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An Investigation into the Home Environments of 10-14 Age Group Children in the Cognitive Maps*

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Abstract

Nowadays, urbanization is increasing and children's relationship with their living environment is becoming more and more important. This study aims to examine the urban imagery elements in children's minds concerning the urban space in which they live and to show how children reflect spatial information about their home and home environment in their cognitive maps. A field study was conducted with children (n=387) in the Kadıkoy neighborhood of Istanbul during the fall semester of the 2021-2022 academic year. The study group was selected using stratified random sampling. Questionnaires and cognitive maps were created with children aged 10-14 years. IBM SPSS 25.0 statistical program was used to analyze the research data. The study used descriptive data analysis to determine frequencies and percentages. The results of the study are divided into two categories. The first consists of drawing an image map of the real environment and determining the image elements, and the second consists of spatially analyzing the content of the cognitive maps drawn by the children. Spatial content analysis of cognitive maps; i) explanation of home environment in children's cognitive maps following Lynch's methodology (path and landmarks); ii) Matthews' categories for classifying children's drawn cognitive maps. The

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research findings show that i) paths are drawn more frequently as landmarks in children's cognitive maps, but landmarks are drawn in more detail and defined in writing. The second finding of the study is ii) that the reflection rate of children's functional cognitive map drawings (elements of the built environment) from the immediate environment of their home is quite high. This study of children's city images and cognitive mapping abilities is likely to give researchers in fields including city planning, architecture, educational sciences, cognitive psychology, and child psychology a new perspective.

Keywords: Children, cognitive map, home environment, urban image element.

10-14 Yaş Grubu Çocukların Ev Çevrelerinin Bilişsel Haritalarda İncelenmesi

Öz

Günümüzde kentleşmenin artmasıyla birlikte çocukların yaşadıkları çevreyle kurdukları ilişkinin anlaşılması daha önemli hale gelmektedir. Bu araştırmanın amacı, çocukların yaşadıkları kentsel mekanla kurdukları ilişkiyi zihinlerindeki kentsel imaj öğeleri üzerinden araştırmak, çocukların ev ve yakın çevresindeki mekansal bilgiyi bilişsel haritalarına nasıl yansıttıklarını ortaya koymaktır. Bu araştırmanın alan çalışması, 2021-2022 eğitim-öğretim yılı güz döneminde İstanbul ili Kadıkoy ilçesindeki (n=387) çocuklarla gerçekleştirilmiştir. Çalışma grubu tabakalı örnekleme yoluyla seçilmiştir. 10-14 yaş grubu çocuklarla anket ve bilişsel harita çizimi yapılmıştır. Araştırmanın verileri IBM SPSS 25.0 istatistik programında analiz edilmiştir. Araştırmada betimsel veri analizi yapılarak frekans ve yüzdeler ortaya koyulmuştur. Araştırma bulguları iki başlık altında yorumlanmıştır. Birincisi kentsel mekanın imaj haritası çizilmesi ve imaj öğelerinin tespit edilmesi, ikincisi ise çocukların çizdikleri bilişsel haritaların mekansal içerik analizinin yapılmasıdır. Bilişsel haritaların içerik analizi; i) çocukların bilişsel haritalarında ortaya çıkan ev çevresine ait imaj öğelerinin Lynch'in metodolojisine göre (yollar ve işaret öğeleri) değerlendirilmesi, ii) çocukların çizdikleri bilişsel haritaların Matthews'in kategorilerine göre sınıflandırılasıdır. Araştırmanın bulgularına göre, i) çocukların bilişsel haritalarında yol imgesinin çizimi, işaret öğesine göre daha fazla görülmesine rağmen, işaret öğeleri daha ayrıntılı çizilmiş ve yazılı olarak tanımlanmıştır. Araştırmanın ikinci bulgusu ise ii) çocukların evlerinin yakın çevresine ait işlevsel (yapılı çevre unsurlarını) bilişsel harita çizimlerine yansıtma oranının oldukça fazla olduğu görülmektedir. Çocukların kent imajları ve bilişsel haritalama yetenekleri üzerine yapılan bu araştırmanın şehir planlama, mimarlık, eğitim bilimleri, bilişsel psikoloji ve çocuk psikolojisi gibi alanlarda yapılacak araştırmalara farklı bir bakış açısı sağlaması beklenmektedir.

Anahtar Kelimeler: Çocuk, bilişsel harita, ev çevresi, kentsel imaj öğeleri.

Introduction

Recognition, perception, learning, and understanding of the environment are important for both children and adults. Children's perspectives are influenced by their relationships to their surroundings in urban spaces and stimuli from their physical environment. This means that the child can position himself in the environment in which he lives, orient himself, pay attention to environmental elements, encode information about the place and create an image of this environment in his mind. Thanks to these images that he/she makes of the urban space, the child can adapt to the environment more easily by feeling comfortable, not being anxious or nervous, and being able to quickly take the desired position. The topic of the image in urban space is explained in detail in Kevin Lynch's theory book titled "The Image of City"[1] Lynch describes how features in urban space are remembered. In his study, Lynch attempted to measure city images using interviews with city residents and the cognitive maps he created. Lynch proposes that these cognitive maps consist of five types of image elements: paths, edges, nodes, districts, and landmarks (Figure 1).

