

# 运用空间句法 衡量小型城市公园的安全性 ——以埃及开罗市 罗德—法拉格公园为例

## SPACE SYNTAX AS A TOOL TO MEASURE SAFETY IN SMALL URBAN PARKS —A CASE STUDY OF ROD EL FARAG PARK IN CAIRO, EGYPT

### 1 引言

在过去数十年间，全球的城市化进程十分迅速，包括埃及开罗在内的许多大都市区都面临着如何提供更好、更安全的城市开放空间（如公园）的挑战。城市公共开放空间可供人们休闲娱乐、亲近自然，有利于促进居民的身心健康<sup>[1][2]</sup>，对生活品质具有深远的影响。有研究指出，安全性是影响公园使用情况的主要因素之一，对使用者行为和态度起决定性作用，令人缺乏安全感的城市空间使用率较低<sup>[3]</sup>。那

诺哈·艾哈迈德·阿卜杜勒·阿齐兹  
开罗大学城市与区域规划学院城市设计系博士、副教授

**Noha Ahmed Abd El AZIZ\***

PhD and Associate Professor at Urban Design Department, Faculty of Urban and Regional Planning, Cairo University

\*Corresponding Author  
Address: I Gamaa Street, Giza 12613, Egypt  
Email: noos2000@yahoo.com

### 摘要

数十年来，厘清犯罪行为及其发生场所之间的关系一直是设计和社会领域的研究重点。尽管空间句法理论为研究环境的布局特征及其对人们活动与犯罪方式的潜在影响提供了有力支持，其在景观设计中的运用却仍然较少。本研究借助空间句法理论，使用depthmapX软件分析了埃及开罗市一座公园的空间布局并预测了其安全水平，以期填补这一空白。研究通过现场观察和采访公园工作人员收集了该公园2019年的犯罪记录，并运用ArcGIS 10.3软件对其进行分析。结果表明，空间深度、整合度、连接度和犯罪模式分布之间存在较强的相关性。公园的可见性分析图则显示了夏季和冬季植被（常绿乔木/落叶乔木）对视觉连接度和犯罪类型的不同影响。研究指出，将空间句法理论应用于景观设计仍面临挑战，但该方法在预测城市公园犯罪情况方面具有较大潜力。此类研究结果可为改进公园的概念设计提供参考，以创造更安全的公园环境。

### 关键词

CPTED；空间句法；开罗公园；安全公园；depthmapX软件；环境设计

### ABSTRACT

Decoding the relationship between crime and place has been the focus of researchers in both design and social fields for a few decades. Space syntax theory offers the possibility of examining the configuration characteristics of the environment and their potential influences on people's activities and crime patterns; however, its implementation in landscape architecture has been limited. This study responds to such a gap by exploring the effectiveness of applying space syntax theory to predict safety levels in a park in Cairo, Egypt. depthmapX was used to analyze the spatial configuration of the park. Crime records from 2019 were collected through site observation and staff interviews, and analyzed using ArcGIS 10.3 software. Results indicated a strong correlation between space depth / integration / connectivity and crime pattern distribution. The park visibility graphs indicated the different impacts of vegetation (evergreen tree / deciduous trees) in summer and winter on visual connectivity and crime types. The research concluded that applying space syntax theory to landscape architecture is challenging; nevertheless, it represents a promising approach to predict committing crimes in urban parks, and the findings can be adopted to enhance park conceptual designs to achieve higher safety level.

### KEYWORDS

CPTED; Space Syntax; Cairo's Parks; Safe Parks; depthmapX; Environmental Design

编辑 王胤瑜 田乐 翻译 王胤瑜  
EDITED BY WANG Yinyu Tina TIAN TRANSLATED BY WANG Yinyu

么，如何设计安全的公园？首先需要承认的是，实现这一目标并非易事，因为“安全感”是一种复杂的感受，受到环境诱因，以及建筑、社会和生态维度等多种因素影响<sup>[4]</sup>。

城市环境中的安全性可以借助环境设计手段来提升，在这个过程中，设计师需要了解物质环境与复杂的个人需求和行为之间的相互联系，从而通过设计来预防潜在的犯罪行为<sup>[5]</sup>。早在1830~1880年间，欧洲的“制图学派”已开始尝试研究犯罪与物质环境及其他社会因素之间的关系<sup>[6]</sup>。20世纪20~40年代，“芝加哥犯罪学派”提出的“社会解组论”，以及克利福德·R·肖和亨利·D·麦凯伊的研究关注于解释为何某些社区的犯罪率要高于其他社区<sup>[5][7]</sup>。

20世纪60年代，简·雅各布斯在《美国大城市的死与生》一书中强调，规划良好的城市社区有助于保障公共安全<sup>[8]</sup>。美国佛罗里达州立大学雷伊·杰弗里的著作《通过环境设计预防犯罪》所提出的同名理论（CPTED）阐述了如何通过建筑和景观设计预防犯罪，亦颇具影响力<sup>[5]</sup>。奥斯卡·纽曼在《防御空间：通过城市设计预防犯罪》一书中进一步指出，地产所属权明确、管控得力且容易使犯罪者暴露或有所忌惮的地区的犯罪率较低<sup>[5][9]</sup>。20世纪70年代末至80年代初，英国家庭研究办公室提出了“情境犯罪预防”理论，认为犯罪机会的增加导致了更多的犯罪<sup>[10]</sup>。另有许多其他研究为CPTED理论的进一步完善做出了贡献。例如，保罗与帕特丽夏·布伦蒂汉姆研究

## 1 Introduction

Over the past decades, the world has experienced an extraordinary increase in urbanization where many metropolitan cities, such as Cairo City, Egypt, are challenged to offer better, safer urban public open spaces like parks, which are well-acknowledged for their profound impact on the quality of the citizens' life by providing places to relax, play, interact, and connect with nature, and to enhance the physical and psychological health of communities<sup>[1][2]</sup>. When analyzing the factors shaping the use of parks, studies concluded that safety is a prominent factor, controlling and maneuvering the users' behaviors and attitudes. Lacking a sense of safety in urban spaces results in underuse, consequently hindering their benefits to the community<sup>[3]</sup>. So how to design safe parks? Achieving the sense of safety is not easy, as it is a very complicated feeling and combines a wide range of factors, including environmental cues, architectural, social, and ecological dimensions<sup>[4]</sup>.

Environmental design is one of the approaches tackling safety in the urban context. It offers a platform to understand the interconnected relationship between physical environments and complex individual needs and behaviors. Such an approach advocates that crime can be reduced by designs that deter potential offenders from committing the crime<sup>[5]</sup>. The first attempts to examine the relationship between crime and the physical environment and other social factors started during 1830~1880 under the name of the “Cartographic School” in Europe<sup>[6]</sup>. From 1920s till 1940s, immersed the Social Disorganization Theory, a theory issued by the “Chicago School of Criminology,” and the work of Clifford R. Shaw and Henry D. McKay sought to understand why crime and delinquency rates were higher in some neighborhoods than others<sup>[5][7]</sup>.

In the 1960s, in her book *The Death and Life of Great American Cities*, Jane Jacobs declared the impact of well-planned urban neighborhoods in endorsing public safety<sup>[8]</sup>. Another influential figure is Ray Jeffery of Florida State University, who introduced the concept of “Crime Prevention through Environmental Design” (CPTED) in his book with the same title, and identified how architectural and landscape design could discourage possible offenders from committing crimes<sup>[5]</sup>. Completing the rally, Oscar Newman's book *Defensible Space: Crime Prevention through Urban Design* claimed that properties with high degrees of ownership and control and making criminals exposed and vulnerable could discourage crime<sup>[5][9]</sup>. From the late 1970s to early 1980s, the Situational Crime Prevention (SCP) theory was developed at the British Home Research Office; it suggested that more crime opportunities lead

了佛罗里达州的盗窃案及其与城市设计的关系<sup>[11]</sup>；詹姆斯·威尔逊和乔治·科林提出了“破窗理论”，认为修复和改善残旧的城市空间以营造此处有人使用或占有的感觉是遏制犯罪率上升的必要举措<sup>[5][11]</sup>。非营利组织对此也有所贡献，例如，加拿大“安全设计委员会”提出了传统的环境犯罪预防方法，即在提高安全性的同时通过建筑和景观设计减少公众对犯罪的恐惧<sup>[5]</sup>。近期的一些研究已开始将这一领域与地理空间技术相结合，例如美国德克萨斯州立大学运用该技术识别和预测犯罪；另一些研究则运用空间句法理论分析空间布局对邻里社区或城市中犯罪的影响，但基于该理论研究公园或小型空间中犯罪情况的案例相对不足。因此，本文试图通过将CPTED概念与空间句法理论相结合来填补这一空白，以评估景观设计对小型城市公园犯罪发生情况和犯罪类型的影响。

## 2 犯罪场所理论和CPTED原则

许多理论都聚焦于分析城市犯罪多发于某些特定地点的原因，它们大致源于三种基本理论：一是“理性选择理论”，该理论认为实施犯罪的决定取决于个人需要和情境因素（如监视情况和被抓住的可能性）；二是“行为地理学理论”，该理论关注犯罪场所的“可达性”，认为犯罪者更倾向于在其工作地、居住地等日常活动区域附近作案<sup>[12]</sup>；三是“日常活动理论”，主要关注三个因素的相互作用：能够接近有吸引力的目标、缺乏有效监视，以及有犯罪动机者<sup>[13]</sup>。环境设计能够对日常活动理论中的两个因素产生影响，即犯罪目标和犯罪者的暴露程度。

保罗·科岑斯与特伦西·拉夫将犯罪发生场所归纳为5种类型：产生犯罪型、吸引犯罪型、转化犯罪型、恶化犯罪型和临时起意型。产生犯罪型场所可吸引大量人群，其中便包括犯罪动机尚不确定但可能实施犯罪的人；吸引犯罪型场所是指能激起人的犯罪欲望的场所；

to more crimes<sup>[10]</sup>。Many others contributed to the development of CPTED. For example, Paul and Patricia Brantingham examined burglaries in Florida, USA and their relation to urban design<sup>[11]</sup>. James Wilson and George Kelling developed the “Broken Windows Theory,” and claimed that in order to prevent escalating crimes it is a must to repair and improve dilapidated urban sites to build a sense of control and ownership<sup>[5][11]</sup>. Non-profitable organizations also joined the ride. For example, Safe Design Council in Canada has developed traditional environmental crime prevention approaches to reduce the public fear of crime by using architectural and landscape design<sup>[5]</sup>. More recent studies introduced geo-spatial technologies; for example, at Texas State University, USA they were applied to identify and predict crime. Other studies included using space syntax theory in studying the impact of the spatial configuration on crime in neighborhoods or cities. Nevertheless, applying space syntax theory in detecting crime in parks or small spaces is rare. Therefore, this paper seeks to fill this gap by integrating CPTED concepts with space syntax theory to evaluate landscape design impact on crime appearance and typology in small urban parks.

