

URBAN SECURITY IN KIBERA BEFORE AND AFTER THE MISSING LINK #12. Integrating MapKibera Trust Participatory Mapping and Space Syntax Analyses.

Original

URBAN SECURITY IN KIBERA BEFORE AND AFTER THE MISSING LINK #12. Integrating MapKibera Trust Participatory Mapping and Space Syntax Analyses / DE FILIPPI, Francesca; Cocina, GRAZIA GIULIA; Martinuzzi, Chiara. - ELETTRONICO. - (2019). (Intervento presentato al convegno 12th International Space Syntax Symposium, SSS 2019 tenutosi a Beijing nel 8 - 13 luglio 2019).

Availability:

This version is available at: 11583/2776954 since: 2020-10-29T15:36:06Z

Publisher:

Beijing JiaoTong University

Published

DOI:

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(Article begins on next page)

12th International Space Syntax Symposium (12SSS)

Beijing, China
8 – 13 July 2019

Volume 1 of 4

ISBN: 978-1-5108-9379-5

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TABLE OF CONTENTS

VOLUME 1

3D PERCEPTION

RESEARCH ON THE RELEVANCE BETWEEN MIXED-USE COMPLEX AND USER BEHAVIOUR BASED ON THREE-DIMENSIONAL SPATIAL ANALYSIS	1
<i>Z. Wang, Y. Pan, Y. Lu, X. Zhou</i>	
ISOMETRIC MEASURANDS ON PERCEIVED SPACIOUSNESS: EXPLORING VOLUMETRIC ISOVIST.....	15
<i>A. Unlu, E. Edgu, M. Salgamcioglu, N. Canakcioglu, E. Yilmaz</i>	
FLAT VERSUS VOLUMETRIC METHODOLOGIES RESTRUCTURING SPATIAL ANALYSIS AND OTHER INDICES.....	35
<i>G. Bruyns, D. Nel, C. Higgins, A. Nes</i>	
FROM AXIAL TO PEDESTRIAN PATH-CENTRE LINE: THE CASE OF 3D PEDESTRIAN NETWORK IN HONG KONG, CENTRAL.....	54
<i>L. Zhang, A. Chiaradia</i>	
URBAN LIGHT ENVIRONMENT PROFILE INFORMATION COLLECTION AND 3D SPACE SYNTAX VISUALIZATION INTERFACE DEVELOPMENT	65
<i>C. Chen, K. Wu</i>	

ARCHITECTURAL FORUM

VISION-AND-MOTION-BASED SPATIAL CHARACTERIZATION OF OPEN SPACE: A STUDY ON ITS STRUCTURE, BOUNDARY AND MEANING IN ARCHITECTURE.....	82
<i>L. Gao, X. Pu, Y. Su</i>	
THE BOUNDARY-BASED CONVEX BREAK-UP: A BOUNDARY-SENSITIVE DESCRIPTION OF BUILDING MORPHOLOGY	98
<i>N. Maghzian</i>	
STUDY OF COMMON SPACE LAYOUT DESIGN IN JAPANESE NURSING HOME: FROM THE PERSPECTIVE OF SPATIAL CHARACTERISTICS AND SPACE UTILIZATION.....	114
<i>L. Bai, S. Nasu</i>	
FROM EXTERIOR TO INTERIOR: MAPPING PEDESTRIAN MOVEMENT IN STATION COMPLEX BUILDINGS	126
<i>S. Wu, Y. Zhuang, Y. Bai, Y. Pei</i>	
CORRESPONDENCE AND NON-CORRESPONDENCE: USING OFFICE ACCOMMODATION TO CALCULATE AN ORGANIZATION'S PROPENSITY FOR NEW IDEAS	140
<i>K. Sailer, M. Thomas</i>	
ARCHITECTURAL ARTICULATION AND CONFIGURATIONS OF SPACE: ADVANCING THEORY, PRINCIPLES AND BASES FOR SPATIAL MODELLING	157
<i>D. Koch</i>	

BACK TO DESIGN FUNDAMENTALS: THE STEP AND THE EYE	174
<i>V. Trova</i>	
FROM PROGRESSIVE TO LABYRINTHINE: TESTING FORMAL VARIATIONS OF AN EXHIBITION SPACE TYPOLOGY	186
<i>A. Rolim, L. Amorim, L. Falavigna</i>	
THE EFFECTS OF LOCAL FACTORS ON BRITISH HOSPITAL DESIGN IN COLONIAL INDIA: THE CASE OF A EUROPEAN GENERAL HOSPITAL.....	200
<i>I. Tyne, M. Rashid</i>	
EMERGENCE OF THE POWER ANALYZING THE RELATIONSHIP BETWEEN RELIGIOUS AUTHORITY AND CONGREGATION IN THE SPATIAL CONTEXT.....	222
<i>M. Tasci</i>	
RETHINKING CONTEMPORARY DOMESTIC SPACE ORGANIZATION: PATTERNS OF ALTERATIONS IN BAHRAIN SUBSIDIZED HOUSING PROJECTS	243
<i>S. Saraiva, M. Serra, G. Furtado</i>	
WARD LAYOUT, COMMUNICATION AND CARE QUALITY: SPATIAL INTELIGIBILITY AS A KEY COMPONENT OF HOSPITAL DESIGN	264
<i>R. Pachilova, K. Sailer</i>	
MEASURING THE MATERIALITY OF SPACE: CAN SPACE SYNTAX PROVIDE THE TOOLS FOR AN ANALYTICAL GROUNDING OF ASSEMBLAGE THEORY?.....	282
<i>I. Geddes, C. Chatzichristou, N. Charalambous</i>	
<u>BEHAVIOUR COGNITION</u>	
THE EFFECT OF SPATIAL CONFIGURATION ON SENSE OF SAFETY THROUGH STREET LEGIBILITY	294
<i>S. Mahdzar, S. Jaberolansar, A. Jamil</i>	
ORGANISING FAMILY LIFE: AN ANALYSIS OF THE SPATIAL ORGANISATION OF PEOPLE AND ACTIVITIES IN THE HOUSEHOLD.....	303
<i>C. Ruivo, T. Varoudis</i>	
BODY - SPACE TENSION: MAPPING / DECODING BODILY EXPERIENCE WITH SPACE SYNTAX.....	317
<i>B. Balaban, M. Kara, P. Cebi</i>	
EMERGENCE OF A NEW TYPE OF CONSUMPTION SPACE IN THE ERA OF MARKETING 4.0: CHANGE IN MERCHANDISING STRATEGY WITH FOCUS ON SPATIAL CONFIGURATION & USER BEHAVIOR	331
<i>I. Kim, Y. Kim</i>	
DISSECTING VISIBILITY GRAPH ANALYSIS: THE METRICS AND THEIR ROLE IN UNDERSTANDING WORKPLACE	347
<i>P. Koutsolampros, K. Sailer, T. Varoudis, R. Haslem</i>	
USAGE OF LANDMARKS IN VIRTUAL ENVIRONMENTS FOR WAYFINDING: RESEARCH ON THE INFLUENCE OF GLOBAL LANDMARKS	371
<i>D. Yesiltepe, R. Dalton, A. Ozbil, N. Dalton, S. Noble, M. Hornberger, A. Coutrot, H. Spiers</i>	
THE URBAN NODE: CONFIGURATIONAL PROPERTIES OF URBAN NODES IN TETOVO.....	381
<i>A. Ferati, A. Saidi, A. Limani</i>	

VISUAL SALIENCY IN NAVIGATION: MODELING NAVIGATIONAL BEHAVIOR USING SALIENCY AND DEPTH ANALYSIS	393
<i>S. Psarras, A. Fatah, A. Zarkali, S. Hanna</i>	
DWELLING BEHAVIOURAL PATTERNS: DEFINING HOUSE USE THROUGH SPACE SYNTAX MAPPING.....	409
<i>A. Moreira, F. Serdoura</i>	
EXPLORING URBAN EXPERIENCES: TWO CASE STUDIES	419
<i>P. Radaczewska, S. Schneider, S. Kuliga</i>	
CORRELATION BETWEEN AESTHETIC PERCEPTION AND SPATIAL COGNITION DURING EXPLORATION IN TRADITIONAL CHINESE VILLAGES	430
<i>S. Yuan, H. Zhang</i>	
RESEARCH ON BEHAVIOR DISTRIBUTION OF SMALL-SCALE COMMERCIAL PUBLIC SPACE BASED ON SPACE SYNTAX – TAKING THE TAIKOO LI COMMERCIAL STREET IN DADI TEMPLE AREA, CHENGDU AS AN EXAMPLE.....	447
<i>X. Jiang, R. Liu, Y. Li</i>	
VISUAL EXPERIENCE ROUTE PLANNING FOR URBAN ENVIRONMENTS.....	465
<i>D. Fisher-Gewirtzman, R. Yosifof, S. Dalyot</i>	

CAMPUS ENVIRONMENT

SPACE SYNTAX AND VOLUNTEERED GEOGRAPHIC INFORMATION FOR UNIVERSITY CAMPUS PLANNING AND DESIGN	477
<i>I. Soares, C. Yamu, G. Weitkamp</i>	
THE DESIGN OF SCHOOL BUILDINGS POTENTIALITY OF INFORMAL LEARNING SPACES FOR SELF-DIRECTED LEARNING	492
<i>A. Fouad, K. Sailer</i>	
THE EFFECT OF MORPHOLOGY OF PUBLIC SPACE IN COLLEGE BUILDINGS ON SELF- ACCESS LEARNING BEHAVIORS: TAKING INNER MONGOLIA UNIVERSITY OF TECHNOLOGY AS AN EXAMPLE	514
<i>Z. Ren, S. Hou</i>	
SPATIAL PREFERENCES IN UNIVERSITY LIBRARIES OF ISTANBUL: A COMPARISON ON SYNTAX AND FUNCTION OF SPACE.....	524
<i>H. Aydogan, M. Salgamcioglu</i>	
BEHIND THE DESIGN: LATIN AMERICAN SCHOOLS OF ARCHITECTURE	546
<i>F. Guevara</i>	
STUDENT BEHAVIOR MODES IN EDUCATIONAL BUILDINGS: INTERPRETATIONS ON VISIBILITY AND PERMEABILITY PARAMETERS	570
<i>D. Cabadak, M. Salgamcioglu</i>	
THE ROLE OF A UNIVERSITY IN CITY TRANSFORMATION	587
<i>N. Namvar, A. Elnokaly, G. Mills</i>	

CULTURAL HERITAGE

MEGA-EVENT LEGACIES.....	604
<i>J. Deepthi, K. Kayvan</i>	
INDEXING CULTURAL HERITAGE VALUE AS A TOOL FOR THE DESIGN OF TOURISTS' THEMATIC ROUTES: INCORPORATING QGIS WITH SPACE SYNTAX APPROACH	624
<i>D. Saadallah, G. Abdelwahed</i>	

