Desisting distance decay again: Distance does not affect whether and where adolescents offend

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Summary

Objectives: It is a well-established empirical regularity that the frequency of crime decays with the distance from the offender's home. Inspired by a classic paper by Peter van Koppen and Jan de Keijser, I argue against the widely accepted view that offenders prefer to offend near their homes. I demonstrate that, in fact, distance from home has no effect at all on an individual's choice on whether and where to offend.

Methods: Data from space-time budget interviews with 868 adolescents, including self-reported offenses, were analyzed to answer two key questions. The question whether the distance from home is related to the individual's decision of *whether to offend* is answered using a fixed-effects logit analysis of situational correlates of offending. The question of whether the distance from home is related to the individual's decision of *where to offend* is answered using a discrete spatial choice analysis.

Results: The results of both analyses suggest that distance decay is a byproduct of where adolescent offenders go during their daily routines. After accounting for where adolescents go during daily routines (their activity spaces), the distance from home is neither related to whether they commit offenses nor to where they commit them.

Conclusions: The reported findings confirm the key proposition advanced by Peter van Koppen and Jan de Keijser, namely the hypothesis that distance decay in offending does not describe a behavioral tendency of individual offenders. Instead, it appears to be a byproduct of the distance decay pattern that characterizes their habitual daily routines.

1. Personal motivation

I admire and envy Peter van Koppen most, and in this order, for his guts, his brains and his voice. The voice is a bonus, but the guts and the brains are strictly necessary when Peter takes up his favorite role of challenging conventional wisdom. In one of his many TV interviews, he addressed errors in police investigations. At the apparently rhetorical question of the interviewer whether the responsible police officers weren't all very experienced police detectives, Peter just responded that experience can also mean that one has been making the same mistake over and over again. It may sound like a truism, but I think it is a remarkable insight. In my memory (which may be biased, I know), it left the interviewer flabbergasted. Who else than Peter would dare to say this on TV at prime time?

Most of Peter's contributions to science are about the psychology of law, in particular about decision making in police investigations and in court. Occasionally, however, he has ventured into other territory. Some of his works address the geography of crime (e.g., van der Kemp & van Koppen, 2007; van Koppen & de Keijser, 1997; van Koppen & Jansen, 1998; van Koppen, van der Kemp, & de Poot, 2002), an area of research that I myself am more familiar with. His most cited work on the geography of crime appeared in *Criminology* (van Koppen & de Keijser, 1997).[1] It is titled 'Desisting distance decay: On the aggregation of individual crime trips'. In the article, the authors criticized the custom of interpreting home-crime distance decay curves as characterizing the behavior of individual offenders. The paper inspired many citations, a comment (Rengert, Piquero, & Jones, 1999) and extensive additional discussions (O'Leary, 2011; Smith, Bond, & Townsley, 2009; Townsley & Sidebottom, 2010). It also inspired me to write the present contribution.

The aggregation fallacy issue raised by van Koppen and de Keijser (1997) has largely been settled. Using statistical methods that take into account the nested structure of home-crime distance data of serial offenders —each offender has committed multiple offenses at varying distances from home— it has been demonstrated for burglary that about half of the variation between home-crime distances can be attributed to variation between offenders (Townsley & Sidebottom, 2010), and that (serial) offenders do display distance decay at the individual level (O'Leary, 2011). However, although these findings help to distinguish variation in home-crime distances at aggregate and individual levels, they do not identify the sources of this variation: they do not answer the question how the distance decay pattern can be explained.

In my contribution I use empirical materials on routine activities and offending, and challenge common interpretations of distance decay in criminal behavior, including ones that I advocated myself in prior work. I use data collected from 868 adolescents in the Study of Peers, Activities and Neighborhoods (SPAN) to demonstrate that distance plays a negligible role in their decision of whether or not to offend. Moreover, and challenging findings in the crime location choice literature, I show that if we make plausible assumptions about the available alternatives, distance is also irrelevant in their decision of where to offend. Some of the findings I present are cited from prior publications, but most are new and have not been published before.

2. Distance decay

In criminology, distance decay has been defined in various ways. A simple definition is 'Distance decay is the observed fact that offenders tend to commit more crimes closer to home than farther away.' (O'Leary, 2011: 161). This definition summarizes an empirical regularity that has been widely documented in the extant literature (e.g., Andresen, Frank, & Felson, 2014; Beauregard, Proulx, & Rossmo, 2005; Bernasco, Block, & Ruiter, 2013; Canter & Hammond, 2006; Gill, Horgan, & Corner, 2017; Hammond & Youngs, 2011; Levine & Lee, 2009, 2013; Rengert et al., 1999; Rossmo, 2000; Santtila, Laukkanen, & Zappalà, 2007; Townsley & Sidebottom, 2010; van Koppen & Jansen, 1998; White, 1932; Wiles & Costello, 2000). The evidence has occasionally been disputed for being selective because, with the exception of a few

[1] According to Google Scholar, it had been cited 125 times on November 25, 2019.

studies (e.g., Pettiway, 1995; Polišenská, 2008), it has been based exclusively on crimes cleared by the police (Van Daele, Vander Beken, & Bruinsma, 2012). Further, it has been suggested that the distance decay pattern is non-monotonic because offenders, for fear of being recognized, avoid offending in a *buffer zone* immediately surrounding their homes (Brantingham & Brantingham, 1981, p. 32; Rossmo, 2000; Turner, 1969; van der Kemp & van Koppen, 2007). However, there is only limited empirical evidence that supports this claim (Kent, Leitner, & Curtis, 2006). In sum, criminal distance decay is a fairly robust empirical regularity.

