Journal of Architectural Sciences and Applications
JASA 2024, 9 (1), 422-443
Research article
e-ISSN: 2548-0170
https://dergipark.org.tr/en/pub/mbud

Cognitive Mapping and Space Syntax Analysis of Universal Design Principles: The Case of the Üsküdar Barrier-Free Life Center

Emine Banu BURKUT [1]*, Bilgehan YILMAZ ÇAKMAK [2]

ORCID 1: 0000-0003-0252-4054
ORCID 2: 0000-0003-4199-0648

[1] *Konya Technical University, Institute of Graduate Studies, Department of Architecture, Konya, Türkiye.*
[2] *Konya Technical University, Faculty of Architecture and Design, Department of Architecture, Konya, Türkiye.*
**** e-mail:** burkutbanu@gmail.com*

Abstract

The purpose of this research was to examine universal design concepts and principles. Within the scope of the research, the spatial and structural features of the Istanbul-Üsküdar Barrier-Free Life Center were examined. The space syntax analysis method was applied in order to access the numerical data of the syntactic analysis of the space, and cognitive mapping analysis was performed in order to reflect the spaces formed in the minds of individuals in the cognitive maps of the space on the drawings. The participants and the sample were selected among individuals who use this place via the random sampling method. As a result of this research, the design features of a space used by disabled and non-disabled individuals, design criteria, syntagmatic features of the space, and cognitive features of the space were determined, and inferences that can serve as examples for the spaces to be built in the future were presented.

Keywords: *Design for all, inclusive design, universal design, accessibility, architecture.*

Evrensel Tasarım İlkelerinin Bilişsel ve Dizimsel Analizi: Üsküdar Engelsiz Yaşam Merkezi Örneği

Öz

Bu araştırmanın amacı, evrensel tasarım kavramları ve ilkeleri incelenerek Üsküdar Engelsiz Yaşam Merkezi örneği üzerinden açıklanmaya çalışılacaktır. Araştırma kapsamında Üsküdar Engelsiz Yaşam Merkezi yapısal, mekânsal ve iç mekân özellikleri incelemektir. Bu araştırmada uygulanan yöntem mekânın dizimsel analizinin sayısal verilerine ulaşabilmek için mekân dizim analizi (space syntax) ve mekânın bilişsel haritalarında bireylerin zihinlerinde oluşan mekânların çizime yansıtılması amacıyla bilişsel haritalama analizi (cogntive mapping analysis) yapılmıştır. Araştırmanın evrenini Üsküdar Yaşam Merkezi ve örneklemi ise bu mekânı kullanan (engelli veya engelsiz) bireyler arasından rastgele örnekleme yöntemiyle seçilmiştir. Bu araştırma sonucunda engelli ve engelsiz bireylerin kullandıkları bir mekânın tasarım özellikleri, tasarım kriterleri, mekânın dizimsel özellikleri ve mekânın bilişsel özellikleri tespit edilerek gelecekte yapılacak olan mekânlar için örnek teşkil edebilecek çıkarımlar ortaya koymaktadır.

Anahtar kelimeler: *Herkes için tasarım, kapsayıcı tasarım, evrensel tasarım, erişilebilirlik, mimari.*

Citation: Burkut, E. B. & Yılmaz Çakmak, B. (2024). Cognitive mapping and space syntax analysis of universal design principles: The case of the Üsküdar Barrier-Free Life Center. *Journal of Architectural Sciences and Applications*, 9 (1), 422-443.

DOI: https://doi.org/10.30785/mbud.1410694

Received: *December 27, 2023 –* ***Accepted:*** *June 30, 2024*

1. Introduction

"Universal design" is defined as a design approach that enables all products and environments to be used by many people, regardless of age, skill, and situation. In addition, universal design covers different fields, from product design to architecture and urban design, from simple systems that provide environmental control to complex information technologies (Dostoglu et al., 2009). Universal design (Goldsmith, 2007), individual differences (Mayer & Rose, 2000), creating inclusive environments (Steinfeld & Maisel, 2012), ergonomics, and universal design (Olguntürk & Demirkan, 2009). Universal design principles (Mustaqium, 2012; Boduroğlu, 2014), principles and models (Null, 2013), themes for wearable (Tomberg et al., 2015), street design (Ahmed & Sungur Ergenoglu, 2016), urban spaces (Meşhur, 2016), old city open space elements (Widiastuti & Harsritanto, 2018), ergonomic investigation of working environment (Aylin et al., 2019), urban public spaces (Meşhur & Yılmaz Çakmak, 2018), historical environment (Tutal & Topcu, 2018), interior architecture education (Usal & Evcil, 2019), re-design of schoolyard (Al Şensoy & Sarı, 2019), park planning (Seçme & Küçük, 2020), interior design (Grimley & Smith, 2021), library interior spaces (Bekar, 2021), impact of the pandemic on the principles of "universal design" (Ensarioğlu, 2020), accessibility and universal design of university spaces (Hilmioğlu & Seçer Kariptaş, 2022), universal design, barrier-free design and technology (Burkut, 2023), universal design approach in universities (Bulut & Halaç, 2023), public space (Süvari, 2023), architectural education (Bakar & Şimşek, 2023) museum (Sayar & Arat, 2024), commercial buildings (İşanç & Yılmaz, 2024), museums' historic buildings (Filová et al., 2022), universal design and barrier-free design with bibliometric analysis (Burkut, 2023), public playground (Moore et al., 2023), urban green space (Selanon & Chuangchai, 2024), online education (Yang et al., 2024), universal design for learning in the classroom (Hall et al., 2024), biophilic design pattern and universal design (Elsafty, 2024) and universal design for the workplace (Doussard et al., 2024).

As seen in Figure 1, the seven principles of universal design are (CEUD, 2024); 1) Equitable Use: The design is useful and welcoming to people with various abilities. 2) Flexibility in Use: The design accommodates a spectrum of individual preferences and abilities. 3) Simple and intuitive use: The design is easy to understand for people of various backgrounds, cultures, and skills. 4) Perceptible Information: The design incorporates the necessary information that is understandable by people of various cognitive abilities. 5) Tolerance for Error: The design minimizes hazards and consequences, intentional and not. 6) Low Physical Effort: The design is efficient and comfortable, with minimal fatigue. 7) Size and Space for Approach and Use: The design is approachable for people of various body sizes, postures, and mobility (NLC, 2022). Table 1 lists the current literature on universal design.

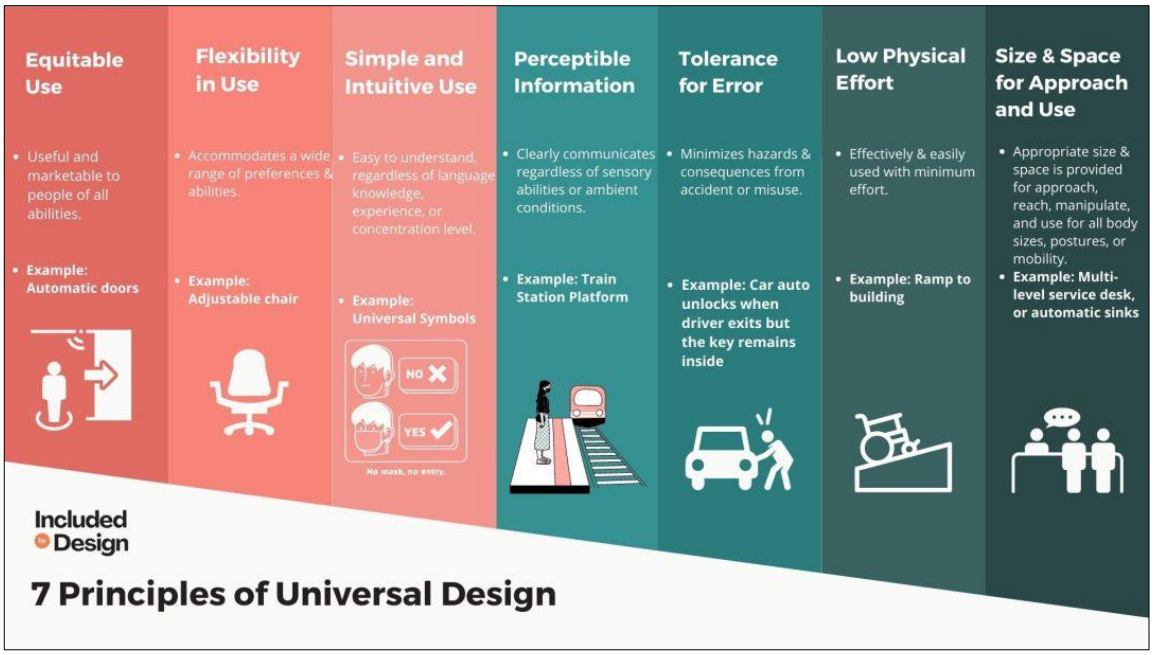

Figure 1. 7 Principles of universal design (CEUD, 2024)

Table 1. Publications on **"**Universal Design" in chronological order over the last five years in Web of Science Core Collection Database (WOS, 2024).