VOLUME 2

EXPLORING THE IMPACT OF STREET RENOVATION ON THE SURROUNDING STORE ECONOMY□FA CASE STUDY OF STREET RECONSTRUCTION IN TIANHOUGONG AREA OF QUANZHOU	647
<i>H. Zehng, J. Han</i>	
THE OPEN LABYRINTH: PATRIMONY, TOURISM, AND CONFIGURATION IN BRAZILIAN HISTORICAL CENTERS	657
<i>R. Silva, V. Medieros</i>	
URBAN TRANSFORMATIONS: FROM RESTRICTED RANDOM AGGREGATION TO DESIGNED CULTURAL INTENT IN MIDDLE EASTERN CITIES.....	668
<i>M. Major, V. Mirincheva, H. Tannous</i>	
HISTORIC MORPHOLOGICAL DEVELOPMENTS OF CAPE TOWN: EVALUATING THE ROLE OF HISTORIC TRANSFORMATIONS IN URBAN MORPHOLOGY AS CONTRIBUTING TO PERSISTENT SOCIO-ECONOMIC TRENDS.....	683
<i>V. Gambill</i>	
EXPLORATION OF URBAN HERITAGE IN THE HISTORIC CORE OF LONDON: A SPATIAL NETWORK APPROACH.....	695
<i>Y. Kong, K. Karimi</i>	
BUILDING TRANSFORMATIONS IN OLD JO O PESSOA (BRAZIL): SPATIAL FORM IMPACTS ON USES AND LEVELS OF BUILT HERITAGE CONSERVATION	708
<i>R. Silva, L. Donegan</i>	
DIGGING MINDSETS: ANALYSING PREHISTORIC SPATIAL THINKING USING SPACE SYNTAX.....	726
<i>M. Spring</i>	

HUMANISED PLACE

LA TRAMA DE LA SEGREGACIO - SSS12.....	746
<i>Margarita Greene Zúñiga</i>	
RESEARCH ON SPATIAL DISTRIBUTION LOGIC OF BEIJING BICYCLE REPAIR POINTS	762
<i>Y. Hu, T. Pang</i>	
STREET NETWORKS AS PLACES OF SOCIAL INTERACTION IN CULTURALLY DIVERSE NEIGHBOURHOODS OF ISTANBUL	773
<i>I. Toprak, A. Unl, A. Nes</i>	

ANOTHER TALE OF THREE BEACHES: PROFILING SEASIDE NEIGHBOURHOODS IN JOÃO PESSOA, BRAZIL.....	792
<i>L. Donegan, S. Sa</i>	
URBAN STREET NETWORK AND MOBILITY: THE CASE OF UBERLÂNDIA/MG (BRAZIL).....	807
<i>B. Oliveira, V. Medeiros</i>	
ASSESSING AUTISTIC COGNITIVE MAP THROUGH SYNTACTIC ANALYSIS: EXAMINING THE EXPECTATIONS OF WEAK CENTRAL COHERENCE THEORY IN ARCHITECTURAL DOMAIN	818
<i>M. Ardekani, M. Salgamcioglu</i>	
THE INFLUENCES OF FORMALLY-PLANNED URBAN MORPHOLOGY ON HOME- BASED ECONOMIC OPPORTUNITIES AND THE ECONOMICALLY-DRIVEN SELF- ORGANISATION OF URBAN FORM.....	833
<i>H. Thai, Q. Stevens, J. Rogers</i>	
THE IMPACT OF URBAN CONFIGURATION ON THE ACCESSIBILITY OF DISABLED PEOPLE. A CASE STUDY FROM ALGIERS, ALGERIA.....	855
<i>C. Hacini, Y. Bada, C. Pihet</i>	
THE HOME AS A THERAPEUTIC ENVIRONMENT	869
<i>S. Bafna, K. Maitra, Y. Lim, W. Newman, M. Shah</i>	
COMFORT AND USE IN BUILDING EVALUATION: INFORMATION MODELLING AND POST-OCCUPANCY IN THE BUILT ENVIRONMENT.....	883
<i>M. Major, M. Indraganti, A. Ahmad, H. Tannous, A. Marri, L. Al-Noaimi, M. Al-Obaidan</i>	
WOMEN AND URBAN SPACE: PERCEPTIONS OF FEAR IN RELATION TO STREET HARASSMENT AND SEXUAL VIOLENCE.....	897
<i>S. Sanabria</i>	
THE GEOGRAPHY OF PHILANTROPIC HOUSING IN LISBON IN THE ADVENT OF INDUSTRIALIZATION.....	928
<i>A. Falcao, J. Correia, R. Machete, T. Heitor, L. Silva</i>	
SPACE IN THE URBAN CONTEXT OF MENTAL HEALTH CARE: ANALYTICAL STUDY ON THE CONTRIBUTION OF SPACE TO THE SOCIAL INTEGRATION OF PATIENTS	938
<i>J. Mangili</i>	
ROLLING THE CITY: TRACING THE SKATERS' COMMUNITIES NETWORKS OF PRACTICE IN LONDON.....	966
<i>A. Bautista</i>	
PEOPLE-FOCUSED URBAN PLANNING WITH THE HELP OF SPACE SYNTAX	999
<i>D. Hadrich, P. Gross, C. Kohlert</i>	
INFLUENCE OF GEOMETRY ON THE VITALITY OF SPACE; A CASE STUDY: LAHIJAN'S INSTITUTE FOR THE INTELLECTUAL DEVELOPMENT OF CHILDREN AND YOUNG ADULTS	1013
<i>H. Safari, F. Moridani</i>	
PASSAGES AS 'URBAN NICHES'	1023
<i>D. Cabadak, M. Salgamcioglu</i>	

CHANGING HOUSEHOLD PATTERN, THE MEANING AND THE USE OF HOME.....	1033
<i>H. Turgut, M. Salgamcioglu</i>	

LANDSCAPE

TRAIL CONFIGURATIONAL ATTRIBUTES AND VISITORS' SPATIAL DISTRIBUTION IN NATURAL RECREATION AREA	1055
<i>Y. Zhai, P. Baran</i>	

COMBINING SYNTACTIC AND SENSITIVE ANALYSES CASE STUDY OF A WATERFRONT DISTRICT IN SOUSSE	1066
<i>T. Ammar, I. Regaya, S. Mazouz</i>	

ON THE BORDERS: REORDERING THE PLANNING LANDSCAPE?	1084
<i>A. Kasemsook, P. Porn, W. Chupradit, S. Boonyanusarn, R. Tanphalang, B. Srisalaui, M. Laithaviwat</i>	

NEW TECHNOLOGY

BETWEEN SEEING AND BEING SEEN: UNDERSTANDING A SOCIAL LOGIC BASED ON ASYMMETRY OF SINGLE VISUAL INTERACTION (ASVI) IN BUILT SPACE AND ITS APPLICATION IN SPACE ANALYSIS.....	1099
<i>W. Huangfu, T. Chung</i>	

NEW PERSPECTIVE ON URBAN FORM WITH THE INTEGRATION OF SPACE SYNTAX AND NEW URBAN DATA: AN EXPLORATORY ANALYSIS OF XI'AN CHINA.....	1113
<i>C. Yang, Z. Qian</i>	

INVESTIGATING RETAIL SPACE PERFORMANCE THROUGH SPATIAL CONFIGURATION OF CONSUMER MOVEMENT: A COMPARISON OF YORK AND LEEDS	1129
<i>A. Adebayo, P. Greenhalgh, K. Muldoon-Smith</i>	

SPATIAL DISTRIBUTION OF BUILDING USE RECOGNITION AND PREDICTION OF USE WITH MACHINE LEARNING.....	1148
<i>T. Thirapongphaiboon, S. Hanna</i>	

A WAYFINDING RESEARCH IN VIRTUAL ENVIRONMENTS: THE EFFECT OF SPATIAL STRUCTURE AND DIFFERENT CONDITIONS ON MOVEMENT.....	1178
<i>D. Yesiltepe, R. Dalton, A. Ozbil, N. Dalton, S. Noble, M. Hornberger, A. Coutrot, H. Spiers</i>	

AN EXPLORATION OF THE PRESENCE AND FLOWS OF VISITORS IN THE CITY USING THE SOCIAL MEDIA DATA IN LONDON.....	1188
<i>Y. Song, K. Karimi</i>	

PATH DIAGRAMS CONFIGURATIONAL DESCRIPTIONS FROM GIS DATA, AN ALGORITHM AND ITS IMPLICATIONS	1201
<i>P. Carranza, A. Legeby, D. Koch</i>	

MODELING AND SIMULATION OF A VISION-DRIVEN PEDESTRIAN AGENT	1216
<i>T. Kaneda, Y. Maekawa, T. Kino, Y. Matsumoto, K. Susaki</i>	

DIGITAL TWIN, VIRTUAL REALITY AND SPACE SYNTAX: CIVIC ENGAGEMENT AND DECISION SUPPORT FOR SMART, SUSTAINABLE CITIES	1230
<i>F. Dembski, U. Wessner, C. Yamu</i>	

RANDOM WALKS ON WEIGHTED GRAPHS: CENTRALITY MEASURES OR SIMPLE AGENTS	1243
<i>S. Hanna</i>	
ICU AS INFORMATIONAL INTERFACE: A MODEL FOR DATA-DRIVEN ICU DESIGN.....	1253
<i>J. Zook, U. Nanda, K. Renner</i>	
VARIATIONAL BEAUTY OF SPACE: MACHINE INTUITION AND NON-LINEAR NEURAL AGGREGATIONS.....	1267
<i>T. Varoudis, A. Penn</i>	
THE RELATIONS BETWEEN PATTERNS OF VISIBILITY QUANTIFICATION AND PERCEIVED VALUES IN VARIOUS URBAN TYPOLOGIES. AN EXPERIMENT IN VIRTUAL REALITY	1277
<i>D. Fisher-Gewirtzman</i>	

VOLUME 3

AGENT BASED SIMULATION FOR 'CHOICE OF SEATS': A STUDY ON THE HUMAN SPACE USAGE PATTERN	1291
<i>J. Chun, A. Schieck, S. Psarras, P. Koutsolampros</i>	

PEDAGOGICAL METHOD

THE ANATOMY OF KNOWLEDGE: QUANTITATIVE AND QUALITATIVE ANALYSIS OF THE EVOLUTION OF IDEAS IN SPACE SYNTAX CONFERENCE ARTICLES (1997-2017).....	1309
<i>K. Krenz, S. Psarra, V. Netto</i>	
SPACE SYNTAX AS A PLATFORM FOR TEACHING ANALYTICAL, RESEARCH-BASED DESIGN: A PEDAGOGICAL EXPERIENCE.....	1330
<i>K. Karimi</i>	
TRIALOGUE ON CENTRALITY: SPACE SYNTAX, URBAN MORPHOLOGY, AND ACTOR-NETWORK THEORY	1347
<i>B. Murati</i>	
VARIOUS MORPHOLOGICAL ANALYSES METHODS APPLIED IN TEACHING ON BSC AND MSC LEVEL	1363
<i>A. Nes</i>	

REGION & CITY

CENTRALITIES IN BRASILIA: AN INEQUALITY RELATION	1379
<i>J. Coelho, V. Medeiros</i>	
QUANTIFYING URBAN GROWTH: CONFRONTING PLANNED AND ACTUAL STREET NETWORK GROWTH IN PORTO, PORTUGAL	1395
<i>J. Krug, S. Schneider, V. Oliveira</i>	
RESEARCH ON REGIONAL SPATIAL STRUCTURE OF JILIN PROVINCE IN CHINA DURING NEW URBANIZATION PROCESS	1414
<i>B. Li, L. Liu</i>	

APPLYING SPACE SYNTAX IN REGIONAL PLANNING: NEW METHODS AND RESULTS	1427
<i>Y. Lerman, Y. Lebediger</i>	
WHEN CITIES LOSE THEIR TAIL: SPRAWL AS A CONFIGURATIONAL MATTER.....	1442
<i>V. Cutini</i>	
THE SPATIAL ORGANIZATION OF ACCESSIBILITY AND FUNCTIONAL HIERARCHY AT THE LOCAL, REGIONAL AND NATIONAL SCALES – THE CASE OF ISRAEL.....	1464
<i>N. Kaplan, D. Burg, I. Omer</i>	

