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(In)formal Distinction in Urban Istanbul: Evaluating Spatial Performance

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(IN)FORMAL DISTINCTION IN URBAN ISTANBUL: EVALUATING SPATIAL PERFORMANCE

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ABSTRACT

As globalization continues to draw the world into closer economic and intellectual dependence, massive tracts of informally designed communities in Istanbul are being cleared to accommodate the growing infrastructure of the modern, tourism-driven city. This attempt to purge the city of its 'squatter' heritage is startling and raises questions of cultural integrity in urban development. Istanbul's desire for expanded global investment is particularly apparent in the object of this study, the blended district of Kartal. This study measures, compares, and evaluates spatial performance of formal and informal neighborhood spaces, but makes no formal attempt to draw normative prescriptive conclusions. The theories of Kevin Lynch and Jane Jacobs are synthesized in order to analyze three constructs of spatial performance: density, grain and access. As such, this study has not only produced a more rigorous tool for remote analysis, but one that can be applied to other urban settlements in the future.

1. Understanding Istanbul & Urban Performance

As globalization continues to draw the cities of the world into closer economic and intellectual dependence, Istanbul stands as a bridge between two continents and a city on the brink of a total urban transformation. International planning theory has become an increasingly influential part of Istanbul's governmental agenda since the fall of the Ottoman Empire; as a result the city has renewed its drive for large-scale redevelopment of its districts (Wende 27). Massive tracts of informally designed communities are being cleared to accommodate the structure of the modern, tourism-driven city. The attempt to purge some areas of Istanbul of its 'squatter' heritage raises questions of cultural and architectural integrity in urban development. For example, what benefits do user-generated design and construction bring to Istanbul, if any, and how do the spaces produced by informal, formal, and blended development compare?

Turkish *gecekondular*, the informally designed squatter settlements prevalent in Istanbul since the 1950s, provide an environment for study unfettered by traditional design standards and regulations, and as such garner further scholarly inquiry. This study focuses on the public spaces of the blended district of Kartal (kahr-tahl), where formally and informally designed areas reside and merge, and attempts to determine the performance or quality of the urban fabric in each type of settlement, as well as the district as a whole (Figure 1). Well documented in urban planning literature, Kartal is a coastal settlement located on the Asian side of Istanbul, just below the former administrative boundary of the city (Urban Age 26).

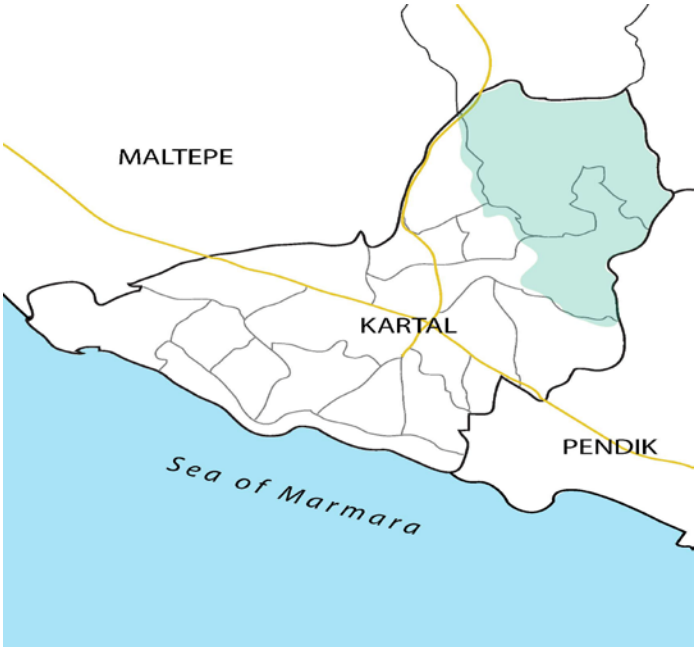

Fig.1: Administrative boundaries of Kartal. Source: Author.

The study area is limited to this district, where the physical configurations of public space in informal neighborhoods are extracted from available aerial imagery and compared to the analogous configurations of formally designed public space within the district. The data under study have been limited to imagery from the last 50 years and representative sites that demonstrate potentially fruitful integrations of local and global norms for study have been selected. Special attention has been paid to the formal planning schemes made and executed for

this area of the city within the allocated time period, with the intent to determine how the developmental patterns identified in informal, formal, and blended areas compare.

According to urban theorist Kevin Lynch, public spaces are "all those regions in the environment which are open to the freely chosen and spontaneous activities of people"; this definition encompasses not only the designated fields and parks traditionally identified as "green space" in a city, but also unfenced vacant lots, streets, alleys, and abandoned waterfronts (Lynch, Banerjee, and Southworth 396). Public space is designed to satisfy the whims of the user, to extend his or her knowledge of self and the environment, and to provide space for growth and change, not merely to exhibit aesthetic charms. Lynch even champions the role of "derelict and waste lands" in the public space system for their ability to provide satisfactions distinct from those afforded by "ordered" space (Lynch, Banerjee, and Southworth 400). He argues that "where open space is not highly manicured, and the social investment is low, the individual has a chance to demonstrate mastery, to meet challenges, and participate actively in a way usually denied him in the protected and expansive city environment" (Lynch, Banerjee, and Southworth 397).

Lynch's position does not 'pigeonhole' informal space and its use as a detriment to a city, but acknowledges the potential benefits such development could bring to urban design and urban experiences. Hulya Ertas similarly advocates for the use of "unprogrammed space" in the city as a purveyor of urban success or failure (57). In her research, Ertas identifies three characteristics deemed most responsible for the success of informal, unregulated space relative to other formal space: openness to transformation and change, encouragement for heterogeneous use, and propensity for privatization (53).

Gecekondu citizens attempt to beautify the streets and gardens close to their homes by adopting public spaces as their own. According to Ertas, this lends a life and vibrancy to the public spaces of informal settlements that are not evident in mass housing projects. The highly mobile vendors of Turkey's informal markets similarly transform space by claiming their place in open forums and along streets, and drawing large crowds of people to unregulated areas. Though both Madanipour and Ertas recognize the influence that urban planners and managers have on the collective domain of the city, they also understand the role of citizen-architects in spatial design and use. While a number of methodological precedents can be identified for urban analysis, there are few theories that provide usable criteria for determining spatial quality or value. Even fewer systems have been widely recognized and applied, though the theories of Jane Jacobs and Kevin Lynch seem to have had the most influence in the last 50 years. While a handful of data-driven systems have emerged post-Lynch, his methods continue to have considerable authority in the fields of urban design and theory and thus form the basis of my own methodology.