Author(s)	Year	Publication Titles	Publishers
Yang et al.,	2024	**"Universal Design** in Online Education: A Systematic Review"	Distance Education
Selanon & Chuangchai	2024	"Improving Accessibility to Urban Greenspaces for People with Disabilities: A Modified **Universal Design** Approach"	Journal of Planning Literature
Ielegems & Vanrie	2023	"The Cost of **Universal Design** for Public Buildings: Exploring a Realistic, Context-Dependent Research Approach"	Archnet-IJAR: International Journal of Architectural Research
Arsenault P.,	2023	**"Universal Design** Incorporating Architectural Linear Drains Designing Buildings and Spaces for All People, with or without Disabilities "	Architectural Record
Hurst et al.,	2023	**"Universal Design** in Playground Environments: A Place-Based Evaluation of Amenities, Use, and Physical Activity"	Landscape Journal
Īle & Bergmane	2023	"Development Patterns of **Universal Design** in Residential Courtyards in the Jugla Neighbourhood"	Landscape Architecture and Art
Yeşiltepe & Demirkan	2023	"Reflection of Empathic Design Process On Interior Architecture Students' **Universal Design** Solutions"	METU Journal of the Faculty of Architecture
Watchorn et al.,	2023	"Evaluating **Universal Design** of Built Environments: an Empirical Study of Stakeholder Practice and Perceptions"	Journal of Housing and the Built Environment
Filová et al.,	2022	**"Universal Design** Principles Applied in Museums' Historic Buildings"	Prostor: znanstveni časopis za arhitekturu i urbanizam
Duman & Asilsoy	2022	"Developing an Evidence-Based Framework of **Universal Design** in the Context of Sustainable Urban Planning in Northern Nicosia"	Sustainability
Moore et al.,	2022	"A National Study of Playground Professionals **Universal Design** Implementation Practices "	Landscape Research
Usal & Evcil	2019	**"Universal Design** in Interior Architecture Education: The Case of Store Design"	ICONARP International Journal of Architecture and Planning
Al Şensoy & Sarı	2019	"Re-Design of Schoolyard for Effective Development of Child From a **Universal Design** Perspective"	Megaron
Meşhur & Yılmaz Çakmak	2018	**"Universal design** in urban public spaces: the case of Zafer Pedestrian Zone/Konya-Turkey"	ICONARP International Journal of Architecture and Planning

Barrier-free design forms the basis of concepts such as "accessible design, adaptable design, design for everyone, universal design, and means creating an environment that will enable each individual in society to live at an equal level of prosperity" (Heiss et al., 2010). A barrier-free design-built

environment allows people with disabilities to move safely and freely and use facilities within the built environment. The purpose of barrier-free design is to create an environment that encourages autonomous functioning so that people can go about their daily lives without help. Some of the publications available in the literature on barrier-free design; and free-life barrier center (Demirci, 2020; Ozalp, 2022; ASHB, 2023). Furthermore, development, services, and applications for barrier-free living centers continue in Türkiye's municipalities of Kayseri, Konya, Gaziantep, and Gebze. Some municipalities in Istanbul have barrier-free living centers. To give an example: Beşiktaş, Çekmeköy, Gaziosmanpaşa, Tuzla, and Pendik Municipality in Istanbul (Beşiktaş, 2023; Çekmeköy, 2023; Gaziosmanpaşa, 2023; Pendik, 2023; Tuzla, 2023). But within the scope of this research, only the Üsküdar Barrier Free-Life Center is focused on (Usküdar, 2023).

2. Methodology

This section provides information about the methodologies applied in the paper. In this article, the Üsküdar Barrier-Free Living Center is examined syntactically and cognitively in terms of universal design criteria using two methods.

1) Space Syntax Methodology:

DepthmapX-0.8.0 and Syntax 2D 1.3 are the software packages utilized in space syntax analysis. Both software packages were used in this study's space syntax analysis. First, the architectural project, floor plans, sections, and facade obtained from the Municipality of Üsküdar were examined. The architectural floor plans were created in the AutoCAD 2018 application in dxf format. Following that, space syntax studies were carried out using the software packages DepthmapX-0.8.0 and Syntax 2D 1.3.B. Data from connection, integration, and intelligibility analyses were displayed visually and numerically.

In the first step, a space syntax analysis was conducted to examine the interaction of space organization and social structure at the Üsküdar Barrier-Free Living Center and to provide quantitative data. The space syntax methodology explores the relationships between spatial organization and a range of social, economic, and environmental phenomena. These phenomena include movement patterns, awareness, and interaction; land use intensity, land use mix, and land value; urban growth and social differentiation; security and crime distribution, etc. Space syntax symposiums are organized to discuss the method, theory, and research with all researchers. It aims to bring together academics, practitioners, and students working on space syntax and related approaches to share knowledge, discuss theoretical and methodological advances as well as practical applications, and find directions for further collaborations. In June 2024, the Space Syntax Symposium will be held in Cyprus (SSS14, 2024). Symposium themes are architecture and complex buildings, spatial cognition, methodological developments, history and urban morphology, evidence based design, teaching and pedagogy, urban design and planning, urban economics and land use, space and society. These themes show that space syntax methodology is used in many fields of science.

Also, numerous research studies in the literature use the space syntax method. Some of the studies using the space sequence method are as follows; urban design (Karimi, 2012), Also, the reference sources of the space syntax method are as follows (Koohsari et al., 2014; Karimi, 2018; Van Nes & Yamu, 2021; Ergün et al., 2022; Arslan & Ergener, 2023). In additionally, some references regarding the space syntax method are as follows: (Oliynyk & Troshkina, 2023; Karimi, 2023; Garau et al., 2024; Yang et al., 2024; Fan et al., 2024; Wu et al., 2024; Behzadfar & Mazarei, 2024; Laouar et al., 2024; Zhang et al., 2024; Lee, 2024; Haghlesan, 2024; Şahin Körmeçli, 2024; Molaei et al., 2024; Günaydın & Selçuk, 2024; Mounia & Foued, 2024; Cao & Li, 2024). Table 2 lists the current literature on space syntax in the Web of Science Core Collection Database.

Table 1. Current articles on "space syntax" that can be accessed through the Web of Science Core Collection Database (WOS, 2024).

Author(s)	Year	Publication Titles	Publishers
Peponis, J.	2024	"**Space syntax** and design"	Environment and Planning B: Urban Analytics and City Science
Qanazi et al.,	2024	"Exploring Urban Service Location Suitability: Mapping Social Behavior Dynamics with **Space Syntax** Theory"	Land
Laouar et al.,	2024	"Do urban renewal programs make suburbs safer? A fine-grained GIS and **space syntax** study of an urban renewal project in the city of Toulouse"	Journal of Urban Design
Günaydın & Selçuk	2024	"How urban growth influences the spatial characteristics of cities: Empirical research in Malatya/Türkiye based on **space syntax**"	Geo Journal
Safizadeh et al.,	2024	"Integrating **space syntax** and CPTED in assessing outdoor physical activity"	Geographical Research
Lee	2024	"Public Memory, Architectural Language, and Its Configurational Relationship in the Memorial Museum: A Case Study of the War Memorial of Korea Using **Space Syntax** and Movement Tracking"	Buildings
Fan et al.,	2024	"Using a **Space Syntax** Approach to Enhance Pedestrians' Accessibility and Safety in the Historic City of George Town, Penang"	Urban Science
Liu & Wang	2024	"Study on the classification of villages in Jilin Province based on **space syntax** and machine learning"	Architectural Science Review
Zhang et al.,	2024	"Analysis of Cross-Generational Co-Living Space Configuration in Residential Communities—Case Study in China and Italy Based on **Space Syntax**"	Buildings
Wu et al.,	2024	"Integrating restorative perception into urban street planning: A framework using street view images, deep learning, and **space syntax**"	Cities
Istiani et al.,	2023	"Investigating the spatial network of playgrounds during covid-19 based on a **space syntax** analysis case study: 10 playgrounds in Delft, the Netherlands"	Cogent Social Sciences
Keles et al.,	2023	"Accessibility analysis of public buildings with graph theory and the **space syntax** method: government houses"	Journal of Asian Architecture and Building Engineering
Lyu et al.,	2023	"Unveiling the potential of **space syntax** approach for revitalizing historic urban areas: A case study of Yushan Historic District, China"	Frontiers of Architectural Research
Körmecli	2023	"Evaluating Accessibility of Street Network in Neighborhood by **Space Syntax** Method: The Case of Çankırı"	ICONARP International Journal of Architecture and Planning
Mohamed & van der Laag Yamu	2024	"**Space syntax** has come of age: A bibliometric review from 1976 to 2023"	Journal of Planning Literature

2) Cognitive Mapping Methodology:

In the second step, the cognitive mapping methodology was applied in the field research. A variety of studies in the literature have employed the cognitive mapping method examples of references (Alinam, 2017; Jang & Kim, 2019; Wu et al., 2020). In addition, current research in cognitive mapping studies are as follows; individual differences (Ishikawa, 2023), wayfinding decision (Bock et al., 2024), suburban (Zheng et al., 2022); landmark and configurationally representations (Chiang et al., 2023); legibility (Ghods et al., 2023); spatial schemas (Farzanfar et al., 2023); urban (Mijani et al., 2023); bibliometrics and visual analysis (Qu et al., 2023); urban spaces (Tchertov, 2024).

In this research, the users of the space were interviewed and asked to draw cognitive maps of the space in their minds, and cognitive mapping analysis was performed on these drawings. Participants were asked to draw on white A4 paper with a pencil. This exercise took an average of 20 minutes. Participants were asked to draw the places they remembered in the space (entrance, garden, workshops, corridors, etc.). Participation in the survey was entirely voluntary. No identifying information or personal data was requested in the survey. In addition, the answers of the participating individuals were kept completely confidential and evaluated only by the researchers. Interviews with volunteer participants in the field study were conducted with the knowledge and accompaniment of the director, managers, and teachers of the Center for Life without Disabilities, and all kinds of abuses were avoided. Inclusion criteria for volunteers: adult educators or administrators over the age of eighteen who wanted to draw voluntarily; adult users were included. Table 3 lists the current literature on cognitive mapping in the Web of Science Core Collection Database.