RESIDENCE

THE APARTMENT LAYOUT TYPOLOGY IN TEHRAN	1483
<i>A. Milani, A. Eynifar</i>	
THE CHINESE DANWEI: MEDIATING CONTINUITY AND CHANGE: AN INVESTIGATION INTO THE SPATIAL CULTURE OF A WORK-UNIT (DANWEI) COMMUNITY	1493
<i>T. Mason, C. Li</i>	
SUBURBS AND POWER: CONFIGURATION, DIRECT AND SYMBOLIC PRESENCE, ABSENCE, AND POWER IN THE SWEDISH SUBURB GOTTSUNDA	1510
<i>D. Koch, A. Legeby, P. Miranda</i>	
SOCIO-CULTURAL FACTORS SHAPING THE SPATIAL FORM OF TRADITIONAL AND CONTEMPORARY HOUSING IN QATAR: A COMPARATIVE ANALYSIS BASED ON SPACE SYNTAX	1531
<i>A. Mohammadi, R. Furlan, M. Major</i>	
LOW INCOME HOUSING, DO DIFFERENT TYPES OF HOUSING REVEAL DIFFERENT SPATIAL PROPOSALS?	1550
<i>F. Fran, E. Sales, N. Paulo</i>	
THE GENERIC PATTERNS OF URBAN VILLAGE SPACE: THE UGLY SIDE OF INTEGRATION AND THE POWER OF CHOICE MOVEMENT	1566
<i>W. Alghatam</i>	

SAFETY EMERGENCY

URBAN GRID AND SEISMIC PREVENTION: A CONFIGURATIONAL APPROACH TO THE EMERGENCY MANAGEMENT OF ITALIAN HISTORIC CENTRES	1586
<i>V. Cutini, A. Falco, F. Giuliani</i>	
SEGREGATION PATTERNS IN THE STREET INTERFACE OF THE BRAZILIAN CITY	1606
<i>L. Filho, A. Nes, C. Nascimento</i>	
MORPHOLOGICAL PROPERTIES OF THE SPATIAL LAYOUT OF FACTORIES – A KEY DETERMINANT IN SETTING THE EMERGENCY ESCAPE ROUTES FOR EVACUATION	1617
<i>F. Nilufar, S. Choiti</i>	
RAPID CONFIGURATIONAL ANALYSIS USING OSM DATA: TOWARDS THE USE OF SPACE SYNTAX TO ORIENT POST-DISASTER DECISION MAKING	1634
<i>C. Pezzica, V. Cutini, C. Souza</i>	

URBAN CONFIGURATION AND CRIME: THE CASE OF BRASILIA, BRAZIL.....	1652
<i>F. Ferraz, F. Holanda</i>	
DIFFERENCE IN THE SUICIDE RATES OF UPPER & LOWER FLOORS OF HIGH-RISE APARTMENT RESIDENTS	1672
<i>B. Ji, J. Kim, Y. Kim</i>	
URBAN TRANSFORMATIONS AND SOCIAL DISPLACEMENT: MEASURING THE SOCIO/ SPATIAL IMPACT OF RESETTLEMENT POLICIES WITHIN THE CITY OF CHANGSHA, CHINA	1685
<i>T. Mason, N. Lu, N. Nikolova, L. Gan</i>	
ISOVIST CONNECTIVITY: MEASURING THE POTENTIAL FOR CONCURRENT TARGETED SURVEILLANCE AND GENERAL AWARENESS.....	1700
<i>M. Ossmann, S. Bafna, C. Zimring, D. Murphy</i>	
SCHOOLS AT 'FRONT ROW' PUBLIC BUILDINGS IN RELATION TO SOCIETAL PRESENCE AND SOCIAL EXCLUSION.....	1716
<i>A. Legeby, D. Koch, P. Carranza</i>	
THE ROLE OF BUILDING ENTRANCES TOWARDS STREETS AND THE PERCEPTION OF SAFETY IN SIX NEIGHBOURHOODS IN BERGEN	1735
<i>N. Nordhov, P. Ritland, A. Larsen, A. Nes</i>	
HOW CHILDREN USE URBAN SPACE IN TWO DIFFERENT NEIGHBOURHOODS IN BERGEN, NORWAY	1751
<i>M. Meinert, S. Thomassen, A. Nes, H. Roald, T. Skovsgaard</i>	
A MACROSCOPIC VIEW OF WATER MANAGEMENT OF THE NEW ADMINISTRATIVE CAPITAL CITY OF EGYPT	1771
<i>W. Abdeldayem, T. El-Khouly</i>	
URBAN SECURITYIN KIBERA BEFORE ANDAFTER THE MISSING LINK #12. INTEGRATING MAPKIBERA TRUST PARTICIPATORY MAPPING AND SPACE SYNTAX ANALYSES.	1789
<i>F. Filippi, G. Cocina, C. Martinuzzi</i>	
DESIGNING CITIES FOR HUMANS	1809
<i>E. Baggs, A. Chemero, A. Penn</i>	

SPACE VALUE

DISCOVERING THE SPATIAL PROPERTIES OF CHINESE HISTORIC TOWNS THROUGH MATHEMATICAL MEANS.....	1820
<i>P. Liao, N. Gu, C. Brisbin, M. Rofo</i>	
ASSESSING WALKABILITY PREMIUM FOR RESIDENTIAL LAND VALUE IN URBAN REGENERATION AREA	1836
<i>H. Park, J. Shin, S. Han</i>	
SPATIAL STRUCTURE OF COMMERCIAL ACTIVITIES IN THE URBAN VILLAGE.....	1855
<i>M. Ling, Y. Wang</i>	
VITALITY AND URBAN VOIDS IN GOIÂNIA (BRAZIL): THE SOUTH SECTOR CASE	1870
<i>A. Torres, V. Medeiros</i>	

RIO DE JANEIRO: URBAN TISSUE AND SOCIETY	1885
<i>J. Cruz, A. Medeiros</i>	
URBAN AND SUBURBAN LEGACIES: SPACE, FORM AND URBAN VITALITY IN TWO LEED-ND CERTIFIED OLYMPIC VILLAGES	1895
<i>N. Martino, E. Trigueiro, C. Girling, M. Martins, F. Lira</i>	
EVOLVING CONFIGURATIONAL PROPERTIES	1913
<i>M. Bielik, R. Konig, E. Fuchkina, S. Schneider, A. Abdulmawla</i>	
IDENTIFYING STREET-CHARACTER-WEIGHTED LOCAL AREA USING LOCALLY WEIGHTED COMMUNITY DETECTION METHODS.....	1932
<i>S. Law, M. Berghauser-Pont, Y. Shen, A. Penn, K. Karimi</i>	

VOLUME 4

MAKING THE MEGACITY FOR EVERYONE: TOWARDS INCLUSIVENESS AND VITALITY FOR SHENZHEN'S URBAN PERIPHERY	1948
<i>J. Jini, P. Chen</i>	
HOW TWO DIVERGING IDEOLOGIES IMPACT THE LOCATION OF FUNCTIONS IN RELATION TO SPATIAL INTEGRATION IN ARCTIC SETTLEMENTS	1963
<i>R. Koning, A. Nes</i>	
THE EFFECTS OF NEW BYPASS ROADS ON SMALL NORWEGIAN TOWNS: SPACE SYNTAX AND LAND USE ANALYSES OF JESSHEIM, ASKIM, GOL AND HOKKSUND.....	1977
<i>S. Lilleslett, K. Ladehaug, A. Nes</i>	
DOES SPACE MATTER? THE 'AWARD-WINNING' CUSTOM-MADE', VERSUS THE 'COMMERCIALLY SUCCESSFUL, MASS-PRODUCED' GREEK-CYPRIT HOUSE	1993
<i>C. Chatzichristou, E. Kranos</i>	
USING VISIBILITY ANALYSIS TO DETECT THE INFLUENCE OF THE DOMESTIC SPATIAL	2008
<i>C. Gomes, S. Sharmin, W. Shakil, M. Thakur</i>	
EMPIRICAL SUPPORT FOR A THEORY OF SPATIAL CAPITAL: HOUSING PRICES IN OSLO AND LAND VALUES IN GOTHENBURG.....	2022
<i>L. Marcus, A. Heyman, A. Hellervik, G. Stavroulaki</i>	

SUSTAINABLE MOVEMENT

STATISTICAL MODELLING AND ANALYSIS OF BIG DATA ON PEDESTRIAN MOVEMENT.....	2037
<i>G. Stavroulaki, D. Bolin, M. Pont, L. Marcus, E. Hakansson</i>	
ESTIMATION OF PEDESTRIAN DENSITY AND SPEED ON STREET NETWORK USING SMARTPHONE SPATIO-TEMPORAL DATA	2061
<i>K. Shimizu, H. Nishi, T. Kishimoto</i>	
SPACE SYNTAX AS A FOUNDATION FOR A TRANSPORT DEVELOPMENT STRATEGY.....	2082
<i>R. Choubassi, J. Dibble, F. Bazzoni</i>	

UNDERSTANDING THE IMPACT OF STREET PATTERNS ON PEDESTRIAN DISTRIBUTION: A CASE STUDY IN TIANJIN, CHINA	2097
<i>Q. Sheng, J. Jiao</i>	
URBAN SPACE AND ENERGY USAGE: HOW SPACE AND MORPHOLOGY RELATE TO ENERGY USAGE FOR MOBILITY	2116
<i>R. Koning, A. Nes</i>	
SPATIAL IMPACT OF NEW PUBLIC TRANSPORT SYSTEM ON STATION NEIGHBOURHOODS: THE CASES OF JUBILEE LINE EXTENSION IN LONDON	2129
<i>P. Chen, K. Karimi</i>	
THE IMPACT OF URBAN TUNNELS ON URBAN DEVELOPMENT AND CHANGE: ISTANBUL EXPERIENCE	2150
<i>S. Apak, H. Apak, E. Ozilturk</i>	
THE INFLUENCE OF THE CONFIGURATION OF URBAN STREET ON THE CHOICE OF PEDESTRIAN ROUTES: THEORETICAL CALCULATION AND EMPIRICAL TESTING	2171
<i>F. Ghalehnoee, D. Martouzet</i>	
THE INFLUENCE OF SPACE SYNTAX ON CYCLING MOVEMENT IN MANTA, ECUADOR	2182
<i>D. Orellana, M. Guerrero</i>	
USING REALISTIC TRAVEL-TIME THRESHOLDS IN ACCESSIBILITY MEASURES OF BICYCLE ROUTE NETWORKS.....	2196
<i>B. Manum, T. Nordstom, P. Arnesen, C. Fooper, J. Gil, E. Dahl, R. Chan, L. Rokseth, S. Green</i>	
PEDESTRIANISED COMMERCIAL AREAS: FROM THE PERSPECTIVE OF THE PEDESTRIAN AND THE VEHICLE	2210
<i>A. Vialard, A. Torun</i>	
SPACE SYNTAX IN A NATIONAL SCALE: A CASE-STUDY ON INTER-URBAN NETWORK TRANSPORTATION IN BRAZIL	2227
<i>L. Silva, F. Holanda</i>	
NETWORK CONFIGURATION AS TOOL FOR IMPROVING PEDESTRIAN ACCESSIBILITY: IMPLEMENTING A STREET DESIGN METHODOLOGY IN AN ATHENIAN NEIGHBOURHOOD	2244
<i>S. Tsigdinos, M. Latinopoulou, Y. Paraskevopoulos</i>	
FRACTAL URBAN MODELS AND THEIR POTENTIAL FOR SUSTAINABLE MOBILITY: A SPATIO-SYNTACTIC ANALYSIS	2254
<i>C. Yamu, A. Nes</i>	
HOW NEGLECTING WALKING INCREASES SOCIO-ECONOMIC INEQUALITIES	2267
<i>I. Hidayati, C. Yamu, W. Tan</i>	
THE SPACE SYNTAX BASED REDEVELOPMENT POTENTIAL EVALUATION FOR SURROUNDING AREA OF RAIL STATIONS IN CASE OF CHANGCHUN LIGHT RAIL LINE 3 AND LINE 4	2279
<i>L. Liu, B. Li, W. Chen, Z. Dong</i>	
EXPLORING A BETTER MODELLING METHOD FOR EVIDENCE BASED DESIGN IN METRO STATION SURROUNDING AREAS	2288
<i>X. Dai, Y. Chen, C. Shi</i>	