## 2 Crime Place Theories and CPTED Principles

Numerous theories seek to explain why urban crime occurs in certain places; basically they can be grounded into three primary theories. The first one is Rational Choice Theory, which claims that the decision to commit a crime depends on personal needs and situational factors such as surveillance and the possibility to be caught. The second theory is Behavioral Geography Theory that considers places closer to the offender’s work or residency are at higher risk than areas not within the offender’s daily route, in other words, referring to accessibility<sup>[12]</sup>. The last theory is the Routine Activity Theory, which looks at the interaction of three factors: the availability of an attractive target, the absence of guardians, and the presence of motivated offenders<sup>[13]</sup>. The environmental design has proven the ability to intervene two of them: the physical target and the offenders’ exposure.

Regarding the urban crime location, Paul Cozens and Terence Love summarized the places where crimes occur into 5 types: crime generators, crime attractors, crime detractors, crime facilitators, and crime precipitators. Crime generators are places that attract a mass of people, some with undetermined motivations to offend that can change to criminal acts. Crime attractors are places that are appealing to perform offending actions. Crime detractors are places that have few people, thus

转化犯罪型场所则指那些少有人来往、可能供潜在犯罪者实施犯罪的场所；恶化犯罪型场所是指那些可供犯罪者藏匿枪支、同党、酒精和毒品的场所，可帮助他们实施犯罪；临时起意型场所的物质环境会促使本无犯罪意图者犯罪，如在没有公共厕所的环境下随地小便的行为<sup>[11]</sup>。

本研究关注的CPTED方法旨在通过扩大监视者视野、建立明确的场所边界，以及创建和维护城市空间的正面形象来减少犯罪机会。在按照CPTED建议设计的场所中，犯罪者会更容易暴露并更有被捕的危机感<sup>[11]</sup>。除了设计建议外，CPTED还为保障设计效果提供了相应的管理策略建议，例如通过对城市环境的妥善维护与恰当使用，充分营造“为人所有、为人所用”的氛围，从而减少犯罪的发生。CPTED提出了7个设计原则，即空间领地性、监视、形象和周边环境、地理环境、出入口控制、合法活动引导，以及目标强化<sup>[11]</sup>，非营利组织“公共空间工程”在此基础上又增加了可理解度和物理通透性——可理解度是指环境空间结构的清晰度和易识别度，物理通透性则是指在某一环境中人们可自由选择如何活动的程度。根据CPTED的建议，充足的照明、可见的入口、适度疏朗的绿植、栅栏和积极的空间使用均有助于提高公共安全<sup>[3][9][12]</sup>。

### 3 空间句法理论与犯罪预防

#### 3.1 空间句法

空间句法（space syntax）是一种城市分析模型，可对城市环境的品质进行定量描述，包含一系列用于量化和分析建筑及城市空间布局的指标<sup>[9]</sup>。空间句法理论由英国伦敦大学学院巴特莱建筑学院的比尔·希里尔和尤利安·汉森于20世纪80年代首次提出<sup>[13]</sup>。希里尔在《空间即机器：建筑的布局理论》一书中将空间句法定义为从空间和形态学布局视角解释人类行为及社会活动的一种客观方式<sup>[14][15]</sup>，认为对空间布局进行分析与理解极为必要，因为空间的系统结构会影响使用者在其中的活动和回避情况，进而决定其对空间的使用及社会关系的形成<sup>[2][15]</sup>。空间句法理论还认为空间的拓扑属性比地理特征更为重要，因为人们更倾向于遵循基于图论的拓扑学规律来使用空间<sup>[16]</sup>。空间句法还提供

to encourage use by potential offenders. Crime facilitators are places that contain things that assist offenders such as firearms, gangs, alcohol, and drugs. Finally, Crime precipitators are places where its physical combinations push non-offenders to commit crimes; for example, public urination due to the lack of public toilets<sup>[11]</sup>.

This research concentrates on CPTED, an approach that seeks to optimize prospects for surveillance, clearly define boundaries, and create and maintain a positive image of the urban area, all to reduce opportunities for offending. Within CPTED recommendations, offenders would be more visible and would feel more at risk of being apprehended<sup>[11]</sup>. Besides offering design interventions, CPTED provides management strategies to support its cause, such as amplifying the sense of ownership and social control by well-maintained and appropriately used urban environment to hinder offenders. CPTED proposes 7 concepts for design: territoriality, surveillance, image and milieu, geographical juxtaposition, access control, legitimate activity support, and target hardening<sup>[11]</sup>. Project for Public Spaces added legibility and physical permeability. The former refers to the clarity of the environment and the degree to which a space is understandable, while the latter means to what extent an environment allows people to alternate choices of movement in it. Sufficient lighting, visible entrances, less dense foliage, fences, and active space use are recommended by CPTED to increase the safety of the public spaces<sup>[3][9][12]</sup>.

### 3 Space Syntax Theory and Crime Prevention

#### 3.1 Space Syntax

Space syntax is a kind of analytical urban model, and a quantitative method aiming to capture the quality of urban environments with a set of measures for space configuration and for quantifying and analyzing the properties of architectural and urban spaces<sup>[9]</sup>. It was first developed in the 1980s at the Bartlett Unit for Architectural Studies, University College London by Bill Hillier and Julienne Hanson<sup>[13]</sup>. In Hillier's book *Space is the Machine: A Configurational Theory of Architecture*, space syntax is defined as an objective way to interpret human behaviors and social activities from a spatial and morphological configuration point of view<sup>[14][15]</sup>. The theory postulates that the system structure of space in which various activities happen can affect users' movement and avoidance, shape their uses, and produce social relations; therefore, the spatial configuration must be analyzed and understood<sup>[2][15]</sup>. Space syntax privileges the topological properties of a space over its geography, as people are likely to move or behave based on topology under

了一系列工具来分析空间的语言学特征，如整合性、布局、使用者选择、可见性及视域等。

### 3.2 空间布局对犯罪的影响

“空间布局”（spatial configuration）是指两种元素之间受同时存在的其他至少一种元素，甚或全部其他元素影响的相互关系<sup>[14]</sup>，即某一时间点上空间之间存在的一系列关联，而这些关联不一定是肉眼可见的或物理层面上的。空间布局会影响人们的认知，随着时间的变化且在特定条件下，认知要素反过来也会影响空间布局。此外，空间布局能够改变日常活动理论中的环境吸引力（即目标）及犯罪机会（即缺乏有效监视），并影响CPTED中空间领地性、监视、出入口控制和目标强化等相关设计（图1），因此空间布局在犯罪预防领域得到了广泛重视。

已有大量研究探讨了犯罪的发生与空间布局之间的关系，但主要关注于居民区或城市尺度<sup>[9]</sup>。对犯罪环境的研究有助于理解犯罪事件，并深入了解与特定犯罪类型（如入室盗窃、街头抢劫、毒品交易和偷窃）高度相关的空间布局特征<sup>[4]</sup>。例如，有研究指出，非法活动与其发生地点的行人流量、可达性和渗透性具有内在联系<sup>[17]</sup>。关于空间布局如何影响犯罪和社区安全主要存在两种观点：其一受简·雅各布斯影响并由“新城市主义派”引导，提倡开放、可渗透的混合功能空间；另一种观点则以奥斯卡·纽曼的理论为代表，强调对公共领域加强控制。空间句法分析研究印证了这两种观点<sup>[17]</sup>：一项在伦敦进行的研究发现，巡逻巡视较少的地点与毒品犯罪事件存在相关性，这与新城市

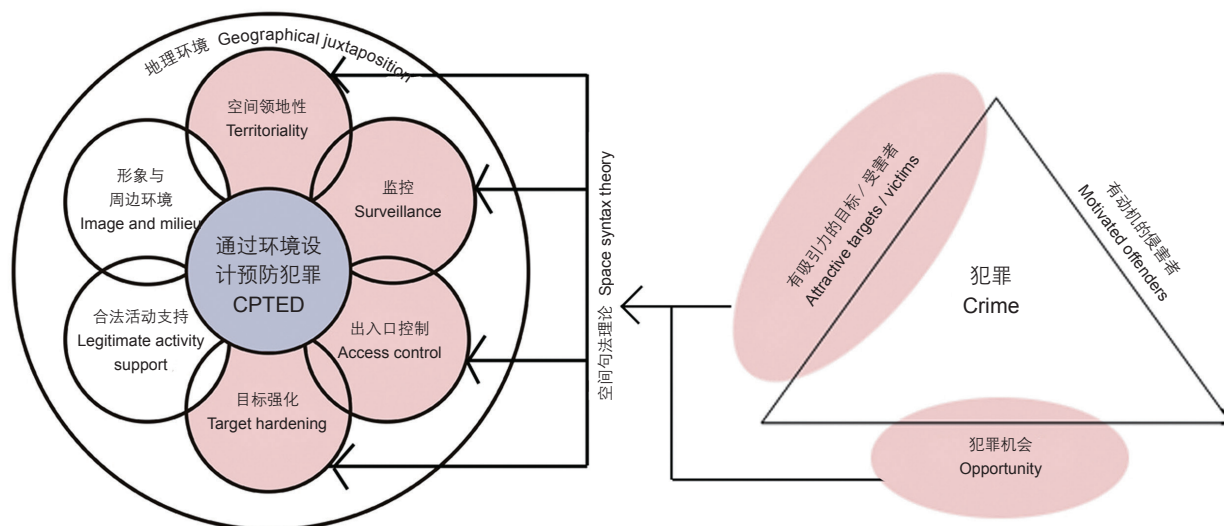
Graph Theory<sup>[16]</sup>。It delivers tools to analyze the linguistic characteristics of space, such as integration, configuration, user choice, visibility, and isovists.