Table 2. Current articles on "cognitive mapping" that can be accessed through the Web of Science Core Collection Database (WOS, 2024).

Author(s)	Year	Publication Titles	Publishers
Zanon et al.,	2024	"Relations between supply chain performance and circular economy implementation: A fuzzy **cognitive map**-based analysis for sustainable development"	Business Strategy & Development
Polykretis & Danielescu	2024	"Mapless mobile robot navigation at the edge using self-supervised **cognitive map** learners"	Frontiers in Robotics and AI
Sarmiento et al.,	2024	"Fuzzy **cognitive mapping** in participatory research and decision making: a practice review"	Archives of Public Health
Dan-Rakedzon et al.,	2024	"A framework for understanding the human experience of nature through **cognitive mapping**"	Conservation Biology
Zhan et al.,	2024	"**Cognitive mapping** of indoor environments: constructing an indoor navigation network from crowd sourced indoor route descriptions"	Cartography and Geographic Information Science
Banerjee	2024	**Cognitive mapping** as a research method: The childhood city"	The Routledge Handbook of Urban Design Research Methods
Peer et al.,	2023	"The format of the **cognitive map** depends on the structure of the environment"	Journal of Experimental Psychology: General
Stein	2022	"De-imaging New York: **cognitive mapping** and the city symphony"	GeoJournal
McNaughton & Saksena	2022	"Route selection with a **cognitive map**"	Neuron

3. Üsküdar Barrier-Free Life Center Location

Üsküdar, which is at the center of Istanbul's historical, cultural, educational, and social life, is home to many different layers due to its location. The coexistence of these layers creates a rich texture. Üsküdar Accessible Life Center, which was examined within the scope of this research, is located between Büyük Çamlıca and Küçük Çamlıca Grove, next to Bulgurlu, Libadiye Junction (Figure 2). Due to its location, it is close to transportation networks such as bridges, highways, Marmaray, metro, and metrobuses and easy to access. It is also in a very central location with its proximity to monuments such as Çamlıca Tower (Figure 2) and Çamlıca Mosque. Çamlık Park is located on the west side of the Üsküdar Barrier-Free Living Center (Figure 3). The entrance of the center is designed on a flat level without stairs for the disabled, elderly, children, and their relatives. It consists of 5 floors, 4 thousand square meters of construction area, a barrier-free park, a barrier-free living garden, a hobby garden for the disabled, and an outdoor parking lot for 50 vehicles (Figure 3).

The Üsküdar Barrier-Free Life Center was planned in consultation with disabled citizens, academicians, and trained experts (Üsküdar, 2023). This building was designed as a completely "barrier-free" building, considering all disability groups (Üsküdar, 2023). Üsküdar Barrier-Free Living Center is used as a special living space for socialization, education, treatment, and support for disabled citizens and their relatives. This center is designed to facilitate the lives of its users with its surroundings, garden, entrance, and interior spaces. Üsküdar Barrier-Free Living Center received the "Turkey Accessibility Award" in 2020 (Savaş, 2021).

Figure 2. Üsküdar Barrier-Free Life Center and Çamlıca Tower (Burkut, 2024)

Figure 3. Üsküdar Barrier-Free Life Center (X, 2024)

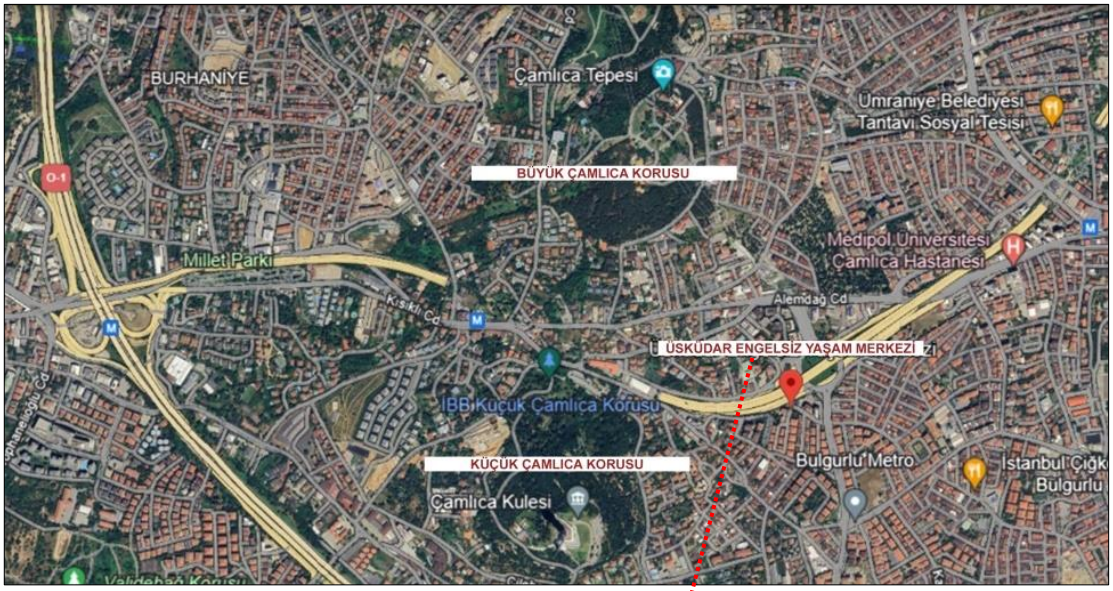

Figure 4. Location in Istanbul (Created by authors)

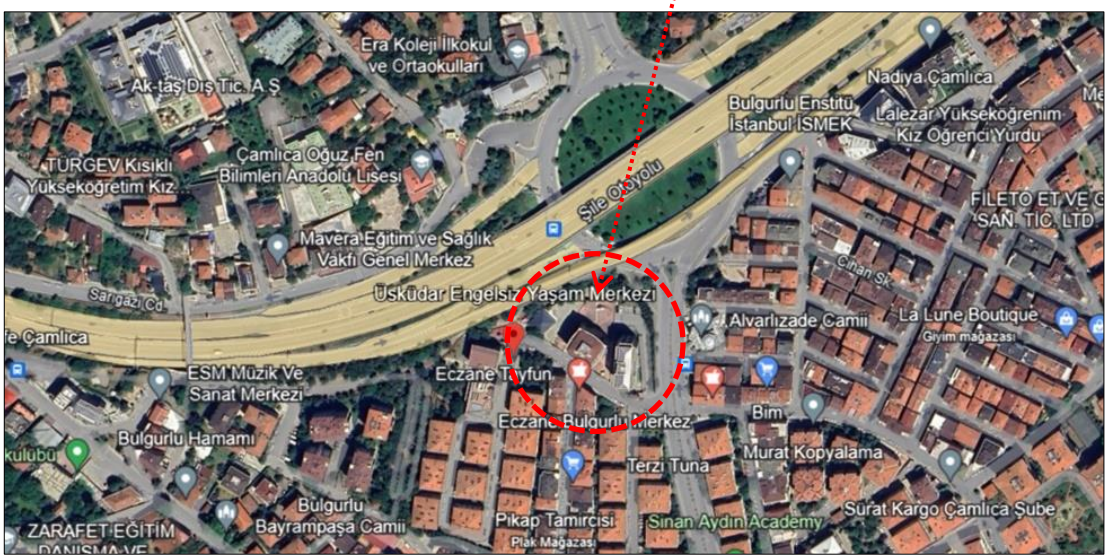

Figure 5. Üsküdar Barrier-Free Life Center Location in Üsküdar (Created by authors)

3.1. Üsküdar Barrier-Free Life Center Spatial Features

Üsküdar Barrier-Free Life Center consists of 5 floors, 4 thousand square meters of construction area, a barrier-free park, a barrier-free living garden, a hobby garden for the disabled, and an outdoor parking lot for 50 vehicles. There is an accessible building entrance and yellow wayfinding floor sign for users (Figure 6). In addition, there are places that serve and educate people with disabilities in Üsküdar Barrier-Free Life Center; there are two pools for men and women according to the disability status of disabled people. Many services, such as hydrotherapy (water therapy), sensory integration therapy, space therapy, physiotherapy, hypnotherapy, speech and language therapy, and techno therapy, are provided. In addition, individual and group education, a pedagogue service, a psychologist service, and a sociology service are provided for individuals requiring special education. In 10 special patient care rooms in the Barrier-Free Life Center, services are provided to disabled people who are bedridden at home. Concert, theater, cinema, conference, and seminar services are provided in the multi-purpose 100-person barrier-free conference hall. Individuals with disabilities are engaged in production by receiving training in computer, filography, calligraphy, handicrafts, music, and art workshops.

Figure 6. Building entrance accessible for users and yellow wayfinding floor sign (image by authors)

In addition, floor layout plan and floor information boards are available on each floor and in the elevator in a location that users can easily see (Figure 7). Also, group education, physiotherapy, psychological counseling, pedagogy, speech and language therapy, sensory integration therapy, space therapy, hydrotherapy (water therapy), technotherapy, sports rehabilitation, creative drama, philography, wood painting, folklore, rhythm, music, and sound, concert studies, image, marbling art, textile, computer, wood burning and etching, calligraphy, Alzheimer's school hobby center, daycare rooms, home health service, and hairdresser service (Uskudar, 2023). The relationship of the building with the environment brings the garden and the green together. The location of the building is designed to maximize daylight, with classrooms and workshops on the east-west façade. There is no elevation difference or stairs at the entrance, making it easier for users to access the space. It is designed as an animal-friendly building that establishes a relationship with the environment with the hobby garden for disabled people and cat houses in the garden (Figure 8, Figure 9).