URBAN MORPHOLOGY

SYNTACTIC STITCHING II: TESTING THE RATIONALISATION OF THE URBAN FABRIC AS AN INTERVENTION METHOD IN CAIRO, EGYPT	2307
<i>E. Zied, A. Vialard, R. Dalton</i>	
HARD AND SOFT REVISITED	2327
<i>F. Holanda</i>	
STUDY ON THE CONTROL METHOD OF THE FORM OF STREET BUILDINGS BASED ON THE CLASSIFICATION VIA SPACE SYNTAX CONFIGURATION	2348
<i>W. Yu, B. Pan, L. Zhu, Q. Yu, L. Tang</i>	
AN ANALYSIS OF TERESINA-TIMON URBAN SYSTEM IN THE SOCIAL LOGIC OF SPACE PERSPECTIVE.....	2365
<i>J. Adao, V. Medeiros, F. Holanda</i>	
APPLICATION OF SPACE SYNTAX TO THE STUDY OF THE HOUSING IN THE PHOENICIAN - PUNIC ERA IN THE CENTRAL SPHERE OF THE MEDITERRANEAN.....	2384
<i>W. Arfoui, S. Mazouz, M. Dhouib</i>	
PROPERTIES OF URBAN FORM INFLUENCING CARBON EMISSIONS: IMPLEMENTING A GIS-BASED METHOD	2403
<i>L. Rokseth, B. Manum, T. Nordstom</i>	
DECODING URBAN KERNEL IN JAPANESE PORT CITIES BY MEANS OF SPACE SYNTAX.....	2419
<i>T. Kigawa, K. Seo</i>	
SPATIAL DISCONTINUITY IN THE MULTI-SCALED AREA STRUCTURES OF THE CENTRAL HISTORIC DISTRICTS OF LONDON AND BEIJING.....	2429
<i>T. Yang, B. Hillier</i>	
MEASURING VISIBILITY TO URBAN FUNCTIONS WITH SOCIAL MEDIA DATA	2459
<i>Y. Shen, S. Law, K. Karimi</i>	
PATTERN OF SPACE AND LIFE IN SUPERBLOCK: TAKING SHENZHEN AS AN EXAMPLE	2472
<i>J. Ma, H. Wang</i>	
FEATURE EXTRACTION METHOD FOR SIMILAR DISTRICTS IN TWO CITIES AND ITS APPLICATION TO OTHER CITIES: IN THE CASE OF TOKYO, KYOTO, AND OSAKA.....	2479
<i>A. Doi, A. Takizawa</i>	
THE THRESHOLD OF RIO DE JANEIRO'S FAVELAS: THE SYNTACTICAL VALUE OF A SPATIAL SIGN	2492
<i>V. Ena, J. Beirao, F. Serdoura</i>	
A PRELIMINARY STUDY ON THE CHARACTERISTICS OF SPATIAL FORM OF CONTEMPORARY BEIJING SCHOOL DISTRICT	2506
<i>W. Bo, Y. Tao</i>	
VISUAL IMPACT ANALYSIS IN THE CONTEXT OF SPACE SYNTAX: THE CASE OF GOLDEN HORN, ISTANBUL.....	2531
<i>A. Kubat, I. Kurtulus, M. Akay, E. Akdogan</i>	

SPATIAL CONFIGURATION OF PLOT SYSTEMS AND URBAN DIVERSITY: EMPIRICAL SUPPORT FOR A DIFFERENTIATION VARIABLE IN SPATIAL MORPHOLOGY	2544
<i>L. Marcus, E. Bobkova</i>	

FOOTBALL STADIUMS' INTEGRATION INTO URBAN FABRIC IN CONTEXT OF SPATIAL DISCOURSE	2557
<i>I. Bayraktar, M. Sahin</i>	

Author Index

URBAN SECURITY IN KIBERA BEFORE AND AFTER THE MISSING LINK #12. Integrating MapKibera Trust Participatory Mapping and Space Syntax Analyses.

Francesca De Filippi; Grazia Giulia Cocina; Chiara Martinuzzi

ABSTRACT

The UN-Habitat Safer Cities Programme states that urban safety is threatened by crime and violence rates, by insecurity of tenure and by natural or artificial disaster risks (UN-Habitat, 2007). In fact, the actual pressing urban population growth, the gentrification processes and the climate change, are increasing the perception of unsafety of inhabitants throughout the most vulnerable areas of the cities, both in developed and developing countries. Thus, it is fundamental to face this issue with an holistic approach, where institutional preventive actions, community engagement and physical environment improvements are synergically undertaken. In the Space Syntax theory, public spaces planning is a crucial element in enhancing crime prevention as well as the street configuration is a determining factor in the pattern of urban crime (Hillier, 2004).

This paper reports the results of an on-going research at the Department of Architecture and Design of Polytecnic University of Turin in which the urban security in the context of Kibera slum in Nairobi is investigated using and combining different analytical datas. In particular, the participatory mapping of MapKibera Trust about security is integrated with the Space Syntax analyses developed by the authors in order to understand the relevance of streets layout, dealing with security.

The research aims to develop an innovative methodology of analysis able to define the link between the criminal activities and the spatial configuration of the street network, in order to draw some recommendations to prevent unsafe conditions in the slum after the construction of the *Missing link #12*, a new road that will cross Kibera and modify completely the integration of its parts (KDI, 2018).

KEYWORDS

Space Syntax analysis, Urban Security, Kibera, MapKibera Trust, Missing Link #12

1. INTRODUCTION

In recent decades, several institutional Organisations and authors have faced the topic of urban security to investigate the role of urban planning as a crime preventive strategy. In 2007, UN-Habitat defines the *urban safety* as a public good and a human right that guarantees the wellbeing of city dwellers. Specifically, it is considered as the right to have free access to all the resources and opportunities connected to an urbanised environment and it encompasses a wide range of issues, from basic needs, such as food, health, tenure, to collective needs, such as protection from crime, violence, natural hazards and terrorism (UN-Habitat, 2007; De Filippi, 2009). As regards the relation between urban security and criminality, recent reports show a slight decrease in the global victimisation trends in the last decade. However, it is still a concerning threat to urban security, both in developed and developing countries (UNODC, 2015). According to UN-Habitat, the main factors influencing the occurrence of a criminal event are: cultural and social aspects, poverty and inequality, rapid population and urbanisation growth, poor urban planning and management, youth unemployment and transition towards democratic policies (UN-Habitat, 2007). These factors affect both the actual incidence rates and the fear of crime, which strongly influences the social behavior of dwellers in public space (Safer Cities, 2002). The consequences of high crime rates have repercussions at the national level, on economic growth, tourism and the attractiveness for international investors, and at the local level, with the stigmatization of some neighborhoods as “no-go areas”.

The relevance of this topic is also highlighted by the large number of authors who have dealt with it. In 60's and 70's, two main theories emerged: Jane Jacobs' ideas, described in her book *The Death and Life of Great American Cities* (1961), and Oscar Newman's theory of *defensible space*, in the homonym volume (1972). The authors disagreed about how a safe place and its natural policing should be planned. Jacobs believes that permeable and open design allows movements through a neighborhood and thus its natural surveillance. Density, in terms of number of inhabitants, flows of people and activities increase the security of the area (Jacobs, 1961). On the other hand, Newman suggests that a closed environment is safer and easier to monitor. The concept of territoriality, one of the pillars of the theory of *defensible space*, explains that inhabitants surveil a part of the surrounding public space as an extension of their dwelling unit. Urban design should shape the public space to enhance this effect and divide it in small clusters with fences, vegetation and street furniture, thereby discouraging strangers from entering the surveilled area. Indeed, Newman believes that density creates anonymity, which improves the chances of criminals to finalise their action (Newman, 1972). However, the authors have also some points in common. They agreed about the necessity of a good visibility and a well-designed illumination in the public space. They also aim to maximise the number of windows that surveil the main street in front of buildings and to differentiate clearly between private and public space in order to avoid ambiguity about the respective uses.

Some other contributions enlarged the literature about urban planning for safe environments. In Paul and Patricia Brantingham's *crime pattern theory*, public space is composed by attractive nodes (schools, workplaces, supermarkets, dwellings), the usual routes that people follow to move through the nodes and the *awareness areas*, where city dwellers feel more comfortable and can orient themselves better. Each inhabitant, including criminals, has a different *awareness area*. Moreover, a



crime is more likely to be committed close to an attractive node, where the awareness areas of criminals and possible targets overlap (ICURS, 2018; Mora, 2013).

Kelling and Wilson argued the importance of maintenance of public space. Their *broken windows theory* explains that a degraded environment affects the identification process between citizens and their neighborhood and thereby their surveillance attitude. If the institutional system does not take care of a building with broken windows, then the dwellers will not feel responsible for its care but will probably develop the interest of breaking other windows and worsening the initial situation (Kelling, 1997).

Finally, Bill Hillier deals with the topic of *urban security* in his book *Space is the machine*. He does not take sides either with Jacobs or Newman, but he believes that both could be correct, depending on the context. First, he questioned Jacobs' concept of permeability, showing that a space with high connectivity value, but not supported by a good integration value could become a security hazard especially in housing states (Hillier, 2004). Secondly, he also comments Oscar Newman's idea of natural surveillance, because of his static conception. In Newman's theories, public space is monitored only by dwellers in static position inside their houses, while Hillier strongly believes in a more dynamic idea of natural policing, in which people movement flows have an active role. More in general, Hillier explains that integration values describe pattern of movement and of co-presence in public space, generating the *virtual community*. The most integrated spaces are naturally surveilled. The integration values depend on the configuration of space, therefore there will be a different perception of the *virtual community* considering the position in the configuration. However, Hillier states: "If a space is designed wrongly, then natural patterns of social co-presence in space are not achieved. In such circumstances, space is at best empty, at worst abused and a source of fear." (Hillier, 2004, p. 141). A bad urban and architectural design could create social malaise. Another interesting aspect emerged with Space Syntax studies is that anti-social use of space occur neither in surveilled areas, nor in the segregated ones, but in the most integrated areas free from natural policing. Empirically, criminals seek out locations with good movement flows and patterns of privacy that provide them with possible targets, but no witnesses. Finally, further studies developed with Space Syntax have shown the strong relation between social behavior, spatial configuration and time (Hillier, 2004; Hillier, Sahbaz, 2005; Hillier, Sahbaz, 2008; Tarkhanyan, 2013; Setola, 2013; Lee, Ha, 2014; Buoncore, Cutini, 2016; Cocina, 2016, 2017).

In this research, the theories emerged from the analysis of literature will be compared with the observations of the case study – the slum of Kibera in Nairobi – with the aim to investigate the role of participatory mapping (De Filippi et al., 2016; De Filippi, Coscia & Guido, 2017; De Filippi, Coscia & Guido, 2018) and city planning strategies in enhancing crime prevention in informal settlements. Drawing upon the main literature about crime prevention through environmental design and the crucial contribution of Space Syntax theories, the authors chose some parameters to identify the key environmental elements that affect the security in an informal context. The dataset of the research is based on the information gathered from the participatory mapping of MapKibera Trust and from the Space Syntax analyses elaborated by the authors. The information from these two sources were



combined in order to achieve a more complete interpretation of the context and to understand the effects of comparing qualitative information with quantitative data.