Offender characteristics such as sex and age have been related to variability in the home-crime distance. The findings suggest that demographic groups with an lower access to motorized vehicles, such as adolescents (Canter & Larkin, 1993; Snook, 2004; Van Koppen & Jansen, 1998; Wiles & Costello, 2000) offend closer to home, although a recent large-scale study found the relation between age and distance to be inversely U-shaped (Andresen, Frank, & Felson, 2013).

The distance decay pattern in the home-crime distance has been applied in an investigative technique labeled 'geographic offender profiling' (Canter, Coffey, Huntley, & Missen, 2000; Levine & Lee, 2009; Rossmo, 2000). The aim of the technique is to help solve a series of linked crimes by prioritizing suspects based on the location of their home (or other known anchor point, such as workplace or school) and the locations of the linked crimes. Based on the distance decay pattern, one would expect the offender to have his or her anchor point near most of the crime locations.

3. Distance decay and criminal decisions

A more informative but also more complex definition of distance decay transcends the empirical regularity: 'Criminal distance decay is the fundamental notion that a relationship exists between the distance from an offender's home base to a potential target location and the likelihood that the offender chooses to offend in that location.' (O'Leary, 2011: 161).

Three related aspects of this definition are important.[2] First, the definition does not refer to the frequency of offenses but to the likelihood of offending. It thus refers to a theoretical construct rather than to an empirical measure. Second, the definition refers to the distance to a potential target location rather than to the actual target location. This emphasizes that the assessment of the relationship requires a counterfactual: an event that could have taken place but did not. Third, the definition emphasizes that offending is an individual decision.

The definition, however, is ambiguous regarding the nature of this decision. Does it apply to the decision of whether or not to offend? Or does it apply to the decision of where to offend? Both interpretations are possible, but they assume different models of offender decision making, and have different implications for how to assess the relation between the distance from home and the outcome of the decision.

[2] An additional but less important feature of the definition is that it does not presume that the relationship is negative. It leaves open the possibility of a positive or a more complicated relationship.

Based primarily on the level of premeditation involved, Bennett and Wright (1984) and Elffers (2004) distinguish three categories of criminal decision making (For a discussion of premeditation and opportunity in crime, see Jacobs, 2010). In both typologies, the first category ('planners') describes a motivated offender who plans ahead the details of a prospective crime, including the target location, before committing it. The second category ('searchers') describes an individual who has decided to commit an offense and subsequently searches for a suitable target location and opportunity. The third category ('opportunists') describes an individual who has not considered offending until an opportunity or provocation appears that makes him or her decide to offend.

These models of decision making have consequences for the role of distance from home. In premeditated offenses (which include both the planner and the searcher models), the individual has decided to commit an offense, and must choose an offense location from a set of alternative locations (that vary in the distance from home). Thus, *criminal motivation is fixed* and the individual must decide *where to commit the offense*. In the analysis of this decision, the crime location is the dependent variable, while the distance from home and other attributes of the location (as compared to alternative locations) are the independent variables. This approach is followed in the literature on crime location choice (Bernasco & Nieuwbeerta, 2005; Bernasco & Ruiter, 2014; Ruiter, 2017), which I briefly discuss in section 5.

In opportunistic crimes, however, it is the *location that is fixed*, and the individual must decide *whether or not to commit the offense*. In the analysis of this decision, whether or not to offend is the dependent variable, and the distance from home and other attributes of the situation are the independent variables. This approach is taken in the literature on situational correlates of crime (Bernasco, Ruiter, Bruinsma, Pauwels, & Weerman, 2013; Wikström, Ceccato, Hardie, & Treiber, 2010), which I briefly discuss in section 4.

Because the data analyzed in this contribution do not allow me to assess the level of premeditation involved in the offenses, my analytical strategy is to follow both approaches consecutively. Thus, I will analyze the role of distance in offending twice on the same data, first by assuming the offenses were opportunistic and analyzing the decision whether or not to offend, and subsequently by assuming the offenses where premeditated and analyzing the decision of where to offend.

4. Whether to offend: Situational correlates of crime

Some or most crime may be committed during trips that started with legal intentions, such as work or school commutes, trips to shopping centers or to the homes of relatives. Empirical evidence suggests that in at least of half of all crimes, committing crime was not the reason why the offender visited the location of the crime in the first place. In an offender-based study on 113 Californian robbers, Feeney (1986) found that of the 30 percent of robbers who committed a robbery in a town other than were they lived, only half had gone there for the purpose of committing a robbery. The others were there to visit friends or relatives, or were just passing by. Other research on robbery also shows that a large percentage of robberies feature minimal planning (Wright, Brookman, & Bennett, 2006; Wright & Decker, 1997). In a sample of 243

incarcerated Australian burglars, when asked about the reason why they were in the area when they committed the burglary, only 47 percent answered they were there to commit a burglary. The others answered they were there to visit friends, to shop, by chance or because the place was near their home (Fernandez, Clare, & Morgan, 2006). Given that burglary and robbery are usually considered to involve more deliberation and planning than many other types of crime (e.g., Rhodes & Conly, 1981, p. 178), it seems reasonable to conclude that the majority of trips that result in an offense, were initiated with a non-criminal intention.

