporated as a control variable.

Analytical Strategy

To analyze the impact of distance on crime, the first part of the analysis will consist of examining each of the variables that will be included further along. Next, a Pearson's correlation analysis will be carried out for the dependent variable crime and each of the independent and control variables. Afterwards, two regression analyses will be executed. Firstly, a regression analysis will be carried out including the crime index and the variables

surrounding the concept of distance. Lastly, a multiple regression analysis will serve to analyze the effect of five control variables on the relationship between distance and crime.

Results

Descriptive statistics

To start off the analysis, the descriptive statistics of each of the variables are presented in Table 1. As mentioned in the methodical chapter of this study, the city of Amsterdam has 99 districts, although some have been grouped together in the dataset, resulting in 91 districts. Since the ten districts that make up the city center will not be incorporated in the analysis, we end up with an N of 81. The variable "cityring" has been created, containing five categories in total. As explained in the methodology chapter of this project, the ten districts that make up the city center will not be incorporated in the analysis, as the goal of this study is to shed light on whether the distance from the city center to outside neighborhoods matters for the amount of crime in the neighborhoods outside of the city center. Therefore, these ten districts have been put in a fifth category, and the first four categories that represent the four divisions around the city center will be incorporated in the analysis. The cityring variable has been recoded into four dummy variables to represent the four district divisions and will account for the element of distance further along in the correlation and regression analyses. The percentage of districts attributed to each ring has been displayed in table 1.

The mean crime index is 88.42, significantly lower than the maximum crime index of 204.44. The average duration of residence at one address for an Amsterdam citizen is 8.6 years. Each of the control variables regarding proximity to resources have a mean score close to .5, meaning that the distance to these resources is around half a kilometer on average.

Table 1. Descriptive statistics

	N	Min.	Max.	Mean	Std.
Dependent variable					
Crime index	81	42.56	204.44	88.4240	27.28070
Independent variable					
Distance	81	1.00	4.00	2.1728	1.00983
Ring 1	28.4%				
Ring 2	40.7%				
Ring 3	16.0%				
Ring 4	14.8%				
Control variables					
Duration of residence	81	2.1	15.6	8.678	2.2076
Distance to a doctor's office	81	.2	2.6	.563	.4164
Distance to a daycare facility	81	.1	1.9	.414	.2489
Distance to a large supermarket	81	.1	2.2	.577	.3617
Distance to an elementary school	81	.2	1.9	.519	.2632

Correlations

Table 2 shows the results of the correlation analyses that were carried out between the dependent variable and the independent and control variables to determine whether there is any correlation between the distance from the inner city to outer neighborhoods and crime. A point-biserial correlation was performed for each of the independent variables. The results show one significant correlation between ring 4, which represents the districts of the Bijlmer and those that surround it, and crime $(r_{pb}(80) = .288^{**}\ p < .01)$. While this correlation indicates a positive relation between the furthest city ring and the crime index, none of the other rings show any significant results, therefore there are no conclusions to be drawn thus far.

Subsequently, a Pearson's correlation was carried out for each of the control variables. The results show one significant correlation, specifically between the distance to a daycare facility and the crime index. This positive correlation shows that neighborhoods with a larger distance to a daycare facility may experience more crime $(r\ (80) = .324, p < .01)$.

Table 2. Correlations (N=81)

	Crime index
Independent variable	
Ring 1	-.036
Ring 2	-.206
Ring 3	.040
Ring 4	.288**
Control variables	
Duration of residence	-.161
Distance to a doctor's office	.073
Distance to a daycare facility	.324**
Distance to a large supermarket	.137
Distance to an elementary school	.212

*p<.05. **p<.01.

Regression

Table 3 shows the results of the regression analysis of the relationship between distance and crime. The dummy variables ring 2, ring 3, and ring 4 were incorporated in the analysis. A multiple linear regression was carried out to shed light on the effect of distance on the amount of crime in each city division. The regression model proved to be significant (R^2 = .098, F (3,77) = 2.789, p < .05), although not all three variables that were added resulted in statistically significant effects. There were no significant effects found for ring 2 (B = -5.178, t (80) = -.722, p = .473) and ring 3 (B = 4.045, t (80) = .441, p = .660). The regression model did show a significant positive effect for ring 4 (B = 20.268, t (80) = 2.155, p < .05), which covers the Bijlmer and its surrounding districts, which is the category that is the furthest removed from the city center. This could indicate that the neighborhoods that are furthest away from the city center experience the most crime, which is directly opposite to *"H1: More crime occurs in neighborhoods close to the inner city than in neighborhoods further away from the inner city."*, but completely in line with *"H3: More crime occurs in neighborhoods further away from the city center than in neighborhoods close to the city center."* However, further analysis is needed

to confirm whether distance is the main factor that influences crime in this case, or if there are other factors involved that cause this effect.