The case study: Kibera

Kenya and, in particular, the slum of Kibera in Nairobi were chosen as case study for a variety of reasons. First, developing countries clearly suffer from most of the factors generating criminality identified by UN-Habitat, especially poverty, inequality, unemployment and corruption (UN-Habitat, 2007). In particular, Kenya was considered an interesting context because of its fragile political situation that caused the post-electoral violence of 2007. After this event, security is a main concern for development in Kenya, dealt with at national and local level (Roberts, 2009; NCRC, 2017). Another relevant aspect deserving further analysis is the informal settlement, often stigmatized as a dangerous place (UN-Habitat, 2003; Davis, 2007). Although *Crime Prevention Through Environmental Design* (CPTED) theories usually took into consideration social housing or poor residential estates, slums are rarely dealt with. Several projects showed the positive impact of slum upgrading programmes and physical improvement of public space in urban security (UN-Habitat, 2008; UN-Habitat, 2011; Mitra, Mullingan, 2017).

Kibera, with an extension of 2,56 km², is the biggest informal settlement in Kenya and is located in the South-west of Nairobi city, next to the railway line. Although the opinions about the population of Kibera are still multiple¹, reliable sources estimated a number of 235.000 – 270.000 inhabitants (Marras, 2010). It is divided in 13 villages, mostly according to the ethnic origin of the people. Kibera is crossed by several water streams that flow into the Ngong River and the Nairobi dam. These are strongly polluted by garbage that blocks the water flow and causes floods during rainy seasons. Hygienic conditions are extremely poor, without adequate toilets and garbage management. Houses are shanties made up of rusty metal sheets, pieces of wood and garbage. Economic conditions of residents are precarious: it is estimated that 60% of youth is unemployed and crime rates are high (Hagen, 2011). Kibera was founded in 1902 by British colonists, as a military reserve for Nubian soldiers. Few years later the government claimed the land and all the inhabitants became squatters. Only in 2017 did president Uhuru Kenyatta issue the Nubian community with a title deed for 1,18 km² of land in Kibera, which was the original perimeter of the military site². However, the pressing urban growth caused the expansion of the settlement over the years and the future prospect of the slum shows the unbinding nature of the land deed. Indeed, in July 2018 construction works started for a new road - *the Missing Link #12* - that will improve the traffic conditions of Nairobi, passing through Kibera and destroying housing, schools and services (KDI, 2018). The *Missing Link #12* was announced in January 2016 by the government of Kenya as a part of the *Nairobi Integrated Urban Development Master Plan* by 2023. The people of Kibera have never been involved during the

¹ See <http://www.mapkibera.org/blog/2010/09/05/kiberas-census-population-politics-precision/> (Davis, 2007; Desgroppes, Taupin, 2012; Marras, 2010).

² <https://www.nation.co.ke/news/Uhuru-issues-title-deed-to-Kibera-Nubians/1056-3953204-9jfwvk/index.html>



decision-making process, almost 11500 people have been evicted, and 13 schools have been closed or moved without any compensation.

The sad notoriety of Kibera has drawn the interest of almost 400 international organisations that collaborate with the community to improve the quality of life in the slum. One of those is MapKibera Trust, founded in 2009 on the basis of the pilot project of Erica Hagen and Mikel Maron, developed to create the first public map of the settlement. Today the organisation carries out activities such as voluntary mapping and participatory journalism and aims to share information about Kibera with the people living inside and outside the slum, in order to involve them in the public discussion and raise awareness. Specifically, it has produced several thematic maps dealing with the urgent issues of the settlement, such as security. Arguing about criminality in Kibera, the current project chief of MapKibera Trust explains that probably the main causes are related to extreme poverty and youth unemployment.

In this research, the security map of MapKibera Trust and the maps obtained from Space Syntax analyses were the bases on which the parameters identified from the literature were applied, in order to achieve a better comprehension of urban security in the slum.

The methodology of the study and the results of the analyses are showed below. Then, some recommendations are proposed for a safer planning of public space. The observations of the current situations are the starting point to define new urban strategies for the future: the Missing Link #12 will completely change the spatial configuration and the social dynamics of Kibera. Therefore, the insights provided by this research aim to contribute to the future prevention of criminality.

2. DATASETS AND METHODS

The study described in this article is part of a broader research project developed by the Department of Architecture and Design of Polytecnic University of Turin. Within the research project, the parameters chosen from the study of the main theories about CPTED and Space Syntax are: *integration, illumination, vitality, visibility, natural surveillance, territoriality* and *maintenance*. These parameters were used to define the role of urban planning for crime prevention, both at large and small scale. At territorial level, the analyses provided a systemic comprehension of crime occurrence, taking into account configurational features of space; while, at the local level, it was investigated the relation of architectural aspects and each specific hot-spot, which is a place considered as prone for crime actions. In this article only the territorial analyses about *integration, illumination* and *visibility* of the current spatial configuration of Kibera are described. Here below is described the dataset of the research, composed by the participatory mapping of MapKibera Trust and the Space Syntax analyses, that describe the current and the future layout of Kibera public space.

2.1 Security mapping by MapKibera Trust

The first security map of the organisation was completed in the 2010 thanks to the support of UNICEF, to monitor the violence in the slum and make residents aware about the safe and unsafe areas. It was upgraded in 2013 and in 2017, before the national elections in order to prevent unfortunate episodes. The merit of MapKibera Trust's work is related to a strong interest in involving



all the relevant stakeholders while defining safety of an area and in valuing their knowledge (Demartis, 2013). In this way, they established trust with citizens and got more information about those crimes, not often reported to police officers in informal contexts (Safer Cities, 2001; Safer Cities, 2002).

As illustrated in figure 1, the map gathers all the relevant element of security, which are: street lighting, bars, black-spot, hatari-spot, police stations, gender-based violence supports, chief camps and other organisations that provide security. The organisation distinguished black-spots, dangerous places where criminal activities have been registered, and hatari-spot, possible unsafe places due to physical and spatial features. Specifically, a place is considered as a black-spot when residents reported more than one criminal action on it and thus there are reasons to believe that is a crime-prone area. In this research black-spots and hatari-spots were dealt without distinctions. The choice to map also bars of Kibera is justified by the alcohol sale, that often cause danger in several informal settlements³. On the other hand, police stations, chief camps and support groups are mapped as safe spots benefitting from active surveillance. MapKibera Trust provided more detailed information for each element of the map: for example, every light sources has an ID code and it is described by the type of light (which could be street light or Adopt-a-light type⁴) and by the maintenance status (operational, not operational, or uninstalled). The reported hot-spots are 37, taking into account both black and hatari spot. Some of them have indications about the occurred crime, which could be pickpocketing, robbery, mugging, murder or rape. Others marked an increased risk during the night. These information were useful to define the research methodology: while the indication of the crime type were not detailed enough, the information about time seemed to be more accurate. Therefore, in this study hot-spots are distinguished between “nocturnal” (15/37), which have a declared increased risk during the night, and “general” (22/37), which have no specific relation with day - or night-time.

³ See also *Spatial Collective* projects in Kayole Soweto slum, Nairobi. <http://mappingnobi.deal.com/2017/01/07/linking-perceptions-of-safety-to-infrastructure-upgrading-in-informal-settlements/>

⁴ See Slum Lighting Initiative of *Adopt-a-light Limited* project. http://www.adopt-a-light.com/about_us.php

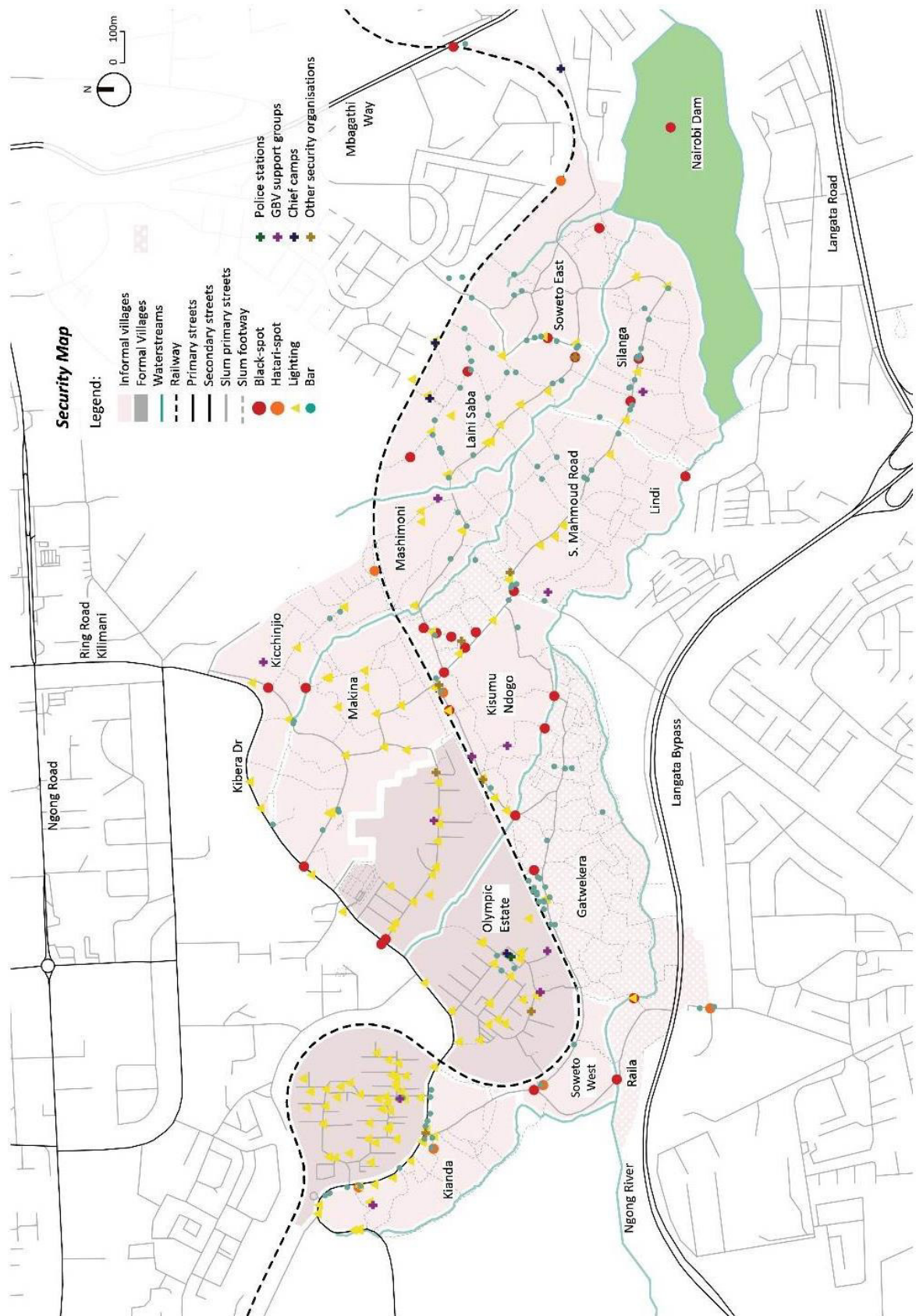


Figure 1, Security map of Kibera Slum (Elaborated by the authors, from the data of MapKibera [Trust](#)).