According to Jane Jacobs, intense zoning laws and use-legislation that strictly limit the style and pattern of development in urban areas have an enormous impact on contemporary design and renewal schemes. Jacobs heavily criticizes such policies for creating unnatural, and as such, unused urban space (J. Jacobs 151). She outlines four conditions necessary to create "healthy" spaces and promotes the chaos and innovation demonstrated in unregulated communities over the order and efficiency upheld by modern planners. Jacobs calls for mixed-use neighborhoods, short blocks to allow high pedestrian permeability, population and structural density, and provisions for buildings of various levels of age and repair (J. Jacobs 151). These characteristics, deemed "generators of diversity," are inherent to *gecekondu* design, though the success of such neighborhoods has not been adequately assessed. This study proposes an analysis

of the informally designed public space of *gecekondular* that will not only contribute to our knowledge of user-generated spaces, but will form a basis for comparison with formal space that can begin to evaluate a number of Jacobs' criteria as measures of good urban space.

Though Lynch disagrees with Jacobs' understanding of diversity, convinced that it could not be measured "until one knows how people perceive difference, and in which features variety is important," his spatial dimensions align with Jacobs' own theories (*A Theory* 192). Together, the theories of Jacobs and Lynch form an analytical base by which quality and performance can be studied, if not measured. Kevin Lynch identifies the notions of perceived vitality, spatial sense, environmental fit, access, and control as "dimensions of performance" that create good urban form (193). In Lynch's system, vitality refers to the capacity of a place to support biological functions –to provide food, water, energy, air, and waste disposal for human inhabitants (*A Theory* 122). A vital city not only shelters from hazard and disease, but also regulates external stimuli to the satisfaction of its citizens.

Spatial sense and access refer to the resident's perception of urban form and its ability to accommodate desired action. The access dimension is measured in a more quantitative way, for it depends heavily on the rate of occupation and the use of city streets, sidewalks, and alleys. It is important to note, however, that social barriers formed by gentrified neighborhoods and government sanctioned commerce as opposed to the informal shops and markets of the *gecekondular* can limit access as effectively as physical barriers (Lynch, Banerjee, and Southworth 401). Spatial sense is a measure of the city's formal structure and the perceived coherence of its linkages. Lynch's system lends itself to quantifiable measurement, even remote analysis in the case of vitality, access, and possibly spatial sense, though the nature of fit and control in the city requires close interaction with its structures and residents.

These measures of urban form were at least partially derived from Lynch's graphic method. Lynch devised and defined five elements with which he was able to distill the key features of virtually any urban area into a legible diagram. A series of paths, edges, districts, nodes, and landmarks were identified for each city case study and used to compare and contrast form as a measurable entity, without auxiliary influences. Though Lynch recognized the city as a "multi purpose, shifting organization…raised by many hands," his method is limited to the physical appearance and structure of a given area and can only measure social or cultural meaning abstractly (K. Lynch 91).

Lynch's five elements of path, edge, district, node, and landmark, though useful in their own right, are incorporated into the notion of grain. Grain seems to function as a more comprehensive analytical device that acknowledges Jane Jacobs' cry for diversity in urban space and is deemed, "critical to the goodness of a place" (*A Theory* 266). In these later writings, Lynch determined that density, grain, and access form the internal texture of a city, and that by measuring these characteristics, its performance might be judged. Density and access have been addressed in various forms already, but grain requires further elaboration. For Lynch, grain refers to the "way in which the various elements of a settlement are mixed together in space;" grain also has multiple strengths or ratings (*A Theory* 265).

Despite the evolution of technologically advanced systems, such as the Global Positioning System (GPS), Google Earth, and smartphones, novice and professional researchers continue to study and employ Lynch's method of imaging. The imaging technique remains relevant in modern urban analysis for its ability to create intuitive maps that capture the way cities "feel" according to land use blogger Roger Valdez (Valdez 1). Lynch's method is widely accepted as one that can be applied at the micro- and macro-levels of urban analysis; it is also

useful for this study in the sense that it can be easily produced for the analysis of multiple sampled areas, and it allows for extremely complex spatial data to be distilled into concise graphic representation.

2. Measuring Urban Performance

Jane Jacobs and Kevin Lynch, both well-respected advocates of micro-level urbanism, champion form analysis as a viable method of study. Jacobs dismisses the solitary application of use-by-use analysis of cities as studies that yield overall pictures "about as useful as the picture assembled by the blind men who felt the elephant and pooled their findings" (143). For Jacobs, spatial and architectural diversity are the keys to "good" urbanism. Jacobs suggests that to understand the life-giving complexity of a thriving city, "we have to deal outright with combinations as essential phenomena" (J. Jacobs 144). Though micro-level studies are important to Jacobs' work, she advocates the form analysis method as a means of comprehending and creating "good" urbanism only when used in conjunction with macro-level analysis.

Kevin Lynch makes a case for form analysis by moving away from the basic units of city form described in *Image of the City* and postulating about the method itself. According to Lynch, good urbanism cannot be achieved by a collection of small, but "handsomely designed" areas, for "every physical whole is affected not only by the quality of its parts, but also by their total organization and arrangement" (Lynch, Banerjee, and Southworth 358).

For the purposes of this study, we combine the two dominant forms of investigation, micro-level and macro-level, to provide a comprehensive analysis of formal and informal design performance in Kartal. It should be noted that the following methodology is based on the work of predominantly western theories of analysis and that certain biases in that respect can be assumed. However, as Anne Vernez Moudon notes in her catalogue of design theory, these methods have been applied in research and planning endeavors across the globe and are readily accepted in the diverse disciplines of planning, architecture, and geography as a viable means of analysis (363).

This study is an explanatory single-case study with three embedded units. Singleton, Straits, and Straits outline three major categories of study that are relevant to the design of this project: exploratory, descriptive, and explanatory research. While exploratory studies simply investigate a phenomenon about which little is known, descriptive and explanatory research are considerably more structured. According to Singleton, descriptive research is normally a "fact-finding enterprise… focused on relatively few dimensions of a well-defined entity" (68). This study moves beyond the singular phenomenon of informal development to analyze the relationships *density*, *grain*, and *access* form in the urban context so that the relative *performance* of formal, informal, and blended spaces might be compared and judged.

Research of this type requires rigorous analysis of each variable and an understanding of their impact on the formation of good urban space that cannot be dismissed as mere description. Data are analyzed within each embedded unit and between them in order to draw conclusions about the main unit (Yin 86). The purpose of this study is to answer the following research questions, understood as stages of analysis conducted chronologically:

1) Can informally and formally designed regions of Kartal be identified and mapped?
2) What spatial typologies can be identified in the fabric of each?
3) What structural and spatial *densities* can be observed in the formal and informal regions?
4) How do the spatial and architectural *grains* of these regions compare?

5) What degrees of pedestrian, vehicular, and transit-oriented *access* can be observed in the informal and formal regions of Kartal?

The objects of study are analyzed through the operationalization of three constructs: 1) *density*, 2) *grain*, and 3) *access*. These constructs are combined through data and methods triangulation to assess the larger construct of *performance* in selectively sampled regions of Kartal.

There is one main unit of analysis defined for this study, with three embedded units. The singular district of Kartal in Istanbul, Turkey, has been selected as the main unit of analysis and is bound geographically by the Omerli Reserve to the north and the Sea of Marmara to the south. Kartal is divided into four quadrants by the D-100 and Samandıra Kartal Bağlantısı highways and has been targeted by the Istanbul Municipality Planning Commission as the site of an urban revitalization scheme submitted by architect Zaha Hadid (Ayatac 8). Kartal's history as an informally designed district has been amended by formal government intervention. The region can now be considered a blended district where formally and informally designed areas co-exist. This blended status provides the conditions necessary for a single researcher to analyze each type of development within a short period of time; it was thus chosen as the basis for this study.