Table 3. Regression analysis of the relationship between distance and crime

	B	SE
Constant	86.882	5.507
Ring 2	-5.178	7.174
Ring 3	4.045	9.164
Ring 4	20.268*	9.405

Note: Dependent variable: crimeindex.

*p<.05.

Another multiple regression was executed to examine the effects of the control variables on the crime index, the results of which are displayed in Table 4. The control variables duration of residence, distance to a doctor's office, distance to a daycare facility, distance to a large supermarket and distance to an elementary school were added to the regression model. This regression model also proved to be significant (R^2 = .259, $F (6,74) = 4.313$, $p < .001$). There were no significant effects found for ring 2 (B = -5.857, t (80) = -.849, $p = .399$), ring 3 (B = -2.337, t (80) = -.245, $p = .807$), and ring 4 (B = -18.844, t (80) = 1.922, $p = .059$). The control variables distance to a doctor's office (B = -10.343, t (80) = -1.079, $p = .284$), distance to a large supermarket (B = -13.643, t (80) = -.984, $p = .346$) and distance to an elementary school (B = 2.730, t (80) = .153, $p = .879$) did not yield any significant effects either. The two control variables that did show significant effects were duration of residence (B = -2.862, t (80) = -2.203, $p < .05$) and distance to a daycare facility (B = 56.972, t (80) = 3.180, $p < .01$). The regression model shows that the effect of ring 4 that was found in the first regression analysis is diminished once the control variables are added. This leads to the outcome that while *H3: More crime occurs in neighborhoods further away from the city center than in neighborhoods close to the city center."* cannot be denied, distance is not the main factor in this finding. However, the decrease of the effect of ring 4 due to the addition of the control variables is in line with "*H2: The impact of distance from the city center to outer neighborhoods on crime is (partially) explained by collective efficacy"*. The results show a significant effect for duration of residence, which is the variable associated with collective efficacy, but the effect of distance

is diminished. This leads to the assumption that collective efficacy may partially explain the effect of distance on crime. The negative significant effect of duration of residence on the crime index indicates that a higher duration of residence leads to a lower crime index. The positive significant effect of distance to a daycare facility on the crime index indicates that neighborhoods where the distance to a daycare facility is larger may experience more crime than neighborhoods that have daycare facilities closer by.

Table 4. Effects of control variables on crime

	B	SE
Constant	101.937	12.320
Ring 2	-5.857	6.897
Ring 3	-2.337	9.523
Ring 4	18.844	9.804
Duration of residence	-2.862*	1.299
Distance to a doctor's office	-10.343	9.584
Distance to a daycare facility	56.972**	17.916
Distance to a large supermarket	-13.643	14.397
Distance to an elementary school	2.730	17.815

Note: Dependent variable: crimeindex

$*p<.05. **p<.01$

Conclusion

The aim of this study was to answer the following research question: *"What is the impact of the spatial distance from inner cities to other neighborhoods on the amount of crime those neighborhoods?"*. Based on the quantitative analysis on the influence of distance and several control variables on crime, there is no clear relationship between distance from inner cities to outer neighborhoods and the amount of crime in those neighborhoods. Three hypotheses were tested by conducting two regression analyses to come to this conclusion.

The first regression analysis aimed to test "*H1: More crime occurs in neighborhoods close to the inner city than in neighborhoods further away from the inner city*" and "*H3: More crime occurs in neighborhoods further away from the city center than in neighborhoods close to the city center.*" While the regression model was significant, only one of the dummy

variables contributed to this. The effect was found for ring 4, which covered the neighborhoods furthest away from the city center. Therefore, hypothesis 1 could not be confirmed. Nevertheless, this effect did lead to the confirmation of hypothesis 3, but further analysis was necessary to confirm whether this effect was in fact caused by distance, or by other factors.

The second regression analysis aimed to test "*H2: The impact of distance from the city center to outer neighborhoods on crime is (partially) explained by collective efficacy*", while also including several control variables to further explore effects on the crime index. Once the control variables were added to the analysis, the effect of ring 4 on crime was diminished. The variable duration of residence, which was connected to the concept of collective efficacy, was added to the analysis to test hypothesis 2. The regression model showed a negative effect of duration of residence on the crime index; therefore, it is safe to assume that crime rates are lower when there is a higher duration of residence in that area. Moreover, the fact that the effect of ring 4 decreased once the control variables were added has led to the confirmation of hypothesis 2, as the effect of the variable associated with collective efficacy has contributed to the decrease of the effect of distance on crime. Based on this, we can assume that collective efficacy may partially explain the effect of distance on crime. The significant negative effect of duration of residence on crime corresponds with the assumption that neighborhoods that possess less collective efficacy experience more crime.