### 3.2 Impacts of Space Configuration on Crime

The term spatial configuration refers to “a relation affected by the simultaneous co-presence of at least a third element and possibly all other elements in a complex”<sup>[14]</sup>. Thus, spatial configuration is a set of relations between spaces that exist at a particular time, which may enable or limit the possibility for visual and physical linkages. Spatial configuration is responsible for shaping cognition, while over a time and certain circumstances, cognitive constructs shape spatial configuration. Moreover, spatial configuration is able to alter the attractiveness of the environment (target) and the opportunity (the absence of a capable guardian) as mentioned in the Routine Activity Theory. In addition, it can control territoriality, surveillance, access control, and target hardening in the CPTED approach (Fig. 1), thus to be widely used in the domain of crime prevention.

A considerable body of research devoted efforts to investigate the relationship between the occurrence of criminal events and spatial configuration, mainly in residential areas or at a city scale<sup>[9]</sup>. Studying crime settings can help understand crime events and gain more knowledge about configurations that are highly connected with particular types of crime such as burglary, street robbery, drug dealing, and theft<sup>[4]</sup>. Studies have shown that illegal activity is intrinsically linked to pedestrian flows, accessibility, and permeability of the place where crime occurs<sup>[17]</sup>. Generally, there are two competing schools of thought on how spatial configuration may influence crime and community safety. The first, driven by “new urbanism school”

1. 空间句法理论与CPTED原则及日常活动理论的关系（改绘自参考文献[11][12]）
1. The contribution of space syntax theory to the CPTED principles and Routine Activity Theory [Adaptation sources: Refs.[11][12]]



© Noha Abu El Aziz  
1

主义学派的观点相一致<sup>[17]</sup>；另一方面，雷伊·杰弗里认为建立具有明确边界、出入口控制有序且景观维护良好的城市空间有助于预防犯罪<sup>[5]</sup>，而另一项针对加拿大某居民区的研究亦发现支路与主干街道的可达性与犯罪率呈正相关<sup>[18]</sup>，二者均印证了第二种观点。

可见性是增强空间安全性及人类安全感的重要因素，其同样受空间布局影响。可见性、自然监视和共现程度的不同也会对犯罪产生不同的影响<sup>[17]</sup>。较高的视线通透性可以使人们清晰地看到周围的其他人并发现潜在的威胁来源，从而感到更加安全。茂密的植被、栅栏、墙体、尖锐的拐角、仓储构筑，以及建筑物的遮挡均会影响视线通透性<sup>[19]</sup>。一些研究表明，公园内低矮且茂密的植被会遮挡视线、为犯罪者提供藏身之所，从而降低人们的安全感<sup>[20]</sup>。然而，也有一些研究发现空间中的植被可以吸引更多的使用者，从而降低犯罪率；同时，没有植被的街道和无地面铺装的区域通常被视为“无人地带”，由于缺少社交活动，犯罪者在这些空间中更不易被发现。相反，维护良好的植被往往意味着该区域为人所有或处于管护之下，因而有助于减少犯罪<sup>[21]</sup>。尽管不同的植被类型与犯罪发生之间的关联可能存在差异，但整体而言，低矮且茂密的植被与犯罪发生之间的正相关性更为显著；相反，场所的空间开阔度与犯罪发生之间存在负相关性<sup>[21]</sup>。

#### 4 案例研究：罗德—法拉格公园

本研究选取埃及开罗市的罗德—法拉格公园（以下简称REF公园）来探索运用空间句法理论预测城市公园中犯罪行为的可能性。该公园位于一处高密度非正式聚居区，周边居民大多是低收入者。公园面积为3.82hm<sup>2</sup>，于1997年建成，场地原为当地的一座蔬菜市场。REF公

and influenced by Jane Jacobs, calls for open and permeable mixed-use environments, whereas the opposition emphasizes the importance of control over people's territory like Oscar Newman's theory. Space syntax analysis has shown that both the theoretical standpoints have their strengths and weaknesses<sup>[17]</sup>. An example supporting the new urbanism school is a study based in London, which showed that locations less likely to be surveyed by police patrol were associated with drug crime<sup>[17]</sup>. In contrast, Ray Jeffery claimed that crime could be prevented by creating urban spaces with well-defined boundaries, well-controlled access points, and well-maintained landscapes<sup>[5]</sup>, and another study in a residential area in Canada found that an increasing accessibility to secondary and arterial streets is associated with an increase in crime<sup>[18]</sup>, both supporting the second vision.

Visibility is an essential factor in enhancing space security and the sense of safety, which is also affected by spatial configuration. Different degrees of visibility, natural surveillance, and co-presence also impact crimes<sup>[17]</sup>. Higher visual permeability can make people feel safer as they can see other people around with clear sightlines, which allows for identifying sources of threat. Visual permeability can be negatively affected by the presence of shrubbery vegetation, fences, walls, sharp corners, storage sheds, and buildings<sup>[19]</sup>. Several studies confirmed that low, dense vegetation in parks obstructs views and offers criminals a place to hide, thus reducing the sense of safety<sup>[20]</sup>. Yet, some other studies have found that vegetation is associated with decreased crime rates due to higher attractiveness to people. Meanwhile, streets and unpaved areas with no vegetation are often seen as “no man's lands,” which would discourage social interaction, making it easier for criminals to go unnoticed. In contrast, well-maintained vegetation might reduce crime since it can be seen as a “territorial marker” or a “cue to care”<sup>[21]</sup>. Generally, this discrepancy can be explained by differences in the types of vegetation analyzed, as the positive correlation with crime appearance were found more in low, dense vegetation; however, the contradicting results might be concluded to more open areas<sup>[21]</sup>.

#### 4 Case Study: Rod El Farag Park

This research selected Rod El Farag Park in Cairo City, Egypt to assess the possibility of using space syntax theory in predicting crime patterns in urban parks. The park is located in a high-density informal district, and residents here are mostly low-income citizens. The 38,200-square meter park was built up in 1997 after the regional vegetable market was relocated outside

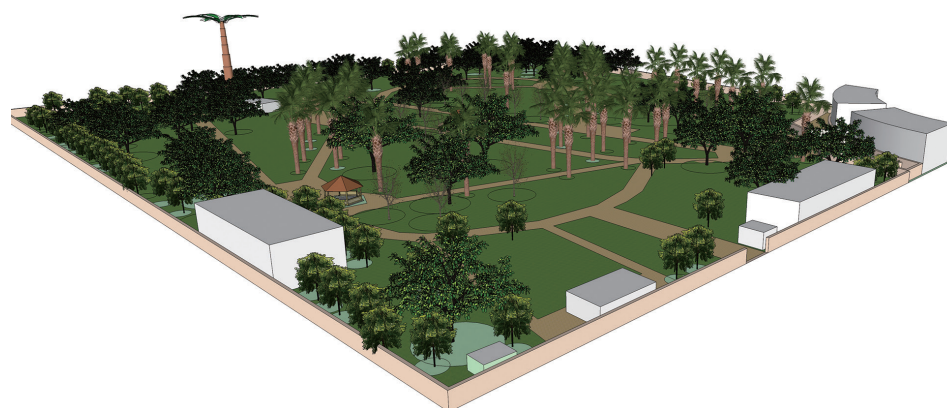


© Noha Abd El Aziz  
2-1



- 1 文化中心 Cultural center
- 2 消防站 Fire station
- 3 中央办公室 Central office
- 4 医院 Hospital
- 5 儿童图书馆 Children's library
- 6 学校 Schools
- 7 青年中心 Youth center
- 8 入口与售票处 Entrance and ticket outlet
- 9 洗手间 Toilets
- 10 公园管理处 Administration
- 11 广场 Plaza
- 12 木制凉亭 Wooden pergolas
- 13 电力设备箱 Electrical box

© Noha Abd El Aziz  
2-2



© Noha Abd El Aziz  
2-3

- 2. REF公园区位、周边土地利用情况及整体透视图（底图来源：Google Earth）
- 2. The location, surrounding land use, and overall perspective of Rod El Farag Park (Base map source: Google Earth)

园隶属于一个服务综合体，内有大片草坪和带有木制凉亭的广场（图2）。尽管公园交通便利，门票价格合理，但由于存在安全隐患及犯罪率较高而难以吸引当地居民前来，公园内多处区域现已无人使用，反而成了犯罪分子的聚集区——正如约翰尼斯·努特森所说，许多吸毒者和贩毒者都认为公园是吸毒或毒品交易的理想场所<sup>[22]</sup>。公园只有一个通往城市主干道的入口，而通往罗德—法拉格文化中心的大门则常年关闭。

#### 4.1 研究方法

研究首先进行了两组采访：一组针对公园管理人员，目的是获取已记录在案的公园非法活动相关资料；另一组针对公园保安团队，通过他们的日常观察与记忆了解那些未被正式记录的公园犯罪情况。研

the city. The park is a part of a service complex, with large lawn areas and plazas with wooden pergolas (Fig. 2). Although the park is highly accessible and with a reasonable entry charge, it fails to attract most locals due to its bad reputation in poor safety and offending acts. Many criminal incidents were recorded here, driving out users from utilizing some zones in the park, which echoes Johannes Knutsson's opinion that drug users and drug dealers find parks to be appealing locations to get high or to trade<sup>[22]</sup>. The park has one entry from the main street, and a gate (always closed) connects it to Rod El Farag Cultural Center.

