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Precious time
Editorial

Aliye Ahu GÜLÜMSER • *Editor*

Time is indefinite, continued, and whole. It is a progress of existence and events. It means performing, planning, arranging and scheduling. Time is inevitable in our life. Its irreversibility makes it the most valuable entity. Therefore, if you want to value, you must give your Time.

It is a process and progress. It will come, and nothing can stop it from going forward. As a scientist or researcher, this is what we try to do: "go forward". Time heals mistakes but never restarts. We are lucky to always restart after a failure.

Time is straightforward, unlike research. It does not have ups and downs, but we experience in time ups and downs. If you are lucky enough, you can manage your Time at least, or, you think you can. But you cannot change it. It will seamlessly flow, and most of the Time, it will fly.

How to spend it will be your choice, but it will not be in your hands to stop it. You cannot produce Time or put it even though you think you do.

During the pandemic of COVID-19, we thought that we bought Time by online learning and online teaching while we assumed we gain the Time that we spent at home. However, it became both a madness and exhaustion to work without time limitations. The whole Time became the Time of working which gave us an unhealthy environment where we could not stop thinking or catch the Time, especially with our family.

We cannot do everything at one Time, but we can do things from Time to Time. Therefore, take a read with our latest issue and enjoy your summertime for some quality Time!

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Spatial productions of a legendary holiday village: Club Med Foça

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Abstract
At the time of its appearance on the outskirts of the infrastructurally underdeveloped and culturally conservative village of Foça in 1966, Club Med was already a widely known international holiday village chain, promoted as an antidote to civilization. The term legend was commonly attached to it at an international scale to refer both to its stunning localities, and the atmosphere of abundance offered within its guarded boundaries. Arguably, a sense of Oriental exoticism was also a source of attraction to the Western patrons of Club Med Foça. This article is based on the hypothesis that Club Med had a significant impact on the cultural environment of Foça, which exemplified the porousness of spatial boundaries. Hence our aim is to surface the spatio-cultural role of the Club for both Foça residents, and the Turkish population at large. Our findings reveal that for Foça residents, the Club was both an economic resource and an agent of significant socio-cultural transformation. For the Turkish population, it was publicized as a microcosm of Europe, and offered a glimpse of a highly desirable, modern culture. Generating a small town bourgeoisie of sorts in Foça, Club Med introduced unprecedented forms of spaces, pleasures and desires. Engaging with archival research, on-site spatial analysis, and oral histories, we explore the mutual production of spatial and cultural boundaries in the historical context of 1960s and 70s Foça vis-à-vis Club Med.

Keywords
Club Med, Foça, Holiday village, Spatial production, Legend.

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1. Introduction

Critical studies in tourism often highlight its partly colonial origins in the context of the relationship of Western tourists and their relationship to a non-Western site (Desmond, 1999; Edensor, 2001). These studies emphasize the idealization and objectification of local sites and populations for and by tourists via such means as 'native' dance and music performances, the commodification of folkloric customs, and picturesque postcard images. Yet, as recent theorists of tourism who are informed by poststructuralist, postcolonial, and feminist positions recognize, the production and consumption of tourism involves a complex network of relationships between multiple agents and cannot be explained by homogenized references to tourists on one side and natives on the other (Aitchison, 2001).

Along similar lines, we contend that besides a multiplicity of agencies, tourism also involves a broad array of spatial productions, which are not independent of and yet not reducible to the materiality of its architecture. Spatial production is a concept that we borrow from Henri Lefebvre, whereby he distinguishes between "the formal abstraction of logico-mathematical space" and "the practico-sensory realm of social space" (Lefebvre, 1991, p. 15). According to Lefebvre, rather than being an a-priori condition, and an empty container of subjects and objects, space is produced by power relations, social divisions of labor, technologies, and social superstructures. As such, space emerges as the outcome of ongoing production processes involving the interrelationship between subjects, objects, discourses, and social practices. We contend that Club Med Foça, operated between 1966 and 2005 and located off the scenic Northbound coastal road from the historic Turkish town of Foça, offers fertile ground for the exploration of such interrelationships due to the fluid spatio-cultural context that it produced.

There are detailed academic studies on Club Med holiday villages, which focus mostly on the emergence of mass tourism in Europe (Tchoukarine, 2016; Furlough, 1993; Furlough, 1998). These are informative studies and provide critical perspectives on such issues as the Club's exclusive nature in terms of ethnicity and class; its exploitation of workers who are obliged to work for long hours; and its relation to consumer culture. Studies on Club Med Foça are scarce and mostly focus on the administrative history of the Club's foundation, with a few highlighting its architectural characteristics. These are largely limited to the analysis of the Club as an autonomous entity, detached from its physical and cultural context. Such work is informative and plausible indeed, considering the latter's seemingly intact spatial and cultural boundaries.

At first sight, Club Med Foça's boundaries seemed insurmountable indeed. Located on the fringes of the village, it was physically isolated from Foça. There were incommensurable cultural differences between the economically and educationally disprivileged residents of Foça and the Club Med vacationers, who were mostly professionals coming from European capitals. Hence, the Club's spatial and cultural boundaries were seemingly intact. The Club was closed to Turkish tourists until the 1980s, and even after the ban on the natives was lifted, the Club remained beyond the reach of many local tourists due to the hefty costs involved. The stories about the Club's admirable atmosphere from the few who had been there contributed to the multiplicity of the spatio-cultural layers that formed its legendary status in the cultural context of the late 1960s and 70s Turkey. The term legendary appeared repeatedly in Club Med's publicity material, and national and international media to describe the exclusive and unique holiday experiences offered in their premises (Skift and Club Med, 2015; Tourism Today, 2021). To examine this legendary status in the context of Turkey, we carry out a sociocultural reading of the complex network of relationships between multiple agents who contributed to the Club's spatial production.

Putting the lens on the impact of the facility on the lives and worldviews of its employees on one hand, and on the

local tourists and Foça residents on the other, this study is supported by archival research, spatial analysis, and oral histories. Besides critical studies on tourism and prior work done on Club Med in general and Club Med Foça in particular, our research is also supported by articles in period newspapers, magazines, and architectural journals; visual material from the private archives of the residents; and 5 site visits to Foça and Club Med premises. The interviews consist of lengthy conversations with 17 first-hand witnesses of Club Med in different capacities, which include 7 previous staff members, 6 Turkish visitors and vacationers, 3 local small business owners, and the former mayor of Foça.

Our research was guided by the following questions: How was the cultural environment of the Club received by the local population? How did the local employees experience the spatio-cultural gap between Club Med and their everyday environment? To what extent and how was this gap breached by their daily crossings? What were the ingredients that earned legendary status to Club Med Foça both for the insiders and for those who had no access? By way of addressing these questions, we aim to expose the multi-layered history of Club Med Foça, whereby its legendary status is irreducible to a singular explanation.

2. Envisioning a touristic legend

At the time of its appearance in Foça in 1966, Club Med was already a widely known international holiday village chain, promoted as an antidote to civilization. It made a name for offering a highly protected environment, where vacationers would be engulfed in personalized and "intimate relations, intensity of life, liberty of choice," and reside in "a utopian society of abundance and ease." (Furlough, 1993, p. 68). As our interviewees explained, opposition to urbanism, materialism, and social stratification was reinforced by such strategies as the absence of TV and newspapers and the use of colored beads instead of cash for purchases within the village boundaries. Every village offered a wide range of sports, nightly animation shows guided by specially trained employees, disco dancing until late hours, and "an erotically charged climate," which encouraged brief encounters (Furlough, 1993, p. 73). The employees, who could be distinguished from the vacationers only by means of a badge, were supposed to mix with the latter in all club activities to make them feel at home and taken care of throughout their stay.

Founded in 1950 by the Belgian entrepreneur Gerard Blitz (1912-1990) in collaboration with French businessman Gilbert Trigano (1920-2001), Club Med's first location was on a small deserted beach in the Balearic Islands in Alcudia. Blitz is known to be the founder of the concept of the "all-inclusive" holiday, his motto being, "The aim of life is to be happy. The place to be happy is here. The time to be happy is now" (Club Med, 2019). Following Blitz's own passions, Club Med resorts boasted of offering relaxation, sunshine, seaside locations, group activities, and sports. They were directed by "attractive young organizers," and in a relaxed social environment "that was conducive to sexual freedom" (E. Britannica, 2019). Club Med employees were called *gentils organisateurs* (GOs), and vacationers *gentils membres* (GMs).

The first village in Alcudia was a modest environment consisting of U.S. army surplus tents. The atmosphere was free from "social hierarchies, interpersonal and personal constraints, and stuffy bourgeois attitudes" (Furlough, 1998, p. 227). The early villages had minimal facilities as the emphasis was on outdoor living and sports. By the late 1950s, Club Med began to employ increasingly expansionist strategies and modern management techniques, which led to agreements with such enterprises as the bank of Edmond de Rothschild (1961) and American Express (1968) (Furlough, 1998, 278). New villages were founded in diverse locations including Djerba (1954), Tahiti (1955), Morocco (1961), Guadeloupe Island (1968), Martinique (1969), Malaysia (1979), Brazil (1979), Maldives (1985), Thailand (1985), and Bahamas (1992) (*Zippia*, 2021). In the 2000s, Club Med targeted the tourism

markets of newly developing economies with more upscale vacation villages. The Chinese company Fosun bid to take over the company in 2015 (*The Local*, 2015). By 2019, Club Med operated 71 resorts, a sailing ship, and luxury tours. It also sold luxury villas and chalets alongside some of its resorts (*Club Med Sunway*, 2019).

The early 1960s saw the beginning of the establishment of planned policies for the tourism industry in Turkey. The Tourism Industry Encouragement Law of 1953 was a significant step in establishing policy and regulations in accordance with international standards. In 1955, the Tourism Bank was founded to develop the industry by opening new facilities and by providing credits for the private sector. As the five-year development plan of 1963 emphasized the importance of tourism, the establishment of the Tourism and Promotion Ministry in the same year mobilized related investments. Facilities on the shorelines, which would appeal to high-income European and American tourists were given priority. In line with these policies, the development of road networks and motor transportation made seashores accessible since the 1950s via the US financial and technical aid extended to Turkey as part of post-WWII geopolitics. Henceforth, the Bank of Tourism and the Pension Fund, which was established in 1949 under the Ministry of Finance, became the major agents in administering the financial and managerial aspects of the tourism industry. While the former acted as the investor by renting its properties, the latter took the role of both investor and manager.

Foça Club Med was one of the earliest examples of collaboration between a local investor and foreign management. It was also the first seaside holiday village of its kind in the country. Negotiations began when Mukadder Sezgin, who worked at the Tourism and Promotion Ministry at that time, contacted a friend of his in Athens, who in turn introduced him to the director of Club Med in Athens (Saf, 2019, pp. 67-68). Soon after this initial contact, Gerard Blitz, whom Sezgin describes as "someone with a philosophical mind who knew the meaning and importance of what he did for the economic, social and cultural aspects of world tourism," visited the Ministry with the Athenian director (Sezgin, 2018, p. 322). Agreeing to work with the Pension Fund, Blitz then met with the Minister of Finance, to explain Club Med's mission. Emphasizing the importance of sports, entertainment, and natural surroundings as an escape from contemporary urban life, Blitz also explained how their investment would contribute to intercultural relationships (Sezgin, 2018, p. 322). According to Sezgin, the Minister was delighted at the "dream-like" opportunity, and the project took off. The negotiations between Club Med and the Turkish government took place at a potent time, which met the current needs and policies of both parties as Club Med was searching for new sites around the world to expand the business, and the Turkish government sought to open up the country to international tourism.

While Blitz, Trigano and the General Director of the Pension Fund, were looking for an appropriate site on the Aegean coasts, Selçuk Dirim, the enthusiastic entrepreneurial Mayor of Foça managed to invite Trigano for a reconnaissance flight over the coastline (Kozak & Coşar, 2017). Trigano preferred Foça both due to its proximity to the airport, and its historical connection with Marseille, which he thought would be attractive for French tourists, as Marseille was founded as a Greek colony (circa 600 BC) and populated by settlers from Phokaia (today's Foça) who did not want to live under the Persian Empire. Upon his first visit, Trigano chose the present site, which had multiple ownership (Kozak & Coşar, 2017, pp. 45-47) (Figure 1). The Pension Fund expropriated the part owned by the Treasury without any charges; the Municipality donated its parcels; the area owned by the Forestry Directorate was rented and the private parcels were bought by the Pension Fund. All parties seem to have enthusiastically participated in this initiative. The facilities would be owned by the Pension Fund, and the management rights would go to Club Med for a 10-year period. The contract was continuously renewed until Club Med left the

facilities in 2005 as the Pension Fund did not want to provide the expenses for maintenance. Both the land and the facilities were transferred to the Treasury Department in 2007.

3. Constructing a legendary setting

Foça was an inconspicuous small town in the 1960s, with a population of around 3000 and an underdeveloped infrastructure (Yıldırım, 2011). It was a historical town with attractive 19th-century stone houses. Only the roads around the two market areas were paved. Street lighting was provided by the municipality by means of gas lamps located at the intersections. Many buildings were in deteriorating condition. Electric supply was available during limited hours and drinking water could be obtained from only five fountains in town. The wells on the streets or in private gardens were the only other water sources (Karaca, 2017). Until the foundation of Club Med, Foça had one 5-room hotel and a 12-room guest house (Kozak & Coşar, 2017, p. 46). During summertime, its breezy beaches were lined up with modest campers' tents, and a few coffee-shops and eateries.

The construction of the Club began at the end of 1964. The design of the project was prepared by the company's French architects headed by Daniel Paterne, while Turkish architects and engineers produced the construction drawings; Turkish construction companies of Emek İnşaat and Yütaş undertook revision and renovation projects in 1972 and 1982 respectively (Foça Tatil Köyü, 1967, p. 152; Saf, 2019, p. 68-69). As the Pension Fund was a shareholder of Emek İnşaat, it is most likely that the initial construction drawings were also prepared by the latter. A year after construction began, the leading architectural magazine in Turkey, *Mimarlık* published two articles by architect Tali Köprülü on holiday villages. While the first one provided advice for future enterprises giving detailed descriptions regarding the architectural program and construction costs (Köprülü, 1965a); the second one reported on a seminar on holiday architecture in Corfu, which was organized by Club Med (Köprülü, 1965b). Köprülü, who was part of the architectural team of Emek construction company, took the architecture of Club Med Foça as the model for his advice and ventured to set the tone for future developments.

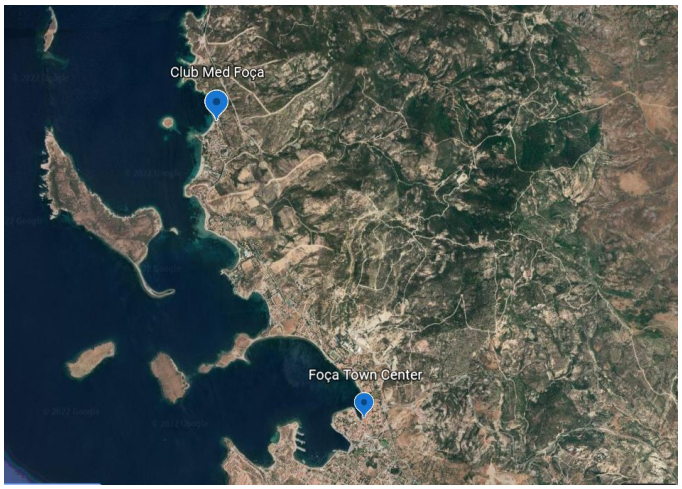

Figure 1. *Aerial view, Club Med, Foça and Foça town center (Google Earth image marked by authors, 2022).*

In Foça, the Municipality arranged for the infrastructural facilities as the Directorate of Highways asphalted the roads, and İzmir deputies supported the expenses for power supply. Two wells were opened for drinking water on a private parcel with the permission of the owner (Kozak & Coşar, 2017, p. 47). Labor for the construction work was obtained from the Foça Agricultural Open Prison. With special permissions issued, prisoners worked both during construction and later in the Club's gardening and cleaning departments (Yiğit, 2012). Club Med, with its refined architecture and well-groomed landscape, seems to have landed like an alien spaceship to Foça's provincial townscape.

