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An investigation into the factors that affect eating and walking behaviour in new public spaces

New Cairo as a case study

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ABSTRACT

Currently, there is a tendency to pursue more healthy habits when using public spaces, such as eating healthy food and depending more on walking rather than using private vehicles. These types of behaviour are still not encouraged in some Mediterranean cities, due to several factors. This paper investigates the main factors that affect two kinds of behaviour in public spaces: eating and walking. The paper seeks to answer a fundamental question: is spatial proximity a significant factor that affects the users' selection of both fast-food as a destination and the transportation method used to reach this destination (as stated in major research), or is it the local cultural habits that have the major influence on both choices?

This investigation aims to explore the daily habits of the local users of public space through various methods. The quantitative analysis methods used are a potential movements analysis using space syntax theory and tools and an analysis of the spatial statistical location of fast-food facilities using GIS statistical tools. The data collection depends on web-scraping to extract the data digitally using Python tailored codes. The outcome will assist in planning appropriate health policies design to maximise the benefits of public space usage. This paper focuses on the New Cairo settlement (Egypt) urban growth extensions.

KEYWORDS

Fast-food, web-scraping, New Cairo, eating behaviour, urban blocks

1 INTRODUCTION

Outside-the-home eating is a global phenomenon that transcends cultures, locations, environmental circumstances, and income levels. The desire to dine outside the home may be motivated by one or more of the following demands: exploration (new places/new types of cuisine), celebration (a local/global event), and/or necessity (lack of ability or time to cook). Individuals and families alike are impacted by these needs when selecting a suitable restaurant or fast-food chain. In general, restaurants and eating facilities play a key role in the foodscape (Eckert and Vojnovic 2017). Answering the question 'where?' in terms of the food provider's location is a fundamental factor not only for consumers (where to eat?) but also for producers (restaurant owners and selecting an appropriate location).

From the perspective of the restaurant owners, fast-food chains and restaurants might need specific population densities to operate effectively from an economic perspective and so try to select appropriate customers with the level of income targeted and who match the type of food offered. The site's location is increasingly acknowledged to be the most critical factor affecting profitability and success (Ghosh and McLafferty 1987, Dock, Song and Lu 2015). The idea that proximity to fast-food restaurants and supermarkets predicts fast food consumption is supported by many researchers (Han, Schwartz and Elbel 2020). Socioeconomically impoverished areas have been shown to have more food stores and larger independent food stores than wealthy areas (Black et al. 2011).

From the consumers' point of view, the decision to walk/move for either transportation or enjoyment is influenced by various circumstances. Improvements in accessibility, attractiveness, safety, comfort and security can lead to behavioural changes and encourage more people to walk. As a result, the neighbourhood walking infrastructure is reflected in the real estate pricing (Longo et al. 2015).

When considering the above two perspectives, other factors emerged. Wealth and politics can influence commercial isolation, particularly from undesired commercial uses (Smoyer-Tomic et al. 2008). The lower the population density, the more difficult it is for commercial developers to locate themselves there (Black et al. 2006). Paradoxically, this means that regions with lower incomes and typically fewer methods of producing community-level mobilisation may be left with better access to food stores, at least in terms of distance from the house (Black et al. 2006). This situation is reflected heavily in this paper's case study of the New Cairo settlement.

Several types of research have focused on examining the situation in existing cities, that are settled and have operated for a period of time already. However, less research has focused on new settlements. New Cairo is currently under development and not all of its neighbourhoods are built or occupied. It is a challenging case since there are little data available published by the authorities or research bodies to analyse. That is why new ways of acquiring fundamental

data from the internet are required to gather information about a restaurant's location, user reviews, income level, and other pertinent data, apply a spatial configuration analysis with space syntax to comprehend the potential movement behaviour in the new city and aggregate all of the data into a GIS platform.

This paper aims to examine customers' eating behaviour in light of two parameters: the potential movement activity from the source to the food provider's location, and the potential mode of transportation associated with this activity, such as walking, taking public transportation or using private vehicles. We considered the Morland model of utilising property values to evaluate neighbourhood wealth rather than income, which is a measure of individual wealth (Morland et al. 2002). The following sections explore New Cairo as an example of a large gathering of separate gated communities, in addition to stand-alone residential dwellings, followed by the research methodology and methods used in the analysis and, finally, the conclusion and discussions.