Figure 7. Floor layout plan (left), floor information board (right) (image by authors)

Figure 8. Facade (image by authors)

Figure 9. Outdoor playground and outdoor seating (image by authors)

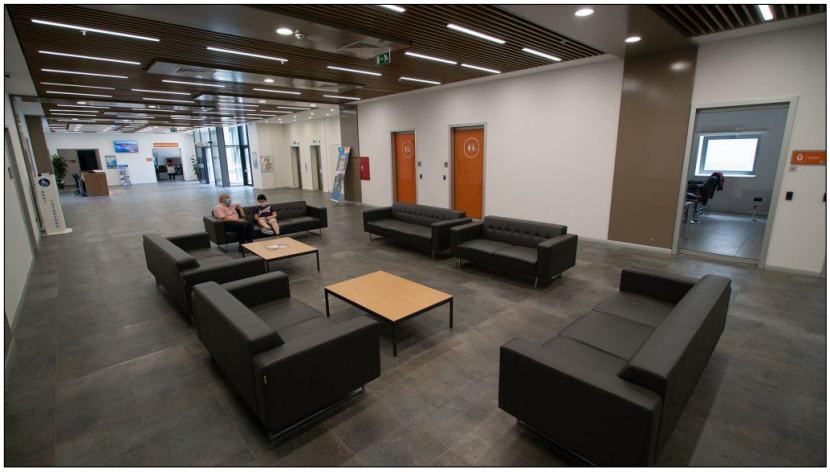

Figure 10. Interior space (Usküdar, 2023)

Figure 11. Wc (image by authors)

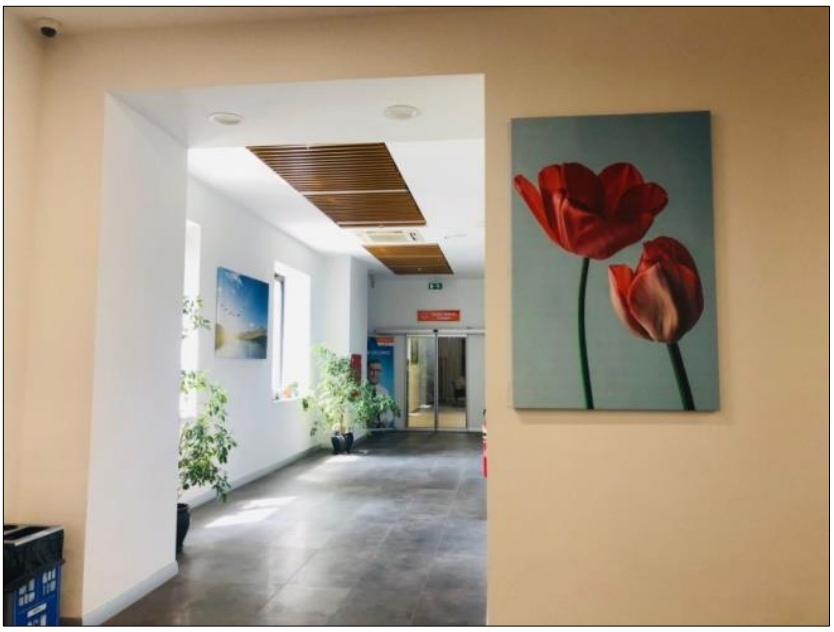

Figure 12. Interior design (image by authors)

The Barrier-Free Living Center floor layout plans on each floor provide detailed information to users about the spaces they want to access. In addition, male and female WCs and washbasins on each floor are specially designed for disabled and wheelchair users (Figure 10). Touchscreen doors provide hygiene by opening untouched. This also makes life easier for disabled individuals Light colors were preferred on the walls in the interior design of the Üsküdar Barrier-Free Living Center. It is quite bright, and daylight is let in in the best way (Figure 11). The paintings preferred on the walls consist of nature and flower themes (Figure 12). The light colors preferred in the interior make it look quite spacious, bright, and wide.

3.2. Participants

On a white A4 sheet of paper, participants were instructed to sketch with a pencil. On average, this activity took 20 minutes. They were requested to draw with a pencil on A4 white paper the places they remembered in the space (entry, garden, workshops, corridors, etc.) (Figure 13). The survey's participation was entirely voluntary. The questionnaire requested no identifying information or personal information. Additionally, the responses provided by the participants were kept totally private and were only examined by the researchers. Such abuses were prevented since interviews were performed with the awareness of the Center for Life without Disabilities' director, managers, and teachers (Figure 13). Interviews with voluntary participants were conducted in the presence of management and teachers. Exclusion Criteria for Volunteers; children, the elderly, and users with disabilities in the eyes, hands, arms and fingers were not included in the study. Inclusion Criteria for Volunteers; Adult educators or administrators over the age of eighteen who want to draw voluntarily, adult users were included.

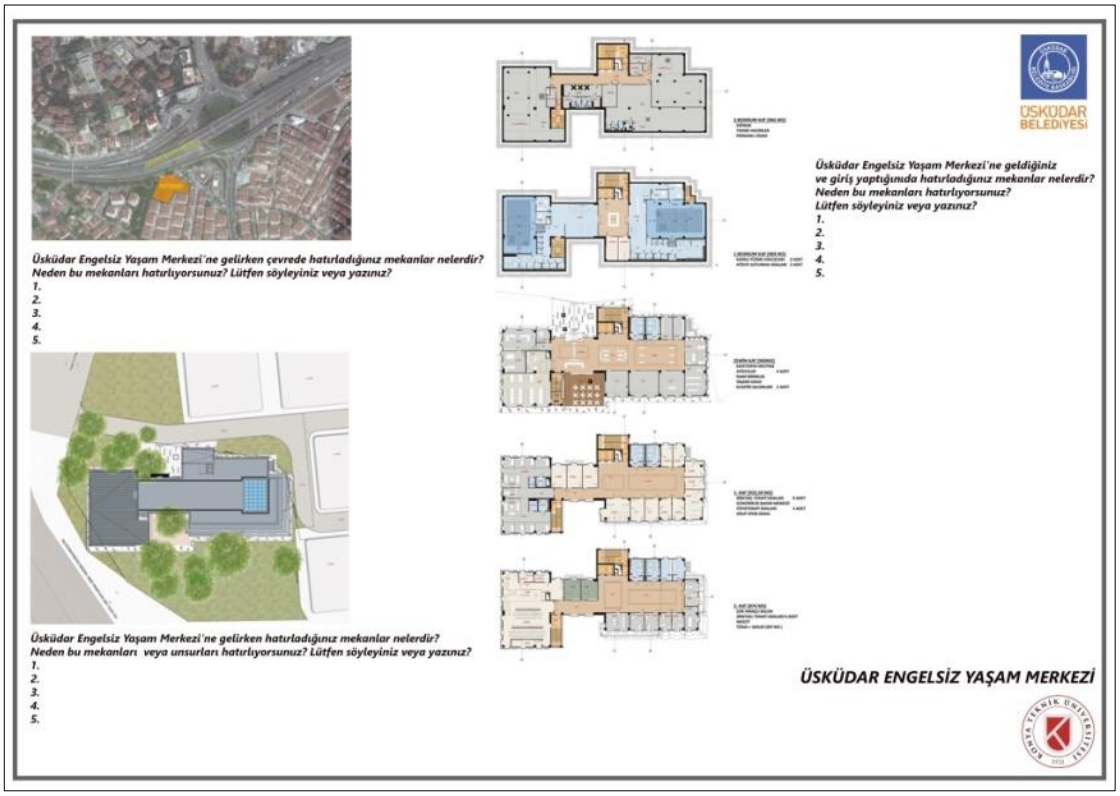

Figure 13. Sketch for cognitive map drawing (creating by authors)

4. Results and Discussion

In this section, the results are analyzed in two steps. The first is the results of the cognitive map of the spaces drawn and verbally remembered by the participants. The second is the results of the space syntax analysis of the space with the DepthMap X program.

4.1. Results of Cognitive Analysis (Cognitive Mapping)

The results of the cognitive mapping analysis are presented in this section. Volunteer participants were questioned briefly and instructed to draw on letterheads for the cognitive map drawings. One of these letterheads was blank, while the other included the site plan and floor plans for the participant to memorize and note.

Table 4 shows the numerical data of the cognitive map drawings. The percentage of administrator/trainer interior a drawing was quite high and the percentage of outside drawings was low when these drawings were analyzed (Table 4). Compared to indoor drawings, the percentage of outdoor drawings by administrators and trainers is slightly greater. One may argue that the increasing popularity of outdoor playgrounds, camellias, and hobby gardens is the cause of this. There were very few user/visitor plan drawings. Facade drawings in staff and employee drawings are a little bit higher than those in other places. The reason for this is that users think that the facade design is remarkable.