At a distance of 5 kilometers from the town center, the holiday village was carefully fitted into the topography and sensitively landscaped to blend in with the natural environment (Figure 2). This scenario fitted well with "Club Med's ethos as an isolated and recuperative Eden" (Furlough, 1993, p. 73). As demonstrated in a 1967 advertising film in German, prospective vacationers were invited to the "magical club" in Foça "which is picturesquely situated by the sea," and nestled in a "charming landscape" like in "a picture book" (Club Méditerranée, 1967). The

Figure 2. *Club Med, Foça. A view of Group B units from the sea (courtesy of Sevki Avci).*

picture book image was supported by the architecture of the 332 accommodation units, which consisted of small and simple prismatic cells with flat roofs, arranged together to compose outdoor areas, courtyards, passages, patios, and terraces (Figure 3). Their white-washed cubic masses adorned with a palette of local materials, such as stone bases, terracotta ventilating pipes, wooden windows, doors, and shutters, manifested a modern architectural language that was responsive to the region.

When first built in 1966, the village included two groups of lodging, accommodating 664 people in 332 units. As published in *Arkitekt*, the leading architectural journal at the time, group A with 208 units was built with an open courtyard system in an olive orchard, whereas group B with 124 units was laid out with a closed courtyard system on a hilly area (Foça Tatil Köyü, 1967, pp. 152-53) (Figure 4). Each unit was designed as a three-meter-high single-story volume and had a little over 20 square meter of floor area. Each included a small bathroom with a simple sink, a water closet, and a basic shower. Hot water was provided by heating coils.

Figure 3. *White washed cubic masses of living units were arranged to compose outdoor areas, courtyards, passages, patios, and terraces (photograph by the authors, 2019).*

The material quality of the units also reflected the minimalist approach. The interior walls were also white and had the same rough texture as the exterior walls. The floors were made of *Palladiana terrazzo*, a characteristic of local building culture. The bathrooms were very small with tiled walls separating the fixtures. Since there was no air conditioning, ventilation was provided by terracotta pipes integrated into the wall along the periphery of the room at the ceiling height together with small-sized windows (Figure 5). All openings were kept small and shutters were used for protection from the sun. The minimalist design of the rooms was to encourage the vacationers to spend more time outdoors and enjoy the social and sportive activities that the village offered (Sezgin, 2016, p. 274). As one vacationer ÖA confirmed, "No one goes to the room. They won't let you sleep even at midday. You cannot find time to sleep from activities ranging from chess to backgammon, billiards, table tennis, seaside activities, and especially sailing" (Figure 6).

The modest accommodation units were supported by distinctive social and sports facilities; an open-air theater; a hammam; a semi-open restaurant with a very long service counter and a bar. Support structures included administrative buildings, manager's and workers' lodgings, an infirmary, and service facilities. This spatial program reflects an age before the arrival of spectacular multi-story, all-inclusive, five-star resorts, which line up the coasts of contemporary Turkey.

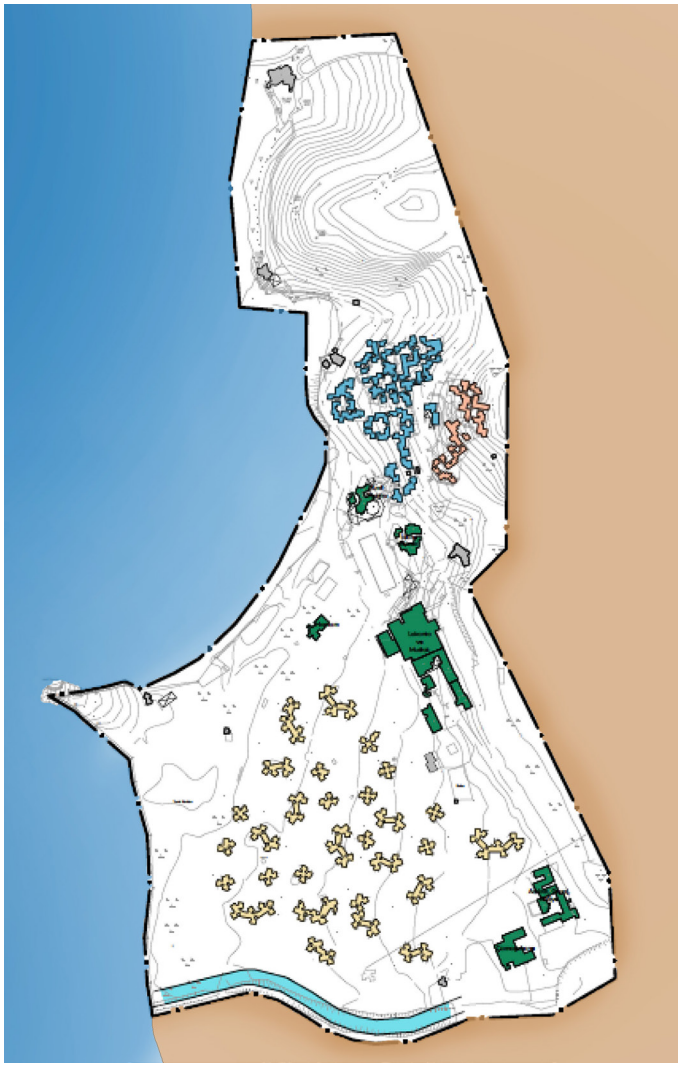

Figure 4. *Site Plan of Foça Club Med. Edited by the authors to indicate the seashore (courtesy of Haluk Erdik). Group A units in the flat area are shown in yellow, group B units on the hilly area are in blue, service and social buildings are in green, technical structures are in gray. Bungalows shown in orange were added later in 1982-83.*

Figure 5. *Ventilation of rooms was provided by terracotta pipes and small openings (photograph by the authors, 2019).*

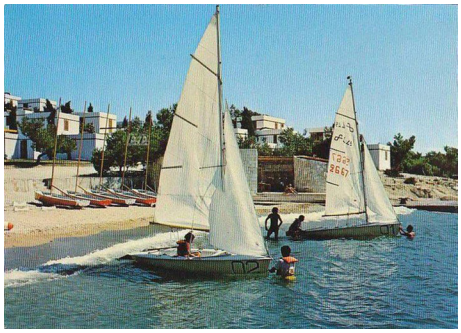

Figure 6. *Sailing at Foça Club Med (courtesy of Haluk Erdik).*

In this much-admired atmosphere, the vacationers were held in public spaces by a chain of organized events. Breakfast, lunch, and dinner times were programmed; open-air shows were organized following dinner hours; the bar and the disco kept the Club grounds active until the wee hours of the morning. At the heart of these activities and the village's physical space was the restaurant designed to seat 400 people. It included room for a legendary open buffet presenting 70-80 kinds of dishes and hors d'oeuvres (Foça Tatil Köyü, 1967, p. 153) (Figure 7). The significance of this space and the food therein were mentioned by all of our interviewees who recalled eating together as a ceremonial activity with the GOs joining the guests for dinner at their tables. Besides the restaurant, the bar, and the disco, social facilities included an outdoor theater where nightly shows were organized to entertain the vacationers. Sports activities were a significant concept of the village. Facilities included volleyball and tennis courts, a sailing club, horseback riding, an Olympic size outdoor pool, and beach amenities.

The simple cubic forms of the accommodation units contrasted the architectural language and material palette of the leisure facilities, each of which was populated at different times throughout the day and night. The use of yellowish-colored local stone and sloped wooden roofs with terracotta tiles set these structures apart from the modern design language of the units (Figure 8). To be sure, Club Med Foça had its share of orientalist gestures through several architectural and organizational moves. Some structures were designed with undertones of Ottoman architecture, evidently to gratify the cultural expectations of the tourists. The hammam with its domes, the restaurant with its arches, and the outdoor theater facility with its vaults and arches all appeared to enrich a touristic experience of the Orient (Figure 9).

This experience was supported by the organization of lectures on Turkish crafts (Kozak & Coşar, 2017, p. 50); folk dancing shows, Turkish nights, and guided trips to souvenir shops in Foça and other historical sites in the vicinity like Ephesus and Pergamon (Karaca, 2017). As a folk-dancer from the 1970s ZU mentioned, a group of them from the İzmir Folklore Association were shuttled for a show from İzmir as part of the celebrations of the French

Figure 7. *Club's restaurant with the legendary open buffet counter in the background (photograph by the authors, 2019).*

Figure 8. *Social facilities designed with yellowish colored local stone and sloped wooden roofs with terracotta tiles differed from the modern design language of the units (photograph by the authors, 2019).*

Figure 9. *Domes of the hamam appeared to enrich a touristic experience of the Orient (photographs by the authors, 2019).*

Figure 10. *The cover of Hayat (1967) magazine, portraying an image of a young woman. The headline reads, "From Paris to Foça: The Hayat team is in the holiday village in İzmir, which is built for European tourists".*

National Anniversary Day on July 4th, 1975. These activities illustrate how the locality was packaged for consumption as part of the Club's administrative strategies. Blitz announced this strategy as a selling point during his first meeting with the Minister of Finance, stating that they would familiarize the vacationers with traditional cultural products like local folklore, music, food, and handicrafts through exhibits and shows, and organize site visits outside the Club. At that level, Club Med can clearly be considered as "a reconfigured colonialist adventure" for the Western tourists where the vacationers "could partake of colonialist exoticism" (Furlough, 1993, pp. 77-78).

Although a sense of Oriental exoticism may partially explain the attraction of Club Med Foça for Western tourists, the source of appeal was very different for the Turkish subjects. For them, the Club offered a glimpse of a highly desirable, modern culture. It was perceived and publicized as a microcosm of Europe in Turkey. A year after Club Med's opening, a popular Turkish magazine *Hayat* featured the village by means of a lengthy article supported with photographs. The cover page had the image of a young woman in a pink plaid bikini holding a giant beach ball, accompanied by the headlines "From Paris to Foça: The *Hayat* team is in the holiday village in İzmir, which is built for European tourists" (Hayat, 1967, pp. 4-5) (Figure 10). The lead article elaborated on how "Westerners who crave the sea, sand, and sun" could purchase a "life in paradise." Readers' appetites were whetted by elaborate descriptions of buffet lunches, sports and entertainment activities, the bar, and the nightclub. A photo caption read, "during the day everybody parades half-naked in the village," while another one stated that "their [the vacationers'] entertainment continues until wee hours of the morning." As Özgün and Şavk (2020) also emphasize, the Club's hedonistic atmosphere with highly sexualized overtones provided the opportunity for sensational press coverage in the popular media of the 1960s. The Hayat article ended in a bewailing tone: "now pity your fate that you are not among the tourists having fun in Foça clad in their bikinis and shorts." As the aforementioned member of the 1975 folk dancing show put it, "popular media created the mythical impression that one would almost turn into a European if one had the privilege of being admitted there."

The analysis of the sources of this generalized understanding of Europe and the European subject remains beyond the scope of this study. Suffice it to say that since the mid-18th century cultural policies of the Ottoman Empire, the term Europe had been equivalent to the equally generalized notions of civility, the West, and modernization (Keyder, 1993). Although the United States replaced Europe as the epitome of modernity in the post-WWII years, there was not a clear distinction between the US and Europe regarding the person on the street; being Western meant being civilized and hence modern. While such moves as Turkey's membership to NATO (1952) and application for EEC membership (1959) manifested political interests in forming Western alliances, "modernization was transmitted to the masses not as a creed that legitimated the modernizing state, but at the level of daily practice - of markets, of consumption, of communication." (Keyder, 1993, p. 25) For the Turkish urban elite with modernizing ambitions, Club Med offered precisely the idealized lifestyle and consumption patterns that were associated with Europe, aka the West, and promoted in the popular media.

4. The spectacle of modernity

Before the 1990s only a handful of Turkish citizens could enter the Club as vacationers through favors extended by acquaintances between Club administrators and high-ranked Turkish bureaucrats. The centralized reservation system did not allow Turkish tourists to stay as guests at this and the ensuing Club Med villages, such as the nearby one in Kuşadası. Only in the 1980s a very small fraction of the reservations was allowed for Turkish people through an office in Istanbul. As more luxurious all-inclusive resorts became widespread in Turkey and competition intensified, more Turks were admitted to the villages. Özgün and Şavk (2020) convincingly argue that the limitation of the number of the Turkish clientele needs to be interpreted in the light of the tension between the Club's hedonistic environment and the nationalist political discourses which were critical of Western cultural practices, viewing the latter as a form cultural imperialism. Nevertheless, for those early Turkish visitors, the attraction of Club Med lay less in the breathtaking seascape and the architectural surroundings, let alone organized site visits, than their own image both as spectators and participants in an otherwise largely unattainable *mise-an-scene*. The Club's isolation helped to reinforce the feeling of superior social status and exclusiveness for the native tourists, and of yearning and curiosity for those who did not have access.

One of the Turkish clients, HK who was granted a week-long stay in 1975 through her acquaintances at the Ministry of Tourism, said that she did not even bother to visit the town center during her vacation. "Who wants to go to Foça" she said, "what to do there? A week flies by until you look around and discover all that is at Club Med." The few Turkish vacationers whom she saw during her stay included three famous pop stars and a few married businessmen who sought anonymity to spend time with their girlfriends. She was apparently struck by the relative absence of children, the elderly, and married couples:

> "All singles; single women and single men. They flirted with everyone. If it worked it worked. Otherwise, it was all about shopping around. If they got a response they stayed, if not they went to someone else without wasting time."

Fascinated by the casualty and transience of intimate relationships, which would be considered unacceptable in the predominantly conservative cultural atmosphere of Turkey, HK added that it was a fun-packed holiday for her where it was impossible to feel down among such a bunch of joyful people. She stated, "You could live the kind of holiday where everything was permissible, which was impossible to experience in Turkey at that time." Another interviewee, HD said that "it was an epic thing to be a guest there. You experienced Europe without being in Europe."

Paradoxically, as Club Med Foça promised a magical atmosphere at least partially due to its native environmental and cultural setting for the foreign vacationers, it owed its legendary sta-

tus to being a microcosm of Europe for Turkish vacationers. The latter seem to have participated both as spectators and as performers on a mythical European stage. HK expressed her spectator status vividly as she described the beach:

> "Some had a book in their hands; others furthered the intimacies established during the previous night. Music blasted everywhere. We were foolishly watching - us being there as two girlfriends. As for the nudist beach, we once looked from afar pretending that we were just passing by. You need to be, well, naked like them in order to participate. That does not seem appropriate, I mean, among all those people. And you cannot fix your gaze at anyone of course, but just throw a side glance."

If HK experienced the club more as a spectator, HD a dentist from İzmir who was invited as a special guest by the Club Director, seemed to have been both a participant and a spectator as he described being served escargot and frog legs, which are categorically excluded from Turkish cuisine:

> "They clean the snails and add sauce and garlic and the like. They bring it as if it is a big favor. My wife said she could not eat anything like that. I said do not ever do such a thing. We are guests here. We can eat even raw fish in order not to humiliate them. Then came frog legs, *cuisses de grenouille.* There, we really learned not to be prejudiced. We had not eaten anything that delicious in our lives."

Both HK's and HD's recollections of Club Med resonated with a sense of discovery of the so-called modern West. The awkwardness that they felt at such unaccustomed sights as the nude beach and frog legs were overcome by the conviction that their cultural status was elevated by the sheer fact of their admission to the Club. In HD's words, Club Med Foça served as a learning space as much as an entertaining environment. His experience resonates with that of a different group that inhabited Club Med, who literally regarded it as an *Ecole*, i.e., staff members from Foça.

