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Turkish informal housing settlements as a typology for modern generative processes in urban design: a case study of Karanfilkoy and Fatih Sultan Mehmet neighborhoods in Istanbul, Turkey

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TURKISH INFORMAL HOUSING SETTLEMENTS AS A TYPOLOGY FOR MODERN GENERATIVE PROCESSES IN URBAN DESIGN: A CASE STUDY OF KARANFILKÖY AND FATIH SULTAN MEHMET NEIGHBORHOODS IN ISTANBUL, TURKEY

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ABSTRACT

Generative development processes adapt to existing conditions and unfold over time. Generative urban design theory proposes that successful communities must be planned and built incrementally, with current and future users participating throughout the process. The theory critiques the modern development processes of master planning and design that disregard adaptations through the building process. Successful examples of generatively built structures and neighborhoods are often cited from pre-20th century traditional societies and vernacular architecture. Generative approaches to urban design and planning need more modern 20th century examples and case studies of successful generatively built structures and communities.

Informal settlements are often cited as places with innovative and adaptive development processes largely determined by the residents. This dissertation contributes to generative urban design theory by analyzing the Istanbul informal housing settlements of Karanfilköy and Fatih Sultan Mehmet. These two settlements evolved in the late 20th and early 21st centuries in a largely owner built, incremental process. The resulting structures and patterns have many qualities that make these two squatter settlements livable, dynamic, and adaptive to the users' needs. The settlements are analyzed for their generative processes and the resultant structures and patterns that evolved over time. This dissertation is an explanatory case study. Its constructs are living structures, patterns/pattern languages, and generative development processes, as described by Christopher Alexander and Nikos Salingaros. This dissertation expands on the rich and

diverse literature of informal settlements in general, Turkish and Istanbul informal settlements in particular, and generative urban design theory. This study establishes the Istanbul informal housing settlement and its processes, structures and pattern language as a defined, modern settlement typology in generative urban design theory.

DEDICATION

This dissertation is dedicated to my wife, Staci, and my daughter, Evelyn. Thank you, Staci, for your continuous support, encouragement, love and patience with my academic endeavors. Evelyn, you brought inspiration, light and pure joy to this undertaking. May you both have a lifetime filled with awe and wholeness.

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CHAPTER ONE

INTRODUCTION

> People used to say that just as the 20th century had been the century of physics, the 21st century would be the century of biology… We would gradually move into a world whose prevailing paradigm was one of complexity, and whose techniques sought the co-adapted harmony of hundreds or thousands of variables. This would, inevitably, involve new technique, new vision, new models of thought, and new models of action. I believe that such a transformation is starting to occur…. To be well, we must set our sights on such a future.
> Christopher Alexander, *The Nature of Order - Book Two* (2002b, 568-570)

> Most people could not care less about a design's formal virtues: they just want something they can truly consider their own.
> Nikos Salingaros, et al, "Favelas and Social Housing: The Urbanism of Self-Organization" (2006b, 16)

1.1 Dissertation Summary

This dissertation contributes case studies and evidence to generative urban design theory. Specifically, it links the development processes, structures and patterns in the Istanbul informal neighborhoods of Karanfilköy and Fatih Sultan Mehmet to generative urban design theory. The main research question asks: Can Istanbul informal housing settlement development processes, structures and patterns be used to develop a new typology for generative processes for urban design? The study's cases are Karanfilköy Mahalle (neighborhood) and Fatih Sultan Mehmet Mahalle (neighborhood) in Istanbul, Turkey. The units of analysis are Karanfilköy and Fatih Sultan Mehmet neighborhoods. The embedded units of analysis are selected blocks/housing groups, buildings, plots and open spaces within Karanfilköy and Fatih Sultan Mehmet. This study is an explanatory cases study using documentation, archival records, direct observations and physical artifacts. The constructs are generative development processes, living structures/degrees of life, and pattern languages.

1.2 Research Problem

This dissertation contributes to generative urban design theory by analyzing the Istanbul informal housing settlements (a.k.a. Squatter housing and "gecekondu" in Turkish) of Karanfilköy and Fatih Sultan Mehmet (formally known as Armutlu). These settlements evolved in a largely owner built, incremental process. The resulting structures and patterns have many qualities that make squatter settlements livable, dynamic, and adaptive to the users' needs. The dissertation explains the development processes, structures and patterns of Karanfilköy and Fatih Sultan Mehmet and how they relate to generative urban design theory.

Generative urban design proposes that successful communities must be planned and built in an incremental process, with all stakeholders (particularly current and future users) participating throughout the process (Alexander 2002b; Alexander 2002a; Salingaros 2006c). The theory criticizes the modern development processes of master planning and design that disregard adaptations through the building process (Alexander 2002b, 107-136, 179-202; Alexander 2005a). The generative approaches to urban design and planning need more modern examples and case studies of successful generatively built communities. Alexander points out that the 20th century had comparatively few examples of successful, generatively built structures (when compared to the many examples of successful generatively built structures found before the 20th century) (2005a, 107-174). Indeed, examples of successful generatively built structures are often cited from traditional societies and vernacular architecture (ibid, 85-106; (Habraken et al. 2000; Hakim 2003, 42; Hakim 2007a, 88-89; Hakim 2007b, 100-105; Hakim 2008, 21-40; Hakim 2010). This study identifies how the Istanbul squatter phenomenon both meets and fails to meet the criteria of successful generative design.

The case studies collect data through documentation, archival records, direct observations and physical artifacts. From these data sources, two case summaries are written. Urban design structures and patterns of buildings are analyzed by using Alexander's 15 properties of living structure (2002a). The specific analysis tool used for living structure is Salingaros's degree of life measure (See Appendix B) (Alexander 2002a, 469-472; Salingaros 2006a, 104-128). Additionally, a pattern language for each settlement is developed using Alexander's methods outlined in *The nature of order- Book 2* (1978; 2002b, 341-368). Finally, a logic model and cross-case analysis are used to analyze the generative processes that formed the informal settlements' structures and patterns (Yin 2003, 127-139). These multiple forms of data bolster the validity of the design and the robustness of the case analyses. Subsequently, the results are more confidently used as a contribution to generative urban design theory.

1.3 Research Questions

Main research question

Can Istanbul informal housing settlement development processes, structures and patterns be used to develop a new typology for generative processes for urban design?

Secondary research questions

1. How have Karanfilköy and Fatih Sultan Mehmet developed in a generative process?
2. Do the structures and patterns in Istanbul informal settlements form wholeness and living structure (as defined by Christopher Alexander (2002a))?
3. What are the degrees of life (Alexander, 2002a, 469-472) of structures and patterns in Karanfilköy and Fatih Sultan Mehmet?
4. What "pattern languages" are found in Karanfilköy and Fatih Sultan Mehmet (Alexander 1978; 2002b, 341-368)?

1.4 Research Hypothesis

The development processes, structures and patterns found in the two Istanbul informal settlements of Karanfilköy and Fatih Sultan Mehmet will provide a new, modern typological contribution to generative urban design theory.

1.5 Research Justification and Significance

This study contributes new and useful information about the generative urban development processes and the resultant forms in Istanbul informal settlements. This information is a valuable and unique contribution to generative urban design theory (as explained below). The study also provides new urban design typologies specific to the Turkish informal housing phenomena.

How does the Istanbul case contribute to new theory?

1. Istanbul squatter settlements developed in the modern era.

The squatter settlement is an example of a generative built environment that has emerged in the 20th and 21st centuries and reflects the complexity of the built environment of modern urbanity. Traditional villages, often cited as generatively built environment examples, lack the contextual reality of late 20th and early 21st century urbanization. The Istanbul squatter settlement is a generative example that provides insights into how a *modern* metropolis can integrate a generative settlement.

2. Turkish squatter settlements share similarities with other squatter settlements.

Turkish squatter settlements also share similarities with the world's other informal settlements. For instance, Mahmud & Duyar-Kienast compared Dhaka, Bangladesh bustees and Ankara, Turkey gecekondus and found differences and some key similarities (2001, 271-280). "Although *gecekondus* and *bustees* are illegal, and under public threat, they are both possibilities for the urban poor to support themselves in the city in terms of housing and other necessities. They live in a physical and social environment which helps them to survive and to integrate into urban life and its economy" (ibid, 278-279). This example shows how Istanbul squatter settlements are related to the current worldwide urban realities of squatterization.

3. Istanbul is a "world city."

The Istanbul squatter phenomenon participates in an emerging, dynamic and culturally relevant city. Istanbul is much more of a "world city" - connected to world events, cultures and economies - than other Turkish cities where squatter settlements could be studied, such as Ankara, Izmir or Antalya.

4. Turkish squatter settlements are a unique squatter settlement example.

Turkish squatter settlements are unique among squatter settlements because they are integrated into the pattern and fabric of the city and they have infrastructure mostly in place. Among the world's squatter settlements, Turkish squatter settlements are often seen as an evolution in the squatterization process producing something more livable in terms of sanitation, building materials, government representation, infrastructure and open space (Mahmud et al. 2001, 271-280; Neuwirth 2007; Neuwirth 2005, 335). Because of these attributes, Istanbul is often seen as examplar for other nations dealing with squatter housing issues. For example, at the 2005 World Congress of the International Union of Architects, UNHABITAT's executive director, Anna Tibaijuka, called on Istanbul as a leader and an example to the rest of the world:

> I am well aware that Turkey, since the mid 1960s, has adopted a comprehensive legislative and policy framework regarding slums. This has enabled Turkey to accomplish many successful initiatives in slum upgrading and low-cost housing. I believe there is much to learn from the experience of Turkey that is relevant to many developing countries and UN-HABITAT is ready to document and disseminate such best practices (Tibaijuka 2005).

5. The two cases provide two different development process examples.

The two cases of Karanfilköy and Fatih Sultan Mehmet neighborhoods provide two scenarios regarding the generative development process. Karanfilköy stopped at low-rise and medium densities, while Fatih Sultan Mehmet developed higher buildings, greater densities and less green space around houses. Each is a different example of variations in the evolution of Turkish squatter settlements.

1.6 Definition of Key Terms

Informal settlements / squatterization:

Issues of squatter housing are complex and need to be defined holistically, (Saglamer et al. 1994, 606-615). Turgut explains the complexity of the problem:

> In the last decades the squatter phenomenon has been studied and interpreted by different researchers having various perspectives. As these researchers have taken into account different aspects of this phenomenon in relation to their background, the definitions and the interpretations have differed from each other to a large extent. This differentiation demonstrates the complexity and the multidimensional nature of the problem (Turgut 2001, 19).

Because of this complexity of informal settlements, three main aspects of informal settlements / squatterization are proposed as definitions:

1. A transition process reflected in form: "A transition process from rural to urban life, a transitional life style and its reflection to space" (ibid, 19).

2. A phenomenon defined in terms of distribution of wealth, social structure, social security, and socio-economic impacts (Arslan 1989, 34-37; Hacihasanoglu et al. 2006, 902-915). Examples in informal neighborhoods include residents' access to internal social networks and economic opportunities (e.g., jobs or the speculation process of renting self-built apartments). This definition looks past informal settlements as simply a built form.

3. Defined in terms of ownership, legislation and construction processes. This phenomenon is defined as, "casual buildings which have been built on lands or plots without having any ownership and the right to built on it in terms of building legislation and laws" (Turgut 2001,19).

Gecekondu:

Gecekondu refers to self-built informal housing in Turkey. Orhan Esen explains:

> *Gecekondu* derived from everyday language to signify a specific housing and settlement typology of self-service urbanisation that occurred during Turkey's industrialisation and rural migration in the period between 1945 and 1985. *Gece* means 'the night' and *kondu* 'landed', hence *gecekondu* translates as 'landed at night' (2009, 49).

"The word *'gecekondu'* in Turkish means 'built overnight'" (Baharoglu et al. 1998, 116).

Mahalle / mahallesi:

"The *mahalle* (neighborhood) was the historic space of urban culture in the Middle East" (Mills 2004, 1). Currently in Istanbul, a mahalle is defined as a neighborhood or ward within the city. If the Mahalle has a population over 2000, they have political representation with the municipal government (Neuwirth 2007).

Muhtar:

A muhtar is a neighborhood representative in the Istanbul municipal government. "Muhtars and district mayors play the most important role in conveying demands from citizens to service providers. Part-time representatives of the State, known as muhtars, are found in every neighborhood of Turkish cities. They channel demand for infrastructure and services to utilities in either an *ad hoc* manner or in a structured way" (Baharoglu et al. 1998, 124).

Generative processes in urban design:

Generative urban design processes are step-by-step, incremental development processes that adapt to existing conditions and unfold over time (Alexander 2002b, 225). defines ten features of generative processes (Table 1.1).

Table 1.1: Alexander's ten features of living generative processes

1. A living process is a step-by-step adaptive process, which goes forward in small increments, with opportunity for feedback and correction at every increment (Chapter 8, 2002b).

2. It is always the whole which governs, in a living process. Even when only latent, whatever greater whole is latent is always the main focus of attention and the driving force which controls the shaping of the parts (Chapter 9, 2002b).

3. The entire living process – from beginning to end – will be governed and guided and moved forward by the formation of living centers in such a way that the centers help each other (Chapter 10, 2002b).

4. The steps of a living process always take place in a certain vitally important sequence, and the coherence of its results will be dependent to a large extent on the accuracy of this sequence which controls unfolding (Chapter 11, 2002b).

5. Parts which are created during the process of differentiation must become locally unique; otherwise the process is not a living process. This means that all repetition is based on the uniqueness of the locally shaped parts, each adapted, by the process, to its situation within the whole (Chapter 12, 2002b).

6. The formation of centers (along with the sequence of their unfolding) is guided by generic patterns which play the role of genes (Chapter 13, 2002b).

7. Every living process is, throughout its length and breadth, congruent with feeling and governed by feeling (Chapter 14, 2002b).

8. In the case of buildings, the formation of the structure is guided geometrically by the emergence of an aperiodic grid which brings coherent geometric order to built form (Chapter 15, 2002b).

9. The entire living process is oriented by a form language that provides concrete methods of implementing adapted structure through simple combinatory rules (Chapter 16, 2002b).

10. The entire living process is oriented by the simplicity transformation, and is pruned, steadily, so that it moves towards formation of beautiful simplicity (Chapter 17, 2002b).

(Alexander, 2002b, 225)

Living structure and wholeness (within generative design theory):

Living structure and wholeness within generative design theory is based on the theory of centers. A "center" is a visual field that is the focus of a region. The region that focuses on a center can be of any size. Centers help to tie the space together by reinforcement. Recursion leads to fractal properties in structures with many centers. Centers have a geometry of mutually reinforcing focal points. Centers are the basic notion describing the ordering process in nature (and in architecture) (Alexander 2002a).

Alexander (2002a, 109) points out four key properties of the structure of centers:

1) Centers themselves have life.
2) Centers help one another: the existence and life of one center can intensify the life of another.
3) Centers are made of centers (this is the only way of describing their composition).
4) A structure gets its life according to the density and intensity of centers which have been formed in it.

"These four points, simple as they are, give us the secret of living structure, and of the way life comes from wholeness" (Alexander 2002a, 109).

Patterns and pattern languages (within generative design theory):

Alexander defines patterns as, "a rule for making or partly making some important type of center, necessary to the life of a living human environment" (2002b, 344). Alexander (2002b, 344-345) also gives eleven essential ideas that make pattern languages (Table 1.2).

Table 1.2: Alexander's eleven essential ideas of pattern language theory

1. In traditional cultures, successful environments were always built by using pattern languages. They showed people how to make an almost infinite variety of buildings by combining and recombining the patterns, and contained within the process a modest guarantee that the buildings would be successful. Hence the great variety and beauty of buildings built by traditional societies.

2. Each culture had its own pattern language. The pattern languages reflected differences from culture to culture, and often nearly embodied the culture as a whole, in the form of rules which defined the spatial structure of the built environment.

3. The patterns were, for the most part, based on human needs, understanding, and necessity. They reflected the deep practical daily concerns of people and were, as rules, expressed in a form which made it possible to put these things into the built environment in an immediate, practical, and effective form.

4. At the same time, although patterns vary from culture to culture, and while human needs vary and are highly specific in different human cultures, there is a core of material – a central invariant structure – which is common to all cultures. A portion of this invariant core – or at least a sketch of such a thing – is described in *A Pattern Language* (Alexander et al. 1977, 1171).

5. It is possible to create pattern languages from our own time, which, like traditional languages, embody knowledge, cultural subtlety, human need, and empirical information about the structure of living environments, in a form which may then be used to generate living centers by a combinatorial unfolding process.

6. It is possible to invent and create new pattern languages, artificially, by trying to see what new patterns will solve problems that exist in a given context. Although these may be new, in the sense that they are newly defined, many of them may, obviously, be versions of ancient patterns, familiar in different cultures, but so deep that in some form they are still relevant to our new era and new settings.

7. The objectivity of the patterns is context-sensitive, and always includes a built-in reference to the context for which that pattern works.

8. The patterns, because of their explicitness, allow discussion, debate, and gradual improvement of the material.

9. The artificial language will work well only to the extent that it embraces *a whole* – that is to say, to the extent that it comprises everything that needs to be said about a given building situation, and that the various patterns it contains work together as a whole system, which accounts for all the morphology that is required to design, plan, or make, a complete building of that type and its immediate surroundings.

10. These artificial languages, like traditional languages, can then be used to steer processes of design and building, just as traditional languages played that role in traditional societies.

11. For *any* new building project it is necessary to construct such a language, merely to provide a clear functional basis for the character and organization of the building. The language that is written down, at the beginning of a project may be invented from scratch, composed of known languages that have been re-combined, or may be a modification of a known language developed earlier. This will vary, according to the degree that the project is new, not yet fully understood, or old and familiar.

(Alexander, 2002b, 344-345)

Sustainability:

This study defines sustainability as described by De Plessis (2000). She defines the major paradigms of sustainability from the late 20th century. These views come largely from a Western mechanistic view of society. She then creates a new definition of sustainability focused on a systemic societal view. De Plessis argues for a holistic approach and definition of sustainability that integrates aspects of both mechanistic and systemic societal paradigms. For this study, sustainability refers to impermanent, qualitative, participatory, intuitive, and iterative processes and networks (De Plessis 2000, 7).

1.7 Organization of Chapters

Chapter Two conducts a review of the theory and literature on informal housing, Turkish informal housing, and generative urban design theory. Chapter Three explains the research methodology used for the study. Chapters Four through Seven report and explain the results of the study. Chapters Four, Five and Six are each devoted to one of the three constructs examined in this study. Chapter Seven provides a cross-case synthesis and summary of the key research findings. Chapter Eight concludes with an analysis of this study's contributions, implications, limitations and recommendations.

CHAPTER TWO

INFORMAL SETTLEMENTS, TURKISH INFORMAL SETTLEMENTS AND GENERATIVE URBAN DESIGN THEORY

2.1 Introduction

This theory / literature review seeks to summarize the rich and diverse literature of informal settlements in general, Turkish and Istanbul informal settlements in particular, and generative urban design theory. This study expands on this literature, offering a new way of analyzing Turkish informal settlements, a new case study for generative urban design theory, and an expanded methodology for generative urban design theory.

2.2 Informal Settlements

Informal settlements have emerged in the second half of the 20th century in major metropolitan areas in the developing world as rural to urban migrations increased. Many researchers and policy makers analyze the issues and policies surrounding informal settlements (Habraken et al. 2000; Neuwirth 2007; Neuwirth 2005, 335; Abrams 1966a; Abrams 1966b; Berner 2001, 292-307; Bromley 2003, 271-292; Bromley 1978, 1033-1039; Budiarto; Burgess 1978, 1105-1133; Danesh 1987, 168; Davis 2006; De Soto 1990; Dwyer 1975; Erickson et al. 1997, 903-928; Greene 2003; Harris 2003, 245-269; Harris 1998, 165-189; Hillier et al. 2000, 61-96; Juppenlatz 1970, 257; Lapping 1973, 446-450; Patton 1988; Payne 1977; Payne 2001, 415-429; Payne 1989; Portugali 2000; Rapoport 1988, 51-77; Seelig 1978, 205; Tipple 2000; Tipple 1996, 367-376; Tipple et al. 1999, 165; Turner 1980, 316; Turner 1968a, 357-360; Turner 1968b, 354-363; Turner 1977, 169; Turner 1982, 99-113; Turner 1996, 339-347). Despite the large body of research and evolving policies dealing with informal settlements in the developing world, the many informal sectors continue to expand, continue to be built on dangerous or ecologically sensitive land, and continue to be places of poverty and inadequate sanitation. Squatter settlements are a current and future urban reality (Brand 2006). Indeed, the population of squatter dwellers has reached one billion and is expected to reach two billion between 2030 and 2050 (United Nations Human Settlements Programme (UN-Habitat) 2009). In order to understand current and future squatter urbanization, it is important to know what theory and policy positions have evolved since 1960, when the squatter phenomenon started to emerge in great numbers.

Informal settlements- Three major theoretical positions

1. Clearance and redevelopment

Clearance and redevelopment schemes have been implemented since the beginning of informal settlements. They are still being conducted throughout the world.

> Apart from the legal aspect, massive *demolitions* and *evictions* are justified on the grounds of improvement and beautification of the city, removal of centres of crime and health hazards, and more intensive and lucrative use of land in strategic locations (Berner 2001, 295).

Within this rationale, there are seemingly positive benefits to slum clearance and redevelopment strategies. However, clearance and redevelopment has few benefits. It has the negative effects of trauma and dislocation of residents. Often the residents in informal communities have social and economic networks within the neighborhood.

These often rely on the spatial arrangements and vibrant community and informal economies that can evolve in a squatter settlement. When people are relocated to government housing, frequently they lose these important connections.

Another point against clearance programs is that,

> This policy is almost always unsustainable. As relocation sites are rarely provided, and even then in most cases are unattractive in terms of location and infrastructure, evicted people find no alternative but to return to informal settlements in the city (Berner 2001, 295-296).

Because of these reasons described by Berner, most clearance and redevelopment policies have proved to be largely ineffective in both the short and long terms.

2. Aided self-help (Sites and services/ upgrading)

Self-help, sites-and-services, and upgrading housing policies have been in place for many decades, but came into wide-spread practice in the 1970s and 1980s. These schemes look to upgrade informal settlements with infrastructure and services, rather than clearing and displacing residents. There is a good body of research and practice that promotes squatter housing as a solution to housing pressures in developing and industrializing countries, most popularly that of Charles Abrams and John F.C. Turner and his colleagues (Harris 2003, 245-269; Turner 1968a, 357-360; 1968b, 354-363; 1977, 169; 1996, 339-347; Caminos et al. 1969, 242) – but also others, such as Tipple (2000; 1996, 367-376; 1999, 165; 1991).

A benefit of the aided self-help approach is it can give a lot of control to the residents. Turner is most famous for espousing the benefits of resident autonomy in informal settlements (1968a, 357-360; 1977, 169; 1982, 99-113; 1996, 339-347).

In his summary of Turner's work, Harris points out what Turner meant by autonomy in self-help housing:

> By self-help Turner has always meant not only the investment of sweat equity by owners in their homes but also the processes of owner-design and management. It is the element of autonomy—which he has defined as the issue of ''who decides''—that is fundamental (Turner, 1976a, 11–34). It was on the basis of their differing ''structure[s] of authority and control'' that he preferred owner-built homes, however modest, to public housing, however well built (Turner,1976b, 5). Owner-building itself, however, was not the issue. ''The best results are obtained by the user who is in full control of the design, construction, and management of his own home,'' he has argued, while ''it is of secondary importance whether or not he builds it with his own hands, unless he is very poor'' (Turner, 1972b, 158). By 'best results' Turner means houses that best suit the changing needs and circumstances of their occupants. In view of the extended process by which homes are framed, adapted, and used by their occupants, and in a phrase that others have echoed, he has suggested that housing should be viewed not as a noun but as a verb (2003, 248).

The sites and services approach to informal housing also seems to best capture the demand for services and infrastructure. Although it is often implemented in an ad-hoc manner, it still gets to the purpose of giving residents necessities. However, as a policy issue it neglects the aspect of land tenure.

Self-help housing policies have been criticized as an excuse for governments neglecting to provide housing for its residents (Berner 2001, 292-307; Burgess 1978, 1105-1133; Davis 2006; Burgess 1977, 50-59; Burgess 1982, 465-480). Berner says that despite these policies being a step in the right direction, "overall performance of upgrading and sites and services schemes is disappointing" (2001, 296). He goes on to mention their ineffectiveness and tendency to displace residents:

> Planning standards for upgrading are often unrealistically high. This leads in turn to rising living costs and the uprooting of considerable parts of the

> population, of course usually the poorest (Hasan 1992). Their resettlement, sometimes welcomed as 'decongestion', entails social, political, and financial costs (Ibid, 296).

Upgrading and sites and services approaches also often fail to address issues of land tenure. When upgraded settlements are still technically illegal, the residents lack security. In turn, these settlements tend to have maintenance problems and limited participation (2001, 296).

Despite the criticisms of self-help policies, it is seen as often the best solution for informal housing policy. As Berner points out, "Recent literature on urban housing (for instance the contributions in *Habitat International* 24(2)) widely agrees that self-help housing is still the only 'architecture that works' (Turner 1968) in sheltering the poor" (Berner later goes on to describe how self-help policies by themselves will not work, but he does acknowledge their importance as part of the solution) (2001, 293). Self-help policies are often grounded in research, focused on: empowering residents; retaining neighborhood social, cultural and economic networks; and improving physical infrastructure. In a practical and normative sense, self-help and upgrading policies and practices are very valuable.

3. *Informal settlements as sub-markets - with emphasis on land tenure and property rights.*

Coccato gives an introduction as to why informal settlement theory started to be evaluated in terms of submarkets:

> Possibly because of disillusion with, and the need of alternatives to self-help and sites-and-services, a new approach emerged in the '80s: low income settlements viewed as informal sub-markets. The so called 'crisis

> of self help' brought about the fact that informal housing through self help does not have just a use value, as argued by Turner (1976; 1982), but a potential market value as attested by Burgess. Once consolidated with security of tenure and basic infrastructure, self-help housing loses its pure use value and becomes a commodity that can be rented or sold (Burgess 1982, 61). According to this new set up in the discussion, studies in different parts of the world begun to report the existence of well-established housing sub-markets, even in the poorest settlements (Sudra 1981; Hart Deneke et al. 1982; Martin 1982) (Coccato 1996, 2.2).

Coccato's explanation views informal housing as a commodity, one that can be bought and sold on the market, expanded in order to charge rents, etc.

Informal housing as a commodity is related to policies which encourage urban land tenure and title rights. Payne points out that the World Bank has relaxed its policies toward land tenure and property rights since the 1980s and 1990s. The World Bank still advocates, "'stronger property rights' in real estate markets and 'secure and clear' tenure." However, Payne suggests that this indicates a reduced focus compared to their 1993 policy which listed improvements to property rights as the first priority in terms of demand side instruments. Furthermore, tenure security and property rights are listed as among the most important factors influencing housing demand and it is claimed that insecure tenure leads to under-investment in housing and to reduced housing quality (2001, 420-421).

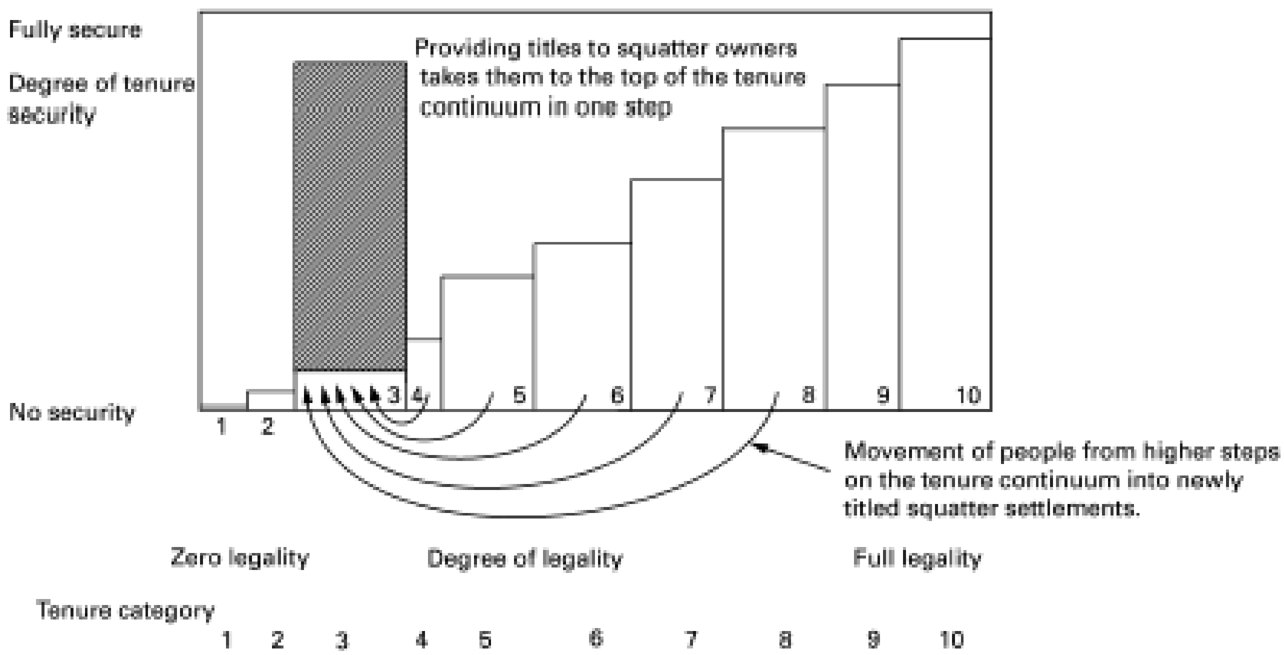
Payne goes on to question the effects of policies encouraging title rights and/or land tenure. He questions some of the common claimed benefits of these policies. He asks:

> To what extent are formal titles essential for: (1) encouraging investment in housing construction and improvements; (2) improving access to formal channels of credit and; (3) widening the property tax revenue base of local

> authorities? Also, to what extent will they: (4) enable urban development authorities to increase their influence over land and housing markets and improve (5) the efficiency and (6) the equity characteristics of such markets (2001, 421)?

Payne gives an argument that these benefits are not always realized when granting tenure rights (Table 2.1).

Table 2.1: Payne's consequences of providing titles to squatter residents



Tenure categories found in many cities:

1 Pavement dweller
2 Squatter tenant
3 Newly legalised freeholder of squatter house or plot
4 Tenant in unauthorised subdivision
5 Squatter 'owner' - regularised
6 Owner - unauthorised subdivision
7 Legal owner - unauthorised construction
8 Tenant with contract
9 Lease-holder
10 Free-holder

NB: For simplicity, this illustration deletes customary and Islamic tenure categories.

Fig. 2. Likely consequences of providing titles to 'owners' of squatter houses.

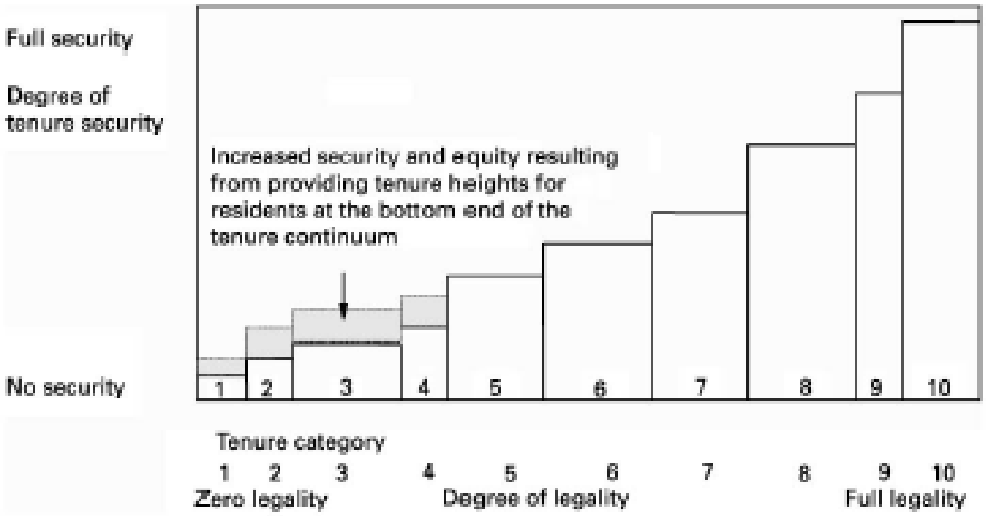
(2001, 423)

Payne refers to this process in Table 2.1 as “downward raiding” of sub-markets. That is, the process of providing titles to squatters “leap-frogs” residents from the bottom to the top of the tenure continuum. This has the effect of destabilizing the tenure sub-markets in-between. These in-between markets were more secure and often occupied by residents with higher incomes than the squatter tenant. However, land-tenure policies encourage people to move back down to the newly titled properties (2001, 423-424). Payne gives examples of land-tenure policies problems:

> If full titles are granted to residents in squatter settlements… it sends a signal to land-owners and developers that significant and sudden increases in land values can be realised by subdividing land illegally. The World Bank reiterates de Soto's point that prices for houses with titles may be significantly higher than for similar houses without it (IBRD, 1993, p. 41), representing a consider [sic] profit margin for agents involved in informal sector subdivisions, but only realisable by households when they sell their home. Title provision or regularisation may therefore stimulate the very processes of unauthorised development they seek to prevent and therefore reduce, not increase, public sector influence over land and housing markets.
>
> For vulnerable social groups… the ‘downward raiding' process may prove disastrous as newly ‘entitled’ owners seek to realise their new found capital assets by increasing rents to unaffordable levels. The mere prospect of full, formal tenure status within informal settlements may raise their commercial value and can therefore actually reduce tenure security for such groups (422-424).