2.2 Space Syntax analyses

The application of Space Syntax aims to generate more information regarding patterns of movement and visibility in the context of the informal settlement. Thus, the analyses carried out with Space Syntax were the Axial lines Analysis and the Visibility Step Depth Analysis. Firstly, it was calculated the Global Integration values of both the current and future layout of Kibera in order to define how the new road will affect the slum and the whole city. Secondly, the configurational information of the current layout were integrated with the security map of MapKibera, taking into account the parameters of *integration*, *illumination* and *visibility*. In particular, the relation of crime and visibility was investigated counting the visual Step Depth between hot-spots and highly visible spaces. Here below is described the process followed for the Space Syntax analysis.

The current axial map was drawn by the authors through QGIS Space Syntax Toolkit with the information of OpenStreetMap on-line platform. When the information about the built structures lacks in OSM, they were implemented with Google Satellite pictures. The axial map cover the entire slum with a buffer area of 1,5 km².

Before discussing the results, it is important to underline some aspects. Firstly, the railway that passes through the settlement is used by dwellers as a path, in which many informal activities and housing are settled, thus it was marked as a street and the intersections with other paths are linked. In this way, the model is more congruent with the actual movement patterns of the settlement. Secondly, the global integration values ($R = n$) were divided in different range depending on the output colours. The more integrated is the axial line, the higher is the defined value: 10 is referred to red axial lines, 9 for orange and so on until 1 for blue lines. In this way, the interpretation of the outputs is more clear and a qualitative comprehension of the context is achieved.

In figure 2a, it is possible to see outputs of the current and the future spatial layout of Kibera. Regarding the current configuration, the main integrated axial lines are described by the two main roads placed out of the slum at North, (Ngong Road, direction West-East; and Ring Road Kilimani, direction North-Sud) and at East (Mbagathi Way, direction North-Sud). Other spaces highly integrated inside the slum are Kibera Drive, the road defining the east border of Makina, Kicchinjio villages and Olympic Estate, a section of Sheikh Mahmoud Road, which pass through Makina, Kambi Muri, Lindi and Silanga villages, and the railway line. This aspect highlights the importance of the railway as pedestrian path in the informal settlement. In general, streets of the slum are quite irregular and intricate, which means that axial lines are quite short. Kibera has few accesses and the mains are located at North from Ring Road Kilimani and at East from Mbagathi Way. The most segregated axial lines are placed in the South of Kibera, far from the main accesses.

Focusing on the future layout, the initial model was modified depending on the demolitions carried out on the site. Some axial lines referred to internal paths were eliminated and it was introduced the new connection passing through the slum. The information about the Missing Link #12 project are very poor and it is not yet specified which will be the relation between the new road and the streets of Kibera. Thus, it was supposed that all the intersections are permeable, as is already happening with Kibera Drive road. Only the railway is unlinked with the new road.

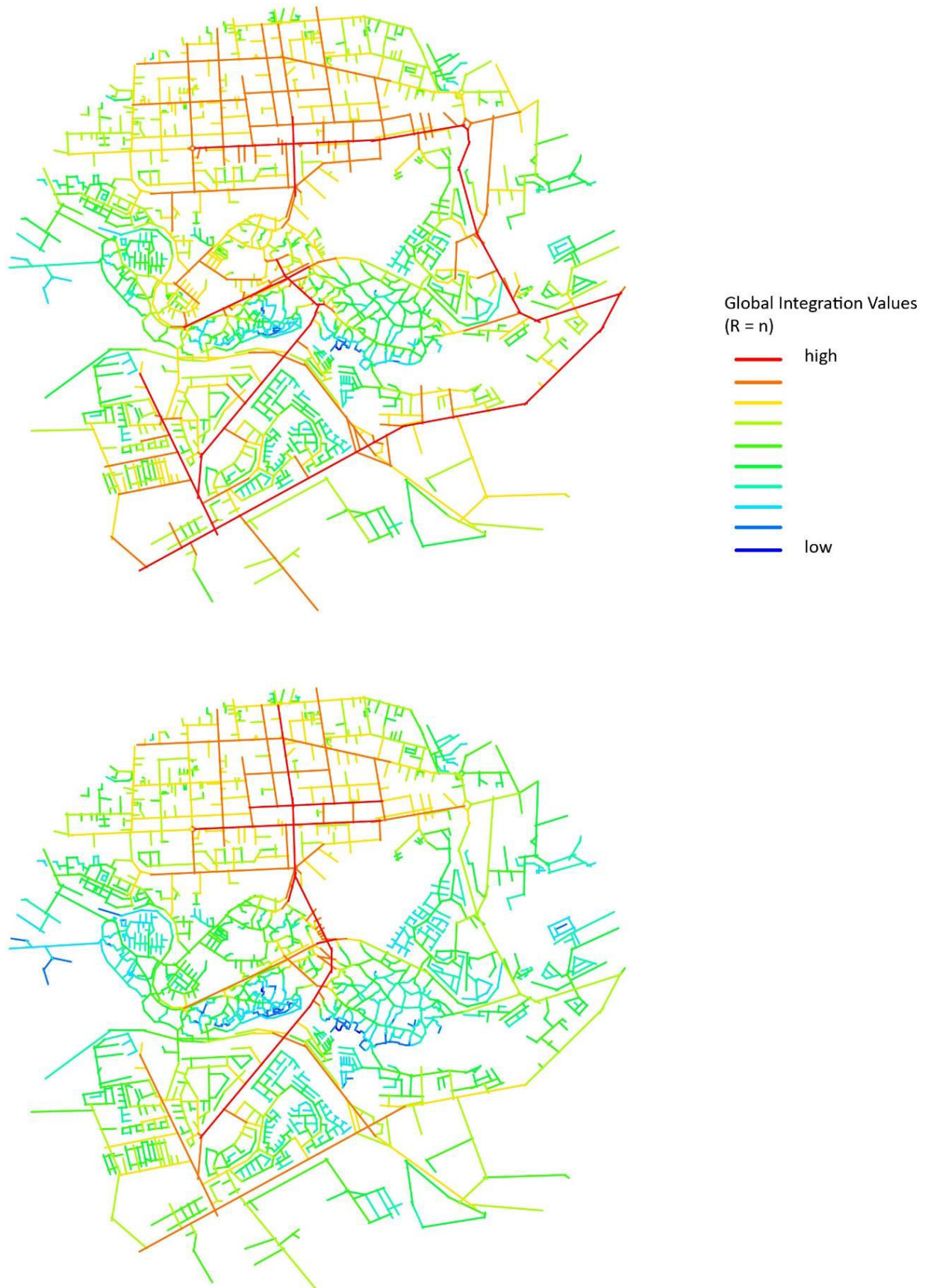


Figure 2, Axial maps of the current (top) and the future (bottom) configuration of Kibera public spaces (Elaborated by the authors)



While the city traffic created a “ring” around the slum in the first configuration, with the introduction of the Missing Link #12, the movement flows of Nairobi change completely. Indeed, the axial lines describing the new road are the most integrated and the movements through the streets of Kibera Drive Road, Mbagathi Road and Langata Road decrease. However, the railway keeps a relevant role in the new layout, with a high integration value. The east access from Mbagathi Way results less integrated than in the first layout. In general, the construction of the Missing Link #12 will definitely improve the traffic conditions of the city. For what concerns Kibera, the new road caused the dislocation of thousands of residents and the demolition of several schools and services. However, the introduction of the new connection is likely to improve the integration of the settlement within Nairobi, resulting an increment of opportunities for slum dwellers.

3. RESULTS

Here below are reported the results of the integration between the configurational information of the current layout and the security map of MapKibera. Three parameters were investigated: *integration*, *illumination* and *visibility*. In the table 2, the environmental conditions of each hot-spot are summarised, to define a systemic comprehension of crime occurrence. Finally, few recommendations are proposed in order to improve the environmental conditions for future preventive strategies after the introduction of the Missing Link #12.

3.1 Crime and Integration

Each hot-spot mapped by MapKibera Trust has a global integration value, that is the value of the axial line in which is located, as illustrated in figure 3. The average integration value of all the hot-spots is 6,89. Specifically, analysing the table 1, 12/37 hot-spots have a global integration value of 8, while 8/37 a value of 7 and 7/37 a value of 6. Thus, it could be argued that the hot-spots generally are placed on more integrated axial lines. Moreover, distinguishing the “nocturnal” and “general” hot-spots, more interesting information emerged. In fact, the average integration value of “nocturnal” hot-spot is 7,47, while regarding to “general” hot-spot is 6,50. Indeed, 53% of “nocturnal” hot-spots have a integration value of 8.

Table 1, Integration value of hot-spots spaces.

Integration value (R = n)	Hot - spot	“general” hot - spot	“nocturnal” hot - spot
10	-	-	-
9	5	3	2
8	12	4	8
7	8	6	2
6	7	5	2
5	1	1	-
4	1		1
3	2	2	-
2	-	-	-
1	1	1	
	37	22	15



This aspect clarifies that crimes occurred in the night or hot-spots that have an increased risk during the hours of dark, are mainly located on high-integrated spaces. The results are coherent with Hillier's theories suggesting that anti-social behaviors occur "in the first integrated space free from natural surveillance" (Hillier, 2004, p. 121). It agrees also with the observations proposed by Hillier and Sahbaz, showing that night crimes mainly occur in high integrated lines (Hillier, Sahbaz, 2008).

3.2 Crime and illumination

As already mentioned, MapKibera Trust has mapped the light sources in the public space of Kibera, which have been categorised considering the maintenance status (operative, not operative and not installed) and the typology (street light or adopt-a-light). In this research, it has been considered only the current operative lighting. For each light source it has been drawn the area that covers considering the typology of the source. While the streetlights are installed at an estimated high between 5-8m⁵ and cover an approximated area of radius 20m, the adopt-a-light masts are almost 20m high and the effects of the lighting power decrease after a radius of 100m (The Steadman Group, 2006). Thus, in the figure 4 it is possible to see the illuminated area of Kibera compared to hot-spots locations. In general, the light sources are mostly placed on the main streets of the slum, characterised by wide transversal sections that allow vehicular movements and relative high integration values. Some villages are completely without public illumination, such as Kambi Muri, Kisumu Ndogo, Gatwekera, Raila e Soweto West. Analysing the results, only 6 hot-spots are inside the illuminated areas, while most of the dangerous places remain in the dark zones. Moreover, only one "nocturnal" hot-spot is illuminated. It is evident that illumination is a striking factor for criminals defining their action area. However, it should be underlined also that lack of illumination it is not a sufficient condition to choose a spot. In fact, the amount of hot-spots on narrow, dark and intricate paths is consistently less than the number on more integrated, not continuously illuminated streets. Thus, criminals of Kibera prefer to set on integrated lines with poor illumination rather than segregated area completely dark.

⁵ The height has been estimated considering Google Street View.