5. *Mission civilisatrice* from within

As the first touristic enterprise of its kind in Turkey, Club Med was not only a means of boosting the economy but also a model for the development of the newly born tourism industry. The agreement between the Club Med administration and Foça Municipality on hiring staff members from Foça reveals the latter's interest in boosting the local economy on one hand, and providing literacy in the tourism sector on the other (Kozak & Coşar, 2017, p. 49). Indeed, Club Med boosted the economy and created new job opportunities for the locals. If the service personnel had houses in Foça, they came to the village on a daily basis. Otherwise, the Club provided housing for them either at the entrance area of the village or at a close-by area within walking distance. According to HKA, who worked at different levels at the Club, the personnel lodgings were kept very clean and neat. The workers were served decent food in a separate cafeteria. This care, in return, helped the personnel to identify with the institution.

Considering the absence of educational institutions on tourism at that time, on-site practice seemed to be the only possible way of training the locals. Such training extended beyond the technical competencies required by the service sector. When the villagers who used to earn their living by olive and tobacco cultivation and fishing were recruited by the Club for employment, they faced an entirely different cultural environment. As YG, a restaurant owner in Foça since the 1960s expressed in a nutshell, "the French Holiday Village was Foça's window to the world." Indeed, prior to the Club's opening, in the absence of TV broadcasting and having limited access to printed media, Foça residents used to lead a sheltered life largely confined within the boundaries of their small town. The appearance of a European urban population with different clothing, eating and behavioral habits in such close proximity resulted in feelings ranging from fascination and desire to resistance and disdain. The newcomers were not only wealthier but also more liberal in their everyday conduct including clothing, liquor consumption, and display of intimacies.

As residents explained, disdain for cultural difference initially overshad-

owed the economic benefits that Club Med promised to offer. It was apparently difficult to find local staff members during the first year. Our interviews with the workers indicated that despite the sense ownership attained, they experienced difficulties regarding not only the cultural but also the physical environment. For example, some female laundry workers complained about the heat in the earlier laundry rooms, which were located under the restaurant. A noteworthy example of cultural difference was the resentment to the unisex restrooms. Initially, the idea of women and men sharing a restroom did not sit well with the cultural practices of Turkish workers.

In a former employee, HKA's words "some wanted to work there, some simply had to. Yet, there were others who resisted, and questioned whether it was appropriate to work under foreigners." For the more conservative ones, the term European resonated with all the negative associations of being *gavur*, a derogatory term to designate non-muslims. A hotel owner, SK vividly explained the locals' early encounters with the tourists:

> "In the beginning, people were hiding as if they saw demons. At the end of the first tourist season, they began to say, 'they are *gavur* but they are like us; their hands, their feet, their faces are exactly like ours. There is no difference. They only dress and behave more liberally; Their men and women can sit together to eat and liquor up. It takes one to know one. In time, our people began to fall into step."

Some were not comfortable with liberal perspectives on gender. Stating that in the first year only one woman could be recruited, SK continued to explain;

> "As other women saw that nothing bad happened to her, they began to plead for employment. When money comes to the household things change: Curtains, lighting, colors, and clothing. Then other women are incentivized."

One of the former employees, AY told us how she "wanted to stand on her feet," and get retirement benefits. Yet her husband, who worked at the Club, tore her job application into pieces, saying that she better stayed home and looked after the children. It took her five years trying to negotiate with her husband before she finally joined the Club without his consent.

Working conditions in the Club were not always comfortable for the women employees. Having joined the cleaning staff, SV recalled how she refused to clean the unisex toilets in the public spaces, as she found it unsuitable for a woman to step into a restroom used by men. However, it seems that shortly after the initial moments of resistance, employees began to not only enjoy the benefits of having a regular income beyond their previous means but also learn the etiquette of the European bourgeoisie. From that perspective, all former employees that we interviewed expressed their admiration for the educational role of Club Med. The term *Ecole* is featured repeatedly in their narrations. IC, a woman who worked both in the laundry and the reception, revealed the rift between the tourists and the staff as she described the expected behavior patterns from the latter:

> "You had to behave elegantly; The way you talked and you walked needed to be adjusted. You learned by observing. You had to. Otherwise, you could not work there. You could not talk loudly for example."

Such changes in behavior did not remain within the boundaries of Club Med. As observed by EÇ, a shop owner in Foça, those who worked there carried themselves differently than the locals. "Even the way they talked had changed," he said. A former Mayor, ND confirmed by stating, "There were so many things that affected us; be it clothing, be it lifestyle." The cultural impact of Club Med on Foça was further reinforced by staff members who were sent to work in Switzerland during off-season months. Household commodities such as colored TV sets, which were scarcely available in Turkey before the late 1970s, became commonplace in the houses of those who returned from their tenure in Switzerland.

In time, etiquette turned into a privilege. A former employee at the Club's laundry, DP boasted of how civilized Foça became, and how many locals learned to speak French through their contacts with the vacationers. According to hotel owner SK, those who were employed by Club Med "acquired

manners and regarded themselves as culturally superior to others. As they learned a foreign language and became more self-confident and as their lives changed through the revenues that they brought from abroad, a different situation emerged." More significantly however, a new cultural rift began to emerge between Club Med employees and others. SK exemplified the situation by saying,

> "They [the employees] learned a lot by observing their [the tourists'] attitude towards children and towards animals; their shopping without bargaining; their carefree attitude at the swimming pool; and their comfort within their world. As you know, we tend to lay eyes on others and they [the tourists] don't. Those who worked there gradually became like them."

Unforeseen as it was, Club Med seems to have generated a small-town bourgeoisie of sorts in Foça, whose lifestyles and consumption patterns differed radically from the rest. Club Med introduced yet another element to Foça's public life, which was arguably an extension of the former, i.e., new kinds of pleasures and desires, which relate to the sexualization of public spaces. Former employee HKA used the term cultural crash to describe the difference between those who had no contact with the Club and those who benefited from it either by working there or via commercial transactions with the foreign tourists who visited the town.

The Club was an erotically charged space similar to its international counterparts. The liberal display of tanned sporty bodies, the encouragement of brief encounters, the nude beach, generous consumption of alcohol, and entertainment at the nightclub and disco clearly contributed to such charge. This atmosphere inevitably crossed the Club boundaries as vacationers visited Foça and as the local employees went back and forth between the Club and their homes in Foça. Apparently, a new cultural space flowed into town, which signaled sensual pleasures. "Those high heels, those perfume scents that swept Foça! It was beautiful," said HKA, a long-term former employee who worked at different departments of the Club. Other interviewees too recalled the scent of perfume that the vacationers brought to town. Ex-Mayor ND fondly remembered how he and his friends, as small-town boys in their early teens, collected used plastic sunscreen bottles from the garbage bins outside the village to squirt water at each other. He also mentioned smell as a newly found source of pleasure. When SK argued that Foça residents became more cultivated after the establishment of Club Med, he did not only refer to economic betterment and acquiring foreign language skills but added that the locals "learned to mix cocktails. They learned to prepare alcoholic drinks; they learned to booze; they learned to converse while boozing." Exposed tanned bodies, the scent of perfume and suntan oil, cocktails, and dinner tables shared by both sexes signaled new sources of pleasure hitherto unknown to the economically deprived and conservative atmosphere of Foça.

Club Med's enormous impact on the cultural environment of Foça is an excellent instance that exemplifies the porousness of spatial boundaries. Despite its physical distance from Foça and its self-sufficient and strictly bounded environment, the Club caused radical economic, social, and cultural changes, and divisions in the small town of Foça, which benefited some, and caused bitterness in others. The beneficiaries were clearly the agents of a *mission civilisatrice* in Foça, which was hardly on Club Med's founding agenda, but the effects of which had a lasting imprint.

6. Conclusion

The term legendary, as used in the publicity material of Club Med, resonates with notions of fame, admiration, and desire. Considering the larger context of the holiday village in Foça, it turns out to be a slippery term with different implications depending on one's position vis-a-vis the Club. For the Western urban tourists, who are targeted by the publicity material, it certainly referred to the ideal of living in a paradise of perpetual fun, away from their daily chores and obligations. That paradise was contained in a bounded space, within a carefully crafted architectural

setting that permitted the practice of individual liberties.

Yet the story takes a different turn when the focus shifts to the local scene. In the newly emerging consumer culture in Turkey, the legendary status of Club Med lay in its relative unattainability on one hand, and its association with an equally glorified Western culture on the other. That association was problematic not only because of the impossibility of homogenizing Western culture as such but also because the Club offered an exceptional environment even for Western tourists, outside the normalized routines of their everyday lives. Nevertheless, for the native population who could not enjoy a vacation there, their distance from the Club marked a space of desire; a space that was physically too close to be excluded and culturally too distant to be included. Their desire was further fueled by the way Club Med was featured in the popular press, which helped to raise its hedonistic atmosphere to legendary status, leaving much room for imagination.

As an escapade for Western vacationers and a space of desire for the upper segments of the Turkish population, Club Med was a bounded space of inclusions and/or exclusions. For the residents of Foça on the other hand, the material boundary of the Club was overwritten by its sociocultural fluidity. The employees apparently began to bridge the spatio-cultural gap between the Club and their everyday environment by adopting new habits and affording consumer goods that changed their domestic settings. The locals then saw a new social hierarchy, which separated the employees and shop owners who received socio-economic benefits from the existence of the Club from the rest of the population. New channels of desire opened up, which could partially be pursued by some, and resented by the culturally more conservative and economically less privileged others.

To conclude, despite its guarded physical boundaries, the carefully constructed culture of Club Med Foça did not remain within its spatial demarcation. While the legend oozed out of its container, it caused significant economic and socio-cultural effects not only in its immediate vicinity but also at the national scale. The space of Club Med Foça is produced both within and outside its boundaries by means of complicated interactions between material, economic, social, political, and cultural factors and a broad array of individuals who re-produced the legend in unpredictable ways. As such, it is an exemplary case to surface the complicated entanglements of different agents in the production of space.

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Competition-based digital design studio experience

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Abstract
This study presents a competition-based digital design studio experience through the use of an updated structure for a graduate-level digital design and modeling course. In the Digital Architectural Design and Modelling (DADM) course, 24 students (in groups) were asked to design a playground for a location in Warsaw. This assignment was given in response to a competition brief organized by UNI.xyz. The course was restructured to function as a design studio and was organized to allow four integrated phases namely: analysis, design, modeling, and fabrication. A total of six student groups succeeded in participating in the competition (week 11). During the final submission (week 15), the students and jury members evaluated the completed projects according to 12 sub-criteria that were applied to the 4 main phases. The competition jury awarded various prizes to four of the projects developed during the semester. The course jury members observed that the biggest deficiencies occurred during the fabrication phase, the students regarded the design-related criteria as the major problem area. As the competition jury had no predefined evaluation criteria, they mostly drew attention to the projects' conceptual, spatial, construction, and material issues. This study proposes a project-based framework that combines computer-aided architectural design as a methodology, distance education as a type of communication, playground design as an architectural program, and participation in international competition as a means of motivation.

Keywords
Computational design pedagogy, CAAD teaching, Design competition, Playground design, CAM.

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1. Introduction

The widespread adoption of digital technologies has a significant impact on architectural education and practice. The use of digital design, modeling, and fabrication technologies has increased and transformed almost all stages of architectural education. The changing profile of an architecture student also affects the structure and strategies of computer-aided architectural design (CAAD) education (Koutamanis, 1996; Kokosalakis et al., 1997; Gross & Do, 1999). Beyond computer literacy, graduate-level architecture students, in particular, arrive at the courses with the skill to use multiple software as a representation tool (2-dimensional drawing and 3-dimensional modeling) in architectural design processes. Furthermore, the adoption of digital technologies has become a common skill for students (Hemsath, 2010), and it has become clear that computational design pedagogy should go beyond simply teaching how to use software and tools. Their use is expected when students are required to solve complex design problems, develop innovative design solutions and fabricate at various scales.

The integration of design studios and CAAD is not a new idea; it has been tested since the 1980s. As a contribution to the existing project-based CAAD frameworks, this paper proposes a competition-based framework that includes all components of a design studio as integrated phases (analysis, design, modeling, and fabrication), an architectural program, a real site, and a user profile specified in the brief.

The proposed framework is tested by updating the content and objectives of of a computational design course. Accordingly, this study describes and evaluates the process and outcomes of an updated graduate-level digital design and modeling course that underwent three major changes during its restructuring, namely:

- Reorganizing the course as a design studio instead of merely theoretical content.
- Requiring the students to design projects using computational methods and to participate in an international design competition.
- Requiring design projects to be produced (prototyped) using digital fabrication tools.

Design competitions are essential platforms for architecture students and recent graduates to develop their practice, increase their visibility, and become more competitive. By having competitions as course elements, the students are required to follow external briefs and deal with real-world problems such as site, climate, and user.

The course focuses on the investigation of design solutions in response to the competition brief, as well as how they can be modelled and materialized using computational design approaches, methodologies, and tools. Another goal of this study is to criticize the overall course structure and make suggestions for improvements based on the evaluations of projects by participating students and jury members. During the semester, the works developed in the studio were evaluated both qualitatively (by the competition jury) and quantitatively (by the guest jury members and peer reviewers). This feedback allowed the course to be evaluated (in terms of its process, content, and structure) and for further improvements to be made.

In terms of educational medium, distance learning, which was made mandatory during the pandemic, had both positive and negative educational effects. Unfortunately, face-to-face education has completely replaced this medium without properly appreciating its advantages. Given the course content and learning objectives, it is critical to reconsider course communication methods and apply hybrid alternatives. Although it was not required, distance learning was used in this study to evaluate its benefits, and the results are presented.

In the following parts of this study, Section 2 details the background of computer-aided architectural design pedagogies, distance education in computational design education, and playgrounds, playground design and related criteria. Section 3 introduces the course, the assignment, the development of the works, and the evaluations of the peer reviewers, the guest jury members, and the competition

jury. The results of the evaluations and related findings are listed in Section 4. Finally, Section 5 discusses the positive (successful) and negative (unsuccessful) aspects of the proposed framework and highlights the necessary modifications to improve it.

2. Background

The project-based framework presented consists of three components: methodology, communication type, and architectural program. The methodology for the teaching experiment presented in this study was computer-aided architectural design (Section 2.1), distance education as the communication type (Section 2.2), and playground design as the architectural program (Section 2.3). Keeping in mind that these selected contents for the components are not fixed, the following subsections provide information about the selected contents for this particular teaching experience.

2.1. Computer-aided architectural design pedagogies

The transition from punched cards and big computers of the 1970s to affordable PCs and available commercial computer-aided design software accelerated computerization in architectural education (Asanowicz, 1989; Pittioni, 1992; Andia, 2002). Many studies have been conducted since the 1980s on how to teach computer-aided architectural design (CAAD) (Asanowicz, 1989; Koutamanis, 1996), how to integrate CAAD into existing curricula, or how to develop CAAD curricula (Asanowicz, 1998; Silva, 2000; Mark et al., 2001; Mark et al., 2003). Traditional CAAD education was a common criticism raised in these studies, which is discussed further below.

CAAD was traditionally taught as a standalone subject/discipline within the architectural curriculum and was attempted to teach in units (Asanowicz, 1998; Roberts & Forster, 1998). A limited number of software compatible with existing computers was taught in traditional CAAD education. Furthermore, rather than working with a computer, the work was limited to the features provided by the software to the user (Roberts & Forster, 1998). Pittioni (1992) defined such an approach as software-specific. The steps of identifying the requirements in the architectural design process, finding the appropriate software for this requirement, and learning how to use it were followed by the software-specific approach (Pittioni, 1992). Achten (1996) raised and discussed the difference between teaching CAAD principles and teaching CAAD principles in this context. Sliwinski (1996) also raised the issue of teaching CAAD by architecture rather than CAAD by architecture.