#### 4.1 Research Methods

In the first section of this research, two sets of interviews were conducted: one with the park's management staff to collect data of illegal activities that were officially recorded, and the

究跨度为2019年全年，其中部分犯罪事件已由警方处理，另一些则由当地保安人员处理或由公园游客制止。研究者根据这些信息判别已记录及未记录犯罪发生的地点与类型，并绘制了公园内犯罪事件的分布图。REF公园内发生的犯罪分为4种类型：自我危害行为、危害他人行为、严重危害他人行为，以及危害公园行为（如破坏公物）。研究在ArcGIS 10.3软件中根据犯罪发生情况对公园各区域进行编码，0表示无犯罪，1表示有犯罪发生；并分别在2019年夏季（7月）和冬季（12月）一天中的不同时段对公园场地进行观察，以了解使用者活动及分布情况。

第二部分是使用depthmapX软件分析公园的空间布局参数，涉及的工具主要包括：

1) 深度分析图：用于表示从某一空间到达另一空间必须经过的拓扑节点数量；数值越小代表空间深度越浅，数值越大代表空间分离度越高<sup>[14]</sup>。

2) 全局整合度（句法意义上空间的可达程度）分析图：用于表征空间可达性或数学意义上的邻近中心度，即反映了空间网络中某一特定路段为行人所踏足的可能性<sup>[23]</sup>，可据此预测行人的移动趋势或网络中潜在的目的地。

3) 连接度分析图：用于衡量直接与原点空间相连的空间数。连接度是指与给定线段直接相连的线段数量。

4) 可理解度分析图：反映环境中寻路的难易程度，即观察者在整个空间系统中从任一位置到达另一位置的容易程度<sup>[14]</sup>。

5) 可见性分析图：用于表示公园向使用者或路过者所提供的自然监视的质量<sup>[2]</sup>。

分析得出的具体空间布局数值范围均以从深蓝色到红色的色阶表示。蓝色表示低值，红色表示高值。

植被对空间可见性、连接度和可达性的影响较为复杂。与充斥着大量建筑物、视线极易受阻的建成环境相比，透过乔木和灌木枝叶进行观察可以增强视觉连接度、连续性，并提供更开阔的视线。经过实地考察，研究将建筑物、凉亭及售货亭作为可见性分析图中的阻碍

other with the park security team to acquire information about the non-documented incidents depending on their observations and memories. The collected crime data records were for the year 2019. Some violations were intervened by police forces; the others were solved by the local security personnel or the response of other visitors. The occurring places and types of both the recorded and non-documented crime events were then identified, and used to create a crime mapping to highlight the crime distributions. Crimes in the park were categorized into 4 types: crimes against oneself, crimes against others, dangerous crimes against others, and crimes against the park (e.g. vandalism). Criminal data were coded, 0 for none, and 1 for appearance, then mapped in ArcGIS 10.3. Besides, site observations were carried out in July (summer) and December (winter) at different hours of the day to record the activities and users' distribution.

The second section was analyzing the parameters of the spatial configuration of the park using depthmapX, and the following tools were adopted:

1) Depth graph shows the number of topological nodes that must be crossed to go from one space to another. In a depth graph, low values mean shallowness of space, while high values mean segregation<sup>[14]</sup>.

2) Integration graph showing global integration values (degrees of syntactic accessibility) measures accessibility or mathematical closeness centrality, showing how likely a particular path segments is to be the destination for those using the network based on the position of the path segment in the network<sup>[23]</sup>. It can be used to predict users' movements or their potential destinations.

3) Connectivity graph measures the number of spaces immediately connecting a space of origin.

4) Intelligibility shows how the environment is easily navigable, which means how easy an observer can be acquainted with his / her position in any location he / she may potentially occupy within the whole spatial system<sup>[14]</sup>.

5) Visibility map presents the quality of natural surveillance by either park users or commuters passing by the park<sup>[2]</sup>.

In these graphs, the analysis value ranges are represented by a gradient of colors ranging from dark blue to red: dark blue indicates lowest values and red indicates highest.

The impact of vegetation on visibility, connectivity, and accessibility is complex. Looking through branches of trees and shrubs enhances the visual connection and continuity, and offers more open sightlines when compared with doing so in urban built environments, where buildings block users' sightlines. Site visits helped with selecting objects that may block sightlines

表1: 公园中树木分类  
Table 1: Tree classification in the Rog El Farag Park

树木名称 Species	种类 Type	树冠大小 Size of canopy	树冠不透明度 Opacity of canopy
阔荚合欢 <i>Albizia lebbbeck</i>	落叶树 Deciduous tree	大 Large	低 Low
印楝 <i>Azadirachta indica</i>	落叶树 Deciduous tree	大 Large	低 Low
腊肠树 <i>Cassia fistula</i>	常绿树 Evergreen tree	大 Large	高 High
节果决明 <i>Cassia nodosa</i>	落叶树 Deciduous tree	大 Large	低 Low
地中海柏木 <i>Cupressus sempervirens</i>	常绿树 Evergreen tree	大 Large	高 High
凤凰木 <i>Delonix regia</i>	落叶树 Deciduous tree	大 Large	低 Low
垂叶榕 <i>Ficus benjamina</i>	常绿树 Evergreen tree	大 Large	高 High
绿黄葛树 <i>Ficus virens</i>	落叶树 Deciduous tree	大 Large	低 Low
榕树 <i>Ficus microcarpa</i>	常绿树 Evergreen tree	中 Medium	高 High
非洲楝 <i>Khaya senegalensis</i>	常绿树 Evergreen tree	大 Large	高 High
山榄科植物 <i>Mimusops laurifolia</i>	常绿树 Evergreen tree	大 Large	高 High
乌墨 <i>Syzygium cumini</i>	常绿树 Evergreen tree	中 Medium	高 High

因素,但不包括座椅等不会遮挡视线的户外家具。根据实地观察结果将公园内的植被分为两类,一类是树冠茂密但树干分叉较低的中型及大型乔木(视线通透性低,即树冠不透明度高),它们被视为可见性分析中的阻碍因素;另一类包括棕榈树(树干极高)、树冠较小且树干较高的其他乔木(树冠视觉通透性高),以及低矮灌木(高度低于50cm)和地被植物,本研究不将它们看作视线阻碍因素。由于公园中绝大部分为成熟植被,一年中公园的植被密度变化较大,这会影响空间的可见性和使用情况,于是研究分别计算了夏季与冬季公园空间的视觉连接度及相应的犯罪事件分布情况。夏季情景将常绿和落叶乔木都考虑在内,冬季情景则不考虑落叶乔木(表1)。笔者收集了这些树木在夏季和冬季的照片(图3),以确定每种树木树冠的不透明度和树干高度。

#### 4.2 研究方法的局限性

运用空间句法对景观进行研究也存在许多困难,因为景观中的空间并不像建成环境中的空间那样,以墙体或建筑物作为明确的边界



© Neha Abd El Aziz

to be added to the visibility graph, such as buildings, pergolas, kiosks, and obstructing vegetation. Seats and other site furniture were excluded as they rarely block people's sight. Based on site visits, vegetation in the site was categorized into two groups. One group is medium and large trees with dense canopies and relatively short trunks (providing low visual permeability, i.e. high opacity), which were added to the visibility map. The other group included palm trees (very high trunks), trees with small crowns and high trunks (providing low opacity), short shrubs (less than 50 cm), and ground covers, which were excluded as they do not affect sightlines. Considering that most vegetation in the park is mature and the dynamic vegetation density throughout the year would impact the visibility and the use of space, scenarios of both the summer and the winter were implemented to acquire the fluctuation in visual connectivity with the crime pattern. The summer scenario took both evergreen and deciduous trees into consideration, while the winter one excluded deciduous trees as they do not represent visual obstacles (Table 1). Pictures of the park trees in the summer and the winter were collected to determine the opacity of their canopies and trunk heights (Fig. 3).

#### 4.2 Limitations

Using space syntax in landscape studies arises many predicaments, such as defining clear boundaries of spaces since they are not well defined by walls or buildings as in urban context (Fig. 4). In their research, Zhai Yujia and Perver Baran<sup>[2]</sup>

- 以凤凰木为例示意同一种乔木夏季与冬季的树冠视觉通透性差异
- An example of *Delonix regia* showing the difference of a tree's canopy opacity in the summer and the winter



4. REF公园中的空间边界类型

4. The boundary types of the spaces in Rod El Farag Park

(图4)。翟宇佳和珀维尔·巴兰指出,空间的边界是由空间功能和设计意图决定的,进而提出了一个问题:在空间句法分析中是否应对道路和活动区域运用同样的处理方式?<sup>[2]</sup>因此,本研究在定义公园空间布局时将小径和广场同等对待,但不包括原本未被设计为活动区域的草坪(尽管实际上已有人在这些草坪上活动)。其他难点包括:研究只能依靠保安团队的回忆来获知未记录在案的犯罪行为的发生地点和时间,而这些数据的准确性无法保证;作为2D软件,depthmapX不支持输入乔木的树冠通透度、高度、覆盖率和生长速率等数据,也无法模拟地形特征,因此本研究的空间句法分析没有考虑颜色和纹理/材质等环境外观特征,以及活动对人群的吸引效果。

## 5 研究结果

### 5.1 公园犯罪地图

对犯罪数据(表2)的分析结果表明,吸毒和酗酒等自我危害行为在REF公园中最为常见,可以通过留下的垃圾(针头及酒瓶等)对其进行追踪;其次是危害公园行为,包括乱抛垃圾、随地小便、涂鸦,以及破坏公物行为(包括爬树、折断树枝、在树上乱涂乱画、喷涂座椅和凉亭,以及破坏木凳和垃圾桶)。其后是青少年的不雅行为、争吵及寻衅滋事行为。在公园发生的严重危害他人行为中,盗窃的比例最高,其次是持刀斗殴,绑架儿童事件也偶有发生。犯罪行为主要发

proposed that boundaries between spaces are defined by spatial functions and design intentions, and they raised the question that whether to consider activity areas and pathways equally in the system. Thus, this study regarded paths and plazas equally in defining the park's spatial configuration, excluding lawn areas that are not intended for use though some people do use. In addition, the research had to acquire locations and occurrence time of those unrecorded crimes depending on the memory of the security team, which was therefore not accurate. depthmapX is a 2D software that cannot deal with data regarding tree opacity, height, spread, or growth rate. Moreover, terrains were not included in the model. Finally, space syntax in this research ignored the superficial appearance of the environment, including surface colors and textures, and discarded the effect of activities in attracting pedestrian flows.