The three embedded units of analysis identified for this study include the formal, informal, and blended regions of Kartal; the regions can be understood as distinct units within the greater district, but also as characteristics representative of the district as a whole. As such, the embedded units have an interdependent relationship that contributes to the spatial and architectural performance of the main unit, the blended district of Kartal. Developmental divisions within the main unit of analysis were inferred and mapped through a critical reading of planning and housing legislation effective in the area since 1950, as well as the analytical reports of environmental studies made in the area since that time (Unsal). Formal and informal regions of the same district were selected to ensure that the legal and cultural factors involved in each area's development were analogous (Figure 2).

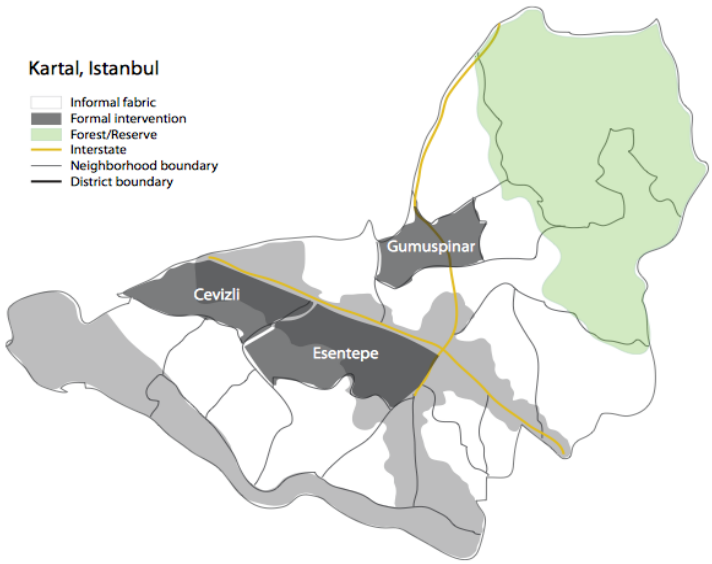

Fig.2: Informal and formal areas of Kartal. Source: Author.

The overarching construct measured by this study is that of *performance*, or *quality* as it is called by Jane Jacobs, of formal and informal fabric in the urban environment of Kartal. Both Jacobs and Lynch recognize that the quality of a place is not simply determined by its physical form, but by the behavior and intent of the society that occupies it. Lynch writes quite extensively about this interdependence, though he contends that a certain degree of goodness can be measured solely by reference to spatial form through the application of *performance dimensions*.

According to Lynch, a city with satisfactory performance is one that is "vital, sensible, well fitted, accessible, and well controlled," such that all characteristics are "achieved with just and internal efficiency" (*A Theory* 235). As a number of these dimensions have been discussed in detail already, in more general terms, good urbanism is found in places that are "continuous, well-connected, open, and conducive to development" (*A Theory* 235). Jacobs agrees that there is no single element or "kingpin" in a city that serves to clarify all, but that "the mixture [of elements] itself is the kingpin, and its mutual support is order" (J. Jacobs 376). She writes that "only intricacy and vitality of use give, to the parts of the city, appropriate structure and shape," and has defined measurable characteristics of diversity to that end in a way much similar to Lynch (377). Jacobs calls for mixed-use districts, pedestrian access, varied structural age, and dense concentrations of streets and intersections to ensure diversity.

The *performance* element is broken into three sub-constructs by Kevin Lynch, who declares that "density, grain, and the access system –the internal texture of a city—are the principal features by which we may judge its performance" (*A Theory* 274). As mixed-use and structural age fall easily under the construct of grain, and pedestrian access and density are even more obviously accounted for, Jacobs' criteria can be analytically subsumed by Lynch's constructs. Thus, the sub-constructs of *density*, *grain*, and *access*, as defined below, form the analytical base of this study by which the main construct of *performance* is judged.

Density

Density, called "concentration" by Jane Jacobs, refers to the quantity of something per unit of measure, particularly a unit of land. As such, several types of density can be observed in a given area, reflective only of the characteristic being measured. Jane Jacobs defined three of these types in her description of urban diversity, each of which play a role in the "goodness" of an urban area and can be quantified for study: structural or built density, dwelling density, and use density, of which use refers to the type and number of amenities available in a given area (200).

Grain

The construct of *grain* refers to the "typical local interrelations between similar or dissimilar elements, without reference to total pattern" described by Kevin Lynch (*Sense* 362). A more accessible definition reveals that grain is "the way in which the various elements of a settlement are mixed together in space…be they activities, building types, persons, or other features" (*A Theory* 265).

Access

The construct of *access* is described as the ability of a resident or visitor to move freely toward desired people, goods, or settings within an urban area, and speaks particularly to the number and quality of paths, edges, and intersections in a given place. According to Allan Jacobs, *access* not only privileges open-space design over structural form, but also begins to measure the comfort of open-space in dimension and movement, elements necessary to the design of "good" urban fabric (A. Jacobs 302).

Table 1 illustrates the study's constructs, with definitions and means of operationalization for each. The construct of *density* is operationalized through the construction of figure-ground diagrams and square-mile studies described (A. Jacobs 302). Figure-ground diagrams are used to create a visual register of occupancy that can be qualitatively described or quantified as a percentage for comparison. The square-mile studies advocated by Allan Jacobs are the limiting framework for these diagrams, designed to showcase street and block patterns that "permit some dimensioning and measuring of differences and similarities and of how those seem to change over time and distance" (268). This type of measurement is applied to the embedded units of analysis (i.e., formal, informal, and blended regions) in order to draw conclusions about the main unit of analysis (i.e., the district as a whole).

Table 1
Performance Dimensions

Element	*Definition*	*Operationalization*
Density -built -dwelling -use	Quantity of something per unit of measure, typically per unit of land	Analyzed through figure ground diagrams and square mile maps from *Great Streets*, grid units coded by development type and concentration, summarized as a percentage for comparison
Grain	Way in which the various elements of a settlement are mixed together in space	Evaluated using Lynch's diagramming and photo-grid techniques, identified using Google Earth photos, 2- and 3-D Geodata
Access -transit -vehicular -pedestrian	Ability of a resident or visitor to move freely toward desired people, goods, or settings within an urban area, particularly the number or quality of paths, edges, or intersections	Analyzed using characteristics of diversity from Jacobs, documented and compared using path network diagrams similar to those found in *Urban Age*

The *grain* construct is operationalized using Lynch's diagramming and photo-grid techniques, created from aerial- and street-level imagery (Lynch, Banerjee, and Southworth 266). Once a visual database is established, iconographic diagrams are drawn utilizing the five elements of urban fabric (paths, edges, districts, nodes, and landmarks) designed by Lynch to create an "image" of the region for analysis and comparison (*A Theory* 47). This type of measurement is applied at a small scale to the embedded units of analysis (i.e., sampled formal and informal regions) in order to understand the main unit of analysis, the entire district of Kartal.