Osgood, Wilson, O'Malley, Bachman, and Johnston (1996) developed a routine activity theory of deviant behavior that is useful to explain opportunistic offending. The theory states that settings and situations of 'unstructured socializing' provide situational motivations for offending. Unstructured socializing combines unstructured activities, the presence of (multiple) peers, and the absence of authority figures. Prior research using space-time budget data demonstrated that involvement in unstructured activities, presence of peers, absence of authority figures, presence in public space and alcohol consumption are associated with an elevated likelihood of offending (Bernasco, Ruiter, et al., 2013). However, it did not assess the situational role of the distance from home. In the analyses reported below, I will use the same data and the same statistical technique (fixed-effects logit analysis) but add distance from home in the situational analysis of offending.

5. Where to offend: Crime location choice

The decision of where to offend is key in the planner and the searcher model of criminal decision making. In these models, it is assumed that offenders leave their homes or other anchor points with the intention to commit an offense. Whether or not the exact location is selected in advance (e.g. in case of planned bank robbery) or the result of a search for attractive targets (e.g., prospective burglars, pickpockets, or street robbers who may wander around looking for suitable targets), perpetrating the offense is the main purpose of the journey.

Premediated offending is an assumption underlying the discrete crime location choice approach (Baudains, Braithwaite, & Johnson, 2013; Bernasco & Block, 2009; Bernasco, Block, et al., 2013; Bernasco & Nieuwbeerta, 2005; Clare, Fernandez, & Morgan, 2009). This approach is is used to explain where offenders commit crimes. It is based on rational choice theory. It assumes that motivated offenders compare all potential locations where they might commit the offense, and select the location with characteristics that optimize the balance of expected benefits, costs and risks. Distance from home is one of these characteristics and is thus one of the independent variables, while the actual location of the offense is the dependent variable. Without exception, crime location choice studies have demonstrated that the probability of committing a crime at a certain location decreases with the distance of that location from the offender's home (for a review of 17 studies, see Ruiter, 2017).

A potential issue with these studies and with the discrete crime location choice model is that without exception, the choice set from which offenders are assumed to select a location, is implausibly large. All studies in this tradition have assumed that each offender has complete knowledge of the full study area, which is typically a complete city or metropolitan area. For

example, on investigating street robbers' location choices, Bernasco, Block, et al. (2013) assume that each offender selects a city block from the approximately 25,000 blocks in the city of Chicago. Other studies use less but larger area as units of spatial choice, but their assumptions on the level of knowledge that offenders have of the study area are equally implausible.

A more plausible assumption is that offenders select a location from those parts of the environment that they are familiar with. In fact, the geometry of crime (Brantingham & Brantingham, 1981) proposes that offenders only offend around their activity spaces, and only in those parts where there are crime opportunities available.

Unlike the data used in other discrete crime location choice studies, the space-time budget interview used in the present study and discussed in section 6, makes it possible to create an estimate of each offender's activity space, and thus to define an alternative, more realistic spatial choice set. Rather than assume that offenders are prepared to offend anywhere in the study area, I assume that their crime location choices are limited to the places they regularly visit during their daily activities, and I assess whether from this limited set of places they prefer offending in nearby locations rather than in distant ones.[3] Descriptive findings based on a space-time budget interview suggest that offenses reported in the interview were not committed any nearer and farther away from home than non-criminal activities (Wikström, Oberwittler, Treiber, & Hardie, 2012, section 7.2). To scrutinize these findings, the analyses reported below take a more rigorous statistical approach to testing the hypotheses.

6. Data

The data were collected in the project Study of Peers, Activities and Neighborhoods (SPAN) conducted by the NSCR. The SPAN is a two-wave study among a sample of adolescents attending secondary schools in the city of The Hague and nearby towns. The adolescents were either 12-13 or 15-16 years of age during the first wave, in 2008–2009. The second wave took place in 2010–2011. During both waves, respondents completed a questionnaire and participated in a *space-time budget interview*. Details of the study have been described elsewhere (Bernasco, Ruiter, et al., 2013; Hoeben, Bernasco, Weerman, Pauwels, & van Halem, 2014; Hoeben & Weerman, 2014, 2016; Weerman, Bernasco, Bruinsma, & Pauwels, 2015, 2016). Here, I will only summarize the space-time budget interview, because it is the main source of data for the present analysis.

The SPAN study utilized the space-time budget interview that was developed in the PADS+ study (Wikström et al., 2012). It is a structured face-to-face personal interview administered in approximate 45–50 minutes by a trained research assistant. The interview procedures are in detail documented by Wikström et al. (2012: 67–78). During the interview, the interviewer

[3] In another study using the same space-time budget data (Bernasco, 2019), I demonstrated that adolescents' activity spaces strongly predict where they commit future (police-recorded) crimes. That analysis, however, still assumed that all adolescents had complete knowledge of the city of The Hague and its adjacent towns.

retrospectively recorded the hourly activities of the participant during four recent days (4 × 24 = 96 hours). The interviews captured the previous Friday and Saturday, and the two most recent other weekdays, excluding Sundays. Using a natural conversation method, the interviewers recorded per hour the nature of the main activity (e.g., sports, learning, sleeping), any persons present in the setting (e.g., teacher, parent, peers), the function of the place where the activity was performed (e.g., home, school, shop) and the geographic location of the place. To help establish the geographic location, interviewers used a map of the greater The Hague area overlaid with 200 × 200 meter grid in which each cell was labeled with a code (e.g. "B37", or "G45"). Selecting only land area (i.e. excluding the North Sea) the study area comprises 4558 grid cells and thus covers 182 km^2. Activities outside the study area, elsewhere in The Netherlands or abroad, were also coded by geographic location, but with less detail. For example, an activity anywhere in the city of Amsterdam would be coded as taking place in the geographic center of Amsterdam.