2 NEW CAIRO: GATED COMMUNITY PROBLEMS

New Cairo city is located on the ring road in the eastern part of Cairo, between the Cairo-Suez desert route and the Cairo El Ain El Sokhna desert road. It covers an area of 294.1 square kilometers (Hafez 2017). Unlike the other new cities in Egypt, the plan was made after constructing the ‘First, Third, and Fifth El-Tagamoa' settlements and then creating residential neighbourhoods between these sections along the city's axis in an east-west orientation (Hafez 2017) (see Figure 1 & 2).

In the city, there are approximately 34 enclosed luxury compounds. Seven of them exceed 2.1 square kilometers (sq km), with the largest being Rehab 9.32 sq km, Barwa 8.48 sq km, Hyde Park 4 sq km, and Imaar 3.8 sq km, as well as 27 residential communities ranging from 0.42 to 0.84 sq km. This brings the overall luxury residential areas close to around 18% of the city area (Hafez, 2017). These compounds are gated to restrict entry, for security and cultural reasons. This tendency to create gated communities began in the mid-1990s in Egypt and has accelerated since then (Mahmoud and Rashed, 2016). The 2011 Egyptian revolution and Egypt's economic instability had a huge effect during this period. Only the real estate market held its worth and prompted greater investment in that market. As a result, the number of gated communities increased to meet the demand, as a secure investment for the upper wealth level (Mahmoud and Rashed, 2016). Unlike the traditional new-town ‘‘master-planning" ideas, these mass housing complexes reflect market-driven factors rather than traditional public-interest norms. These communities are marketed as more homogeneous than the open city. Gated communities are often criticised for creating isolation in the city's spatial and social fabric (Almatarneh, 2013).

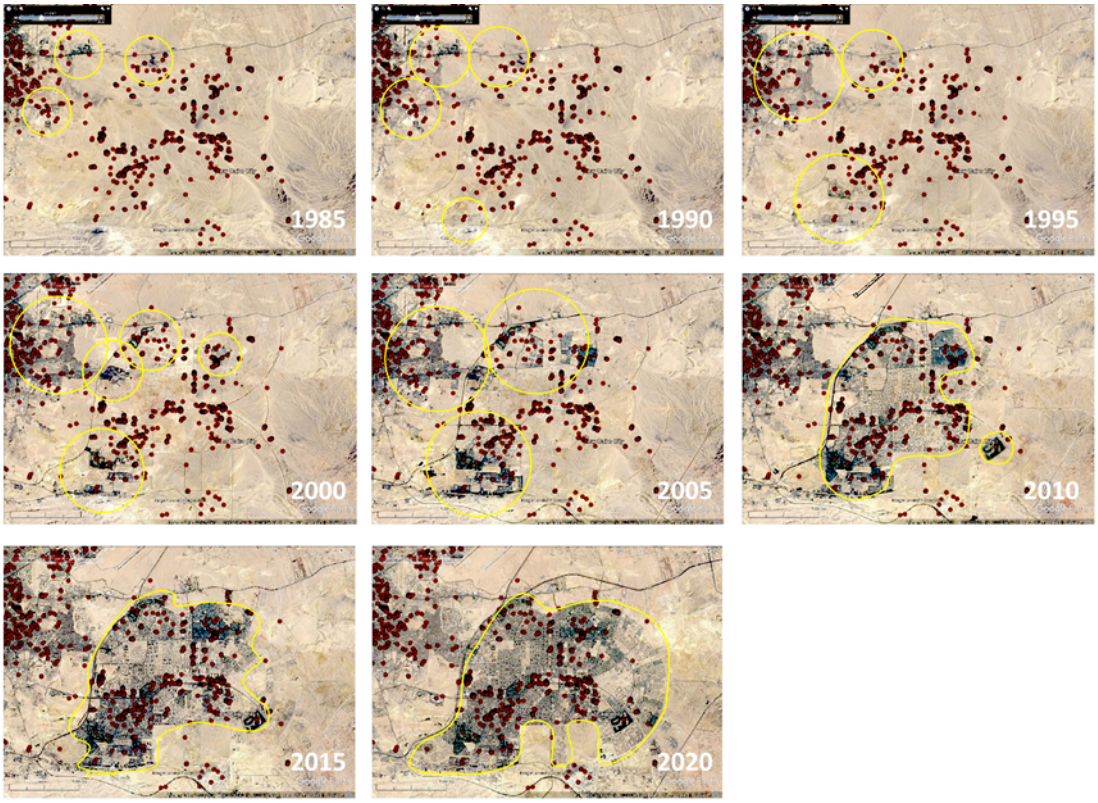

Figure 1. The urban growth of New Cairo from 1985 to 2020. The yellow circles highlight the settlement extensions, and the red dots show the final location of the eating facilities. The base map is extracted from Google Earth software, while the location of the eating facilities was produced by the author.