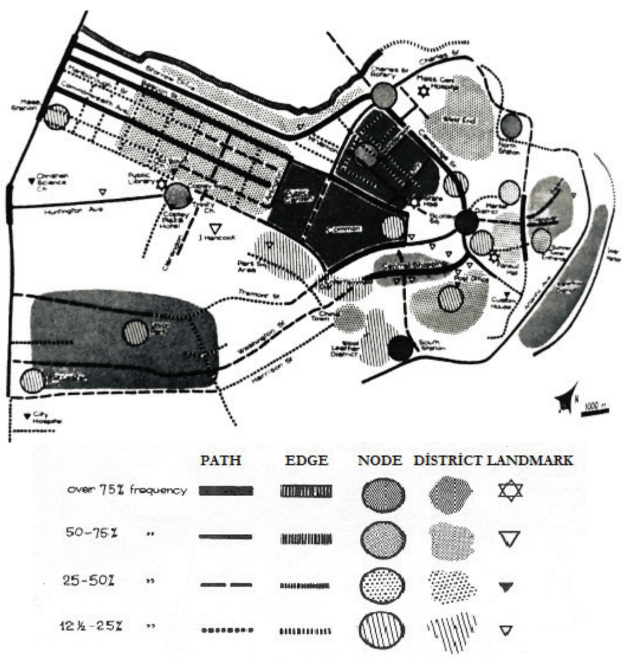

Figure 1. Image maps of Boston and five image elements[2]

1 Kevin Lynch, *The image of the city,* MIT Press, 1960.

2 Kevin Lynch, *a.g.e.,* p. 145-146.

It can also be said that environmental images emerge from a reciprocal process between children and their environment.[3] This article examined the image elements drawn by children in their cognitive maps and their differences in terms of individual and environmental characteristics. This paper focuses on the following questions:

1. How can an image map of the real environment be drawn and the image elements be determined?
2. How do analyze the spatial content of children's cognitive map drawings and classify children's cognitive maps?
3. What is the relationship between children's spatial perception and their real environment?

Theoretical Background of Children's Cognitive Maps

Down and Stea defined "cognitive mapping" as *"a process consisting of a series of psychological transformations by which an individual acquires, encodes, stores retrieves, and decodes information about the relative locations and properties of phenomena in his or her everyday spatial environment."*[4] It can be said that there are detailed studies on cognitive maps, with some studies looking in-depth at children's cognitive maps. [5][6][7]

Among the first studies on children's cognitive maps, Trowbridge (1913) was the first to examine the development of cognitive mapping in childhood. [8] One of these studies demonstrated the importance of landmarks in the cognitive development of young children beginning in infancy. Hermer and Spelke's research clarified how children (between the ages of 18-24 months) use landmarks in a room. [9] In the 1940s and 1950s, there were extensive studies of children's spatial

3 Kevin Lynch, *a.g.e.,* p. 6.

4 Roger Down - David Stea, *Cognitive maps and spatial behavior: Process and products,* 1973, p. 7.

5 Rob Kitchin - Scott Freundschuh, *Cognitive Mapping: Past, present and future*, Routledge Frontiers of Cognitive Science, 2000.

6 Reginald G. Golledge - Robert J. Stimson, *Spatial behavior: A geographic perspective*, Guilford Press, 1997, p. 224-263.

7 Reginald G. Golledge, *Wayfinding behavior: Cognitive mapping and other spatial processes*, The Johns Hopkins University Press, 1999, p. 5-24.

8 C. C. Trowbridge, "On Fundamental Methods of Orientation and``Imaginary Maps", *Science*, 38 (990), 1913, p. 888-897.

9 Linda Hermer - Elizabeth S. Spelke, "A geometric process for spatial reorientation in young children", *Nature*, 370, 1994, p. 57-59.

knowledge of small and large environments. Piaget explained the development of children's spatial perception in terms of three categories of spatial relations: topological space, projective space, and metric space. [10] In addition, Siegel and White had a theory about the development of children's representations of the large-scale environment that was their most influential work.[11] According to their theory, young children initially focus on landmarks. Children act in the context of this orientation knowledge, route knowledge, and survey knowledge, which is the final stage in Siegel and White's theory of the development of cognitive mapping.[12] In the years that followed, Siegel and White's theory was tested by many researchers in a variety of settings.[13][14] While most of these studies examined children's spatial relationships in indoor settings,[15] there are also examples of studies conducted in urban settings.[16]

One of the major limitations of the cognitive mapping technique is validity, as drawing skills can distort the representation of the environment, especially in children.[17] Another problem with children's cognitive maps is that their drawing abilities differ from one another. The fact that some children's drawing skills are not developed depends on their age and characteristics. One of the biggest problems in assessing cognitive mapping is measurement. In cognitive mapping, two types of measurements are possible: i) the shape of the cognitive map and ii) the content of the cognitive map. Lynch's measurement of cognitive mapping content is the most commonly used. In studies that consider Lynch's research groundbreaking, various content analyzes of cognitive maps have been conducted.

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10 Jean Piaget - Barbel Inhelder, *The Child's Conception of Space,* New York, 1956.

11 Alexander W. Siegel-Sheldon H. White, "The development of spatial representations of large-scale environments", *In Advances in child development and behavior*, vol. 10, 1975, p. 9-55.

12 Jennifer H. Cousins - Alexander W. Siegel-Scott E. Maxwell, "Wayfinding and cognitive mapping in large-scale environments: A test of a developmental model", *Journal of Experimental Child Psychology*, 35 (1), 1983, p. 1-20.

13 Alexander W. Siegel - Margaret Schadler, "The development of young children's spatial representations of their classrooms", *Child Development*, 48, 1977, p. 388-94.

14 Alexander W. Siegel - Margaret Schadler, "Young children's cognitive maps of their classroom", *Child Development*, 48 (3), 1977, p. 88-94.

15 Christopher Spencer - Mark Blades - Kim Morsley, *The child in the physical environment: The development of spatial knowledge and cognition,* John Wiley & Sons Incorporated, 1989.

16 Christopher Spencer-Mark Blades-Kim Morsley, *The child in the physical environment: The development of spatial knowledge and cognition,* John Wiley & Sons Incorporated, 1989.