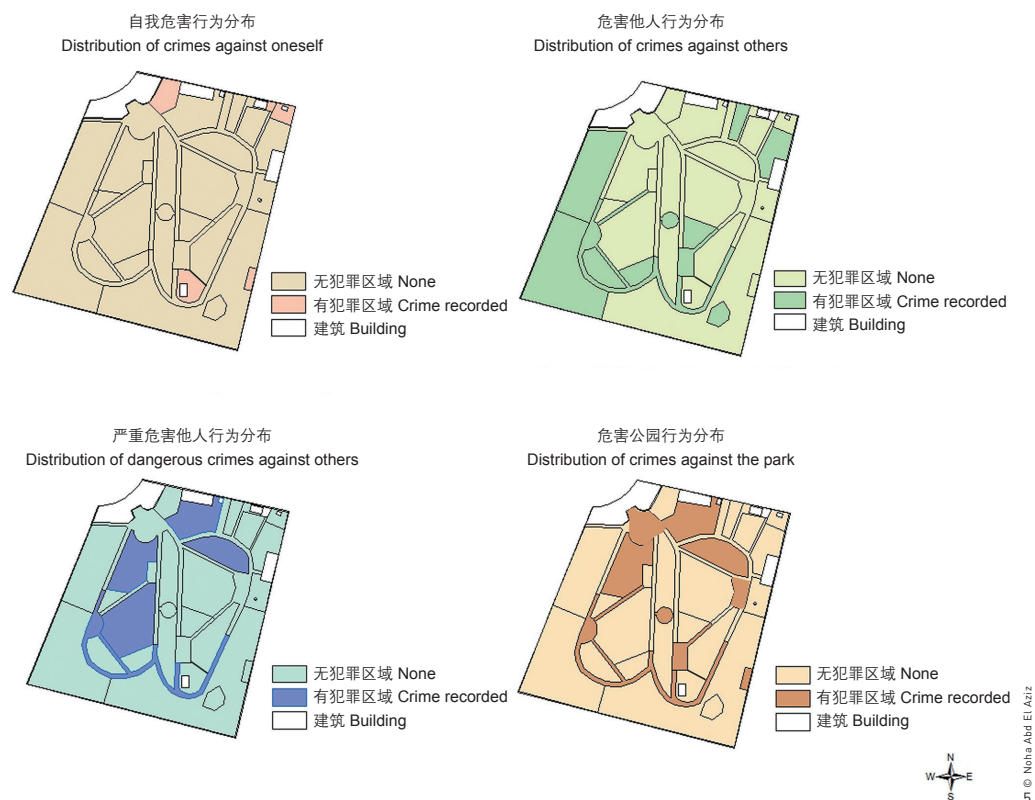
## 5 Results

### 5.1 The Crime Mapping of the Park

After analyzing the crime data (Table 2), results showed that crimes against oneself, like drug and alcohol abuse, were the most common crimes in the park. They can be tracked by the waste left behind (e.g. needles and bottles). In the second place came crimes against the park represented by littering, public urinating, graffiti, and vandalism including breaking tree branches, carving in trees, spraying seats and pergolas, and dismantling wooden benches and trash bins. Teenagers' inappropriate behaviors, quarrels, and harassment followed in the third place. As for dangerous offenses against others, theft was in the lead, then armed fights, and few cases of kid's

表2: 公园中犯罪类型分析  
Table 2: Crime typology analysis in the Rog El Farag Park

犯罪种类 Crime types	犯罪行为 Crime activities	占总犯罪数百分比 Percentage (%)
自我危害行为 Crimes against oneself	毒品交易 吸毒 酗酒 Drug trading Drug abuse Alcohol abuse	46
危害他人行为 Crimes against others	不雅行为 争吵 寻衅滋事 Inappropriate behaviors Quarrels Harassments	20
严重危害他人行为 Dangerous crimes against others	偷盗 / 扒窃 持械斗殴 绑架儿童 Thefts / pocket-picking Armed fights Child kidnapping	7
危害公园行为 Crimes against the park	乱丢垃圾 随地小便 涂鸦 破坏公物 Littering Public urinating Graffiti Vandalism	27



生在公园外围和西侧，而公园中心区域较为安全，几乎没有犯罪发生（图5）。

## 5.2 公园空间布局分析

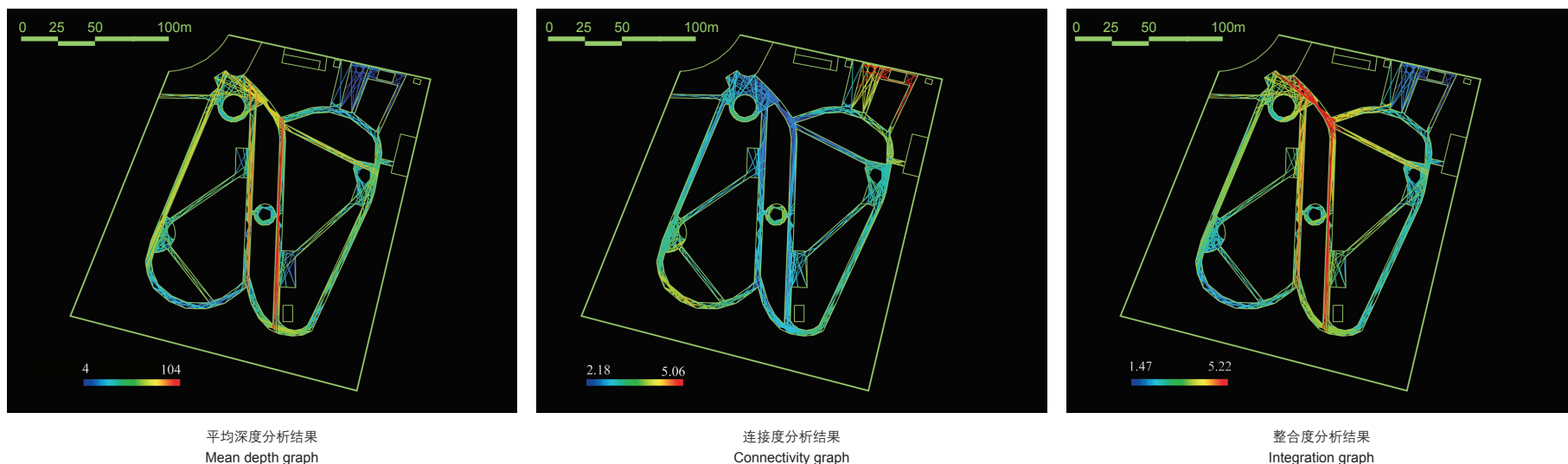
空间深度分析的结果（图6-1）表明，公园北部的洗手间周边和南部区域的空间深度值最大，即洗手间周边区域和南部区域在空间上是高度隔离的；北部广场和公园中部两条主要道路的空间深度值最小；公园的其余区域深度值为中等。连接度分析结果（图6-2）表明，公园中部的两条道路和东北部的广场连接度最高，公园入口、中央广场和南部连接度最差。整合度分析结果（图6-3）则表明，将北部广场和公园南部区域相连的道路空间整合度最高，东侧和南侧道路的空间整合度最差。

kidnapping attempts. Crimes were mainly found at the park periphery and the west section, whereas the central area of the park was considered safe and free from criminal activities (Fig. 5).

## 5.2 Spatial Configurations Analysis of the Park

The result of the space depth analysis (Fig. 6-1) shows that the area around the toilet in the north and the southern section of the park had the highest depth values, indicating that these two areas were the most spatially isolated, while the plaza in the north section and the two main paths in the center of the park had the least depth values. The rest of the park is intermediate in space depth. As for the connectivity analysis (Fig. 6-2), the two paths in the center of the park and the north plaza were the most connected areas; the entrance, the plaza in the center, and the southern section were the most disconnected areas. In regards to integration analysis shown in Figure 6-3, it was found that the most spatially integrated path is the one connecting the north plaza with the southern section. In contrast, paths in eastern and southern parts of the park had the least integration with the other paths and spaces.

5. 不同类型犯罪事件在REF公园中的分布情况
5. The distribution of different crime types in the Rod El Farag Park



平均深度分析结果  
Mean depth graph

连接度分析结果  
Connectivity graph

整合度分析结果  
Integration graph

© Noima Abd El Aziz

6. REF公园空间布局分析结果
6. The spatial configuration analysis of the Rod El Farag Park

图7显示了整合度值分布的偏差情况，其表明公园内约一半地点的空间整合度值适中且较为接近，而另一半地点的空间整合度值则呈显著的两极分化。此外，研究也分析了空间连接度与整合度之间的关系，即可理解度（图8）：整合度和连接度之间的相关系数为0.70，表明整合度高的空间或路径连接度也较高，而整合度与平均空间深度，以及平均空间深度与连接度之间则呈负相关（相关系数分别为-0.94和-0.69）。各项空间布局分析结果见表3。

### 5.3 可见性图分析

在可见性研究中对道路和草坪区域进行了无差别处理。值得注意的是，由于存在树木、建筑物及覆盖着金属薄板的栅栏等遮挡物，无法透过公园外围看到其内部（图9）。

结果表明，整个公园的可见性在夏季和冬季均呈辐射状分布，即中心区域可见性最高，外围可见性最低。由于公园内建筑物和凉亭极少，因此对可见性的影响范围较小。落叶乔木（图中黑色圆点）对可见性的负面影响在夏季较为显著，致使高可见性区域明显缩小（图10-1）；在冬季，树冠的通透度较高，因此公园东部和西部区域的可见性有所提升（图10-2）。

Figure 7 displays the integration value deviation, showing that half of the park integration values are close while the other half is either highly integrated or disconnected. Additionally, the intelligibility of the park was measured by investigating the relation between the connectivity of space and its integration (Fig. 8). In terms of the degree of intelligibility, the correlation coefficient between integration and connectivity was 0.70, indicating that spaces / paths with high integration are also highly connected and intelligible. However, integration and mean depth saw a negative correlation (correlation coefficient was -0.94), so did mean depth and connectivity (correlation coefficient was -0.69). The spatial configuration analyses are summarized in Table 3.