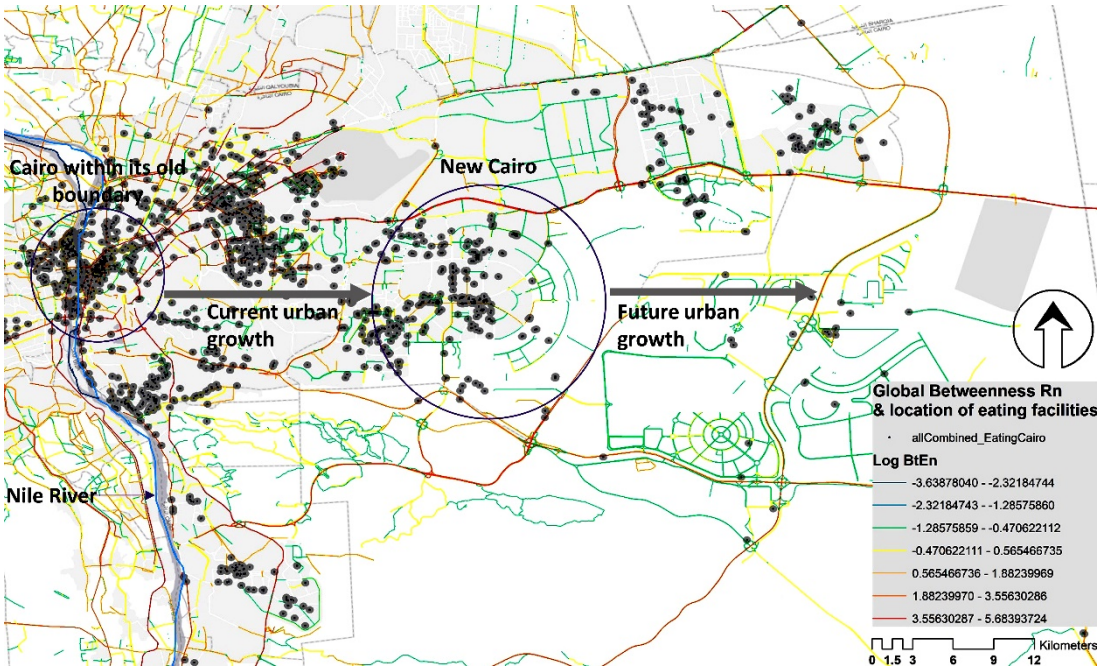

Figure 2. The global betweenness (global choice) with radius N. The red lines represent highly accessible routes, while those shown in blue are less accessible. It also highlights the urban growth extension of the Great Cairo periphery from its old boundary to the new extensions towards the east to New Cairo and the New administrative capital. Finally, the black dots demonstrate the eating facilities' distribution and densities. Source: the author.

3 METHODOLOGY AND FRAMEWORK OF ANALYSIS

The paper suggests a framework of analysis that focuses on two types of user behaviour: walking stimulation and outside-the-home eating activities, as shown in Figure 3. Since New Cairo is a new settlement with limited available data, the researcher depends on computational data and specific parameters extracted from the internet, such as income level, the location of eating facilities, and spatial configuration information. There are no data available on the income level in New Cairo; that is why the property square meter prices extracted from online property finding websites are used as an indicator for the income level of their owners and inhabitants. Since the start of the COVID19 pandemic, most restaurants have switched to online delivery, not only to avoid the spread of the virus but also to survive the economic crisis and avoid closure. That is why there is sufficient detailed information online about eating facilities. The geo-distribution of the eating facilities is also needed to identify potential clustering patterns. The location of eating facilities would stimulate movements either on the pedestrian level or using private or public transportation. Extracting geolocations for a large area from Google Maps is expensive and needs special treatment. Standard programming libraries, such as Scrapy and BeautifulSoup used in Python programming, will not provide sufficient geolocation information. Therefore, the research used free API web scraping software to obtain the required information.

Consequently, a spatial configuration analysis is needed to identify the potential local and global movements. The spatial map was extracted using another Python library named OSMnx. It is a Python package that is designed to retrieve, model, analyse and visualise street networks from OpenStreetMap. Furthermore, this street network map was used to perform a Space Syntax analysis.