17 Charles L. Holahan, *Environmental Psychology,* NY, Rondom, 1982.

Pocock (1976)[18] examined sequential map types such as line, branch-focal, branch-spinal, Brach loop, net-spinal, and net-pattern; spatial map types such as mosaic, scatter, scatter-link, pattern-sketch, pattern-map, and a cognitive map classified by the researchers. [19] The cognitive maps are classified into three categories as described by Hart and Moore (1973) [20], namely egocentric (level 1), differentiated and partially coordinated (level 2), and abstract coordinated (level 3). Pictorial, schematic, diagrammatic (map-like) maps without landmarks, and diagrammatic (map-like) maps with landmarks are four types of maps classified by Ladd (1970).[21] Appleyard (1970) categorized cognitive maps into spatial maps and sequential maps according to the type of elements and the degree of accuracy. Spatial maps such as scattered maps, mosaic maps, linked maps, and patterned maps; sequential maps such as fragmented maps, chain maps, branching and looping, and netted maps.[22] Matthews (1984) also divided the six categories into functional, recreational, natural, transportation, personal, and animal.[23] He examined three groups: a) pictorial, b) pictorial-verbal (Grade I); c) pictorial-plan, d) pictorial-plan-verbal (Grade II); e) pictorial-plan-verbal, and f) plan-verbal (Grade III).

18 D. C. D. Pocock, "Some characteristics of mental maps: an empirical study", *Transactions of the Institute of British Geographers,* NSl, 1976, p. 493-512.

19 D. C. D. Pocock, "Some characteristics of mental maps: an empirical study", *Transactions of the Institute of British Geographers*, NSl, 1976, p. 493-512.

20 Roger A. Hart - Gary T. Moore, "The Development of Spatial Cognition: A Review", *Image & environment: Cognitive mapping and spatial behavior*, ed. R. M. Downs - D. Stea, Aldine Transaction, 1973.

21 Florence C. Ladd, "Black youths view their environment: Neighborhood maps", *Environment and Behavior*, 1970, p. 74-99.

22 Donald Appleyard, "Styles and methods of structuring a city", *Environment and Behavior*, 2 (1), 1970, p. 100-117.

23 M. H. Matthews, "Environmental cognition of young children: images of journey to school and home area", *Transactions of the Institute of British Geographers*, 1984, p. 89-105.

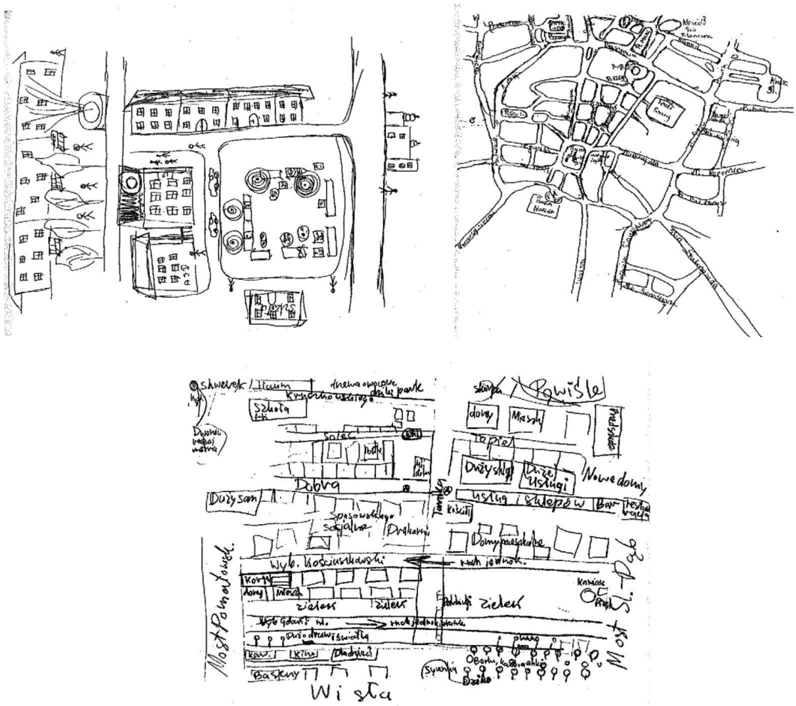

Figure 2. Example of children's cognitive map drawing[24]

Researchers also focused on specific elements that influence children's cognitive maps, such as age, gender, familiarity[25], mode of travel[26 27], mode of transportation[28], and social/cultural differences[29]. In addition, elements other than paths and landmarks (traffic lights, trees, cars, signs, etc.) regularly appear in children's cognitive maps.

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24 Kevin Lynch, *Growing up in cities: Studies of the spatial environment of adolescence in Cracow, Melbourne, Mexico City, Salta, Toluca, and Warszawa*, MIT Press, 1977, p. 40-41.

25 Linda J. Anooshian-Douglas Young, "Developmental changes in cognitive maps of a familiar neighborhood", *Child Development*, 1981, p. 341-348.

26 James Paskins, "Are differences in children's travel reflected in their cognitive maps", *Traffic and transport psychology: theory and application*, 2005, p .49-62.

27 Jo-Ting Fang - Jen-Jin Lin, "School travel modes and children's spatial cognition", *Urban Studies*, 2017, p. 1578-1600.

28 Alper Ünlü - Hüray Çakir, "A study on perception of primary school children in the home environment", *Journal of Architectural and Planning Research*, 2002, p. 231-246.

29 Kate W. Grieve - Fred J. Van Staden, "A cross-cultural study of children's cognitive maps", *South African Journal of Psychology*, 18 (3), 1988, p. 91-95.

Recent studies have highlighted the importance of urban image elements, which are essential components of the physical environment in which children live. A variety of approaches have been used in studies of cognitive maps. There have also been studies that examine children's cognitive maps using the method of space syntax.[30] Recent studies have examined individual differences and landmarks in children's cognitive maps in a real environment[31] and virtual environments.[32] There are also studies conducted in urban environment,[33] [34] pediatric healthcare spaces,[35] education spaces [36] [37] [38] [39] Table 1 shows some studies on cognitive maps comparing research method.

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30 Nevşet Gül Çanakçıoğlu, "Can cognitive maps of children be analyzed by space syntax", *ITU J Fac. Arch*, 12, 2015, p. 127-140.

31 Yasemin Çakırer Özservet, "Discussing Street and Neighborhood Relations from Children's Paintings: The Case of Sütlüce and Örnektepe Neighborhoods", *International Journal of Political Science and Urban Studies*, 7 (2), 2019, p. 516-542.