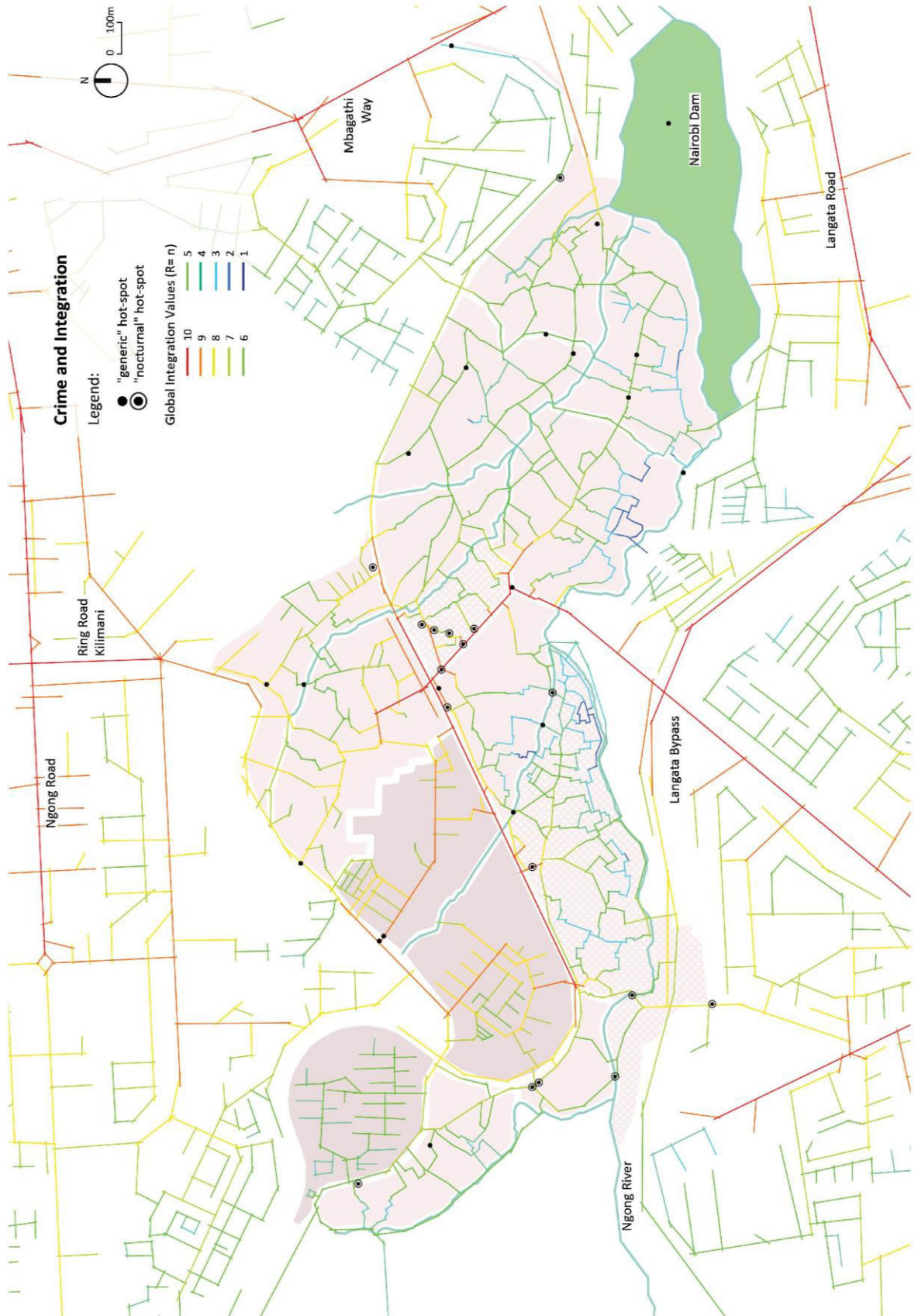


Figure 3, Correlation between crime and global integration in Kibera (Elaborated by the authors).

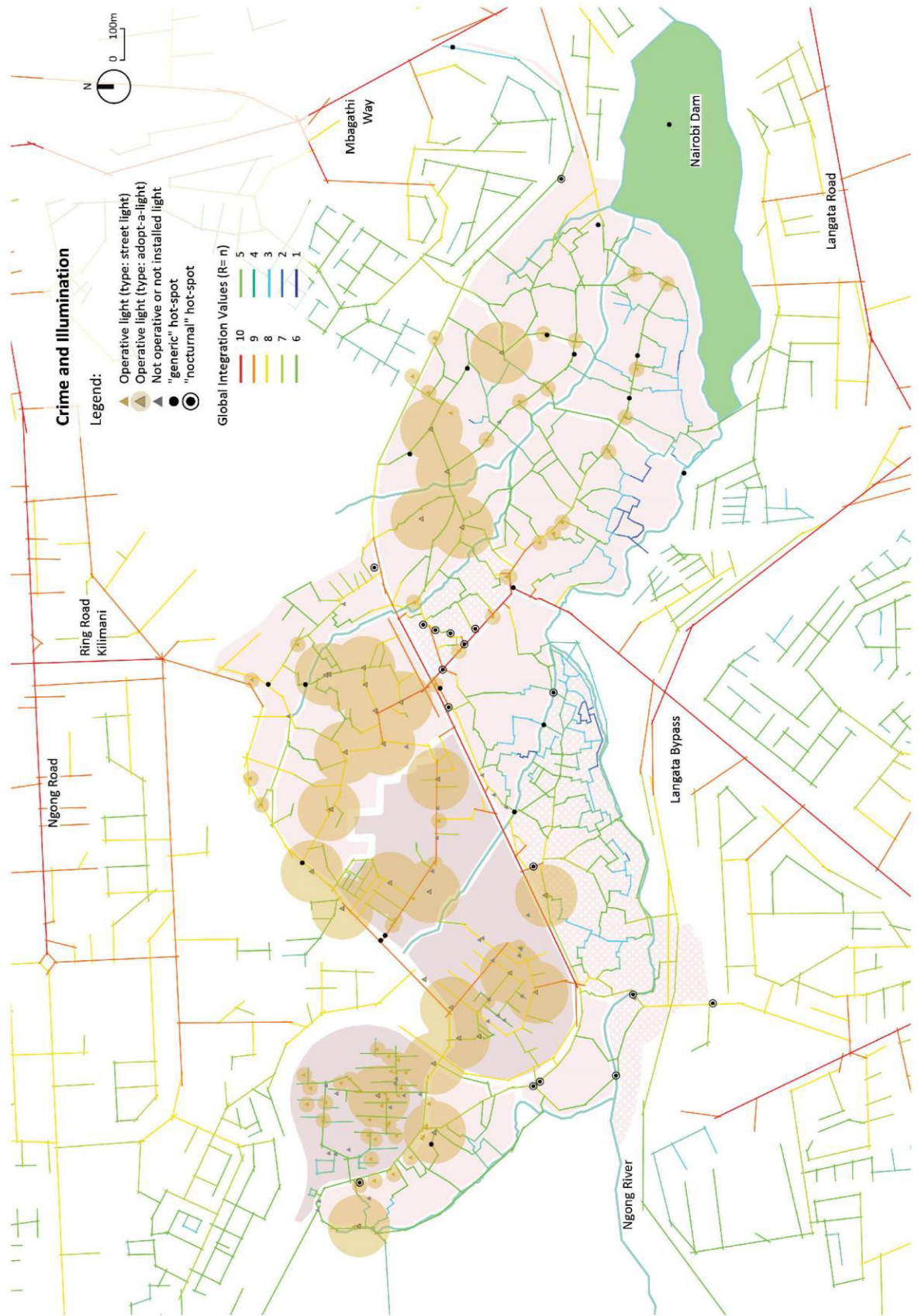


Figure 4, Correlation between crime and illumination in Kibera (Elaborated by the authors).

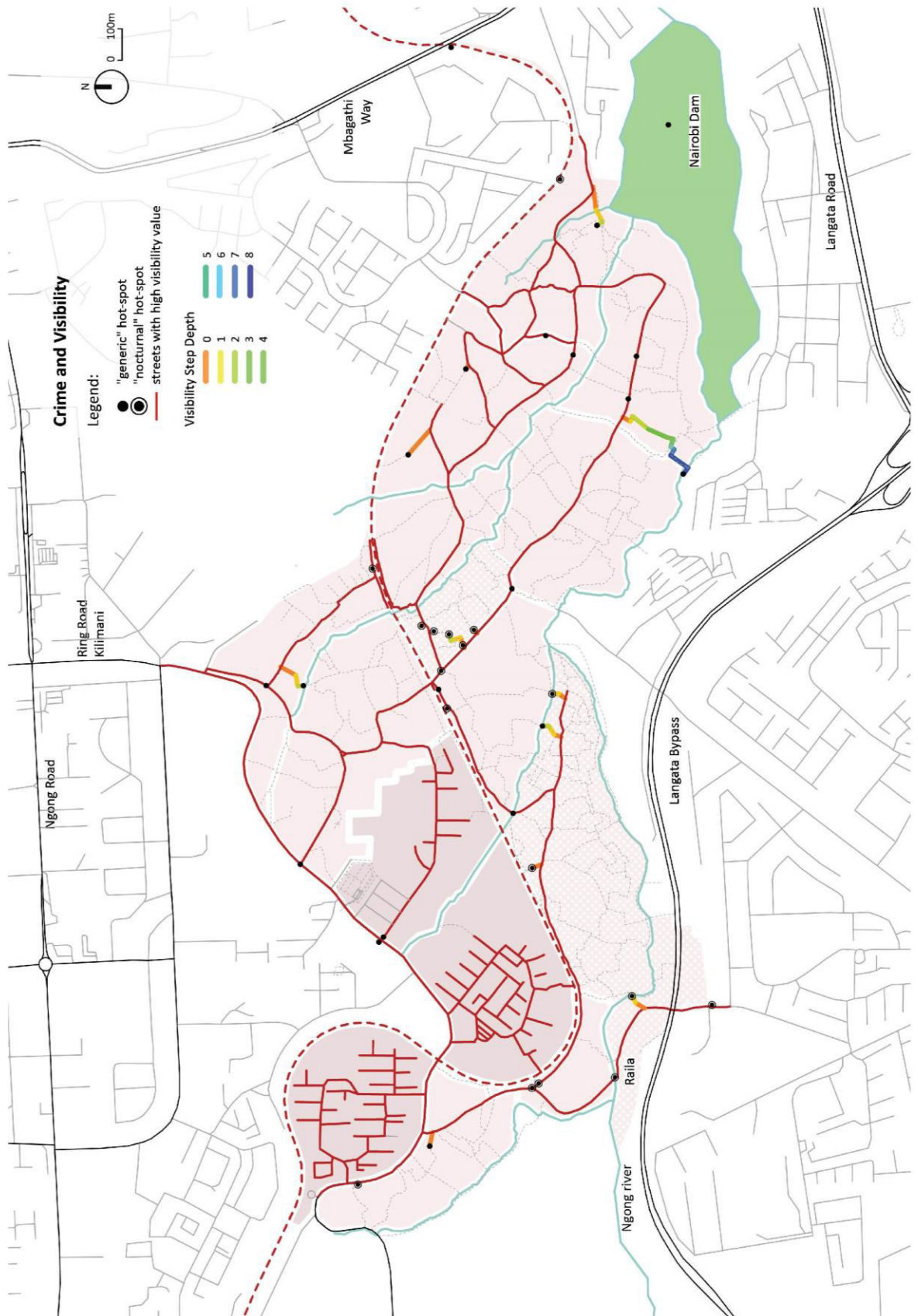


Figure 5, Correlation between crime and visibility in Kibera (Elaborated by the authors).

3.3 Crime and visibility

Visibility is a spatial feature that depends on the configuration of built structures and on street furniture collocation. A space with good visibility allows people to keep surveilled the public space and prevent anti-social behaviors. In crowded informal settlements such as Kibera, open spaces are limited and good levels of visibility are rarely achieved. For these reasons, in this research it is supposed that spaces with good visibility are safer. These are often related to main streets, enough wide to allow vehicular transits. Moreover, these spaces benefit from higher movement flows, which prevent in itself criminal actions. The Visibility Step Depth between safer streets and hot-spots were analysed, in order to define whether criminals mainly act in more visually integrated or segregated areas.