Payne recommends some alternatives to tenure rights. One alternative is, “to increase the rights of residents rather than changing their formal tenure status” (2001, 427). He cites successful examples from Botswana and Lesotho, where residents are granted “certificates of use.” He also mentions a successful policy in Hyderabad, India, in which squatter settlements can gain the designation of “un-objectionable” and then they are officially accepted. Payne also recommends extending local customary arrangements that seem to be working. He cites an example in Egypt in which squatter residents on government land pay a small rent to the government. This rent acts to secure compensation from the government in the event of displacement. Both of these options have the benefit of improving security for residents, without the negatives (that Payne outlines) of granting land titles (Table 2.2) (2001, 427-428).

Table 2.2: Payne's consequences of providing tenure rights to squatter residents



Tenure categories found in many cities:

1 Pavement dweller with approval to remain
2 Squatter tenant with protection
3 Squatter 'owner' - regularised
4 Tenant in unauthorised subdivision - with protection
5 Squatter 'owner' -regularised
6 Owner - unauthorised subdivision
7 Legal owner - unauthorised construction
8 Tenant with contract
9 Lease-holder
10 Free-holder

NB: For simplicity, this illustration deletes customary and Islamic tenure categories

Fig. 3. Likely consequences of improving tenure rights in unauthorised settlements.

(2001, 428)

Evaluating informal settlement submarkets - with emphasis on land tenure and property rights – has many benefits. This position is grounded in theory. It also takes advantage (or at least attempts to take advantage) of economic systems, both informal and formal. Like sites-and-services, it has the advantage, in some cases, of empowering residents. In terms of normative physical improvements – such as infrastructure improvements – it is best made possible with the collaboration of upgrading schemes.

Informal settlements – Berner's recommendations based on informal housing policies and theories

Berner (2001) gives a list of rational recommendations based on the lessons learned from informal housing policies and theories in the second half of the 20th century. His approach is an important hybrid that seems to get past arguments between theories, and get to an approach that provides multiple tools to deal with pressing informal housing issues. His suggestions, along with Payne's argument for rights in lieu of titles, offer an array of solutions for the complex phenomena of informal settlements:

- There is always a need for active policy in urban environments. To expect market forces to generate a rational distribution of urban land has proved a mistake, to say nothing of being an inequitable one. Industrial and commercial ventures are able to bid much more for the use of limited urban space than all but the wealthiest groups. Even in the industrialised countries, governments take this into consideration by applying a certain policy mix of zoning, land price control/taxation, rent ceilings, provision/support of low-cost housing, and/or rent subsidies.

- Given governments' limited resources and capacity they should simply abandon the role of housing provider and turn towards a truly enabling approach. In other words, they should contribute the 'essential ingredient', namely land, and leave housing production to people's initiative. Effective cooperation between government and other actors, NGOs, and the private sector in particular, is an essential element of the enabling approach.

- The conventional sequence of Planning–Servicing–Building–Occupation turns raw land into a scarce and expensive commodity, especially if cumbersome administrative procedures and transaction costs are considered. The lesson to be learned from illegal subdividers is to reverse this sequence: start with absolutely minimal infrastructure and services and allow for *incremental* development of individual houses and settlements. This strategy implies the need for a thorough revision of regulated standards, and an annulment of most of them.

- The fundamental importance and tremendous economic value of the existing housing stock—whether or not it was produced legally—needs to be recognised. This suggests the need for large-scale consolidation and legalisation of squatter settlements. Insecurity of tenure, apart from increasing people's vulnerability and putting their assets into jeopardy, is a major obstacle to investment: as squatters are forced to keep their property mobile they are reluctant to put money into productive ventures.

- Insecurity is also a fundamental cause of the persistence of unsanitary conditions. Environmental upgrading requires considerable investment and the long-term commitment of the residents, e.g. in non-pollutive sanitation and waste disposal management (Lee 1998, 993-1011). Such contributions are unlikely if people are unsure whether they will enjoy the benefits.

- If demolitions are unavoidable, it is crucial to have an adequate relocation site. Relocation to places far away from the cities is unacceptable to the 'beneficiaries' and has to be forced on them at high economic, social, and political cost. Moreover, it is not sustainable as many of the affected families return to the city, frequently to their original site (Berner 2001, 303).

Informal settlements gaining increasing notice

Today informal settlements are gaining increasing attention and concern due to their sheer ubiquity and number. Currently there are approximately one billion squatters in the world (United Nations Human Settlements Programme (UN-Habitat) 2009). It is estimated that by 2030 there will be two billion (ibid). Consequently, informal settlements *are* our current and future urban realities (Brand 2006). As McGuirk points out, cities, particularly the expanding informal ones, are our biggest design challenge (2010). As such, they need addressing in a variety of places and from a variety of disciplines, including urban design (UNCHS [HABITAT] 1996).

Research also focuses on squatter settlements' innovative nature (i.e., the spatial, economical, and/or social aspects). For example, Berner claims that, "The informal sector's strategy of incremental development and improvement of housing and infrastructure can be incorporated into public policies" (2001, 292). Likewise, Greene studies the "movement economy's" role in consolidating informal settlements in Santiago, Chile (2003). She claims that the informal neighborhoods she studies support the notion that, "Planning should be understood as the nurturing of an organic process, requiring ever improving understanding of these processes and feedback from interventions" (ibid, 38.21). Other research has been done linking spatial experiences and patterns in squatter communities (Urueta 1999). Still others, such as architect Teddy Cruz, have used the informal settlement as a typology for designs in the planned, formal development process (Ouroussoff 2006). The popular media is also picking up on the notion of squatter settlements as an innovative housing typology (McGuirk 2010; Ouroussoff 2006; Tuhus-Dubrow 2009).

Current architects and landscape architects are working on design projects in the informal city (e.g., Urban Think Tank's (Brillembourg et al. 2005; 2009) work with what they call "urban acupuncture" in India). These architects try to create tension relief points in dense squatter communities through architectural interventions. Similarly, Beardsley and Werthmann (2008) are landscape architects working and teaching in Brazillian favelas. They think of their work as “operations” and “tactics” inserted into the fabric of the squatter communities. Their “operations” are necessarily altered from formal landscape architecture processes in order to effectively work in the squatter communities. They point out that few landscape architects work in the informal world, yet urban squatter settlements are where two billion people will be living in 2030 (ibid). Other research and practice is also reaching out to informal settlements through landscape architecture in Khulna, Bangladesh (Rekittke 2009). All of these researchers and practitioners attest to the urgency of the planning and design professionals in engaging with growing squatter communities.

Informal settlements and their urban design and form

There are efforts to study the spatial patterns and organization of squatter settlements. For example, Barros and Sobreira examine the self-organizing spatial patterns of squatter settlements (Amorim et al. 2009). They see slums as complex sub-systems within the global dynamics of development (Barros et al. 2002, 8-9). That is, the settlements’ spatial instability is seen as a stable part of the wider development patterns of a city or region. They describe texture analysis as, “A description of the spatial variability of pixel tones in a digital image. Texture analysis of digital images aims at recognizing and distinguishing spatial arrangements of gray levels values.” (ibid, 9). Amorim, et al, (2009) study squatter settlements using texture analysis that combines satellite images and interface maps. In another study, Pontikis conducts a spatial analysis of informal housing areas in Greece with an emphasis on policy implications (2009, 7-33). Two dissertations were conducted that used mixed methods to analyze spatial characteristics of Tanzanian housing settlements, including squatter settlements (Lupala 2002; Nguluma 2003). Many researchers also use Space Syntax theory to explored spatial qualities and urban design aspects of squatter settlements (Budiarto; Erickson et al. 1997, 903-928; Hillier et al. 2000, 61-96; Cardoso 2004; Carvalho et al. 2004, 539-547; de Holanda 1997; Mills 1992, 13-21; Ortiz-Chao et al. 2007; Ortiz-Chao 2008; Sobreira 2003; Sobreira 2002; Sobreira et al. 2001; Zetter et al. 2006). These studies certainly address spatial characteristics, urban morphology (in many studies) and concepts (e.g., movement economies) in informal settlements. All the aforementioned studies provide rich and compelling examples of potential research techniques. However, these studies do not explicitly analyze squatter settlements with regard to generative design theory (although urban morphology is typically highly related to generative urban processes).

2.3 Turkish Informal Settlements

The phenomenon of Turkey's informal housing coincided with huge rural to urban migrations (Baharoglu et al. 1998, 115-135; Ergun 1991a, 125-137; Egercioğlu et al. 2007; Keyder 2005, 201-215; Metz 1995, 550-580). The Turkish informal settlement phenomenon started in the 1950's, as industrial jobs in Istanbul, Ankara and other medium sized cities (e.g., Izmir) drew workers from rural villages in Turkey. The housing needs were not adequate for the new population. Subsequently, squatter settlements developed on the edge and sometimes center of large cities. Istanbul has clearly felt the full impact of this phenomenon. Its informal housing sector has grown greatly in the last 50 years. Currently, fifty percent of Istanbul's 14-20 million residents live in informal housing (Leitmann et al. 1999, 195).

Legal rights have often been established in gecekondus through laws meant to bribe the electorate in these settlements (Buğra 1998, 310). As Ergun explains, "The squatter areas have become very populous over time and formed a political power. They have therefore been provided with infrastructure and social facilities generally in the periods before and after elections" (Ergun 1991b, 137). Yalcintan and Erbas also studied the strong geographic correlations between Istanbul electoral political changes and the rise of gecekondu populations (2003, 91-111). Buğra goes on to explain that amnesty laws were established to allow squatters to gain title rights:

> Hence, the gecekondu, once built and occupied, sooner or later attain legal status and are regularized by government action… Most gecekondu owners hold some kind of property title to land: 45.3% have a regular property title, 25.8% hold shared title deeds, and 8.6% have acquired a government certificate that will eventually entitle them to formal legal ownership of their house… This percentage of irregular houses with no entitlements is estimated to be 15.8% in Istanbul (1998, 310).

However, despite infrastructure provision, it can often be inadequate (Leitmann et al. 1999, 195-198; Ergun 1991b, 137). Additionally, gecekondus and their infrastructure provisions often lie outside formal rules. Leitmann and Baharoglu explain their findings that rules meant to regulate infrastructure provisions in gecekondus are largely irrelevant:

> The formal rules governing infrastructure and service delivery to gecekondus are largely irrelevant [for a number of] reasons: sheer

demographics; a lack of penalties and enforcement; cumbersome procedures; and conflicting signals from central government. First, the sheer magnitude of illegal settlements makes implementation of the rules impossible… The rules cannot be applied by denying services to the majority of structures in a city just because the rules classify them as illegal…There [is] consensus that the rules are irrelevant because of the absence of penalties and the existence of loopholes (1998, 109-110).

Senyapili provides a summary table of the history of Turkish squatter housing:

Table 2.3: Framework of transformations of squatter housing in Turkey

	1950-60	1960-70	1970-80	Post 1980
Government Model	Nation state, welfare state	Nation state	Nation state questioned, rise of the local	Nation state narrows down, increasing dominancy of the local, governance concept
Economic Policy	Liberal development model, Keynesian policy, rapid development, government intervension for full employment and stability, industry led growth, foreign aid, eradication of poverty and equity in distribution of income to be achieved in time in development, growth poles, spillover effect	Planned development, import substitution model, internal market protected by customs, quotas, only factors of production imported, neo-classic economic approach	Impact of oil crisis, urban problems hinder national development, solution of these will lead to general development, World Bank enters the poverty agenda, collaboration with IMF, criticisms of import substitution models, reorganization of production towards flexibility	Foreign debt crisis and transition to neo-liberal, export-oriented, privatization model, flexibilization of markets, social policies structured by market forces
World Bank Policy	Conducts research especially in Latin America and Asia to clarify the squatter problem	Research continues, culture of poverty, poverty is 'fate' therefore it is the problem of the poor	Restructuring of policy after Turner approach, financial support to project based 'site and services'	Restructuring of policy, enabling, general urban policy, housing and urbanization finance organizations
Type of Urban Planning	Comprehensive	Comprehensive	Incremental, project level approaches, strategic planning, Infrastructure development	Structure planning Strategic planning
Dominant Urban Land Supply Model	Illegal invasion	Shared ownership	Housing cooperatives	Mass housing, cooperatives, transformation of squatter housing,
Public Approach to Squatter Housing Problem	Squatting is an illegal and dilapidated housing problem, elementary measures to stop or to re-direct migrant flow, the problem is temporary, public housing, multi-party system starts political patronage	Housing sector is unproductive, squatting is a housing problem, central government intervenes through Law 775, legalizing and classifying existing stock, prohibiting new stock, political patronage expands, worker migration to Europe eases migration pressure on cities	Populist subsidies to rural area, credit flow and subsidy to prices of agricultural products slows down rate of migration flow, politization of squatter housing areas between nationalist and radical left groups cooperative organization in housing sector, squatter problem more and more identified with poverty, starts to lose its 'housing' connotation.	The problem is now poverty, rent allocation provided through Law 2981, commercialization of squatter areas, transformation, forced migration from the east, increased migration to especially coastal cities, internal fragmentation and rising conflicts in squatter communities due to decreasing opportunities

(Senyapili 2004)

Much of the literature and research involving Turkish informal housing sees it as a problem to be changed (Yalcintan et al. 2003, 91-111; Tas et al. 2005, 263 - 271; Türker-Devecigil 2005, 211 - 229; Dündar 2001, 391-401). For example, a study by Turker-Devecigil focuses heavily on informal housing in the context of urban transformation. Other research studies Istanbul residents' satisfaction with their housing environments and finds residents more satisfied and comfortable in planned versus squatter settlements (Türkoglu 1997, 66).

However, there has also been a call for a better understanding of informal housing, moving beyond understanding them only in terms of illegal phenomena:

> One finds, among the realities of gecekondus, that they are dynamic social environments whose residents maintain implicit and explicit links to rural areas, extended families, and village groups even as they are economically integrated into the employment offered within the city. It can be shown that when building gecekondus, immigrants were guided by knowledge they learned while living as rural people or village residents. Furthermore, the houses and housing clusters reflect a deep architectural understanding towards the use of space, materials, scale, and colors. Typically they followed a harmonious building process adapted to climate, rhythms and patterns of living, and the environment as they staked out yards, and built one- or two-bedroom huts of scavenged materials.
>
> To better understand gecekondus, architects need not only be aware of them as an illegal phenomenon. They must also understand the housing communities as positive adaptations by rural masses to the urban situation in ways that are fundamentally sensitive to nature and open to change (Cavender 2006).

In a similar sentiment, the economist wrote in 1991 about Turkey's gecekondus:

> The result is no mass slum. Even the most basic of these settlements--a hillside of one-storey brick of wood huts with two or three narrow rooms apiece--has the feel of a settled community. The place is dusty, but not dirty; it has schools and mosques; there is space, sometimes a small garden, around each home; the children's clothes are clean; people are

> poor, but not desperately. …This shows that Turks are self-reliant, ingenious and, as citizens or city authorities, admirably practical about bending rules (Economist 1991, 15-17).

Some researchers also study Turkish informal housing objectively as a fact:

> Such an urbanization starting with migration to towns from rural agricultural-traditional areas and ending in an urban, industrial-modern society can be analyzed for its values of culture-space interactions according to different scales, leading to a better understanding of squatterization as a fact, not only as a problem area (Turgut 2001, 19).

Additionally, Turgut researches squatterization as a continuing process and an emerging housing problem around the urban centers in developing countries with rapid physical and socio-cultural changes. During this process of squatterization changes, housing patterns show a dramatic transition procedure from a temporary shelter to a permanent house in squatter settlements. Turgut aims to explore the transition process focusing on socio-cultural aspects of changing housing patterns in squatter settlements. She also examines the reciprocal relationship of the physical environment of the home with the family socio-cultural environment within the context of the urbanization process (ibid). The theoretical approach of these studies is based on a holistic concept that includes cultural, psychological, spatial and temporal components in a transactional perspective. In the light of this framework, her paper analyzes the structure of the housing patterns in squatter settlements. The paper does an excellent job of analyzing individual squatter housing patterns (particularly their progression in the urbanization process) in Turkey. However, this research does not extend to the public sphere of urban design. To fill this gap, further research should be conducted regarding analysis of urban design patterns and processes of squatter settlements that extend beyond the private dwelling unit (ibid).

Ozdemir, et al., aim to define the basic Turkish traditional housing principles with important examples (2007, 1445-1452). Cultural, social and psychological components in traditional Turkish houses are analyzed. The organization rules, the effects of the basic psycho-social component, and the presence of these principles are criticized with Turkish housing examples before and after 1980. The chosen period in this study is not coincidental. The aim of choosing the periods before and after 1980 has a special meaning in Turkey's economic, politic and social life. Choosing these two basic periods not only points out the changes—like a metamorphism—in cultural life, but in architectural needs in Turkish houses (ibid). Therefore, in the aim of analyzing cultural changes and their effects on housing design, the architectural meanings in the elements of Turkish houses are put forward in details, in order to make some estimation for the future of changing Turkish architectural life (ibid).

Ozdemir summarizes the history and cultural underpinnings of housing types and their design details in Turkey. However, his article does not address the differences in the urban design patterns that result from these housing designs and/or the systems that elicit such urban design patterns (e.g. Gecekondu verses planned apartment blocks). It also does not analyze in any detail the interaction of the house and the street, or the interaction of the house and outdoor spaces. Therefore, further research should be conducted analyzing the urban design of squatter settlements.

Turkish informal settlements and their urban design and form

Some researchers study Istanbul residents' satisfaction with regard to adaptability in their housing environment (Altas et al. 1998, 315-323; Ozsoy et al. 2005, 17-28). However, they focus mostly on planned housing and mainly on interior aspects (i.e., not urban design) of the housing developments. Others have looked at Istanbul's newest housing trends and patterns, but mostly in the formal sector (Turgut-Yildiz et al. 2007).

Senyapili analyzes the Turkish informal settlements in terms of their social and architectural flexibility (1978). Cagdas also evaluates the spatial, morphological and functional aspects of Turkish informal settlements, but stays at scale of the house (Cagdas 1995, 40-45). In contrast, Ozsoy, et al., provide a great qualitative assessment of outdoor open spaces in Turkey housing developments(Ozsoy et al. 1996, 163-173). However, their work is conducted in the planned, mass housing settlements and not squatter communities.

The gecekondu settlements have gone through a series of transformations since their inception:

> The *gecekondu* constituted a highly "flexible" form of housing open to conversion into apartment buildings, larger in size and more modern in their building structure. As they thus changed form through time, they did not only provide shelter to immigrant families and their grown up children, but also an additional source of income as they expanded with the addition of new floors to be rented (Buğra et al. 2005, 24-25).

Terzi and Bolen point out how the law change to allow higher buildings in 1983/4 (through Act 775), "In Turkey, in 1984, each squatter was given permission to build 4 floors and many squatter areas rapidly transformed and turned into high density areas"

(Terzi et al. 2005, 1). This high-density pattern can be seen today in Fatih Sultan Mehmet Mahalle.

Turkoglu points out typical physical differences in the old verse newer squatter neighborhoods: "Traditional squatter areas'… characteristics are l-2 stories single family buildings, l00-250 persons/ha neighborhood density. New squatter areas'… characteristics are 3-5 stories attached or detached apartments, relatively new buildings, 250-500 persons/ha neighborhood density" (1997, 58).

Turgut's study on the physical progression of tradition squatter housing - from a temporary one-room building to a semi-permanent multi-room building to a larger, multi-story permanent building – is very valuable (Turgut 2001, 17-25). These morphological elements provide good examples of the Istanbul squatter process in terms of physical form. Turgut, et al., also take this analysis to the relationship between homes and streets in squatter communities (Turgut et al. 1995, 153-163).

2.4 Generative Urban Design Theory

Generative theories in urban design, planning and architecture are based on step-by-step, adaptive processes that unfold over time. A common example of this is vernacular settlements in traditional societies that were built in incremental processes. Much of the thought in generative urban design theory is influenced by complexity theory and inspired from physics, mathematics and biology (Alexander, 2002a). Although the influences on generative theories are many, it is worth noting the contribution of Jane Jacobs. Jacobs was a pioneer in generative thought in urban planning and design. Her *Death and life of great American cities* (1960) expounds on the concepts of organized complexity and the spontaneous city (Jacobs 1992). As Helie points out, Jacobs, "describes in great details how the functions of a spontaneous city related and supported each other" (Helie 2009, 78). Her final chapter, *The kind of problem a city is*, rails against modernist urban planning methods and calls for a more organic and spontaneous approach to urban planning and design. This is thought to have greatly influenced many of the thinkers responsible for generative urban theories (Mehaffy 2008, 59).

Christopher Alexander is a leading researcher in generative methods for urban design, architecture and planning. He has a body of work that addresses issues of generative processes in design and planning (1977, 1171; 1964; 1966, 58-62; 1978, 552; 1985, 381; 1987). In *A New Theory of Urban Design*, Alexander lays out seven rules of generative development that he believes contribute to healing action and a renewed sense of place in urban environments (1987) (Table 2.4). This work can be seen as an extension of his seminal book, *A Pattern Language* (Seamon 2004, 123-145). It can also be seen as the precursor to his more precise definition of wholeness and centers found in *The Nature of Order*.

Table 2.4: Alexander's seven rules of growth from A New Theory of Urban Design

1. Piecemeal growth. The grain of development must be small enough so there is room and time for wholeness to develop, thus building increments must not be too large and there must be a reasonable distribution of functions and project sizes. **2. Growth of larger wholes.** Every building increment must be created in such a way as to increase the number of wholes that exist in space. **3. Visions.** Every project must be imagined intuitively as the appropriate next element for healing the existing structure. **4. Positive outdoor space.** Every building must create coherent, well-shaped adjoining public spaces, including streets, walkways, plazas, parks, and gardens. **5. Layout of buildings.** The ordering of every building—its massing, placement of entrances, layout of circulation, etc.—must be coherent as a whole unto itself and in its relationship with the larger district of which it is part. **6. Construction details.** Every building must generate smaller wholes in its physical parts—in its structural bays, columns, walls, windows, etc. **7. Formation of centers.** Every whole must be a "center" in itself and must also contribute to a system of smaller and larger centers within and around it.

(Alexander 1987; Seamon 2004, 8)

Alexander's most recent work, a four-volume magnum opus, *The Nature of Order*, is a culmination of his previous work and greatly focused on generative processes and their relation to design, planning and the built environment (Alexander 2002b; Alexander 2002a; Alexander 2005a; Alexander 2007, 11-19; Alexander 2004; Alexander 2003). He expands his rules of growth in *The Nature of Order* when he explains what constitutes a good generative development process (2002b). He calls this living process and defines it as follows: "A living process is any adaptive process which generates living structure, step by step, through structure-preserving transformations" (2002b, 204). He goes on to define ten features of living processes (Table 2.5):

Table 2.5: Alexander's ten features of living generative processes

1. A living process is a step-by-step adaptive process, which goes forward in small increments, with opportunity for feedback and correction at every increment (Chapter 8, 2002b).
2. It is always the whole which governs, in a living process. Even when only latent, whatever greater whole is latent is always the main focus of attention and the driving force which controls the shaping of the parts (Chapter 9, 2002b).
3. The entire living process – from beginning to end – will be governed and guided and moved forward by the formation of living centers in such a way that the centers help each other (Chapter 10, 2002b).
4. The steps of a living process always take place in a certain vitally important sequence, and the coherence of its results will be dependent to a large extent on the accuracy of this sequence which controls unfolding (Chapter 11, 2002b).
5. Parts which are created during the process of differentiation must become locally unique; otherwise the process is not a living process. This means that all repetition is based on the uniqueness of the locally shaped parts, each adapted, by the process, to its situation within the whole (Chapter 12, 2002b).
6. The formation of centers (along with the sequence of their unfolding) is guided by generic patterns which play the role of genes (Chapter 13, 2002b).
7. Every living process is, throughout its length and breadth, congruent with feeling and governed by feeling (Chapter 14, 2002b).
8. In the case of buildings, the formation of the structure is guided geometrically by the emergence of an aperiodic grid which brings coherent geometric order to built form (Chapter 15, 2002b).
9. The entire living process is oriented by a form language that provides concrete methods of implementing adapted structure through simple combinatory rules (Chapter 16, 2002b).
10. The entire living process is oriented by the simplicity transformation, and is pruned, steadily, so that it moves towards formation of beautiful simplicity (Chapter 17, 2002b).

(Alexander, 2002b, 225)

Alexander, et al, (2005b, 4; 2008) also describes the social-spatial characteristics typical of generatively developed places:

Table 2.6 Social-spatial characteristics of generatively developed places

1. A more beautiful and coherent geometric form that is natural to the land.
2. More probable successful integration and adaptation to plants, trees, animals, and land form; resulting in communities and built areas which, like traditional towns and villages, seem like part of nature.
3. Successful fine tuning and deep adaptation.
4. More successful integration with living process in the daily life of the inhabitants.
5. Better fit with individual local needs of any given building, garden, space, or enclosure.
6. Far greater likelihood that genuine community will emerge in the new place.
7. More uniqueness of each place, each street, each building, and each project.
8. More profound linkage to sustainability and environmental objectives.
9. An easier path to the desired end state.

(Alexander et al. 2005b, 4; 2008)

Wholeness and living structure are two key concepts in *The Nature of Order*. These concepts are very complex and difficult to summarize succinctly. One must refer to Alexander's *The Nature of Order* to gain a complete understanding. However, Mehaffy provides an excellent overview of *The Nature of Order*:

> Alexander studied the designs of cultures throughout history and across the world, and formulated some empirical notions about their geometric properties. He distilled these down to 15 recurrent geometric properties, and developed them into a theory of design.
>
> At the core of his theory is the idea that good design is not a matter of elements working properly in a mechanistic system, but rather of regions of space amplifying one another in a larger totality. That is, one cannot

> take the environment apart into elements, but must see the environment as a field of wholes, each supporting and amplifying one another in an interlocking totality. One can be very precise and descriptive about these wholes, but one cannot avoid looking at the totality at each step of the way.
>
> Alexander calls each spatial region a "center," emphasizing that it is not an isolated entity, but an embedded field within an infinitely larger system of fields, with gradually diminishing contextual influences. One cannot look at a part of the whole without looking at its relation to the whole, and the complex influences of its location within the field.
>
> This geometric holism is not a new view of things, although perhaps, as Alexander suggests, it holds revolutionary implications for the way we order the architecture of modern society. As Alexander correctly notes, we are still captivated by the power of Cartesian reductionism, the metaphor of the machine. It utterly dominates our conception of the natural world and of the design problem. It gives us great reductive power over nature, the power to take apart and reassemble at vast scales for our own purposes. And yet we pay a terrible price: like Humpty Dumpty, we sometimes find ourselves unable to get all the pieces to go back together again. Or rather, we find it impossible, since we don't really understand, in the current world view, what it means for "things to go together" in the first place. And thus the iconoclastic quality of this work (2006).

Alexander defines fifteen properties that work together to enhance and make wholeness or living structures. These properties all work to create stronger centers and enhance the centers of the greater structure or whole. Indeed, Alexander proposes that the degree of life and quality of a living structure is directly proportional to the degree that these fifteen properties are present or absent in a something. Table 2.7 shows Alexander's fifteen structural properties of living structure from the Nature of Order (2002a). Appendix A also provides further explanation of the fifteen properties' key concepts.

Table 2.7: Alexander's fifteen properties of living structure / wholeness

1. LEVELS OF SCALE
2. STRONG CENTERS
3. BOUNDARIES
4. ALTERNATING REPETITION
5. POSITIVE SPACE
6. GOOD SHAPE
7. LOCAL SYMMETRIES
8. DEEP INTERLOCK AND AMBIGUITY
9. CONTRAST
10. GRADIENTS
11. ROUGHNESS
12. ECHOES
13. THE VOID
14. SIMPLICITY AND INNER CALM
15. NON-SEPARATENESS

(2002a)

Alexander also is known as the father of the Pattern Language. He devotes a portion of *The Nature of Order, Book II* to example patterns and pattern language. Table 2.8 is Alexander's summary of pattern language theory. This study will use this theory to help define the pattern language for each informal settlement.

Table 2.8: Alexander's eleven essential ideas of pattern language theory

1. In traditional cultures, successful environments were always built by using pattern languages. They showed people how to make an almost infinite variety of buildings by combining and recombining the patterns, and contained within the process a modest guarantee that the buildings would be successful. Hence the great variety and beauty of buildings built by traditional societies.

2. Each culture had its own pattern language. The pattern languages reflected differences from culture to culture, and often nearly embodied the culture as a whole, in the form of rules which defined the spatial structure of the built environment.

3. The patterns were, for the most part, based on human needs, understanding, and necessity. They reflected the deep practical daily concerns of people and were, as rules, expressed in a form which made it possible to put these things into the built environment in an immediate, practical, and effective form.

4. At the same time, although patterns vary from culture to culture, and while human needs vary and are highly specific in different human cultures, there is a core of material – a central invariant structure – which is common to all cultures. A portion of this invariant core – or at least a sketch of such a thing – is described in *A Pattern Language* (Alexander et al. 1977, 1171).

5. It is possible to create pattern languages from our own time, which, like traditional languages, embody knowledge, cultural subtlety, human need, and empirical information about the structure of living environments, in a form which may then be used to generate living centers by a combinatorial unfolding process.

6. It is possible to invent and create new pattern languages, artificially, by trying to see what new patterns will solve problems that exist in a given context. Although these may be new, in the sense that they are newly defined, many of them may, obviously, be versions of ancient patterns, familiar in different cultures, but so deep that in some form they are still relevant to our new era and new settings.

7. The objectivity of the patterns is context-sensitive, and always includes a built-in reference to the context for which that pattern works.

8. The patterns, because of their explicitness, allow discussion, debate, and gradual improvement of the material.

9. The artificial language will work well only to the extent that it embraces *a whole* – that is to say, to the extent that it comprises everything that needs to be said about a given building situation, and that the various patterns it contains work together as a whole system, which accounts for all the morphology that is required to design, plan, or make, a complete building of that type and its immediate surroundings.

10. These artificial languages, like traditional languages, can then be used to steer processes of design and building, just as traditional languages played that role in traditional societies.

11. For *any* new building project it is necessary to construct such a language, merely to provide a clear functional basis for the character and organization of the building. The language that is written down, at the beginning of a project may be invented from scratch, composed of known languages that have been re-combined, or may be a modification of a known language developed earlier. This will vary, according to the degree that the project is new, not yet fully understood, or old and familiar.

(Alexander, 2002b, 344-345)

Salingaros also clarifies and summarizes the significance of Alexander's patterns:

> Alexandrine patterns express strong local forces that manifest themselves as either a particular geometry or as a repeating human action (Salingaros, 2000). By encapsulating the essence of why similar structures arise repeatedly around the world and throughout history, \`patterns' represent the most intelligent decomposition of architectural and urban systems that has ever been attempted. Alexander *et al.*'s (1977) *A Pattern Language* was misunderstood as being a catalogue of modules, whereas in fact many of the patterns identify interfaces that govern how modules connect to each other. Alexander and his colleagues realized that connective interfaces, such as boundaries, physical connections, transition regions and geometrical edges that harbour fundamental human activities, are essential to creating urban coherence. As in the decomposition of any complex system, architectural and urban interfaces have to be designed with just as much care as the modules themselves.
>
> Alexander looked for patterns of human activity and interaction, and analysed to what extent the built geometry either encouraged or discouraged them. He thus designed modules of human and social \`life' in a way that correlates them with special geometrical settings. Invariably, these functional modules do not correspond to any self-contained geometrical module, but rather to edges and interfaces in the urban geometry. Here is the alternative decomposition of a living system that follows human activity modules, and which we expect from systems theory. What life a city has occurs as a result of emergence along the interfaces of a decomposition carried out along geometric lines. Emergent properties will not appear directly from the geometrical modules, because those are usually fixed. The exception to this is free, unrestrained building, such as occurs in the *favelas* of the Third World (2000, 303-304).

Some people are trying to implement Alexander's generative processes and fifteen properties in built works. Pontikis (2007) works with Greek apartment complexes incorporating Alexander's principles. Salingaros, et al's, work in Latin American squatter settlements also uses generative processes (Salingaros et al. 2006b; Salingaros et al. 2006b; Pontikis 2007). Pagliardinin, et al, even propose a new name for community development conducted with bottom-up generative techniques: urban seeding instead of urban planning (2010, 331-354).