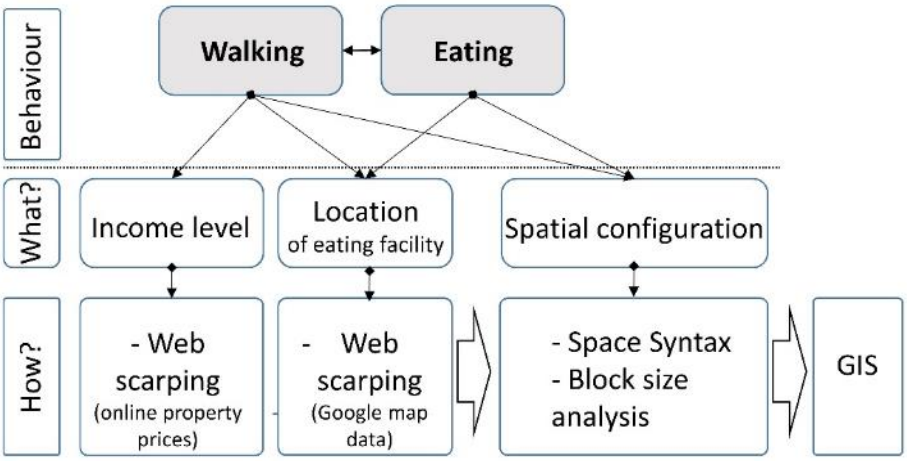

Figure 3. The proposed framework for analysing two types of associated behaviours walking and eating outside-the-home in New Cairo's new communities. This concept is beneficial in locations that lack available information (maps/final land use distribution/densities, public transit hubs/other pertinent information) or are currently under development and require a sizable workforce to extract this information.

4 SPACE SYNTAX AND BLOCK ANALYSIS

Space syntax emerged as a theory and a set of tools in the early 1970s, proposed by Bill Hillier and colleagues at the Bartlett School of Architecture, University College London. The theory seeks to explain why, from a spatial standpoint, the physical environment takes form in connection to related socio-cultural activity (Hillier & Hanson 1997). Urban grids, according to Hillier, are a record of human development rather than a static framework for human activity (Hillier et al. 2007). Even though a civilisation constructs the spatial system that it employs, it is impacted and influenced by the places that it occupies (Dalton & Holscher 2006). For example, higher pedestrian traffic rates are recognised on more integrated streets, which encourages retail land users to make use of the passing commerce and profit from it. These land users have a multiplier impact on the initial flows over time (Hillier & Vaughan 2007). The paper uses two methods in its segment spatial analysis: integration and choice analysis. Integration, which relates to accessibility, displays the preferred prospective locations to move to as a movement destination (using the phrase 'to-movement' as a term) by describing the average depth of the space compared to all of the other spaces in the systems (Hillier et al. 2007).

Another measurement is choice analysis, which determines the degree of choice that each space represents, or how often it is to be passed through on the shortest paths between all spaces in the system (Hillier & Hanson 1997). It is the 'through-movement' (the primary term in space syntax) potential (Hillier & Iida 2005). This paper follows Turner's advice to employ metric radii in graph analysis inside the boundaries of the simulated case study to understand different probable motions (Turner 2007). Lower metric values (radii) are appropriate for analysing pedestrian movement (the paper uses a radius of 500 m), whereas larger values (Rn) are appropriate for analysing vehicle movement.

The layout and design of urban blocks structures, including street morphology, influence the mobility patterns and establish criteria for future growth (Mohareb 2009). The route patterns depict the arrangement of urban blocks and the spaces between them, forming a space network, so the blocks determine the space (Carmona et al. 2003). According to Leon Krier, 'comparison and experience' might reveal 'more suitable' urban block sizes for a 'complex urban pattern' (Krier 1990). Hillier et al. suggested that block forms and sizes shape the patchwork that determines the city's functioning patterns (Hillier et al. 2007). Also, the size and shape of urban blocks have varying effects on permeability, connectedness, and accessibility (Mohareb 2016). These patterns directly impact the route selection, preference, mobility, legibility, and time spent in the urban environment. Smaller blocks provide more path options and typically produce a more permeable environment than bigger ones, increasing the visual permeability (see Figure 4). Smaller blocks make it simpler to see from one junction to another, increasing people's knowledge of their options with regard to navigation (Carmona et al. 2003).