32 Petra Jansen - Osmann-Juliane Schmid - Martin Heil, "The influence of landmarks and pre-exposure to a structural map during the process of spatial knowledge acquisition: A study with children and adults in a virtual environment", *Spatial Cognition and Computation*, 7 (3), 2007, p. 267-285.

33 Çisem Seyhan, "*Çocukların zihin haritalarında kentsel mekân imgesi; Trabzon ili Ortahisar ilçesi örneği",* (Yayımlanmamış Yüksek Lisans Tezi), Karadeniz Teknik Üniversitesi, Trabzon, 2021.

34 Ayşen Celen Ozturk, "Studies on reading the urban center via cognitive maps: The example of Eskisehir", Turkey, *WIT Transactions on Ecology and the Environment*, 226, 2017, p. 29-38.

35 Nevşet Gül Çanakçıoğlu, "Analysis of perceptual processes of individuals using pediatric spaces by the methods of cognition and space syntax", (Unpublished Ph.D. Thesis), *İstanbul Teknik Üniversite*si, İstanbul, 2016.

36 Mine Tunçok Sarıberberoğlu - Alper Ünlü, "Spatial Cognition Depending On The Spatial Order In Education Buildings", *International Journal of Advanced Research and Review, (IJARR),* 3 (1), 2018, p.1-10.

37 Ahmet Türel - Elmira Gür, "Effects of primary school's physical environment on children's spatial perception and behavior: the case of Kagithane, Istanbul, Turkey", *Archnet-IJAR: International Journal of Architectural Research*, 2019.

38 Sindokht Rezaei Liapaee - Reza Askarizad-Fariba Alborzi, "Investigation of Physical Factors Affecting the Wayfinding of Educational Spaces Children aged 7-12 years old in Rasht, North of Iran", *International Journal of Pediatrics*, 8 (1), 2020, p. 10689-10704.

39 Kadriye Topçu-Mehmet Topçu, *"Visual presentation of mental images in urban design education: cognitive maps",* Procedia-Social and Behavioral Sciences, 51, 573-582. 2012.

Table 1. Comparing research methods in cases of cognitive map some related research (created by author)

Classification	**(Lynch, 1960)**	**(Appleyard, 1970)**	**(Ladd,1970)**	**(Matthews, 1984)**	**(Cho et al. 1999)**	**(Choi, 1991)**	**(Park-Kim, 2012)**	**(Meehan,2018)**
Research area	Boston, Jersey, Los Angles/ USA	Guarana/ Venezuela	Roxbury-North Dorchester/ Boston	Coventry/ England	Busan/South Korea	Busan/ South Korea	Gwangju, Mokpo and Yeongam / South Korea	East Kent/Uni-ted Kingdom
Respondent sampling	60 professi-onal	75 persons	12-17 age groups student	6-11 age / 172 children	285 persons of housewives with children of elementary and midd-le school students/ 167 persons	276 for survey 241 for cogni-tive map materials	6,8 and 10 age groups children / 206 children	7-9 age /40 children
Research method	To draw a cognitive map	To draw a cognitive map	To draw a cog-nitive map	To draw a cogniti-ve map	Survey ques-tionnaire and cognitive map	To draw a cognitive map	Survey questionnai-re and draw a cognitive map	Survey and cognitive map
Analysis image element	Five image elements; path, edge, node, district, and landmark	Sequential maps such as fragmen-ted, chain, brach, and loop, netted; Spatial maps such as scattered, mosaic, linked, and patterned.	Group I drawing is pic-torial, Group II drawing is sc-hematic, Group III drawing re-sembles a map, and Group IV drawing resembles a map with landmarks.	Group I such as pictorial, and pictorial-verbal; Group II such as pictorial-plan, pictorial-plan-ver-bal, Group III such as plan, and plan-verbal Also, Lynch's four image elements such as path, node, district, and landmark.	Lynch's two image ele-ments; path and landmark	Lynch's five image elements; path, edge, node, district, and landmark	Appleyard's types (sequ-ential maps and spatial maps)	Lynch (1960), and Matt-hews(1984) spatial typology

Research Method

A framework was needed to design the research; this conceptual framework was based on theories related to the subject and concerns observed during the field observation. Firstly the theoretical constructs were identified and some research methods in the literature were compared to the study (Table 1). Accordingly, the research design was created (Table 2). In this process, the methods selected are: questionnaire surveys and cognitive mapping were used to collect data. The reason for choosing the quantitative research method is to obtain objective numerical data or data that can be converted into usable statistics.

Table 2. Research Design

Research question	How can the spatial content of children's cognitive map drawings be analyzed? How can children's cognitive maps be classified?
Research area	Kadıkoy, İstanbul
Respondent sampling	10-14 age children / 387 survey and 315 cognitive mapping
Research method	Survey and draw a cognitive map
Analysis image element	Lynch's two image elements (landmark and paths)
	Matthews's classification

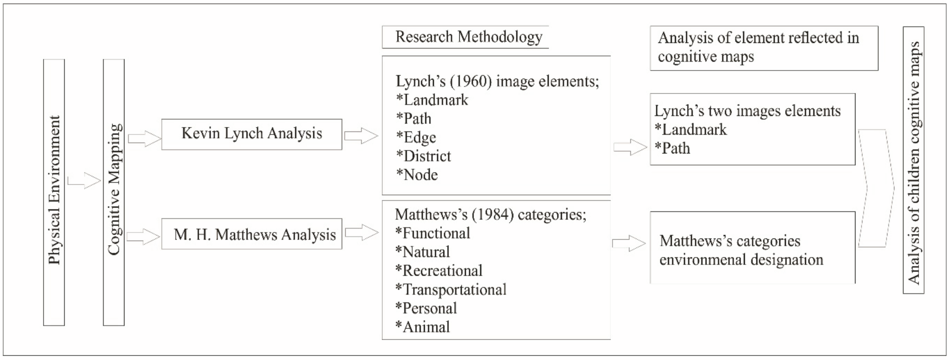

Figure 3. Conceptual framework of the study (created by author)

The research design of the study was based on Kevin Lynch's methodology and Matthews's classifications. The research design of the study based on this framework is detailed in Table 2.