According to Flemming and Schmitt (1986), in the 1980s design studio, the computer was used to automate routine tasks and increase drawing productivity. The representation-oriented use of CAD in architecture education was more developed in the 1980s and early 1990s (Pittioni, 1992). Similarly, Andia (2002) asserted that between the mid-1970s and the mid-1980s, CAD was used for architectural documentation and visualization. Many researchers have criticized CAAD education for providing students with skills required in architectural practice, such as modeling and visualization (Roberts & Forster, 1998; Koutamanis, 1999; Pektaş, 2007). Another issue that traditional CAAD education caused was the focus of students and educators (CAAD on technology rather than design, and becoming computer technicians) (Koutamanis, 1996; Sliwinski, 1996; Koutamanis, 1999).

More than 30 years ago, Akin (1990) argued that changing the role of the computer in the design studio had to result in a change in design pedagogy. Since then, many pedagogies aimed at integrating CAAD into design studios have been developed (Flemming & Schmitt, 1986; Kokosalakis et al., 1997; Roberts & Forster, 1998; Koutamanis, 1999; Chiu et al., 2003; Duarte, 2007). According to Achten (2003), the ability to design is the primary subject that is attempted to be taught to architecture students. Since the design process has no specific formula, CAAD in the design process can concentrate on addressing complex design problems and creating innovative solutions (Roberts

& Forster, 1998; Achten, 2003; Duarte, 2007). However, the experiments in previous CAAD courses do not fully correspond to real-world projects. CAAD skills taught in separate courses are ineffective unless accompanied by applications, and the learned skills are only superficial (Pektaş, 2007; Covill et al., 2008). To address this issue, Pektaş (2007) proposes project-based CAAD education. Because the student who is confronted with a real project must apply the learned CAAD skills to the given context in order to produce higher-quality projects.

Over the last decade, project-based CAAD frameworks have been tested through furniture (bench) (Agirbas, 2020) and product (lamp) design (Lanzara, 2021). At the architectural scale, structures such as bridges (Stavric et al., 2019), gridshells (Naboni, 2016; Wallisser et al., 2019), and vaults (Sousa & Xavier, 2015) have been commonly included in educational approaches that include phases from design to construction.

2.2. Distance education for computer-aided architectural design

With the advancement of collaboration technologies and CAD literacy, researchers have contributed to the field of architectural education by developing new types of design studios such as virtual studios, web-based studios, and online studios (Andia, 2002; Pektaş, 2007). Due to the Covid-19 pandemic in 2020, many researchers had to experience distance education for all courses, regardless of their relationship to digital technologies (Yorgancıoğlu, 2020; Akçay Kavakoğlu et al., 2021; Alnusairat et al., 2021; Ceylan et al., 2021). According to Gelmez and Arkan (2022), a course with a specific focus on computer-aided design plays a distinct role in online education due to its technology, computer-based nature, and virtual medium.

In an online course conducted during the pandemic, Ostrowska-Wawryniuk et al. (2022) focused on teaching algorithmic thinking and the necessary skills to students for developing design solutions to abstract mathematical problems. In another online taught course, students were asked to design interventions for their own living space while keeping the live connection with augmented reality systems and software (Weissenböck, 2021). Another online teaching experiment by Goepel and Crolla (2021) uses mixed reality (MR) and photogrammetry technologies for collaborative clay modelling production without the necessity of physical presence.

There are also pedagogies that adopt the computational design method and continue with the computer-aided manufacturing of the designed products. In such cases, experiments with fabrication machines and materials are required in addition to the physical workshop space. Benabdallah et al. (2021) addressed the question of how digital fabrication can be taught in the lack of physical workshop spaces and fabrication equipment/machines and presented new possibilities such as producing at-home machines for fabrication tasks. Due to the Covid-19 pandemic, physical dimensions in courses that used computational design methods had to be partially or completely canceled for a time. Güzelci et al. (2022) responded to this situation by replacing the teaching of more digital tools for modeling and performance analysis for the fabrication phase of the process.

2.3. Playgrounds, playground design, and related criteria

Previous research has demonstrated that playground design is important for the development of children's social, cognitive, and physical abilities as it can enrich their experience and encourage better behavior. Furthermore, studies have been conducted to examine playground safety and risk minimization (Little & Eager, 2010), the development of social and physical skills (Barbour, 1999), and inclusive play strategies and design (Siu et al., 2017).

Creative playground design is an important aspect of children's social and cognitive development. The early work of Susa and Benedict (1994) analyzed the pretend play behavior of 80 children in two different playgrounds: contemporary and traditional. Accord-

ing to the findings of this study, the modern playground encourages more pretend play and greater creativity. Furthermore, a study developed for an undergraduate-level design course to raise awareness among students by Acar (2015) demonstrated how module design can be organized according to affordances in playgrounds.

On the manufacturing side, some global organizations support playground design and research. For example, the International Play Equipment Manufacturers Association (IPEMA, 2022) supports the "Voice of Play" initiative, which aims to improve the quality and quantity of children's play and playgrounds (Voice of Play, 2020). According to IPEMA 2020 research, public playgrounds play a significant role in fostering inclusiveness and play equity. In a survey of parents regarding the benefits of a playground, a majority stated that encouraging play between children of all abilities and improving physical fitness are two important aspects for playground design. Furthermore, during the Covid-19 pandemic, the majority of surveyed parents (87%) stated that play became more important than ever.

There are guidelines for creating a safe and creative environment when designing a playground (Moore et al., 1992). The main points of playground design, according to the Whole Building Design Guide (WBDG Whole Building Design Guide, 2017), are safety, design, materials, accessibility, and estimated costs. Besides that, the overall design parameters should include zones for age-appropriate equipment and activities, as well as quiet and noisy zones.

3. Teaching experiment

3.1. The digital design course

As one of the 5 compulsory graduate-level courses, Digital Architectural Design and Modelling (DADM) has been taught every fall semester within the Architectural Design Computing graduate program at Istanbul Technical University since 2008. The DADM course is taught by different tutors every year and the course is constantly improved through the contributions of professors. The duration of the course is 14 weeks, with 3 hours of class per week. According to the criteria of the European Credit Transfer and Accumulation System (ECTS), the ECTS of the DADM course is 7.5, which is approximately equal to 187.5 hours of study during a semester.

In the course catalog, the objectives of the course are given as 3-dimensional modeling and designing a building using solid modeling software. Considering the students' existing abilities in 3-dimensional modeling and their widespread use of solid modeling software, the tutors updated the course objectives of the course for the 2021-2022 fall semester. The teaching of solid modeling software was excluded in favor of a visual scripting environment (Grasshopper) and its plug-ins (i.e. Kangaroo 2, Ladybug, Lunchbox) to demonstrate the generative nature of modeling. The teaching methodology of the DADM course includes tutorials, lectures by tutors and guests, group work, critiques by tutors, and mid-term and final reviews with guest jury members.

The authors decided to update the DADM course based on their previous teaching experience in Digital Architectural Design Studio (DADS) (another compulsory course of the graduate program), which resulted in award-winning projects. For the 2021-2022 fall semester, the DADM course was redesigned as a project-based computational design course rather than a design and modeling course, as the title indicates. Under its new structure students are encouraged to accomplish the following:

- To use digital design and modeling as a methodology through a project development experiment, rather than learning digital design and modeling as a skill,
- To develop design solutions for a real-world problem with a specific site and user with the introduced methodology,
- To work on the materialization of their designs rather than exploring design solutions only in the digital environment.

While the course duration and the number of weeks remained unchanged in the fall semester of 2021-2022, the

communication method of the class was changed to online (distance learning). In the fall semester of 2021-2022, the communication type of the courses was optional and determined by the tutors' preferences. The tutors decided to conduct the course remotely since one of the instructors was in another country and the other was in another city. Another reason for conducting the course remotely was to allow for jury meetings with international guests and to receive their feedback.

3.2. The assignment: International competition for a playground design

In the 2021-2022 fall semester, instead of planning a series of assignments, the students were asked to focus on the design problem given in the brief of an international design competition. The competition, which was selected by the tutors prior to the start of the semester, was organized by UNI.xyz. This brief was to create a play structure for children to be located in a public park. The project site given by the organization was Old Orchard Park in Zoliborz, a residential district of Warsaw, Poland. The park was full of fruit trees, a traditional playground for children, and paths for walking with benches. The site area was 693 square meters, however, the designs were limited to a maximum of 50 square meters, with a height constraint of 5 meters. Although the participants were not required to follow a fixed approach, they were expected to design a single structure (UNI.xyz, 2021).

As stated in the competition brief, the aim was to generate a healthy lifestyle within the playground, and to this end, the available activities must satisfy the physical, mental, and social requirements for the well-being of the children using it. The experiences of digital play are very common among children, but especially after the Covid-19 period, it has become very important that their opportunities for physical play are also engaging and attractive. The competition also demanded that the submitted designs allowed for multiple activities and also included qualities such as accessibility, security/safety, modularity, durability, and eco-friendliness (UNI.xyz, 2021). The reasons for the selection of the competition included in this study are as follows:

- The emphasis on a specific user and architectural program,
- The necessity for extensive research and analysis when designing a playground,
- The requirement to meet multiple architectural qualities such as tangible, modularity, structural durability, and constructability,
- The competition's schedule, which begins and ends within the academic term.

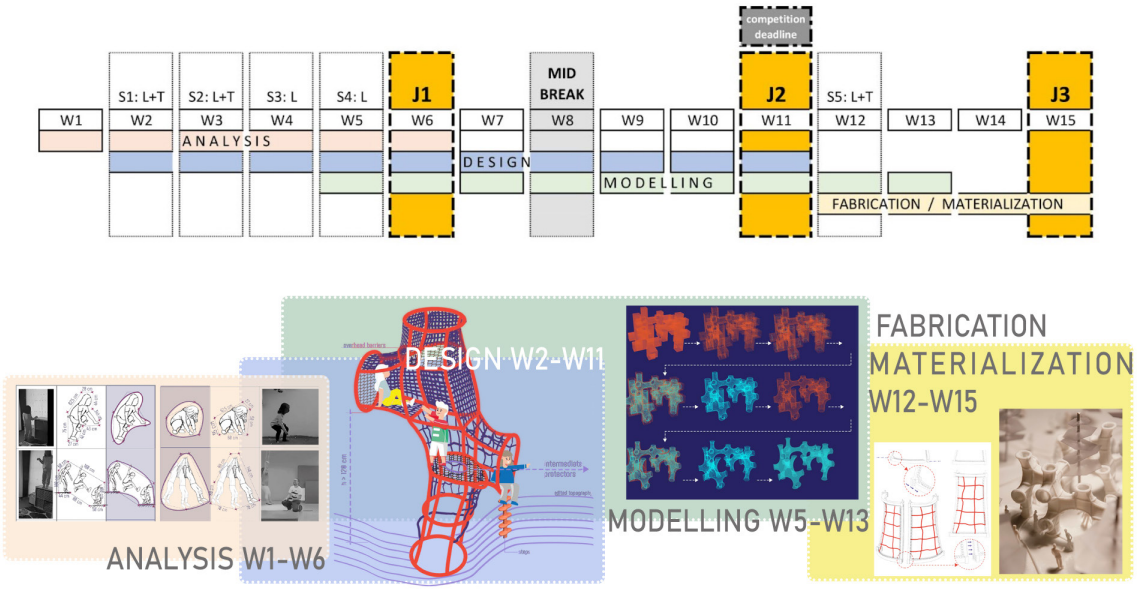

Figure 1. *(Top) Course structure; (Bottom) Sample products for the phases (Group 5).*

3.3. Development of the works

The 15-week DADM course (including a final jury day) is organized to allow 4 processes, namely analysis (A), design (D), modeling (M), and fabrication/ materialization (F). These processes overlap as a result of the integrated and continuous nature of design studios. The course is also supported by seminars (S), lectures (L), and tutorials (T), and by jury evaluations (J) from students, guest jury members, and tutors (Figure 1).

3.3.1. Process of week 1 to 5

The student groups were formed in the first week. Thus, the groups started to develop their conceptual framework in parallel to the process of learning through the series of seminars. Over the following 4 weeks, 2 of the tutors and 2 guest lecturers gave seminarsto support the analysis, design, modeling, and fabrication processes. The first seminar dealt with form-finding strategies in architecture and was supplemented with a tutorial for real-time form exploration using physics engines. The goal of the second seminar was to explain the logic of the data structures necessary to work with a variety of data in the virtual scripting environment (VSE). The second seminar also included a short tutorial to demonstrate these data structures through basic 2-dimensional shapes and operations. A third seminar on environmental performance, sustainability, and Life Cycle Assessment (LCA) was given by a Polish architect and scholar familiar with the site, climate, and local materials of Warsaw. The third seminar also included a tutorial on solar analysis by using Ladybug plug-in. The subject of the final seminar was the materialization of complex forms through both analog and digital making techniques. The possible bio-based construction materials for the playground design were also discussed with the guest lecturer (Figure 1).

3.3.2. Process of week 6 to 11

The first jury (with the participation of guest jury members) was held on the 6th week. Each student group presented a flowchart as the route map they intended to follow during the semester (Figure 2). Since the design brief is both site- and user-specific, the students made intensive analyses regarding children's play, behaviors, and movements, as well as the specific site conditions. In addition, the students started to develop ideas for playground design and to test various digital modeling tools and methodologies to produce their intended design solutions.

For their analyses of the unfamiliar site, the students preferred to use the Ladybug plug-in of Grasshopper VSE. After the import of the necessary EnergyPlus Weather (EPW) data of the selected location from the related databases (https://www.ladybug.tools/epw-map/), Ladybug was used to generate solar and shading analysis for selected times or time periods within the year. The use of Ladybug during the analysis

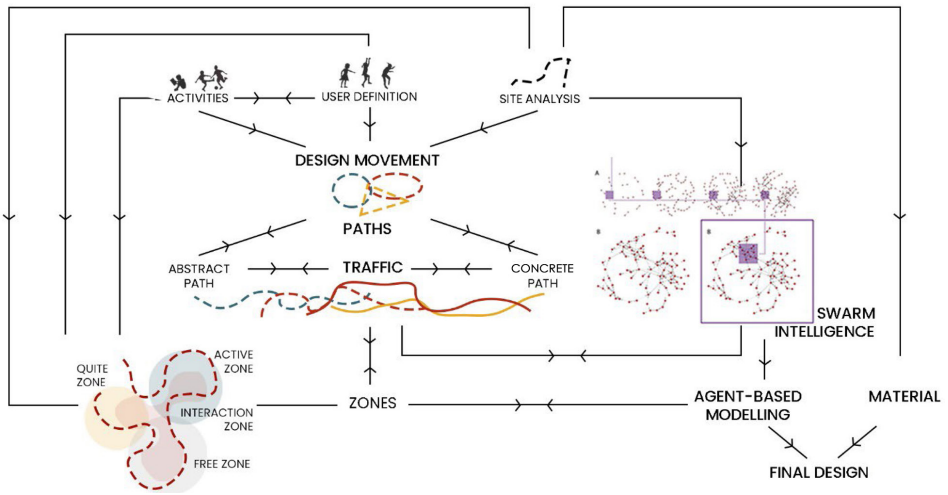

Figure 2. *Design flowchart by Group 3.*

phase was mostly associated with decisions regarding zoning. For instance, while Figure 3a illustrates the annual direct sun hours analysis by Group 1, Figure 3b shows the sunlight analysis of Group 2 for a definite time period which is between March and July. Similarly, Group 3 presented the solar analysis performed for the site (Figure 3c).

Generative design approaches were both used for analysis and design development. For instance, while swarm intelligence was used to analyze the individual and collective behavior of children, cellular automata were chosen for game design (Figure 3d). In the work of Group 7, Voronoi pattern was used for form finding for the task of layout design (Figure 3e). Last, the magnetic field diagram was used by Group 5 for form-finding on the site plan level (Figure 3f).