Table 4 Spaces drawn on cognitive maps

Spaces Drawn on Cognitive Maps	Employee / Staff	Users / Visitors	Administrator / Instructor
Garden	**53,1**	**74,6**	**62,3**
Waiting and Rest	**82,5**	**65,8**	**57,9**
Pool / Sports area	**35,78**	**65,7**	**72,3**
Therapy rooms	**64,2**	**76,4**	**65,9**

4.2. Results of Syntactic Analysis (Space Syntax)

The floor plans of the architectural project were prepared in the AutoCAD 2018 program in dxf. format. In DepthmapX-0.8.0 and Syntax 2D 1.3.B software programs, connectivity, integration, and intelligibility analysis of visual and numerical data were revealed. Figure 10 shows axial lines in the connectivity analysis. The fact that these lines are blue indicates that the depth value of the space is high, and the fact that they are red indicates that the connectivity value is high. Accordingly, the connectivity value of the central area where waiting, resting, and exhibition areas are located is quite high (Figure 14). Figure 15 shows the graph of the intelligibility analysis. The fact that this curve approaches 45 degrees and the R-value is close to 1 indicates that the intelligibility of the space is strong. According to the analysis, the R-value is R=0.829107 (Figure 15). According to Figure 16 space syntax analysis results attribute summary and minimum, average and maximum numerical data.

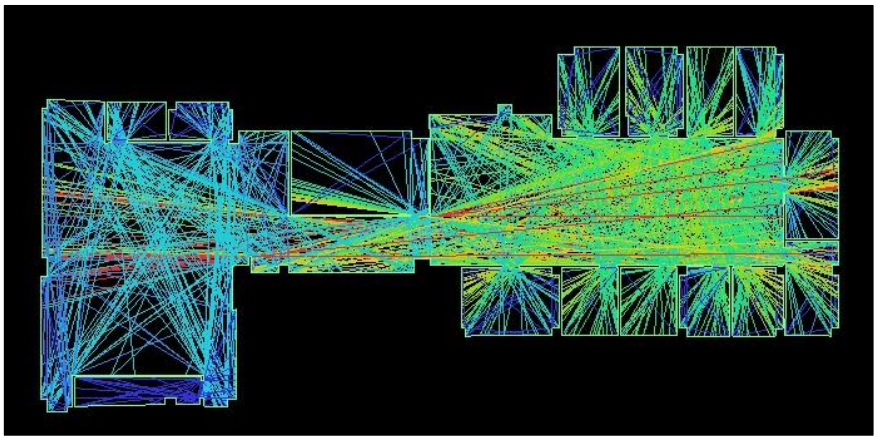

Figure 14. Connectivity analysis (analyzed and visualized by the Authors)

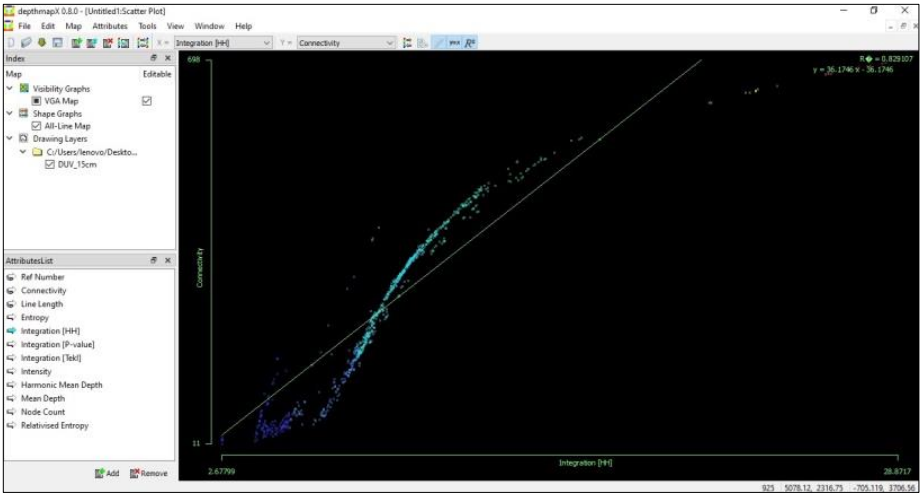

Figure 15. Intelligibility (analyzed and visualized by the Authors)

Attribute Summary

	Attribute	Minimum	Average	Max
1	Connectivity	14	286.543	621
2	Line Length	179.041	1795.41	5282.19
3	Entropy	1.01051	1.47135	1.86907
4	Integration [HH]	2.66426	8.4685	18.917
5	Integration [P-value]	2.66426	8.4685	18.917
6	Integration [Tekl]	0.783315	0.910911	1.04308
7	Intensity	0.547052	1.68625	2.87446
8	Harmonic Mean Depth	47.5794	130.951	350.108
9	Mean Depth	1.3872	2.02163	3.74921
10	Node Count	954	954	954
11	Relativised Entropy	1.11202	1.53576	2.82958

Figure 16. Space syntax analysis findings (analyzed and visualized by the Authors**)**

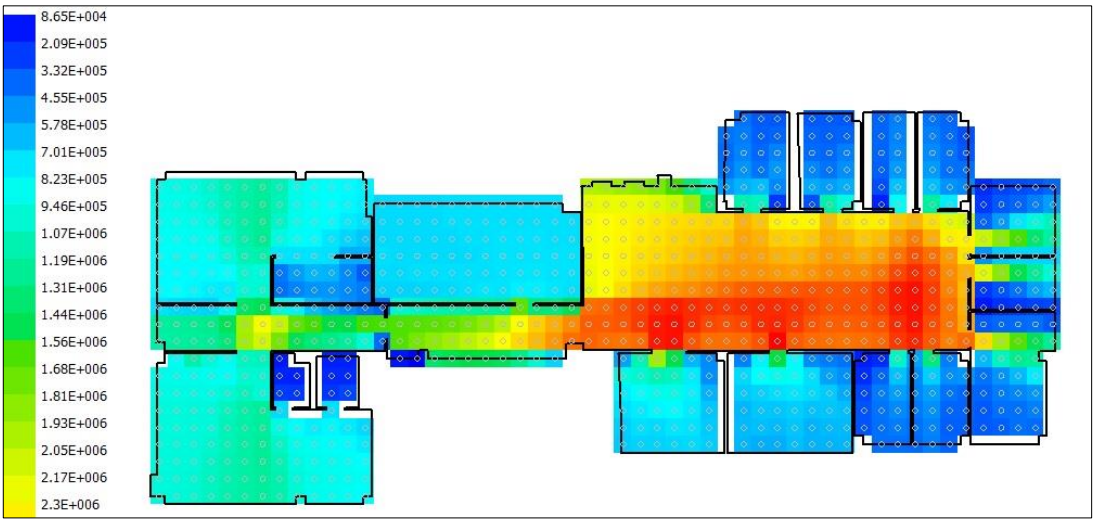

Figure 17. Space syntax analysis in Syntax2D software (analyzed and visualized by the Authors)

Syntax2D software was used to do space sequence analysis. As a result, waiting, listening, and exhibition areas are positioned in locations with the highest connectedness and integration values. These areas are highlighted in red. The color shift from red to yellow, turquoise blue, and dark blue reflects the space's circulation density (Figure 17). In other words, the psychologist, pedagogue, and therapy rooms are the shallowest environments. The locations of the pool and gymnasiums are in areas with low connectivity value. The organization of the space provides accessible solutions for disabled individuals and their families; equal use; the presence of guidance and information boards in the use of the spaces; and the accuracy of the information.

5. Conclusion and Suggestions

The Üsküdar Barrier-Free Living Center was analyzed cognitively and syntactically in terms of universal design principles in this study. In the first step, a space syntax analysis was performed to evaluate and give numerical data on the relationship between space organization and social structure at the Üsküdar Barrier-Free Living Center. In the second step, users of the space were interviewed and instructed to create mental cognitive maps of the space, which were then analyzed using cognitive mapping software. The research findings are intended to shed light on new research in terms of universal design standards, contribute to the field of barrier-free design, and offer an example for new barrier-free living centers to be developed. During the field research phase, Üsküdar Barrier-Free Living Center participants openly indicated their pleasure with the services provided by the center. Users of the facility and their families urged that similar services be provided for the disabled throughout Üsküdar's various towns and neighborhoods. This service is expected to be replicated by other municipalities in Istanbul as a model initiative. The fact that services and training are provided for free is seen positively.

In addition, the availability of free shuttle service facilitates access to the center. During the time when disabled individuals receive services, it is desired to create a training, seminar, waiting area, or sports area for mothers and caregivers. While the presence of an indoor playground gives satisfaction to the users, they expressed the demand that the playground should be larger and the play materials should be increased. Creating a sports and gymnastics (sportive rehabilitation) area for special children. For users with more than one child, it is expected to create a suitable environment for children during the waiting process and to create an indoor-outdoor play and activity area for children of different age groups. The services provided by the Üsküdar Barrier-Free Life Center were thanked again. It is aimed at contributing to the future design of centers for administrators, managers, educators, parents, academicians, researchers, and interested parties, as well as the individuals and their relatives who will use these centers. The space can be said to meet many basic needs, such as education, socialization, learning, personal care, the need for exercise and play with its green areas and parks, repairing disabled cars, barbers, and therapies, learning while socializing with family participation, and turning leisure time into an opportunity. As a result, all sociological, psychological, and pedagogical components of accessible and barrier-free environments must be approached from an interdisciplinary standpoint. In the future, new designs can be available to users with the assistance of municipalities and local governments in designing and constructing new barrier-free access to all (elderly, disabled, children, etc.) spaces.

Acknowledgements and Information Note

Committee approval in the study, Ethics Committee of the University of Konya Technical University 02.06.2023 dated, meeting number 2023/05 and E-2443673-051.99-115602 decision number. This research was presented during the Konya Technical University Graduate Education Institute Architecture Master Thesis seminar. The data for this article were collected during the master's thesis seminar.