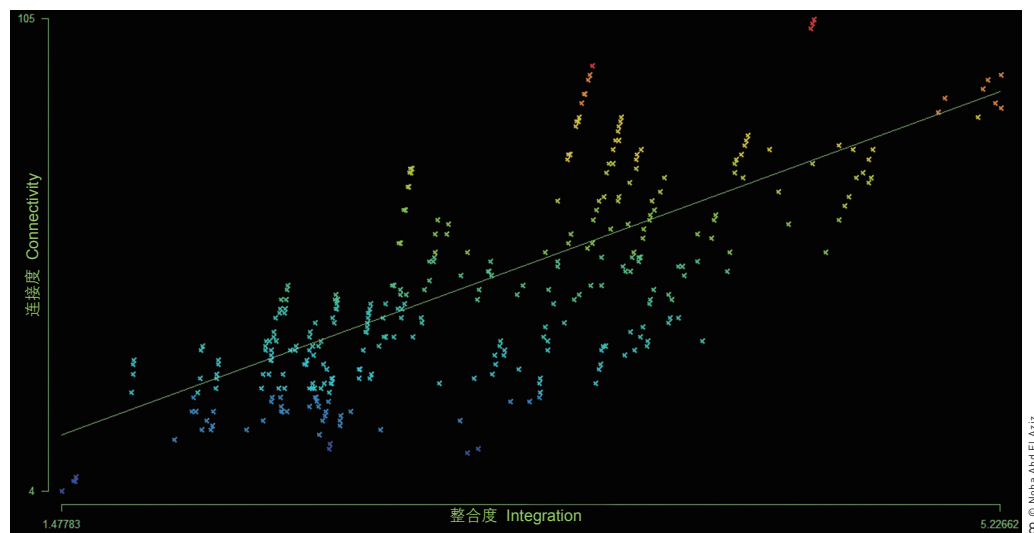
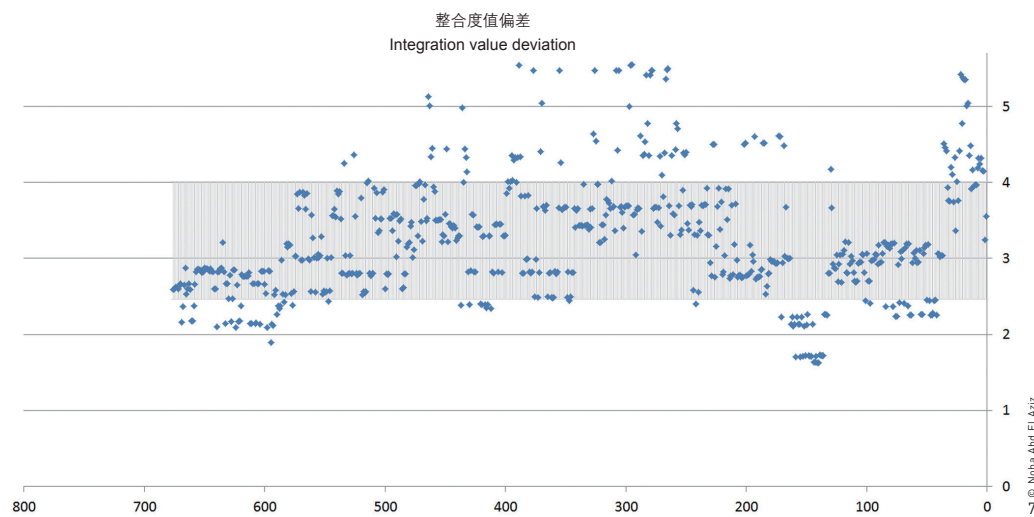
### 5.3 Visibility Graph Analysis

In the visibility analysis, paths and lawn areas were treated the same. It is important to note that the park cannot be seen from the surroundings due to trees, buildings, or metal sheets covering the park fence (Fig. 9).

A radial visibility distribution pattern was found in both the summer and the winter. The park center was the most visible zone, while the park periphery was the least visible section. Since there are few buildings and pergolas at the site, their impact on visibility was localized. The negative effect of the deciduous trees (black dots on the graph) can be noticed in the summer scenario (Fig. 10-1), as they shrunk highly visible areas. In the winter scenario, the eastern and western sections were more visible due to sightline penetrating the translucent tree canopies (Fig. 10-2).

表3: 公园空间布局分析结果  
Table 3: Results of the spatial configuration analysis of the park

	整合度 Integration	平均深度 Mean depth	连接度 Connectivity
平均值 Average	3.1	3.1	47.8
最小值 Minimum	1.4	2.1	4.0
最大值 Maximum	5.2	5.2	105.0
标准差 Standard deviation	0.8	0.5	20.8



7. 空间整合度值偏差分布图
8. 空间整合度-连接度散点图, 从中可看出公园空间布局的可理解度较好。

7. Integration value deviation analysis
8. The scatter graph of integration and connectivity implying that the park has a good intelligibility of spatial configuration

## 6 结论

### 6.1 空间布局对犯罪类型及其分布的影响

研究发现, 公园中犯罪类型与特定的空间布局相关。例如, 空间深度小、整合度及连接度高的区域犯罪记录最少, 且犯罪类型以乱扔垃圾为主; 在空间深度、整合度与连接度均中等的区域发生的犯罪活动主要为言语骚扰、破坏公物、不雅行为和乱扔垃圾; 空间深度大、整合度与连接度极低的区域最容易发生严重犯罪活动, 如酗酒、吸

## 6 Conclusions

### 6.1 The Impact of Spatial Configuration on Crime Types and Distribution

The research found that certain spatial configuration characteristics had relations with crime types. For example, the areas with low depth, high integration, and high connectivity recorded the least crimes, and crimes in these areas were basically littering. Spaces with medium depth, medium integration, and medium connection recorded criminal activities such as verbal harassment, vandalism, inappropriate behaviors, and littering. Serious criminal activities such as alcohol / drug abuse, public urination, and physical harassment took place mostly in spaces with high depth, minimal integration, and minimum connectivity. Most crimes against oneself did not occur in the paths or plazas



9. 来自REF公园外部被阻挡的视野
10. 夏季和冬季情境下的可见性分析图

9. The blocked views from outside of the Rod El Farag Park
10. Visibility analyses in summer and winter scenarios

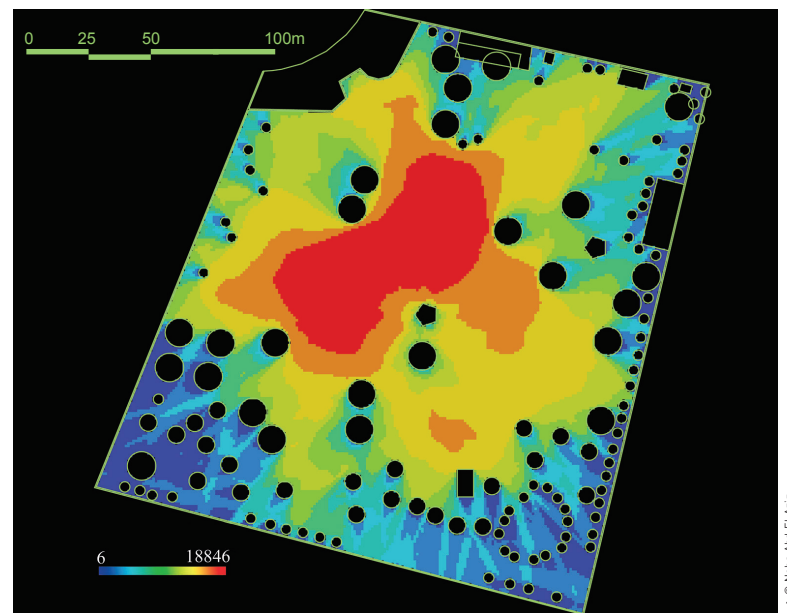
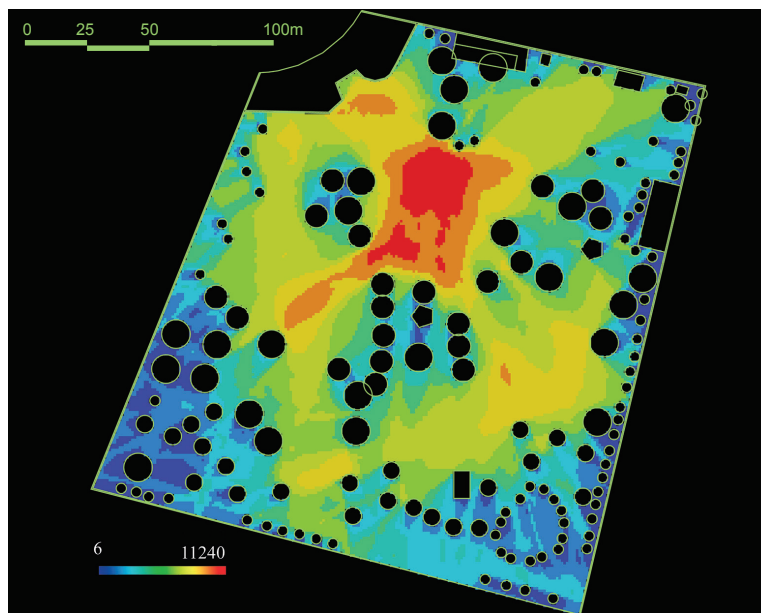
© Noha Abd El Aziz

毒、随地小便和肢体骚扰。大多数自我危害行为发生在空间整合度低的区域，而非道路或广场上。

此外，公园入口处更易发生绑架和持刀斗殴等犯罪活动，因为犯罪者逃脱的可能性相对较大。此外，现场观察结果表明，游客更喜欢坐在公园的入口和出口附近，这里的扒窃犯罪也更为多发。从表4所示的各类型犯罪发生场所的空间整合度数值范围可知，除入口区域和具有自然监视的公园管理处周边区域以外，无犯罪区域的整合度相对较高（可达5.2）。

but in the areas with low integration values.