Hakim, also influenced by Alexander, proposes the following five components as part of generative system for neighborhood development:

> I – Meta-principles comprised of ethical/legal norms that is derived from the history and value system of the society for which such a program is proposed.
>
> II – Private and public rights are fairly and equitably exercised.
>
> In a generative bottom-up system most of the decisions affecting the built environment are made by the people living in their neighborhoods. Rights that affect those decisions have to be clearly articulated and understood by the public.
>
> III – Private and public responsibilities are properly allocated and implemented.
>
> Historically, the responsibilities of private citizens and institutions in generative systems that were clearly evident in societies and cultures located around the Mediterranean basin were:
>
> IV – Control and Management
>
> It is important to establish a system of control and management that will be guided by the metaprinciples and that would ensure private and public rights are fairly and equitably exercised, and that responsibilities are properly followed by private and public parties. Such a system of control and management should be based locally and must have legitimacy to the people living in the area or who will live there in the near future. One effective method that was predominant in many traditional societies was the system of neighborhood representatives, that is, one person is elected or selected/identified by the majority residents of a neighborhood to represent them at a council of representatives.
>
> V – Rules and codes.
>
> Another important component of a generative system are the necessary rules and codes that can be followed during the process of growth and

> change and for resolving unforeseen conflicts between neighbors. It is preferable that such a system of rules and codes is compatible with the ethical/legal norms, the rights and responsibilities of private and public parties, and should also be linked in content to traditional local customs that are still viable socially and technically. They should also be proscriptive in nature and their intention clear, that is, what is to be achieved must be understood by everybody involved in the generative process. They are to be open for interpretation in response to the peculiarities of each location and condition. Prescriptive codes that do not allow localised interpretation must be discouraged unless they are absolutely necessary (2007a, 87-99).

Hakim conducts a thorough analysis of generative processes and structures in traditional Islamic and Mediterranean settlements (2003, 2007a, 2007b, 2008, 2010). These studies are a very valuable documentation of generative processes and forms in the built environment. Additionally, they are relevant to the historic culture and geography of Turkey. Nonetheless, these studies still leave room for the analysis of *modern squatter* settlements.

Salingaros has a large body of work which seeks to quantify and describe the living structures that Alexander describes (2006b; 2000, 291-316; 2006a; 2005; 1998, 53-71; 1997, 165-173; Klinger et al. 2000, 537-548). For instance, Salingaros's "urban web" proposes mathematically based processes for urban design that are, "derived from connective principles in complexity theory, pattern recognition and artificial intelligence" (Salingaros 1998, 53-71). He gives three structural principals of the urban web (which are reminiscent of Lynch's theories, but, according to Salingaros, are more specific and capable of stronger conclusions (Salingaros 1998, 55; Lynch 1960)):

> *Nodes:* The urban web is anchored at nodes of human activity whose interconnections make up the web. There exist distinct types of nodes: home, work, park, store, restaurant, church etc. Natural and architectural elements serve to reinforce human activity nodes and their connective

paths. The web determines the spacing and plan of buildings, not vice versa. Nodes that are too far apart cannot be connected by a pedestrian path.

Connections: Pairwise connections form between complementary nodes, not like nodes. Pedestrian paths consist of short straight pieces between nodes; no section should exceed a certain maximum length. To accommodate multiple connections between two points, some paths must necessarily be curved or irregular. Too many connections that coincide overload the channel's capacity. Successful paths are defined by the edge between contrasting planar regions, and form along boundaries.

Hierarchy: When allowed to do so, the urban web self-organizes by creating an ordered hierarchy of connections on several different levels of scale. It becomes multiply connected but not chaotic. The organization process follows a strict order: starting from the smallest scales (footpaths), and progressing up to the higher scales (roads of increasing capacity). If any connective level is missing, the web is pathological. A hierarchy can rarely be established all at once (Salingaros 1998, 55).

Another Salingaros paper, "Complexity and urban coherence," describes eight rules geometric coherence for urban form:

Rule 1. Couplings: strongly coupled elements at the same scale form a module. There should be no unconnected elements inside a module.

Rule 2. Diversity: similar elements do not couple. A critical diversity of different elements is needed because some will catalyse couplings between others.

Rule 3. Boundaries: different modules couple via their boundary elements. Connections form between modules, and not between their internal elements.

Rule 4. Forces: interactions are naturally strongest at the smallest scale, and weakest at the largest scale. Reversing them generates pathologies.

Rule 5. Organisation: long-range forces create the large scale from well defined structure at the smaller scales. Alignment does not establish, but can destroy, short-range couplings.

> *Rule 6. Hierarchy:* a system's components assemble progressively from small to large. This process generates linked units de® ned at many distinct scales.
>
> *Rule 7. Interdependence:* elements and modules at different scales do not depend on each other in a symmetric manner: a higher scale requires all lower scales, but not vice versa.
>
> *Rule 8. Decomposition:* a coherent system cannot be completely decomposed into constituent parts. There exist many inequivalent decompositions based on different types of units (2000, 291-316).

Many of Salingaros's formulas - although very insightful, original and useful - are very complex and beyond the scope of this study. However, in his works, "Life and complexity in architecture from a thermodynamic analogy," "A pattern measure," and *A theory of architecture*, he creates an empirical method to measure the degree of life in buildings (Alexander 2002a, 469-472; Salingaros 2006a; Salingaros 1997, 165-173; Klinger et al. 2000, 537-548). The method is best refined in his *A Theory of Architecture*, and it is this method that is used as part of the methodology for this study (See Section 3.5 and Appendix B).

In summary, generative urban design theories are in an exciting, expanding stage. New research is being conducted and living structures are becoming operationalized better (Alexander 2002a, 472). Perhaps most relevant to this proposal, more studies need to be done:

> Alexander argues that we must have a much more serious look at the way natural systems use generative processes to achieve sustainable morphologies and work to integrate those lessons into our own human systems… The opportunity remains to develop further generative processes as a means to deliver more robust and more efficacious results – that is, more sustainable results – within the field of urban design (Mehaffy 2008, 73).

2.5 Summary

There is a large body of literature on informal settlements in general and also Turkish informal settlements in particular. The planning, design and policy implications of the literature and theories are also numerous. This study does not seek to offer prescriptive or proscriptive design or planning solutions to the informal housing situation in Istanbul or elsewhere. Instead, this study seeks to contribution to generative urban design theory using Istanbul informal settlements as the example case study. To the author's knowledge, this has not been accomplished in any theories on Turkish informal settlements or generative urban design. This study also uses and expands some generative urban design methodology – particularly when measuring degrees of life. Finally, this study does not seek to prove or refute the aforementioned generative urban design theories. Instead, it simply seeks to make a contribution to those theories.

CHAPTER THREE

METHODS FOR ANALYZING GENERATIVE STRUCTURES, PATTERNS AND PROCESSES IN KARANFILKÖY AND FATIH SULTAN MEHMET

3.1 Epistemological Framework

The dissertation research design is based in critical realism as summarized by Sayer (1992). First, as Sayer proposes, this study is guided by a metaphorical, "triangle whose corners are method, object and purpose," where, "each corner needs to be considered in relation to the other two" (ibid, 4). The details of how this is met in this dissertation are discussed in this chapter.

Sayer summarizes realism's epistemological and ontological underpinnings as follows:

1. The world exists independently of our knowledge of it.

2. Our knowledge of that world is fallible and theory-laden. Concepts of truth and falsity fail to provide a coherent view of the relationship between knowledge and its object. Nevertheless knowledge is not immune to empirical check and its effectiveness in informing and explaining successful material practice is not mere accident.

3. Knowledge develops neither wholly continuously, as the steady accumulation of facts within a stable conceptual framework, nor wholly discontinuously, through simultaneous and universal changes in concepts.

4. There is necessity in the world; objects - whether natural or social - necessarily have particular causal powers or ways of acting and particular susceptibilities.

5. The world is differentiated and stratified, consisting not only of events, but objects, including structures, which have powers and liabilities capable of generating events. These structures may be

present even where, as in the social world and much of the natural world, they do not generate regular patterns of events.

6. Social phenomena such as actions, texts and institutions are concept-dependent. We therefore have not only to explain their production and material effects but to understand, read or interpret what they mean. Although they have to be interpreted by starting from the researcher's own frames of meaning, by and large they exist regardless of researchers' interpretations of them. A qualified version of 1 therefore still applies to the social world. In view of 4-6, the methods of social science and natural science have both differences and similarities.

7. Science or the production of any other kind of knowledge is a social practice. For better or worse (not just worse) the conditions and social relations of the production of knowledge influence its content. Knowledge is also largely - though not exclusively - linguistic, and the nature of language and the way we communicate are not incidental to what is known and communicated. Awareness of these relationships is vital in evaluating knowledge.

8. Social science must be critical of its object. In order to be able to explain and understand social phenomena we have to evaluate them critically (ibid, 6).

Additionally, realism differs from positivism (which proposes a closed system of discreet events) by, "assuming a stratified and differentiated world made up of events, mechanisms and structures in an open system where there are complex, reproducing and sometimes transforming interactions between structure and agency whose recovery will provide answers to questions posed about processes" (Cloke et al. 1991, 146). For this dissertation, the context of the study and the units of analysis exist in an open system. This open system, including but certainly not limited to the physical, social and cultural environment of Istanbul squatter settlements, is in constant flux. The discreet phenomena researched can only be analyzed within its real-world context, not as though it were in a "vacuum."

Realism also posits that individuals make choices within an infrastructure that both constrains and enables. That is, human agency is both restricted and stimulated by infrastructure (Johnston et al. 1997). Accordingly, this dissertation is a study of the physical manifestation (in built forms) of human behavior and process that is both restricted and stimulated by the infrastructure or situation of living in a Turkish squatter settlement.

3.2 Methodology

The study is an explanatory case study. It uses an embedded, multiple-case design. Data triangulation and methods triangulation are used for the study (Yin, 2003, 98-100). Convergence of evidence is used to analyze the main units of analysis (Ibid, 100).

The purpose of the study is to answer the research questions:

- How have Karanfilköy and Fatih Sultan Mehmet developed in a generative process (Alexander 2002b, 225; 2005b, 4; 2008)?

- Do the structures and patterns in Istanbul informal settlements form wholeness and living structure (as defined by Christopher Alexander, 2002a)?

- What are the "degrees of life" of structures in Karanfilköy and Fatih Sultan Mehmet? (Ibid, 469-472; Salingaros 2006a, 104-128).

- What "pattern languages" are found in Karanfilköy and Fatih Sultan Mehmet (Alexander 2002b, 341-368; Alexander et al. 1977, 1171)?

Subsequently, the objects of study in these research questions are operationalized through the methods. Specifically, the methods include measuring the three constructs of

1) living structure / degrees of life, 2) pattern languages, and 3) generative development processes.

3.3 Units of Analysis

Main units of analysis

There are two main units of analysis (one for each case) and two embedded (a.k.a., sub) units of analysis. The main units of analysis are Karanfilköy and Fatih Sultan Mehmet, two geographically and politically defined informal housing districts in European Istanbul. Parts of Karinfilkoy and Fatih Sultan Mehmet Mahallesi were originally one settlement. The construction of the Trans European Motorway (TEM) (which leads to the Fatih Sultan Mehmet Bridge [completed in 1988] crossing the Bosphorus Straight) cut the neighborhood into two separate settlements (Ergun 2008). The neighborhoods have since developed separate urban design patterns and attributes. These two districts provide interesting case studies of how informal housing patterns and structures can change over time.

Why two cases?

These districts were recommended as typical representations of Istanbul's informal housing settlements by experienced informal housing researcher, Nilgun Ergun, of Istanbul Technical University's Department of Urban and Regional Planning (Ergun 2008). Two cases are chosen in order to make the overall study more robust and to offer replication (Yin 2003, 46-54). The two-case method is not an example of sampling logic, but of replication logic (ibid, 47). Specifically, it is a theoretical replication logic because each case, “predicts contrasting results but for predictable reasons” (ibid, 47). Yin mentions typical representation as justification for single-case designs (or in this study, a two case design) (2003, 41). The two cases offer predictably different results because their urban forms and development processes are different. Specifically, Karanfilköy is low-rise in structure and Fatih Sultan Mehmet is higher-rise with higher population density and less green space. Fatih Sultan Mehmet and Karanfilköy each represent a certain typology of Turkish squatter development. Because of these differences, each is a representative case of different development processes that potentially contributes to generative urban design theory. It could also be argued that they are examples of literal replication logic, because each, “predicts similar results” (ibid, 47). That is, both cases are typical examples of the Istanbul squatter settlement as a representative of generative urban design (as previously mentioned). The cultural antecedents and histories in many ways are the same in each settlement and, as such, each case could be expected to produce some similar results when looked at holistically within Turkish squatter culture and processes.

It should be noted that both cases/main units of analysis were evaluated for any discoveries that warranted a change in the study’s methodological design. For example, a new discovery might have demanded that data collection and analysis techniques change, or, perhaps, a new case/unit of analysis needs to be found (ibid, 50-51, 55).

Embedded units of analysis

The embedded units of analysis vary in scale. These are analyzed individually as distinct units, but also holistically with the main neighborhood unit analysis. The embedded-units inform and return to the main units of analysis (Yin 2003, 45). Additionally, the interdependent relationships between main and embedded-units of analysis are actually aspects of generative processes and living structure (e.g., Levels of scale in Alexander's 15 fundamental properties (Alexander 2002a, 145-150)).

The first embedded unit of analysis is the urban block/multiple buildings. This selection for unit of analysis for study has been successfully used by Lupela (2002, 77-82). The second embedded unit of analysis is houses, plots and open spaces within the blocks, again based on Lupela's work (ibid, 79-81). Also, as previously mentioned, these embedded units of analysis enable a test for recursive structures and patterns in a holistic study of the entire settlement (i.e., main unit of analysis).

Visual introduction to the main units of analysis

Figures 3.1 – 3.32 offer a visual introduction to each settlement. Karanfilköy and Fatih Sultan Mehmet neighborhoods are located in European Istanbul, approximately two kilometers west of the Bosphorus Strait (see Figures 3.1 and 3.2). The settlements are separated by the Trans-European Motorway (TEM). However, there is no direct vehicular access to the TEM from either settlement. There is an overpass over the TEM that connects the two settlements. Fatih Sultan Mehmet is approximately 0.844 square kilometers in area; while Karanfilköy is approximately 0.253 square kilometers in area.

Karanfilköy has, “574 households… 75 small shops… [and] about 4000 inhabitants in total” (Alkan 2006, 64). Fatih Sultan Mehmet has a higher population and population density.

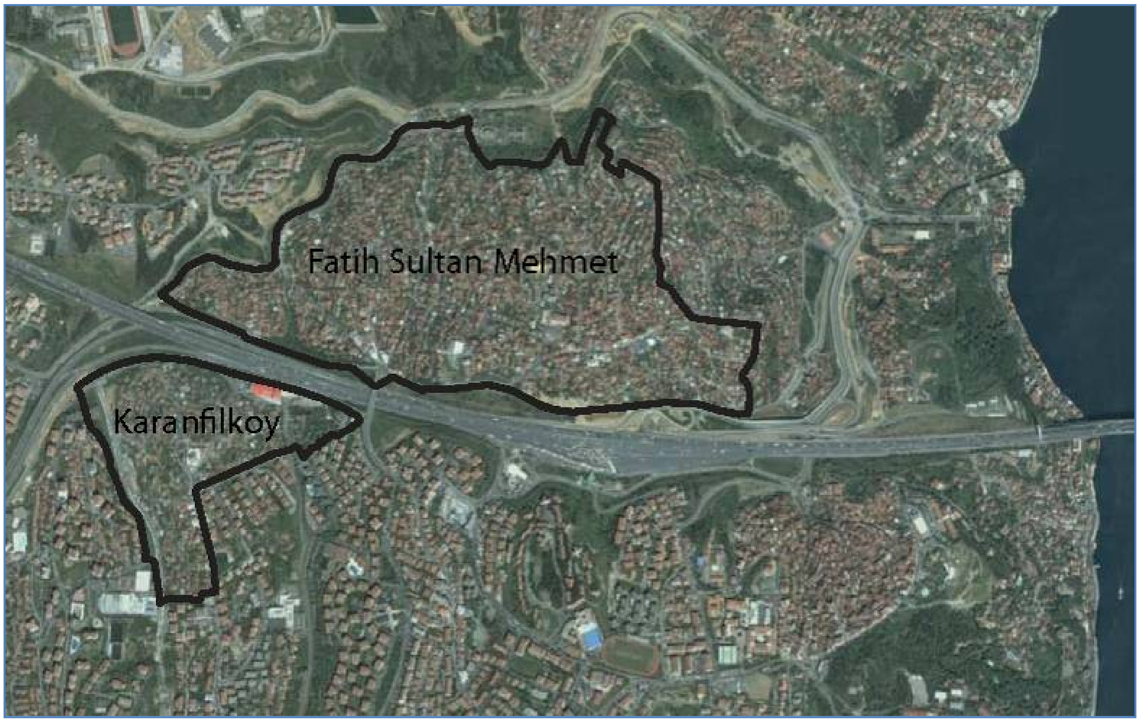


Figure 3.1: Aerial photograph - Fatih Sultan Mehmet and Karanfilköy with Trans European Highway dividing the settlement. The Bosphorus Strait is on the right.


Figure 3.2: Urban patterns of Fatih Sultan Mehmet (above highway) and Karanfilköy (below highway)

Figure 3.3: Fatih Sultan Mehmet streets

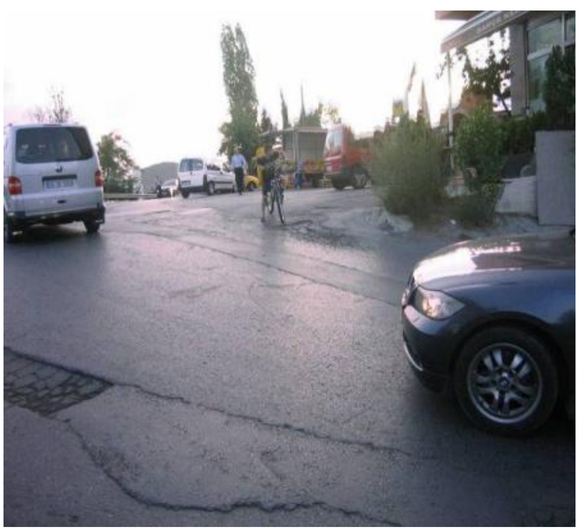


Figure 3.4: Fatih Sultan Mehmet streets at west entrance

Figure 3.5: Fatih Sultan Mehmet private car park

Figure 3.6: Fatih Sultan Mehmet main street business

Figure 3.7: Fatih Sultan Mehmet side-street

Figure 3.9: Fatih Sultan Mehmet side-street

Figure 3.8: Fatih Sultan Mehmet side-street

Figure 3.10: Fatih Sultan Mehmet residence window

Figure 3.11: Fatih Sultan Mehmet side-street

Figure 3.12: Fatih Sultan Mehmet side-street

Figure 3.13: Fatih Sultan Mehmet vegetation

Figure 3.14: Fatih Sultan Mehmet side-street with ad-hoc seats

Figure 3.15: Fatih Sultan Mehmet residence patio entrance

Figure 3.16: Fatih Sultan Mehmet street

Figure 3.17: Fatih Sultan Mehmet main street businesses

Figure 3.18: Karanfilköy near main street

Figure 3.19: Karanfilköy residence

Figure 3.21: Karanfilköy residence

Figure 3.20: Karanfilköy residence

Figure 3.22: Karanfilköy street


Figure 3.23: Karanfilköy residence


Figure 3.26: Karanfilköy garden


Figure 3.24: Karanfilköy garden


Figure 3.27: Karanfilköy residence


Figure 3.25: Karanfilköy garden


Figure 3.28: Karanfilköy street

Figure 3.29: Karanfilköy main street

Figure 3.30: Karanfilköy main street

Figure 3.31: Karanfilköy street

Figure 3.32: Karanfilköy residence alley

3.4 Constructs and Operational Definitions

Table 3.1 shows the study's constructs, operationalization of the constructs, and in what units of analysis the construct is analyzed.

Table 3.1: Constructs

Nominal construct	Operationalization of the construct	What units of analysis
Living structures	Degrees of life using Salingaros's degrees of life test (*Life = Temperature* x *Harmony*) (See Appendix B)	• Embedded
Pattern languages	Recording (through field notes, photos and plan map analysis) recurring patterns found in each settlement using Alexander's 11 essentials of pattern language theory (see Table 2.7)	• Main • Embedded
Generative development processes	Evaluation of settlement features through reports, historic aerial photos and observation and how they adhere to Alexander's *Social-spatial characteristics of generatively developed places* and Alexander's *10 living processes* (See Tables 2.5 and 2.6)	• Main

The construct of *living structures* is operationalized using Alexander's and Salingaros's arithmetic functions of the 15 properties of living structure (Alexander 2002a, 469-472; Salingaros 2006a, 104-128). The embedded unit of analysis (i.e., houses) is measured using this function.

The construct of *pattern languages* is operationalized using Alexander's 11 essentials of pattern language theory (Alexander 2002b, 344-345). Observing and recording recurring patterns, using Alexander's *11 features* as a guide, occurs at the main units of analysis (the settlements as a whole) and the embedded units of analysis (i.e., block/building groups, buildings and open spaces). The result is a “pattern language” for each settlement.

The construct of *generative development processes* is operationalized using Alexander’s *social-spatial characteristics of generatively developed places* (Table 2.6) and his *ten features of living generative processes* (Table 2.5) (2002b, 225; 2005b, 4; 2008). The *ten features of living generative processes* are used as a general guide when describing the processes of development (which uses reports and historic aerial photographs). Settlement features are evaluated through analysis of reports, historic aerial photographs and on site observations and how they adhere to Alexander’s *social-spatial characteristics of generatively developed places*. The main units of analysis (the settlements as a whole) are analyzed for this construct.

The constructs and measures for the study are concerned with identification of *how* the generative development happened (causal mechanisms) and how *extensive* the phenomena of generative development processes, living structures and pattern languages are in the settlements being studied (empirical regularity). Both of these concerns are central to realist studies (Kitchin et al. 2000, 15).

Realism also states that the charge of research “is not simply to collect observations, but to explain these within the theoretical frameworks that structure people’s actions” (May 1993, 7). This study explains the aforementioned observations of generative processes, structures and patterns in Karanfilköy and Fatih Sultan Mehmet within the larger framework of Turkish informal housing and generative urban design theory.

The construct of wholeness (mentioned in the research questions) is described within the constructs of living structure and pattern languages in the case analysis. Because of this analysis within other constructs and not by itself, wholeness is observed as more of a sub-construct.

This study omits Alexander's "felt wholeness" and "mirror-of-the-self test" (2002a, 298-402, 472). This test could make the study's analysis of living structure and wholeness more robust. However, these tests are left out because of time constraints and the likely need for additional researchers. In order for their methods to be reliable, structures or items need to be evaluated in pairs against each other. For example, comparing two photographs of objects and answering the question, "Which object is more of a mirror of the self?" (Although seemingly qualitative, Alexander makes a good argument that these measures of wholeness are quantitative, valid and reliable). The contrasting pairs would likely need to be structures outside of the settlements, such as planned housing in Istanbul. Additionally, the pairs would be very numerous in number in order to ensure valid results (i.e., one selected element from a squatter settlement would need to be evaluated against all selected elements from a planned settlement, and vice versa). This analysis would take too much time and would likely require additional researchers, which makes it beyond this study's scope.

3.5 Data Collection and Analysis

Data Sources

According to Yin, six data sources can be used for a case study: documents, archival records, interviews, direct observation, participant observation, and physical artifacts (2003, 85-97). This study uses published literature on the object of study (*documents*), *archival research/records*, and critical, direct analysis of artifacts (*direct observations* and *physical artifacts*) (Table 3.2).

The *documents* (i.e., published literature about the study's main units of analysis, Karanfilköy and Fatih Sultan Mehmet neighborhoods) for the study include any previous reports, accounts (as an interview of a scholar studying these settlements – not of the residents themselves), scholarly articles, demographic data, and published administrative documents. These documents are small in number. Nonetheless, they are used to inform the case descriptions of each settlement. They are particularly useful in informing the analytical framework for Karanfilköy's and Fatih Sultan Mehmet's development processes over time. These documents are also used to inform and contextualize the final cross-case synthesis conducted for the study. The small amount of data available is a limiting factor on published literature as a data source. Also, low retrievability, biased selectivity if the collection is small, reporting bias of the document's author, and lack of access are all limitations of documentation/published literature (Yin 2003, 86).

The *archival research and records* used for the study include historic aerial photos, maps and demographic data. Like the aforementioned documents/published literature, the archival records are used to inform case descriptions and the cross-case synthesis. They are also used to analyze the processes and patterns of development over time for each settlement. They are important in determining *how* the settlements have or have not developed in a generative process. Some limitations of this data source are availability and gaps in time. Indeed, the maps and aerial photographs procured have gaps that number many years. The researcher is then forced to interpolate patterns and processes of development that bridge the time-gap between maps. This is not such a problem for observing organic patterns and structures, but it is a limiting factor in terms of observing *processes*. As in the previous data source, archival records can have the limitations of low retrievability, biased selectivity if the collection is small, reporting bias of the document's author, and lack of access (Yin 2003, 86).

Direct observations used for this study include photographs of the settlements (taken by author) and field notes, including observations on degrees-of-life test; placement, indentifying of structures; and indentifying patterns; and observations of social-spatial characteristics of generative development . The degrees-of-life test is conducted using observations of photographs and on site evaluation. This quantitatively measures the construct of "living structure" in the settlements. The observations and recording of patterns measure the construct of "pattern languages" in the settlements. Identifying and recording structures' characteristics and placements is used in the case descriptions and cross-case synthesis. Limitations to using direct observations include the possibility of researcher bias through selective observations. Yin points out that multiple researchers could be used to increase reliability of observational evidence (Yin 2003, 92-93). Unfortunately, that is not feasible for this study. Other limitations of observations is that they are time consuming, there can be a high cost, and reflexivity – that the event may occur differently because of the presence of the observer (Yin 2003, 86). For this study these are not a great concern. In the case of reflexivity, this study is observing physical structures and patterns, so it is of modest concern.

Physical artifacts include small scale structures that might be observed in the settlements (such as a tool or work of art). These, if observed, are used to inform the case descriptions and cross-case analysis. These small scale structures are important because they have potential, as Alexander says, to contribute to the living structure as a whole (Alexander 2002a). They are also important to include as potential data sources because (in this study) they might bring up questions that the researcher did not know to ask. For instance, if a researcher finds a small scale artifact that provides evidence for or against generative development processes, living structure, and/or pattern languages being found in the settlements, than the researcher should have the option to use it in the case description and analysis as evidence. Some limitations to physical artifacts are that they are prone to selectivity bias and lack of availability, and, "have less potential relevance in the most typical kind of case study" (Yin 2003, 86, 96).

These multiple methods and data sources are combined to form a coherent work that measures the constructs of generative development processes, living structures and pattern languages. Data triangulation (i.e., multiple sources of data) and methods triangulation are used for the study. Convergence of evidence is used to meta-analyze the main units of analysis. The balance of these multiple sources increases construct validity.

As Yin points out, the ability to use multiple data sources is a major strength of case study research (Yin 2003, 97-100).

Table 3.2: Data sources

Data source	Specific source
Documents	• Studies on each settlement • Demographic data • Administrative documents (if available)
Archival records	• Historic and current aerial photos (from Istanbul Municipality) • Historic and current maps, GIS files, and/or AutoCAD files • Historic photos (if available) • Historic demographic data (if available)
Direct observations	• Photographs • Field notes, including: - Possibly degrees of life test in the field - Written dimensions of structures - Written placement of structures - Identifying & counting structures and features - Identifying & counting patterns
Physical artifacts	• Possible small scale structures or items found in each settlement

The data collection instruments for the field include a: notebook, pen, digital camera, map of Karinfilkoy and Fatih Sultan Mehmet, and a Turkish/English dictionary.

Data analysis

Data analysis for embedded units of analysis

The embedded units of analysis address measurements of living structure by conducting mathematical analysis of degrees of life as proposed by Salingaros (2006a, 104-128). (See Appendix B for a thorough explanation of how to estimate each component). The degrees of life calculation is explained below:

$L = T\,H; \quad C = T(10\text{-}H),\ \ 0 \leq C < 100$

Where,

L = Degree of Life

T = Architectural temperature

H = Architectural harmony

$T = T_1 + T_2 + T_3 + T_4 + T_5$

$H = H_1 + H_2 + H_3 + H_4 + H_5$

C = Architectural Complexity

Definitions:

Temperature

The architectural temperature T is constituted as five components, each of which assumes a value of 0 to 2. Very little = 0; some = 1; considerable = 2. The total temperature T ranges from a score of 0-10 (ibid, 107).

T_1 = intensity of perceivable detail

T_2 = density of differentiations

T_3 = curvature of lines and forms

T_4 = intensity of color hue

T_5 = contrast among color hues

Harmony

“The architectural harmony H is constituted as five components, each of which assumes a value of 0 to 2” (ibid, 110). Very little = 0; some = 1; considerable = 2. The total harmony H ranges from a score of 0-10 (ibid, 110).

H_1 = reflectional symmetries on all scales

H_2 = translational and rotational symmetries on all scales

H_3 = degree to which distinct forms have similar shapes

H_4 = degree to which forms are connected geometrically to one another

H_5 = degree to which colors harmonize (ibid, 110).

An elevation (as photograph), other photographs, and on-site observation are used for analysis. Salingaros states that, to his knowledge, the degrees of life test has not been conducted at a scale beyond an individual building, such as the scales of neighborhood, block, outdoor spaces or multiple buildings (Salingaros 2010). This study intended to use the degrees of life test at the scales of the block/multiple buildings, the individual building and the open spaces incorporated into the block. Subsequently, this could provide an additional new contribution to generative urban design theory. However, it was found while conducting the study that this was unattainable (this is described in more detail in Chapter Five). Because of this, the degrees of life test is only implemented at the scale of the individual building.

Data analysis for main units of analysis

Case descriptions are written qualitatively and quantitatively, with an emphasis on the following questions:

1) Do structures and patterns in Istanbul informal settlements form wholeness and living structure (as defined by Christopher Alexander (2002a))? How do they meet and fail the criteria for wholeness/living structure? How are the living structures similar in the two settlements? How are they different?
2) What are the degrees of life of structures in Karanfilköy and Fatih Sultan Mehmet (Alexander, 2002a, 469-472, Salingaros 2006a, 104-128)?; and
3) What "pattern languages" are found in Karanfilköy and Fatih Sultan Mehmet (Alexander 2002b, 341-368)?
4) Evaluate the process of development - How is it and is it not an example of a generative unfolding over time? How do each settlement's development processes fit Alexander's *social-spatial characteristics of generatively developed places* (Table 2.6)? How were/are the processes different for Karanfilköy and Fatih Sultan Mehmet? Additionally, the processes of development are clarified (as much as possible with the available data) in reference to the influences of government, society and culture. This includes attempting to clarify how influential religion is in the development processes and resulting built structures.

The main units of analysis are evaluated for patterns at the scale of the entire settlement. This is done by analyzing current aerial photographs and figure-ground maps in plan view. This analysis quantifies patterns present / develops a pattern language (Alexander 1977; 2002b, 341-368).

Case descriptions are written that provide an analytical framework for Karinfilkoy's and Fatih Sultan Mehmet's development processes over time. In particular, the cases describe and quantified how each settlement's development processes are and are not examples of generative processes. Historic aerial photographs, maps, and demographic data are analyzed to determine spatial growth trends over time. Lupela successfully used this technique in his study (2002, 84). This part of the case analysis answers the questions of generative development processes (Item 4 above).

A cross-case synthesis (Yin 2003, 133-137) is conducted summarizing how Karanfilköy and Fatih Sultan Mehmet are similar and different in regards to their development processes, levels of wholeness / degrees of life, and found patterns.

Results from the analysis of the embedded units of analysis are used to inform the main unit of analysis. That is, a global, holistic analysis is conducted of each settlement which takes regard for the results at all scales studied within the settlement. This is similar to Yin's convergence of evidence used to arrive at conclusions about the study (2003, 100). In regard to writing a pattern language for each settlement, it is thought that some patterns may not become apparent until they are analyzed at the embedded unit of analysis level. However, pattern languages are only written for the main unit of analysis, which includes patterns found at all scales.

Concluding data analysis

A conclusion addresses inferences and implications from the study for generative urban design theory and for Turkish informal settlements. The study's limitations and areas for further study are also addressed.

3.6 Sampling

The sampling frame is a map of Fatih Sultan Mehmet and Karanfilköy. The sampling size is 16 sites at each sub-unit of analysis for each study area. That is, each settlement contains 16 sites or observation points that look at the individual building. Together both settlements have 32 observations. Dixon states that, "In general, a sample of 30 is the smallest that can be expected to conform to the normal distribution on which sampling theory is based" (1977, 11).