Additional research was also carried out to determine what effect the available materials may have on structures designed for use by children and on the life cycle assessments of the structures themselves. Since modularity was an important design criterion specified in the competition brief, experiments to combine the designed modules were conducted using 3D-printed models. Finally, the students presented their initial design solutions to be implemented at the site.

The 3 weeks between the first and

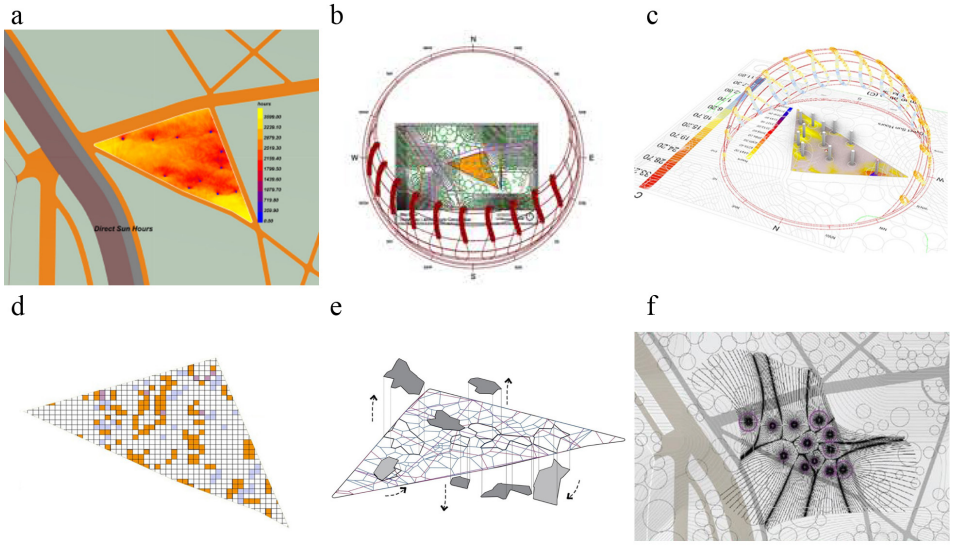

Figure 3. *Conducting environmental analysis and adaptation of generative approaches.*

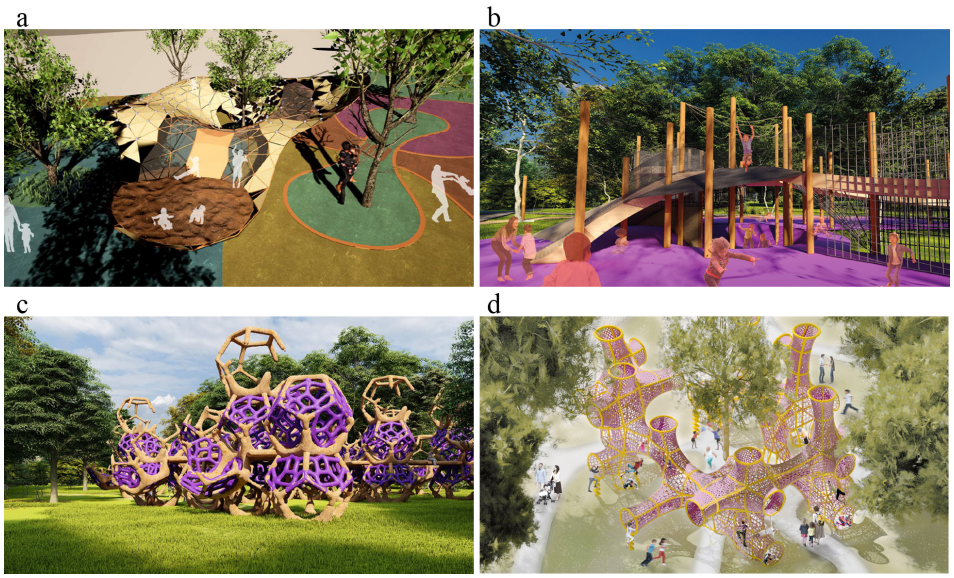

Figure 4. *Visuals from the final posters of (a) Group 1, (b) Group 3, (c) Group 4, (d) Group 5.*

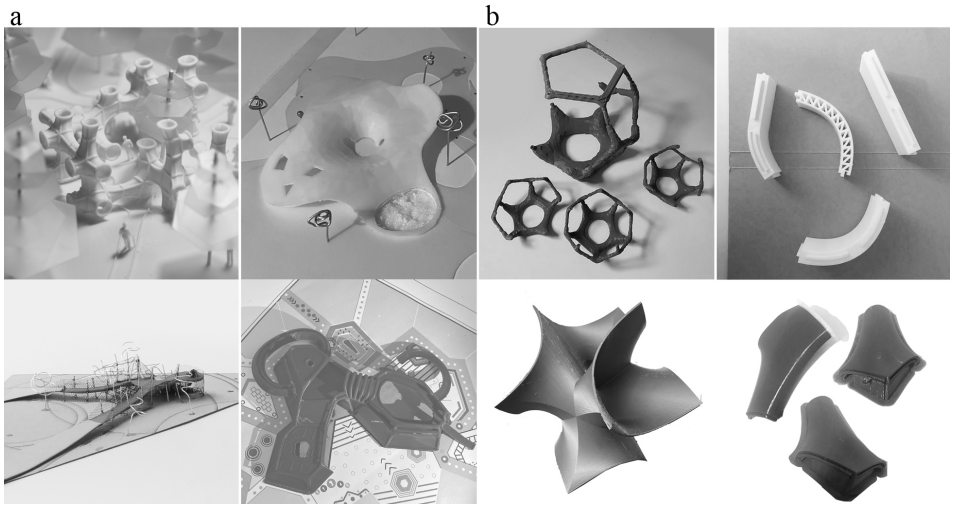

Figure 5. *Physical models (a) 1:100 scale models, (b) Detail models.*

second jury continued with design development through presentations, critiques, and discussions. However, the eleventh week, which was planned as the second jury week, overlapped with the submission deadline for the competition (15th December 2021). For this reason, the students participated in the second jury with their projects prepared in the specific format required by the competition. The following developments were observed in the projects submitted to the competition and evaluated by the second jury:

- The analyses of children's behavior and activities became more in-depth.
- The designs and their forms were developed in relation to the created/selected games and activities.
- The materials research resulted in definitive material selections.
- The components of the playground structure, as well as the details of their combination, were provided.
- The designs were implemented on the site and the areas not including the play structure were modeled to-scale with the master plan.

3.3.3. Process of week 12 to 15

Between the eleventh week (second jury and competition deadline) and the fifteenth week (third jury and final submission date), the students focused on the fabrication of their final designs. Since no physical models were requested by the competition, the students postponed the materialization and fabrication of their designs to the period between weeks 12-15. In the twelfth week, the tutors conducted face-to-face lectures and tutorials to introduce the students to the 3D printers and software necessary to fabricate the models of their designs. During the materialization and digital fabrication process, the students continued to develop their designs according to the critiques given by the second jury and presented their projects for the final jury review (Figure 4).

For their final submission (week 15), the groups presented posters and 1:100 scale physical models (Figure 5a); four of the eight groups also provided detail models at various scales. These detail models were made to clarify the assembly of playground parts or to show their structural principles (Figure 5b).

Table 1. *Design and evaluation criteria.*

Analysis			**Design**			**Modelling**			**Fabrication/Materialization**		
A1	**A2**	**A3**	**D1**	**D2**	**D3**	**M1**	**M2**	**M3**	**F1**	**F2**	**F3**
Ability to analyze children behaviour	Ability to analyze playgrounds and the activity of playing	Ability to analyze the site, environmental conditions, and program	Ability to develop a design problem in terms of innovative/computational approaches	Ability to develop appropriate design solution for children (scale, security etc.)	Ability to develop a sustainable design solution (Life Cycle Assessment, material selection etc.)	Ability to use parametric tools	Ability to use generative tools	Ability to integrate various data (climate, movement, material behavior etc.)	Ability to materialize the design with the proper material	Ability to use digital fabrication tools	Ability to develop design with digital fabrication solutions (trial-error etc.)

During the modeling phase, digital models created with Rhino CAD software were exported in .STL or .3MF format for the 3D printing preparation process. Before the printing phase, the dimensions of the models were set to millimeters and scaled. The models were imported into CURA software and were then sliced to evaluate their 3D printability. Considering the printing capacities of the available 3D printers for the course, the majority of the 3D printing operations were performed using Fused Deposition Modeling (FDM) 3D printers (Creality Ender-3, Creality Ender-6, Ultimaker 3-Extended, and Creality CR10-S5) and PLA material supplied by the ITU Faculty of Architecture. However, the student groups were also free to use any 3D printers that they owned or had access to. Five student groups (Group 2, Group 4, Group 6, Group 7, and Group 8) used the facilities of the ITU Faculty of Architecture for the 3D printing of both their 1:100 scale project models and their detail models. During the 3D printing process, a trial-and-error approach was followed and most of the digital models had to be 3D printed more than once. The situations that commonly caused errors in the 3D printing process were as follows:

- Lack of necessary thickness: In each layer, the thinnest part of the model should be at least twice the thickness of the nozzle diameter. The 3D printers used for this project have a nozzle diameter of 0.4 mm. This means that the thinnest part of the models was required to measure at least 0.5 mm.
- Lack of adhesion surface: 3D printed objects require sufficient ground surface contact with the print bed for good adhesion. There are options to increase the first layer surface (brim, raft) to reduce the chance of 3D prints breaking off the print bed.
- Support material removal: Some of the models exceeded the maximum amount of overhangs that the 3D printers can support (around 60°). Support geometry was added to the models in order to achieve a successful print, but removing the support material after printing increased the risk of damage, especially for those models with thin parts.

Table 2. *Evaluation results of the peer-reviewers and guest jury members.*

Peer Reviewers (S)	Ranked as Worst	Ranked as Best
S1	Group 2 (46)	Group 5 (55)
S2	Group 2 (50)	Group 4 (57)
S3	Group 2 (49)	Group 7 (59)
S4	Group 2 (51)	Group 7 (59)
S5	Group 8 (47)	Group 6 (60)
S6	Group 1 (50)	Group 4 (57)
		Group 6 (57)
S7	Group 8 (28)	Group 3 (53)
		Group 4 (53)
S8	Group 8 (50)	Group 1 (53)
		Group 7 (53)
S9	Group 4 (50)	Group 7 (55)
S10	Group 8 (51)	Group 4 (57)
		Group 7 (57)
S11	Group 7 (52)	Group 5 (55)
	Group 2 (52)	
S12	Group 8 (49)	Group 2 (56)
	Group 6 (49)	
S13	Group 6 (49)	Group 1 (55)
S14	Group 2 (54)	Group 5 (59)
S15	Group 6 (49)	Group 1 (55)
S16	Group 8 (47)	Group 1 (58)
S17	Group 8 (47)	Group 1 (58)
S18	Group 4 (52)	Group 5 (58)
	Group 3 (52)	
S19	Group 7 (48)	Group 5 (57)
S20	Group 7 (43)	Group 1 (55)
		Group 5 (55)
S21	Group 2(48)	Group 1 (58)
		Group 8 (58)
S22	Group 8 (47)	Group 5 (58)
S23	Group 8 (46)	Group 5 (56)

Jury Members (J)	Ranked as Worst	Ranked as Best
J1	Group 1 (36)	Group 4 (60)
J2	Group 8 (31)	Group 3 (60)
J3	Group 2 (44)	Group 3(60)
		Group 5 (60)
		Group 6 (60)
J4	Group 8 (35)	
	Group 2 (39)	Group 5 (50)
J5	Group 8 (39)	Group 5 (60)
		Group 6 (60)
J6	Group 8 (22)	Group 4 (52)
J7	Group 8 (35)	Group 4 (52)
J8		Group 2 (54)
	Group 8 (37)	Group 5 (54)
J9	Group 8 (42)	Group 6 (59)

Table 3. *Summary of the evaluations (overall).*

Project	Voted as Best by Jury Members	Voted as Worst by Jury Members	Voted as Best by Peer Reviewers	Voted as Worst by Peer Reviewers
Group 1	0	1	7	1
Group 2	1	2	1	7
Group 3	1	0	1	1
Group 4	3	0	4	2
Group 5	5	0	8	0
Group 6	3	0	2	3
Group 7	0	0	5	3
Group 8	0	7	1	9

*The number shows that how many people voted for the best/worse case.

For the final submission, except for that of Group 2, all the other models were successfully 3D printed. Due to the wire-frame nature of the Group 2 design, it was impossible to 3D print at a scale of 1:100 using the FDM method. The model was 3D printed using a stereolithography (SLA) machine after the final submission date with the permission and support of the tutors.

According to the competition brief, the size of the playground design was limited to 50 square meters. Therefore, the 1:100-scale version of each design solution was printable in a basic 3D printer as a single piece due to their small size. However, conventional model-making techniques were preferred for the construction of a 50x25 cm scale model of the site. For the physical model of the site and the existing elements in the park, students used various materials such as paper, foam

Table 4. *Evaluation results of the peer-reviewers and guest jury members (phases and individual criterion).*

Peer Reviewers (S)	Phase Rated as lowest	Criteri-a/on Rated as lowest
S1	D	D3
S2	M,F	F3
S3	M	D1
S4	F	D3, M3, F1, F3
S5	A	A1,A2,A3,D3,M1,M2,F1,F2
S6	D,F	D2,M1
S7	F	D1
S8	D	D1,M3
S9	D	D1,D2
S10	A	M3
S11	D	A2
S12	M	A1,M1
S13	M	M1
S14	D	D3
S15	M	M1
S16	D,M,F	M1
S17	D,M,F	M1
S18	D	D3
S19	D	D2
S20	A,D	A3,D2
S21	D	D2,D3,M3
S22	D	D3
S23	F	M3

Jury Members (J)	Phase Rated as lowest	Criteri-a/on Rated as lowest
J1	F	F1
J2	F	F3
J3	M	M2
J4	D	D1
J5	F	F1,F2,F3
J6	F	F1
J7	F	F2
J8	D, F	D3, F1
J9	M	M2

board, cardboard, net, metal stick, steel wire, miniature plants, and plexiglass.

3.4. Evaluation of the final work

For the final jury, a quantitative evaluation method was adopted. The tutors prepared an evaluation form containing three criteria to be rated under each main phase, namely analysis (A), design (D), modeling (M), and fabrication/materialization (F). The twelve evaluation criteria were extracted from the course catalog, the syllabus of the course, the competition brief, and the discussions that took place during the mid-term juries (Table 1).

On the final jury day, the same evaluation form was shared with the students for peer review and with the jury members for expert review. 23 of the 24 students who took the course and made their presentations in the final jury filled in the evaluation form and 9 out of the 10 jury members also completed their evaluations. The evaluation results of the peer reviewers and jury members are given in Table 2. Table 3 and Table 4 summarize both sets of evaluations for further analysis given in the following section.

3.5. Evaluation of the competition projects by the organization

The results of the competition were announced in February 2022. Four projects received awards: Winner (Group 6); People's Choice award (Group 4); and Editor's Choice awards (Group 3 and Group 7). In addition to the jury's evaluations of the projects, there were also valuable comments posted on the accompanying competition website. With regard to the winning Group 6 design, it was stated that the proposal is very interesting, conceptual, spatial, and has an interesting constructive logic that uses a module from which multiple possibilities and spaces can be created and which can be installed at various locations. It was also underlined that it was the best proposal as it quickly hooked into a simple and consistent idea and concept in line with playground design (Figure 6a). For Group 4, which received the People's Choice award, it was mentioned that although their project proposed a constructive logic with material possibilities, it did not present any new approaches to design or possible future explorations (Figure 6b). For Group 3 and Group 7, which received Editor's Choice awards, it was stated that the Group 3 project addressed the issue of being able to develop multiple spaces and uses, but that it lacked material development. It was recommended that the design avoid catwalks in favor of building everything from mesh to better define games (Figure 6c). For Group 7, the jury found it interesting how their project developed a section with all play opportunities but that it was chaotic in its overall design (Figure 6d).

