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# ENVIRONMENTAL CRIME PREDICTORS AND THE SPATIAL DISTRIBUTION OF CRIME. THE CASE OF STARE BALUTY IN LODZ, POLAND

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ABSTRACT: The article refers to various studies on the creation of safe spaces as well as works on the influence of land-use on the distribution of crime in urban space. The goal of the study is to identify places and facilities which constitute a potential threat to safety and impact the spatial distribution of crime. An analysis of relationships between various types of crime predictors and the spatial distribution of crimes at the address-level has also been made. The most important conclusion drawn from the study is that the distribution of crime predictors strongly impacts the presence of crime in their direct vicinity and this influence on crime gradually lessens as the distance increases. The influence of such crime predictors as *honeypots* and *public facilities* on attracting crime as well as *movement predictors* and *conflicts of land use* on repelling crime was determined.

KEYWORDS: urban crime, environmental crime predictors, crime location quotient, Lodz, Poland.

ŚRODOWISKOWE CZYNNIKI ZAGROŻEŃ A ROZMIESZCZENIE
PRZESTĘPCZOŚCI NA PRZYKŁADZIE STARYCH BAŁUT W ŁODZI

ZARYS TREŚCI: W artykule nawiązano do dwóch nurtów badań przestrzennych aspektów
przestępczości: kształtowania przestrzeni bezpiecznych, a także wpływu użytkowania tere-
nu na rozmieszczenie przestępczości w przestrzeni miejskiej. Celem pracy jest identyfikacja
miejsc i obiektów, które stanowią potencjalne zagrożenie bezpieczeństwa oraz wywierają po-
tencjalny wpływ na przestrzenne rozmieszczenie przestępstw. Dokonane zostały analizy za-
leżności między różnymi typami czynników zagrożeń oraz przestrzennym rozmieszczeniem
przestępstw na poziomie danych adresowych. Najważniejszym wnioskiem wypływającym
z badań jest stwierdzenie funkcjonowania silnego wpływu czynników zagrożeń na występo-
wanie przestępczości w ich bezpośrednim sąsiedztwie oraz, że ten wpływ na przestępczość
stopniowo maleje wraz ze wzrostem odległości. Zidentyfikowane zostało silne przyciągające
przestępczość oddziaływanie takich czynników zagrożeń, jak: beczki miodu i obiekty pub-
liczne, natomiast odpychająco na przestępczość oddziałują miejsca determinujące drogę prze-
mieszczania się oraz konflikty użytkowania przestrzeni.

SŁOWA KLUCZOWE: przestępczość miejska, czynniki zagrożeń, wskaźnik lokalizacji prze-
stępstw, Łódź, Polska.

## 7.1. Introduction

The main purpose of this work is to determine the influence of the environmental
predictors regarding threats to safety on the distribution of crime. The important
contribution of this work includes the inspection and inventorying of the research
area, where it was determined which objects and places may pose a potential threat
in their local context. Such analyses have not been carried out yet in Poland. At the
same time, the majority of studies on the influence of land use on the distribution
of crime simply utilize the facilities in the topographic geodatabases, without
analysing and interpreting their direct neighbourhood or the local situation.

Spatial studies on crime with increasing frequency go beyond the basic
description of the spatial distribution of this pathology. This work refers to two
research approaches focusing on studying the properties of space as a location of
a potential crime, what is mainly supported by research in the field of environmental
criminology. Works that are part of the first approach describe the possibilities
of creating safe spaces by reducing those features of space that can be in favour
of the perpetrator, while the researchers of the second approach deliberate on the
influence of forms and functions of land use on the distribution of crime. The first
approach is far more popular and prominent. Throughout the years, a number of
solutions and strategies aimed at the prevention of crime development in an urban
environment were determined. These solutions more frequently succeed in newly-
-designed layouts. Most of these strategies can also be used in the built environment,
though a previous identification of the existing crime predictors is required.