The sampling design uses systematic unaligned sampling (also known as unaligned grid sampling or nonaligned systematic sampling) to select sites at the embedded units of analysis (Dixon et al. 1977; Ripley 2004, 19-27; Gilbert 1987). This method ensures that samples are gathered from throughout the study areas in order to capture possible variance of different areas (although there are not enough known variances at this time to divide the site into separate strata). Gilbert states that, "this design combines the useful aspects of random, stratified, and systematic sampling methods" (1987, 93).

Each settlement is divided into a grid with 16 areas (Figures 3.33 and 3.34). One sample point in each square of the grid is chosen using the unaligned grid sampling technique (Dixon et al. 1977, 33). From this point the nearest road with buildings is chosen, where one sample is taken at the building scale.

Figure 3.33: Karanfilköy sampling locations

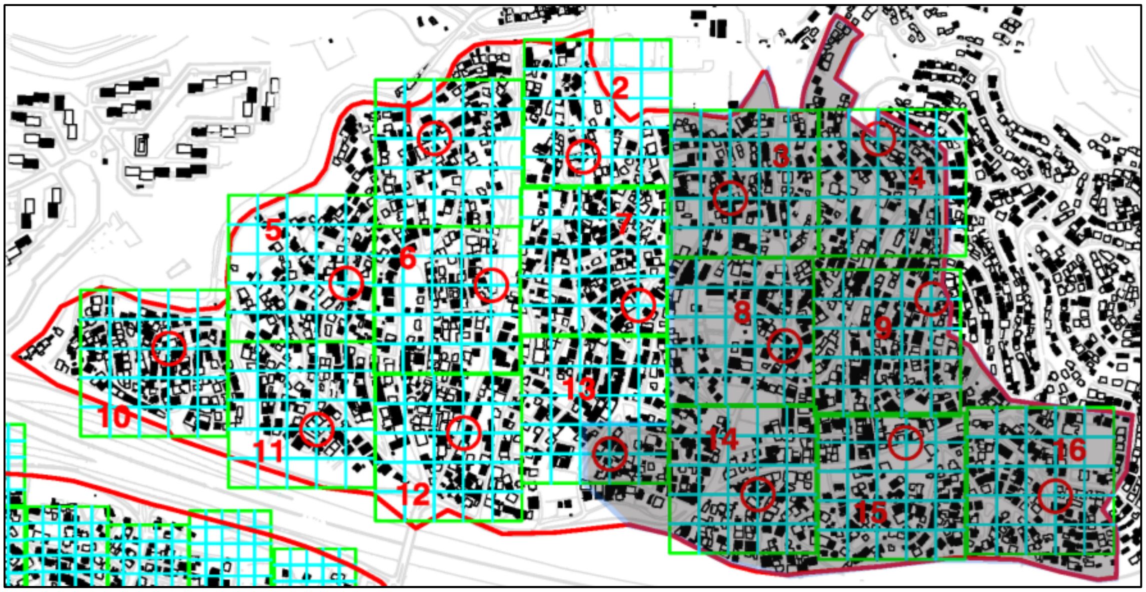


Figure 3.34: Fatih Sultan Mehmet sample locations and un-sampled area (shaded)

3.7 Addressing Validity and Reliability Issues

Construct validity

Construct validity is accounted for by uses multiple modes of data gathering and using established and accepted construct definitions provided by Christopher Alexander. Data triangulation helps to ensure that the measures of wholeness, living structure, and patterns in Karanfilköy and Fatih Sultan Mehmet are valid. (Yin 2003, 97-99; Singleton et al. 2005, 381-384; Tashakkori et al. 1998, 91).

A threat to construct validity is the reliance on the new methodologies provided by Alexander and Salingaros (2002b; Alexander 2002a; 2005a; 2004; Salingaros 2006a). These methods push the boundaries of empirical science by relying on the researchers' personal understanding and evaluation of wholeness/living structure components. Data triangulation (i.e., multiple data sources) and multiple measures of the construct help increase construct validity for the study.

The degrees of life test is also conducted on separate test cases outside of the study area - the planned, modern social housing project, Grossfeldsiedlung, in Vienna, Austria (Figure 3.35); two Post-modern apartment buildings in the Nineteenth District in Vienna, Austria (Figure 3.36); the Post-modern Spittelau Viaducts Housing Project in Vienna, Austria (Figure 3.37); the Hagia Sophia in Istanbul (Figure 3.38); and the Pompidou Center in Paris, France (Figure 3.39). Grossfeldsiedlung is a social housing project built in the 1960s and is notorious for its monotony and uniform parallel blocks (Forster 2005, 11). Because of this monotony, it is predicted to score low on the degrees of life test and particularly low on Temperature. The Post-modern Vienna examples are predicted to score even lower in the degrees of life test due to lack of symmetries and scaling hierarchies. The Hagia Sophia and Pompidou Center were evaluated by Salingaros and are a test to see how close the researcher's scoring of the degrees of life test match Salingaros's (Salingaros 2006a, 109). In order to reach broader conclusions about generative design theory and the degrees of life test conducted in Karanfilköy and Fatih Sultan Mehmet, the researcher should score close to what other researchers (i.e., Salingaros) scored. That is, the degrees of life test can be better assumed to validly and reliably measure the construct. It is thought that conducting the degrees of life test on these test cases will assess whether the degrees of life test (and the researcher conducting the test) is really validly measuring living structure.

Figure 3.35: Grossfeldsiedlung social housing complex, Vienna, Austria (Vogl 2008)

Figure 3.36: Post-Modern housing - Nineteenth District, Vienna, Austria

Figure 3.37: Spittelau Viaducts Housing Project, Vienna, Austria

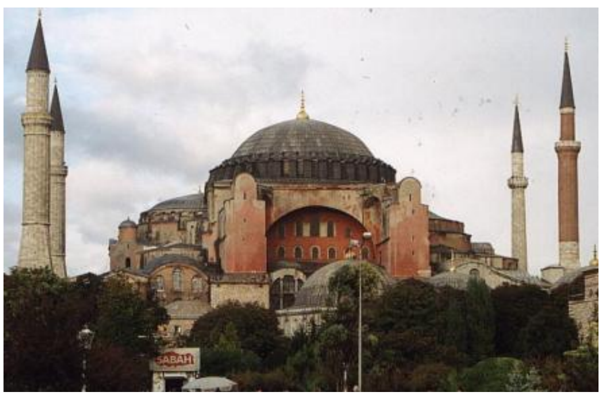


Figure 3.38: Hagia Sofia, Istanbul, Turkey (Furbush 2011)

Figure 3.39: Pompidou Center, Paris, France

Lastly, this study does not seek to prove or refute the generative urban design theories proposed by Alexander and Salingaros. Instead, the study seeks to make a *contribution* to the body of generative urban design theory. Arguments for or against the theories proposed by Alexander and Salingaros are beyond the scope of this dissertation.

Internal Validity

Internal validity is countered through pattern matching, logic models, and addressing possible rival explanations (Yin 2003, 34-36). Rival explanations may not become apparent until data is collected and analyzed.

External Validity

Analytical generalization is provided by relating the findings to established theories of generative urban design. However, stronger external validity could be established by replicating findings by conducting case studies of more Istanbul informal housing settlements. However, because Karinfilkoy and Fatih Sultan Mehmet are in many ways considered typical informal housing examples (Ergun 2008), and because resources are limited, the study is limited to two districts.

Reliability

The reliability is tested by conducting two case studies and cross analyzing them. Also, maintaining a clear chain of evidence (i.e., documenting the procedures) allows others to reveal the source of any conclusions (Yin 2003, 105-106). Thirdly, the case conducts quantitative and qualitative analysis with multiple units of analysis, which helps increase reliability (Singleton et al. 2005, 97). Finally, adhering to a specific case study protocol helps increase reliability (Yin 2003, 33-39; Singleton et al. 2005, 90-97).

3.8 Summary

This study is guided by Sayer's metaphor of a triangle consisting of method, object and purpose. As Sayer states, "Methods must be appropriate to the nature of the object we study and the purpose and expectations of our inquiry" (Sayer 1992, 4). That is, these three components are used to inform each other. Specifically, the *objects* of study are the development processes, structures and patterns in the Istanbul informal settlements of Karanfilköy and Fatih Sultan Mehmet. The *purpose* of the study is to find out to what extent the development processes, structures and patterns of the Istanbul informal neighborhoods of Karanfilköy and Fatih Sultan Mehmet can be linked to generative urban design theory. The *methods* of the study include an explanatory case study using documentation, archival records, direct observations and physical artifacts.

CHAPTER FOUR

DEGREES OF LIFE IN KARANFILKÖY AND FATIH SULTAN MEHMET

4.1 Introduction

This chapter uses Salingaros arithmetic function to measure the degrees of life and complexity of buildings in Karanfilköy, Fatih Sultan Mehmet, and in test cases for construct validity. Salingaros ran the degrees of life test for 25 famous buildings (See Appendix B) (Salingaros 2006a, 109). He states that for his estimates he, "used a variety of published photographs, coupled in some cases with my personal recollection of those buildings in the list that I have experienced first hand" (Salingaros 2006a, 109). This study uses photographs taken by the researcher, an on-site degrees of life evaluation, and the researcher's personal recollection of each site. The results in Appendix C show a photograph for each site. However, these were not the only photographs used in estimating the degrees of life.

The degrees of life test was originally planned to be used at the scale above the individual building, such as the block scale. While collecting data and trying to assess the degrees of life on site, it became apparent that the instrument does not work well at the larger scale in the study areas. The study areas' buildings usually do not aggregate into wholes that can be analyzed with the degrees of life test. Because of this, the assessment is unlikely a valid measure at the block/multiple building scale. So, the degrees of life test is only used for individual buildings.

The results of each site's Temperature and Harmony subscores, the degree of life score and the architectural complexity score are all located in Appendix C. Descriptive statistics are used to analyze the data.

Unexpected sampling error

Each settlement was to have sixteen sample sites from the total study area using the unaligned grid sampling technique, as explained in Chapter 3. Karanfilköy does have 16 samples from the entire study area using the unaligned grid sampling technique. Fatih Sultan Mehmet, however, only includes samples from a little over half the study area (Figure 4.1). This is because there were potential safety risks for the researcher in one part of the settlement. These risks, to the best of the researcher's knowledge, were not due to the research being conducted. Instead, the risks were simply because of general safety issues (although based on specific warnings). The unaligned grid sample sites determined by the investigator were still used, but some sites instead had two or three samples to make up for the unsampled areas. The decision to sample by doubling and/or tripling sample sites (instead of, for example, redrawing the entire grid on the safe areas of the settlement) was made in the field. The decision had to be made quickly in order to successfully finish the sampling and degrees of life evaluations. The sample is still representative enough to offer valid and reliable results because the form is similar between the sampled and unsampled areas. This similar form assessment is based on previous visits to the unsampled area and the analysis of aerial photographs (Figure 4.2). The aerial photographs show similar form patterns. The previous site visits revealed a similar mix of low-rise and multi-story buildings in both sides of the settlement. Because of these observations, the areas sampled are considered valid, representative samples of Fatih Sultan Mehmet's entire area.

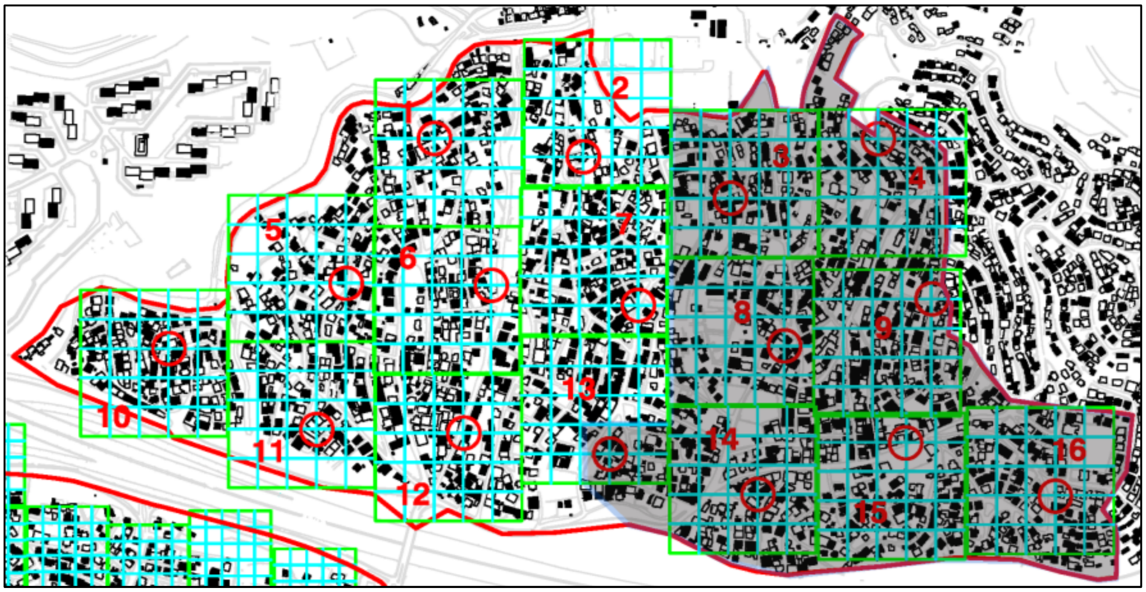


Figure 4.1: Fatih Sultan Mehmet sample locations and un-sampled area (shaded)

Figure 4.2: Aerial Photograph – 2007 - Karanfilköy and Fatih Sultan Mehmet (ibid)

4.2 Degrees of Life Test Cases for Construct Validity

In order to test the construct validity – specifically the researcher conducting the degrees of life test – separate cases are used to test the instrument: the planned, modern social housing project, Grossfeldsiedlung, in Vienna, Austria; two Post-modern apartment buildings in the Nineteenth District in Vienna, Austria; the Post-modern Spittelau Viaducts Housing Project in Vienna, Austria; the Hagia Sophia in Istanbul; and the Pompidou Center in Paris, France.

Full results are found in Appendix C.

Grossfeldsiedlung, Vienna, Austria – A Modern social housing project

The social housing block of Grossfeldsiedlung in Vienna Austria is used as a case to test the construct validity of the degrees of life test and the researcher conducting the test. Grossfeldsiedlung is known as a very banal social housing project (Forster 2005, 11). It is thought that this settlement should score low on the degrees of life test. If it does not score low, the degrees of life test and researcher need to be reevaluated for construct validity.

Grossfeldsiedlung is sampled using eight sites. The sample size is not as large as in the two main study neighborhoods, because it is not necessary for the testing of construct validity. If the study was seeking to compare and contrast planned verses unplanned settlements, for example, then it would be necessary to use a similar sampling size as used in Karanfilköy and Fatih Sultan Mehmet. However, as a test of construct validity, eight sites should be adequate. The buildings sampled were all so similar that they all scored exactly the same in every measure. Grossfeldsiedlung scored an 8 on the degrees of life scale and a 2 in Complexity. These low scores were expected and help to bolster the construct validity. One interesting result is that it scored a high Harmony score of 8 due to symmetries and uniformity.

Spittelau Viaducts Housing Project, Vienna, Austria – A Post-Modern building

The Spittelau Viaducts Housing Project scored very low: 3 on the degrees of life test and 7 on Complexity. These low scores were predicted and help bolster the construct validity.

Nineteenth District, Vienna Austria – Post-Modern housing

The two Post-modern housing examples in Vienna also scored very low: 3 on the degrees of life test and 7 on Complexity. These low scores were predicted and help bolster the construct validity.

Hagia Sophia, Istanbul, Turkey and the Pompidou Center, Paris, France

Salingaros evaluates 25 architecturally renowned buildings using the degrees of life test (Salingaros 2006a, 109). Among these are the Hagia Sophia in Istanbul, Turkey and the Pompidou Center in Paris, France. These two buildings are evaluated in order to compare the researcher and Salingaros in their degrees of life test methodology.

The Hagia Sophia scores degrees of life of 90, and Complexity of 10. This compares to Salingaros's scores of degrees of life of 80, and Complexity of 20. The

Pompidou Center scores degrees of life of 28, and Complexity of 42. Salingaros scored the Pompidou Center as degrees of life of 24 and Complexity of 36. The researcher is close to Salingaros in the assessment of degrees of life. With the Hagia Sophia, Harmony was rated one point higher. In the Pompidou Center, Temperature was rated one point higher. So, given Salingaros's statement that these are estimates and not perfect assessments, the researcher's scores and Salingaros's scores seem close enough to each other to bolster the construct validity and reliability of the measurement instrument, researcher and process (2006a, 107).

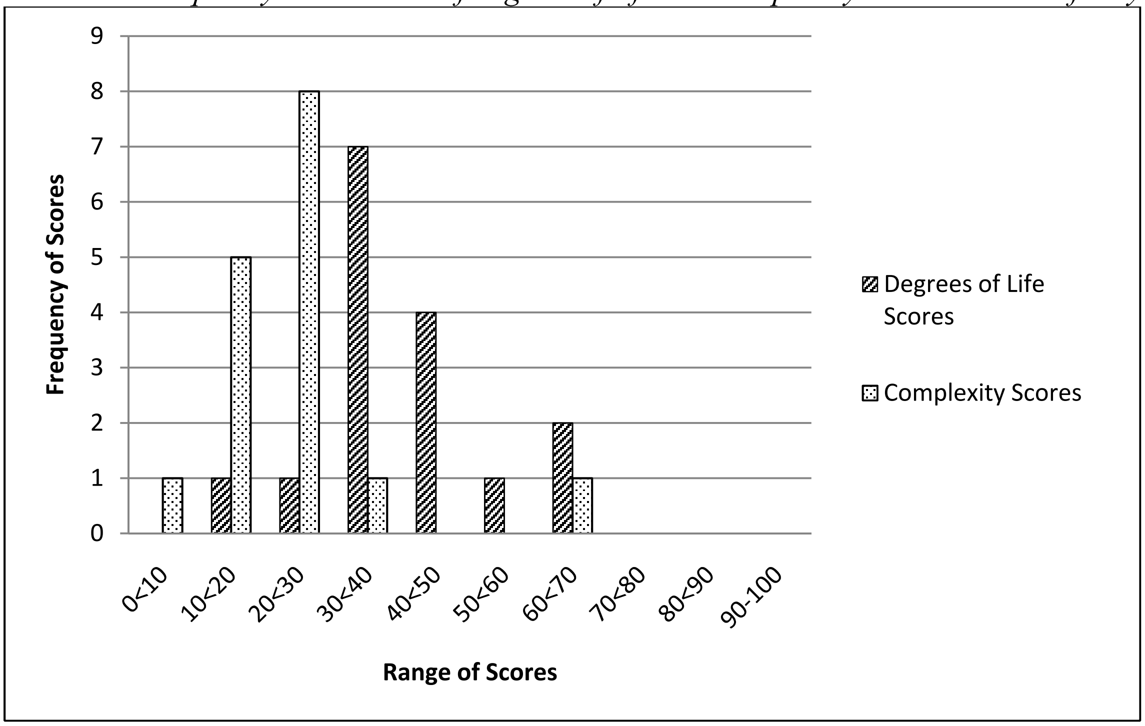
4.3 Degrees of Life in Karanfilköy

See Table 5.1 for the results of the degrees of life test in Karanfilköy. Sixteen sites were sampled. The average degrees of life score is 41.00, with the standard deviation of 12.94. The range of scores for the degrees of life test is 16 to 63. The average Complexity score is 23.38, with a standard deviation of 12.87. The average Temperature score is 6.44, with a standard deviation of 1.44. The average Harmony score is also 6.44, with a standard deviation of 1.50. Table 5.2 gives the frequency distribution of scores for degree of life and Complexity.

Table 4.1: Data summary – Averages and standard deviations for Karanfilköy

	Avg	*SD*		*Avg*	*SD*						
T_1 =	1.31	0.48	H_1 =	1.31	0.60						
T_2 =	1.31	0.48	H_2 =	1.31	0.60						
T_3 =	1.00	0.00	H_3 =	0.94	0.25						
T_4 =	1.56	0.81	H_4 =	1.06	0.25						
T_5 =	1.25	0.45	H_5 =	1.81	0.40		*Avg*	*SD*		*Avg*	*SD*
***T* =**	**6.44**	**1.41**	***H* =**	**6.44**	**1.50**	***L*=**	**41.00**	**12.94**	***C* =**	**23.38**	**12.87**

Table 4.2: Frequency distribution of degrees of life and complexity scores in Karanfilköy



Some interesting results include the high average scores for T_4 - *intensity of color hue*, and H_5 = *degree to which colors harmonize*. These scores are caused by the rich, bright and warm colors that many of the buildings are painted. These high scores also indicate a high level of color harmony. This feature – the feature of color – is judged to be well understood in Karanfilköy, as the degrees of life test indicates a balance of high temperature and high harmony. This is seen well in Sites 10, 11 and 15 (Figures 4.3 - 4.5 and Tables 4.3 – 4.5).

Sites 10 and 11 are examples of buildings with overall high degrees of life in Karanfilköy.

Figure 4.3: Site 10 – Karanfilköy

Table 4.3: Data - Site 10 – Karanfilköy

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 9}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 63}$	$\boldsymbol{C = 27}$

Figure 4.4: Site 11 – Karanfilköy

Table 4.4: Data - Site 11 – Karanfilköy

$T_1 = 2$	$H_1 = 2$		
$T_2 = 2$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 9}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 63}$	$\boldsymbol{C = 27}$

Figure 4.5: Site 15 – Karanfilköy

Table 4.5: Data - Site 15 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 49}$	$\boldsymbol{C = 21}$

Another interesting feature is the use of details - such as curved and intricate window grates, richly colored roof tiles, and scalloped fascia boards – that repeatedly raised the scores of T_1 - *intensity of perceivable detail*, T_2 - *density of differentiations*, and T_3 - *curvature of lines and forms*. If these often simple details were left off or more streamlined, the average Temperature would have scored much lower in Karanfilköy.

For example, Sites 9 and 13 have their T_1, T_2, and T_3 scores raised from 0 to 1 mostly due to the detailed window bars, fencing, gate and visible corrugated roof (Figures 4.6 – 4.7 and Table 4.6 - 4.7).

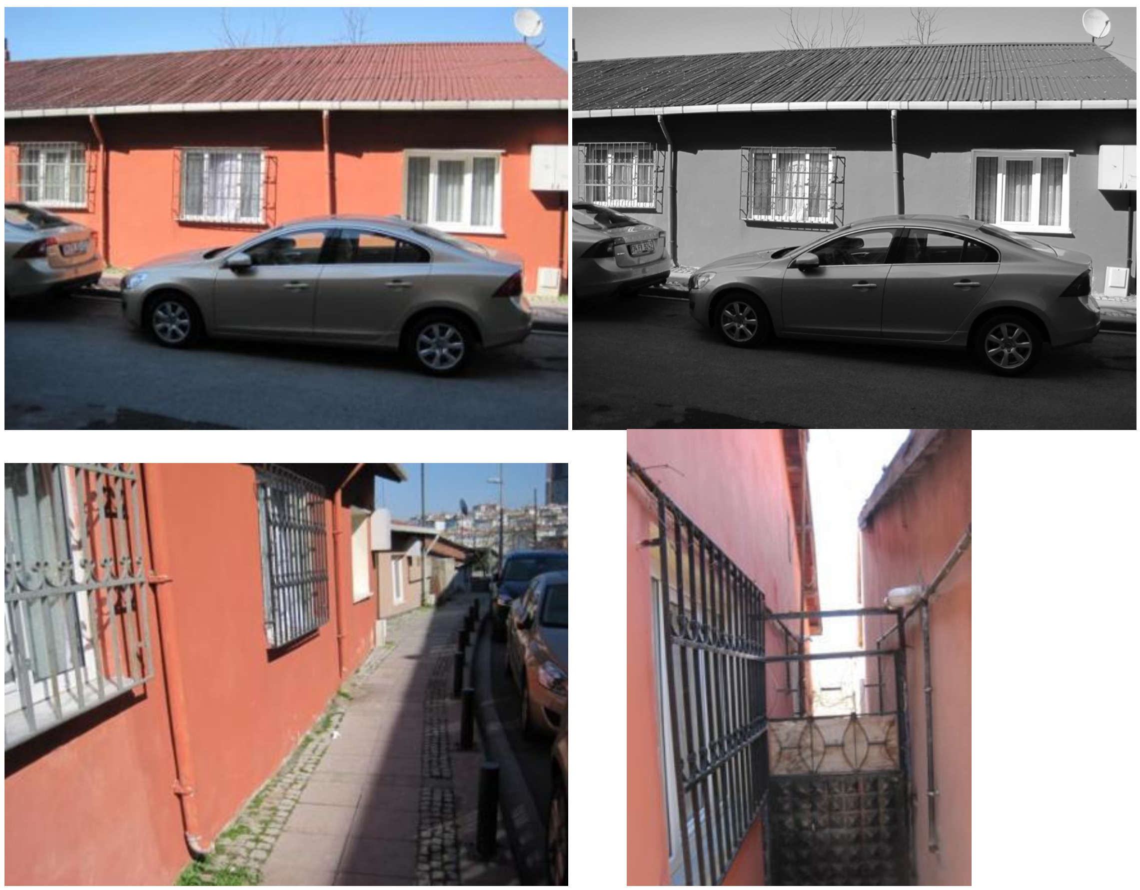


Figure 4.6: Site 9 – Karanfilköy

Table 4.6: Data - Site 9 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 8}$	$\boldsymbol{L = 48}$	$\boldsymbol{C = 12}$

Figure 4.7: Site 13 – Karanfilköy

Table 4.7: Data - Site 13 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 36}$	$\boldsymbol{C = 24}$

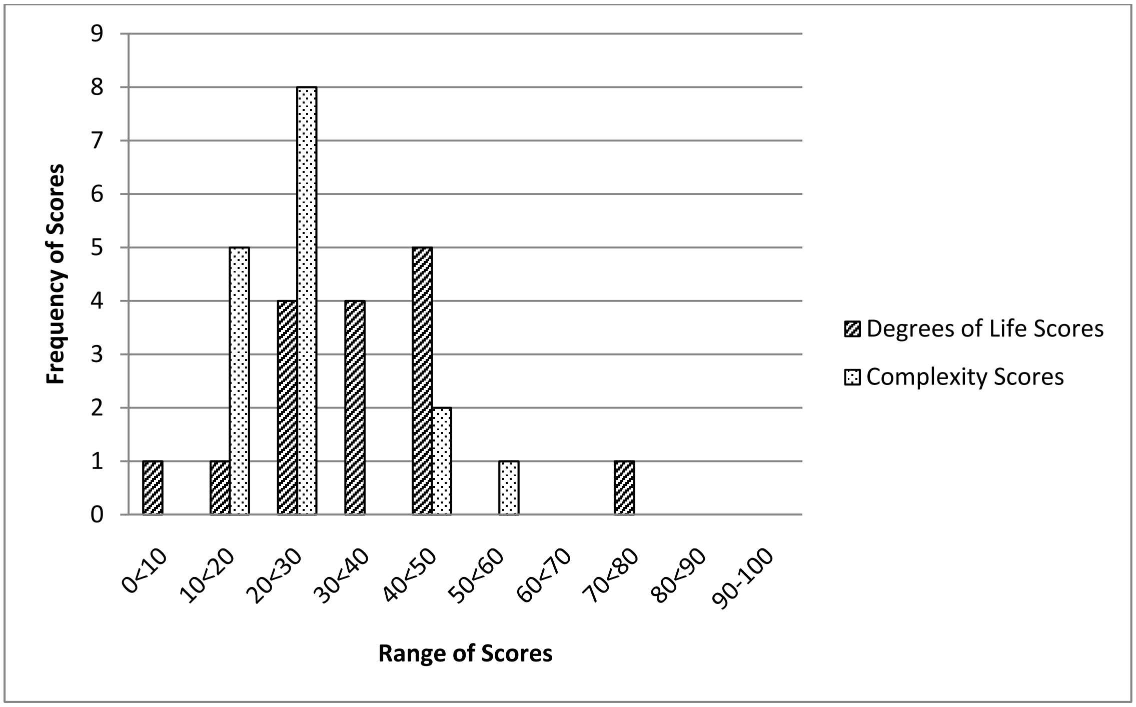
4.4 Degrees of Life in Fatih Sultan Mehmet

See Table 5.3 for the results of the degrees of life test in Fatih Sultan Mehmet. Sixteen sites were sampled. The average degrees of life score is 34.75, with the standard deviation of 15.29. The range of scores for the degrees of life test is 6 to 72. The average Complexity score is 27.13, with a standard deviation of 12.75. The average Temperature score is 6.19, with a standard deviation of 1.28. The average Harmony score is also 5.56, with a standard deviation of 1.90. Table 5.4 gives the frequency distribution of scores for degree of life and Complexity.

Table 4.8: Data summary – Averages and standard deviations for Fatih Sultan Mehmet

	Avg	*SD*		*Avg*	*SD*						
T_1 =	1.31	0.60	H_1 =	1.13	0.50						
T_2 =	1.31	0.48	H_2 =	1.13	0.62						
T_3 =	0.75	0.45	H_3 =	0.88	0.50						
T_4 =	1.56	0.73	H_4 =	1.06	0.25						
T_5 =	1.25	0.45	H_5 =	1.38	0.72		*Avg*	*SD*		*Avg*	*SD*
***T* =**	**6.19**	**1.28**	***H* =**	**5.56**	**1.90**	***L*=**	**34.75**	**15.29**	***C* =**	**27.13**	**12.75**

Table 4.9: Frequency distribution of degrees of life and complexity scores in Fatih Sultan Mehmet



Site 5a has the highest degree of life score in Fatih Sultan Mehmet. Perhaps ironically, within about one block of this building is the building with the lowest degrees of life score, 5c (See Figures 4.8 - 4.9 and Tables 4.10 – 4.11).

Fatih Sultan Mehmet has high average scores for T_4 - *intensity of color hue*. This high score is caused by the rich, bright and warm colors of many of Fatih Sultan Mehmet's buildings. Sites 5a, 10 and 11c are good examples of these rich colors (Figures 4.8, 4.10 – 4.11 and Tables 4.10, 4.12 – 4.13).

Figure 4.8: Site 5a – Fatih Sultan Mehmet

Table 4.10: Data - Site 5a – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 2$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{9}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{72}$	$\boldsymbol{C} = \mathbf{18}$

Figure 4.9: Site 5c – Fatih Sultan Mehmet

Table 4.11: Data - Site 5c – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 0$		
$T_2 = 2$	$H_2 = 0$		
$T_3 = 1$	$H_3 = 0$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 0$		
T = 6	**H = 1**	**L = 6**	**C = 54**

Figure 4.10: Site 10 – Fatih Sultan Mehmet

Table 4.12: Data - Site 10 – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{6}$	$\boldsymbol{L} = \mathbf{36}$	$\boldsymbol{C} = \mathbf{24}$

Figure 4.11: Site 11c – Fatih Sultan Mehmet

Table 4.13: Data - Site 11c – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 42}$	$\boldsymbol{C = 28}$

4.5 Summary

The average degree of life for all sites in both settlements is 37.88. This average is lower than many of the Architectural masterpieces analyzed by Salingaros (2006a, 109). However, it is higher than most of the famous 20th century buildings Salingaros analyzed (ibid). There are certainly aspects of the buildings that could be improved in order to raise the degrees of life scores in the settlements. However, it can be concluded that Karanfilköy and Fatih Sultan Mehmet contain buildings with a higher degree of life than most modern 20th century buildings – particularly the buildings analyzed in section 5.2 and those modern examples analyzed by Salingaros (ibid).

Some specific features that repeatedly raise the life of structures in both settlements include:

- vibrant and rich colors;
- corrugated roofs;
- scalloped fascia;
- red, clay tile roofs;
- intricate wrought iron fences;
- detailed wrought iron window safety bars;
- strong earth border around the building connecting it to the earth;
- vines and other plants on and/or near the house.

A comparison and analysis of the degrees of life in Karanfilköy and Fatih Sultan Mehmet is included in Chapter Seven - Synthesis.