In regard to hypothesis 3, the finding that the effect of distance was diminished once the control variables were added indicates that while the hypothesis cannot be rejected, distance is not the main factor contributing to the crime index; rather the control variables that were added contribute to the effect on the crime index.

Another control variable that showed a significant effect on crime was distance to a daycare facility. The positive effect that was found in the analysis indicates an increase in crime when there is a large distance to the nearest daycare facility. This is in line with the study results as found by Tung, Boyd, Lindau & Peek (2018), leading to the assumption that the proximity to different resources may influence crime rates. However, none of the other variables related to proximity to resources showed any significant effects.

Discussion

To examine the effect of neighborhood location on crime, this research project used data from the 2017 Landelijke Veiligheidsmonitor and the Central Bureau for Statistics, focusing on the city of Amsterdam. The data was collected through a stratified sample and the results were calculated for each neighborhood in Amsterdam. The representativity and validity of the data

was secured prior to the study. Based on this, we can assume that if this study was to be replicated with the same data, the results would be identical.

The results of this study have led to the conclusion that there seems to be no clear relationship between distance and the amount of crime in outer city neighborhoods. Based on the theoretical framework, a hypothesis was formed expecting that neighborhoods close to the city center would experience more crime than neighborhoods further away from the city center. A contradictory hypothesis was formed as well, expecting that neighborhoods further away from the city center would experience more crime than neighborhoods close to the city center. The only significant positive effect on crime was found for the neighborhoods furthest away from the city center, namely the Bijlmer and its surrounding districts which cover the south-east of Amsterdam. An explanation for this result may be that the south-east has long been known as an area affected by high rates of poverty and crime and faces a negative stigma as a "black area" or "Dutch Black ghetto" as it is home to one of the largest populations of immigrants and citizens with a non-Dutch background in Amsterdam (Van Engelen, 2012; van Gent & Jaffe, 2016). Research has also shown that it is an area holding high numbers of underprivileged families and citizens (Dekker, Hermens, & Zandijk, 2011), which along with the aforementioned factors could be of influence on the high crime rates in the south-east. It could also be connected to the previously mentioned strain theory by Merton (1938). Underprivileged citizens will likely experience difficulty in achieving their desired success in comparison to privileged citizens, increasing the likelihood of becoming involved in crime.

The significant result that was initially found for the neighborhoods surrounding the Bijlmer was diminished once the control variables were added to the analysis. The two variables that decreased the effect of distance were duration of residence, which was added to measure collective efficacy, and distance to a daycare center, which was added to examine resource proximity. Therefore, the situation in and around the Bijlmer is most likely not a product of distance, but a product of community factors and socio-economic characteristics.

The relationship between residential mobility, distance and crime was examined in this research project as well. While there was no effect found for the relationship between residential mobility and distance on crime, the results did show interesting effects between residential mobility on its own and crime. The analysis resulted in a negative effect, meaning that a higher duration of residence in a certain area could result in lower crime rates. Research has repeatedly shown that high residential mobility negatively affects social cohesion and destabilizes social networks (Volker, Flap, & Lindenberg, 2006). In addition to this, the anticipation of others relocating could act as a negative incentive for neighborhood residents

and prohibit them from pursuing stronger social connections (Putnam, 2007). The results of this study are therefore in line with prior research and can be considered for further research on residential mobility in Amsterdam in relationship to crime rates.

The analysis also led to insight on the relationship between the distance to a daycare facility and crime. The positive effect that was found was in line with the study by Tung, Boyd, Lindau & Peek (2018) on neighborhood crime and access to health-enabling resources. Moreover, it has added to the notion that proximity to resources in general affects crime rates, as a daycare facility would not necessarily be considered a health-enabling resource but rather a social care resource. This could be taken into account for further research on the concept of resource proximity and crime.

There are several limitations to this study. The analysis was based on a visual division of the city of Amsterdam, mostly striving to just create logical divisions, but also striving to make the size of the categories approximately the same to create somewhat equal categories. This idea was partly based on the concentric zone theory by Burgess (1925), and on the limitations that the measuring of literal physical distance might bring as mentioned in the methodological section. Nonetheless, future research may yield different results by taking a different approach to the concept of distance; for example, measuring the physical distance in kilometers. Furthermore, the results of this study may be applicable to the city of Amsterdam, yet due to the unique nature of the city they may not be applicable to other European or even Dutch cities.

While this study did not find conclusive results on the relationship between the distance from inner cities to outer neighborhoods and the amount of crime in those neighborhoods, it did find insightful results on the importance of collective efficacy and resource proximity and availability. These findings could contribute to policy implications surrounding communities within troubled neighborhoods and efficient resource allocation. Amsterdam remains to be one of the cities with the highest crime rates in the Netherlands, thus further research should take into account any and all factors that could contribute to these crime rates, and how to combat these factors.

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