1. Lynch (1960) examined how people understand the cities in which they live through cognitive maps. He studied three cities-Boston, Jersey City, and Los Angeles-and found that people in these different places used five similar ele-

ments in their cognitive maps of cities: pathways, edges, districts, nodes, and landmarks. Lynch's methodology;

- *Paths:* According to Lynch (1960), paths form the main vessels of cognitive maps in people's minds (e.g. roads, walkways, railroads, or canals).
- *Landmarks*: Landmarks play an important role in the orientation and cognitive values of a city. Landmarks are memorable, conspicuous elements, even if they are in a physical setting, with contrasting features such as height, width, or even color. (e.g. buildings, signs, towers, and mountains).
- *Edges:* Edges are pictorial elements (e.g. rail lines, walls, fenced areas) that create interruptions in urban space.
- *Districts:* Districts are various physical features (e.g. shapes, buildings, symbols, land use activities), and spatial qualities that can define the main characteristics of a district.
- *Nodes:* A node is a significant focal point or transition point where one function transitions into another. (e.g. spaces, plazas, corner lots, or street intersections).

2. Matthews's (1984) study data such as landmarks, paths, and neighborhoods were classified using Lynch's typology of urban elements, and assessments of the different data sets were presented in cognitive maps. Additionally, the elements on the maps drawn by the children were categorized into six groups. Matthews' categories;

- *Functional:* Aspects of the built environment such as stores, buildings, and schools.
- *Recreational:* Play and leisure spaces such as parking areas, and playgrounds.
- *Natural:* Aspects of the natural environment such as trees, flowers, clouds, and the sun.
- *Personal:* Drawing people such as friends and neighbors.
- *Transportation:* Transportation drawings such as road, street and bridge.
- *Animals:* Animal drawings such as cats, dogs and birds.

In Matthews's (1984) study a strong functional orientation was evident, with buildings, stores, and shops being the most common. The smaller the age group became, the fewer functional items were drawn. However, the younger children's drawings included more personal material, such as images of animals they see in their environment, friends and relatives, or moving cars.

Case Study

The field research of this study was carried out in the Kadıkoy district in Istanbul, Turkey. Kadıkoy is a historically, culturally, and socially significant district. Kadıkoy has a population of 481,983, with 218,424 males (45.32 %) and 263,559 females (54.68%).[40] The child population is 68208 (14.15%) children aged 0-17 and 56611 children aged 0-14 (11.74%) in the Kadıkoy. In the study, a survey was conducted with children between the ages of 10 and 14 who received education in six neighborhoods (Caferaga, Caddebostan, Kozyatagı, Kosuyolu, Hasanpasa, and Merdivenköy) in the district of Kadıkoy. The reason for choosing these six neighborhoods is that they show different spatial characteristics and the differentiation in the child population density. Examining the cognitive maps of children who live in a community with such qualities can give us valuable information about children's spatial perception.

Figure 4. Case study of Kadıkoy (created by author)

40 Tuik, 2020 (tuik.gov.tr).

Data Collection and Process

Data collection for this study took place between September 15, 2021 and October15, 2021. The data for this study were collected using a questionnaire among students enrolled in the fall semester of the 2021-2022 academic year who voluntarily participated in the survey in the Kadıkoy district. The questions in the questionnaire were prepared by the researcher based on the opinions of experts in different fields and were asked of the participants. The survey the questionnaire includes multiple-choice questions that explore children's relationships with the places where they live and demographic information. The survey in the questionnaire includes multiple-choice questions investigating the relationships of the children with the places they live, as well as demographic information.

The questionnaire consists of three parts and 32 questions. The first part of the survey consists of questions 1-19, and this part is answered by the parents. The second part of the survey (20-31) consists of questions. This part is answered by the children. The third and last part of the questionnaire is the question about drawing cognitive maps. The 32nd question is about cognitive map drawing. The children were asked the question, *"Can you draw your house and its immediate surroundings?"* They were asked to draw with a black pencil on a white A4 sheet of paper. Each application lasted for one lesson hour (30 minutes).

Participants

The study group for this research consists of children aged 10-14 years (4^{th}-5^{th}-6^{th}-7^{th} and 8^{th} grade) studying in primary and secondary schools in Kadıkoy. The sample group for the study was formed using the stratified random sampling method. In proportional stratified sampling, the number of items to be sampled from each sub-universe is arranged to be proportional to the proportion of that sub-universe in the total.[41] In the stratified sampling technique, the following formula was used to determine the sample size, proposed in particular by Cochran (n0 = Z2 p q / e2).[42] The sample number of children in the six districts of Kadıkoy was determined as the population was calculated in the schools of the districts. 387 children participated in the study. Their profiles are presented in Table 3.

41 Joy Paul Guilford, *Fundamental statistics in psychology and education,* Mc Graw-Hill, 1950, p. 140.

42 William G. Cochran, *Sampling Techniques*, 2nd ed., New York, John Wiley and Sons, Inc., 1963, p. 75.

Table 3. Demographic information about participants

		Frequency (n)	**Percentage (%)**
Residential district	Caddebostan	47	12.1
	Caferaga	59	15.2
	Kosuyolu	57	14.7
	Kozyatagı	92	23.8
	Merdivenköy	83	21.4
	Hasanpasa	49	12.7
Education level	Primary school	151	39.0
	Secondary school	236	61.0
Socioeconomic level	Lower-income group	65	16.8
	Middle-income group	272	70.3
	High-income group	19	4.9
Residential type	Apartments	315	81.4
	Gated Community Residence	27	7.0
	Single Family House	15	3.9
	Residence	6	1.6
	Shanty	1	0.3
	Other	8	2.1
Gender	Female	241	62.3
	Male	144	37.2
Age	10	198	51.2
	11	67	17.3
	12	65	16.8
	13	48	12.4
	14	9	2.3
Education level	4^{th} grade	149	38.5
	5^{th} grade	68	17.6
	6^{th} grade	49	12.7
	7^{th} grade	73	18.9
	8^{th} grade	48	12.4