In her world-wide known book, J. Jacobs (1961) claimed that spatial organisation of cities creates favourable conditions for the development of crime and the sense of threat. She has also identified the threats that can lead to the fall (death) of cities and the conditions for their survival. A decade later, O. Newman (1972) elaborated on these ideas by introducing the concept of defensible space, defined as: "a residential environment whose physical characteristics – building layout and site plan – function to allow inhabitants themselves to become key agents in ensuring their security".

In the following years, the concepts of Jacobs and Newman were both continued and criticised. The most important contributors to the idea of defensible space include: Armitage, Atlas (offensible space), Brantingham and Brantingham (crime pattern theory), Coleman (utopia on trial), Crowe (architectural design guidelines), Hillier (space syntax), Jeffery (the first to introduce the notion of crime prevention through environmental design, CPTED), Merry (undefended space), Poyner and Webb (crime-free housing), van Sommeren (containers concept), or Wilson and Kelling (broken windows) – these classic concepts were discussed by e.g. I. Colquhoun (2004). The result of the actions of both these people and others was the creation of various models, methods and strategies of CPTED, aimed at the "proper design and effective use of the built environment which can lead to a reduction in the fear of crime and the incidence of crime, and to an improvement in the quality of life […] The goal of CPTED is to reduce opportunities for crime that may be inherent in the design of structures or in the design of neighborhoods" (Crowe 2000). Obviously, there is no single universal solution that would improve urban safety, since criminals are, to a large extent, specialised and the conditions created against some of them may attract other perpetrators. For this reason, some authors analyse the effectiveness of CPTED solutions in their works. The results of these analyses not necessarily indicate maximum effectiveness of these solutions (Armitage, Monchuk 2009). Mistakes may be made both on the level of diagnosing crime predictors and on the level of actions aimed at removing these predictors. Using the current theoretical and methodological works as well as practical achievements of various concepts regarding the shaping of safe spaces, B. Czarnecki (2011) has developed a method of identifying crime predictors in the physical urban space.

The second research approach referred to in this work suggests there are specific relationships between the intensity of crime and land use. It turned out that there are land use features that strongly attract all kinds of forbidden actions (e.g. shops, restaurants, pawnshops, entertainment facilities); those that attract individual types of crimes to a higher or low degree (schools, service stations, car parks, railway stations); yet, there are also those that generally deter all crime (churches, cemeteries). Various spatial models of crimes were developed to determine where certain acts are committed particularly often and where they are

unlikely to occur (Mordwa 2011; Sypion-Dutkowska 2014; Sypion-Dutkowska, Leitner 2017; Wang *et al.* 2017; Yue *et al.* 2017).

Analyses of the influence of specific land use features on the probability of occurrence of crime in their vicinity were conducted. The role of alcohol outlets such as shops, bars, restaurants, clubs or discotheques was investigated early on. Thefts, assaults and muggings often occur in these facilities and in their neighbourhood. Criminals are aware that their customers have cash they can be easily deprived of. Additionally, decisions on whether to commit a crime are made more easily and quickly with high blood alcohol content (Roncek, Bell 1981; Roncek, Maier 1991; Gruenewald *et al.* 2006; Day *et al.* 2012; Toomey *et al.* 2012; Snowden 2019). The impact on the distribution of crime was proven also in case of: parks (Groff, McCord 2012; Boessen, Hipp 2018; Matijosaitiene *et al.* 2019; Shepley *et al.* 2019; Taylor, Haberman, Groff 2019), football stadiums (Ristea *et al.* 2018), public transport stops (Ceccato, Uittenbogaard 2014; Matijosaitiene, Stankevice, Velicka 2016), schools (Roncek, Faggiani 1985; Yue *et al.* 2017) and many others. The possibility of predicting what kinds of actions may be conducted in the vicinity of other forms of land use and when was also described (Lin, Yen, Yu 2018; Matijosaitiene *et al.* 2016).

In this work, the achievements of both research approaches are combined. The subject of study is the influence of these crime predictors which will be identified in accordance with the concept of shaping safe spaces on the distribution of crime.