This research was presented as a master thesis seminar on June 20, 2023. Before the research, necessary permissions were obtained from Üsküdar Municipality and Üsküdar Barrier-Free Life Center managers and administrators. This article was presented at the XIIth International Üsküdar Symposium on October 13-15, 2023. The article complies with national and international research and publication ethics.

Author Contribution and Conflict of Interest Declaration Information

1st Author % 60, 2nd Author % 40 contributed. There is no conflict of interest

References

Ahmed, M. & Sungur Ergenoğlu, A. (2016). An assessment of street design with Universal Design principles: case in Aswan/As-Souq. *Megaron,* 11(4). Access Address (22.10.2023): https://megaronjournal.com/jvi.aspx?pdir=megaron&plng=eng&un=MEGARON-98704

Al Şensoy, S. & Sarı, R. M. (2019). Re-design of schoolyard for effective development of child from a universal design perspective. *Megaron*. 2019; 14(3): 443-459. Access Address (16.10.2023): https://megaronjournal.com/jvi.aspx?pdir=megaron&plng=eng&un=MEGARON-72677

Alinam, Z. (2017). The effects of individual factors on the formation of cognitive maps. ICONARP *International Journal of Architecture and Planning*. Access Address (1.10.2023): https://gcris.ktun.edu.tr/bitstream/20.500.13091/1816/1/document%20%286%29.pdf

Arsenault P., (2023).Universal Design Incorporating Architectural Linear Drains Designing buildings and spaces for all people, with or without disabilities, 211 (6), *Architectural Record*, pp.184-185

ASHB. (2023). T.C. Aile ve Sosyal Hizmetler Bakanlığı. Engelli ve Yaşlı Hizmetleri Genel Müdürlüğü. Access Address (19.10.2023): https://www.aile.gov.tr/eyhgm

Arslan, H. D. & Ergener, H. (2023). Comparative analysis of shopping malls with different plans by using space syntax method. *Ain Shams Engineering Journal*, 14(9), 102063. Access Address (1.10.2023): https://www.sciencedirect.com/science/article/pii/S2090447922003744

Aylin, A., Kaya, B. Y. & Dagdeviren, M. (2019). An ergonomic investigation of working environment with Kano Model and Universal Design Principles. *Gazi University Journal of Science*, 32(2), 582-593. Access Address (21.10.2023): https://dergipark.org.tr/tr/download/article-file/726177

Bakar, S., & Şimşek, O. (2023). Mimarlık eğitiminde evrensel tasarım içerikli derslerin yeri. *Kırklareli Üniversitesi Mimarlık Fakültesi Dergisi,* 2(1), 57-69.

Banerjee, T. (2024). Cognitive mapping as a research method: The childhood city. *The Routledge Handbook of Urban Design Research Methods, 1*15-126.

Behzadfar, M., & Mazarei, M. (2024). Utilization of space syntax technique in spatial structure analysis; Case Study: Resalat Square, Tehran. *Naqshejahan-Basic studies and New Technologies of Architecture and Planning,* 13(4), 49-72.

Bekar, İ. (2021). Kütüphane iç mekânlarının evrensel tasarım ilkeleri bağlamında değerlendirilmesi: Karadeniz Teknik Üniversitesi Faik Ahmet Barutçu Kütüphanesi. *Journal of Architectural Sciences and Applications,* 6 (1), 178-194. DOI: 10.30785/mbud.875137. Access Address (1.10.2023): https://dergipark.org.tr/tr/download/article-file/1558440

Besiktas (2023). Beşiktaş Engelsiz Yaşam Evi. Access Address (5.10.2023): https://besiktas.bel.tr/merkezler/hizmet-merkezleri/engelsiz-yasam-evi

Bock, O., Huang, J. Y., Onur, O. A., & Memmert, D. (2024). The structure of cognitive strategies for wayfinding decisions. *Psychological Research*, 88(2), 476-486.

Boduroğlu, Ş. (2014). Universal design of instruction: definition, principles, and examples. Iconarp *International Journal of Architecture and Planning*, 2 (1), 37-53. Access Address (5.10.2023): https://dergipark.org.tr/en/pub/iconarp/issue/7900/103992

Bulut, B., & Halaç, H. H. (2023). Üniversitelerde evrensel tasarım yaklaşımı çalışmaları üzerine sistematik bir literatür analizi. *Uluslararası Sosyal Bilimler Akademik Araştırmalar Dergisi*, 7(1), 74-91.

Burkut, E. B. (2023). Evrensel Tasarım, Engelsiz Tasarım ve Teknoloji Konusunda Yapılan Araştırmaların Bibliyometrik Analizi. Teknolojik Gelişmeler Işığında Evrensel Tasarım (Editörler: Havva Filiz

Meşhur, Bilgehan Yılmaz Çakmak, Ceyhun Şekerci). Serüven Yayınevi. Ankara. Access Address (12.10.2023): https://gazikitabevi.com.tr/urun/teknolojik-gelismeler-isiginda-evrensel-tasarim

Cao, P., & Li, W. (2024). Evaluation and optimization of outdoor wind environment in block based on space syntax and CFD simulation. *Plos one*, 19(3), e0297683.

CEUD (2024). The 7 Principles. The Center for Excellenge in Universal Design. Access Address (5.05.2024): https://universaldesign.ie/about-universal-design/the-7-principles

Chiang, N. C. R., Huang, S. C. L., Kuo, N. F. & Shih, C. C. (2023). Understanding cognitive maps from landmark and configurational representations*. Learning and Motivation*, 83, 101910. Access Address (19.10.2023): https://www.sciencedirect.com/science/article/abs/pii/S0023969023000413

Çekmeköy (2023). Çekmeköy Engelsiz Yaşam Merkezi. Access Address (1.10.2023): https://www.cekmekoy.bel.tr/tesis/engelsiz-yasam-merkezi

Dan-Rakedzon, N., Fleming, W., Lissovsky, N., Clayton, S., & Shwartz, A. (2024). A framework for understanding the human experience of nature through cognitive mapping. *Conservation Biology*, e14283.

Demirci, A. (2020). Erişilebilirliğe Yönelik Engelsiz Yaşam Merkezi Tasarım Yaklaşımları: Etimesgut Belediyesi Engelsiz Yaşam Merkezi Örneği. Yüksek Lisans Tezi. Başkent Üniversitesi Sosyal Bilimler Enstitüsü, İç Mimarlık ve Çevre Tasarımı Ana Bilim Dalı, Ankara. Access Address (1.10.2023): http://acikerisim.baskent.edu.tr/handle/11727/6504

Dostoğlu, N., Şahin, E. & Taneli, Y. (2009). Evrensel tasarım: Tanımlar, hedefler, ilkeler, *Mimarlık,* 347. Access Address (6.10.2023): http://www.mimarlikdergisi.com/index.cfm?sayfa=mimarlik&dergisayi=361&recid=2062

Doussard, C., Garbe, E., Morales, J., & Billion, J. (2024). Universal design for the Workplace: Ethical considerations regarding the inclusion of workers with disabilities. *Journal of Business Ethics,* 1-12. Access Address (23.03.2024): ://link.springer.com/article/10.1007/s10551-023-05582-y

Duman, Ü., & Asilsoy, B. (2022). Developing an evidence-based framework of universal design in the context of sustainable urban planning in Northern Nicosia*. Sustainability*, 14(20), 13377.

Elsafty, M. W. M. (2024). Biophilic design patterns and universal design principles application in the long-term residential care centers for the elderly*. International Design Journal*, 14(2), 405-415. https://idj.journals.ekb.eg/article_339514_43337.html

Ensarioğlu, S. A. (2020). Pandemi sürecinin "evrensel tasarım" ilkelerine etkileri. *International Journal of Social and Humanities Sciences Research (JSHSR),* 7(55), 1673-1680.

Ergün, R., Kutlu, İ. & Kılınç, C. (2022). A comparitive study of space syntax analysis between traditional Antakya houses and social housing complexes by TOKI. *Journal of Architectural Sciences and Applications,* 7 (1), 284-297. DOI: 10.30785/mbud.1068659. https://dergipark.org.tr/en/download/article-file/2234372

Fan, M., Hedayati Marzbali, M., Abdullah, A., & Maghsoodi Tilaki, M. J. (2024). Using a space syntax approach to enhance pedestrians' accessibility and safety in the Historic City of George Town, Penang. *Urban Science,* 8(1), 6. Access Address (19.03.2024):

Farzanfar, D., Spiers, H. J., Moscovitch, M., & Rosenbaum, R. S. (2023). From cognitive maps to spatial schemas. *Nature Reviews Neuroscience*, 24(2), 63-79.

Filová, N., Rollová, L. & Čerešňová, Z. (2022). Universal Design Principles Applied in Museums' Historic Buildings. Prostor: Znanstveni Časopis Za Arhitekturu I Urbanizam, 30(1 (63)), 92-105. Access Address (19.10.2023): https://hrcak.srce.hr/clanak/405238

Garau, C., Annunziata, A., & Yamu, C. (2024). A walkability assessment tool coupling multi-criteria analysis and space syntax: The case study of Iglesias, Italy. *European Planning Studies*, 32(2),

211-233. Access Address (11.03.2024): https://www.tandfonline.com/doi/abs/10.1080/09654313.2020.1761947

Gaziosmanpaşa. (2023). Gaziosmanpaşa Engelsiz Yaşam ve Sağlık Merkezi. Access Address (1.10.2023): https://www.gaziosmanpasa.bel.tr/det/739/engelsiz-yasam-ve-saglik-merkezi

Ghods, H., Bemanian, M., & Moradinasab, H. (2023). Investigating the effect of cognitive mapping of users on the legibility of the environment, Tehran City: Sattarkhan Street, First Sadeghieh Square to Second Sadeghieh Square. *Journal of Urban Ecology Researches*, 14(Series 31), 67-84.