CHAPTER FIVE

PATTERN LANGUAGES IN KARANFILKÖY AND FATIH SULTAN MEHMET

> The collective vision which emerges from a pattern language created by a true unfolding process is not just any vision. When people are given the freedom to speak truly about their lives, they have an unconventional wisdom, an idiosyncratic quality, which brings forth unique centers, unique living structures in each situation. That is what we mean by their culture or their "way." It is a shared vision, not a typical one, not part of the conventional professional wisdom of architects and planners, more like the voice of Dostoevsky.
>
> Christopher Alexander, *The Nature of Order – Book Three* (2005a, 281-282)

> The notion of a collective intelligence embodied in patterns should not be understood as a claim to have discovered a final truth, but rather as recognition of the importance of a living process. It re-establishes the cultural capacity to engage in place making as a collaborative social process. Success is not measured in abstract terms, but rather by the local experience of continuous improvement in the quality and sustainability of human settlements. The use of patterns in design provides a necessary foundation for a collaborative method that is adaptive and particular to a place (i.e., the constraints of the moment), yet is also capable of responding to human aspirations for something better.
>
> Nikos Salingaros, et al, "Favelas and Social Housing: The Urbanism of Self-Organization" (2006b, 19)

5.1 Introduction

Patterns are found using Alexander's 11 essentials of pattern language theory (Table 2.8) (Alexander 2002b, 344-345). Observing and recording recurring patterns, using Alexander's *11 features* as a guide, occurs at the main units of analysis (the settlements as a whole), while observations also take place at the embedded units of analysis. The result is a "pattern language" for each settlement. It should be noted that this study uses Alexander's *Features* numbered 1-9, as 10-11 are more about applying a pattern language to planning, design and development projects, where as this project is concerned with observation (Table 2.8).

Alexander points out that identifying patterns is really about identifying centers and wholeness (as he defines these constructs in *The Nature of Order – Book One*) (Alexander 2002b, 342-368). He describes this process:

> Each pattern is a rule which describes a type of strong center that is likely to be needed, on a recurring basis, throughout a particular environment or class of environments. Further, a pattern not only describes a recurring center, but also describes a relation between *other* generic centers. The pattern both describes a generic *center*, and describes a generic *relation* among other generic centers. But it must be remembered that the pattern describes a *generic* center, not a particular center. In this sense the pattern is not so much like an element in an erector set, but more a rule for making a certain kind of center capable of making an infinite number of particular centers of the same type, whenever they are needed (2002b, 345).

Alexander further summarizes the observation technique for discovering a pattern language as follows:

> The essential technique in the observations of centers, in any social situation, and in any culture, is to allow the feelings to generate themselves, inside *you.* You have to say, "What would I do if I were one of the people living here, what would it be like for me?" thus inserting yourself into the situation, and using your own common sense and feelings as a measuring instrument (2002b, 352).

This chapter establishes a pattern language for both Karanfilköy and Fatih Sultan Mehmet. Many of the patterns listed are found in both settlements, and are noted as such. Despite this repetition of patterns, the patterns are listed and described separately for each settlement. This uses replication logic (Yin 2003, 47-51). A separate listing and description also allows an easier comprehensive overview of what makes each settlement unique. Also, some of the patterns may have the same name, but may be realized in physical form differently for each settlement.

Salingaros warns that patterns must be integrated and coupled into a unified whole:

> In writing *A Pattern Language*, Alexander *et al.* (1977) wanted above all a method for generating coherence in the built environment. As clearly articulated by Alexander himself, buildings and urban regions designed according to the `pattern language' , although far more accommodating of human movement and interaction than equivalent structures that violate it, have not always added up to a coherent whole (Alexander, 2000). This practical observation is consistent with our interpretation of patterns as modules and interfaces: one can put them together correctly but still not recover (or generate) the emergent properties of a coherent system, such as the essential qualities of great historical buildings or urban regions that have developed over time. Even though a driving criterion for distilling each individual pattern originally was `to what extent does this pattern contribute to generate a unified whole?' achieving system wholeness depends upon the organization of connections outside the `pattern language' (2000, 304).

This chapter's results must be read in the context of the other results of this study. That is, the connections formed outside the pattern language of each settlement (such as, the generative processes of development) need to be understood as integral to the success of each settlement's patterns.

Some of the patterns found in each settlement are patterns found in *A Pattern Language* and The Nature of Order – Book Two (Alexander 2002b; Alexander et al. 1977, 1171). As Alexander mentions, there are patterns unique to each place, as well as patterns that are successful across various cultures and places (Alexander 2002b, 344-348). This study identifies both.

5.2 Pattern Language of Karanfilköy

The following list identifies and sometimes briefly describes (often with an accompanying image) patterns found in Karanfilköy that contribute to greater wholeness and stronger centers. The list is divided into categories of spatial, structural and/or social characteristics.

House, garden and street relationships

1. Gardens near the street

Karanfilköy has many gardens adjacent to the street. This includes seasonal gardens.

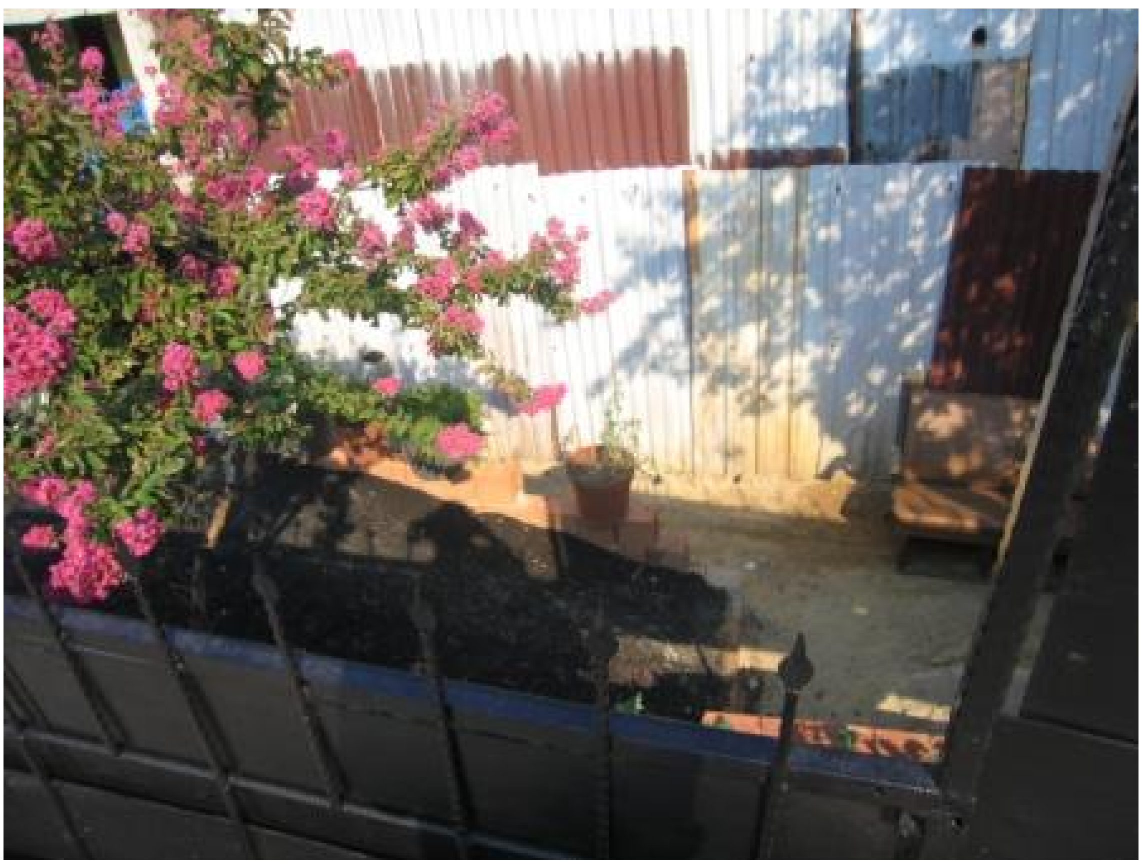


Figure 5.1: Gardens near the street - Karanfilköy

2. Patios between house and street

Figure 5.2: Patio between house and street - Karanfilköy

3. Degrees of publicness / intimacy gradient

There is an intimacy gradient in residences that goes from more public on the street, to semi-public in the patios and gardens, to more private in the homes.

Figure 5.3: Degrees of publicness / intimacy gradient - Karanfilköy

4. Gardens/patios/yards interlock with street

Figure 5.4: Gardens/patios/yards interlock with street - Karanfilköy

Gardens and vegetation

5. Private yards/gardens

Figure 5.5: A Private Garden - Karanfilköy

6. Half-hidden gardens

Many gardens in Karanfilköy are half hidden by low gates, low walls and vegetation. This half-hidden quality provides a simultaneous intimacy and openness; privacy and welcome.

Figure 5.6: Half-hidden gardens - Karanfilköy

7. Walled gardens and yards

Figure 5.7: Walled gardens and yards - Karanfilköy

8. Living courtyards and patios

Figure 5.8: Living courtyards and patios - Karanfilköy

9. Living walls

Many shrubs, trees and walls or fences with vines growing on them form walls between the street and yards and between yards.

Figure 5.9: Living walls - Karanfilköy

10. Gardening (as an activity)

Many residents are active in gardening, including growing vegetables, flowers and caring for trees and shrubs.

11. Extensive pruning and maintenance of plants; Respect and care for trees

Figure 5.10: Respect and care for trees - Karanfilköy

12. Gardens and patios interlock

Gardens and patios flow into each other, helping to form distinct boundaries and spaces. Also, the boundaries where they interlock often become spaces in themselves.

Figure 5.11: Gardens and patios interlock - Karanfilköy

13. Structures modified to accommodate trees

Figure 5.12: Structures modified for trees - Karanfilköy

14. Green space and fences form the street

Figure 5.13: Green space and fences form the street - Karanfilköy

15. Green streets

Figure 5.14: Green streets - Karanfilköy

16. Connection to the earth

Figure 5.15: Connections to the earth - Karanfilköy

17. Fruit trees

Figure 5.16: Fruit trees - Karanfilköy

18. Gardens growing wild

Figure 5.17: Gardens growing wild - Karanfilköy

19. Garden seats

20. Vegetable garden

Figure 5.18: Vegetable gardens - Karanfilköy

21. Climbing plants

Figure 5.19: Climbing plants - Karanfilköy

22. Gardens in buckets and/or pots

Physical characteristics of buildings and other structures

23. 1-2 story houses

24. House clusters/groups

Figure 5.20: House cluster - Karanfilköy

25. Entrance transitions and thresholds

Figure 5.21: Entrance transitions and thresholds - Karanfilköy

26. Gates

Figure 5.22: Gates - Karanfilköy

27. Archways

Figure 5.23: Archways - Karanfilköy

28. Decorative window safety bars

Figure 5.24: Decorative window safety bars - Karanfilköy

29. Roofseats

30. Lean-tos

31. Outdoor rooms

Figure 5.25: Outdoor rooms - Karanfilköy

32. Common areas at the heart

Figure 5.26: Common areas at the heart - Karanfilköy

33. Roughness

Figure 5.27: Roughness - Karanfilköy

34. Warm and rich colors for houses

Figure 5.28: Warm and rich colors - Karanfilköy

35. Outdoor sitting circles/seat spots

36. Front door seats

Figure 5.29: Front door seats - Karanfilköy

37. Different chairs

38. Sitting wall

39. Things from your life

Figure 5.30: Things from your life - Karanfilköy

Networks and infrastructure

40. Loose, informal paths to outside of neighborhood

Figure 5.31: Loose paths to outside of neighborhood - Karanfilköy

41. Taxi Stands

Figure 5.32: Taxi stands - Karanfilköy

42. Dolmus (mini-buses)

43. Busline

44. Hierarchy of Streets

45. Organic street patterns with undulating edges

46. Network of paths, streets and cars

47. Distinct, yet permeable border / Identifiable neighborhood

Figure 5.33: Distinct, permeable borders - Karanfilköy

48. Main gateways (kind of)

Figure 5.34: Main gateway - Karanfilköy

Social activities and relationships

49. Activity nodes

Figure 5.35: Activity nodes - Karanfilköy

50. Household chores in gardens, patios and/or yards

Figure 5.36: Household chores in garden - Karanfilköy

51. Eyes on the street

52. Conversations with passersby

53. Cats

Like most of Istanbul, cats are ubiquitous.

Figure 5.37: Cat - Karanfilköy

54. Dogs – mostly unleashed

55. Mosque – Sacred Space forms a center (even though many are not religious)

Figure 5.38: Sacred space of the mosque courtyard colonnade - Karanfilköy

56. Calm streets

Figure 5.39: Calm streets - Karanfilköy

57. Quiet yards

58. Car-pedestrian symbiosis (on the side/small streets, not on the main roads through the settlement)

59. Streetball – (soccer/football, basketball)

Figure 5.40: Streetball - Karanfilköy

60. Bicycles in the street

61. Connected play (to other children, visitors, adults, nature, the physical neighborhood, etc)

62. Children in street, public spaces and private spaces (with and without adult supervision)

63. Multiple generations (life cycle)

64. Men and women

65. Household mix

66. House for a small family/for one person/for a couple

67. Housing clusters for extended family

68. Old people throughout neighborhood

69. Teenage society

70. Family

Family ties are strong in Karanfilköy. This includes multiple generations, immediate and extended family relationships (Alkan 2006).

71. Friends

72. Web of shopping

The main commercial street provides multiple small businesses.

73. Work community and socio-economic relationships and networking

74. Physical work and adaptations

Figure 5.41: Physical work - Karanfilköy

75. Self-governing workshops and offices

76. Small services without red-tape

The residents often provide direct services, such as repairs and building, by dealing directly with each other.

77. Street cafes and/or food stands on or near the street

78. Restaurants

79. Teahouses for gathering of men

80. Small grocery stores

81. Produce stores

82. Produce sold on streets and from trucks

5.3 Pattern Language of Fatih Sultan Mehmet

The following list identifies and describes (often with an accompanying image) patterns found in Fatih Sultan Mehmet that contribute to greater wholeness and stronger centers. The list is divided into categories of spatial, structural and/or social characteristics.

House, garden and street relationships

1. Gardens near the street

Fatih Sultan Mehmet has some gardens, both in plots and in the ground, near the street.


Figure 5.42: Gardens near the street - Fatih Sultan Mehmet

2. Narrow gathering stoops between house and street


Figure 5.43: Narrow stoops between house and street - Fatih Sultan Mehmet

3. Degrees of publicness / intimacy gradient

Fatih Sultan Mehmet has two main types of intimacy gradients. One is with homes that have a yard, patio or stoop to form semi-public space (as seen in the left image in Figure 6.44). The other is where an apartment building has a zero lot line with the street or sidewalk, but still has some elevation to give privacy to some quarters, such as the higher floors (as seen in the right image in Figure 6.44). In the latter case, the intimacy gradient is weaker.

Figure 5.44: Degrees of publicness / intimacy gradient - Fatih Sultan Mehmet

4. Windows on the street
5. Interplay between interior private house and public street (conversations, etc)

Gardens and vegetation

6. Half-hidden yards

Some yards in Fatih Sultan Mehmet are half hidden by gates, walls and vegetation. Here the hidden yards feel more private and less open to the street than in Karanfilköy.

Figure 5.45: Half-hidden yards - Fatih Sultan Mehmet

7. Living courtyards and patios

Figure 5.46: Living courtyards and patios - Fatih Sultan Mehmet

8. Living walls

Many shrubs, trees and walls or fences with vines growing on them form walls between the street and yards and between yards.

Figure 5.47: Living walls - Fatih Sultan Mehmet

9. Gardening (as an activity)

Many residents are active in gardening, including growing vegetables, flowers and caring for trees and shrubs.

10. Extensive pruning and maintenance of plants; Respect and care for trees

11. Structures modified to accommodate trees

Figure 5.48: Structures modified for trees - Fatih Sultan Mehmet

12. Houses and stoops form the street

Figure 5.49: Houses and stoops form the street - Fatih Sultan Mehmet

13. Green near the streets

Figure 5.50: Green near the streets - Fatih Sultan Mehmet

14. Connection to the earth

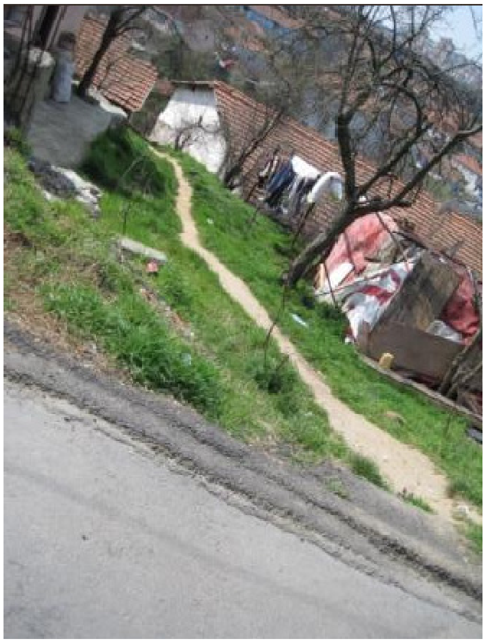


Figure 5.51: Connections to the earth - Fatih Sultan Mehmet

15. Fruit trees

Figure 5.52: Fruit trees - Fatih Sultan Mehmet

16. Gardens growing wild

Figure 5.53: Gardens growing wild - Fatih Sultan Mehmet

17. Garden seats

18. Vegetable garden

19. Climbing plants

Figure 5.54: Climbing plants - Fatih Sultan Mehmet

20. Gardens in buckets and/or pots

Physical characteristics of buildings and other structures

21. 2-6 story buildings

22. Outdoor ovens

Figure 5.55: Outdoor ovens - Fatih Sultan Mehmet

23. Innovative fence materials

Figure 5.56: Innovative fences - Fatih Sultan Mehmet

24. Flexible buildings – ready to expand

Figure 5.57: Roof with infrastructure ready to expand - Fatih Sultan Mehmet

25. Entrance transitions and thresholds

Figure 5.58: Entrance transitions and thresholds - Fatih Sultan Mehmet

26. Gates

Figure 5.59: Gates - Fatih Sultan Mehmet

27. Archways

Arches, quite often decorative with various wrought iron designs and growing vines, are common in Fatih Sultan Mehmet. They most often signal a threshold.

Figure 5.60: Archways - Fatih Sultan Mehmet

28. Decorative window safety bars

Figure 5.61: Decorative window safety bars - Fatih Sultan Mehmet

29. Street-seats

Figure 5.62: Street seats - Fatih Sultan Mehmet

30. Lean-tos

31. Outdoor rooms

32. Common areas at the heart

33. Roughness

Figure 5.63: Roughness - Fatih Sultan Mehmet

34. Bright colors for houses

Houses are sometimes brightly colored, and sometimes richly and warmly colored.

Figure 5.64: Bright colors - Fatih Sultan Mehmet

35. Outdoor sitting circles/seat spots

36. Front door seats

Figure 5.65: Front door seats - Fatih Sultan Mehmet

37. Different chairs

38. Sitting wall

39. Things from your life

Figure 5.66: Things from your life - Fatih Sultan Mehmet

Networks and infrastructure

40. Taxi Stands

Figure 5.67: Taxi stand area - Fatih Sultan Mehmet

41. Dolmus (mini-buses)

Figure 5.68: Mini-bus (Dolmus) - Fatih Sultan Mehmet

42. Busline

43. Hierarchy of Streets

44. Network of paths, streets and cars

45. Organic street patterns with undulating edges

46. Distinct, yet permeable border / Identifiable neighborhood

47. Main gateways

Figure 5.69: Main gateway - Fatih Sultan Mehmet

Social activities and relationships

48. Activity nodes

49. Household chores in gardens, patios and/or yards

50. Eyes on the street

51. Conversations with passersby

52. Cats

Like most of Istanbul, cats are ubiquitous.

53. Dogs – mostly leashed

Figure 5.70: Dog - Fatih Sultan Mehmet

54. Mosque – Sacred Space forms a center (even though many are not religious)

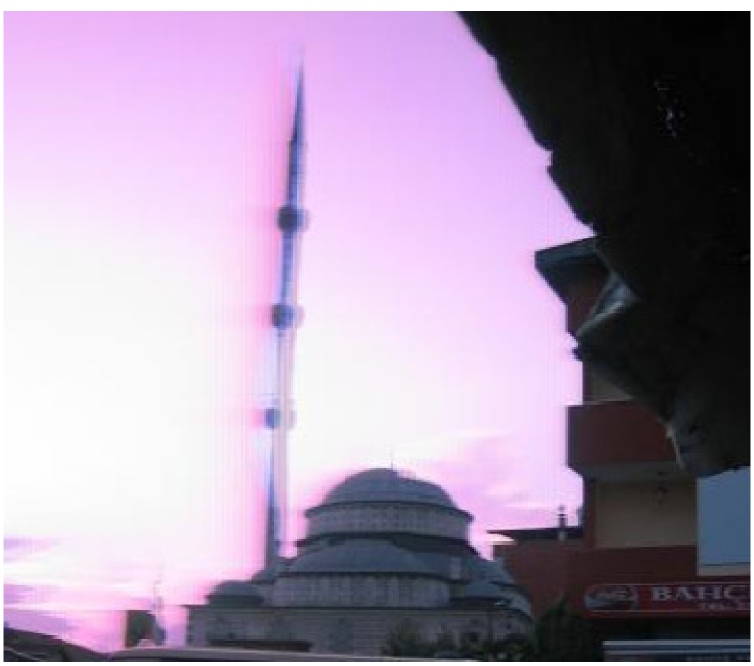


Figure 5.71: Sacred space of the mosque - Fatih Sultan Mehmet

55. Calm streets

56. Car-pedestrian symbiosis (on the side/small streets, not on the main roads through the settlement)

57. Streetball – (soccer/football, basketball)

Figure 5.72: Streetball - Fatih Sultan Mehmet

58. Bicycles in the street

59. Connected play (to other children, visitors, adults, nature, the physical neighborhood, etc)

60. Children in street, public spaces and private spaces (with and without adult supervision)

61. Multiple generations (life cycle)

62. Men and women

63. Household mix

64. House for a small family/for one person/for a couple

65. Housing clusters for extended family

66. Old people throughout neighborhood

67. Teenage society

68. Family

69. Friends

70. Web of shopping

The main commercial street provides multiple small businesses.

Figure 5.73: Shopping - Fatih Sultan Mehmet

71. Work community and socio-economic relationships and networking

72. Physical work and adaptations

Figure 5.74: Physical work - Fatih Sultan Mehmet

73. Self-governing workshops and offices

74. Small services without red-tape

The residents often provide direct services, such as repairs and building, by dealing directly with each other.

75. Street cafes and/or food stands on or near the street

76. Restaurants

77. Teahouses for gathering of men

78. Small grocery stores

79. Produce stores

80. Produce sold on streets and from trucks

Figure 5.75: Produce truck - Fatih Sultan Mehmet

81. Sunday street bazaar

Figure 5.76: Street bazaar - Fatih Sultan Mehmet

5.4 Summary

The patterns identified and described in Karanfilköy and Fatih Sultan Mehmet are successful examples of people and a culture creating living centers that follow the *generic* patterns that Alexander advocates. Importantly, these patterns are successful in both the context of each neighborhood, and the context of the modern, urbanizing Istanbul of the last 50 or so years. As Alexander points out, such examples are rare:

> The crux of the whole thing is that we seek patterns which are *good*, patterns which will generate life when we create them in a building built in the context we are facing.
>
> In our modern world, where societies are often in flux, the stability and coherence of such a traditional society is rarely found. Instead, people are usually struggling to create for themselves a system of coherent environmental objects and spaces, in which they can live well, be comfortable, and feel at ease (2002b, 346).

The people of Karanfilköy and Fatih Sultan Mehmet have been largely successful in creating and repeating patterns which are *good* and generate life. As Alexander points out, the patterns and centers found in these neighborhoods get to the heart of the matter of the residents' experiences and functions (Alexander 2002b, 357-360). The patterns listed in this chapter are less concerned, for the most part, with stylistic concerns, and instead concerned with the important essentials and life of the place and spaces in the neighborhoods.

A comparison and analysis of the pattern languages in Karanfilköy and Fatih Sultan Mehmet is included in Chapter Seven - Synthesis.

CHAPTER SIX

GENERATIVE DEVELOPMENT PROCESSES IN KARANFILKÖY AND FATIH SULTAN MEHMET

> We can learn a lot by studying the natural growth of the urban fabric, as it occurs in the *favelas* and squatter settlements of the Third World….beneath the squalor and misery lies a real-world illustration of urban coherence….Note the causality of scales expressed in the typical *favela*: the smaller scales—such as individual buildings—often precede the large scale that is defined by a path and road network. This causality is reversed in planning, where the large-scale infrastructure is laid down first, to be followed only much later by houses and other buildings. One sees in hybrid systems of slums, where a government lays down a rectangular grid of wide roads, while leaving the building of houses up to the residents, a notable lack of organic coherence such as is found in totally free systems.
>
> Nikos Salingaros, "Complexity and urban coherence" (2000, 313)

6.1 Introduction

This chapter evaluates the generative development processes in Karanfilköy and Fatih Sultan Mehmet. Generative urban design processes are step-by-step, incremental development processes that adapt to existing conditions and unfold over time (Alexander 2002b, 225). Alexander's *ten features of living generative processes* (Table 2.5) are used as a general guide to evaluate the processes (2002b, 225). Alexander's *social-spatial characteristics of generatively developed places* (Table 2.6) are used to evaluate settlement features (2005b, 4; 2008). Literature (books, papers and reports), aerial photographs, site photographs and on site observations are also used for this analysis. In particular, aerial photographs retrieved from the Municipality of Istanbul for the years

1946, 1966, 1982 and 2007 are compared (Istanbul Municipality 2011) (Figures 6.1 - 6.8). Case descriptions about generative processes are difficult to do with this study's limited historic data. Additionally, the qualitative character of Alexander's descriptions makes the creation of a quantitative rubric or score impossible (in contrast, for example, to the degrees of life test). Nonetheless, explanations are given of how development processes in Karanfilköy and Fatih Sultan Mehmet include Alexander's *social-spatial characteristics of generatively developed places* (Table 2.6). These explanations are supported with evidence from the aerial photos (Figures 6.1 – 6.8), studies about the settlements and on-site observations.

6.2 Analysis of Historic Aerial Photographs

Aerial photographs of the study sites were acquired from the Istanbul Municipality covering the years 1946, 1966, 1982 and 2007 (Figures 6.1 – 6.8) (Istanbul Municipality 2011). The large gaps in this spatial data require much interpolation in analysis. Despite these gaps, a basic visual summary of the development processes can be ascertained. As seen in Figures 6.1-6.3, the settlements began as two separate settlements. However, there is a portion of the settlements that meet and evolve together. Figures 6.5 – 6.8 show a close-up of the settlement areas that were connected, much of which was eliminated with the building of the TEM. The 2007 images show where the Trans European Motorway (TEM) divided the settlement (Figures 6.4 and 6.8). This area was once the connecting point between the two neighborhoods, but the TEM made it the neighborhoods distinctly separate.

The road networks in both Karanfilköy and Fatih Sultan Mehmet have evolved in dendritic patterns, with the road networks following smaller scale adaptations typical of generative urban design found in other squatter communities (Salingaros 2000, 313). The road network and road hierarchy have essentially stayed similar to their original patterns, with additions and infill happening as populations increased. The exception to this is the edge of the settlements, which used to blend into the surrounding urban fabric. Now many of the settlements' edges have sharp boundaries, often caused by roads or adjacent planned neighborhoods that are fenced off (e.g., the south side of Karanfilköy). Despite the increased hard boundaries/barriers in post-1982 Karanfilköy and Fatih Sultan Mehmet, the settlements (especially Karanfilköy) have still maintained loose, informal footpaths to the outside of their neighborhoods (Figure. 5.31).

The roads leading to Fatih Sultan Mehmet were destroyed and/or cut off after the TEM was built (Figures 6.1 – 6.4). In this observation, and in on-site observations, it is seen that the TEM is more of a barrier between the settlements and the rest of the city, rather than a connecter. It is seen particularly clearly on the south side of Fatih Sultan Mehmet, where the main roads once connected to the larger city (or suburban) network.

A large increase in development can be seen in Fatih Sultan Mehmet between 1982 and 2007 (Figures 6.3 and 6.4). This is linked to an increase in urban migrations and the change in settlement policies starting in the 1980s, which is explained in more detail in Section 4.4 (Keyder 2005, 202). Fatih Sultan Mehmet developed along two main axes, with roads branching off in dendritic patterns, complete with an organic hierarchy similar to a tree (Figures 6.2 and 6.3). The buildings stayed close to these main roads, creating two major centers with open space in between. In contrast, the present settlement has filled in all these open spaces. The two main roads are still present, but the sub-roads in the street network have increased greatly. With the increase in buildings and roads, Fatih Sultan Mehmet is now much more complex in its organic, dendritic patterns.

Karanfilköy development processes and structure had dendritc, organic street patterns based on a main axis (Figures 6.3 and 6.7). The settlement had open space on its eastern side which filled in after 1982 (Figures 6.3, 6.4, 6.7 and 6.8). Also, the original branching road networks are still very clearly seen (Figures 6.4 and 6.8).