## 7.2. The case study area

The studies were conducted on the Area of City Information System Stare Baluty (Lodz is divided into 56 such areas). This region lies downtown, in the city centre, north of the so-called historic urban core. Stare Baluty is one of the areas with the highest risk of crime in Lodz (Mordwa 2013). The criminal nature of the area and the stereotype formed are doubtlessly connected to its history.

Village Baluty used to border Lodz on the south. It was incorporated into Lodz by the German authorities only in 1915. For a long time it functioned as a village. In 1854, it had 157 inhabitants. In 1857, an idea emerged to establish a factory settlement here. In 1882, the settlement had as many as 1.5 thousand inhabitants, and their living costs were much lower than in Lodz (they were mainly Jews prohibited from settling in Lodz, the poor, profiteers as well as ex-prisoners placed here by the tsarist authorities). The following years brought a dynamic and uncontrollable spatial and demographic development of Baluty. In 1884, the settlement had 6.6 thousand inhabitants and in 1913 – 105 thousand. The development resulted in a huge demand for housing. Therefore, all vacant plots were freely divided, developed and private streets leading to the plots were built

in accordance with the owners' whims. Since Baluty was officially a village, there were no entities responsible for its construction management or the maintenance of social order. The tsarist regulations were chronically violated. The spatial chaos was increasing, with its low quality buildings that met only the minimum housing quality standards. Such conditions were acceptable only to the poorest. Since the very beginning, Baluty had a bad reputation – it was believed it was the heart of criminal activities in Łódź (Sygulski 2003, 2006; Walicki 2016; Badziak 2017).

Ever since Stare Baluty was incorporated into Lodz, there were no spectacular planning actions of social or spatial nature undertaken within the oldest building development. In the 1960s and 70s, blocks of flats were built north of the oldest building development. In the current functional and spatial structure of Stare Baluty (approx. 3.61 km$^2$), there are mainly: historical multi-functional quarters in the south (15% of surface area), multi-functional areas with no historical layout (30%) as well as large living complexes in the east and north (43%).

## 7.3. Data and methods

Field research was conducted between September and November 2017. Czarnecki's method (2011) was used to identify the environmental crime predictors[1]. This method enumerates two types of crime predictors: 1) influencing the presence of perpetrators; 2) restricting the performance of defensive functions. All twelve types of crime predictors are listed in Table 1.

In order to analyse the level and distribution of crime in Stare Baluty, data from Regional Police Headquarters in Lodz was collected. The obtained tabular juxtaposition listed the address, date, type and nature of criminal activities registered in 2016. Unfortunately, in 19% of cases the police data was incomplete, which prevented geocoding and excluded the data from further analyses (still, an 81% geocoding rate is an acceptable level; Ratcliffe 2004). Therefore, the analyses of the spatial distribution of crime were conducted on the basis of the group of 895 criminal acts, divided into 11 groups of crimes (Table 3). Kernel density estimation was used to determine places with the highest risk of crime. The advantage of this technique is that it can be used directly on address data (point pattern data), and provides results in the form of clear, easy to interpret, quasi--continuous surfaces (Mordwa 2015).

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[1] For this purpose, each predictor was evaluated in relation to the level of threat posed on the basis of twenty various criteria. Areas with the same land use or facilities with the same functions could be considered crime predictors in certain cases, but not in others. The identified crime predictors got the worst ratings in the following criteria: the sense of anonymity, territoriality, presence of third persons, presence of risk groups, attractiveness of place and conditions for obtaining help.