Goldsmith, S. (2007). Universal design. Routledge. Access Address (11.10.2023): https://www.taylorfrancis.com/books/mono/10.4324/9780080520209/universal-design-selwyn-goldsmith

Grimley, C. & Smith, K. H. (2021). Universal Principles of Interior Design: 100 Ways to Develop Innovative Ideas, Enhance Usability, and Design Effective Solutions. Rockport Publishers. Access Address (6.10.2023): https://www.amazon.com/Universal-Principles-Interior-Design-Innovative/dp/0760372128

Günaydın, A. S., & Selçuk, E. B. (2024). How urban growth influences the spatial characteristics of cities: empirical research in Malatya/Türkiye based on space syntax*. GeoJournal*, 89(2), 1-16.

Haghlesan, M. (2024). Analyzing the legibility of the spaces of urban metro stations using the method of space syntax (case study: El Goli and Kohen stations in Tabriz*). Journal of Transportation Research*, 21(1), 167-180.

Hall, T. E., Robinson, K. H., & Gordon, D. (2024). Universal Design for Learning in the Classroom: Practical Applications for K-12 and Beyond. Guilford Press. Access Address (1.03.2024): https://eric.ed.gov/?id=ED643793

Heiss, O., Degenhart, C. & Ebe, J. (2010). Barrier-Free Design. Traduzido do Alemão por G. Soffker, P. Thrift. Munique: Edição Detail. Access Address (13.10.2023):https://www.detail.de/de_en/barrier-free-design

Hilmioğlu, S., & Seçer Kariptaş, F. (2022). Erişilebilir üniversite kavramı üzerine bir inceleme: üniversite mekânlarının erişilebilirlik ve evrensel tasarım yönünden değerlendirilmesi. *Online Journal of Art and Design,* 10(2), 40-51.

Hurst, K., Lee, C., & Ndubisi, F. (2023). Universal design in playground environments: A place-based evaluation of amenities, use, and physical activity. *Landscape Journal*, 42(2), 55-80.

Ishikawa, T. (2023). Individual differences and skill training in cognitive mapping: How and why people differ. *Topics in Cognitive Science*, 15(1), 163-186.

Istiani, N. F. F., Alkadri, M. F., van Nes, A., & Susanto, D. (2023). Investigating the spatial network of playgrounds during covid-19 based on a space syntax analysis case study: 10 playgrounds in Delft, the Netherlands. *Cogent Social Sciences*, 9(1), 2163754.

Īle, U., & Bergmane, L. (2023). Development Patterns of Universal Design in Residential Courtyards in the Jugla Neighbourhood*. Landscape Architecture and Art*, 109.

Ielegems, E., & Vanrie, J. (2023). The cost of universal design for public buildings: exploring a realistic, context-dependent research approach. Archnet-IJAR: *International Journal of Architectural Research.*

İşanç, D., & Yılmaz, S. (2024). Ticari yapıların evrensel tasarım ilkelerine göre incelenmesi: alışveriş merkezi örneği. Mimarlık, Planlama ve Tasarım Alanında Uluslararası Araştırmalar V, 53.

Jang, K. M. & Kim, Y. (2019). Crowd-sourced cognitive mapping: A new way of displaying people's cognitive perception of urban space. *PloS one*, *14*(6), e0218590. Access Address (16.10.2023): https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0218590

Karimi, K. (2012). A configurational approach to analytical urban design: 'Space syntax

'methodology. *Urban Design International*, *17*(4), 297-318. Access Address (1.10.2023): https://link.springer.com/article/10.1057/udi.2012.19

Karimi, K. (2018). Space syntax: consolidation and transformation of an urban research field. *Journal of Urban Design,* 23(1), 1-4. Access Address (1.10.2023): https://www.tandfonline.com/doi/full/10.1080/13574809.2018.1403177

Karimi, K. (2023). The configurational structures of social spaces: Space syntax and urban morphology in the context of analytical, evidence-based design. *Land*, 12(11), 2084. https://www.tandfonline.com/doi/abs/10.1080/01490400.2013.856722

Keleş, B. N., Takva, Ç., & Çakıcı, F. Z. (2023). Accessibility analysis of public buildings with graph theory and the space syntax method: government houses. *Journal of Asian Architecture and Building Engineering*, 1-15.

Koohsari, M. J., Kaczynski, A. T., Mcormack, G. R. & Sugiyama, T. (2014). Using space syntax to assess the built environment for physical activity: applications to research on parks and public open spaces. Leisure Sciences, 36(2), 206-216. Access Address (1.10.2023):

Körmeçli, P. Ş. (2023). Evaluating accessibility of street network in neighborhood by space syntax method: The case of Çankırı. *ICONARP International Journal of Architecture and Planning,* 11(2), 625-649.

Laouar, D., Mokrane, Y., & Claramunt, C. (2024). Do urban renewal programs make suburbs safer? A fine-grained GIS and space syntax study of an urban renewal project in the city of Toulouse. *Journal of Urban Design*, 1-26.

Lee, J. H. (2024). Public Memory, Architectural Language, and Its Configurational Relationship in the Memorial Museum: A Case Study of the War Memorial of Korea Using Space Syntax and Movement Tracking. *Buildings,* 14(3), 590.

Liu, D., & Wang, K. (2024). Study on the classification of villages in Jilin Province based on space syntax and machine learning. *Architectural Science Review*, 1-16.

Lyu, Y., Abd Malek, M. I., Jaafar, N. H., Sima, Y., Han, Z., & Liu, Z. (2023). Unveiling the potential of space syntax approach for revitalizing historic urban areas: A case study of Yushan Historic District, China. *Frontiers of Architectural Research*, 12(6), 1144-1156.

McNaughton, B. L., & Saksena, R. (2022). Route selection with a cognitive map. *Neuron*, 1441-1442.

Meshur, H. F. A. (2016). Evaluation of urban spaces from the perspective of universal design principles: The case of Konya/Turkey. *TeMA-Journal of Land Use*, *Mobility and Environment,* 9(2), 191-208. Access Address (13.10.2023): http://www.serena.unina.it/index.php/tema/article/view/3786

Meşhur, H. F., & Yılmaz Çakmak, B. (2018). Universal design in urban public spaces: the case of Zafer Pedestrian Zone/Konya-Turkey. *Iconarp International Journal of Architecture and Planning.* Access Address (1.10.2023): https://iconarp.ktun.edu.tr/index.php/iconarp/article/view/223

Meyer, A. & Rose, D. H. (2000). Universal design for individual differences. Educational leadership, 58(3), 39-43. Access Address (1.10.2023): https://eric.ed.gov/?id=EJ617848

Mijani, M., Gharehbeiglu, M., Reshad, L., & Nejadebrahimi, A. (2023). Evaluation of Students' Cognitive Maps from an Urban Perspective as a Mental Image Output. Geographical Researches, 38(3), 381-389.

Mohamed, A. A., & van der Laag Yamu, C. (2024). Space syntax has come of age: A bibliometric review from 1976 to 2023. *Journal of Planning Literature*, 39(2), 203-217.

Mounia, B., & Foued, B. (2024). Space Syntax: a Method for assessing the urban policies in Ain M'lila city. *Tobacco Regulatory Science* (TRS), 1393-1405.

Molaei, M., Safari, H., & Asadi Malek Jahan, F. (2024). Configuration analysis of the passage of historical fabric of cities with the space syntax method (Case study: Sharbafan neighborhood in

Lahijan). *Geographical Engineering of Territory*, 8(1), 1-18.

Moore, A., Boyle, B., & Lynch, H. (2023). Designing public playgrounds for inclusion: A scoping review of grey literature guidelines for Universal Design. *Children's Geographies*, 21(3), 422-441. Access Address (21.10.2023): https://www.tandfonline.com/doi/full/10.1080/14733285.2022.2073197

Moore, A., Lynch, H., & Boyle, B. (2022). A national study of playground professionals universal design implementation practices. *Landscape Research*, 47(5), 611-627.

Mustaquim, M. M. (2012). A study of universal design principles assessment. *Advances in Physical Ergonomics and Safety,* 271. Access Address (1.10.2023): https://www.routledge.com/Advances-in-Physical-Ergonomics-and-Safety/Ahram-Karwowski/p/book/9781439870389

Null, R. (Ed.). (2013). Universal design: Principles and models. CRC Press. Access Address (6.10.2023): https://www.routledge.com/Universal-Design-Principles-and-Models/Null/p/book/9781138076006

NLC, (2022). Using Universal Design to Create Safe Welcoming and Joyful Spaces. Access Address (1.10.2023): https://www.nlc.org/article/2022/05/31/using-universal-design-to-create-safe-welcoming-and-joyful-spaces/

Olguntürk, N., & Demirkan, H. (2009). Ergonomics and universal design in interior architecture education. *METU Journal of the Faculty of Architecture*, 26(2). 123-138 Access Address (1.10.2023): http://jfa.arch.metu.edu.tr/archive/0258-5316/2009/cilt26/sayi_2/123-138.pdf

Oliynyk, O., & Troshkina, O. (2023). Analysis of architectural urban spaces based on space syntax and scenario methods. *Spatium*, 24-32.