Additionally, the entrance of the park attracted crimes like kidnapping and fights with pocket knives, as this area maximizes the probability of escaping. Moreover, site observation found that the park visitors prefer to sit near the park access, where pocket-picking crimes were mostly occurred. Table 4 shows the range of integration values for each crime type. The integration values of non-crime zones were relatively higher (up to 5.2), except for the entrance and the area near the administration that provided natural surveillance.



© Noha Abd El Aziz

表4: 各类型犯罪发生区域的空间整合度值  
Table 4: Integration value for each crime type

犯罪类型区域 Crime type areas	整合度值 Integration value
自我危害行为区域 The area of crimes against oneself	1.4 - 2.0
危害他人行为区域 The area of crimes against others	2.0 - 3.9
严重危害他人行为区域 The area of dangerous crimes against others	2.0 - 3.2
危害公园行为区域 The area of crimes against the park	2.0 - 4.6
无犯罪区域 No-crime area	2.0 - 5.2

表5: 冬季情境下各类型犯罪发生区域的可见性值  
Table 5: Visibility value of the areas of each crime type in the winter scenario

犯罪类型区域 Crime type areas	可视性值 Visibility value
自我危害行为区域 The area of crimes against oneself	1,000 - 9,500
危害他人行为区域 The area of crimes against others	800 - 14,000
严重危害他人行为区域 The area of dangerous crimes against others	2,500 - 17,000
危害公园行为区域 The area of crimes against the park	2,500 - 14,000
无犯罪区域 No-crime area	15,000 - 18,000

## 6.2 场地可见性对犯罪类型和分布的影响

将公园的可见性分析图与犯罪类型及其分布图进行比较可知，空间可见性越高，发生非法行为的可能性就越小（如公园中心区域）；围栏附近可见性较差的区域会发生酗酒、吸毒等事件；危害他人行为（尤其是不雅行为）多发生于公园西南部和东北部的低可见性区域；可见性中等或较高但人群密集的空间容易发生严重危害他人行为，如盗窃、扒窃和绑架儿童，因为这些地点邻近出入口，更便于犯罪者逃脱；危害公园行为则多发生在可见性中等及较低的区域，个别发生在高可见性区域。表5总结了不同犯罪类型发生区域所对应的可见度取值范围（平均值为10 600）之间的关系，图11展示了公园内不同位置的植被对视线的影响。

综上，公园南部区域的低空间整合度助长了犯罪活动的发生。此外，遮阴植被虽然提升了公园的舒适度和视觉吸引力，但也带来了空间安全隐患，尤其是在公园外围地区。公园保安队伍的监视活动主要集中于入口区域，无法覆盖整个公园。作为自然监视的来源，公园入口和公园管理处的位置对犯罪行为的分布有明显影响，而人群分布则与特定类型的犯罪有关。

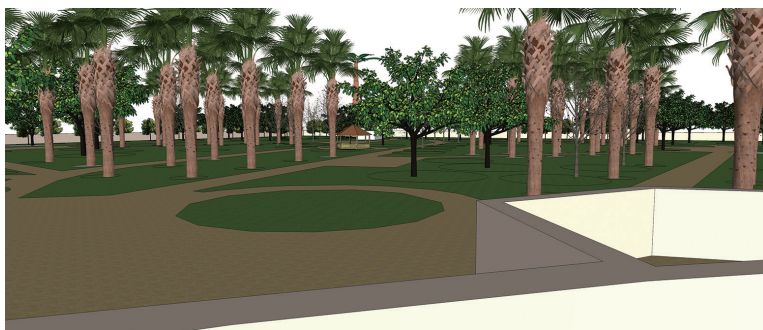
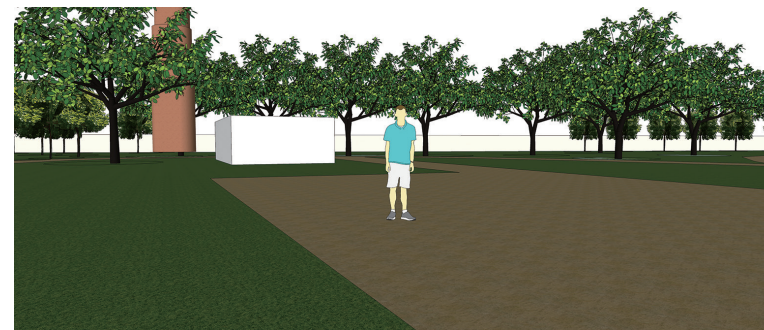
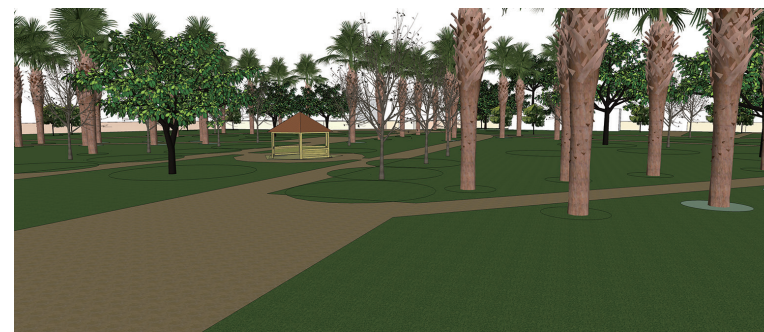
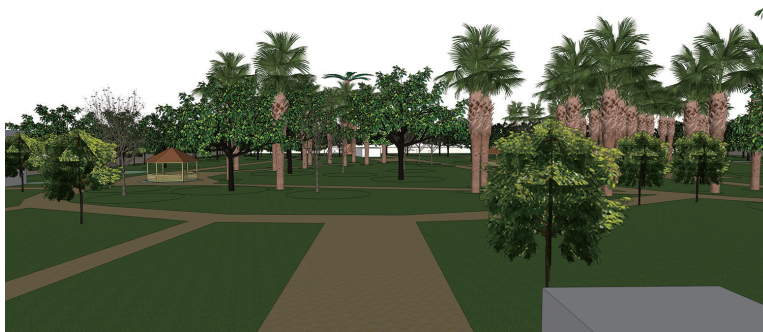
## 6.2 The Impact of Site Visibility on Crime Types and Distribution

When comparing the park's visibility graph with crime types and distribution, it was found that the more visible the area was, the fewer illegal actions occurred, e.g. the park center. The less visible area near the fence recorded alcohol / drug abuse incidents. Crimes against others, especially inappropriate behaviors, appeared in the low visible zones in the southwest and northeast sections. High and medium visible spaces occupied by crowds were prone to dangerous crimes against others, like thefts / pocket-pickings, and child kidnapping due to their proximity to the escape point (entrance). As for vandalism against the park, it occurred in medium to low visible areas and a few spots with high visibility. Table 5 summaries the visibility value ranges of areas for different crime types (average visibility value is 10,600). Figure 11 illustrates the impact of vegetation on sightlines in different locations in the park.

It can be concluded that the poor integration of the southern sections encouraged the crimes. Furthermore, the lack of a balance between shading trees for thermal comfort / visual appeal and high visibility compromised safety levels, particularly at the park periphery. The surveillance of the security team was concentrated at the entrance gate, and cannot cover the whole park visually. The locations of the entrance and the administration affected the crime distribution by offering natural surveillance, while crowd distribution had an impact on the appearance of some crime types.

11. 3D模拟图展示了公园内不同位置的植被对可见性的影响

11. 3D models illustrating the impact of vegetation on visibility at different locations in the park



© Noha Abu El Aziz  
11

## 7 讨论

空间句法理论被用于研究城市环境空间布局与人类活动模式 / 行为之间的关系已有20余年的历史。本研究选择了位于埃及开罗市非正式聚居区且犯罪频发的REF公园为研究对象，探究了公园空间布局与在此发生的犯罪类型及空间分布的影响。结果表明，空间连接度、整合度、深度均与犯罪行为存在相关性。具有较大空间深度、与周边连接度较低的地点易发生吸毒、不雅行为和寻衅滋事等犯罪活动；连接度较高的道路及区域能吸引更多人群，有助于减少大多数的犯罪行为，

## 7 Discussion

In the past 20 years, space syntax theory has been adopted to examine the relationship between the spatial configuration of urban contexts and human activity patterns / behaviors. In this study, Rod El Farag Park situated in an informal district in Cairo City, Egypt, with a noticeable criminal records, was selected to investigate the effect of its spatial configuration on crime distribution and types. The results indicated a correlation between measurements as space connectivity / integration / depth and crime commitment. Deep, isolated spaces offered opportunities for drug use, inappropriate behaviors, and harassment. As for well-connected paths or areas that welcomed more people and hindered most crimes nevertheless offered

却是盗窃和持械斗殴的易发场所。危害公园行为（如破坏公物）常见于除中心区域以外的任何区域，与空间整合度的关联性不明显。研究对空间深度的分析结果印证了比尔·希利尔和奥兹莱姆·萨巴兹的观点，即可达性差的街道（空间深度值较大）每单位长度发生的抢劫事件更多<sup>[24]</sup>；但也有一些研究得出了相反的结论，如伊琳娜·马蒂诺塞汀在美国纽黑文市和立陶宛考纳斯市进行的研究表明，公共区域中抢劫案的发生率更高<sup>[25]</sup>；托比·戴维斯和肖恩·约翰逊在加拿大进行的另一项研究也发现，潜在使用者更多的街道周边更易发生入室盗窃<sup>[18]</sup>。