Access is operationalized using Jane Jacobs' four *characteristics of diversity* as a guide for quantitative measurements of the pedestrian and vehicular path networks observed in each sampled area (150). Once calculated, these measurements are reproduced as a series of path diagrams that can be used to interpret the strengths and weaknesses of the *access* system in each sampled region. This type of measurement is applied to the embedded units of analysis (i.e., formal, informal, and blended regions). All analyses are combined in a cross-case synthesis at the main unit of analysis, Kartal. This is achieved by creating a photo-grid of the entire area,

from which observations informed by Kevin Lynch's five elements are made and "imaged" through a series of iconographic diagrams. The process of creating each of these tools is described in the next section.

Photo-grid

To create an urban photo-grid in the style of Lynch, a grid is laid over the base map of the study area, at a scale analogous to the fabric of the region (Figure 3). Once this grid has been established, the nearest accessible point to each grid intersection is found and documented to produce a "complete sampling of the visual character of the area" that can be used in further analysis (Lynch, Banerjee, and Southworth 266).

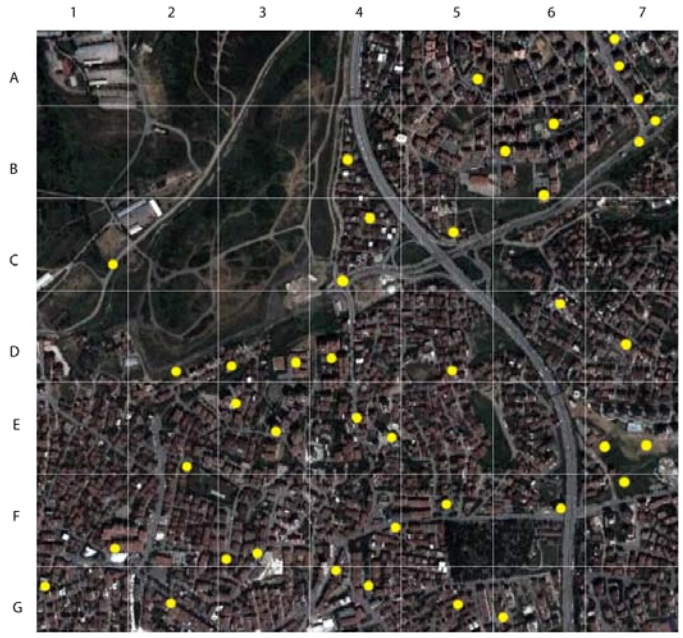

Fig.3: Example photo grid, Gumuspinar. Source: Author.

Iconographic diagrams

Using the spatial characteristics observed in the imagery of the photo-grid, the five elements of urban fabric conceived by Kevin Lynch are catalogued as observed in the sampled area. Once the elements are coded for diagrammatic reproduction using Lynch's iconographic key, they are re-applied to the map of the area of study to create a symbolic "image" of the urban form (Figure 4). This method of analysis is used to distill complex spatial data into a diagram that can be used to identify and compare form qualities within the city or district fabric and to illuminate the role of physical form in spatial *performance*.

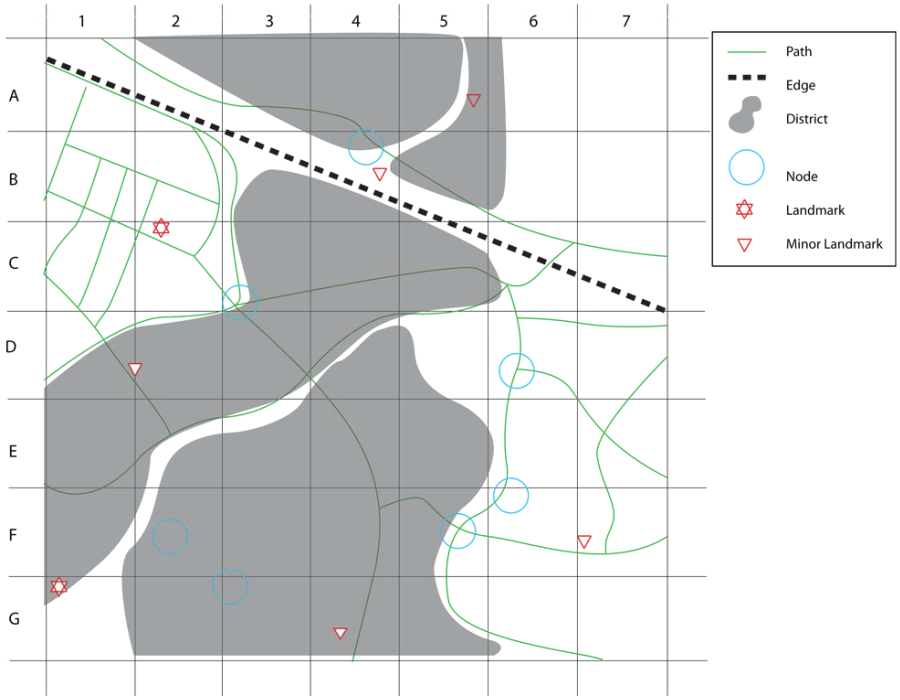

Fig.4: Lynchian image, Cevizli. Source: Author.

The embedded units of analysis are evaluated for the constructs of density, grain, and access at the scale of the sampled region. This is achieved using the previously described iconographic diagrams of Lynch, as well as the figure ground method of analysis proposed by Allan Jacobs and measurements guided by the diversity criteria proposed by Jane Jacobs. The sampled areas addressed in this study have been limited to one square mile in accordance with Allan Jacobs' method. This limitation was adopted to ensure that multiple units could be documented and analyzed under the time constraints of the study using the two techniques described in the next sections.

Figure Ground

Figure ground studies are simple diagrams that give order to the complicated relationship of structure and space in an urban area (Figure 5). Figure ground images "help visualize the microstructure of urban neighborhoods, how buildings (in black) and open spaces (in white) come together to create an integrated urban whole" (*Urban Age* 36).

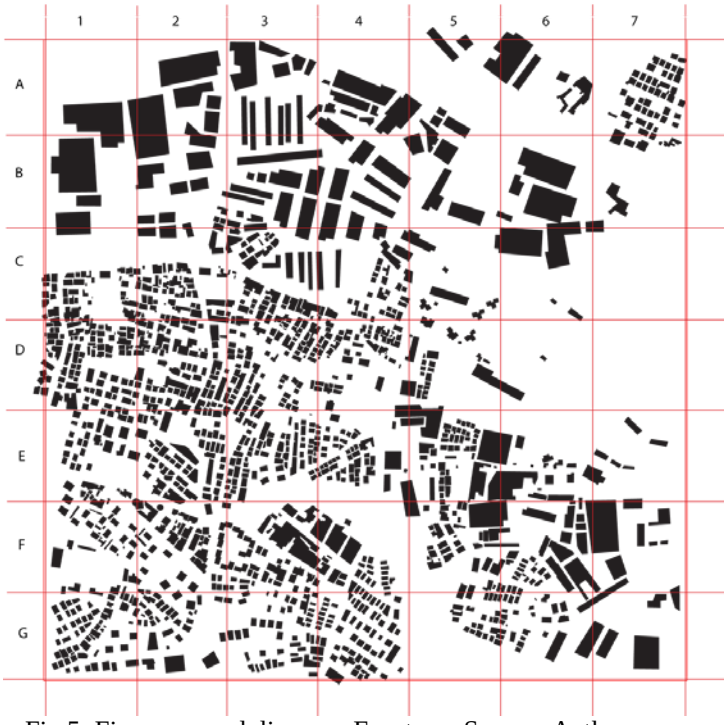

Fig.5: Figure ground diagram, Esentepe. Source: Author.