Crime location quotient (LQC) was used to assess the impact of crime predictors on the distribution of crime. Its application concept was presented in greater detail by, for instance, N. Sypion-Dutkowska and M. Leitner (2017). Its formula is:

$$LQmC_i^f = \frac{\dfrac{NmC_i^f}{A_i^f}}{\dfrac{NmC^f}{A^f}}$$

where: $LQmC_i^f$ – the $LQC$ for crime type m for distance zone i and crime predictor type $f$; $NmC_i^f$ – the number of events for crime type $m$ within distance zone $i$ from crime predictor type $f$; $A_i^f$ – the area of distance zone i from crime predictor type $f$; $NmC^f$ – the number of events for crime type $m$ within the potential influence range of crime predictor type $f$ (distance zone 0–200 m); $A^f$ – the area of the crime predictor type $f$ with the potential influence range of distance zones 0–200 m); $I$ – three distance zones: $i = 1$–3 (0–50; 51–100; 101–200 m); $F$ – defines the 15 crime predictor types ($f = 1$–15); $M$ – defines the number of crimes in total and the eleven individual crime types ($m = 1$–11).

$LQC$ indices are calculated for the previously-determined distance zones – buffers – around individual crime predictors (the multiple ring buffers tool). This study focuses on the closest zone of influence of threat-posing places and facilities, which is justified in light of the results obtained by other researchers (Sypion-Dutkowska, Leitner 2017). For this purpose, buffers were determined for three distance zones for individual crime predictors: up to 50 m, 50–100 m and 100–200 m.

The calculated $LQC$ values make it possible to determine the strength and direction of the influence of potential crime predictors on the distribution of crime. The value of 1 stands for a lack or balance of influence. The higher the value above 1, the stronger the attraction; while the lower the value below 1, the stronger the repulsion (detraction).

## 7.4. Research results

**Crime predictors in urban environment**

Within the space of Stare Bałuty, 294 crime predictors were identified; their types, number and location in space is presented in Table 1. Most of them belong to one of two types of predictors influencing the presence of a motivated perpetrator: crime attractors and crime enablers. The identified structural factors of urban environment are much less numerous, though they occupy a significant surface area of the studied region.

The most numerous crime predictors among the crime attractors are *transit paths and routes*, which include public transportations stops, major intersections as well as pedestrian routes or roads. *Honeypots*[2] include fast food restaurants and grocery stores that sell alcohol, liquor stores as well as bars serving alcohol (i.e. alcohol outlets). *Conflict and fear generators* are facilities and functions that cause conflict in a given spatial context. They include some schools, children's homes, social welfare centres, prosecutor's offices, police stations, churches of various faiths. *Public facilities* are various facilities of mass or universal use with properties that attract criminals. In Lodz, those include the well-known covered market 'Balucki Rynek' as well as a neighbouring marketplace. Moreover, several other marketplaces and supermarkets were identified in this category.

**Table 1.** Identified crime predictor types, numbers of cases, and area

| Crime predictors | Objects | | Area | |
|---|---|---|---|---|
| | No. | % | ha | % |
| 1. Crime attractors | 116 | 39,5 | 17,6 | 4,9 |
| 1.1. Public facilities | 15 | 5,1 | 6,3 | 1,8 |
| 1.2. Honeypots | 30 | 10,2 | 0,7 | 0,2 |
| 1.3. Transit paths and routes | 48 | 16,3 | 3,5 | 1,0 |
| 1.4. Conflict and fear generators | 23 | 7,8 | 7,1 | 2,0 |
| 2. Crime enablers | 138 | 46,9 | 33,6 | 9,3 |
| 2.1. Movement predictors | 7 | 2,4 | 0,1 | 0,0 |
| 2.2. Unguarded car parks and garages | 39 | 13,3 | 4,6 | 1,3 |
| 2.3. Problematic open spaces | 92 | 31,3 | 28,9 | 8,0 |
| 3. Structural factors of urban environment | 40 | 13,6 | 79,7 | 22,1 |
| 3.1. Areas which hinder the sense of orientation | 32 | 10,9 | 63,6 | 17,6 |
| 3.2. Spatial structures restricting social integration | 0 | 0,0 | 0,0 | 0,0 |
| 3.3. Conflicts of land use | 2 | 0,7 | 13,1 | 3,6 |
| 3.4. Spatial fragmentation | 6 | 2,0 | 3,0 | 0,8 |
| 3.5. Discontinuities of urban fabric | 0 | 0,0 | 0,0 | 0,0 |

Source: own work.