Analysis of Data

In this study, a quantitative method was used to analyze the data. The statistical program IBM SPSS 25.0 was used to analyze the responses to the survey questions. Percentage, number, and average analyzes were used to determine participant demographics. Survey data and drawings of children who participated in the survey, which was conducted with children in schools in these communities, were analyzed. Survey responses and content analysis of the cognitive map were summarized at the end of the study, and descriptive data such as percentages and frequencies were included. The analysis of the cognitive map and the categorization made in the literature review were used to conduct the content analysis. The analysis of the research data was conducted in 2 steps:

1. Drawing an image map of the real environment and determining the urban image elements (paths and landmarks),
2. Spatial content analysis of children's cognitive maps:
   i. Finding the elements of the home environment

      They were classified according to an item of Kevin Lynch's five environmental image elements (e.g., districts, edges, nodes, paths, and landmarks).[43] In this study, only paths and landmarks of Lynch's parameters were examined.

   ii. Classifying the types of cognitive maps

      According to Matthews[44] classification, the cognitive maps were functional (aspects of the built environment), recreational (play and leisure spaces), natural (aspects of the natural environment), transportation (modes of transport), personal (people), and animal.

Results and Discussion

The findings and the relationship between children's urban image elements and drawings on cognitive maps were investigated in this study. With the help of the tables and figures below, the research findings were described.

43 Kevin Lynch, *a.g.e.*

44 M. H. Matthews, "Environmental cognition of young children: images of journey to school and home area", *Transactions of the Institute of British Geographers*, 1984, p. 94.

1. Drawing an image map of the real environment and determining the urban image elements

As described in this article, the existing maps of the urban space were examined, and paths and landmarks were marked on the image maps of the real environment. In this analysis part, the neighborhood image map, which was created by taking the image maps in Lynch's[45] work as an example is shown in the figure. Image maps of all neighborhoods were not included in the article, but only the image map of the Caferağa neighborhood can be seen in the figure below (Figure 5).

Figure 5. Image map of Caferaga (created by author)

The landmarks and paths marked on the image maps of the neighborhoods were compared to the children's cognitive maps to determine commonalities. Even though children's drawings contained spatial information about the real en-

45 Kevin Lynch, *a.g.e.,* p. 166-173.

vironment, some participants did not explicitly state it. Thus, after the drawings are completed, children may be asked to verbally confirm spatial information in future studies.

Table 4. Spatial elements of the real environment appearing in children's cognitive maps

Neighborhoods	Spatial elements and buildings	Paths
Caferaga	Barıs Manco Museum, Churches, Attached building, shops	Moda Street, General Asım Gündüz Street
Caddebostan	Gated community with pool	Bagdat Street
Kosuyolu	Low-rise construction, green-textu-red construction	Kosuyolu Street
Kozyatagı	Dense apartment building, offices	Street drawings without names
Merdivenköy	High-rise apartments and residences	Street drawings without names
Hasanpasa	Gazhane Museum, five-six floor attached building	Street drawings without names

Table 4 shows the results of the analysis of the children's cognitive maps. In six neighborhoods, spatial aspects from the real world appear in the children's cognitive maps. In this table, spatial components, buildings, and pathways are presented based on the urban characteristics of the neighborhood.

The data in Table 4 show that the information on paths differs significantly in the first three neighborhoods. During the field study in the Caferaga neighborhood, we discovered spatial features such as the Baris Manco Museum, churches, outbuildings, and stores in the children's cognitive maps. In addition, the routes were expressed in writing by drawing Moda Street and General Asim Gunduz Street. Secondly, the listed objects were found in a closed residential complex with a pool in the Caddebostan district. In addition, the route was written by drawing Bagdat Street.

Third, the cognitive maps were found in a low-rise building and a building with a green texture in the Kosuyolu district. In addition, the path through the drawing of Kosuyolu Street was recorded in writing. Despite the dense residential and office development, the path was recorded in writing in the Kozyatagi district by drawing streets without names. In the Merdivenkoy district, there are high-rise buildings and residential buildings, and the way was recorded in writing by drawing streets without names. Finally, spatial features were found in the Gazhane Museum, a five to six-story annex. The paths were also recorded in writing in the Hasanpasa district through street drawings without names.

2. **Spatial content analysis of the children's cognitive maps:**

   i. Locating the elements of the home environment

They were classified according to one element of Kevin Lynch's five environmental image elements (e.g. districts, edges, nodes, paths, and landmarks), although only paths and landmarks of Lynch's parameters were examined in this study.

Table 5. Percentage and frequency values of urban image elements in children's cognitive maps

	Frequency (n)	Percentage (%)
Urban Image Elements		
Path	170	53.97
Landmark	145	46.03

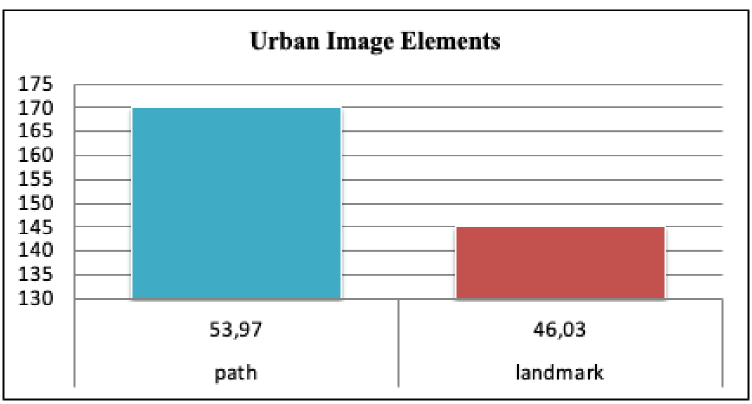

Figure 6. Urban image elements in children's cognitive maps (path, and landmark)

Table 5 provides information about two urban image elements in the children's cognitive maps. Although the survey was conducted with 387 participants, only 315 of the participants completed the task. While 170 of them (53.97%) drew roads, streets and avenues as urban image elements in the cognitive maps, landmarks account for 46.03% of the 145 drawings (Figure 6).