In the figure 5, spaces with high visibility levels are identified, depending on the wideness of the transversal section. Using OSM information and Google Satellite pictures, streets with wideness between 5 and 16 meters were chosen as safe spaces with high visibility. The visual Step Depth of each hot-spots and the closer high visibility space were calculated. 20/37 hot-spots are located on high visibility spaces or with 0 Step Depth distance. 8/37 have 1 Step Depth distance and thus they need only one visual change to reach the main visually integrated area. Considering the hypotheses, this striking aspect highlights again the interest of criminals in positioning themselves in more integrated areas instead of visually segregated, with the aim of monitoring coming targets. Deepening the relations of the Step Depth measurement and the actual position of each hot-spot in the urban layout, it emerged that 10 hot-spots with 0 Step Depth are located closed to crossings.



Figure 6, Step Depth analysis of the hot-spots in Kibera (Elaborated by the authors).

In the figure 6 a zoomed image of Kibera layout shows this second aspect. Therefore, hot-spots located on crossings benefit from high visibility value, remaining hidden from the view of coming targets. No relevant distinction between “general” and “nocturnal” hot-spots were detected.

Table 2, Hot-spots information summary.

hot-spots information			integration	illumination		visibility	
ID	crime	Notes	R = n	light	type	street wide	Step Depth
712964757	hatari		7	yes	adopt	4	1
712890336	hatari		8	yes	street	16	1
612007130	black	crossing	8	yes	adopt	13	0
712884575	black		3	no			10 +
712891350	black		7	no		9	0
712908180	black	bridge	7	no		5	0
712903911	black	bridge	3	no		1,7	3
713027609	black	crossing + bus stop	9	no		9	0
948311711	black	nys road	6	no		10,3	0
948311715	black	nys road	6	no		9,2	0
712884565	black	nys road	6	no		8,8	0
612009744	black		7	yes	adopt	3,6	3
2117408674	black	bridge + railway	5	no		7	0
712916686	black	pickpocketing	9	no		10,3	0
713194093	black	robbery	8	no		9,4	0
713194103	black	robbery	6	yes	street	9,6	0
713194146	black	robbery	6	no		4,3	1
713194153	black	robbery	7	no		5,5	2
	robbery +						
712884579	black	pickpocketing	1	no			10 +
	robbery +	dam					
712884580	black	pickpocketing	7	no		3,4	3
713194111	hatari	robbery + raped	8	no		7	0
713194076	hatari	robbery + raped	9	no		12	0
Average of "general" hot-spots			6,50	22,7%			
712964089	hatari	crossing	8	no		4	1
712964098	hatari	crossing	8	no		6,3	0
712903697	hatari	crossing	7	yes	bar	11,4	0
712903771	black	bridge + crossing	4	no		3	2
713074380	black		9	no		2,7	1
713124716	black	bridge	8	no		3,2	2
713124731	black	bridge + crossing	8	no		5,3	0
712964083	black	crossing	8	no		9	0
712890332	black	murder	8	no		1	1
712892550	black	crossing	9	no		13,2	0
	mugging +						
712890340	black	murder	6	no		2,1	1
712890334	black	mugging	7	no		4	1
712876953	black	raped	8	no		10,7	0
712890333	black	murder	6	no		1	3
712890337	black	murder	8	no		3,5	0
Average of "nocturnal" hot-spots			7,47	6,7%			
Average of total hot-spots			6,89	16,2%			

4. CONCLUSIONS

The analyses carried out show that in an informal settlement like Kibera, the highest number of crimes occurs in more integrated spaces, rather than segregated areas. In this case study, most of the hot-spots, in particular the “nocturnal” ones, are located in axial lines with high global integration values free from natural surveillance. In this way, criminals benefit from high movement flows of possible targets and avoid possible witnesses present in the most integrated lines with value of 10 and 9. Then, most of the hot-spots are located out of the illuminated areas of the slum, but close to it. Infact, villages completely unprovided with light have less hot-spots than illuminated villages. This aspect allow criminals to monitor public space and coming targets, without being noticed. Finally, more than 50% of hot-spots are 0 Step Depth far from spaces with high visibility and more than 25% are located closed to crossings. Thus, local configuration of buildings helps criminals to intercept coming targets and remain out of their visual field.

Therefore, most threatend areas by crime are not the highest integrated streets, with good illumination and visibility, nor segregated areas, with no light and bad visibility. Instead, criminals seek out for those places directly connected to the highly integrated lines, in which light is not continuously installed and local configuration creates hidden spots.

Moreover, the results of this research suggest that after the construction of the new road, *the Missing Link #12*, the spatial configuration of the slum will change, and with it the patterns of crime. Basing on the results achieved, the areas directly connected to the new road are likely to be at risk.

The Missing Link #12 is likely to be a good opportunity for Kibera development and an occasion to intervene in the surrounding areas of the decanting site. For instance, illumination is lacking and the installation of new light sources could be a deterrent for future criminal actions. In addition, local configuration defined by buildings disposition should aim at safer layout. However, it is important to involve the local community before define any further design decision.

The current research still presents some weaknesses such as the lack of a direct experience of Kibera from the authors and the difficulty to define statistical results caused by the small amount of hot-spots reported. These limitations can be represent as starting points for future research opportunities in which the knowledge of the place, the involvement of the local organisation and the community will provide a better understanding of crime patterns in Kibera and make the study more detailed. Moreover, a further possible development could be the update of the security map after one year from the end of the road construction, showing how security has changed in Kibera and thus enriching the research.

The most relevant contribution of the research is to provide an innovative methodology of analysis able to define the relation between crime and space, combining different data and approaches: the configurational analysis of Space Syntax and the participatory mapping of MapKibera. The methodology converts some theoretical parameters identified through the literature review in practical parameters by comparing qualitative and quantitative data from the two different analysis tools used and obtaining results that can help to understand which are the most important spatial elements that influence criminal behavior.



Proceedings of the 12th Space Syntax Symposium

The methodology, currently tested in a real case study, can be also applied in other slums of Nairobi where MapKibera Trust is already involved in participatory mapping projects or in different contexts in other parts of the world.

REFERENCES

- Brantingham P.J., Brantingham P.L., Crime pattern theory, lecture at Institute for Canadian Urban Research Studies in <https://www.scribd.com/document/86908463/Crime-Pattern-Theory> (2018)
- Buoncore M., Cutini V.(2016). We were building a camp, they were building a city, Refugee camps as a spatial laboratory for social inclusion, in 11th International Space Syntax Symposium, Pisa: University of Pisa
- Cocina G.G. (2016). *Cultural needs in hospital humanization*, in Caumme III/PAUMME International Symposium “Migration and the Built Environment in the Mediterranean and the Middle Est”, Napoli
- Cocina G. G. (2017). *Responding to user cultural needs in hospitals with the support of Space Syntax Analysis*”, Proceedings of the 11th International Space Syntax Symposium
- Davis M. (2007). *The Planet of Slums*, London: Verso
- De Filippi F. (2009). *Slum[e]scape: A Challenge for Sustainable Development Projects*, Firenze: Alinea.
- De Filippi F. et al., (2016). *MiraMap: A We-Government Tool for Smart Peripheries in Smart Cities*, IEE Access, Vol. 4.
- De Filippi F., Coscia C., Guido R. (2017). *How Technologies Can Enhance Open Policy Making and Citizen-responsive Urban Planning*, International Journal of E-Planning Research (IJEPR), Vol.6 (1).
- De Filippi F., Coscia C., Guido R. (2018), *Miramap: a collective awareness platform to support open policy making and the integration of the citizens’ perspective in urban planning and governance*, in S. Hostettler, S. Najih Besson, J. C. Bolay (eds), *Technologies for Development*, Springer International Publishing.
- Demartis E. (2013). *Geografie per la pace e la cooperazione allo sviluppo. mappare e prevenire le violenze e i disordini post-elettorali negli slum di Nairobi: un progetto di ICT4D partecipativo*, Torino: MSc Degree Thesis, University of Torino. Supervisors: prof. E. Dansero, prof. F. De Filippi.
- Desgroppes A., Taupin S.(2012). *Kibera: The Biggest Slum in Africa?* HALarchives-ouvertes.fr
- Hagen E.(2011). *Mapping Change, community information empowerment in Kibera*, in Innovations: Technology, Governance, Globalization Volume 6 pp.69-94

- Hillier B. (2004). *Space is the machine*, London: University College London
- Hillier B. (2004). *Can streets be made safe?* In Urban Design International, pp. 31-45
- Hillier B., Sahbaz O. (2008). *An evidence based approach to crime and urban design or, can we have vitality, sustainability and security all at once?* London: Bartlett School of Graduate Studies
- 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*, London: University College London
- Jacobs J. (1961). *Vita e morte delle grandi città*, Torino: Piccola Biblioteca Einaudi
- Kelling G., Cole C. (1997). *Fixing broken windows: Restoring order and reducing crime in our communities*
- Lee S., Ha M. (2014). *The duality of visibility: Does visibility increase or decrease the fear of crime in schools' exterior environments?* Seoul: Yonsey University
- Marras S. (2010). *Mapping the unmapped*, PhD Thesis, Department of Sociology and Social Research, Milano: Università di Milano-Bicocca
- Mitra S., Mulligan J., Schilling J., Harper J., Vivekananda J., Krause L. (2017). *Developing risk or resilience? Effects of slum upgrading on the social contract and social cohesion in Kibera, Nairobi* in Environment & Urbanization, vol 29(1)
- Kounkey Design Initiative (2018). *Division or Development? Missing Link #12: A new road through Kibera* in <http://blog.kounkey.org/2018/07/18/division-or-development-missing-link-12-a-new-road-through-kibera/> (2018)
- Mora A. (2013). *La progettazione partecipata per la sicurezza urbana*, MSc Degree Thesis, Politecnico of Torino
- NCRC (2016). *Elections Crimes and Offences in Kenya*, Nairobi
- Neuwirth R. (2006). *Shadow Cities: a billion squatter, a Urban New World*, New York
- Newman O. (1972). *Defensible Space, Crime prevention through environmental design*, New York
- Roberts M. J. (2009). *Conflict analysis of the 2007 post-election violence in Kenya*, in *Managing Conflicts in Africa's Democratic Transitions*, Lexington Books
- Safer Cities (2001). *Urban safety and good Governance: The role of the Police*, Nairobi
- Safer Cities (2002). *Crime in Nairobi Results of a City wide Victim Survey*, Nairobi



Proceedings of the 12th Space Syntax Symposium

- Setola N. (2013). Percorsi, flussi e persone nella progettazione ospedaliera. L'analisi configurazionale, teoria e applicazione, Firenze: Firenze University Press
- The Steadman Group (2006) An evaluation of the lighting initiative in Nairobi slums, Nairobi
- Tarkhanyan L. (2013). *Drug crime and The urban Mosaic: The location choice of drug crime in relation to high streets, bars, schools and hospitals*, in 9th International Space Syntax Symposium, London: University College London
- UN-Habitat (2007) Enhancing urban safety and security, vol. I, II e III, London: Earthscan
- UN-Habitat (2003) The Challenge of Slums, London: Earthscan Publication Ltd
- UN-Habitat (2008) *Kenya Slum Upgrading Programme: Strategy document*, Nairobi
- UN-Habitat (2011) *Building Urban Safety through Slum Upgrading*, Nairobi
- UNODC (2015) State of crime and criminal justice worldwide, 13th United Nations Congress on crime prevention and criminal Justice, Doha: 12 – 19 April 2015

<http://www.adopt-a-light.com/>

<http://blog.kounkuey.org/>

<http://www.mapkibera.org/>

<https://www.nation.co.ke/>

<http://mappingnobigdeal.com/>