Figures 6.1 – 6.8 are taken from the Istanbul Municipality and altered by the author (Istanbul Municipality 2011)

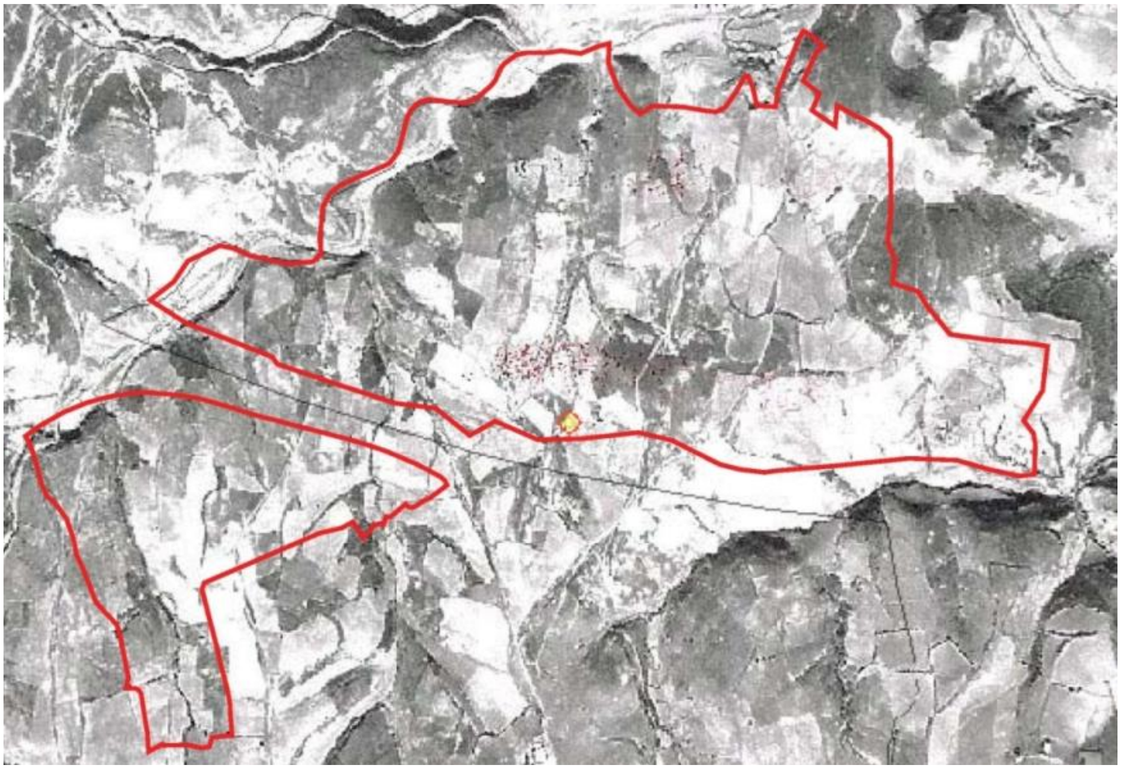


Figure 6.1: Aerial Photograph – 1946 - Karanfilköy and Fatih Sultan Mehmet (ibid)

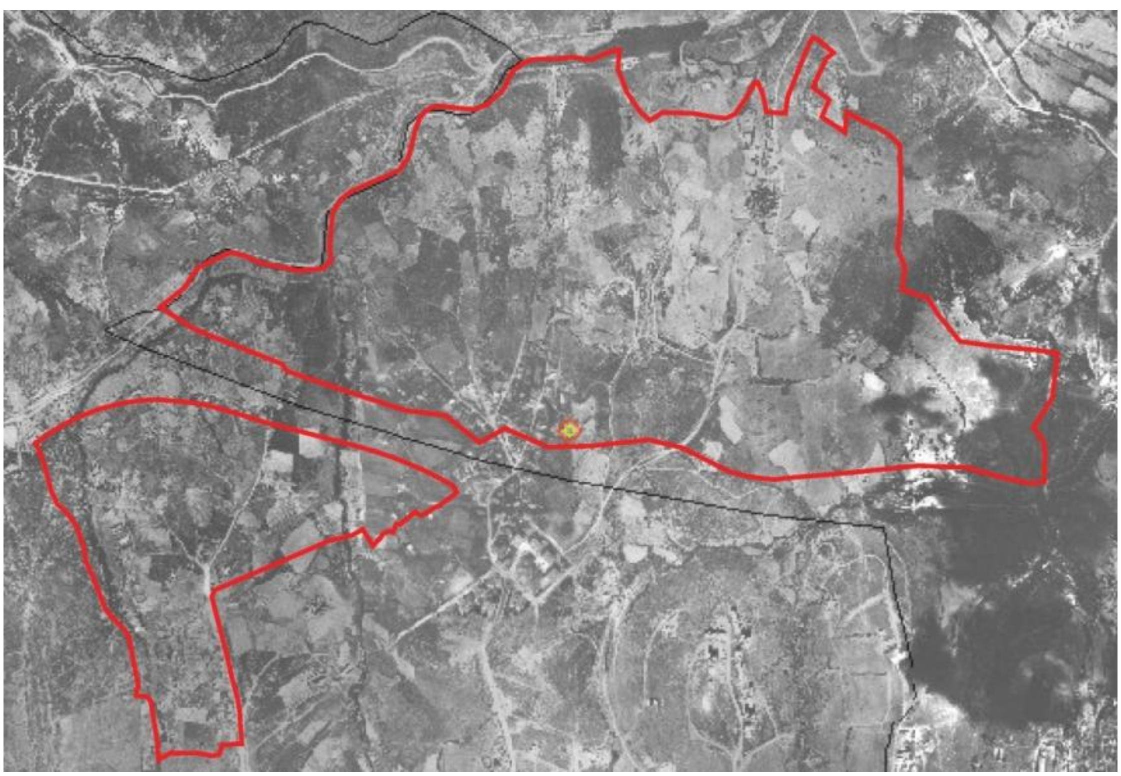


Figure 6.2: Aerial Photograph – 1966 - Karanfilköy and Fatih Sultan Mehmet (ibid)

Figure 6.3: Aerial Photograph – 1982 - Karanfilköy and Fatih Sultan Mehmet (ibid)

Figure 6.4: Aerial Photograph – 2007 - Karanfilköy and Fatih Sultan Mehmet (ibid)

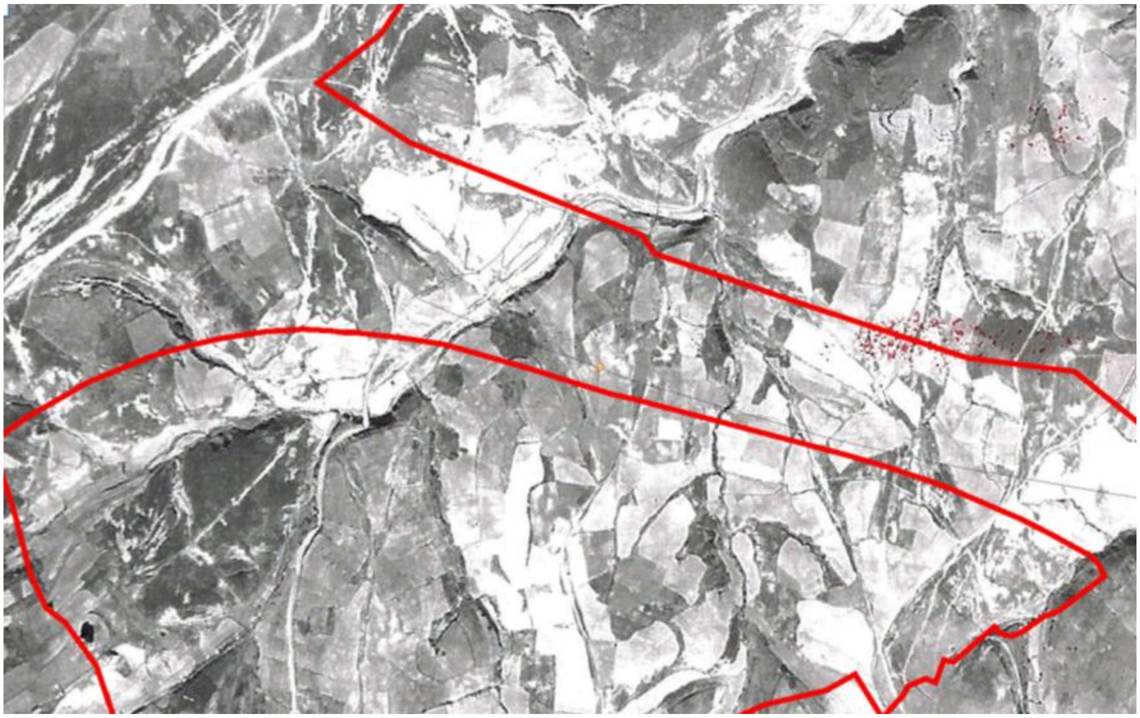


Figure 6.5: Close-up Aerial Photograph – 1946 - Karanfilköy and Fatih Sultan Mehmet (ibid)

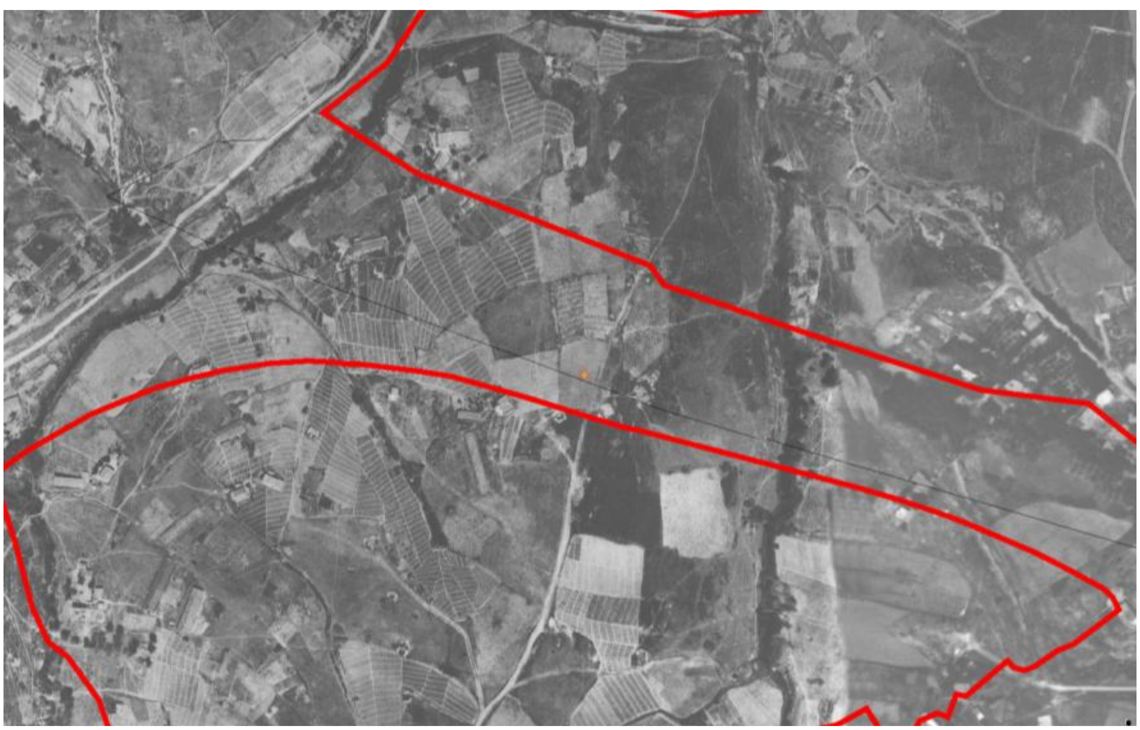


Figure 6.6: Close-up Aerial Photograph – 1966 - Karanfilköy and Fatih Sultan Mehmet (ibid)

Figure 6.7: Close-up Aerial Photograph – 1982 - Karanfilköy and Fatih Sultan Mehmet (ibid)

Figure 6.8: Close-up Aerial Photograph – 2007 - Karanfilköy and Fatih Sultan Mehmet (ibid)

6.3 Development Processes of Karanfilköy

Sevil Alkan has an excellent summary of the settlement processes that emerged in Karanfilköy (the text is not altered):

> The life in Karanfilköy started with the settlement of some families from the East Black Sea region. There were only 15 households at the beginning. At that time, the land on which Karanfilköy exits today was full of carnation fields16 which immigrants started to make their living with it… Later, the early inhabitants from the Black Sea region started to sell the land piece by piece to the other immigrants. People mostly from central Anatolia, especially from Sivas and Tokat, bought these lands in order to construct gecekondu for themselves… At the end, Karanfilköy became a neighbourhood whose inhabitants are mainly from the Black Sea region as well as the central Anatolia. They started to live together without any serious conflict. Today, Karanfilköy is a gecekondu neighbourhood with 574 households and 75 small shops that are about 4000 inhabitants in total (2006, 63-64).

Alkan goes on to explain the physical attribute of Karanfilköy:

> The first impression about Karanfilköy is that it is a gecekondu settlement. However, it is not post-gecekondu which has been converted into apartment building after 1980s. It has a kind of a village structure, and it is pre-modern in the middle of Istanbul's representation to the global network. It seems that it is incorporated and left behind… The place has been frozen as it is in 50s.
>
> While the other gecekondu areas turned mostly into apartment buildings, Karanfilköy carries physically still very early gecekondu features since they were not allowed to construct anything new. One house can be sometimes shared by 2-3 families that can be considered as one household. Most of the houses are 1-2 storeys constructions mostly with gardens. There is always a continuous attempt to beautify gecekondus… These features, being green and low storey settlement, are also used as very strong arguments in the identity construction of the neighbourhood (2006, 61, 64-65).

Accordingly, the morphology of Karanfilköy involves the heavy connections to community and family. These connections point to reasons why similar structures and patterns repeat throughout the settlement. The residents are not isolated individuals that join a neighborhood, but more a community that also allows individual expression. Alkan explains open space configuration and social use in Karanfilköy:

> There are not definite borders between public and private in the neighbourhood itself, since the neighbourhood is treated as a common public space, because of strong sense of belonging to the place. The borders blurred in Karanfilköy because of the uncertainness of the property rights and habit of using the space by the locals. Since there are very strong social relations between the locals, the streets and the semi-open places of the houses become public places used by the inhabitants. The streets in Karanfilköy are also places for their social interaction (2006, 69).

Karanfilköy residents also identify with the greenness of their neighborhood, houses and gardens. Alkan points out:

> The inhabitants are quite proud of the fact that Karanfilköy is a very green settlement. Undoubtedly, the idea of keeping some features of rural life plays very important role to have a green environment in this part of the city. Most of the interviewees mentioned the beauty of the neighbourhood and similarity with village life because of physical attributes (2006, 65).

This pride in quality and beauty reflects an understanding of wholeness and living structure, or it is at least manifest quite often as living structure in Karanfilköy.

These features and processes of physical, social and community development that Alkan describes are all linked together as generative processes over time. The residents of Karanfilköy have continually adapted their living environments through time, as outlined be Alkan (2006). The whole of the community influenced how individual homes were built and adapted. That is, interconnected social networks of the entire settlement (the whole) (aka, neighborliness), influenced the physical structures present (Alkan 2006).

The aerial photographs (Figures 6.1 – 6.8) also show how the street networks and houses evolved as a part of the whole. That is, the main street acted as a center, which then guided subsequent road and building additions. They all are scaled in a hierarchy which honors the whole of the entire network of streets. No road seems out of place or detracts from the whole. As far as it can be determined, living centers have guided decisions made on the ground in each development. For instance, people make many of their choices about building (what, how, where, etc) based on how to make their small scale structures fit in with the large scale structures, and vice versa. Additionally, these choices are often in the pursuit of what works and what is beautiful (Alkan 2006).

The aerial photographs (Figures 6.1 – 6.8) also show how the street networks and houses evolved by an evolution of centers. That is, the main street acted as a center, which then guided subsequent road and building additions. They all are scaled in a hierarchy that reinforces the centers of the homes and roads at many scales.

The sequence of the development processes allowed the right features to evolve to form the physical structure of the neighborhood. The road networks sometimes came before buildings, but not the entire road network (Figures 6.1 – 6.8). Instead, the roads and building placement evolved as people moved in and adapted their local structures into the community structures.

Each home and each place within the yard, garden and street, is locally unique. This can be seen by the small adaptations people make to adjust their homes as needed (See Chapter Five). Thus, the patterns and repetition found in Karanfilköy are locally shaped but still fit into the greater whole of the street and community. This can be seen in the repeating patterns occurring throughout the settlement (see Chapter Five).

It is likely that feeling governs many, if not most, adaptations in the built environment in Karanfilköy. It seems the residents are not so interested in stylistic concerns but more about what feels right to them. “In the case of Karanfilköy, it is self-evident that the sense of belonging to the neighbourhood is quite strong” (Alkan, 2006, 82). This sense of belonging is a *feeling* residents have for their neighborhood. It could be surmised that, because they are the main builders in the generative processes that created this neighborhood that they feel connected to, than feelings must have been a part of the iterative processes of development.

The form language in Karanfilköy can be seen in the repeated patterns listed in Chapter Five. The patterns form repetitions of what works for the settlement’s residents. They can be said to “work” based on previous studies (Alkan 2006). Homes and structures often have a simple design vocabulary that cuts to the heart of what is needed and desired. This can be seen in Chapter Five and Appendix C.

Alexander’s social-spatial characteristics of generatively developed places in Karanfilköy (2005b, 4; 2008)

1. *A more beautiful and coherent geometric form that is natural to the land.*
2. *More probable successful integration and adaptation to plants, trees, animals, and land form; resulting in communities and built areas which, like traditional towns and villages, seem like part of nature.*

Social-spatial characteristics 1 and 2 are manifested in Karanfilköy with the way roads, buildings and yards adapt and respect the natural topography. Buildings feel like they natural are part of the topography and seemingly “sprout” from the ground (Figure 6.9 – 6.15). Also, the streets adherence to natural topography makes for interesting juxtapositions of road and buildings (Figures 6.9 – 6.15).

Karanfilköy also successfully integrates with plants, trees, animals (dogs and cats are plentiful), and landform. This is manifested in both a respect for trees and topography that exist, as well as the addition and care of natural, growing, living things (Figures 6.15 6.20). As Alkan points about Karanfilköy, “There is always a continuous attempt to beautify gecekondus. Some houses were renovated during the time according to the financial ability of the householders. Some even look like small villas with gardens” (2006, 64-65).


Figure 6.9: Buildings adapting to topography Karanfilköy

Figure 6.10: Buildings and roads adapting to topography Karanfilköy

Figure 6.11: Buildings and roads adapting to topography Karanfilköy

Figure 6.12: Buildings and roads adapting to topography Karanfilköy


Figure 6.13: Buildings and roads adapting to topography Karanfilköy


Figure 6.14: Buildings and roads adapting to topography Karanfilköy

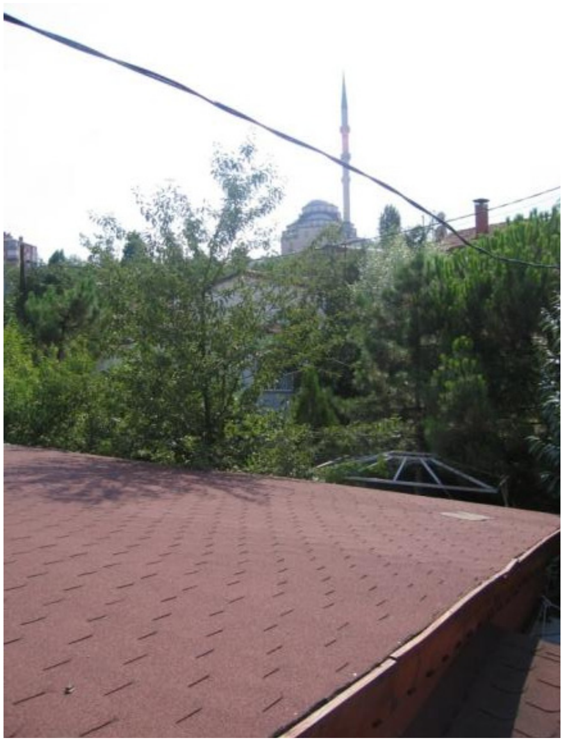


Figure 6.15: Buildings adapting to topography and plants Karanfilköy

Figure 6.16: A well-cared for garden - Karanfilköy

Figure 6.17: Living plants and living structures merge - Karanfilköy


Figure 6.18: A well-cared for mini-orchard - Karanfilköy

Figure 6.19: Small plant life and beauty emerging from a well-cared for garden - Karanfilköy

Figure 6.20: Green streets - Karanfilköy

3. Successful fine tuning and deep adaptation.

4. More successful integration with living process in the daily life of the inhabitants.

Integration with living processes is seen in the deep adaptations found throughout Karanfilköy. This includes adaptations of structures – both inanimate and biologically living (Figures 6.15 - 6.20).

5. Better fit with individual local needs of any given building, garden, space, or enclosure.

7. More uniqueness of each place, each street, each building, and each project.

The degrees of life test (Chapter Four) and pattern languages (Chapter Five) show in detail how different streets and buildings emerge with unique qualities. For example, the two buildings with the highest degrees of life were built and adapted within about 100 meters of each other (Figure 6.21). This demonstrates that Karanfilköy has allowed room for individual and successful (based on the degrees of life test) adaptations to occur.

Figure 6.21: Two unique buildings with high degrees of life - Karanfilköy

6. Far greater likelihood that genuine community will emerge in the new place.

9. An easier path to the desired end state.

Alkan (2006) gives strong evidence that genuine community has emerged in Karanfilköy. Her study is based on the premise that Karanfilköy should be preserved because of its strong community ties and unique built environment. The end state of a living community has been accomplished and is continually refined by Karanfilköy's residents. Alkan gives an account of the community from a resident's perspective:

> Sinan Emre Zengin also mentions, "There is a division socially within the neighbourhood". Despite… this social difference which is reflected [in] the spatial organization, all of the interviews stressed that the inhabitants do not have any conflicts although it may be expected that there is [an] ethnic and religious clash among them. Indeed, they are quite happy about sharing the same neighbourhood with the others. Sinan Emre Zengin comments, "There are many people with different cultural and social backgrounds. However, they live together harmoniously. We live an ideal life here" (2006, 68).

8. More profound linkage to sustainability and environmental objectives.

As mentioned earlier, Karanfilköy residents and their neighborhood are linked to sustainability. Alkan describes Karanfilköy's bottom up, resident built infrastructure and landscaping:

> There were no water, no electricity and no infrastructure which are the basic requirements for living in the neighbourhood. The situation stayed more or less as it is until 1980s. Karanfilköy completed its streets, infrastructure, electricity and water supply with its own efforts without any help from the government and municipality within the time. Today, the neighbourhood does not have any severe infrastructure and service problems because of the inhabitants` big efforts. The solution which was developed by the neighbourhood [for a] drainage system was even chosen as the best 10 project by Human Settlement Foundation.

> The neighbourhood is relatively green, if compared to the close settlements which are mostly apartment buildings. The inhabitants are quite proud of the fact that Karanfilköy is very green settlement. Undoubtedly, the idea of keeping some features of rural life plays very important role to have a green environment in this part of the city. Most of the interviewees mentioned the beauty of the neighbourhood and similarity with village life because of physical attributes. The rural way of living can be easily attached with the physical elements in Karanfilköy.
>
> These features, being green and low storey settlement, are also used as very strong arguments in the identity construction of the neighbourhood. In most of the declarations by the neighbourhood, it is always mentioned that Karanfilköy is quite different from the other gecekondu areas as well as close settlements like Sarı Konaklar, Bahçeşehir etc. in terms of being green and sensitive to the environment. "Since the inhabitants prevented massive concrete development, attached importance to green and they are careful about air pollution with their cultural and environmental consciousness, Karanfilköy became the "lungs" of the region," states one of the declarations. They claim that they are not "gecekondu" but "green-kondu" in Istanbul. In short, green characteristic of Karanfilköy appears as a very important feature to defend the neighbourhood against the possible attacks, although it has a very physical attachment to the place (2006, 64-65).

6.4 Development Processes of Fatih Sultan Mehmet

Fatih Sultan Mehmet (formerly known as Armutlu) has been studied by multiple researchers (Keyder 2005, 201-215; Ergenoglu et al. 2005; Ertaş 2010, 52-57; Gonul et al. 2007, 33-67; Gulersoy 1999). It shares many features of typical Istanbul squatter communities, particularly with its development processes and the resultant structures. The development has occurred in relatively incremental steps until the 1980s, when higher-rise buildings and denser building footprints began to dominate the settlement. "In Armutlu, there began a process of moving away from the houses carrying rural characteristics and apartment type houses are beginning to be seen more widely"

(Ergenoglu et al. 2005, 11). Keyder mentions the point in time that Fatih Sultan Mehmet residents began to build higher structures:

> During the 1980s, along with all the other shantytown dwellers, residents in Armutlu [Fatih Sultan Mehmet] were also given the right to obtain papers which allowed them to regularize their possession rights so as to be able to construct four- or five-storey apartment buildings on their lots, which until then had contained picturesque single-family dwellings surrounded by rudimentary gardens (2005, 202).

Ergenoglu, et al, point out that a number of Fatih Sultan Mehmet's residents have not built their homes:

> 48% of the families [have] built their houses themselves. 41% [have] owned the houses by purchasing. This situation shows that the squatter settlement has transformed into a property that is bought and sold rather than being a place of shelter (2005, 6).

Thus, the higher- rise buildings can become a means for speculation and renting.

They also describes the physical features of Fatih Sultan Mehmet:

> The settlement carries the characteristic of the first generation squatters. The majority of the houses are 1-2-storey houses with gardens. Residing function is dominant. Small scale shops exist to meet the everyday-life needs. The settlement has a lower density than the other squatter settlements… in population and building density. 60% of the buildings are single-storey, 20% are 2-storey, 10% are 3-storey and 10% is 4-5-6-storey. Heights of the buildings are perceived different from different sides of those buildings as a result of using the slope. Low-storey buildings are sometimes below the street level (ibid, 7).

The processes in Fatih Sultan Mehmet are incremental and there is room for feedback loops and correction. However, in cases of higher buildings, adaptive feedback opportunities seem to be less compared to the lower-rise parts of the settlement. Nonetheless, the overall development processes through the settlement's history have been largely step-by-step adaptive processes. Ergenoglu, et al, go on to describe the adaptive, generative nature of development in Fatih Sultan Mehmet:

> The flexibility and adaptability of the houses are in the form of %64 adding an extra storey, %23 adding an extra room, 13% adding balcony to the closed spaces. If thought how quickly these houses are built, these additions can be considered as a natural consequence (ibid, 9).

The street has evolved as an important open space typology and is seen as the public and community realm in Fatih Sultan Mehmet:

> Streets bordered by one or two storey houses do not form an insecure environment for the children to play. These streets are mostly used by the residents themselves and sometimes other people who use shortcuts but in this case, speed is limited by these narrow streets anyway. Narrowness of the streets is not forming a negative perspective thanks to the few-storey houses and spaces between them (ibid, 10).

The street is also the place where typical social activities can play out, like in this account: "Activities like standing in front of the doorway and baking bread with neighbors or feeding animals are rural life activities that can also be continued…" (ibid, 10). This account of social and physical spatial characteristics attests to the ownership of space by the residents. That is, many of the residents of Fatih Sultan Mehmet either created and/or adapted the spaces and forms that make up the neighborhood. Subsequently, they find this generatively defined neighborhood to be a place to feel comfortable and at home. The whole of the community influenced how individual homes were built and adapted. That is, interconnected social networks of the entire settlement (the whole) influenced the physical structures present.

Living centers have guided decisions made on the ground in Fatih Sultan Mehmet. For instance, people make many of their choices about building (what, how, where, etc) based on how to make their small scale structures fit in with the large scale structures, and vice versa. Additionally, these choices are often in the pursuit of what works and what is beautiful. Each home and each place within the yard, garden and street, is locally unique. This can be seen by the small adaptations people make to adjust their homes as needed. It is likely that feeling governs many if not most adaptations in the built environment in Fatih Sultan Mehmet. It seems the residents are not so interested in stylistic concerns but more about what feels right to them.

The sequence of the development processes allowed the right features to evolve to form the physical structure of the neighborhood. The road networks sometimes came before buildings, but not the entire road network. Instead, the roads and building placement evolved as people moved in and adapted their local structures into the community structures. This sequence was interrupted by the construction of the TEM, as can be seen on the southern edges of Fatih Sultan Mehmet (Figures 6.1 – 6.8).

The form language in Fatih Sultan Mehmet can be seen in the repeated patterns listed in Chapter Five. The patterns form repetitions of what works for the settlement's residents. We can say it "works" based on previous studies (Keyder 2005, 201-215; Ergenoglu et al. 2005; Ertaş 2010, 52-57; Gonul et al. 2007, 33-67; Gulersoy 1999). Homes and structures often have an overall simple design vocabulary that cuts to the heart of what is needed and desired. This can be seen in Chapter Five's patterns.

Alexander's social-spatial characteristics of generatively developed places in Fatih Sultan Mehmet (2005b, 4; 2008)

1. *A more beautiful and coherent geometric form that is natural to the land.*
2. *More probable successful integration and adaptation to plants, trees, animals, and land form; resulting in communities and built areas which, like traditional towns and villages, seem like part of nature.*

The buildings in Fatih Sultan Mehmet are mostly adapted to fit the existing topography. This gives a feel of the buildings rolling along with the original terrain (Figures 6.22 – 6.26). Interesting juxtapositions of buildings and the street are often created to adapt to the landform (Figures 6.23 – 6.26)

The streets in Faith Sultan Mehmet often have the juxtaposition of plants and hardscape (Figures 6.22, 6.25 - 6.28). The trees and plants are respectfully integrated into the streets, open spaces and structures. The buildings closer to the edges of the settlement tend to have more open green space and gardens, much of it in a semi-wild state (Figures 6.29 -6.30). These aspects combine to make Fatih Sultan Mehmet feel closer to nature.

Figure 6.22: Buildings adapted to the terrain - Fatih Sultan Mehmet

Figure 6.23: Building adapted to the terrain - Fatih Sultan Mehmet

Figure 6.24: Building elegantly adapted to the terrain - Fatih Sultan Mehmet

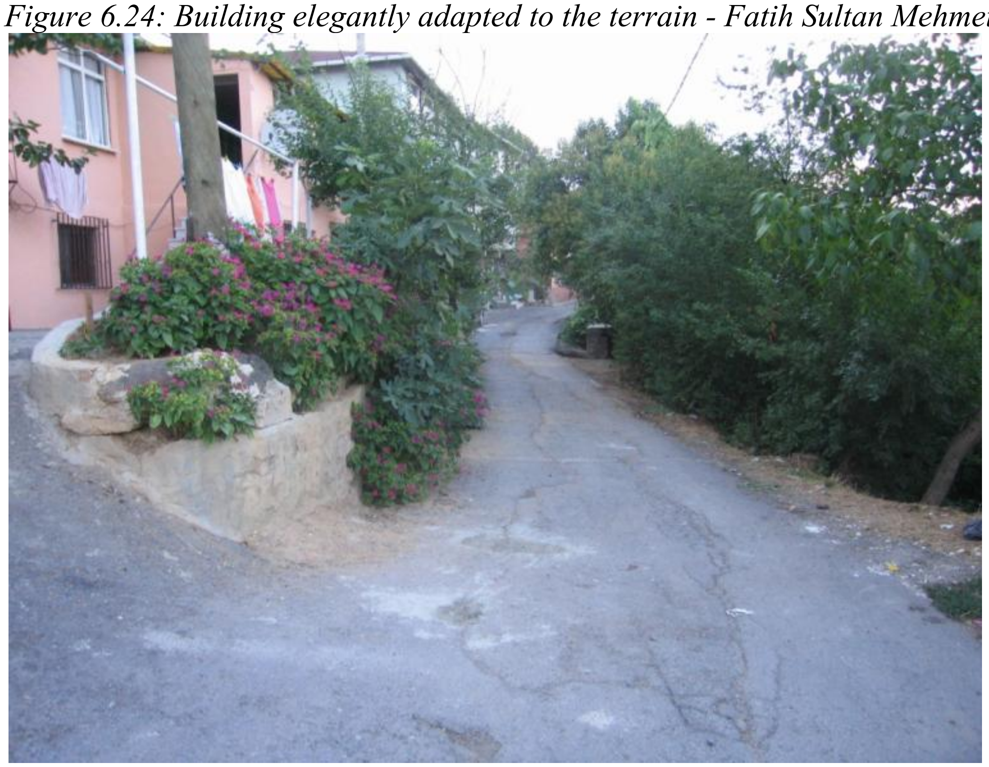


Figure 6.25: Buildings and roads adapted to the terrain - Fatih Sultan Mehmet

Figure 6.26: Interesting adaptations to the terrain - Fatih Sultan Mehmet

Figure 6.27: Plants juxtaposed with hardscape - Fatih Sultan Mehmet

Figure 6.28: Plants juxtaposed with hardscape - Fatih Sultan Mehmet

Figure 6.29: Garden and path near the settlement's edge - Fatih Sultan Mehmet

Figure 6.30: Green yards near the settlement's edge - Fatih Sultan Mehmet

3. Successful fine tuning and deep adaptation.

4. More successful integration with living process in the daily life of the inhabitants.

5. Better fit with individual local needs of any given building, garden, space, or enclosure.

7. More uniqueness of each place, each street, each building, and each project.

Fatih Sultant Mehmet's development processes fulfill social-spatial characteristics 3, 4, 5 and 7. Integration with living processes is seen in the deep adaptations found throughout Fatih Sultan Mehmet. Ergenoglu points out how Fatih Sultan Mehmet residents act freely and as needed in their spaces:

> [T]he people [who] reside in squatter settlements see these areas as 'toleranced' living spaces [where] the residents can act freely. These people also think that the living spaces in the planned areas are 'pressuring/ restraining' that one has to be more cautious (2005, 9).

The degrees of life test (Chapter Four) and pattern languages (Chapter Five) show in detail how different streets and buildings emerge with unique qualities. People adapt structures to fit their specific needs and the local conditions. For example, residents built a rough, yet very functional bench adapted for sitting in the street (Figure 6.31). Another example is a wall adapted to steep terrain and an existing tree (Figure 6.32). Both of these examples demonstrate generative building processes allowing room for individual and successful adaptations to occur.

Figure 6.31: Uniqueness of place fit to people's needs – Fatih Sultan Mehmet

Figure 6.32: Uniqueness of place fit to people's needs – Fatih Sultan Mehmet

6. Far greater likelihood that genuine community will emerge in the new place.

9. An easier path to the desired end state.

Ergenoglu talks about the community that has emerged in Fatih Sultan Mehmet:

> Close social relationships and collaboration between the resident are important characteristics of these settlements. Residents try to support each other and act respectfully to each other. One of the reasons for the people belonging to the same ethnical group to live together is this characteristic; because, they know they will get support when faced with a problem (2005, 9).

Ergenoglu goes on to mention the cultural changes in the Fatih Sultan Mehmet community evolve over long periods of time and show unique “developments/changes in its cultural process” (2005, 10). Ergenoglu’s study indicates the presence of community in Fatih Sultan Mehmet.

8. More profound linkage to sustainability and environmental objectives.

Connections to earth, respect for topography, high densities, and mixed-used streets all occur in Fatih Sultan Mehmet. These are all indicators of environmental sustainability. However, there are no known intentional sustainability and environmental objectives in Fatih Sultan Mehmet.

6.5 Summary

Karanfilköy and Fatih Sultan Mehmet have developed with largely generative, step-by-step, incremental processes that adapt to existing conditions and unfold over time. The settlements have often developed in different ways, but also within the similar cultural context of Istanbul informal settlements. Also, both settlements have certainly had external, top-down influences that affected their development processes and characteristics. These include government policies for informal settlements and infrastructure installations and upgrading. Nonetheless, both settlements can be said to have developed in fundamentally generative practices. Karanfilköy and Fatih Sultan Mehmet have been planned and built in an incremental process, with all stakeholders (particularly current and future users) participating throughout the process (Alexander 2002a; Alexander 2002b; Salingaros 2006c).

A comparison and analysis of the generative development processes in Karanfilköy and Fatih Sultan Mehmet is included in Chapter Seven - Synthesis.

CHAPTER SEVEN

SYNTHESIS OF RESULTS

7.1 Introduction

This chapter provides a synthesis of the results. This includes a cross case synthesis addressing similarities and differences in Karanfilköy and Fatih Sultan Mehmet in terms of the constructs addressed in Chapters Four, Five and Six. The chapter then addresses how the research questions are addressed. Finally, other key findings are summarized.

7.2 Cross-case Synthesis

Degrees of life

The degrees of life average slightly higher in Karanfilköy than Fatih Sultan Mehmet (41.00 versus 34.75). Greater harmony in Karanfilköy is the main difference in degrees of life between the two settlements.

On average for both settlements, the degrees of life were higher than most 20th century architectural buildings evaluated by Salingaros, with an overall average score of 37.88 (2006a, 109). However, the buildings also average lower than many of the architectural buildings evaluated by Salingaros (ibid). However, this is likely to be expected because these buildings Salingaros evaluated are considered masterpieces. In other words, the buildings of the study areas are being judged against some of what many people consider the greatest buildings ever built. It can be expected that the informal settlements might not rate as high. However, the fact that their overall averages rate higher than all but two of the 20th century buildings evaluated by Salingaros is a testament to the high degrees of life present in the Istanbul squatter development context of the late 20th century.