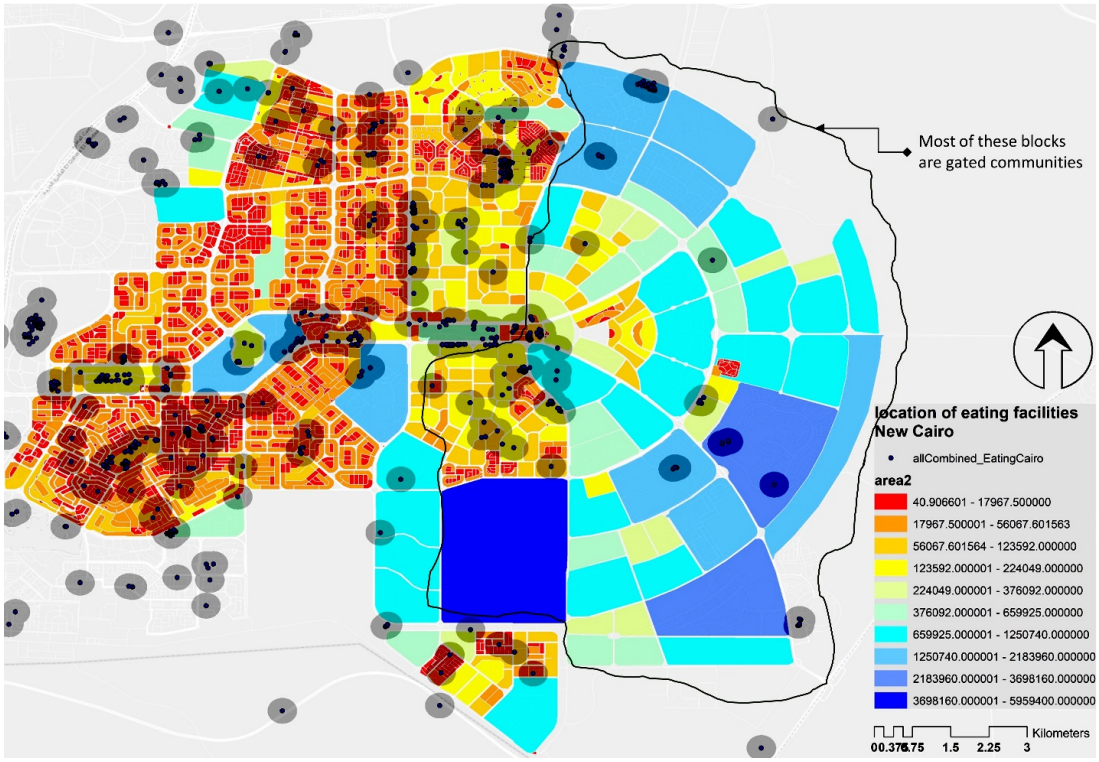

Figure 4. The study's results on New Cairo's urban block sizes. Blue denotes a large area that might extend to 5.95 Km2 in specific gated communities, while the smaller urban blocks, which may be mini-compounds or plots with stand-alone structures, are shown in red. The map depicts the primary locations of the gated communities. Furthermore, the map presents the distribution of eating establishments (shown by black dots) and their buffer zones (shown by grey circles) with a radius of 250 m. This radius covers the walking and parking distances from each facility.

The block analysis in Figure 3 reveals the location of the gated community as they have the most prominent urban blocks in New Cairo. It is also related to the food facilities distribution, which is highly integrated and distributed among the smaller blocks and plots, and occupies the central commercial and retail spine enclosed between 90's north and south avenue.

All of the data were aggregated using the GIS system ArcGIS 10.7 desktop software. The research uses the Optimised Hot Spot tool to analyse the possibility that certain instances are more closely related to others statistically, forming a tendency for spatial clustering. This assists the determination of whether or not the location of the food facility data are randomly dispersed or not. Optimised Hot Spot Analysis uses the Getis-Ord Gi* statistic to build a statistically significant hot and cold spots map using event points or weighted features (points or polygons). Each feature generates a new output feature class with a z-score, p-value, and confidence level bin (Gi Bin) (ArcGIS 2022) (see Figure 5 & 6).