In addition to the recurring situational elements discussed in section 4 (activity, location and presence of others), the interviewer asked whether at any time during the day the respondent had been involved in offending, whether s/he had used alcohol or used drugs, and whether s/he had carried a weapon. In case of a positive answer, the specific hours during which this had happened were recorded. Note that the data allow us for each of these events to establish at what distance from the participant's home they took place. A total of 868 participants completed the space-time budget interview during the first wave, 615 completed the interview in the second wave.

In sum, the space-time budget interview recorded very detailed information about *where*, *when* and *what* respondents were doing *with whom*, during four days of the week before the interview. For each item in the space-time budget interview (such as place, activity, people present) there were typically dozens of answer categories available to code the item (see Wikström et al., 2012: 423–436, for a complete list). The external validity of the space-time budget instrument has been demonstrated with regard to time use measures (Hoeben & Weerman, 2014), substance use (Bernasco, Ruiter, et al., 2013) and offending (Wikström et al., 2012: 325–327).

7. Findings

The analysis of the data proceeds in three steps. The first step is descriptive. It shows how far away from their home adolescent offenders were when they committed offenses, and how far from home they were when they performed other activities. In the second step I use a modeling approach to answer the question of whether distance from home matters in *the decision to offend or abstain from offending*. In the third step I also use a modeling approach, but here the question is whether the distance from home matters in *the decision where to offend*.

7.1 First stage: Distance decay in offending and legal activities

In total, 76 participants reported 104 offenses in the space-time interview of the first and second waves of the study. The minimum and maximum distances from home at which the offenses were committed was 0 and 183.7 km, whereas the mean distance was 5.2 km and the median was 1.8 km.

To visually describe and to compare the distance from home during offending and during other activities, I excluded all hours spent at home, including the hours during which 5 of the 104 offenses were committed. The exclusion of hours spent at home was made in to be consistent with most other studies on the home-crime distance. On average, the participants spent 59.0 percent of their time at home (14.2 hours per day), of which 57.1 percent sleeping (8.1 hour per day).

In addition, but only for plotting and not for statistical testing, I removed all hours (including 2 offenses at 36 and at 183 km from home) spent more than 21 km away from home, which is the maximal straight-line distance that could be traveled in the study area). The reason for this particular selection, which applies to 3.6 percent of the hours not spent at home, is merely to improve the readability of the figures.

INSERT FIGURE 1 HERE

Figure 1 compares the offending distance pattern to the distance pattern of all hours in which any other activity was performed away from home but within 21 km from home. The comparison helps us answer the question of whether the distance from home during offending is actually different from the distance from home during other activities away from home when no offenses were committed. To facilitate the comparison, the bars for offending are plotted as an overlay on the bars for non-offending hours, and slightly narrower. The figure shows a clear distance decay pattern in both distributions, although the offending distribution is more irregular because it is based on 101 hours only, whereas the non-offending distribution is based no less than 138,852 hours. Nevertheless, there appears to be a fairly strong similarity between both distributions, suggesting that in terms of distance from home, offending might not differ much from other activities away from home.

To verify this intuition, a Wilcoxon rank-sum test (Wilcoxon, 1945) was performed to establish whether both distributions are equal or different. The test showed that they are not significantly different ($p = .10$). In other words, for hours spent away from home (within 21 km), the distance from home during an offense is not different from the distance to home during other activities. The Wilcoxon rank-sum test is also non-significant ($p = .07$) when distances above 21 km are included.

Although the distance to offending does not appear to differ from the distance to non-offending activities, the latter is a container category that includes a great variety of activities. To assess the differences and similarities between offending and more specific common activities , Figure 2 presents the distance to offending, together with the distance to five common legal activities that were recorded in the space-time budget interview.[4] All six activities display a clear distance decay pattern, as all activity categories are systematically more likely nearer to home than further away, with only a few minor exceptions in the right tails. There are also some differences

[4] The categories are aggregates of more specific activities that were reported in the interview. For example, structured sports included more than twenty categories, such as football, hockey, tennis, volleyball, or horse-riding. The activities do not exhaust all activities reported in the space-time budget interview. For example, sleeping, eating, and personal care are excluded here. Offenses included mostly assaults, threats, vandalism and thefts.

between the distributions, most notably the flatter distribution of the distance to learning (typically distance between home and to school) and the steeper distance decay pattern in unstructured activities. Overall, and in line with Figure 1, the distance to home during offending appears quite similar to the distance from home during Working, Structured sports and Structured leisure. During offending, however, the distance seems larger than during Unstructured activity, and smaller than during Learning.

INSERT FIGURE 2 HERE

To support the conclusions based on a visual inspection with a statistical argument, I performed statistical tests of the equality of the home-crime distance distribution and each of the other five home-activity distance distributions, again using the Wilcoxon rank-sum test.

Confirming the interpretation of Figure 2, the Wilcoxon rank-sum tests are significant ($p < .001$) for Learning and for Unstructured activity and nonsignificant for Working, Structured sports, and Structured Leisure ($p = .85$, $p = .34$, and $p = .24$ respectively). This finding shows that although in adolescent offenders the home-crime distance is clearly subject to distance decay, this distance decay pattern is hardly different from the distance decay pattern of their legal daily routine activities.[5]

7.2 Second stage: Distance and the decision to offend

The findings in the first step of the analysis confirmed the well-established decay pattern in the distance to offending among a sample of adolescents. They also established, however, that this pattern is not very different from most legal activities that these adolescents are involved in on a daily basis. This similarity suggests that most of the committed offenses may have been committed not by a deliberate premeditation of targets and locations, but in the context of and during the offenders' daily routines, and that they were caused or facilitated by situational elements of that context. One of these situational elements is the distance from home.