Path Network Diagrams

To create a path network diagram, lines of varying thickness and hue are laid over a map of the sampled area to represent the size, direction, and density of accessible paths (Figure 6). This method is used to distill the complex network of transportation and mobility into a simple graphic representation that can be compared across and between sampled areas (*Urban Age* 30).

Fig.6: Path network diagram, Gumuspinar. Source: Author.

The sampling frame is a map of the district of Kartal, Istanbul, as defined by the administrative boundaries created in 2004. The sampling design uses stratified random sampling to select sample sites for the embedded units of analysis, as well as the main unit, Kartal, for the singular construct of grain (Singleton, Straits, and Straits 124). The administrative boundaries of the district's individual neighborhoods, called *mahalleler*, divide the area of study into 21 representative units. These administrative divisions are a more efficient means of understanding the district than conventional sampling techniques and have been used to select representative samples of the area in the place of a traditional polygonal grid.

For the embedded units of analysis, the sampling size is limited to a single neighborhood, or *mahalle*. Three spatial strata were identified during preliminary analyses of the district: *formal*, *informal*, and *blended* space. A single *mahalle* was selected for each stratum, of which 75% of the land area within the *mahalle* conforms to the stratum identity. Purposive sampling strategies were employed to ensure analogous conditions were present in each of the sample units, particularly in the study of housing types/densities and access to major highways (Singleton, Straits, and Straits 133).

Each sampled unit was restricted to a square mile of land in accordance with the analytical technique defined by Allen Jacobs (260). Observation sites were again selected using stratified random sampling of selected grid units from within the square mile sample in order to measure the *pedestrian* strata of analysis for the construct of *access* (Figure 7). Purposive techniques, as defined by Dixon, were used to ensure that grid units representative of the urban fabric were chosen for analysis (33). The stratified method of analysis utilized in this study is summarized graphically in Figure 8 to clarify the diagramming techniques employed throughout the study. Though each *mahalle* was subjected to the full range of analysis and documentation described previously in this chapter, only the blended unit of Cevizli is represented in Stages 3 through 5 of the figure.

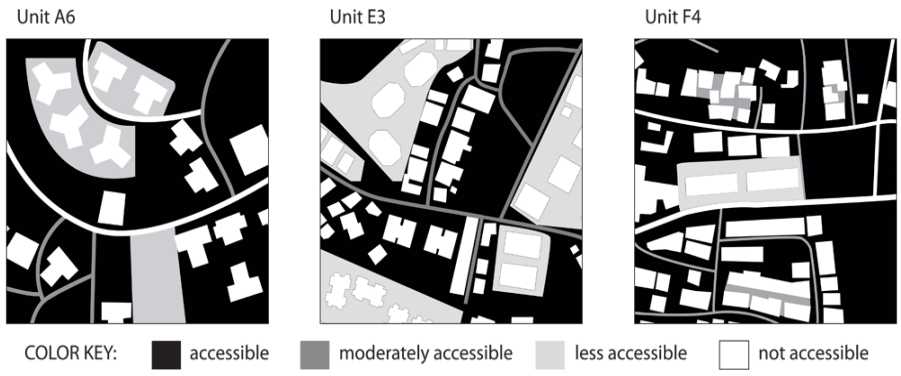

Fig. 7: Pedestrian units, Gumuspinar. Source: Author.

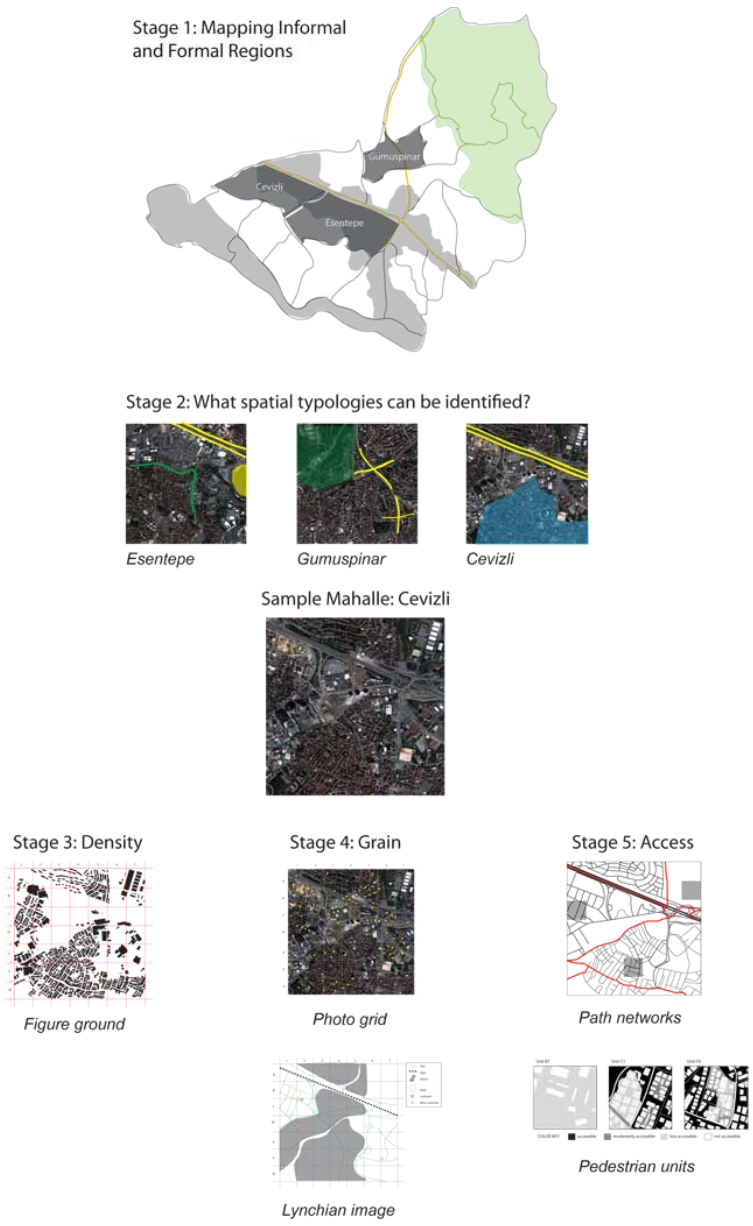

Fig.8: Methods summary and graphic techniques. Source: Author.