4. Results and findings

This section presents the results of the evaluations given in Section 3.4 and Section 3.5 and gives the related findings.

- An overlap was observed in the two projects voted as the least successful (Group 8 and Group 2) by the guest jury members and peer reviewers. Except for these two projects, only the work of Group 1 was the lowest-rated project by the jury members (once). On the other hand, all the projects except that of Group 5 were rated as the lowest at least once by the peer reviewers.
- Both the guest jury members (5 times) and the students (8 times) rated the Group 5 project as the best. A conflict was observed regarding the project of Group 1,

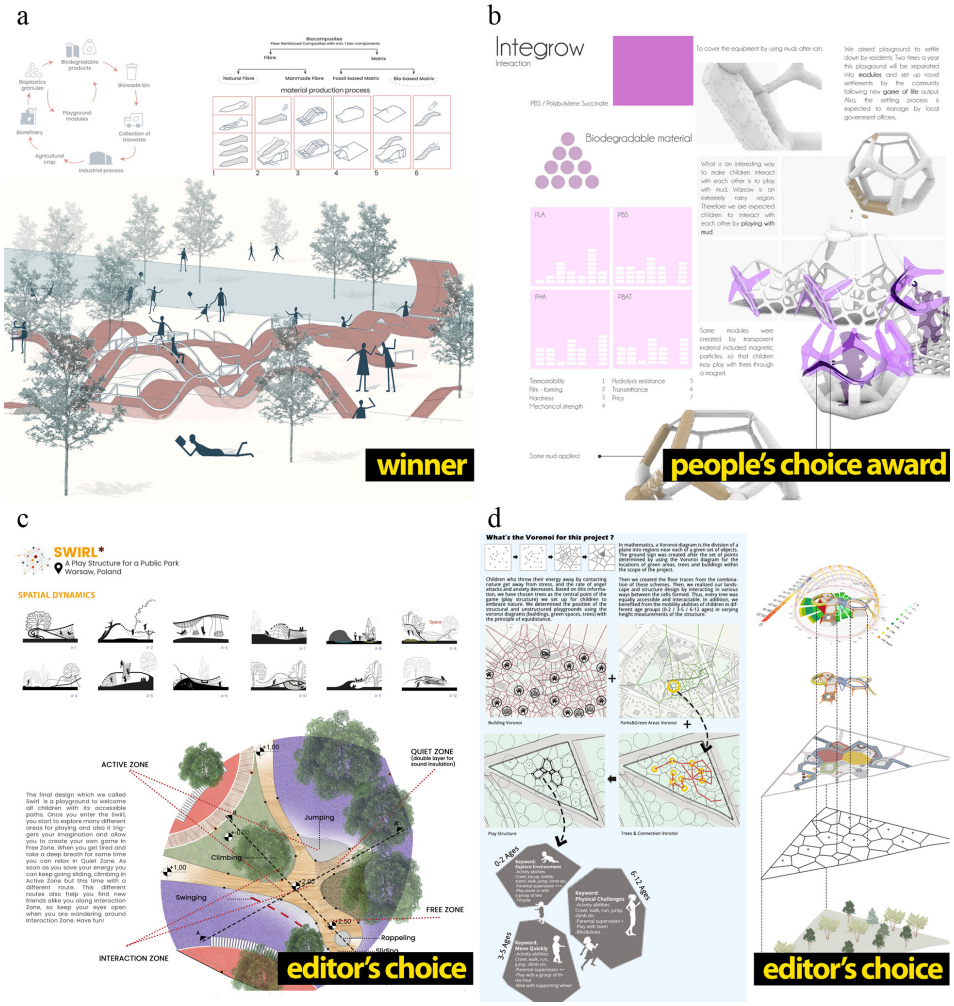

Figure 6. *Prize winning projects developed in DDM course. (a) Winner; (b) People's choice; (c) Editor's Choice; (d) Editor's Choice.*

which was rated as the best 7 times by the peer reviewers but was not rated as the best by the guest jury members.

- With regard to the project evaluations made by the guest jury members, the D, F, and M phases were rated as the worst phase at least once. While 6 of the 9 jury members evaluated the F phase as the worst, the D and M phases were rated worst 2 times. On the other hand, the students rated D (15 times), F (7 times), M (6 times), and A (3 times) as the worst.
- Phase F, which the jury members rated as the most unsuccessful, and phase D, which the students rated as the most unsuccessful, do not overlap. However, the F phase was rated as the most unsuccessful by the students 7 times. While the jury members never voted for phase A to be the most unsuccessful, the participants noted it 3 times.
- When considering the evaluation of the criteria instead of phases, according to the jury members the fabrication material selection (F1) and the ability to use digital fabrication tools (F2) should be developed. Due to the competition's final submission date, the fabrication phase was limited to the weeks following the second jury. Students' opportunities to experiment with materials (F1) and experience digital fabrication tools (F2) were also limited in a completely online course. However, while generative modeling tools (M2) were used in some phases of the projects, they were not dominant throughout the entire workflow. Since the generative modeling tool was only used in a single phase, its role in the final project was found to be insufficient.
- When the evaluation done by the

students was examined in detail, the sustainability of the design solutions (D3) was criticized more compared to the appropriateness of the design solutions for children (D2), and the development of innovative/computational approaches.
- When the evaluations of the peer reviewers and jury members (Table 3) were compared to those of the competition jury, there were clear differences in opinion. Group 5 was evaluated to have the best project by the peer reviewers and jury members during the semester, but they were unable to participate in the competition.
- The projects that received awards from the competition jury did not match the final evaluations. A reason for this mismatching was the difference between the evaluation criteria defined by the tutors and those of the competition jury. The 12 criteria listed in Table 1 were defined by the tutors, but the competition jury focused on their own subjective evaluation criteria that considered the conceptual, spatial, construction, and material aspects of the projects.

5. Discussion and conclusion

This study presents a competition-based framework and tests it through a digital design studio experience. The quantitative evaluations by both the guest jury members and the peer students, as well as the qualitative evaluation by the competition jury, allowed the tutors to assess the effectiveness of the proposed framework and improve the course. As these qualitative and quantitative evaluations were based solely on the course's final products, the tutors also considered the project development phases throughout the semester. According to the tutors' observations, students had no difficulty developing a project that considers the real site, user, and architectural program described in the competition brief while employing computational design approaches, methodologies, and tools throughout the process. It is possible to develop and represent a competition project with the traditional use of CAAD software. However, there were no misconceptions about the methodology used among the students, and CAAD tools were not used in the traditional manner. On the other hand, the fact that students were awarded in an international design competition demonstrates that projects of a certain level of quality can be produced using the proposed framework.

The evaluations of the guest jury members (partially supported by peer reviewers) showed that the most evident shortcoming in the assignment occurred in the materialization phase. Within this context, the authors raised the question of what kind of strategies should be developed to produce a more successful materialization phase. When the project processes were examined, it was observed that the initial studies of materialization presented to the first jury were abandoned in the later process. The fact that physical models were not requested in the competition was the most important factor for the submission of the competition projects as this followed a design and modeling path that was already familiar to the students. On the other hand, being completely online, working on computers instead of in an atelier, and having limited access to digital fabrication equipment are other factors that affected the materialization stage negatively. The time period between weeks 12 and 15 was determined as the fabrication phase, and the students faced all of the material selection, structural issues, and detail problems of the physical models during these weeks.

The authors suggest the following strategies to achieve more successful results in the fabrication phase:
- Fabrication at every phase of the semester without the requirement for a fully developed design,
- Conducting seminars and tutorials on the use of digital fabrication tools at the beginning of the semester instead of during week 12.
- Short-term integration of consultants from related disciplines within the university to resolve structural and detail problems.

Another strategy for increasing the efficiency of the materialization phase is to continue fabrication work in the graduate program's fabrication-ori-

ented courses the following semester. Award-winning projects of some competitions are built by the institution that launched the competition. In the case that the competition project becomes a construction, a collaborative study with industry actors can be conducted to improve the project's quality in detail production, material selection, and structural issues.

In contrast to the guest jury members, the students regarded phase D as the most unsuccessful. Since the beginning of the semester, students have evolved their designs based on a variety of criteria such as child behaviors, types of play, security, and the scale of the structure in relation to the size of the children. Furthermore, the materials to be used in the design's construction, the material's sustainability, and the life cycle assessment of the playground have been explored since the conceptual design stage. According to the evaluations, the students have gained a more critical perspective for phase D, where they had the opportunity to think deeply, as a result of these discussions.

Similar to the project-based CAAD pedagogies discussed in Section 2.1, the framework presented in this study is project-based and includes both individual and group works. Current project-based digital design pedagogies are not limited to digital productions; rather, through the use of digital fabrication, their processes result in physical products at 1:1 scale (Stavric et al., 2019; Wallisser et al., 2019). However, since the organization did not request the fabrication of the competition projects, the projects were not rationalized/simplified for 1:1 scale fabrication.Instead, using digital design and modeling tools and methods, conceptual designs that focused on the site and the user were developed. In the presented teaching experiment, the site served as more of a context and environmental data input to the project. The physical characteristics of the site (e.g., level, paving) are not considered in the design process, yet is likely to arise during a 1:1 scale fabrication of the design on site. In other project-based digital design pedagogies, designs are generally developed for a generic user (Sousa & Xavier, 2015; Agirbas, 2020; Lanzara, 2021). This teaching experiment differs from other digital design pedagogies in that it includes an in-depth analysis of children's behavior and physical play, as well as the development of customized designs for children as users.

In previous years, distance education was not the communication type of course. It was preferred for the experiment and semester presented in this paper, and it offered some advantages. The group work of the students created a synergy in this online course, and the collaborative environment provided by the online meeting platforms positively affected the design process with task definition, completed tasks, and transparent data flow. Participation in the competition gave the students the opportunity to compete with other designers from all around the world instead of the other students enrolled in the course. Being involved in a design competition also lead to the students' exploration of novel design solutions. In addition, having a strict submission date and the opportunity to win awards provided extra motivation.

The proposed framework could be used in other digital design studios. While the framework's components remain constant, their contents can change depending on the new term project or competition brief. According to the brief, the user profile, location, and architectural program may vary. Furthermore, the modeling approach and software (e.g., solid, parametric, generative), fabrication tool and technique, and scale of the prototypes may differ depending on the expected digital and physical outcomes.

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Digitally enhancing interior architecture education: Case of online building surveying class

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Abstract
Interior architecture has a key role in the sustainability agenda of the architecture, engineering and construction (AEC) industry, being directly related to adaptive reuse projects. As adaptive reuse projects rely on the analysis of the existing building and its environment, building surveying (BS) has significant importance for the profession. While the BS practice has significantly evolved through the use of new technology encompassing digital photogrammetry, BS education seems lagging behind. Despite the presence of promising computer-assisted learning prototypes for decades, these methods are far from being implemented broadly into the curriculum. However, this reluctance is challenged by the emergency situation caused by the Covid-19 pandemic and the need for new digital teaching methods became apparent. This paper describes the development of a digital practice module for BS education for interior architecture students. In an experimental practice based on action research, interior architecture students are introduced to a digital surveying application. After a brief introduction by an expert, students are directed to research sources and third-party video tutorials. They are asked to collaborate in groups to solve how to use the software application themselves. Following the research period, students completed two sets of practices. Although the research period was kept short, the progress of the students' performance between these two practices, and the results indicate interest in digital practices. The outcomes of the research are promising for implementing digital technologies into the interior architecture department's BS course curriculum.

Keywords
Action research, Digitalization, Information Technology (IT), Innovation, Surveying application.

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1. Introduction

Developments in the Information Technology (IT) domain introduced several technological advancements into the Architecture, Engineering, and Construction (AEC) industry. Various digital tools and equipment became common and accessible, transforming different areas of architecture such as design, planning, practice, and education. Building Surveying (BS) did also take its share. Today, apart from the conventional surveying techniques, electronic leveling and measuring equipment as well as mechanical ones, Geographical Positioning System (GPS) technology, 3D laser scanning and digital photogrammetry are widely used depending on various requirements.

Despite this digitally evolving business environment, evidence of new technology implementation into the BS education in literature is limited. Efforts dating back to the 1990's are present, but such technologies did not show up in our education systems and did not become widely accepted, despite the evolving educational problems and the advancements in IT. The need for adapting new technologies became evident in early 2020, this time because of the emergency caused by the Covid-19 pandemic. Face-to-face classes were canceled, and universities had to turn into an online distance education setup. The biggest challenge appeared for the courses that depend on practice such as design studios and BS courses. Neither instructors nor students did have enough time to get ready for it, but new ways of teaching practices had to be developed in a limited time.

On the other hand, renovations and adaptive reuse projects are common practices of the interior architecture profession. From the sustainability perspective, interior architecture supports AEC industry to upcycle the building stock by demanding interior designers to focus specifically on an already existing building envelope. This 'already existing' state brings the need for proper documentation of the building, thus requires a detailed BS work. Regarding its key position for the profession, BS courses should be given a particular importance in the interior architecture education.

In this context, a digital surveying practice is introduced to the interior architecture fourth semester students, within the BS course program. Considering the challenges of online distance education setup, the practice focused on digital photogrammetry technique, by using a dedicated software and the equipment students already have, using action research methodology. The main aim of this study is to determine the integration of new technology implementations into the online BS education and identify the potential use of such techniques as an online education tool, while exploring the barriers of implementing IT into the conventional surveying education setup. After diagnosing the problem as the first phase of AR, students were asked to apply a digital surveying practice through software that performs photogrammetric processing of digital images and generates 3D spatial data for the creation of digital surveying documents. An online questionnaire was used to gather technical details and to understand the participants' observations as well as other qualitative and quantitative aspects of the case.

The results are promising for developing new educational material and integrating them into the curriculum by taking the IT developments in BS practice into consideration. Moreover, the need for further research on the impact and efficiency of new BS techniques compared to the conventional surveying methods becomes prominent.

2. Theoretical framework

Architects intend to record and identify their observations about a building or space by conducting sketches and diagrams. These are part of survey drawings, operating as both documentation and analysis, enabling an architect to examine certain conditions of the built environment, whether it's geometric, relational, material or technical (Wells, 2021). Surveying is a measurement system made for expressing a three-dimensional (3D) structure with two-dimensional (2D) drawings such as plan, section, elevation, and details (Uluengin, 2016). It also comprises a thorough identification of materials,

and structural design, together with social and historical aspects as layers beneath its skin, that has undergone change through its lifespan. In this context, taking measurements is one of the fundamental activities that will affect other components of surveying as well as other stages of architectural work that will be built upon the surveying documents. In order to avoid mistakes, surveying methodology has discrete rules and systematics (Pehlivan et al., 2022). The process is labor intensive and open to human error. Nevertheless, BS techniques are evolving with the effect of technological advancements.

2.1. Technological advancements and digitalization in surveying

The origin of the building measurement systems is based on geodetic surveying techniques with single-point methods used in manual surveying and aerial measurement methods like photogrammetry (Blankenbach, 2018). Photogrammetry is a documentation method (Hamamcıoğlu Turan, 2004) which has a past almost as old as the photography itself.

In contrast with the conventional surveying methods, digital surveying methods are focused on 3D models by creating point cloud data that enables depicting height, distance, coordinates and volume by the use of dedicated computer software (Pehlivan et al., 2022; Vlachos et al., 2019). These software enable creating orthophotos that can be transformed into 2D drawings where needed, as a later stage following the model. Workflow change, brought by these technological advancements, alters the order of conventional drawing process both architecturally and for the BS practice. These technologies reduce the margin of error by making more precise measurements, save time for the surveying work (Benli, 2015), and provide detailed information during the deskwork stage of surveying (Başar et al., 2021). While giving information about the materials and elements used in the building, the damage determination can be made through photographs (Zağra & Özden, 2020).