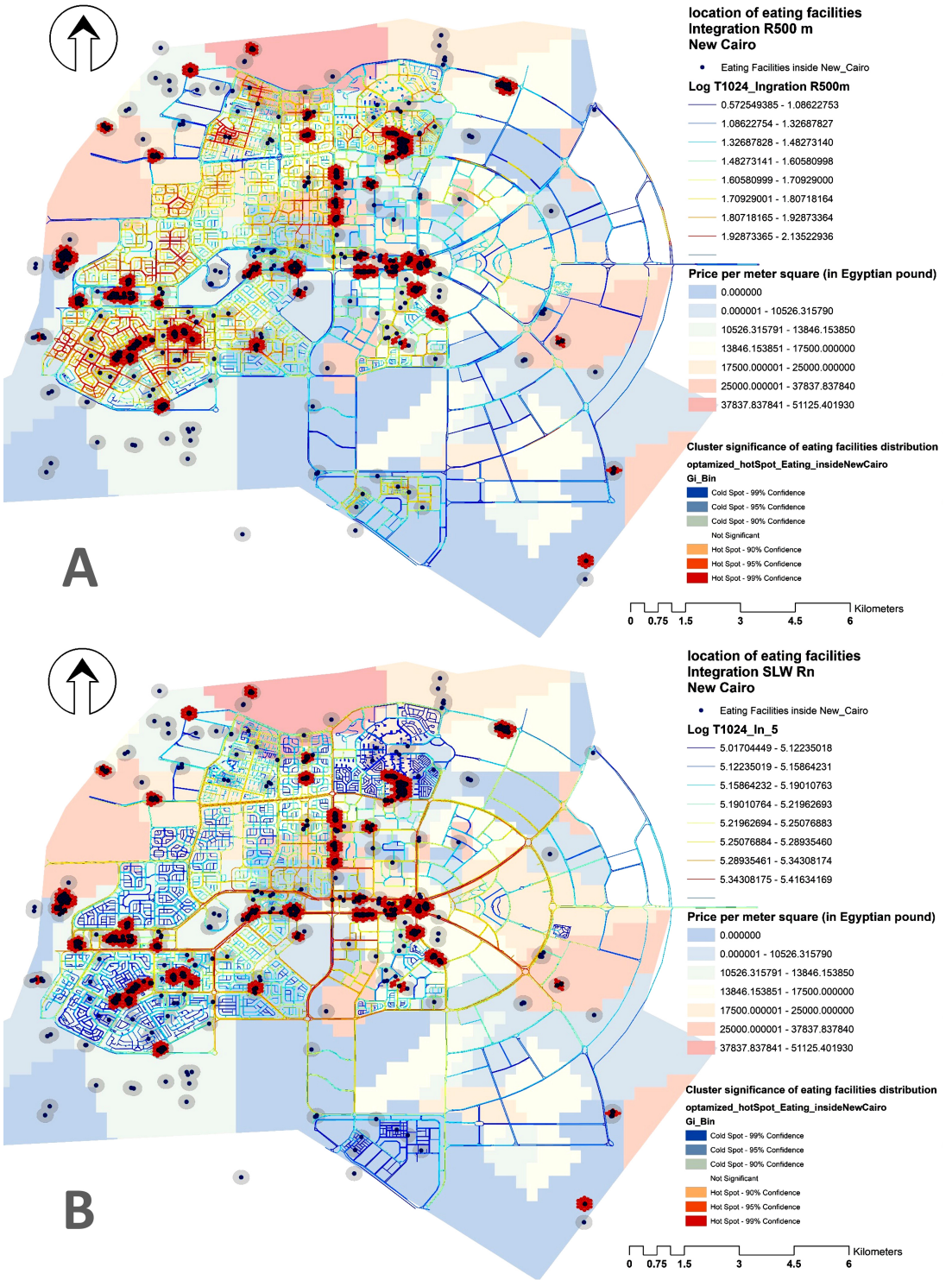

Figure 5. Three significant issues: 1. Spatial configuration analysis using space syntax segment analysis; 2. Real estate prices per square metre as a background colour; 3. Distribution of eating facilities in New Cairo, with red dots indicating the statistical potential for gathering patterns of eating facilities that are potentially not randomly distributed. Figure 5 (A) shows the potential local 'to-movement' Intergation R 500m in New Cairo. Figure 5 (B) shows the potential global 'to-movement' Intergation (segment length weighted) Rn in New Cairo.