3. Defining Urban Performance

Once the *mahalleler* of Esentepe, Gumuspinar, and Cevizli were identified for sampling, a preliminary analysis of each *mahalle* was conducted to identify the form typologies described by Lynch. Direct observations from satellite imagery were recorded using hand-sketching techniques. No more than four form typologies were identified in any one *mahalle*, and only the characteristic of *dominance* was present in each. In the formally designed *mahalle* of Esentepe, the dominance and singularity types were observed. The informal *mahalle* of Gumuspinar was clearly dominated by small-scale residential fabric, though a large area of open farmland in the northeast corner of the sample area formed a singularity clearly far removed from the dense housing blocks. The blended *mahalle* of Cevizli exhibited only the characteristics of dominance and continuity.

3.1 Density Analysis

Square mile maps and figure ground diagrams were used in the first stage of analysis to distill complex housing and land use data. These diagrams were constructed for each *mahalle* using area maps and building information supplied by the Istanbul Buyuksehir Belediyesi and the Istanbul Electricity, Tramway, and Tunnel General Management Department. This data was cross-referenced with satellite imagery from Google Earth taken as late as December 2012 to produce square mile diagrams of each sample area using AutoCad 2012 software. The gridded system developed for photo documentation was employed in each analysis to divide the sample area into describable units. As such, specific units have been referenced by their grid designation in the remainder of this chapter (A1, B2, etc.).

The built density, dwelling density, and use density, as described by Jane Jacobs, were evaluated in each sample and are included in Table 2 as percentages for easy comparison between cases (200). For the purposes of this analysis, built density refers to the percentage of land covered by buildings, regardless of use. Dwelling density is more selective, referring specifically to the percentage of land covered by residential buildings, regardless of scale, though an attempt to differentiate between mass housing and low-density housing was made. Use density refers to the percentage of land employed as industrial, residential, and blended space, each represented as a percentage of the total land area. Units with no structural presence were labeled open space, and thus included as a fourth category of use. All density types were evaluated on a unit-by-unit basis and calculated as a percentage of the total number of units observed in the sample grid. Only the final percentages for each density type are included in Table 2.

Table 2: Density Measurements

Mahalle	*Built density*	*Dwelling Density*	*Use Density*
Esentepe	Low: 34.7% High: 63.3% None: 2.0%	Mass housing: 4.1% Low-density: 38.8% Combined: 16.3% Total housing units: 59.2%	Industrial: 38.8% Residential: 30.6% Blended: 28.6% Open: 2.0%
Gumuspinar	Low: 30.6% High: 57.1% None: 8.2%	Mass housing: 6.1% Low-density: 38.8% Combined: 36.7% Total housing units: 81.6%	Industrial: 8.2% Residential: 83.7% Blended: 0.0% Open: 8.2%
Cevizli	Low: 38.8% High: 59.2% None: 2.0%	Mass housing: 8.2% Low-density: 51.0% Combined: 12.2% Total housing units: 71.4%	Industrial: 20.4% Residential: 44.9% Blended: 32.7% Open: 2.0%

The formally designed *mahalle* of Esentepe exhibited a high built density overall, with few undeveloped units in the sample area. Low development areas occur along the edges of the industrial districts and near a pond observed in the sample area, creating wide gaps between residential and industrial fabric. Units with purely industrial fabric are most prevalent in the formally designed *mahalle*, forming nearly 40 percent of the total land area. Residential and blended units, those exhibiting both residential and industrial fabric, comprise 30 percent and 28 percent of the settlement respectively. Only one unit was determined to be open space, exhibiting no structural development whatsoever.

The informally designed *mahalle* of Gumuspinar also exhibited a fairly high built density, though a larger number of grid units had not been developed at all. Low development areas are found along the edges of this large undeveloped area and in the grid units nearest to the major highways. Highly developed units dominate the sample, comprising 50 percent of the total land area. Both mass housing and low-density housing are present in this *mahalle*, though units with only low-density housing outnumber the units with both types by only two percent. More than 80 percent of the units in the *mahalle* contained some type of housing.

The percentage of highly developed areas in the blended settlement of Cevizli was similar to that of the other two settlements, at 59 percent. Low development areas comprised 39 percent of the sample area and were most concentrated in the industrial areas near the D-100 highway. Just over 70 percent of the settlement contained some type of housing, with more than 50 percent of the units devoted to low-density housing alone. Eight percent of the units contained only mass housing. Residential fabric was most prevalent in the blended settlement, with nearly 45 percent of the land area consumed by low-density housing.

3.2 Grain Analysis

Photo grids were constructed for each of the sampled *mahalleler* using the user-generated Panoramio™ photos available on Google Earth. Each *mahalle* was restricted to a square mile sample, which was then divided into a 49-square grid. From the available imagery, photos were selected from within each square for inclusion in the photo grid. An effort was made to verify the location of each geo-tagged photo using satellite imagery, street maps of the area, and building websites to eliminate redundancies and unusable data. This process generally produced 2 to 3 viable images per gridded square. Banks of photos amassed from each grid were used in conjunction with satellite imagery to create the summary Lynchian images (Figure 4). Paths, edges, districts, nodes, and landmarks (major and minor) were identified for each sample area using Lynch's method for analysis and comparison (*Image* 46).

Esentepe, grain

As suggested by the preliminary analysis of the area, the formal settlement of Esentepe contained two dominant edges, the inter-district highway in the north and the industrial pond on the east side of the sample area. The settlement's users heavily documented both edges and their images confirm the high visibility of each in the landscape. Five large districts were identified from user photos as well, one above the highway and four below it. The most expansive of these districts are industrial in nature, with urban fabric of a considerably larger scale than the surrounding residential areas.

Gumuspinar, grain

The image of the informal settlement of Gumuspinar contained two distinct edges. The first edge separates the open farmland in the northwest corner of the sample area from the residential area below the D-100 highway, while the second edge splits the sample area into east and west sectors, forming a natural barrier between residential districts in the north. A larger number of paths were documented in this *mahalle* as well. Unlike the previous settlement, these paths intersect the edges present in the sample area, diminishing their potential as barriers to movement. Four districts were documented in Gumuspinar, all exhibiting predominantly residential fabric. Of these districts, only one occurs on the east side of the central highway. It appears to have been formally planned, as it is considerably larger than the others, with radial streets and repeated building footprints. The other districts are smaller and irregular in nature.

Cevizli, grain

The image of the blended settlement of Cevizli also contained four districts, though these were of significantly larger scale than those observed in the other *mahalleler*. The inter-district highway in the north formed the most distinct edge in the settlement. Its position on the grid not only partitioned the formal housing districts from the rest of the *mahalle*, but severely limited movement from north to south overall. Only one path was documented above the highway edge, which seems to echo the trajectory of the highway at a scale more conducive to residential movement. Paths between the two lower districts help to solidify the change in fabric from industrial to residential, though a larger number of paths cross between districts in this settlement. More than half of the nodes observed in the *mahalle* occur at path intersections. Two of these nodes seem to signal a particularly walk-able segment of the blended settlement not seen in other *mahalleler*.