In the second step I extend a previously published fixed-effects panel analysis approach of the same space-time budget data (Bernasco, Ruiter, et al., 2013). The approach is based on the assumption that the offenses were not premeditated before arriving in the setting where they were committed. Most importantly, it is assumed that committing the offense was not the main reason why the adolescent offender was at the location. To assess whether distance from home affects an adolescent's decision to offend, the analysis compares the awake hours during which adolescent offenders refrained from offending with the hours during which they committed offenses.[6] To account for other situational elements, other than distance, that may affect the offending decision, and replicating Bernasco, Ruiter, et al. (2013), the following situational elements were included: presence of peers, absence of adults, involvement in unstructured

[5] As in Figure 1, the test included the legal routine activities of all study participants, both offenders and non-offenders. I conducted an additional rank-sum test on the crimes and routine activities of offenders only. Again, none of the five comparisons resulted in a statistically significant difference between the home-crime and the other five home-activity distributions. The conclusion thus also holds within the offender group.

[6] The fixed-effects estimates are based only on the repeated hourly measures of the same individual. Therefore, they cannot be confounded by stable differences between individuals.

activity, public place, alcohol use, cannabis use and carrying weapons as additional situational variables.[7]

The results of the analysis are reported in Figure 3. The figure includes odds ratio estimates and 95% confidence intervals of three models. One model includes only the distance from home as an independent variable (labeled *Distance only*). Another model includes other relevant situational elements, but not distance (labeled *Without distance*). This model was estimated and reported in Bernasco, Ruiter, et al. (2013). The third model includes both distance and the other elements (labeled *Full model*).

INSERT FIGURE 3 HERE

Clearly, the relation between distance and the likelihood of offending is not significant, neither in a bi-variate assessment (*Distance only*) nor in the multivariate assessment when potential confounders are included (*Full model*). This demonstrates that if adolescents' decisions to commit the reported offenses are indeed caused by situational factors, the distance from home is not among these factors. It apparently is not a relevant criterium for deciding whether or not to offend. This confirms the descriptive findings of Wikström et al. (2012)

7.3 Third stage: Distance and the decision where to offend

The third step of the analysis applies a discrete spatial choice approach (Bernasco & Nieuwbeerta, 2005) to the offenses that participants reported in the space-time budget interview. Here, I first assume that these offenses were premeditated, and I analyze the perpetrator's decision of where to commit it. For each of the 4558 grid cells in the study area, I estimate the effect of the distance from the offender's home on the probability that the offense is committed in this grid cell. In addition, to account for criminal opportunities, I also estimate a full model that includes the presence in the grid cells of schools, retail business and catering businesses (bars, snack bars, restaurants, etc.). Based on the interpretation of distance decay as the result of an offender minimizing effort by reducing travel distance, and in line with a wealth of empirical support in other crime location choice studies (Ruiter, 2017), a negative effect of distance from home would be expected on the probability that a location is selected as the offense location. The estimation results presented in the left panel of Figure 4 (labeled *Study area*) confirm this hypothesis: the odds ratio of distance from home equals .43 in the *Distance only* model and .44 in the *Full model*, which implies that for every kilometer that a location (i.e. a 200 × 200m grid cell) is further away from the offender's home, the offender's odds of selecting this location decrease by a factor .44.

INSERT FIGURE 4 HERE

As argued in above, a potentially problematic issue of this approach is that the assumed size of the choice set is unrealistically large: we assume that the offenders can make an informed choice amongst 4558 grid cells in the city of The Hague and its adjacent towns, and thus that they are

[7] In practice, I adapted to the Stata computer script that generated the original findings to include a new situational variable —distance to home– for every recorded hour of each individual, and added the newly created distance variable to the model specifications.

aware of the existence and properties of these locations. A more realistic assumption about the spatial choice set of the adolescent offenders is that is consists of the locations that they visited during the four days covered in the space time budget interview. During these four days, they visited only a very small fraction of the 4558 grids cells. On average, they visited only 7.79 different grid cells (standard deviation 3.17, minimum = 3, maximum = 15, median = 7).

Based on this more realistic assumption, the right panel of Figure 4 displays estimates of two conditional logit models that are equal to those in the left panel and apply to exactly the same offenders and offenses, except that the offenders' choice sets are restricted to their measured individual activity spaces, i.e. to those locations that they visited during the four days recorded in the space-time budget interview. If, for example, an adolescent offender visited five different locations during these four days, and offended in one of them, the distance from home and other attributes of the offense location are compared only with the six other locations in the offender's activity space, and not the 4557 other locations in the complete study area. Clearly, the estimates in the right panel of Figure 5 demonstrate that if the choice set is restricted to the offender's activity space, distance is not a significant choice criterion at all.[8]

8. Discussion

Like many other species, most humans have a fixed anchor point where they return to at least once per day to sleep. Virtually all of our activities are characterized by *distance decay from home*: their frequency tends to decay with the distance from our homes. The pattern applies to where we work, go to school, run errands, visit the gym or meet with friends. The proposed mechanism underlying this phenomenon is energy conservation, which is a specific case of the principle of least effort (Zipf, 1949). To preserve energy while pursuing a set of activities, we must minimize the energy spent on moving from one activity to the other. Ultimately, it is the need to come home that constrains our mobility.