Qzalp, Y (2022). Barrier-Free Living Centers. Access Address (15.10.2023): https://epale.ec.europa.eu/en/blog/barrier-free-living-centers

Peer, M., Nadar, C., & Epstein, R. A. (2023, January 31). The format of the cognitive map depends o*n the structure of the environment.* Journal of Experimental Psychology: General, https://doi.org/10.1037/xge0001498

Pendik (2023). Pendik Engelsiz Yaşam Merkezi. Access Address (7.10.2023): https://www.pendik.bel.tr/yer/detay/pendik-engelsiz-yasam-merkezi#ad-image-0

Peponis, J. (2024). Space syntax and design. Environment and Planning B: *Urban Analytics and City Science,* 51(5), 1073-1078.

Polykretis, I., & Danielescu, A. (2024). Mapless mobile robot navigation at the edge using self-supervised cognitive map learners. Frontiers in Robotics and AI, 11.

Qanazi, S., Hijazi, I. H., Shahrour, I., & Meouche, R. E. (2024). Exploring urban service location suitability: Mapping social behavior dynamics with space syntax theory. *Land*, 13(5), 609.

Qu, H., Nordin, N. A., Tsong, T. B., & Feng, X. (2023). A Bibliometrics and Visual Analysis of Global Publications for Cognitive Map (1970-2022). IEEE Access.

Safizadeh, M., Hedayati Marzbali, M., Abdullah, A., & Maghsoodi Tilaki, M. J. (2024). Integrating space syntax and CPTED in assessing outdoor physical activity. *Geographical Research*.

Sarmiento, I., Cockcroft, A., Dion, A., Belaid, L., Silver, H., Pizarro, K., ... & Andersson, N. (2024). Fuzzy cognitive mapping in participatory research and decision making: a practice review. *Archives of Public Health,* 82(1), 76.

Savaş, B., (2021). Üsküdar Engelsiz Yaşam Merkezine Sürdürülebiirlik Ödülü. Access Address (21.03.2024): https://www.sabah.com.tr/gundem/2021/03/24/uskudar-engelsiz-yasam-merkezine-surdurulebilirlik-odulu#:~:text=%C3%9Csk%C3%BCdar%20Belediyesince%20hayata%20ge%C3%A7irilen%20Eng

elsiz,a%C3%A7%C4%B1k%20ara%20farkla%201'incilik

Sayar, G., & Arat, Y. (2024). Evrensel tasarım kriterleri bağlamında konya kelebekler vadisi müzesinin incelenmesi. *The Journal of Academic Social Science*, 149(149), 354-367.

Selanon, P., & Chuangchai, W. (2024). Improving Accessibility to Urban Greenspaces for People with Disabilities: A Modified Universal Design Approach. *Journal of Planning Literature*, 39(1), 79-83. Access Address (21.03.2024): https://journals.sagepub.com/doi/abs/10.1177/08854122231212662

Seçme, M. & Küçük, V. (2020). Denizli Vali Recep Yazıcıoğlu (İncilipınar) Parkı evrensel tasarım ve planlama bağlamında değerlendirilmesi. *Journal of Architectural Sciences and Applications*, 5 (1), 93-107. DOI: 10.30785/mbud.667598. Access Address (1.10.2023): https://dergipark.org.tr/tr/download/article-file/1136619

Steinfeld, E. & Maisel, J. (2012). Universal design: Creating inclusive environments. John Wiley & Sons. Access Address (8.10.2023): https://www.wiley.com/en-us/Universal+Design%3A+Creating+Inclusive+Environments-p-9780470399132

Stein, E. (2022). De-imaging New York: cognitive mapping and the city symphony. *GeoJournal,* 87(Suppl 1), 33-41.

Süvari, A. (2023). Kamusal mekânlarda evrensel tasarım ile ilgili lisansüstü tezlerin incelenmesi. *Online Journal of Art & Design*, 11(4).

SSS14 (2024). 14th International Space Syntax Symposium. Access Address (8.10.2023): https://cyprusconferences.org/14sss/

Şahin Körmeçli, P. (2024). Accessibility of urban tourism in historical areas: Analysis of UNESCO World Heritage Sites in Safranbolu. *Sustainabilit*y, 16(6), 2485.

Tomberg, V., Schulz, T. & Kelle, S. (2015). Applying universal design principles to themes for wearables. In Universal Access in Human-Computer Interaction. Access to Interaction: 9th International Conference, UAHCI 2015, Held as Part of HCI International 2015, Los Angeles, CA, USA, August 2-7, 2015, Proceedings, Part II 9 (pp. 550-560). Springer International Publishing. Access Address (11.10.2023): https://link.springer.com/chapter/10.1007/978-3-319-20681-3_52

Tchertov, L. (2024). Mental models of urban space and their semiotic means. In Semiotic Approaches to Urban Space (pp. 158-174). Edward Elgar Publishing.

Tutal, O., & Topcu, M. (2018). Thinking with universal design in historical environment. *ICONARP International Journal of Architecture and Planning*, 6, 63-80. Access Address (61.10.2023): https://iconarp.ktun.edu.tr/index.php/iconarp/article/view/229

Tuzla (2023). Tuzla Engelsiz Yaşam Merkezi. Access Address (11.10.2023): https://www.tuzla.bel.tr/icerik/1178/7975/engelsiz-yasam-merkezi.aspx

Usal, S. S. Y. & Evcil, A. N. (2019). Universal Design in Interior Architecture Education: The Case of Store Design. *ICONARP International Journal of Architecture and Planning*. Access Address (1.10.2023): https://iconarp.ktun.edu.tr/index.php/iconarp/article/view/273

Uskudar, (2023). Üsküdar Belediyesi Engelsiz Yaşam Merkezi, Access Address (5.10.2023): https://www.uskudar.bel.tr/tr/main/pages/engelsiz-yasam-merkezi/431

Van Nes, A., & Yamu, C. (2021). Introduction to space syntax in urban studies (p. 250). Springer Nature. Access Address (8.10.2023): https://library.oapen.org/handle/20.500.12657/50404

Watchorn, V., Hitch, D., Tucker, R., Frawley, P., Aedy, K., & Grant, C. (2023). Evaluating universal design of built environments: an empirical study of stakeholder practice and perceptions. *Journal of Housing and the Built Environment*, 38(3), 1491-1510.

WOS (2024). Web of Science Database, Search. Access Address (1.07.2023): https://www.webofknowledge.com/

Widiastuti, R. & Harsritanto, B. I. (2018). Study of Universal Design Principles on Old City Open Space Elements. *Advanced Science Letters*, 24(12), 9764-9766. Access Address (1.06.2024): https://www.ingentaconnect.com/contentone/asp/asl/2018/00000024/00000012/art00183

Wu, C. M., Schulz, E., Garvert, M. M., Meder, B., & Schuck, N. W. (2020). Similarities and differences in spatial and non-spatial cognitive maps. *Plos Computational Biology*, 16(9), e1008149. Access Address (1.03.2024): https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008149

Wu, Y., Liu, Q., Hang, T., Yang, Y., Wang, Y., & Cao, L. (2024). Integrating restorative perception into urban street planning: A framework using street view images, deep learning, and space syntax. *Cities,* 147, 104791. Access Address (1.03.2024): https://www.sciencedirect.com/science/article/abs/pii/S0264275124000052

X, (2024). Engelsiz Yaşam Merkezi. Access Address (1.06.2024): https://x.com/engelsizyasamrk

Yang, L., Jin, Q., & Fu, F. (2024). Research on urban street network structure based on spatial syntax and POI Data. *Sustainability*, 16(5), 1757. Access Address (1.03.2024): https://www.mdpi.com/2071-1050/16/5/1757

Yang, M., Duha, M. S. U., Kirsch, B. A., Glaser, N., Crompton, H., & Luo, T. (2024). Universal design in online education: A systematic review. *Distance Education*, 45(1), 23-59.

Yeşiltepe, M., & Demirkan, H. (2023). Reflection of Empathic design process on interior architecture students' Universal Design Solutions*. ODTÜ Mimarlık Fakültesi Dergisi*, 40(1), 59–82. https://hdl.handle.net/11511/104798

Zanon, L. G., Bertassini, A. C., Sigahi, T. F. A. C., Anholon, R., & Carpinetti, L. C. R. (2024). Relations between supply chain performance and circular economy implementation: A fuzzy cognitive map-based analysis for sustainable development. *Business Strategy & Development*, 7(2), e373.

Zhan, Z., Huang, H., Winter, S., & Van de Weghe, N. (2024). Cognitive mapping of indoor environments: constructing an indoor navigation network from crowdsourced indoor route descriptions. *Cartography and Geographic Information Science*, 1-19. Access Address (20.03.2025): https://www.tandfonline.com/doi/abs/10.1080/15230406.2024.2305450

Zhang, D., Setola, N., & Chen, Y. (2024). Analysis of cross-generational co-living space configuration in residential communities—case study in China and Italy Based on Space Syntax. *Buildings*, 14(2), 346.

Zheng, J., Bai, X., Wu, Z., Zhang, S., Zhang, T. & Wang, H. (2022). Research on the spatial behavior conflict in suburban village communities based on GPS tracking and cognitive mapping. *Journal of Asian Architecture and Building Engineering,* 21(6), 2605-2620. Access Address (14.10.2023): https://www.tandfonline.com/doi/full/10.1080/13467581.2021.1971680