Pattern languages

Most patterns are found in both Karanfilköy and Fatih Sultan Mehmet (Tables 7.1 - 7.2). Thirty of these similar patterns are manifested differently in each settlement. The distinctions between the two settlements in terms of pattern languages most often emerge from differences in building height, size and type, and what those characteristics do to form the spatial and social relationships to people and their environment. For example, the street in Fatih Sultan Mehmet is often more distinct as a social place in areas where there is a zero lot line, compared to the looser use of the street in Karanfilköy where it borders a garden and/or garden wall (Figures 7.1 -7.2).

Table 7.1: Patterns in Karanfilköy

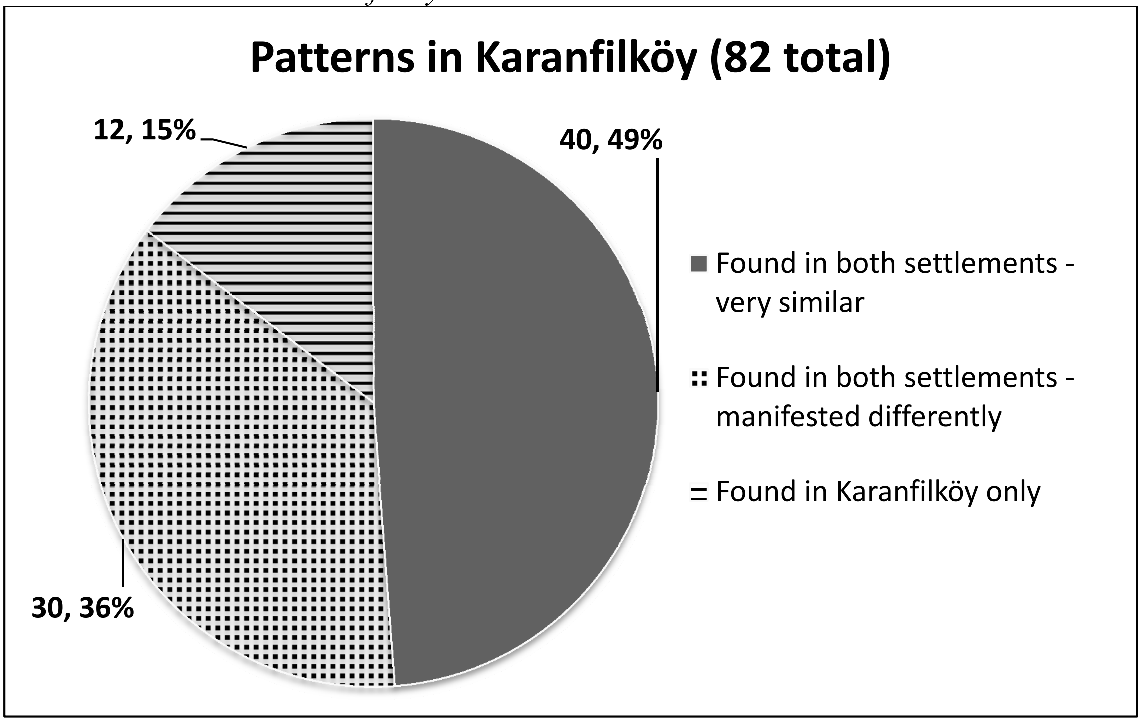
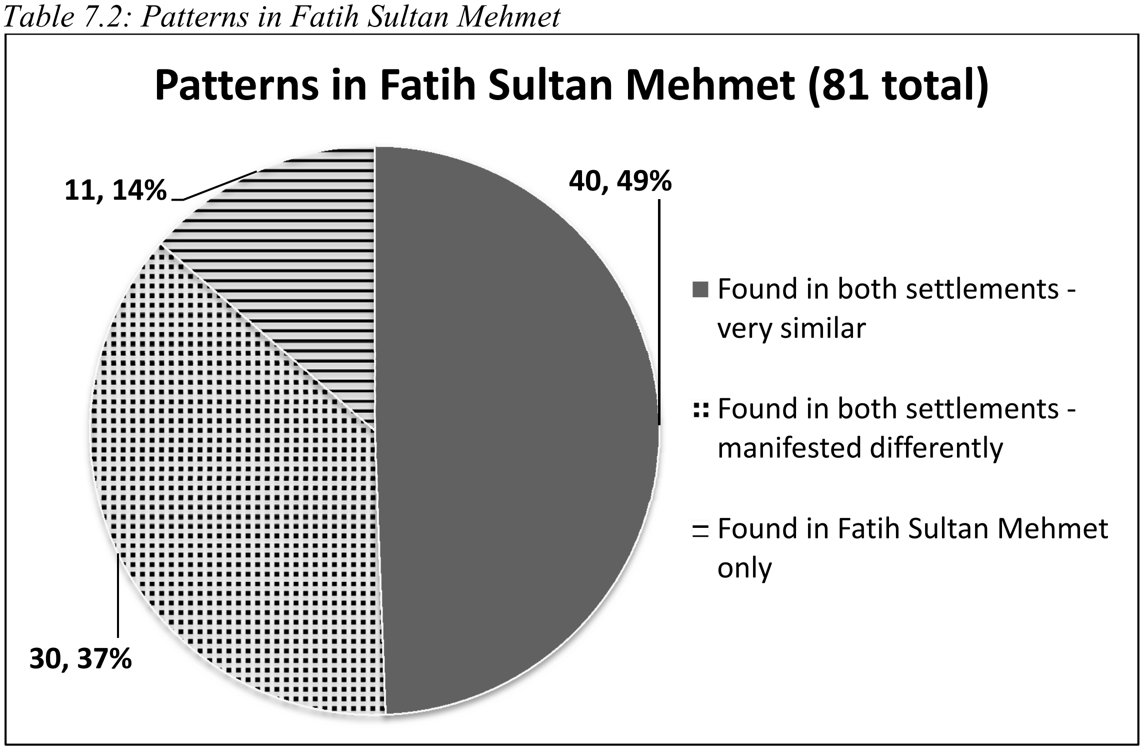


Table 7.2: Patterns in Fatih Sultan Mehmet



One of the main differences in patterns between the two settlements involves the relationship with the street. Fatih Sultan Mehmet's buildings and open spaces front the street – and in some cases the open spaces are in the street (Figure 7.1). Karanfilköy, in contrast, more often has a buffer of gardens and/or yards between the buildings and street. This has the effect of making the recurring patterns more often happen in private or semi-private spaces (Figure 7.2).

Figure 7.1: Zero lot line - Fatih Sultan Mehmet


Figure 7.2: Buffer wall and garden space between street and house – Karanfilköy

The patterns that involve connections to plants and earth are found in both settlements. However, Karanfilköy has more connections to the plants and earth, and these connections are more often found immediately adjacent to people's homes in the form of gardens and yards (Figure 7.3). Fatih Sultan Mehmet has these features, but the connections to the plants and earth are more often juxtaposed with hardscape surfaces, such as concrete paving and planters (Figure 7.4).

Figure 7.3: Yard as place to connect to plants and earth – Karanfilköy

Figure 7.4: Plants juxtaposed with hardscape - Fatih Sultan Mehmet

Generative processes

The 1980s marked the time when Fatih Sultan Mehmet and Karanfilköy started to differ in their building typologies (Keyder 2005, 202). This also happened to coincide with the construction of the Trans-European Motorway (TEM), which divided part of the settlement of Fatih Sultan Mehmet, leaving the houses on the other side of the TEM as part of Karanfilköy (Figures 7.5 – 7.6). This division created and still acts as a barrier between the two settlements (Ergun 2008).

Figure 7.5: Close-up Aerial Photograph – 1982 - Karanfilköy and Fatih Sultan Mehmet (Istanbul Municipality 2011)

Figure 7.6: Close-up Aerial Photograph – 2007 - Karanfilköy and Fatih Sultan Mehmet (ibid)

The main differences in the generative processes over time involve the scale of the buildings. Karanfilköy stayed predominately low-rise one to two-story buildings (Figures 7.7 – 7.8) (Alkan 2006). Fatih Sultan Mehmet often built higher, multi-story buildings (Figures 7.9 – 7.12) (Keyder 2005, 201). This had an economic consequence: Fatih Sultan Mehmet was able to participate in the speculation process of building additional stories and renting out flats (Keyder 2005, 201). Karanfilköy did not participate in this process. The implications for this on the built environment are that Karanfilköy is quieter, greener and more private. Fatih Sultan Mehmet is denser, more mixed-use and noisier. (Although Fatih Sultan Mehmet is denser than Karanfilköy, it is still considered less dense and more low-rise than other Istanbul squatter neighborhoods (Ergenoglu et al. 2005, 7)).

Figure 7.7: Low-rise buildings - Karanfilköy

Figure 7.8: Low-rise buildings - Karanfilköy

Figure 7.9: Multi-story buildings –Fatih Sultan Mehmet

Figure 7.10: Multi-story buildings –Fatih Sultan Mehmet

Figure 7.11: Multi-story buildings –Fatih Sultan Mehmet


Figure 7.12: Multi-story buildings –Fatih Sultan Mehmet

Despite these differences, there are many similarities between the two settlements' generative processes. This can be seen particularly near the edges of both settlements, where the houses in both settlements tend to be lower stories, surrounded by a small green space or stoop, and often in more disarray (Figures 7.13 – 7.18). These commonalities in structural form are linked to the common Istanbul squatter development processes that both settlements share.

Figure 7.13: Low-rise buildings near edge of neighborhood - Karanfilköy

Figure 7.14: Low-rise buildings near edge of neighborhood - Karanfilköy

Figure 7.15: Low-rise buildings near edge of neighborhood - Karanfilköy

Figure 7.16: Low-rise buildings near edge of neighborhood – Fatih Sultan Mehmet

Figure 7.17: Low-rise buildings near edge of neighborhood – Fatih Sultan Mehmet

Figure 7.18: Low-rise buildings near edge of neighborhood – Fatih Sultan Mehmet

7.3 Research Questions Addressed

Main research question

Can Istanbul informal housing settlement development processes, structures and patterns be used to develop a new typology for generative processes for urban design?

Through convergence of evidence and data triangulation, this study shows that the Istanbul informal settlements of Karanfilköy and Fatih Sultan Mehmet are new typologies for generative urban design. The processes of their development are largely generative; the buildings have degrees of life that are on average higher than most other 20th century buildings; and each settlement has a pattern language that exemplifies successful, "rules[s] for making or partly making some important type of center, necessary to the life of a living human environment" (Alexander, 2002b, 344). The combination of all these findings indicate that, yes, Istanbul informal housing settlement development processes, structures and patterns do form a new, modern typology for generative processes in urban design: the Istanbul informal settlement.

Secondary research questions

1) How have Karanfilköy and Fatih Sultan Mehmet developed in a generative process?

   The development processes in Karanfilköy and Fatih Sultan Mehmet are generative and largely resident determined. These development processes formed a community context and are formed by the context of the Turkish squatter housing phenomena. These development processes must be understood within this larger cultural framework. However, the generative development processes also determine the physical and social cultural context of the neighborhood.

2) Do structures and patterns in Istanbul informal settlements form wholeness and living structure (as defined by Christopher Alexander (2002a))?

The settlements of Karnfilkoy and Fatih Sutlan Mehmet do form wholeness and living structure. This is shown through the convergence of evidence, methods triangulation and data triangulation used in the study (Yin 98-100). The successful patterns identified often contain living structure and wholeness (See Chapter Five). Additionally, some buildings display medium level degrees of life (See Chapter Four). Based on the degrees of life tests, it could be concluded that the settlements do contain wholeness/living structures, but the levels of wholeness/living structure have room to increase. Karanfilköy's wholeness is likely at a higher level, particularly based on the higher degrees of life scores.

3) What are the degrees of life of structures in Karanfilköy and Fatih Sultan Mehmet (Alexander, 2002a, 469-472, Salingaros 2006a, 104-128)?

The degrees of life average scores for each settlement are higher than most 20th century examples cited by Salingaros, but lower than many of the architectural masterpieces cited by Salingaros (2006a, 109).

The degrees of life (and, to a broader degree, the wholeness) of each settlement was raised by seemingly small and/or simple features that are repeated throughout the settlement, including:

- vibrant and rich colors;
- corrugated roofs;
- scalloped fascia;
- red, clay tile roofs;
- intricate wrought iron fences;
- detailed wrought iron window safety bars;
- strong earth border around the building connecting it to the earth;
- vines and other plants on and/or near the house.

4) What "pattern languages" are found in Karanfilköy and Fatih Sultan Mehmet (Alexander 2002b, 341-368)?

The pattern languages found in each settlement are examples of what is successfully repeated in each specific settlement. Many of these patterns are likely to also be successful outside the context of the settlement, both in other Istanbul neighborhoods and neighborhoods outside of Turkey. As Alexander mentions, there are patterns unique to each place, as well as patterns that are successful across various cultures and places (Alexander 2002b, 344-348).

The pattern languages in each settlement reflect both step-by-step, on the ground adaptations *and* repeated elements used by many of the residents. These patterns thus reflect both individual adjustments and neighborly/community cohesion of physical parts.

7.4 Other Key Findings

The findings from this study include a holistic understanding of the processes and resulting structures and patterns in Karanfilköy and Fatih Sultan Mehmet. Data triangulation and convergence of evidence make this holistic analysis more robust. Within this holistic framework of understanding, here are some of the key findings:

1) These settlements are modern, 20th century examples of generative urban design and development. This study shows commonalities between Karanfilköy and Fatih Sultan Mehmet that offer a single generative urban design typology: the Istanbul informal settlement. The commonalities can be seen in the seventy patterns found in both settlements (See Tables 7.1 – 7.2).

2) Additionally, the differences in development processes and the resultant structures in each settlement provide unique examples of modern, 20th century generative urban design. That is, Karanfilköy and Fatih Sultan Mehmet are both additional examples of modern generative urban design in their own right, regardless of what typology they help define together.

3) As far as can be determined, religion has little influence on the structures in either settlement (outside of the mosques and mosque gardens). As Alkan explains about Karanfilköy:

> It is mentioned before that Karanfilköy consists of immigrants from East Black Sea region and Central Anatolia. People from these regions certainly carry different religious and political backgrounds. There are people from two denominations of Islam, which are Alevi and Sunnites in terms of religious identity. The political preferences are also so different that vary from leftist to rightist and conservative to progressionist. In short, it can be deducted that there is no ideological and religious dominancy in the neighbourhood (2006, 68).

There is nothing indicative of religious influence that the researcher observed. Also, the structures and patterns in each settlement were more likely influenced from other community members and possibly from the building knowledge retained and passed down from the original Anatolian settlements where most of the residents or the residents' parents came from. However, to truly answer how much religion is or is not an influence on the built environment in Karnfilkoy and Fatih Sultan Mehmet, a different type of study needs to be conducted. This might include a survey of residents about the effects of religion in their choices when adapting their surroundings. However, that method is outside the scope of this study.

CHAPTER EIGHT

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

> The effect of time on the process of adaptation is huge, and leads to types and styles of order quite different from any planned arrangement. Even in this first very small increment of construction, the dynamic time-dependent process creates and maintains relatedness. The static master-planned process does not… Thus, the main problem of community development, of growing a neighborhood, is to do it in the dynamic way not the static way. That is the big challenge. How can it be done?
> Christopher Alexander, *The Nature of Order – Book Three* (2005a, 336)

8.1 Introduction

This chapter summarizes how this dissertation contributes to theory and its implications for Istanbul informal housing. It also addresses limitations of the study, focusing on issues of validity and reliability. Finally, this chapter offers recommendations for further research and a summary of the study.

8.2 Contributions to New Theory

New cases for generative urban design theory

This study provides new cases for generative urban design theory. In particular, it provides contemporary, 20th and 21st century examples of generative processes and their resultant structures and patterns. Such modern examples are rare in generative urban design theory. Section 1.5 helps explain this study's contributions to new theory, with a focus on why the specific study areas (i.e., informal settlements in Istanbul) are a unique and valuable contribution to generative urban design theory. These contributions are summarized below:

1. Istanbul squatter settlements developed in the modern era, providing a generative development example from the 20^{th} and 21^{st} centuries.
2. Turkish squatter settlements share similarities with other squatter settlements, making them relavent to the mass squatter urbanization world-wide.
3. Istanbul is a “world city,” more connected to global economic, social and cultural affairs than other Turkish cities with squatter settlements. These global connections makes it a valuable context for analyzing generative urban design because Istanbul shares similarities with other large cities outside Turkey.
4. Turkish squatter settlements are a unique squatter settlement case. For example, Istanbul squatter settlements are well integrated into the urban fabric of the city in terms of infrastructure, transit, and politics. They provide a new contribution to generative urban design theory that is different than other squatter settlements previously studied in generative urban design.
5. The two cases provide two different development process examples. Karanfilkoy provides a generative urban design example that stayed at a low-rise and smaller scaled buildings typical of the original Istanbul squatter settlements. Fatih Sultan Mehmet provides a generative urban design example that developed high-rise, larger scaled buildings typical of post-1984 Istanbul squatter settlements.

Each settlement adds to the body of generative urban design theory as an individual example. Additionally, the settlements together provide enough evidence to offer a new, modern type to generative urban design theory: Istanbul informal settlements. It must be noted that Istanbul informal settlements are not entirely informal, as there are interactions with the planned, formal world (e.g., some infrastructure retrofits, including electricity, gas, and road paving; and public transit systems). It is particularly important to have examples of successful 20th century generative developments, as the most often cited examples of successful generative development predate the 20th century (Mehaffy 2008, 57-75). This study's compelling, relavent and unique examples add to the relatively young body of literature on generative urban design.

This study's data triangulation and convergence of evidence (i.e., its analysis of multiple constructs that help define generative design theory) also help make its contribution to generative urban design theory more valuable and valid.

8.3 Implications for Istanbul Informal Housing

This study's main goal is to contribute to theory, not to provide proscriptive or prescriptive advice regarding Istanbul squatter settlements and their policies, plans and designs. Nonetheless, this study's findings do reaffirm that the bottom-up, user-built planning and design of these settlements creates a number of benefits for these communities. It is found that the settlements' physical environments often contain wholeness and living structure (as defined by Christopher Alexander (2002a)). Also, the neighborhoods contain successful pattern languages. Ostensibly, all these physical attributes are a good thing. As such, policies should likely foster the continuation of such successful or “good” environments in Karanfilköy, Fatih Sultan Mehmet, and other Istanbul informal neighborhoods.

The degrees of life test results also show that living structure could be increased in both settlements. There are physical changes that could occur to increase the temperature and/or harmony of buildings and structures in both settlements.

Based on the findings from the degrees of life test, these include adding:

- harmonious details to buildings that have low life;
- recursive (or similarly shaped but differently scaled) elements to buildings (H_3 = degree to which distinct forms have similar shapes);
- forms to increase geometric connections, such as edges that join through an intermediary region of substantial width (H_4 = degree to which forms are connected geometrically to one another);
- elements of curvature (T_3 = curvature of lines and forms) (Salingaros 2006a, 107-112).

Additionally, the elements that repeatedly raised the degrees of life in both settlements (mentioned in Section 4.5) could often be added to the buildings that do not currently have these features.

Neither Karanfilköy nor Fatih Sultan Mehmet are perfect environments. There are certainly some improvements of infrastructure, environment, and/or services that could be added. However, many of these exact needs are unknown within the scope of this study.

8.4 Limitations

This study is limited by its size. To gain a better understanding of the phenomena being analyzed and increase construct validity, external validity and reliability, it would be advisable to increase the number of sites tested, units of analysis, operational measures, cases and researchers.

Of all the aforementioned possible improvements, perhaps the most important is additional researchers. This study's use of one researcher is certainly a limitation. For example, as Alexander points out, it is valuable to have a number of researchers evaluate pattern languages together in order to conclude what patterns are present and the most salient (2002b, 342-368). That is, the researchers' personal understandings of what constitutes important patterns are made more valid when ideas can be bounced off other researchers. To help bolster this weakness, construct validity is accounted for by using multiple modes of data gathering and using established and accepted construct definitions provided by Alexander and Salingaros. Additionally, data triangulation helps to ensure that the measures of wholeness, living structure, and patterns in Karanfilköy and Fatih Sultan Mehmet are valid. (Yin 2003, 97-99; Singleton et al. 2005, 381-384; Tashakkori et al. 1998, 91). Nevertheless, because this dissertation is conducted by one person, this study is limited by possible errors of the researcher's techniques in evaluating the constructs of generative process, living structure/wholeness, degrees of life, and pattern languages.

Although this study's main objective is to make a contribution to generative urban design theory, the study is limited by the reliance on the new methodologies provided by

Alexander and Salingaros (2002b; Alexander 2002a; 2005a; 2004; Salingaros 2006a). These methods push the boundaries of empirical science by relying on the researchers' personal understanding and evaluation of wholeness/living structure components and pattern languages. Nonetheless, this limitation is of slight concern in this study's context.

8.5 Recommendations for Future Research

This study leads to a number of possibilities for further research, including:

- More studies on Turkish informal housing in terms of their generative aspects. Such studies could expand the evidence collected in this study. There could be more test cases and/or more tests of this study's cases.
- Proscriptive and/or prescriptive design, planning and policy implementations that replicate some of the most successful generative processes, structures and patterns found in this study. These applications could be used in a variety of settings, including Turkey and the United States. One possible method for applying these lessons to the built environment is to use Alexander's methods for modifying land development processes, which he outlines in *The Nature of Order – Book Three* (Alexander 2005a, 561-578; Alexander et al. 2008).
- Expansion of the degree of life test. Ultimately, the degree of life test is a measure of living structure and wholeness. Likewise, Alexander and Salingaros provide multiple criteria (beyond the degrees of life test) to measure and evaluate these constructs (e.g., the felt wholeness test and Alexander's 15 properties) (Alexander 2002a). Nonetheless, the degrees of life test will likely continue to

remain an important quantitative assessment tool. It will need to be continually refined – such as it was in this study. Such refinements include expanding how the test functions, expanding what the test measures, and increasing the number of test cases.

- Construct validity for measuring generative urban design and wholeness could be bolstered by using Alexander's "felt wholeness" test (2002a, 298-402, 472). This test, if set up properly (perhaps, for example, by comparing the settlements with a planned settlement), could provide another reliable measure of the constructs this study is seeking to measure. Felt wholeness was likely used to some degree when identifying patterns in each settlement. However, it was not used in the methodologically rigorous way that Alexander describes (ibid).
- This study's methods could be implemented in planned Istanbul settlements in order to compare and contrast development processes and their resultant structures and patterns in squatter settlements versus planned settlements. This could be particularly valuable for determining whether the living structures and patterns observed are correlated with the Istanbul squatter culture and processes or Istanbul culture as a whole. For example, the pattern of "cats everywhere" is certainly found throughout Turkey, not just in informal neighborhoods.
- Expansion of efforts to preserve what is found "good" in these and other Turkish informal settlements. This includes studies examining planning policies that affect (i.e., either disrupt or enhance) the living structures found in these settlements.

8.6 Summary

This study provides a new, modern typology for generative urban design theory. It provides a rich explanatory case study evaluating multiple constructs of generative urban design processes and structures that are found in Istanbul informal settlements. Overall, the generative processes in these settlements have evolved into sustainable settlements (as defined by De Plessis) that offer participation, constant change and feedback loops which contribute to a living whole (2000, 7). This study is a testament to the ability of a community to build places of beauty and wholeness from the bottom up. The insights gleaned are valuable for researchers, planners, designers and policy makers. This study also hopes to be an inspiration for anyone creating a settlement, dwelling place or any kind of space of their own.

APPENDICES

Appendix A

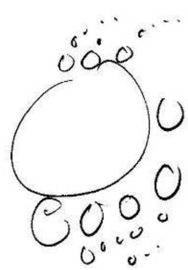
15 Properties of Living Structures

This appendix is a scanned copy of Alexander's *The nature of order, Book 1* (2002a 239-242). It is meant as a visual explanation to help further clarify how the role of centers, structure of wholeness and the 15 properties all relate. Alexander's simple diagrams get straight to the point of each property's essential features and functions. Of course, a deeper understanding of the 15 properties of living structure/life comes from reading Alexander's entire book.

5 / HOW THE FIFTEEN PROPERTIES HELP CENTERS COME TO LIFE

Let me therefore now go over, once again, the specific individual roles of the fifteen properties. Having observed the properties, having noticed them, it is important to ask exactly what they are, and to understand them more deeply, in relation to the structure of wholeness, and the structure of centers. Simply put, *I believe that these properties arise because they are the principal ways in which centers can be strengthened by other centers.*[8] They are, if you like, fifteen ways of talking about centers, and the way that the existence and life of centers dominates the existence of life in the world.

1. LEVELS OF SCALE is the way that a strong center is made stronger partly by smaller strong centers contained in it, and partly by its larger strong centers which contain it.

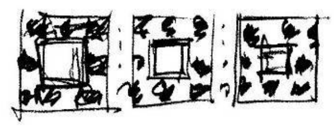


1. Levels of scale

2. STRONG CENTERS defines the way that a strong center requires a special field-like effect, created by other centers, as the primary source of its strength.

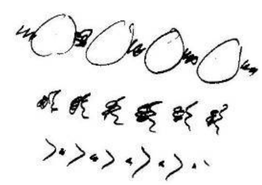
2. Strong centers

3. BOUNDARIES is the way in which the field-like effect of a center is strengthened by the creation of a ring-like center, made of smaller centers which surround and intensify the first. The boundary also unites the center with the centers beyond it, thus strengthening it further.



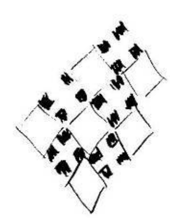
3. Boundaries

4. ALTERNATING REPETITION is the way in which centers are strengthened when they repeat, by the insertion of other centers between the repeating ones.



4. Alternating repetition

5. POSITIVE SPACE is the way that a given center must draw its strength, in part, from the strength of other centers immediately adjacent to it in space.

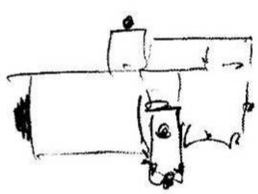


5. Positive space

6. GOOD SHAPE is the way that the strength of a given center depends on its actual shape, and the way this effect requires that even the shape, its boundary, and the space around it are made up of strong centers.

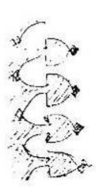
6. Good shape

7. LOCAL SYMMETRIES is the way that the intensity of a given center is increased by the extent to which other smaller centers which it contains are themselves arranged in locally symmetrical groups.



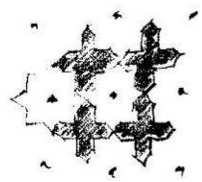
7. Local symmetries

8. DEEP INTERLOCK AND AMBIGUITY is the way in which the intensity of a given center can be increased when it is attached to nearby strong centers, through a third set of strong centers that ambiguously belong to both.



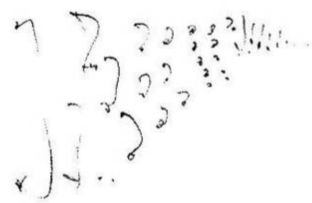
8. Deep interlock and ambiguity

9. CONTRAST is the way that a center is strengthened by the sharpness of the distinction between its character and the character of surrounding centers.



9. Contrast

10. GRADIENTS is the way in which a center is strengthened by a graded series of different-sized centers which then "point" to the new center and intensify its field effect.

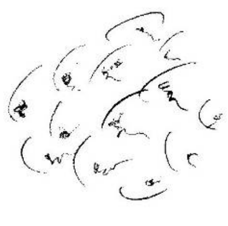


10. Gradients

11. ROUGHNESS is the way that the field effect of a given center draws its strength, necessarily, from irregularities in the sizes, shapes and arrangements of other nearby centers.

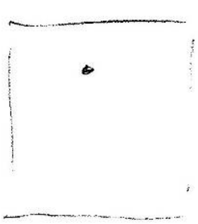
11. Roughness

12. ECHOES is the way that the strength of a given center depends on similarities of angle and orientation and systems of centers forming characteristic angles thus forming larger centers, among the centers it contains.



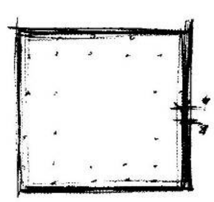
12. Echoes

13. THE VOID is the way that the intensity of every center depends on the existence of a still place — an empty center — somewhere in its field.



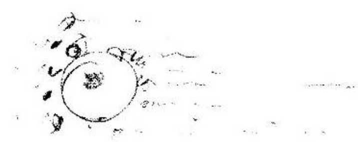
13. The void

14. SIMPLICITY AND INNER CALM is the way the strength of a center depends on its simplicity — on the process of reducing the *number* of different centers which exist in it, while increasing the *strength* of these centers to make them weigh more.



14. Simplicity and inner calm

15. NOT-SEPARATENESS is the way the life and strength of a center depends on the extent to which that center is merged smoothly — sometimes even indistinguishably — with the centers that form its surroundings.



15. Not-separateness

The fifteen properties are not independent. They overlap. In many cases we need one of them to understand the definition of another one. This is because it is the field of centers itself which is primary, not these fifteen properties. The properties are simply aspects of the field which help us to understand concretely how the field works.

However, even though the properties do not have primary significance and it is the field of centers, or the wholeness itself, which is primary, still there is an important sense in which the fifteen ways may represent an exhaustive description of all possible ways in which the field of centers works. *Each of the properties describes one of the possible ways in which centers can intensify each other.* Each one defines one type of spatial relationship between two or more centers, and then shows how the mutual intensification works in the framework of this relationship.

In effect, the fifteen properties are the glue, through which space is able to be unified. The fifteen properties provide the ways that centers can intensify each other. Through the intensity of centers, space becomes coherent. As it becomes coherent, it becomes alive. The fifteen properties are the "ways" it comes to life.[9]

Are there any other ways? Is this catalogue of fifteen merely a random sample of the possible ways in which centers can produce a field? Or is this an exhaustive and complete list?

The number fifteen is only rough. At various stages in the evolution of this theory, I have had a catalog of twelve, fourteen, thirteen, fifteen, sixteen. The precise number fifteen is not significant. But I do believe that the order of magnitude of the number is significant. Throughout my efforts to define these properties, it was always clear that there were not five, and not a hundred, but *about* fifteen of these properties. It wasn't possible to go on listing new ones indefinitely.

There is no certainty that this list is exhaustive. On the other hand, if you try to think up other effects which are combinatorially different from these, you will find it is not very easy. When we focus on the mathematical ways in which centers can be built out of other centers, or the ways in which one center helps to make other centers stronger, there is a limit to the number of ways in which this can be done.

NOTES

1. These properties may be thought of as an elaboration of the observations, recorded more informally in THE TIMELESS WAY OF BUILDING (New York: Oxford University Press, 1979), chapter 23. It was the content of that chapter, written in 1975, which stirred in me the need to start the observations that are recorded here.

2. Christopher Alexander and Susan Carey, "Subsymmetries," PERCEPTION AND PSYCHOPHYSICS 4 (1968): 2, 73–77; Christopher Alexander and Bill Huggins, "On Changing the Way People See," PERCEPTUAL AND MOTOR SKILLS 19 (1964): 235–53. The experiments are also discussed further in appendix 2.

3. Toward the end of Book 2 (chapter 14), we shall see that almost everything about life in buildings can, in the end, be understood through symmetries, and that, indeed, there may be a way in which the concept of wholeness, and the field of centers, when understood dynamically, can be understood completely in terms of a sequential unfolding of symmetries.

4. Evidently there is a deep connection between the presence of local symmetries in a field and the occurrence of a center. In empirical studies of wholeness symmetry has always played a role. Symmetry is one of the powerful ways that space is made whole. When a part of space is symmetrical it is internally coherent.

5. For the case of a crystal, Humphries argues that there is more structure in the grid with slight irregularities, because it still has the grid structure, but some additional differentiations and other structures as well. Humphries in ASPECTS OF FORM, ed. L. L. Whyte 1951 (Bloomington, Indiana University Press, 1961).

6. Soetsu Yanagi, THE UNKNOWN CRAFTSMAN (Tokyo: Kodansha International Ltd, 1972).

7. In physics and biology, "homology."

8. See chapter 4.

9. It is vital for the reader to understand that, even though they are so important, the fifteen properties are not essential in themselves. What matters in the end is the life of the *centers*. The importance of the properties is simply that they help you to understand the way that centers come to life. I often give students the task of making small drawings in which they illustrate the fifteen properties one by one. When a student does this, there are two kinds of things that can happen. In one case, A, the property is present in the drawing so that, formally, one may say that the property exists there. But in the case A, nothing really happens. Life does not enter the drawing because the student has not really understood the meaning of the property. Life and feeling are not increased: so the essential inner meaning of the property has not been understood.

In another case, B, the student uses the property in such a way that *because* of it the drawing gets more life. Thus the property is useful, active, powerful, in helping to bring life and feeling into that drawing. In this case, B, I say that the student has understood the property.