本研究还指出公园树木现状分布和类型对视线存在的负面影响，这些树木有可能成为犯罪者的藏身之处；公园四周种植的常绿乔木带使公园丧失了来自周边街道的自然监视；落叶乔木使得公园冬季的视线通透性较高，而在夏季，常绿和落叶乔木庞大、茂密的树冠则大大降低了许多区域的可见性。自我危害行为和（严重）危害他人行为的发生地点都具有一定的隐蔽性，而危害公园行为则多发于开阔场所，这与另一项研究的发现——可达性或可见性较高的场所犯罪率整体较低<sup>[9]</sup>——基本一致。席恩·E·迈克尔、R·布鲁斯·胡尔与戴安·L·扎姆<sup>[26]</sup>在对当地警察的陈述资料进行研究后，发现犯罪分子经常在植被茂密区域藏匿或处置赃物。但本研究并不建议公园对乔灌木进行清除（因为这类植被能为公园营造空间私密性和神秘感），而是倡导公园的种植设计应在考虑植物的观赏性与遮阴功能的同时，也能够保障周围环境的可见性。需要指出的是，本研究存在许多局限性，其中之一是未考虑空间使用对犯罪的影响，因为入口和管理区域在一定程度上提供了自然监视，从而预防了大多数犯罪行为的发生。

尽管空间句法已被广泛运用于邻里及城市尺度的研究，其在开放空间和公园等场地尺度研究中的应用仍然非常有限。本研究证明了运用空间句法理论预测埃及城市公园内犯罪发生区域的可行性，鼓励在公园设计阶段即引入安全性模拟分析，从而最大限度地提高公园安全性。未来还需进一步探究本研究方法在其他地域背景下的适用性，运用3D软件对空间布局进行更准确的模拟；在研究对象方面，应对活动及设施类型更多样、更具吸引力的公园予以更多关注。LAF

the opportunity for thefts and armed fights. Crimes against the park (e.g. vandalism) did not associate with a specific integration level as it occurred all over the park except for the center. The finding about space depth supported the finding of Bill Hillier and Ozlem Sahbaz that less accessible segments (with more space depth) were associated with more robberies per unit of street length<sup>[24]</sup>. But some other studies held the opposite opinions: Irina Matijosaitiene's study in New Haven, USA, and Kaunas, Lithuania<sup>[25]</sup> declared that more robberies happened in common use areas. Another study in Canada by Toby Davies and Shane Johnson concluded a higher risk of burglary for streets with more potential usage<sup>[18]</sup>.

The results of this study also reveal the negative impact of the existing tree distribution and types on the sightlines, as they create blind spots for crime to hide. The evergreen buffer placed around the periphery deprived the park of natural surveillance from the streets around it. The use of deciduous trees enhanced the park's visual connectivity in winter, while in summer, large, dense canopies of evergreen and deciduous trees obstructed the visibility to many zones. Crimes against oneself and (dangerous) crimes against others sought hiding places, while crimes against the park did not need such secrecy. This conclusion supports a study showing that places with higher accessibility / visibility tend to have lower crime rates<sup>[9]</sup>. Sean E. Michael, R. Bruce Hull, and Diane L. Zahm<sup>[26]</sup> discussed in their research on statements by local police that dense vegetation was used by criminals to hide or dispose unwanted goods. Nevertheless, this does not mean removing shrubs or trees, as parks need intimate private places and some mystery. Vegetation should be designed in such a way to ensure the visibility of the surroundings while performing its ornamental and shading functions. Meanwhile, this study has many limitations, one of which is failing to consider the impact of space uses on crimes, as the entrance, the administration, and the office provided some natural surveillance hindering most of the crimes.

Although space syntax has been widely used in research at the neighborhood or city scale, its site-scale implementation, such as open spaces and parks, is still very limited. This study proves that space syntax theory is able to predict the crime zones in urban parks in the Egyptian context. The results open the door to including safety simulations in the design stage of parks to improve the safety level as much as possible. More studies should be conducted to evaluate the method's applicability in other regional contexts, preferably through utilizing 3D software for more accurate representation of the spatial configuration, and with parks accommodating various activities and attraction points. LAF

## REFERENCES

- [1] UN Habitat. (2017). Global Public Space Programme Annual Report 2017. Retrieved from <https://unhabitat.org/global-public-space-programme-annual-report-2017>
- [2] Zhai, Y., & Baran, P. (2013). Application of space syntax theory in study of urban parks and walking. Proceedings of the ninth international space syntax symposium (p. 32). Seoul: Sejong University.
- [3] Project for Public Spaces. (2008, December 31). What role can design play in creating safer parks?. Retrieved from <https://www.pps.org/article/what-role-can-design-play-in-creating-safer-parks>
- [4] Çamur, K., Roshani, M., & Pirouzi, S. (2017). Using Space Syntax to Assess Safety in Public Areas—Case Study of Tarbiat Pedestrian Area, Tabriz-Iran. IOP Conference Series Materials Science and Engineering, 245(8), 082022. <https://doi.org/10.1088/1757-899X/245/8/082002>
- [5] Sundberg, K. W. (2013). Preventing crime through informed urban design. Security Solutions Magazine, (87), 30-35.
- [6] Courtright, K., & Mutchnick, R. (2002). Cartographic School of Criminology. In D. Levinson (Ed.), Encyclopedia of Crime and Punishment. Thousand Oaks: SAGE Publications, Inc.
- [7] Hardyns, W., & Pauwels, L. J. R. (2017). The Chicago School and Criminology. In R. A. Tripplett (Ed.), The Handbook of the History and Philosophy of Criminology (pp. 123-139). Hoboken: Wiley-Blackwell. <https://doi.org/10.1002/9781119011385.ch7>
- [8] Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Vintage Books.
- [9] Pourmohammadi, M. R., & Ghorbanian, M. (2013). Crime prevention in urban design: Towards space syntax approach as a quantitative analytic modeling of qualitative. Armanshahr Architecture and Urban Development, 6(10), 157-166.
- [10] Clarke, R. V. (1983). Situational Crime Prevention: Its Theoretical Basis and Practical Scope. In M. Tonry (Ed.), Crime and Justice: An Annual Review of Research, (4), 225-256. <https://doi.org/10.1086/449090>
- [11] Cozens, P., & Love, T. (2015). A Review and Current Status of Crime Prevention through Environmental Design (CPTED). Journal of Planning Literature, 30(4), 393-412. <https://doi.org/10.1177/0885412215595440>
- [12] Nubani, L. N. (2006). Targets for crime: Measuring the spatial and visual attributes of crime locations using space syntax (Doctoral thesis). University of Michigan, Michigan.
- [13] Hillier, B., & Hanson, J. (1984). The Social Logic of Space. Cambridge: Cambridge University Press.
- [14] Hillier, B. (1996). Space is the Machine: A Configurationally Theory of Architecture. Cambridge: Cambridge University Press.
- [15] Abd El Raheem, A. A. (2019). Spatial Conditions for Sustainable Communities: The Case of Informal Settlements in GCR (Master's thesis). Al Azhar University, Cairo.
- [16] Ostwald, M. J. (2011). The mathematics of spatial configuration: Revisiting, revising and critiquing justified plan graph theory. Nexus Network Journal, 13(2), 445-470. [doi:10.1007/s00004-011-0075-3](https://doi.org/10.1007/s00004-011-0075-3).
- [17] Bolton, T., Froy, F., Khan, S., & Francis, N. (2018). Crime Policy and Place Layout. Retrieved from [http://spacesyntax.com/wp-content/uploads/2018/03/3.-Crime-policy-and-place-layout\\_2018.pdf](http://spacesyntax.com/wp-content/uploads/2018/03/3.-Crime-policy-and-place-layout_2018.pdf)
- [18] Sahajramani, D., Purkayastha, S., Ranjit, R., & Vyas, A. (2018, October). Determination of correlation between street accessibility and crimes using space syntax network graph analysis. Paper presented at the 39th Asian Conference on Remote Sensing, Kuala Lumpur, Malaysia.
- [19] Iqbal, A. (2015). Assessment of Crime and Safety Issues in Parks (Licentiate thesis). Royal Institute of Technology, Stockholm.
- [20] Lis, A., Pardela, L., & Iwankowski, P. (2019). Impact of vegetation on perceived safety and preference in city parks. Sustainability, 11(22), 1-20. <https://doi.org/10.3390/su11226324>
- [21] Troy, A., Grove, M., & O'Neil-Dunne, J. (2012). The relationship between tree canopy and crime rates across an urban-rural gradient in the greater Baltimore region. Landscape and Urban Planning, 106(106), 262-270. [doi:10.1016/j.landurbplan.2012.03.010](https://doi.org/10.1016/j.landurbplan.2012.03.010)
- [22] Knutsson, J. (1997). Restoring public order in a city park. Stockholm: National Council for Crime Prevention Sweden.
- [23] Summers, L., & Johnson, S. D. (2017). Does the configuration of the street network influence where outdoor serious violence takes place? Using space syntax to test crime pattern theory. Journal of Quantitative Criminology, (33), 397-420. <https://doi.org/10.1007/s10940-016-9306-9>
- [24] Hillier, B., & Sahbaz, O. (2005). High Resolution Analysis of Crime Patterns in Urban Street Networks: An Initial Statistical Sketch from an Ongoing Study of a London Borough. In A. V. Nes (Ed.), Proceedings of the 5th International Space Syntax Symposium (pp. 451-478). Delft: Delft University of Technology.
- [25] Matijosaitiene, I. (2016). Combination of CPTED and space syntax for the analysis of crime. Safer Communities, 15(1), 49-62. [doi:10.1108/SC-05-2015-0013](https://doi.org/10.1108/SC-05-2015-0013)
- [26] Michael, S., Hull, R., & Zahm, D. (2001). Environmental factors influencing auto burglary—A case study. Environment and Behavior, 33(3), 368-388. [doi:10.1177/00139160121973034](https://doi.org/10.1177/00139160121973034)