Today, a moderate smartphone camera offers enough resolution and quality that can be used to capture images to produce low-budget 3D models in surveying studies (Caroti & Piemonte, 2020). Smartphones and tablet computers with integrated Lidar technology, mobile device applications that provide an augmented reality interface for taking measurements and draw floor plans that can be exported in many industry-standard formats are on the market. As these technologies are getting more accessible, new opportunities loom up for further enhancements of architectural education, and in particular, BS courses in the scope of this research.

2.2. Building surveying education

Although it has an established part in architectural heritage research due to preservation by documentation purposes, BS is an important part of contemporary architectural practice for all kinds of adaptive reuse and renovation projects. Especially when interior architecture is considered, dealing with a building that is already present is the nature of the profession in most cases (Coles & House, 2007). Residential buildings are taking the lead in renovation works, while spaces such as bathroom and kitchen are the most studied areas. These spaces are on top of the frequently renovated list (Coles & House, 2007), and make up an important part of renovation costs (Yazıcıoğlu, 2014). With this potential, residential units have a prospective potential to be one of the first professional experiences in students' professional lives. As a result, all this work is related to an existing structure and dependent on thorough surveying documentation. Therefore, BS courses have a significant importance for the interior architecture profession and especially for new graduates.

Site work stage of the surveying practice can be considered as the introduction of the building with all its tangible and intangible assets to the students personally, as the students perceive all the schematic layout, structural design, and used materials as well as its cultural aspects and relation with the surrounding environment. As for the technical aspects of BS requests, much of the surveying work

and presentations are performed within groups (Uluengin, 2016). Students are being asked to prefer sketching techniques in order to develop their drawing skills with hand–brain coordination, while having direct contact with the building.

However, the conventional BS methods are not being practiced by the industry without the support of digital technologies. The agenda for integration under Building Information Modeling (BIM) creates new challenges for the future AEC industry with unfortunate outcomes for BS (Blankenbach, 2018). Besides, the labor-intensive character of surveying lacks its answer in education for some time now. Increasing number of students, and reduced staff/student contact time due to institutions transferring resources out of teaching and into research, are being criticized for decades (Mika, 1999), because of restricting such a master-and-student process. New educational programs with digital methods are proposed by many (Shults, 2019), such as the Interactive Survey Information System prototype (Mika, 1991, 1995, 1999) and the building pathology education application by Shelbourn et al., (2000). These were remarkable efforts on digitalizing the BS education based on computer aided learning applications, proposed during the infancy of operating systems with a graphical interface. Their aim was to train building surveyors by enhancing traditional teaching techniques, through simulating a real-life survey experience. These prototypes were developed decades ago in order to avoid foreseen shortages of the higher education system. Nevertheless, none of these justifications have succeeded to start a comprehensive debate on the digitalization of the BS education, until the online education setup that was enforced by the Covid-19 restrictions made it apparent.

2.3. The challenges caused by the online education

Online education requires students to problem solve and learn new skills using the internet, with resources such as online tutorials, lectures, blogs, and social networks. It gives a great flexibility of time and location and resolves many problems related to the physical limitations of a classroom. However, online education is debated to have specific issues for departments that require group work, common working space, and equipment usage (Ceylan et al., 2021), insufficient physical, social, and cultural site analysis practice (Yazıcıoğlu Halu & Kula Say, 2021), and loss of student-student and student-lecturer social and learning interaction (Iranmanesh & Onur, 2021), which is considered as an essential characteristic of studio classes (Ahmad et al., 2020; Yu et al., 2021). Other challenging topics include the level of attraction and performance score differences between genders towards technology-based courses (Demirbas & Demirkan, 2007) and the huge impact of socio-economic factors (Marshalsey, 2021).

However, technology can be adapted to enhance pedagogical frameworks with special emphasis on providing support for personalized, self-directed, and distributed learning, while enabling diverse and innovative communication methods (Hassanpour & Şahin, 2021; Kocatürk et al., 2012). Students of today are considered as digital natives (Kennedy et al., 2008), but the attitude of students towards online learning is largely underexplored, especially for design-oriented departments like architecture (Fleischmann, 2020).

3. Methodology

This research focuses on simulating the site work practice of BS education using digital tools that became difficult to exercise during the online education setup. The research methodology structured under four subtopics is given below.

3.1. Study participants

This research is conducted in the building surveying undergraduate course of interior architecture department, in a state university, in Istanbul, Turkey. The authors were the instructors, and the participants are the active attendees of the building surveying course.

3.2. Action research

Design of this study is collaborative action research (AR) that follows the practical AR principles, which is frequently used in studies related to education. In practical AR, the educator defines the research problem and collaborates with experts where needed (Sáez Bondía & Cortés Gracia, 2021). AR includes a reflective process of inquiry and knowledge generation, to generate new practices (Somekh & Zeichner, 2009). In educational contexts, the reflective process of AR allows to deepen the studied situations and obtain more socially just and productive outcomes (Sáez Bondía & Cortés Gracia, 2021). AR is a five-phase cyclical process (Azhar et al., 2010), consisting of: (1) Diagnosing the problem, (2) Action Planning, (3) Action taking, (4) Observing, analyzing, and evaluating, (5) Reflecting the lessons learnt back into action/intervention.

3.3. Material and instruments

After diagnosing the problem, a digital surveying practice is planned. A dedicated surveying application, Agisoft MetaShape trial version is implemented for creating digital surveying documents. The software is selected with the guidance of a BS expert, who is an interior architect and partner of a digital surveying company. An initial enquiry showed that none of the students had previous experience with the chosen software, which contributes to the objectiveness of the research during the initiation and learning process.

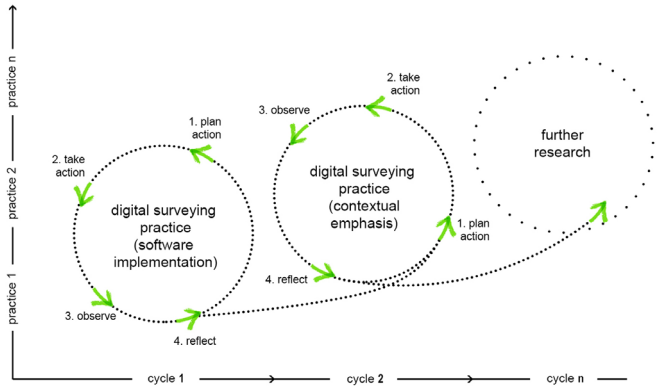

Figure 1. *The cyclical process of AR following problem diagnosis.*

3.4. Data analysis

Following the iterative process of AR, observations are made during the first stage of the practice, and students' feedback is collected during the presentations, trying to identify their preliminary studies for using the software, equipment they used, method of photographic documentation, and their satisfaction, with unstructured and open-ended questions. Additionally, student comments about different phases of the process are noted by the researchers to design and improve the second practice experience. After the second practice, an online questionnaire is used to gather technical details and to understand the participant observations as well as other qualitative and quantitative aspects of the case in a more structured way. The data is obtained by the questionnaire and student submissions form the main sources of evidence for the research. During the data analysis, each student is coded to keep their anonymity in terms of their personal space and remarks about the experience. Microsoft Excel is used for the descriptive parts of the analysis and IBM Statistical Package for Social Sciences (SPSS v27) is used for correlation and variance analysis of the data where needed.

4. Action research process and the results

According to the methodological framework, an online practice of the digital surveying software is implemented in the building surveying undergraduate course of the interior architecture department. Number of students enrolled in the course was 75, but the number of active students fell to 67, as 8 students dropped or did not attend the course.

In accordance with the AR principles, the research started with problem diagnosing as shown in Figure 1.

4.1. Problem diagnosing

The program of the survey class required practices that should be done as a group, and on site. Students were being assigned to conventional tape measure and hand sketch surveying

practices in their living environment. However, the health and safety measures taken nationwide during the Covid-19 restrictions transformed the course into an online studio setting, creating a challenge to find new ways to compensate for the fundamental exercises. The online setup lacked the assistance of the instructors during the surveying practice and restricted the instructor-student and student-student interactions. Scanned submissions and deskwork end-products were causing doubts about their originality, and students were signaling knowledge gaps. Executing these tasks appeared as a problem to solve. At that point, the researchers realized that trying to imitate conventional measuring practices were inadequate to compensate for the loss. Instead, it is decided to implement a digital practice that will fit into the course syllabus and help alter the adverse effects of the online class, while improving other skills for BS education. Consequently, this digital surveying study aimed at planning and executing two separate digital surveying tasks, which are labeled as Practice 1 and Practice 2, for fitting into and fulfilling the cyclical process of AR.

4.2. Practice one

4.2.1. Action planning

The first digital surveying practice started with the dissemination of the project brief of the module, during the 11th week of the undergraduate course. The software they will use, technical equipment they need, and the spaces they will survey are released with this brief. The object of their first 3D model is identified as the students' own work environment, where they participate in the online surveying class. To limit the irregularities, two intersecting walls, floor and ceiling partitions intersecting with these walls are asked for their model. A short introduction for the selected software is given by a BS expert. Students are asked to work as a team of five arranged by the instructors, and to complete the installation process themselves by getting help and sharing their newly gained software experience within the group where needed. Additional educational resources are also given with the brief such as the user manual of the software and a third-party YouTube video link that has a step-by-step guide for the software. They are asked to make further research on using the application as required.

4.2.2. Action taking

At this stage, students are asked to take photos of the space as defined in the previous stage and start using the designated software to create their 3D models. Each student had one week to create their room's 3D model and prepare a single group presentation together with their teammates to accomplish this stage.

4.2.3. Observing, analyzing, and evaluating

Before the group presentations, students are asked to give detailed information on their preparation process for using the software, technical specifications of the computer and camera they utilized, photography technique, light sources, and number of photographs they used for creating their 3D models. Moreover, following the presentations, they are asked for their comments on the experience. Their feedback is used to develop the Practice 2.

Demographic data

At this first stage, 47 (39 female, 8 male) out of 67 students presented their 3D models created by using the software. Among them, the course was selected mostly by students who were in their 3rd year of study by 53,2% (N:25). Students who were in their second year of study were 27,7% (N: 13), fourth year by 8,5% (N: 4), fifth year by 6,4% (N: 3), and finally, sixth year by 4,3% (N: 2).

Technical capabilities of the equipment used

One of the first challenges that was critical for the success of this research was whether the students have computer and camera equipment with necessary technical specifications or not. On the computer side, the minimum system requirements expected for the program to run smoothly and the recommended configuration to achieve

the best outcomes were compared with the specifications revealed by the students. Considering the suggested configurations, the answers revealed that all the students (N: 47) provided the minimum processor speed requirements and 65,9% of the students (N: 31) used at least the recommended processor specifications. While all the students used at least the minimum Random Access Memory (RAM) size of 4 Gigabytes (GB), the recommended RAM size of 32 GB was nonexistent. However, in compliance with the Metashape User Manual (2021), minimum configuration values were sufficient to create a 3D model based on 30 to 50 photos with a single image resolution of 10 MegaPixels (MP). Moreover, the higher value of RAM used by students was 16 GB, used by 48,9% (N: 23).

In terms of camera specifications, a resolution of 5 MP or above was recommended by the software to provide the most appropriate data for a 3D model. The first practice revealed that 95,7% (N: 45) of the students had a digital camera capable of taking 5 MP pictures or over. The presence of the remaining 4,3% of students (N: 2) are noted for the evaluation of this stage and planning of the next.

Preparation process

Students in the same group are expected to get in touch with each other and share their experiences for installing and using the software. In the assignment sheet given for the group work, three different kinds of documents were suggested as learning resources: Agisoft MetaShape user manual in Portable Document Format (PDF), tutorial videos and third-party YouTube links for the utilization of the software. While 85,1% (N: 40) of the students stated that they read the PDF document partially or as a whole, the number of the students who didn't read the document was 14,9% (N: 7). The number of students who watched the given tutorials were 93,6% (N:44) . The number of students who researched a different resource was 46,8% (N: 22) excluding the online sources given in the brief. It is decided that the students who participated in the group work completed their initial training in Practice 1. Also, students commented on group work as "…a good start to understand the program interface" (S1).

Photography technique, source of light and number of photos used

In the scope of photography techniques to capture the appropriate scenarios, panning and tracking methods are recommended for the camera angle and positioning. Panning is pivoting the camera on a vertical axis, to follow horizontal movement of the subject. However, this is only limited to object motion that is parallel to the image plane. For capturing more complex object motion that is not parallel to the image plane, the camera should move in the 3D space to track the object, which we call a tracking shot. Both methods are defined for a moving object of interest, followed by the camera during a relatively long exposure.

Presentations showed that 48,9% of the students (N: 23) used the panning method, while 40,4% of the students (N: 19) used the tracking method for capturing photographs. 10,6% (N: 5) of the students did not define their photography technique. Most of the students preferred natural light while taking photos by 40,4% (N: 19). Students who used only artificial light sources were 42,5% (N: 20). Moreover, students who used both natural and artificial light for capturing photos were 17% (N: 8).

The number of photos required for reaching best results for a 3D model is not clearly stated in the user's manual as it depends on the spatial dimensions and details of the space the user is dealing with. However, minimizing the number of blind-zones was critical for a better result and depends on an optimum number of photos taken and used for the model. Most frequently used range was 101-150 photos with 44,6% (N:21). Range of 51-100 photos was the second with 36,1% (N: 17), and 151 and above was third with 11% (N: 8). On the lower end, only one student used a photo quantity in the range of 0-50 for the 3D modeling process.

S53 stated that they carried out the modeling phase individually, but real-

Figure 2. *Model images of S56 with 570 photos (left) versus S53 with 75 photos (right).*

Figure 3. *Model by S59 showing the consequences of skipping the 'building dense point cloud' phase.*

ized the different range of image numbers used for final models, when they came together with their peers before the presentation to compare the work they have done. However, they realized that, after a certain amount, the number of photographs did not directly affect the final product, but the photography technique used, positioning of the camera was the most important factor to get a good result (Figure 2), as well as using the needed commands.

Using the software

Between the eight fundamental steps defined in the Metashape User Manual, (2021), four of them are considered in the scope of this research. Aligning photos phase (4) produces an estimated exterior (translation and rotation) and interior camera orientation parameters together with a tie point cloud containing triangulated positions of matched image points. Building dense point cloud phase (5) includes procedures for detecting and matching points after data is loaded into the system. Building mesh phase (6) reconstructs the polygonal mesh model based on point cloud information that was generated before, and the texture feature phase (7) allows the user to build different types of textures for a model. Since the students were expected to do their own preparations using the provided and online resources, the commands they used for processing images are also examined. Answers showed that a significant number of students 78,7% (N: 37) used all the four steps mentioned above for image processing and generating the model, in Practice 1.

3D Models of students who skipped these vital steps easily revealed themselves. While models of the students who skipped phase 5 (building dense point cloud) showed blurry and watercolor like images (Figure 3), other models that skipped the phase 7 (building texture) resulted with grainy images resembling colored sand formations (Figure 4). It is understood that the model without material assignment spreads over the space as points and a clear image cannot be obtained. Students also commented that despite the existing resources and user-friendly setup of the software, "…getting good results were not that easy" (S22).

Figure 4. *Images of the model by S36 that show the consequences of skipping the 'mesh building' phase.*

4.2.4. Reflecting the lessons learnt back into action

The first practice started with a brief, addressing the resources needed for students to prepare themselves for using the introduced software. They were expected to make their own research, learn how to use the software, follow the instructions of the user manual to take the pictures, and use the commands to build up their 3D models. Evidently, student presentations and the unstructured interviews revealed success of the planned tasks. Their additional comments also made important contributions to the planning of the second study.