3.3 Access Analysis

Path network diagrams were constructed for each settlement in two stages. The first diagram aggregated the transit network and vehicular path data collected from Google Earth, the Istanbul Electric, Tramway and Tunnel Department, and the İstanbul Büyükşehir Belediyesi (IBB) into a single square mile map, in accordance with the Allen Jacobs' method. Though several transit systems exist in Istanbul, public buses called *otobüsler* had a significant presence in the sample *mahalleler*. A distinction was made between the transit, highway, street, and road systems, with bus routes receiving the highest position in the visual hierarchy, shown in red (Figure 6). Transit and highway networks are given preference as "higher order" path systems in the remainder of this analysis, with street and road networks designated as "lower order" systems by comparison.

When pedestrian path networks proved too difficult to assess at the scale of the square mile diagram, a second round of stratified sampling was applied to each *mahalle*. Purposive techniques were again employed, and three grid units were selected from each *mahalle* to ensure an analogous sampling. The figure ground and higher order paths were reassessed in these samples and combined with pavement data available at the scale of the grid unit. Pedestrian-accessible areas are thus defined in black and gray tones, limited to areas not covered by industrial buildings, residences or higher order paths (i.e. highways or streets). As such, all of the following inferences about pedestrian access within the sampled *mahalleler* are based on the author's direct observations of satellite imagery, user-generated photos, and previous diagrams.

4. Translating Urban Performance

Once individual analyses of the sample areas for each construct were complete, a cross-case synthesis was conducted using the criteria defined by Kevin Lynch and Jane Jacobs so that more formal conclusions could be drawn about the performance of urban fabric in each settlement. The qualities of formal, informal, and blended fabric have been coarsely divided in previous discussions, though such divisions are much more difficult to identify at the pedestrian level. In light of this, the following narrative attempts to aggregate and synthesize the data collected from each sample area into more comprehensive statements about the variable levels of density, grain, and access found in the district of Kartal.

Density

Lynch strongly suggests that there is no general optimum density that can be applied to urban fabric, for desired concentrations vary widely by use, age, societal expectations, and countless other considerations (*A Theory* 262). Despite this tangible ambiguity, density is one of the most primary and influential factors in urban design of any type and its presence or absence

in the district of Kartal merits further discussion. Jacobs writes extensively about the myths of density and over-crowding. She concludes that despite the warnings of planning literature against high-density settlements, low-density areas are often dull and lifeless, unable to sustain a diverse population or amenities (J. Jacobs 204). Jacobs draws sharp lines between dwelling and use density however, claiming that a dense concentration of people, not structures necessarily, are required for vibrant urbanism.

Of the *mahalleler* sampled in this analysis, the informal and blended settlements had the highest concentrations of housing, though the composition, or grain, of the two sectors were very different. Gumuspinar was completely dominated by residential use, with nearly an equal amount of low density and combination housing observed. In contrast, Cevilzi had a much higher proportion of low-density housing, with less than 50 percent of the settlement devoted to residential use. The formal settlement of Esentepe had a much lower concentration of housing, due in part to its even use distribution. This sample area had the largest percentage of highly developed units however, leaving little undeveloped land for green space or expansion.

The need for open, green, and derelict spaces is addressed more directly in Lynch's text. He writes that open space is the "negative, extensive, loose, and uncommitted complement to the [built] system" that is necessary for the "freely chosen and spontaneous activity" required to sustain city residents (*A Theory* 396). The informal settlement of Gumuspinar had the highest percentage of low-development and undeveloped land, units most likely to exhibit spaces of this type. This percentage was not significantly higher than that of the other two samples, however. Though dedicated parks were much easier to identify from photos and satellite imagery of each *mahalle* than derelict and waste areas, the blended settlement of Cevizli seemed to contain the highest proportion of derelict space.

The farmland observed in the northwest corner of Gumuspinar was the highest single concentration of green space in the sampled areas. This settlement also contained the largest number of residential parks and fields overall. The formal settlement of Esentepe exhibited a much smaller percentage of open and derelict space by comparison, though the industrial pond on the east side of the sample area created a significant figure in the landscape. The open spaces that did exist were distributed more evenly throughout the *mahalle*, however, and may provide greater benefits to the population than more dense concentrations.

Grain

In Jane Jacobs' defense of urban diversity, she preys on the master plan mentality, commenting that "large swatches of construction built at one time are inherently inefficient for sheltering wide ranges of cultural, population, and business diversity" (191). Both Jacobs and Lynch describe the ideal urban situation as one containing multiple functions, textures, and amenities, though their terms for this quality vary. The types of grain defined by Lynch are not mutually exclusive. The majority of planning professionals agree, for example, that the ideal grain composition for residential areas would be fine and blurred, so that "each small area [of urban fabric] should be a microcosm of the whole" (*A Theory* 267).

Of the *mahalleler* examined in this analysis, the informal settlement of Gumuspinar exhibited the highest proportion of finely grained fabric, though relatively little industrial fabric was observed. The formal housing district in the northern portion of the sample area presents the sharpest departure from the mixed residential fabric dominant in the rest of the settlement, though the presence of the inter-district highway negates the shift. Regardless, the formal buildings are only slightly larger and more widely spaced than the informal buildings and do not create an obvious shift in texture.

Transitions between industrial and residential fabric in the blended settlement of Cevizli are much more pronounced, however, and constitute a coarser grain in the settlement overall. Large industrial buildings and waste areas were often separated from low-density residential areas by a single street or path, eliminating the physical and visual transition time Lynch suggests is most desirable in urban fabric. The residential grain in Cevizli was much more fragmented as well. Mass and formal housing was relegated to the north and west areas of the settlement, with few units exhibiting a mixture of high and low-density housing overall.

Though the highest proportion of coarse industrial fabric was observed in the formal settlement of Esentepe, a high number of finely grained residential units were also present in the *mahalle.* Mass and low-density housing were mixed throughout the residential area with a surprising number of small-scale industrial buildings as well. The presence of multiple grains within a single settlement seemed to suggest a discontinuity between districts, but transitions between the industrial and residential areas of Esentepe were sufficiently gradual to be considered blurred.

Access

Jacobs' notion of diversity surfaces again in Lynch's discussion of *access*, which he calls for alongside equity and control to create a pleasing system. Both theorists agree that access cannot be measured by the sheer number of options or amenities available in a place, for "to have everything instantly available is no more desirable than to live in an infinitely adaptable world" (*A Theory* 191). Lynch concedes, however, that a good environment is one which "affords obvious and easy access to a moderate variety of people, goods, settings," with the potential that these choices could be expanded at will (192). To this end, various types of paths and access networks are necessary, "in sufficient number," to ensure vital urban space (272). Jane Jacobs elaborates on this by listing short blocks and numerous intersections as additional requirements.