What is the real difference between these two cases, A and B? It hinges on the fact that a drawing gets life when the centers in the drawing have life; when there are many living centers, instead of a few only; and when the centers have a deep intensity of life in them. So, in a drawing which has life and feeling, it has it because the centers in it are alive. What all this means is that the property itself is not important. What is important is only the fact that centers must be created, densely, and that they must be given life.

That is what I mean by saying that, really, the properties are not so important, and can be "thrown away" — and that what really matters is the person's ability to see the centers, to make more and more centers, and to make them come to life. But I do not want to undervalue the properties. It takes years — perhaps three, five, ten years — to learn the process of making centers, and to know what it means to make a center come to life. In the meantime, the properties are a very useful tool; they are a way of focusing our attention on the centers. By following the properties, even if blindly, like a mechanical tool, we gradually come to know more and more and more about the life of centers — we appreciate the way that centers interact, we learn to make the life of one center more intense, by adding, or providing other centers — and the property thus teaches us, concretely, more and more about how we can make centers come to life. That is the whole ball game in the end.

Appendix B

Calculating Degree of Life

This method for calculating the degree of life (and architectural complexity) in structures, houses, etc, is taken from Salingaros (2006a, 104-128).

$L = T\,H; \quad C = T(10\text{-}H), \; 0 \leq C < 100$

Where,

L = Degree of Life

T = Architectural temperature

H = Architectural harmony

$T = T_1 + T_2 + T_3 + T_4 + T_5$

$H = H_1 + H_2 + H_3 + H_4 + H_5$

C = Architectural Complexity

Definitions:

Temperature

The architectural temperature T is constituted as five components, each of which assumes a value of 0 to 2. Very little = 0; some = 1; considerable = 2. The total temperature T ranges from a score of 0-10 (ibid, 107).

T_1 = intensity of perceivable detail

T_2 = density of differentiations

T_3 = curvature of lines and forms

T_4 = intensity of color hue

T_5 = contrast among color hues

How to estimate each component of architectural temperature:

(T_1) - The limit of perceived differentiations in material texture at arm's length is roughly 1 mm. Well-defined detail at any comparable size in surfaces that a person can touch, regardless of whether the detail is localized or spread over the entire region, suggests we assign a value of 2 for T_1. On regions farther away, textural differentiations that contribute to T_1 should be much larger so as to appear the same size as detail would appear at arm's length. Coarser, or less sharply-defined detail, assigns a 1 for T_1. Detail is defined by the width of a substructure or differentiation. Detail that is too small or is faintly-defined assigns a 0 for T_1. Smooth or textured monochromatic surfaces rate a 0; to count, detail must be articulated against the background. High-tech precision should not be confused with detail. The interface where two edges come together has no width or dimensions, thus it does not define a material line. Detail is not defined by a single discontinuity or sharp interface.

(T_2) - T_2 measures how much substructure and variety is presented to the viewer. I will treat every geometric differentiation such as a relief or color pattern as having the same effect as its grayscale value. T_2 of a colored relief is therefore judged in terms of a flat black-and-white photograph. (This is done because color is a separate measure). In this projection, any differentiation or texture is perceived in terms of its grayscale contrast, or by the shadows it casts. A high density of sharp differentiations assigns a 2 for T_2, whereas a plain surface assigns a 0 for T_2. That color value itself, which represents a particular shade of grey, doesn't contribute to T_2 directly.

(T_3) - T_3 measures the smallness of the radius of curvature of lines and forms (a smaller radius corresponds to greater curvature), and also how many curves are present. A curve can be approximated by a very large number of small straight-line segments. Any curve and inflection (for example, the graph of a higher-order polynomial; or a zigzag) has a higher architectural temperature than a straight line. The architectural temperature is proportional to the curvature of lines and forms. Curved forms on the intermediate scales (that is, between detail and the overall size) assign a 1 to T_3; if they have a high degree of curvature, or if there are many curves, we assign a 2 for T_3. Straight lines and rectangular forms assign a value of 0 for T_3.

(T_4) - T_4 estimates the chromatic depth of any color present: high for a vivid, intense color, but low for a dull, grayish, muddy color. A richly colored building, even if it is of one color (say, all red), has a higher temperature than a grey building (which assigns a 0 for T_4). A design with some color overall suggests a value of 1 for T_4; an intense though not necessarily bright color assigns a 2 for T_4. The actual color (e.g., yellow, green, red, blue, or purple) is immaterial.

(T_5) - T_5 measures the interaction among several distinct colors. The architectural temperature is increased further by having complimentary colors, for example,

yellow next to violet, orange next to blue, or red next to green. It is also high for black-and-white contrast. If there is any contrast among colors, assign a 1 for T_5; if there is a great variety, or the contrast is particularly vivid, assign a 2. Having a uniform color or no color at all assigns a 0 for T_5.
(ibid, 108)

Harmony

"The architectural harmony H is constituted as five components, each of which assumes a value of 0 to 2" (ibid, 110). Very little = 0; some = 1; considerable = 2. The total harmony H ranges from a score of 0-10 (ibid, 110).

H_1 = reflectional symmetries on all scales

H_2 = translational and rotational symmetries on all scales

H_3 = degree to which distinct forms have similar shapes

H_4 = degree to which forms are connected geometrically to one another

H_5 = degree to which colors harmonize

How to estimate each component of architectural harmony:

(H_1) – An average numerical value has to be assigned for the presences of symmetries on all scales, not just for the largest scale. Moreover, the quantity H_1 actually depends on the orientation of the symmetry axis, because gravity defines a preferred direction for both life forms and materials. Of the possible axes for reflectional symmetry, the vertical one raises the architectural harmony the most. For having many vertical symmetries on distinct scales, assign a 2 for H_1, whereas a vertical symmetry on a single scale assigns a 1 for H_1. Symmetry about a diagonal axis clashes with natural symmetries created by gravity, and the ensuing imbalance lowers the architectural harmony to 1 (e.g., the leaning Campanile of the Cathedral at Pisa). Lack of reflectional symmetry on different scales leads us to assign a value of 0 for H_1. In plain surfaces with no distinguishing elements, H_1 is defined by the edges; if they are parallel, then assign a 2 for H_1.

(H_2) – The contribution H_2 measures translational symmetries (and the less common rotational symmetry) on walls, doors, and windows; not on a building's plan. If the same element is repeated in a regular pattern along one or two directions, then assign a 2 for H_2. Elements repeated randomly lower H_2, assigning it a 0 instead.

> (H_3) – Self-similarity raises the architectural harmony, by scaling up the same figure to several different sizes, then aligning all the scaled copies. The contribution H_3 measures the similarity of overlapping or spatially-separated figures occurring at different sizes. For example, a group of parallel lines or similar nested curves is related by a scaling transformation, so in that case we assign a 2 for H_3. This mechanism works when the windows have the same proportions as the entire wall or façade, in which case we also assign a 2 for H_3. Pieces with markedly different shapes do not harmonize with the whole, and we assign a 0 for H_3.
>
> (H_4) – The quantity H_4 estimates the presence of geometrical connections. Internal and external connections can take many different forms: connecting lines or columns; intermediate transition regions; a wider surrounding border, etc. Piecewise connections raise H_4 to 1 or 2. Edges that touch but fail to join through an intermediate region or frame, jutting overhangs without obvious supports, and breaks in lines all lower H_4 to 0. The main connection of any building is to the ground (earth); if this is not strongly expressed by means of structural elements, then we assign a 0 for H_4.
>
> (H_5) – A building of single color or without any color at all has color harmony, so assign a 2 for H_5. If different colors are used, one has to estimate how well the various hues blend to create an overall color harmony. Even with bright colors, a harmonious ensemble is possible, which assigns a 2 for H_5. Look at paintings, which can have thousands of different colors that harmonize: nothing really jumps out at the viewer (unless that was the artist's intention). The departure from a unified color effect – an unbalanced, clashing, or garish combination – lowers H_5 to zero. Statistical correlation of color effects finds that people agree about which color combinations appear "harmonious".
> (ibid, 111)

Below is an example of the degree of life scale used to analyze the architectural temperature, harmony and degrees of life of twenty-five famous buildings:

Table B.1: Salingaros's examples of buildings and their degree of life

Table 5.2. ***Twenty-five famous buildings and their values. Buildings are numbered in chronological order. The third and fourth columns are computed from the first and second columns as L = TH , and C = T(10 – H).***

Building	***Place***	***Date***	***T***	***H***	***L***	***C***
1. Parthenon	Athens	–5C	7	8	56	14
2. Hagia Sophia	Istanbul	6C	10	8	80	20
3. Dome of the Rock	Jerusalem	7C	9	9	81	9
4. Palatine Chapel	Aachen	9C	7	9	63	7
5. Phoenix Hall	Kyoto	11C	7	9	63	7
6. Konarak Temple	Orissa	13C	8	8	64	16
7. Cathedral	Salisbury	13C	7	9	63	7
8. Baptistry	Pisa	11/14C	7	8	56	14
9. Alhambra	Granada	14C	10	9	90	10
10. St. Peter's	Rome	16/17C	9	6	54	36
11. Taj Mahal	Delhi	17C	10	9	90	10
12. Grande Place	Brussels	1700	9	7	63	27
13. Maison Horta	Brussels	1898	8	7	56	24
14. Carson, Pirie, Scott	Chicago	1899	7	8	56	14
15. Casa Batlló	Barcelona	1906	8	5	40	40
16. Fallingwater	Bear Run	1936	4	5	20	20
17. Watts Towers	Los Angeles	1954	10	4	40	60
18. Corbusier Chapel	Ronchamp	1955	3	2	6	24
19. Seagram Building	New York	1958	1	8	8	2
20. TWA Terminal	New York	1961	3	4	12	18
21. Salk Institute	San Diego	1965	1	6	6	4
22. Opera House	Sydney	1973	4	5	20	20
23. Medical Faculty	Brussels	1974	7	4	28	42
24. Pompidou Center	Paris	1977	6	4	24	36
25. Foster Bank	Hong Kong	1986	3	7	21	9

. Table from *A theory of architecture* (Salingaros 2006a, 109)

Appendix C

Degrees of Life Results

C.1 Formulas

This method for calculating the degree of life in structures, houses, etc, is taken from Salingaros (2006a, 104-128). See Appendix B for a complete description of how to estimate each *Temperature* and *Harmony* component.

$L = T\,H; \quad C = T(10-H), \ 0 \leq C < 100$

Where,

L = Degree of Life
T = Architectural temperature
H = Architectural harmony
$T = T_1 + T_2 + T_3 + T_4 + T_5$
$H = H_1 + H_2 + H_3 + H_4 + H_5$
C = Architectural Complexity

Temperature

The architectural temperature T is constituted as five components, each of which assumes a value of 0 to 2. Very little = 0; some = 1; considerable = 2. The total temperature T ranges from a score of 0-10 (ibid, 107).

T_1 = intensity of perceivable detail
T_2 = density of differentiations
T_3 = curvature of lines and forms
T_4 = intensity of color hue
T_5 = contrast among color hues

Harmony

"The architectural harmony H is constituted as five components, each of which assumes a value of 0 to 2" (ibid, 110). Very little = 0; some = 1; considerable = 2. The total harmony H ranges from a score of 0-10 (ibid, 110).

H_1 = reflectional symmetries on all scales
H_2 = translational and rotational symmetries on all scales
H_3 = degree to which distinct forms have similar shapes
H_4 = degree to which forms are connected geometrically to one another
H_5 = degree to which colors harmonize

C.2 Degrees of Life Test Cases for Construct Validity

Grossfeldsiedlung, Vienna, Austria – A Modern social housing project

The eight buildings examined in Grossfeldsiedlung all scored the same on the degrees of life test, so only one table is included.

Figure C.1: Grossfeldsiedlung samples - Vienna, Austria

Figure C.2: Grossfeldsiedlung samples - Vienna, Austria

Table C.1: Data – Grossfeldsiedlung, Vienna, Austria

$T_1 = 0$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 0$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{1}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{8}$	$\boldsymbol{C} = \mathbf{2}$

Spittelau Viaducts Housing Project, Vienna, Austria – A Post-Modern building

Figure C.3: Spittelau Viaducts Housing Project – Vienna, Austria

Table C.2: Data – Spittelau Viaducts Housing Project, Vienna, Austria

$T_1 = 0$	$H_1 = 0$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 0$	$H_3 = 0$		
$T_4 = 0$	$H_4 = 0$		
$T_5 = 0$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{1}$	$\boldsymbol{H} = \mathbf{3}$	$\boldsymbol{L} = \mathbf{3}$	$\boldsymbol{C} = \mathbf{7}$

Post-Modern housing - Nineteenth District, Vienna Austria

The two buildings examined scored the same on the degrees of life test, so only one table is included.

Figure C.4: Post-Modern housing - Nineteenth District - Vienna Austria

Table C.3: Data – Post-Modern housing - Nineteenth District, Vienna Austria

$T_1 = 1$	$H_1 = 0$		
$T_2 = 0$	$H_2 = 0$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 0$	$H_4 = 0$		
$T_5 = 0$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{1}$	$\boldsymbol{H} = \mathbf{3}$	$\boldsymbol{L} = \mathbf{3}$	$\boldsymbol{C} = \mathbf{7}$

Hagia Sophia, Istanbul, Turkey

Figure C.5: Hagia Sofia - Istanbul, Turkey (Furbush 2011)

Table C.4: Data – Hagia Sophia, Istanbul, Turkey

$T_1 = 2$	$H_1 = 2$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 2$	$H_3 = 2$		
$T_4 = 2$	$H_4 = 2$		
$T_5 = 2$	$H_5 = 1$		
$\boldsymbol{T = 10}$	$\boldsymbol{H = 9}$	$\boldsymbol{L = 90}$	$\boldsymbol{C = 10}$

Pompidou Center, Paris, France

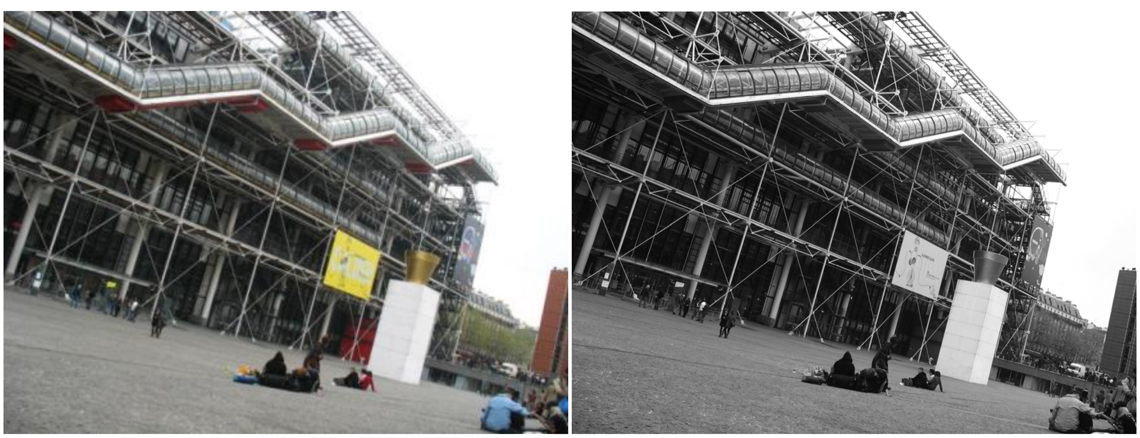


Figure C.6: Pompidou Center - Paris, France

Table C.5: Data – Pompidou Center, Paris, France

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 1$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 0$		
T = 7	**H = 4**	**L = 28**	**C = 42**

C.3 Degrees of Life in Karanfilköy

Figure C.7: Karanfilköy sampling locations

Table C.6: Data summary – Averages and standard deviations for Karanfilköy

	Avg	*SD*		*Avg*	*SD*						
T_1 =	1.31	0.48	H_1 =	1.31	0.60						
T_2 =	1.31	0.48	H_2 =	1.31	0.60						
T_3 =	1.00	0.00	H_3 =	0.94	0.25						
T_4 =	1.56	0.81	H_4 =	1.06	0.25						
T_5 =	1.25	0.45	H_5 =	1.81	0.40		*Avg*	*SD*		*Avg*	*SD*
***T* =**	**6.44**	**1.41**	***H* =**	**6.44**	**1.50**	***L*=**	**41.00**	**12.94**	***C* =**	**23.38**	**12.87**

Site 1

Figure C.8: Site 1 – Karanfilköy

Table C.7: Data - Site 1 – Karanfilköy

T_1 = 2	H_1 = 1		
T_2 = 1	H_2 = 1		
T_3 = 1	H_3 = 1		
T_4 = 1	H_4 = 1		
T_5 = 1	H_5 = 2		
***T* = 6**	***H* = 6**	***L* = 36**	***C* = 24**

Site 2

Figure C.9: Site 2 – Karanfilköy

Table C.8: Data - Site 2 – Karanfilköy

$T_1 = 2$	$H_1 = 0$		
$T_2 = 2$	$H_2 = 0$		
$T_3 = 1$	$H_3 = 0$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T} = \mathbf{8}$	$\boldsymbol{H} = \mathbf{2}$	$\boldsymbol{L} = \mathbf{16}$	$\boldsymbol{C} = \mathbf{64}$

Site 3

Figure C.10: Site 3 – Karanfilköy

Table C.9: Data - Site 3 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
T = 6	**H = 6**	**L = 36**	**C = 24**

Site 4

Figure C.11: Site 4 – Karanfilköy

Table C.10: Data - Site 4 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{48}$	$\boldsymbol{C} = \mathbf{12}$

Site 5

Figure C.12: Site 5 – Karanfilköy

Table C.11: Data - Site 5 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 2$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 42}$	$\boldsymbol{C = 18}$

Site 6

Figure C.13: Site 6 – Karanfilköy

Table C.12: Data - Site 6 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{4}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{32}$	$\boldsymbol{C} = \mathbf{8}$

Site 7

Figure C.14: Site 7 – Karanfilköy

Table C.13: Data - Site 7 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{6}$	$\boldsymbol{L} = \mathbf{36}$	$\boldsymbol{C} = \mathbf{24}$

Site 8

Figure C.15: Site 8 – Karanfilköy

Table C.14: Data - Site 8 – Karanfilköy

$T_1 = 2$	$H_1 = 2$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{7}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{56}$	$\boldsymbol{C} = \mathbf{14}$

Site 9

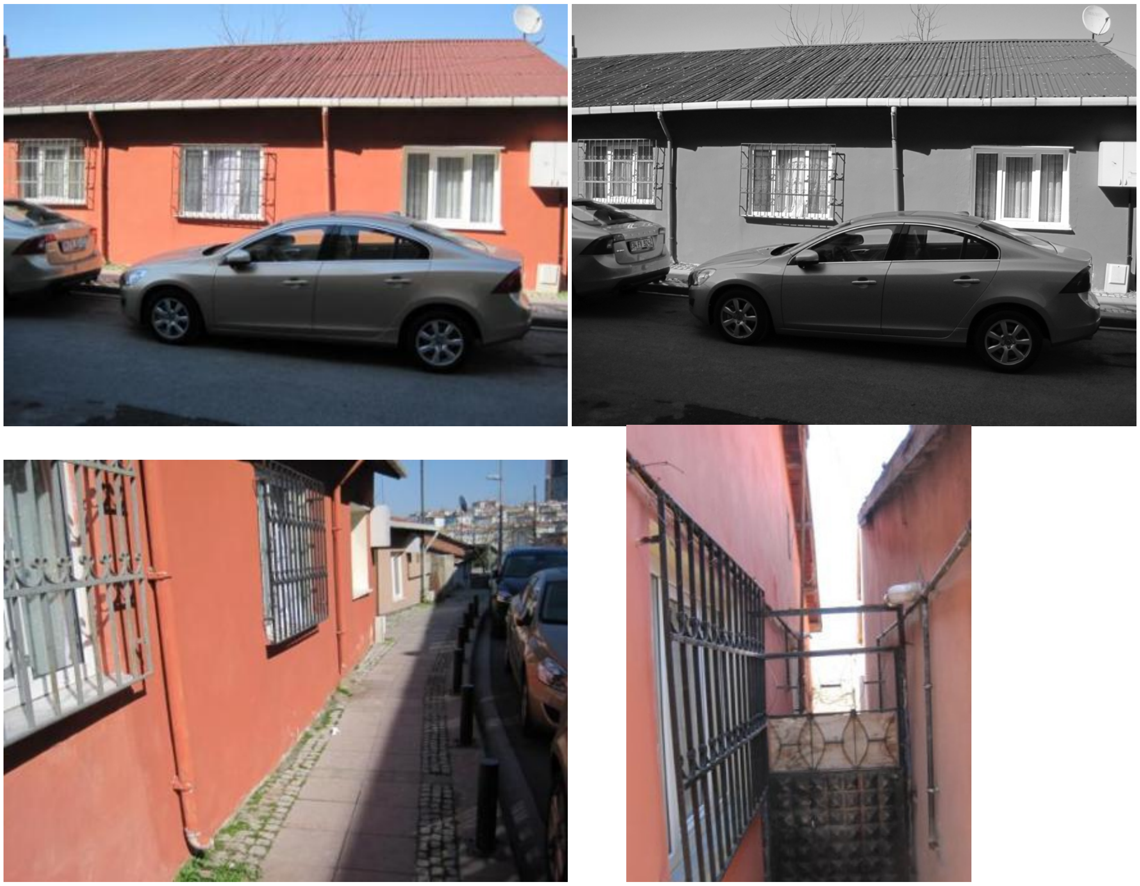


Figure C.16: Site 9 – Karanfilköy

Table C.15: Data - Site 9 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{48}$	$\boldsymbol{C} = \mathbf{12}$

Site 10

Figure C.17: Site 10 – Karanfilköy

Table C.16: Data - Site 10 – Karanfilköy

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 9}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 63}$	$\boldsymbol{C = 27}$

Site 11

Figure C.18: Site 11 – Karanfilköy

Table C.17: Data - Site 11 – Karanfilköy

$T_1 = 2$	$H_1 = 2$		
$T_2 = 2$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{9}$	$\boldsymbol{H} = \mathbf{7}$	$\boldsymbol{L} = \mathbf{63}$	$\boldsymbol{C} = \mathbf{27}$

Site 12

Figure C.19: Site 12 – Karanfilköy

Table C.18: Data - Site 12 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{4}$	$\boldsymbol{H} = \mathbf{6}$	$\boldsymbol{L} = \mathbf{24}$	$\boldsymbol{C} = \mathbf{16}$

Site 13

Figure C.20: Site 13 – Karanfilköy

Table C.19: Data - Site 13 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{6}$	$\boldsymbol{L} = \mathbf{36}$	$\boldsymbol{C} = \mathbf{24}$

Site 14

Figure C.21: Site 14 – Karanfilköy

Table C.20: Data - Site 14 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{6}$	$\boldsymbol{L} = \mathbf{36}$	$\boldsymbol{C} = \mathbf{24}$

Site 15

Figure C.22: Site 15 – Karanfilköy

Table C.21: Data - Site 15 – Karanfilköy

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 7}$	$\boldsymbol{L = 49}$	$\boldsymbol{C = 21}$

Site 16

Figure C.23: Site 16 – Karanfilköy

Table C.22: Data - Site 16 – Karanfilköy

$T_1 = 1$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T} = \mathbf{7}$	$\boldsymbol{H} = \mathbf{5}$	$\boldsymbol{L} = \mathbf{35}$	$\boldsymbol{C} = \mathbf{35}$

C.4 Degrees of Life in Fatih Sultan Mehmet

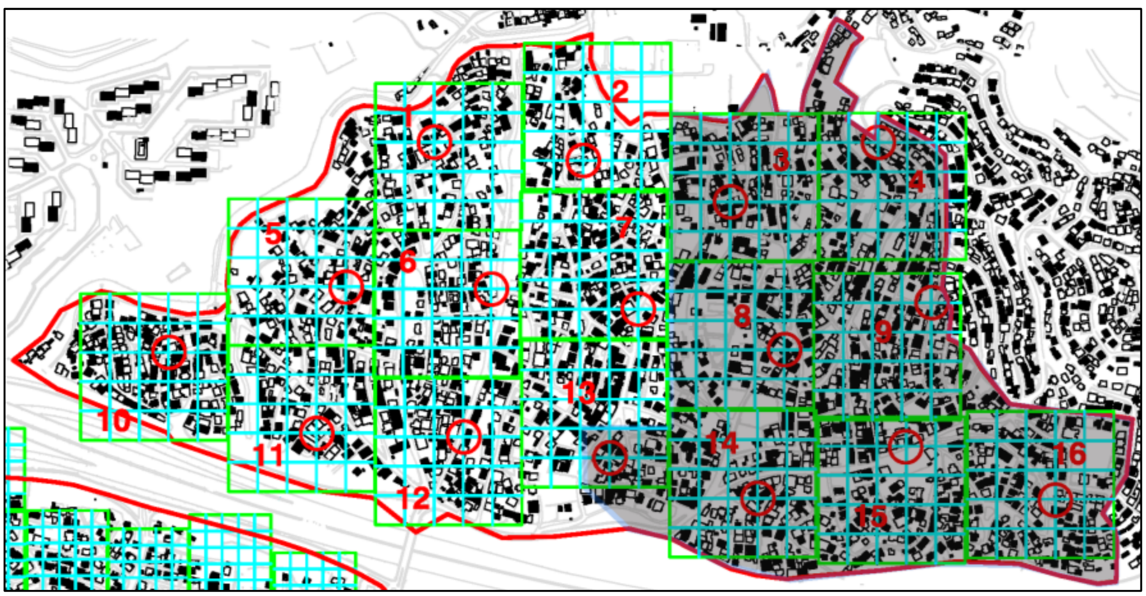


Figure C.24: Fatih Sultan Mehmet sample locations and un-sampled area (shaded)

Table C.23: Data summary – Averages and standard deviations for Fatih Sultan Mehmet

	Avg	*SD*		*Avg*	*SD*						
$T_1 =$	1.31	0.60	$H_1 =$	1.13	0.50						
$T_2 =$	1.31	0.48	$H_2 =$	1.13	0.62						
$T_3 =$	0.75	0.45	$H_3 =$	0.88	0.50						
$T_4 =$	1.56	0.73	$H_4 =$	1.06	0.25						
$T_5 =$	1.25	0.45	$H_5 =$	1.38	0.72		*Avg*	*SD*		*Avg*	*SD*
$\boldsymbol{T} =$	**6.19**	**1.28**	$\boldsymbol{H} =$	**5.56**	**1.90**	$\boldsymbol{L}=$	**34.75**	**15.29**	$\boldsymbol{C} =$	**27.13**	**12.75**

Site 1a

Figure C.25: Site 1a – Fatih Sultan Mehmet

Table C.24: Data - Site 1a – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 0$		
$\boldsymbol{T} = \mathbf{8}$	$\boldsymbol{H} = \mathbf{4}$	$\boldsymbol{L} = \mathbf{32}$	$\boldsymbol{C} = \mathbf{48}$

Site 1b

Figure C.26: Site 1b – Fatih Sultan Mehmet

Table C.25: Data - Site 1b – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 0$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T} = \mathbf{4}$	$\boldsymbol{H} = \mathbf{4}$	$\boldsymbol{L} = \mathbf{16}$	$\boldsymbol{C} = \mathbf{24}$

Site 2a

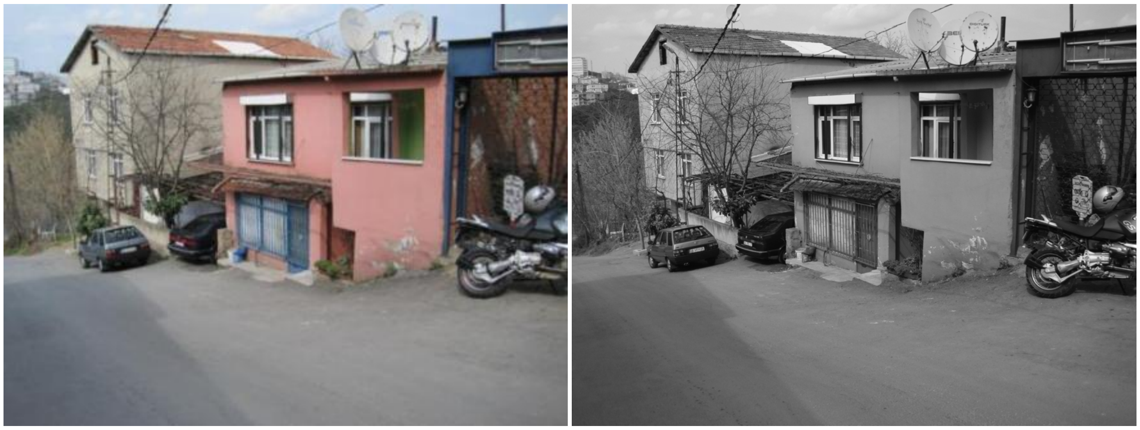


Figure C.27: Site 2a – Fatih Sultan Mehmet

Table C.26: Data - Site 2a – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T} = \mathbf{5}$	$\boldsymbol{H} = \mathbf{5}$	$\boldsymbol{L} = \mathbf{25}$	$\boldsymbol{C} = \mathbf{25}$

Site 2b

Figure C.28: Site 2b – Fatih Sultan Mehmet

Table C.27: Data - Site 2b – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 5}$	$\boldsymbol{L = 30}$	$\boldsymbol{C = 30}$

Site 5a

Figure C.29: Site 5a – Fatih Sultan Mehmet

Table C.28: Data - Site 5a – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 2$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T = 9}$	$\boldsymbol{H = 8}$	$\boldsymbol{L = 72}$	$\boldsymbol{C = 18}$

Site 5b

Figure C.30: Site 5b – Fatih Sultan Mehmet

Table C.29: Data - Site 5b – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 36}$	$\boldsymbol{C = 24}$

Site 5c

Figure C.31: Site 5c – Fatih Sultan Mehmet

Table C.30: Data - Site 5c – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 0$		
$T_2 = 2$	$H_2 = 0$		
$T_3 = 1$	$H_3 = 0$		
$T_4 = 0$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 0$		
$\boldsymbol{T = 6}$	$\boldsymbol{H = 1}$	$\boldsymbol{L = 6}$	$\boldsymbol{C = 54}$

Site 6a

Figure C.32: Site 6a – Fatih Sultan Mehmet

Table C.31: Data - Site 6a – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 1$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 1$		
$T = 6$	**$H = 6$**	**$L = 36$**	**$C = 24$**

Site 6b

Figure C.33: Site 6b – Fatih Sultan Mehmet

Table C.32: Data - Site 6b – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{48}$	$\boldsymbol{C} = \mathbf{12}$

Site 7

Figure C.34: Site 7 – Fatih Sultan Mehmet

Table C.33: Data - Site 7 – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 0$		
$T_3 = 1$	$H_3 = 0$		
$T_4 = 1$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 3}$	$\boldsymbol{L = 21}$	$\boldsymbol{C = 49}$

Site 10

Figure C.35: Site 10 – Fatih Sultan Mehmet

Table C.34: Data - Site 10 – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$T = 6$	**$H = 6$**	**$L = 36$**	**$C = 24$**

Site 11a

Figure C.36: Site 11a – Fatih Sultan Mehmet

Table C.35: Data - Site 11a – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 2$		
$T_3 = 0$	$H_3 = 2$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 2$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{8}$	$\boldsymbol{L} = \mathbf{48}$	$\boldsymbol{C} = \mathbf{12}$

Site 11b

Figure C.37: Site 11b – Fatih Sultan Mehmet

Table C.36: Data - Site 11b – Fatih Sultan Mehmet

$T_1 = 1$	$H_1 = 2$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T} = \mathbf{6}$	$\boldsymbol{H} = \mathbf{7}$	$\boldsymbol{L} = \mathbf{42}$	$\boldsymbol{C} = \mathbf{18}$

Site 11c

Figure C.38: Site 11c – Fatih Sultan Mehmet

Table C.37: Data - Site 11c – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 42}$	$\boldsymbol{C = 28}$

Site 12a

Figure C.39: Site 12a – Fatih Sultan Mehmet

Table C.38: Data - Site 12a – Fatih Sultan Mehmet

$T_1 = 2$	$H_1 = 1$		
$T_2 = 2$	$H_2 = 2$		
$T_3 = 1$	$H_3 = 1$		
$T_4 = 1$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 1$		
$\boldsymbol{T = 7}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 42}$	$\boldsymbol{C = 24}$

Site 12b

Figure C.40: Site 12b – Fatih Sultan Mehmet

Table C.39: Data - Site 12b – Fatih Sultan Mehmet

$T_1 = 0$	$H_1 = 1$		
$T_2 = 1$	$H_2 = 1$		
$T_3 = 0$	$H_3 = 1$		
$T_4 = 2$	$H_4 = 1$		
$T_5 = 1$	$H_5 = 2$		
$\boldsymbol{T = 4}$	$\boldsymbol{H = 6}$	$\boldsymbol{L = 24}$	$\boldsymbol{C = 16}$

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