Although the findings presented here come with a number of minor and major caveats,[9] the arguments and empirical results presented strongly suggest that in line with the key point that Peter van Koppen and Jan de Keijser made more than twenty years ago (van Koppen & de Keijser, 1997) criminal distance decay is a byproduct of the centrality of our homes in our daily routine activities, and that its explanation does not require us to theorize any additional mechanisms.

[8] The statistical power of the significance test only depends on the number of included offenses (which is equal in all four models) and not on the number of alternatives (which is 4558 for each offender in the left panel and only 7.79 in the right panel).

[9] The main limitations are (a) the sample includes only 12–17 your old adolescents living in or near the city of The Hague who were attending school on a regular basis, (b) the a limited set of offenses was reported (mostly violence, vandalism, and theft), (c) that the measures are retrospective self-reported activities and offending, and thus potentially biased by memory and social desirability effects, (d) that the reported period included 4 days only and no Sundays, (e) that the spatial resolution of the measures is limited to square areas of 200 × 200 meter and the temporal resolution to 1 hour, and finally (f) that offenses and other activities taking place at the adolescent's home are excluded from the analysis.

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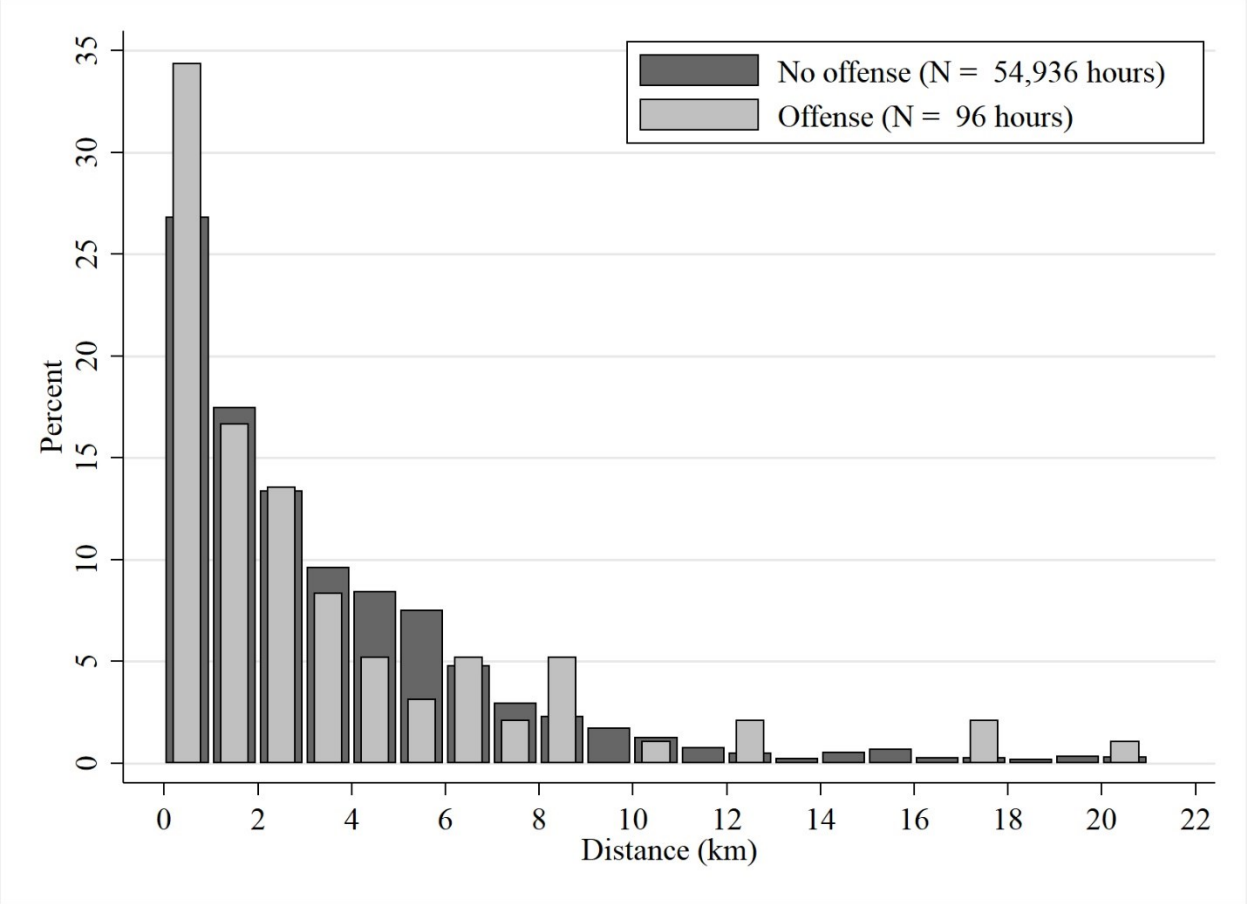
Figure Captions

Figure 1: Percentages of hours during which no offense was committed and during hours when an offense was committed, by distance from home. Only the 55,032 hours are included that were spent away from home, but within 21 km. Based on 1484 space-time budget interviews (868 adolescents in wave 1 and 616 in wave 2).

Figure 2: Distance from home by selected activity categories. Only the 31,829 hours are included that were spent away from home but within 21 km. Values in parentheses indicate the total number of hours during which the activity was reported as the main activity. For offending, it indicates the number of hours during which an offense was committed. Based on 1484 space-time budget interviews (868 adolescents in wave 1 and 616 in wave 2).