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[2] The term *honeypots* was introduced in the British program "Secured by design", where it was defined as: "places, such as fast food restaurants, where people congregate and linger" (*Safer places…* 2004: 104).

Crime enablers are various types of facilities and places which, due to insufficient and low-quality supervision and maintenance, may facilitate committing a crime. The most numerous *problematic open spaces* are characterised by major level of disorder and spatial degradation, unclear purpose and development, caused by a lack of visible supervision and ownership status. The studied area included numerous natural wastelands, abandoned areas, uninhabited buildings, areas degraded due to human activity, parks, greens and squares with numerous access points. In Polish cities, *unguarded car parks* are a major problem. Due to insufficient numbers of parking spaces, intra-estate space is often utilized by cars, damaged and chaotically appropriated. Moreover, several *movement predictors*, or isolated places determining pedestrian routes during the conditions with limited visibility or help accessibility, were identified. Such crime predictors include narrow passages and pedestrian routes with buildings or walls on both sides, or with limited visibility.

A continuous urban space and a clear layout of public places improve users' self-orientation and their sense of safety. A clear arrangement of local roads and access routes to housing and facilities improves circulation and orientation, causes local sense of security, improves visibility and spontaneous or organised surveillance. Structural factors of urban environment are places which facilitate social disorganisation and lack possibilities of conducting defensive actions. In the analysed space, there were the most *areas which hinder the sense of orientation* among this type of crime predictors. Those include intra-estate spaces, mostly in housing estate areas. The bus depot and Municipal Waste Management Company represent *conflicts of land use*, while the factors with *spatial fragmentation* consist solely of gated communities. Two types of structural crime predictors were not identified within Stare Baluty: *spatial structures restricting social integration* and *discontinuities of urban fabric*.

**Crime within Stare Baluty space**

The register of crimes committed in 2016 in Stare Baluty, obtained from Regional Police Headquarters in Lodz, listed 895 acts that could be geocoded. The majority of them were criminal acts against the property (60%) or against the person (9%). There were fewer acts against freedom, dignity and bodily integrity, as well as car crimes (approx. 6% each).

A map designed with the use of kernel density estimation makes it possible to name six visible clusters with high values of crime density (Fig. 1). There is very similar land use in all six of these areas, with the predominating function of housing, followed by trade and services. In three "southern" clusters, the residential buildings mostly comprise 19th century tenement houses and a large number of post-war four- or five-storey blocks. In the three remaining clusters,

block-type buildings predominate (also taller than 8-storey buildings). Areas with the lowest crime density overlap with two forms of land use: greeneries or developed areas with industrial or storage functions.
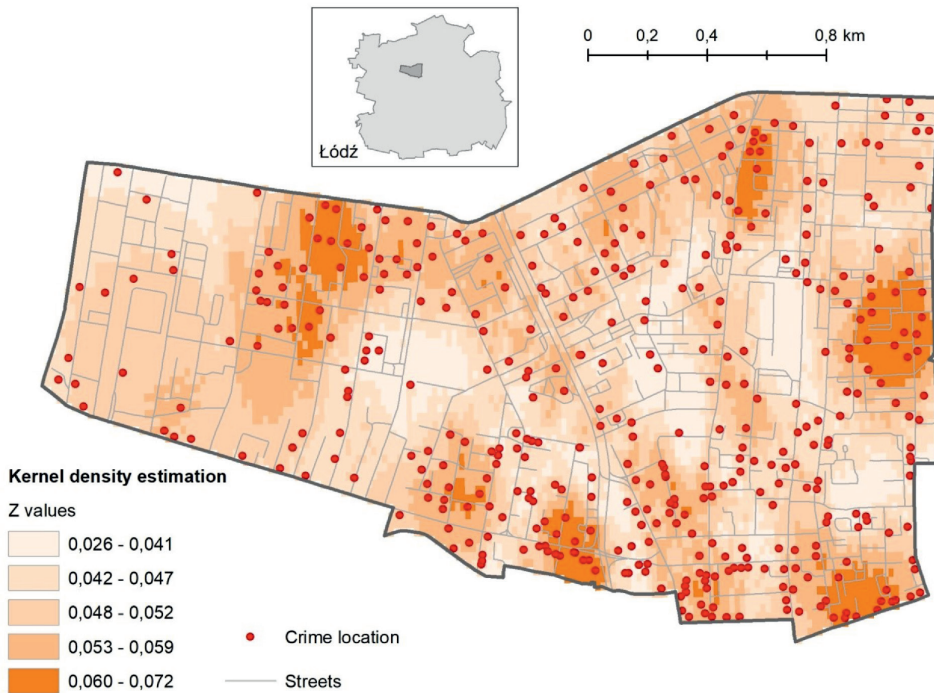