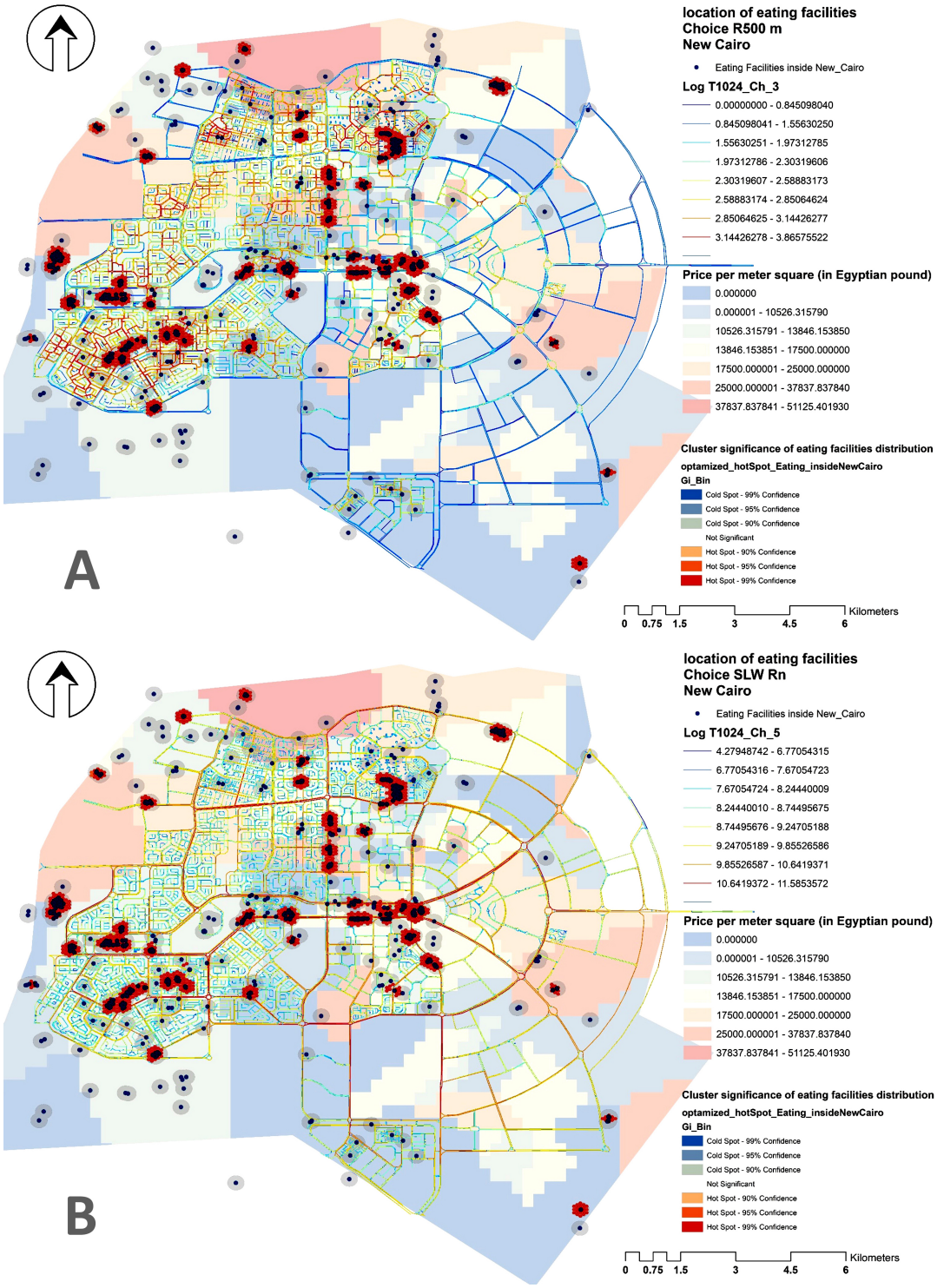

Figure 6. Three significant issues: 1. Spatial configuration analysis using space syntax segment analysis; 2. Real estate prices per square metre as a background colour; 3. Distribution of eating facilities in New Cairo, with red dots indicating a statistical potential for gathering patterns of eating facilities that are potentially not randomly distributed. Figure 6 (A) shows the potential local 'through-movement' Choice R 500m in New Cairo. Figure 6 (B) shows the potential global 'through-movement' Choice (segment length weighted) Rn in New Cairo

At this stage, the paper aggregated the space syntax outcome of local and global integration and choice (radius 500 m and R n) analysis with the property prices distribution, in addition to the

eating facilities distribution (generally and statistically significant patterns). Local accessibility (and integration R 500m in particular) appears to have a more significant impact on where eating facilities are situated, as well as where they (particularly the clustered patterns) are positioned in relation to medium-priced residences. High-priced properties tend to be positioned near high-access roads (Integration R n), whereas the global choice Rn is more likely to attract clustered patterns of eating establishments.