A full range of paths was observed in each of the sampled *mahalleler*, though the types (transit, highway, street, road, and pedestrian) presented at varying strengths in each. The transit network of Cevizli was the most expansive of the three samples, able to serve residential areas (formal and informal) and industrial areas equally. The settlement's lower order paths were not so evenly distributed. Though larger streets dominated in the formal housing districts of the north, fewer numbers of them were present in the informal housing districts of the south. Small walk-able roads were most prevalent in the central residential area of the blended settlement where pedestrians were more likely to travel and congregate. Unpaved paths were less likely in the industrial areas of the settlement at the pedestrian level, though both paved and unpaved paths were observed in the formal and informal housing districts.

Higher order paths (transit and highways) were more widely distributed in the informal settlement of Gumuspinar, despite having relatively little industrial fabric. Small roads were observed throughout the settlement, facilitating vehicular access even in the most densely concentrated residential areas. A greater number of street and road intersections were observed in this *mahalle* than the other sample areas combined, suggesting that more path choices exist for the user at this level. Paved and unpaved pedestrian paths were identified throughout the informal settlement as well, due in part to the fine residential grain discussed previously. Walk-able streets and roads were identified in every pedestrian unit, with no visibly restricted areas.

The formal settlement of Esentepe exhibited the least expansive path network of the sampled areas. Street and road systems were extremely limited in the industrial areas above and below the inter-district highway, though large paved areas may provide additional access. The road system is much more dense and complex in the residential districts, however, allowing

greater vehicular access to these areas than the rest of the settlement. Though massive industrial structures dominate the settlement visually, the concentration of lower order paths in the south suggests more consistent movement and use in the residential areas. A similar conclusion has been drawn from the shape and positioning of transit networks in the *mahalle*. Of the two routes observed, the winding nature of the southern route seems to provide more flexibility to its users than the highway-centric routes in the north, signaling a greater need for transit access in this area. Pedestrian paths were much more consistent. Paved and unpaved paths existed in each of the sampled units, with fewer paved areas observed in the informal residential fabric.

4.1 Concluding Cross-case Synthesis

Each of the initial research questions was addressed in the course of this study, beginning with the identification of the informally and formally designed regions of Kartal seen in Figure 2. From this map, the blended regions of the district were also observed and incorporated into the remainder of the analysis as a third embedded unit. The spatial typologies defined by Kevin Lynch were addressed in the second stage of analysis. Though certain characteristics were identified in each of the sampled *mahalleler*, more typologies were exhibited by the blended settlement of Gumuspinar than either of the other sample areas.

In the next stage of analysis, three types of structural and spatial densities were observed in the sample regions: built, dwelling, and use density. The built densities of the sampled *mahalleler* were generally consistent, though the dwelling and use densities varied widely by development pattern. Gumuspinar had an extremely high proportion of residential fabric in comparison to the formal and blended settlements, with other uses each accounting for less than 10 percent of the total land area. In a similar manner, low-density housing existed in much higher quantities in the blended settlement of Cevizli, though the distribution of industrial and blended areas seemed to suggest a more even mixture of uses.

The spatial and architectural grain types defined by Lynch were observed in the fourth stage of analysis and have been analyzed in great detail already. Though none of the sampled *mahalleler* conformed to the planning ideal of a fine and blurred grain, the blended settlement of Cevizli seemed least amenable. The informal settlement of Gumuspinar exhibited the finest grain overall, but did not contain a sufficient number of large industrial buildings to justify comparison with the other *mahalleler* on this point. The formal settlement of Esentepe exhibited a fine and blurred grain in certain instances, but as previously mentioned, this was not a widespread phenomenon.

In the final stage, variable levels of pedestrian, vehicular, and transit-oriented *access* were observed in the sampled *mahalleler*. Of the three settlements, the most comprehensive transit network was observed in the blended *mahalle* of Cevizli, though the formal *mahalle* of Esentepe was moderately well served. The informal *mahalle* of Gumuspinar exhibited the most comprehensive vehicular network, and seems to have the highest level of pedestrian access as well, though no conclusive determination on this point could be made from the available data.

5. Discussion

The performance construct, though only one of many measurements considered in the field of urban design, remains critical to the analysis and refinement of cities. This study, from its inception, was an attempt to address the complex phenomena involved in the formation of vital and diverse urban fabric through a stratified, descriptive method of analysis, and to determine, to a lesser degree, the benefits and limitations of remote form analysis. The study stands as a substantive-descriptive analysis of selected *mahalleler* within the district of Kartal, a single *vilayet*, or province, within the greater city of Istanbul.

5.1 Implications

The implications of this study for the district of Kartal are numerous, as it provides a comprehensive picture of three different types of settlements within its administrative boundaries. The analytical maps produced by the study revealed issues with the access networks in each settlement, as well as certain inconsistencies in the grain and density measurements of each. This study additionally expands the body of data publicly available for analysis in Kartal, a district of Istanbul of considerable interest to the country of Turkey, and the world, as globalization brings increased social and economic attention to the area. This information, and the cursory maps, could prove extremely useful as development and revitalization schemes are formed and implemented in the district in the future.

The study has the potential to serve as an analytical base for further research in the city of Istanbul as questions about the risks and benefits of mixed-use and development arise. By synthesizing the theories of Jane Jacobs and Kevin Lynch into a single, stratified method, this study has not only produced a more rigorous tool for remote analysis, but one that can be applied to numerous other urban settlements in the future. As was previously mentioned, the method relies on western planning theory, not Turkish development patterns and culture. Though certain biases exist, the use of dominant theories in this study ensure that the method is not confined to the borders of Turkish development and culture and can thus be applied to a much larger range of blended settlements.

The *substantive-descriptive* data produced for the sampled *mahalleler* of Kartal, though quite rigorous in its own regard, has the potential to provide an even richer base for additional research and planning endeavors. The stratified nature of the method and hierarchical rating system it produces is well suited to Geographic Information System (GIS) analysis, and could be used to create a modeling base for such programs in the future. A model of this type would allow intricate maps of performance criteria to be constructed and interpreted by researchers quickly and accurately, to the benefit of planning professionals across the globe.

6. Conclusion

For any urban analysis to be considered viable it must produce an intimate understanding of the multiple and complex phenomena at work in a city's growth and development. As demonstrated by this study, no aspect of urbanism can be evaluated on its own, but must be measured in concert with a host of other variables. Repeated analysis ensures that the elements of "good" urbanism are nourished and cultivated over time, while detriments are identified and removed, like weeds in a garden. Performance ratings are crucial in this sense because they beg for iteration; a city's performance, on any level, must be assessed again and again as development continues.

Descriptive-substantive measurements facilitate the method by providing the most comprehensive knowledge of an urban condition without defaulting to prescriptive generalizations, as demonstrated by this study. Though user-generated settlements have been romanticized and condemned at regular intervals by users and professional planners alike, a critical evaluation of performance avoids such biases altogether. This study not only illuminates the successes and failures of the traditional formal and informal fabric found in the district of Kartal, but also begins to identify what has been gained and lost when the two are merged in blended areas. Such determinations are particularly poignant for the city of Istanbul, and other cities, where cultural heritage is closely tied to the simultaneous chaos and wonder of informal settlements.

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