**Fig. 1.** The spatial distribution of crime in Stare Baluty (Lodz, Poland) in 2016
Source: own work based on the data of the Regional Police Headquarters in Lodz.

**Crime predictors attracting and repelling crime**

As much as 89% of all geocoded crimes were committed in the areas within 50 m of the locations of all crime predictors. According to the authors of this work, this value illustrates the effectiveness of the influence of identified crime predictors on the distribution of crime.

The values of the *LQC* index, which determines the level and direction of influence of crime predictors on the distribution of all types of crimes in individual distance zones, was presented in Table 2. High attraction level (*LQC* > 1.5) of each crime group occurs only within the 0–50 m zone and gradually decreases in subsequent distance zones. This influence is typical of four types of crime predictors: *honeypots*, *public facilities*, *transit paths and routes* as well as *unguarded car parks or garages*. Honeypots may be considered the strongest attractors, though only in the closest vicinity surrounding each of the places. The

remaining three types of predictors display a much lower level of *LQC* influence, although still noticeable within 100 or even 200 m. It should be mentioned that the factors with *spatial fragmentation* also appear to attract crime to the 50-metre zone.

**Table 2.** *LQC*s of total crimes across three distance zones

| Crime predictors | Distance zone [m] | | |
|---|---|---|---|
| | 0–50 | 51–100 | 101–200 |
| **1. Crime attractors** | | | |
| 1.1. Public facilities | 1,69 | 1,28 | 0,92 |
| 1.2. Honeypots | 1,80 | 1,05 | 0,96 |
| 1.3. Transit paths and routes | 1,55 | 1,48 | 1,43 |
| 1.4. Conflict and fear generators | 1,16 | 1,07 | 1,36 |
| **2. Crime enablers** | | | |
| 2.1. Movement predictors | 0,26 | 1,48 | 1,16 |
| 2.2. Unguarded car parks and garages | 1,51 | 1,45 | 0,81 |
| 2.3. Problematic open spaces | 1,06 | 0,98 | 0,86 |
| **3. Structural factors of urban environment** | | | |
| 3.1. Areas which hinder the sense of orientation | 1,08 | 0,77 | 0,71 |
| 3.3. Conflicts of land use | 0,28 | 0,79 | 0,92 |
| 3.4. Spatial fragmentation | 1,37 | 0,96 | 0,83 |

Source: own work.

Only two crime predictors strongly repel all crimes, mostly in the 50-metre distance zone. In this zone, *movement predictors* detract crime the most, although in two subsequent zones, their influence changes to an average attraction. The strong, although diminishing with distance, repulsion of *conflicts of land use* is most probably the result of their areas being strongly monitored, protected and guarded.

Generally, the strong attracting or repelling influence of environmental crime predictors on various types of crime is limited to their closest vicinity (0–50 m). *LQC* for this highly-specific value zone was presented in Table 3, which makes it possible to emphasise the significant differences between the crimes committed in the zone. Major disproportions in the strength of the influence on crime between individual types of crime predictors are also noticeable.