5 WEB SCRAPING

Urban data studies concentrate on collecting, analysing, and displaying data that are intrinsically related to geolocation information, especially geographical big data maps and observations of geospatial patterns of urban phenomena. They are often used to study real estate rental and sales prices, mapping and geographic analysis, which can be used to assess how a property's location affects its value. Another type of data that have been used in urban analysis research are geo-tagged social media content. These data have also been used to access how active cities are. Many internet platforms, such as Google, Instagram, Facebook, Flickr, Foursquare, and Twitter, have APIs (application programming interfaces) that enable users to query and download user-created material, which becomes particularly useful for urban researchers when combined with geolocation data (Ensari and Kobaş 2018).

This research uses web scraping to gather data from several websites and consolidate it into a single spreadsheet or database (Asikri et al. 2020). For example, in the New Cairo settlements, it was found that there are almost 750 eating facilities, covering cafés, restaurants, resto-cafés, and food supply shops. Also, the property prices were gathered for 98 properties distributed across New Cairo’s different gated communities and other free-standing properties.

However, this process has several limitations. The sheer volume of online data, coupled with the fact that they were not developed for specific research purposes, leads to the need for data filtering. A more practical approach would be to filter the data based on predetermined criteria like keywords and then analyse only those that pass through the filter. Studying the data set to validate a filter entirely defeats the purpose of filters (Xu, Zhang and Zhou 2019). For example, the hashtag #cafe or #cafe & restaurants may be used when scraping online data. The results may be distorted if a filter only includes #cafe and excludes other combinations of names or the name in other languages, like Arabic keywords in the case of New Cairo. Also, when using web scraping in relation to property prices, there is a possibility that the information supplied by the listing owners about real-estate data are inaccurate or motivated by commercial interests. Due to the free data-entry approach, the generated data might sometimes create mistakes, such as in social media postings where users are prone to invent their lingo, acronyms, and hashtag use methods (Ensari and Kobaş 2018).

6 CONCLUSION AND DISCUSSIONS

New Cairo is divided into two categories of residential properties: those located within gated communities, with mass land areas and high walls, that are usually adjacent to one another, and created by developers primarily targeting the upper-income classes. Another is stand-alone homes that appeal to society's middle and upper-income classes. Gated communities provide abundant recreational amenities and attract brand names to entice people to relocate and have little desire to leave the compound except for work. This problem is addressed in Figures 4, 5, and 6, as most eating facilities are located on small urban blocks, away from the gated communities. Also, the local integration and choice analysis of a radius of 500m was found to be higher in the smaller urban blocks, indicating the potential movements located in the western part of the city, leaving the eastern side (mostly the gated communities) as places that do not encourage walking in public places. Many scholars have previously addressed this dilemma, which is also identified in this paper. If the gated communities continue to grow at their current rate, the city's road system and open public spaces will become marginalised, and the rest of the urban fabric will be viewed as left-over areas (Mahmoud and Rashed, 2016). This issue is reflected in the mode of transportation as well. Because the gated communities have lower densities than other areas and the upper classes own private automobiles, the government will not introduce formal public transportation (this expectation is based on other previous new settlements cases). As a result, informal modes of transport have become the primary mode of transportation for the lower income classes who work within the gated community. Additionally, this informal mode of transportation attracts informal street vendors who meet the lower-income workers' need for fast food so, eventually, public spaces attract unplanned activities for specific users, while private spaces are well-designed for specific income classes. Eventually, two distinct eating and walking cycles will occur on the periphery of one another.

Undertaking initial examinations of new locations with less documentation and less readily available data represents a challenge. Unfortunately, New Cairo lacks adequate internet data from a single source, such as an open-street-map, making it necessary to search through numerous sites to extract the data. Therefore, this article proposed a system for digitally collecting georeferenced data via online scraping from various sources, including street networks, eating facilities, and property values. As mentioned in the article, this technique offers several advantages and limitations; yet, it is quick and produces sufficient information to initiate the analysis.

While further variables exist, urban block size, spatial configuration, and the existence and location of catalysts for movement such as food facilities serve as powerful motivators for walking and using public areas. This activity is necessary to promote a healthy atmosphere not only from a health lens but also from a social standpoint in order to bring together diverse social classes. Unfortunately, this issue is absent from New Cairo's eastern sector and requires urban design and planning action.

Additional layers of analysis are required for future research, as are additional interviews with members of various income classes to verify their actual behaviour in public spaces, compare it with the simulated analysis, and use the results to forecast future scenarios in the new extensions between New Cairo and the new Administration Capital.

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