Even though the percentage of paths in the drawings is slightly higher, the importance of landmarks in defining space is greater because more detailed drawings were made in perceiving, defining, and representing the dwelling and its immediate surroundings. In addition, although there were path and street drawings, some of the children struggle to remember the names of the streets.

Table 6. Landmark in children's cognitive maps

Landmarks	**Frequency (n)**
Schools	31
Grocery	23
Pharmacy	18
Bakery	17
Sok Market	13
Cafe	13
Barber	11
BIM Market	11
A101 Market	9
Mosque	9
Construction	9
Hairdresser	8
Shop	7
Drink	7
Patisserie	6
Estate Agent	6
Butcher	6
Hospitals	6
Restaurants	9
Cemetery	4
Migros Market	4
Ozkuruslar Market	4
Mechanics	4
Banks	3

Museum	3
Pet shops	3
Florist	3
Tailor	3
Dentist	3
Greengrocer	2
Pizzeria	2
Post Office	2
Hotel	2
Police station	1
Petrol	1

Table 6 details the landmarks on the children's maps and the frequency values of landmarks. Schools (n=31), grocery stores (n=23), pharmacies (n=18), and bakeries (n=17) are the most frequent landmarks in the cognitive maps. In addition, it is hypothesized that tiny image features may emerge as landmarks when children are asked to convey them verbally, although this is the case in the drawings. In other words, a ruined wall, the texture of a wall, or the color and shape of structures can be considered spatial features that are visible to children.

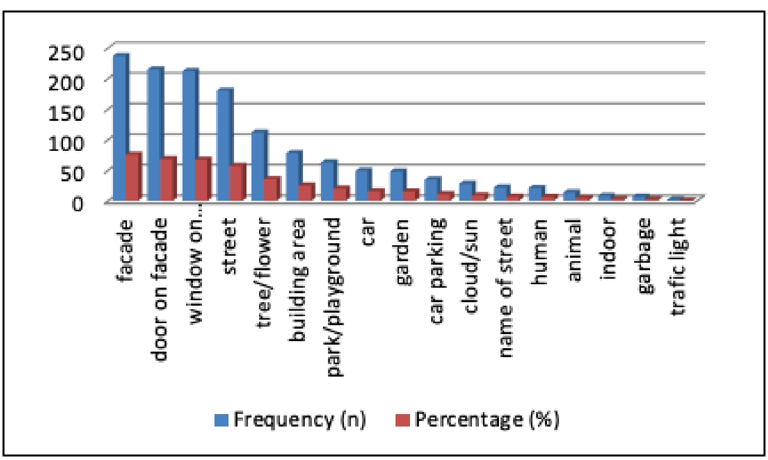

Figure 7. The elements of the home environment in cognitive map drawings

Table 7. Frequency and percentages of elements in cognitive map drawings

Element	Frequency (n)	Percentage (%)
Facade	237	75.24
Door on facade	215	68.25
Window on facade	212	67.30
Street	180	57.14
Tree/flower	112	35.56
Building area	78	24.76
Park/playground	63	20.00
Car	49	15.66
Garden	48	15.24
Car parking	35	11.11
Cloud/sun	28	8.89
Name of street	22	6.98
People	21	6.67
Animal	14	4.75
Indoor	8	2.54
Garbage	7	2.22
Traffic light	2	0.63

Table 7 shows the frequency and percentage of elements in cognitive map drawings. According to Table 6, the cognitive maps reflect facade drawing n=237 (75.24%), door on the facade n=215 (68.25%), window on the facade n=212 (67.30%), street in 180 (57.14%), tree/flower drawings n= 112 (35.56%), building area n=78 (24.76%), park/playground n=63 (20.00%), car n=49 (15.66%), garden n=48 (15.24%), parking lot n=35 (11.11%), cloud/sun drawings n=28 (8.89%), street name n=22 (6.98%), people n=21 (6.67%), animals n=14 (4.75%) animal figures such as cats, dogs, and birds, indoor space n=8 (2.54%), garbage n=7 (2.22%) and traffic light in 2 (0.63%) in their cognitive map drawings. While the majority of children who wanted to draw the house and its immediate surroundings in the question drew the urban space, neighborhood, and street, only 8 (2.54%) preferred to draw the interior or floor plan of their own house.

According to the responses collected in the field study, school and class are the areas where adolescents spend most of their time outside the home. In addition, various other areas were mentioned, including school/course by 132 (34.3%), home garden by 82 (21.4%), playgrounds by 82 (21.4%), urban green spaces by 61 (15.8%), shopping malls by 18 (4.7%), and city squares by 9 (2.5%). According to the results of the field study, there is a significant relationship between the places where children spend the majority of their time outside the home and the spaces represented on the cognitive maps.