*Honeypots* strongly impact almost all groups of punishable offences, although their influence on crimes against dignity and bodily integrity, against freedom, car crimes and against the administration of justice is the strongest. *LQC* values higher than in case of the whole of crime occur in case of *public facilities* influencing commercial crimes, crimes against documents and alcohol and drugs crimes. Near *transit paths and routes*, high *LQC* values were calculated in the case of car crimes and crimes against the administration of justice, against freedom, against dignity and bodily integrity and also against the person. Sexual crimes or those against employee rights clustered in the vicinity of *unguarded car parks and garages*.

The environmental crime predictors that have a strong detracting impact on the distribution of crime within 50 m include *movement predictors* as well as *conflicts of land use*. However, while the *conflicts of land use* repel the distribution of crime to areas as far as 200 m away, the influence of *movement predictors* changes to highly-attracting in case of some groups of crime already in the 50–100 m zone (e.g. the value of *LQC* for sexual crimes is 3.5).

**Table 3.** *LQC*s of crime types in the distance zone 0–50 m around crime predictor

| Groups of crimes | Crime predictors* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.1. | 1.2. | 1.3. | 1.4. | 2.1. | 2.2. | 2.3. | 3.1. | 3.3. | 3.4. |
| Against dignity and bodily integrity | 1.0 | 4.1 | 2.1 | 1.2 | 0.0 | 1.3 | 1.3 | 1.5 | 0.0 | 0.0 |
| Against documents | 4.2 | 1.6 | 1.2 | 0.6 | 0.0 | 0.5 | 0.9 | 0.7 | 0.5 | 1.5 |
| Against employee rights | 0.4 | 1.1 | 0.5 | 1.0 | 0.0 | 2.6 | 0.8 | 1.0 | 0.0 | 5.0 |
| Against freedom | 1.4 | 2.3 | 2.4 | 1.0 | 0.7 | 1.4 | 1.2 | 0.8 | 0.4 | 1.7 |
| Against property | 1.2 | 1.7 | 1.7 | 1.0 | 0.8 | 1.2 | 0.9 | 1.2 | 0.4 | 0.9 |
| Against the administration of justice | 0.6 | 2.4 | 2.8 | 4.6 | 0.0 | 1.2 | 1.5 | 1.4 | 0.0 | 2.2 |
| Against the person | 1.2 | 1.4 | 2.0 | 0.9 | 0.4 | 1.2 | 1.2 | 0.9 | 0.7 | 2.0 |
| Alcohol and drugs | 2.5 | 0.8 | 1.5 | 1.3 | 0.0 | 1.4 | 1.5 | 0.9 | 0.4 | 0.0 |
| Car | 1.7 | 2.8 | 2.4 | 0.2 | 0.9 | 1.1 | 1.0 | 1.1 | 0.7 | 1.8 |
| Commercial | 4.4 | 1.6 | 0.5 | 1.0 | 0.0 | 0.3 | 0.8 | 0.6 | 0.0 | 0.0 |
| Sexual | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 0.7 | 1.7 | 0.0 | 0.0 |

* predictor numbers as in Table 1

Source: own work.

The *LQC* values in Table 3 should also be perceived from the angle of crime groups. Crimes against property constitute a wide group of acts, including thefts, burglaries and property damage, all committed frequently, at all times of day. Their significant relationship with crime predictors comes down to their closest vicinity and in further *LQC* zones oscillates around 1. In the 50 m zone, these acts concentrate around *honeypots* (numerous cases of shoplifting during the day, breaking and entering and burglaries in shops or institutions in the evenings and at night) and *transit paths and routes* (numerous cases of pickpocketing from 8 am to 2 pm, car thefts from 10 am to 4 pm and thefts from cars in the evenings and at night). Crimes against the person committed in the vicinity of gated communities (factor of *spatial fragmentation*) occurred between 8 pm and 12 am and included extortion with violence, robbery and robbery with violence. Other crimes in this group, such as fights and battery or robbery also occurred near transit paths, usually between 10 am and 4 pm. Alcohol and drugs crimes also have their own spatio-temporal specificity of distribution. They mostly occur in the marketplace (*public facility*) between 8 am and 4 pm, near schools (*conflict and fear generator*) between 12 pm and 14 pm, and in parks (*problematic open space*) in the evenings. If car crimes (tipsy drivers, car accidents) occur near *transit routes*, it is usually in the morning or close to noon, while in the morning, evening or night they mostly concentrate around *honeypots*.