Figure 3: Situational causes of adolescent offending: fixed effects logit estimates of three models. **Markers** (square, triangles and diamonds): Point estimates of odds ratios. **Lines**: 95% confidence intervals. Model "Without distance" was published as Model 2 (Table 4, page 916) in Bernasco et al. (2013). Offenders only, wave 1 (n = 51), wave 2 (n = 22), and both waves (n = 3). N = 4,949 hours awake. Min / Max / Mean hours awake per individual: 50 / 78 / 62.6.

Figure 4. Location choices in 82 adolescent offenses: conditional logit estimates of distance only and distance + opportunity models. **Markers** (triangles and squares): Point estimates of odd ratios. **Lines**: 95% confidence intervals. **Study area**: Choice set contains 4558 alternatives (all 200 × 200 grid cells in the study area). **Activity space**: Choice set contains alternatives (200 × 200 grid cells) inside the adolescent's activity space (minimum = 3, maximum = 15, average = 7.79, standard deviation = 3.17, median = 7 grid cells).



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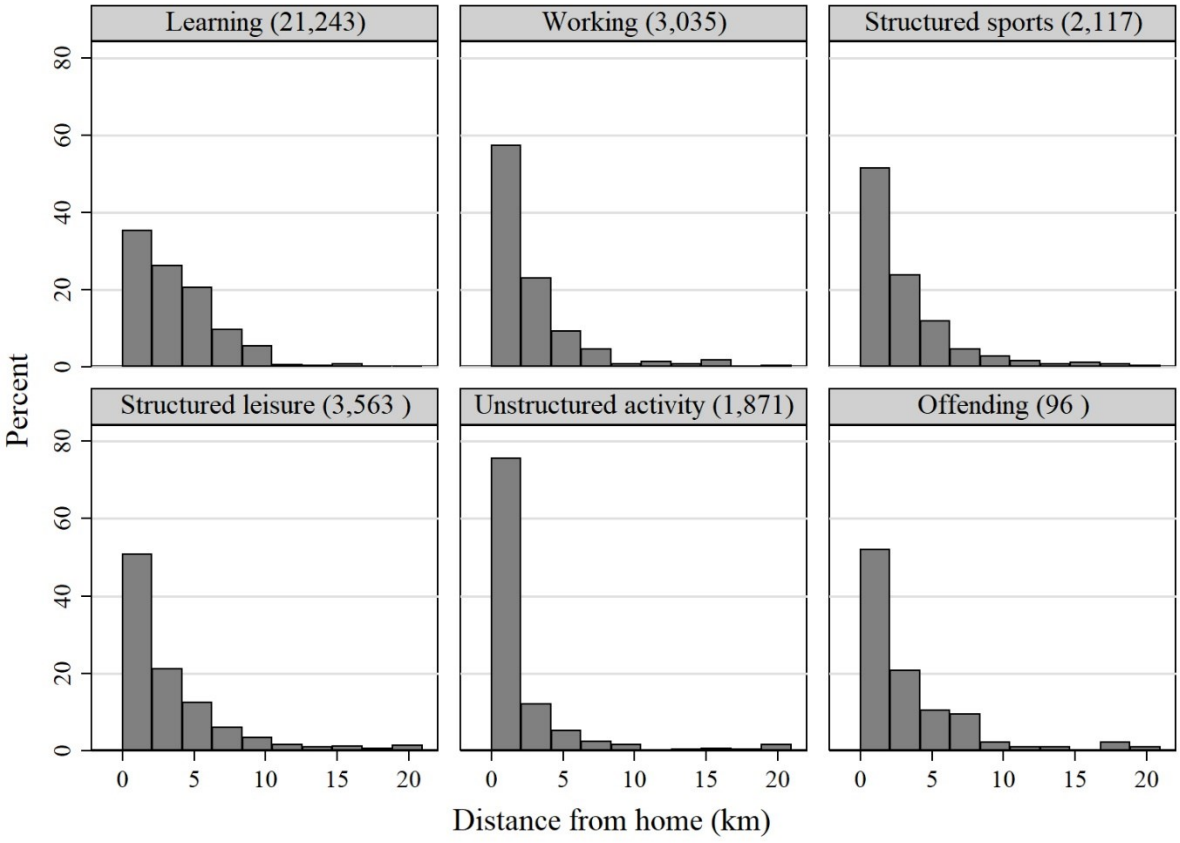