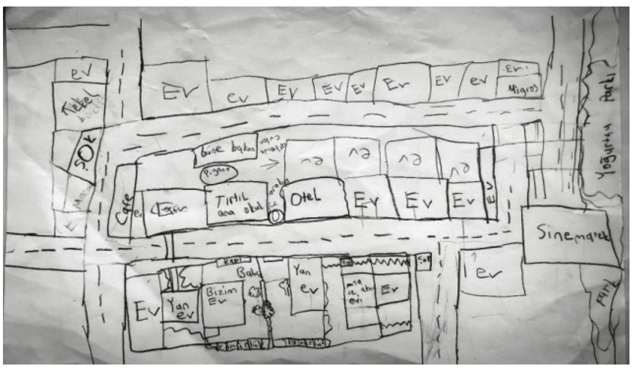

Figure 8. Examples of cognitive maps of Caferaga

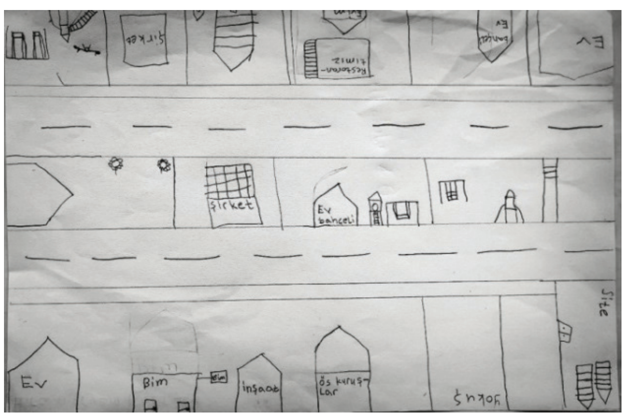

Figure 9. Examples of cognitive maps of Kosuyolu

ii. Classification of the types of elements in cognitive maps

According to Matthews' classification, cognitive maps were functional (aspects of the built environment), recreational (play and leisure spaces), natural (aspects of the natural environment), transportation (modes of transport), personal (people), and animal. It can be seen that children's functional drawings have a higher rate of cognitive maps. Similar to the literature research and Matthews' (1984)[46] studies, children's cognitive maps were found to consist mainly of functional drawings.

Table 8. Types of the element in cognitive maps

	Frequency (n)	Percentage (%)
Classification of element		
Functional	301	54.9
Natural	120	21.9
Recreational	57	10.4
Transportation	33	6.0
Personal	23	4.0
Animal	15	2.7

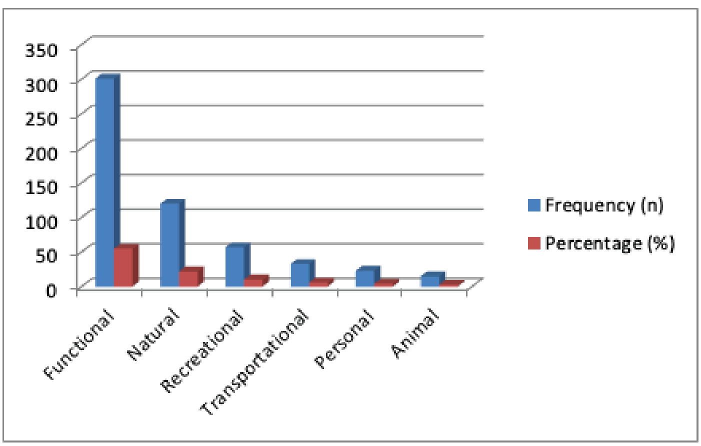

Figure 10. Types of the element in cognitive maps

In Matthews' study, the elements on the maps were categorized into six groups: functional, nature, recreation, transportation, personal, and animal. When the children's cognitive maps are examined according to Matthews' cognitive map categories, this can be seen in detail in Table 8. Table 8 shows that children's cognitive maps are classified according to Matthews' categories. It represents the

46 M. H. Matthews, "Environmental cognition of young children: images of journey to school and home area", *Transactions of the Institute of British Geographers*, 1984, p. 89-105.

classification of elements regarding Matthews' categories, Functional (aspects of the built environment) frequency (n=301) and percentage (54.9%) of all drawings drawn by participants. Natural (aspects of the natural environment) frequency (n=120) and percentage (21.9%), Recreational (play and leisure spaces) frequency (n=57) and percentage (10.4%), Transportation (modes of transport) frequency (n=33) and percentage (6.0%), Personal (people) frequency (n=23) and percentage (4.0%) and Animal drawn frequency (n=15) and percentage (2.7%) of all drawings drawn by participants.

Conclusions

In this study, children's relationship with the urban space in which they live was examined through the urban image elements in their minds. In addition, it examined how children reflect spatial information from their environment. According to the results of the study, features of the physical environment and experiences in urban space are significant in children's cognitive maps. The visual elements that children draw in their cognitive maps are critical to understanding their spatial perceptions. The children's cognitive maps were analyzed according to Lynch's methodology (path and landmark) and Matthews' classifications. In summary, although the children drew more paths than landmarks in their drawings, the landmarks were drawn in more detail and defined in writing. It can also be seen that the children's reflection rate of the functional cognitive maps (elements of the built environment) of the immediate environment of the home is quite high.

This study has several advantages since one of the advantages of the study is that it provides a thorough analysis of the child's environment. Another advantage is that it establishes links between the real environment and the cognitive maps. The results contribute to our understanding of children's urban images in a variety of ways and serve as a foundation for future research. However, there are at least three limitations to the conclusions of this study. First, since the study was conducted during the pandemic, there was limited time for interviews with children. Conducting more in-depth interviews can provide more valuable information. Second, after children have drawn their cognitive maps, they can be asked to verbally articulate their drawings. Finally, it is possible to inquire why they remembered the landmarks they drew or marked. In addition, the same study can be conducted in a variety of urban and rural settings.

The results of this study have several important implications for future practice. For example, three-dimensional models of visual objects drawn by children can be made. A project on children's perception of space could be developed by combining the perspectives of different disciplines collaborating on the project with the participation of children accompanied by architects, teachers, and psychologists. In addition, more in-depth workshops on cognitive mapping studies with children could be organized.

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Authors' Contribution

The first author contributed 60%, the second author 40%.

Competing Interest

The author declares no conflict of interest.

Ethical Approval and Consent

With the document date and the number of 14.07.2021-46, board decision no 2021-06/07, Fatih Sultan Mehmet Vakif University Scientific Research and Ethics Committee Permission for this study conducted with children was received. In addition, the Istanbul Provincial Directorate of National Education granted permission for study and application in schools on 10.09.2021 with document number 31536082 and document number dated 10.09.2021.

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Araştırmacıların Katkı Oranı

Araştırmacıların her birisinin mevcut araştırmaya katkı oranı aşağıdaki gibidir.

Yazar 1: %60

Yazar 2: %40

Çatışma Beyanı

Araştırmada herhangi bir çıkar çatışması bulunmamaktadır.