## 7.5. Conclusion

The authors of this article realise that the spatial structure of crime is influenced by numerous predictors: demographic, social, economic *etc*. But this study explores the relationship only between crime and crime predictors from a spatial perspective. The authors have drawn three basic conclusions from the conducted analyses. Firstly, urban space is not homogenous in terms of the level of crime threat; patterns of its non-random distribution are similar to those in the numerous American works (despite the significantly different social and cultural description of American society). Places where criminal acts are committed with increased frequency can be identified and, more importantly, they largely overlap with the identified locations of crime predictors. Secondly, strong relationships between the distribution of crime and the identified crime predictors mostly occur in the closest vicinity of these predictors. This impact generally decreases as the distance grows. Thirdly, individual crime predictors have varying influence on the distribution of all crime in the urban space as well as the distribution of specific types of crimes. Some research results taking into account land use features were confirmed. *Honeypots* (which included *alcohol outlets*) turned out to be the predictors that attract crime the most, as it was in the studies by T.L. Toomey *et al.* (2012), N. Sypion-Dutkowska, M. Leitner (2017), A.J. Snow-

den (2019). The attracting properties and their significance of public facilities (Yue *et al.* 2017), transportation routes and nodes (Ceccato, Uittenbogaard 2014; Matijosaitiene *et al.* 2019), or schools (Sypion-Dutkowska, Leitner 2017; Yue *et al.* 2017) were assessed similarly in the works referred to. Moreover, the repelling influence of *movement predictors* and *conflicts of land use* on the tendency to commit crimes in their vicinity was confirmed. The presented study on the relationships between the distribution of crime and crime predictors should be supplemented with an analysis of causes and determinants of these relationships.

The purpose of the research was to determine the influence of environmental crime predictors on the distribution of crime and this goal was achieved. A thesis claiming the strong attracting or repelling influence of individual crime predictors on crime was confirmed.

Certain recommendations regarding social policy and spatial planning can be made on the basis of the research results obtained. It turned out that the functioning stereotype about the dangers lurking in the vicinity of 19th century tenements in Bałuty was not quite true. The area of 20th century block estates is more dangerous. The distribution of crime predictors helps identify places that are problematic due to the tendency to commit crimes there. Local and municipal authorities should recognize these problematic areas and prepare plans of fixing them. Until the plans are implemented, these places should see increased police patrols (by optimizing the relocation of its limited human resources) or effective monitoring. In the authors' opinion, pinpointing specific crime predictors as problematic places is much more accurate than in the types of studies based on the pro-criminal influence of land use features. Moreover, the policy on alcohol outlets should be revised, due to their strong impact on the presence of crime. Universal and almost limitless access to alcohol should be reasonably restricted in terms of time and space, e.g. when issuing the subsequent permits and licences to sell alcohol.

From the methodological point of view, the authors, having conducted the research described in this article, would like to indicate the necessity of improving police databases, suitable to conduct spatial analyses, since they are frequently incomplete and incomprehensive. It should be obligatory to both identify the location of a crime as exactly as possible and provide a basic description of the area.

The main purpose of future studies will be to test the method of identifying the environmental crime predictors with regards to the temporal changeability of facilities and places that pose a potential threat. Additionally, the perception of the environment at risk of crime by inhabitants and users of the areas where crime predictors were identified will be studied. The issue of whether the inhabitants correctly perceive and evaluate the level of their personal risk in the vicinity of these predictors is incredibly interesting. Future studies will utilize the methods of moments of stress (MOS) as well as sensations curve.

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