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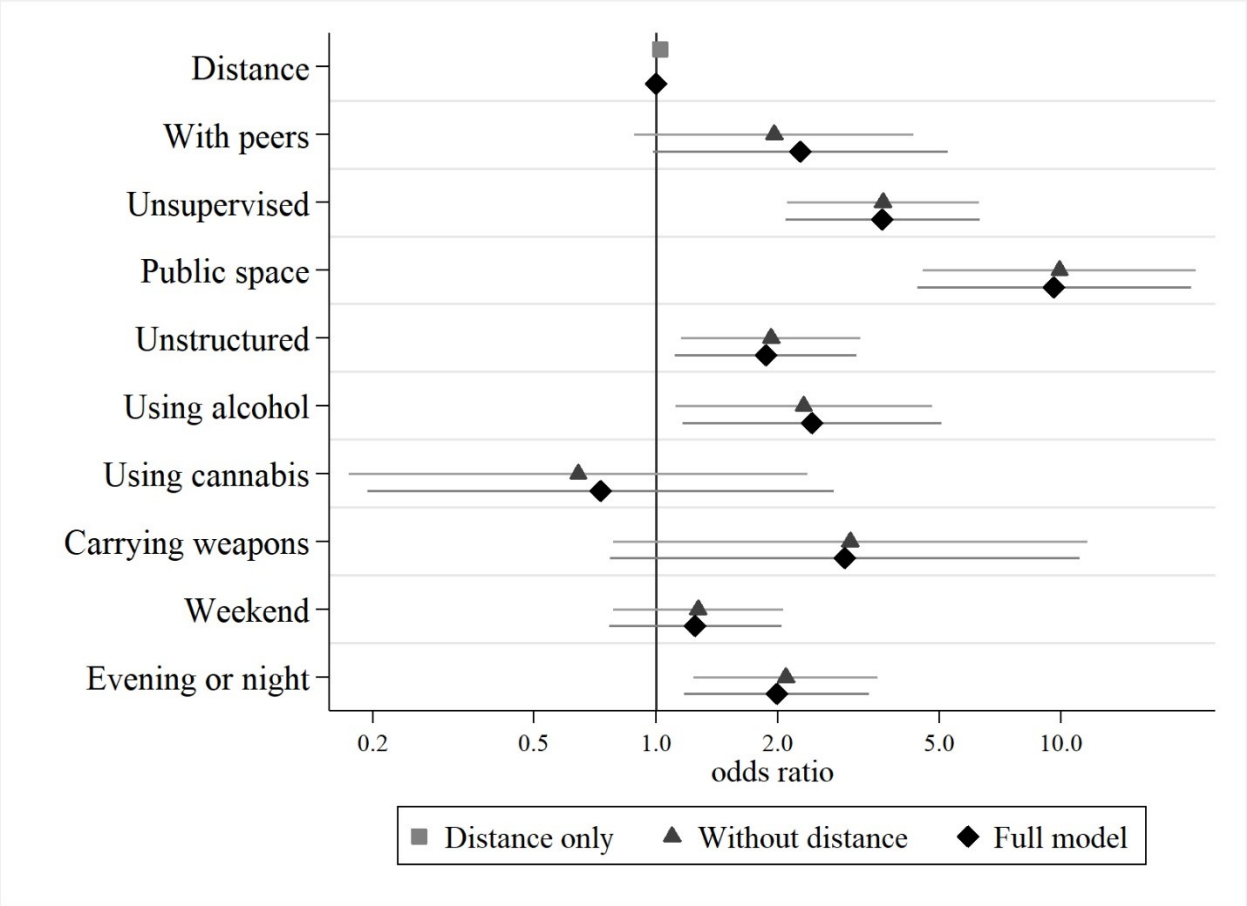

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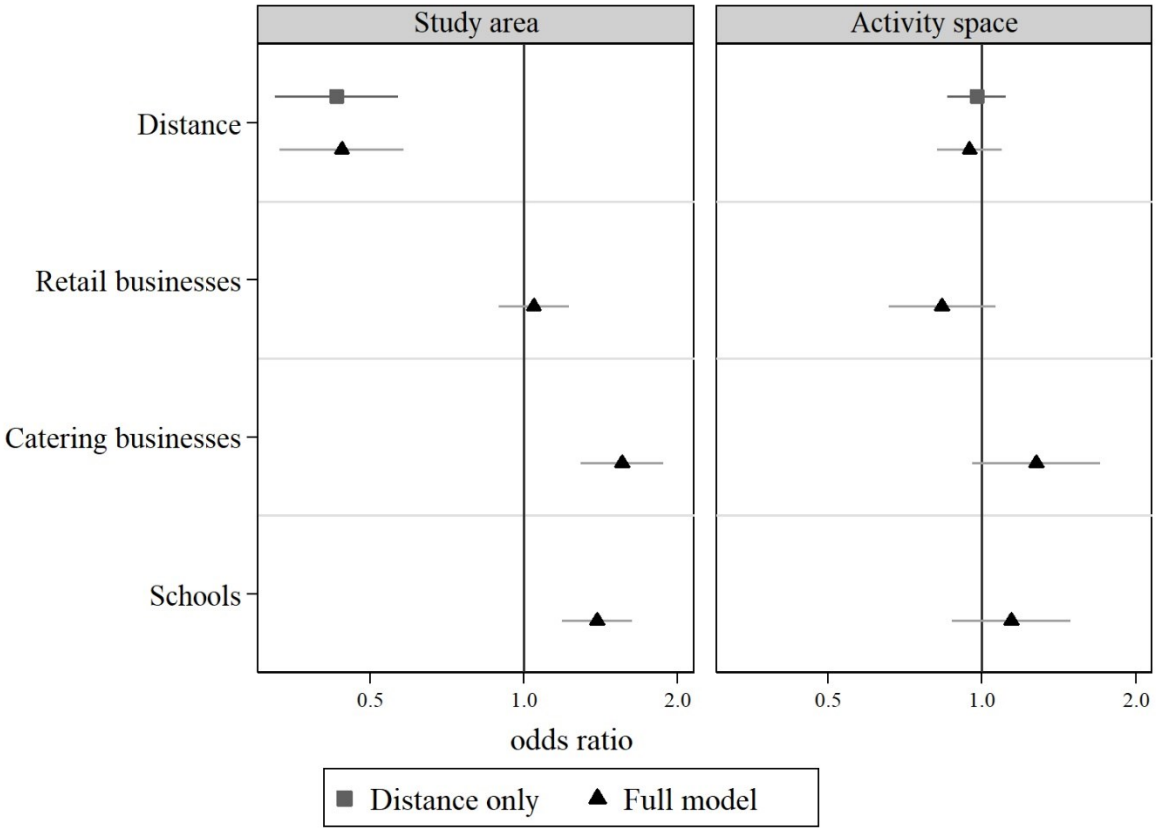

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