Technical specifications of the equipment that students were able to access and use showed that there was no need to have any concerns about the quality of the photographs or the software to work properly. However, two students who used cameras below the minimum specifications are informed about the problem, and practical solutions are discussed.

Presentations showed that not all the students did comply with the assigned learning and preparation tasks before the start. Some model images showed photography technique problems and skipped commands. Instructors gave critiques and offered solutions to correct such technical problems. Regarding the previous weeks' subjects of the course, students are reminded that the modeling software works like a laser scanner. Therefore, taking photos with a well-structured pattern, covering wider areas instead of focusing on details, using light sources effectively, and avoiding reflective surfaces are recapped once more. Regarding the photography technique, a plan diagram showing the camera movement and shooting pattern is asked to be included as a documentation, for the next practice. Also reminded that, this practice was all about BS work, and a complete set of documentation is needed to complete the asked task, not only the images of their models.

The lack of needed documentation that completes this modeling task showed the lack of comprehensive understanding of BS procedures. In order to reinforce this key, but missing viewpoint, the differences between the nature of conventional surveying methods and digital methods are given in another short presentation. The reverse order of the conventional method is highlighted as initially creating a digital model, and then extracting the needed 2D drawings with the help of technologically advanced equipment. To make students apprehend this methodological difference and understand the process in the BS context, the second practice is postponed for a week. Instead, they are asked to work on a set of predisposed orthophotos of their faculty building interior, which were created using a professional laser scanner in the previous weeks of the course to demonstrate such digital advancements in BS business.

The efforts to enable and enhance group work during the practice worked for the preparation stage of the practice. Students shared third-party resources for installing and using the software, their first experiences with the application, and some of the groups did come together and discussed the process and gave critiques about each other's 3D models. However, as the capturing

and processing phases should be done separately in each student's private environment, the effort to make students work in groups delivered only a limited interaction.

4.3. Practice two

4.3.1. Action planning

In accordance with the problem definition of the study, and the outcomes of the first practice, Practice 2 started after a week's delay on the 14th week of the course schedule. Students are once more asked to use the previously introduced software, and to create a model for their household unit's kitchen area in this practice.

4.3.2. Action taking

Practice 2 is released by a similar brief, but students are asked to work on their own instead of forming groups. They are reminded of the importance of the preparation stage before capturing the photos and using the software, photography technique that will be suitable for the practice and the processing, commands that should be executed in the correct order while using the software, and most importantly, documentation of all the process as a BS work. Similar to the first task, the duration of the task is limited for a week.

While student comments and evaluations about Practice 2 are captured by unstructured interviews during and at the submission of the 3D models, following the end of the semester, a questionnaire with 19 questions is conducted. The questionnaire also tried to identify the differences between the two practices, what students made differently or used to complete the tasks. Likewise, they are asked to compare their level of satisfaction both for the process and end-products of the two practices, which also sheds light for the lessons learnt for further research studies and implementation of digital tools in BS education.

4.3.3. Observing, analyzing, and evaluating

The analysis of Practice 2 is made by the student comments during the practice and submission process, submitted 3D digital model images, and the questionnaire that is conveyed after the course period. Although the questionnaire is designed to explore the digital BS practice as a whole with both applications, the analysis and evaluations in this section are summarized using the results of this questionnaire.

Demographic data

The questionnaire received 65 replies from 67 students, and 59 of them are considered valid. Statistical validity of the questionnaire is checked for 59 replies. Sample size calculations resulted with a margin of error < 5%, with a confidence level over 95% for the population of 67 students, which is found satisfactory under these accepted metrics.

Among the 59 valid answers, 76,2% were female (N: 45) and 23,7% were male (N:14). Analysis of students' year of study showed similar distribution with the first practice. Students who were in their 3rd year of study were 55,9% (N: 33), second year were 25,4% (N: 15), and they were forming the majority. Following them, fourth years were 8,5% (N:5), and finally, fifth and six years were 5,1% (N: 3) with the same score.

Technical capabilities of the equipment used

As Practice 1 revealed, both computer and camera vise, most of the students are regarded as capable of accessing the needed equipment to use the software and fulfill the tasks. Two students who used cameras below the minimum specifications in the first practice also cleared the hurdle by employing higher resolution cameras in Practice 2.

Preparation process

Students who partially or fully read the user manual document as a preparation resource were 79,6% (N: 47). It is revealed that 20,3% (N: 12) of the students did not read the manual till the end of the second practice. Number of students who watched the videos from the provided links, for using the software were 93,2% (N: 55). On the other hand, the number of students who looked for and used an extra resource were 47,4% (N: 28).

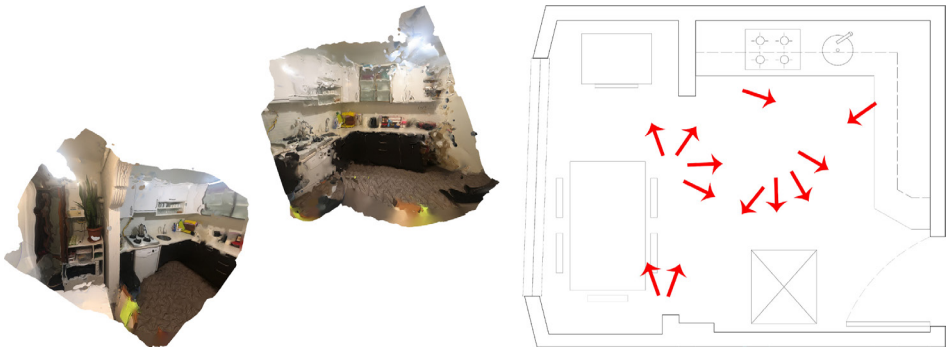

Figure 5. *Model created by photos taken from a couple of stationary points (S52).*

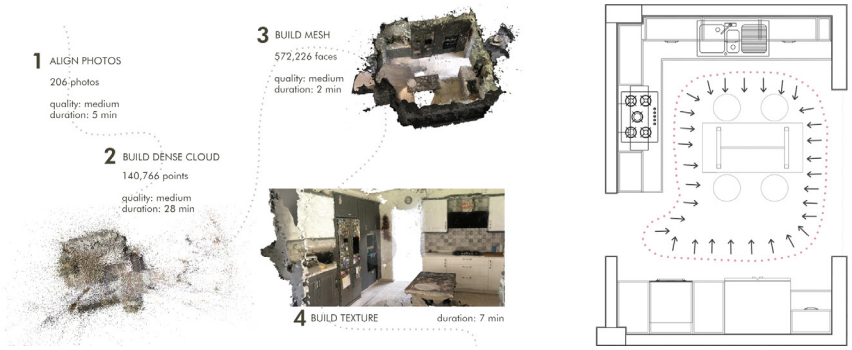

Figure 6. *Image capturing method and the created model in different software processes (S51).*

Photography technique, source of light, and number of photos used

28,8% of the students (N: 17) used the panning method, while 42,3% of the students (N: 25) used the tracking method for capturing photographs. Only 6,8% (N: 4) of the students used both methods in combination, and a significant number of students 22% (N: 13) did not define their photography technique. In comparison with Practice 1, 6 students (10,1%) increased the number of photos they used for the final model, while 4 students (6,8%) stated that they used fewer photos. Students using photos between 0-50 were 5,1% (N: 3), between 51-100 were 28,8% (N: 17), 101-150 were 28,8% (N:17). Students who used 151 photos or more are revealed as 37,2% (N: 22) for the second practice.

Although the user manual recommended tracking method, students used different capturing scenarios. One of the frequently used photography technique by the students was taking all the necessary photos from a single or a few stationary points, by repeatedly changing the position of the camera on all three axes. However, this technique did not work well, and the photographs captured by this method caused defects on the 3D models created by the software.

While using photographs taken from a single point creates distorted model images, an increased number of stationary points may increase the quality of the end-product but still involve unpleasant distortions (Figure 5). Capturing from a stationary point changes many variables on photos, such as distance, angle, and reflection, and that causes information loss in the end-model, while photographs are being stitched together by the software. However, the sketch showing the stationary points on S52's work shows a progress towards the documentation aspect of surveying, which was missing at large in the first practice.

On the contrary, using the tracking method seems to improve the expected quality significantly (Figure 6). Learning and using the recommended technique, Student 51's (S51) work shows that keeping up with the instructions rigorously and well documenting them helps fulfilling the requirements of surveying work.

In the case of light source, 31 students used natural light, 17 students

Figure 7. *Two models where the natural light source ends-up with different results (left S14 and right S4).*

Figure 8. *Artificial light source and different effects on models (left S41, right S19).*

used artificial light, and 11 students used both lights together during their photo shoot. Submissions and grades showed that the same light source did not always have the same effect on the end-model output. Figure 7 shows two different examples using natural light as their single light source capturing the photos. While S14's model achieved a better result, S4's model seems far from achieving the desired result.

Similarly, in Figure 8, two models created using only images captured under artificial light source show two different results. S41's model clearly shows the kitchen counter and cupboards clearly, while data loss is quite significant in S19's model.

Using the software

During Practice 2, 84,7% of the students (N: 50) used four key commands that were vital to get sufficient results. 11,9% (N: 7) of the students used three phases, while the remaining 3,4% (N: 2) created their model using a single command. S5 and S26, who applied only the first key command, stated that they had problems with using the software and therefore they could not apply all the necessary commands to create the 3D model. Meanwhile, there were students who skipped other phases in line, such as S59 skipping building dense point cloud phase. Results of such occasions showed data loss on the end-models despite the application of the other key phases.

4.3.4. Reflecting the lessons learnt back into action

When the submissions were examined, it was observed that the problems related to the use of the program were solved to a large extent. The interventions made in the previous practice and the students' own experiences contributed to the improvement of their work. Students tended to change the methods they used in Practice 1 to improve their studies and achieve better results. They tried to achieve good results by making changes on parameters such as light sources, number of photos, and photography technique. Consequently, it's revealed that the photography technique and use of light are as important as executing the key commands of the software to get good results. In case of light, it is understood that there are many variables that have an effect on the 3D model's quality such

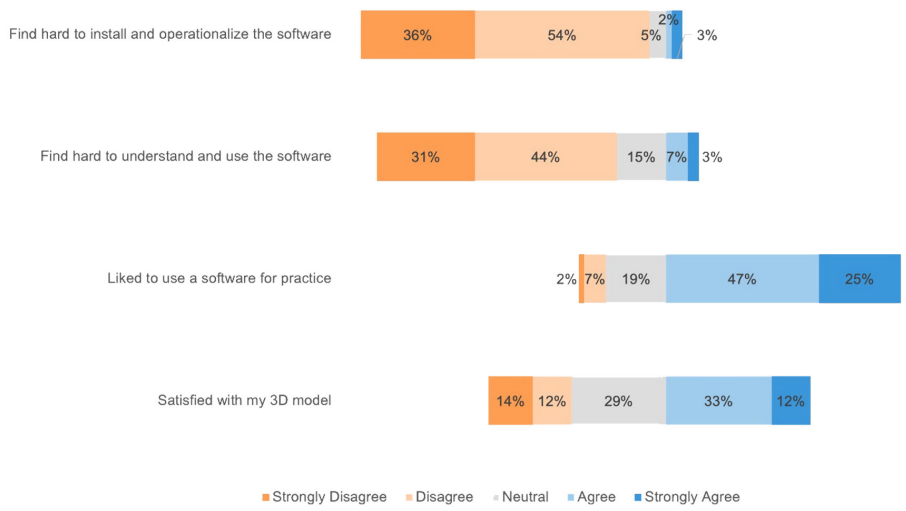

Figure 9. *Digital surveying practice satisfaction levels.*

as its direction, amount and reflections. Students learned alternatives such as using light sources together and the effect of artificial light as a fill-in light source. All in all, the results revealed that only a single parameter is not effective, and different parameters should work together to obtain a good model.

The questionnaire conducted after the semester involved four questions that were designed to collect the student evaluations for the digital surveying practice as a whole. In all four questions, their evaluations are asked using a 5-point Likert scale, starting from 1: Strongly disagree to 5: strongly agree, and 3 is used for neutral. The results are displayed in Figure 9.

The first question showed that, while 89,8% (N: 53) of the students had no problems with the digital practice, 5,1% (N: 3) had difficulties. In the second question, 74,6% (N: 44) of the students stated that they had no difficulty in understanding the software, contrary to 10,2% (N: 6). The third question revealed that 71,2% (N:42) of students liked to use it while %8,5 (N: 5) of students indicated the opposite. Finally, the fourth question revealed the approval of 45,8% of the students (N: 27), who are satisfied with their end product, contrary to 25,4% (N: 15) (Figure 9).

Another question aimed to find out students' satisfaction level from the deskwork and site work stages of the BS course. 64,4% of students (N: 38) stated that deskwork was sufficient, while 6,8% (N:4) of students disagreed, and 16,9% (N:10) stayed neutral. 27,1% of the students (N: 16) specified that site work was sufficient, contrary to 35,6% (N: 21). 25,4% (N:15) stayed neutral. Both deskwork and sitework questions are not answered by 11,9% (N: 7). Meanwhile, the statistical analysis to explore possible relationships between students' gender, year of study, preparation and methodological behaviors, and evaluations did not show any statistically significant relationships.

Despite some improvement, most of the students did not properly document the process as needed, although its importance has been prompted on the brief and reminded throughout the course.

5. Discussion and recommendations

The work expected from the students through a surveying software took place within the scope of the building surveying education. Practice 1 started with capturing photographs and creating 3D models of student rooms, using the designated software. Photography technique, number of photos used, and light source, camera and computer system specifications are examined while students represent their models as a group. During the presentations, instructors gave critiques about their survey work and prepared students for the next step of the research. For Practice 2, students are asked to work on their kitchen space by considering the lessons learned from Practice 1.

All the students managed to install and run the software and the number of students who read the tutorial and checked other resources were significantly high. Correspondingly, the analysis of student evaluations shows results more on the positive side, with comments like "…(was) fun and efficient…" (S17) or "… (the instructors) did everything to adapt the online education process…" (S10).

However, there were also critical comments given to the open-ended question. Main topics of criticism were about the difficulty of using the software, problems about the surveyed space, and problems arising from misunderstood contextual associations. While some students complained about the software as "technically very incomplete" and having a "complicated interface" (S57) or gave statements such as "I could not get enough efficiency from … the software" (S07), their subsequent comments as well as other student critics pointed out the real problem that arises from difficulties, they encountered during capturing their photos. S57 stated "…with dense interior spaces, the software remains very weak, it could not model most kitchen items" indicating problems arising from the space itself, with similar comments such as "…it was hard to produce data from a narrow area…" (S07), "my final model was not satisfactory, probably because of the narrow space" (S35).

The feedback provided by the students and the observations showed that the kitchen space was appropriate to the aim of making students perceive the capabilities of a digital photogrammetry practice. As a common space that every student can reach in their own habitat, the kitchen was compact yet full of details and tricks. In particular, the excess of reflective surfaces, mechanical and electrical appliances, combinations of portable and fixed furniture, with a limited movement area, gave useful hints about the conventional practice of surveying and helped students generate ideas about how fieldwork and digital tools could come together.

Other student comments added up on the challenges they faced with their photography technique. One student commented on how they solved problems in their model by experimenting with natural and artificial light: "…with natural light in the second practice, … homogeneously dispersed and no burst of light, I got more efficient results" (S03). Although the success of photography technique depends on a couple of variations, and there is no single recipe that is clearly given for the use of light sources in the user manual, this comment shows that students can take initiative to solve problems they face and try to improve their work, when they have to.

Unfortunately, one of the comments showed the gap between the practice and the surveying context, showing the software may be considered as a modeling program only: "…It would be easier if I modeled by myself using Sketchup or 3ds Max instead…" (S57). Despite the contextual framework of the BS course and recurring reminders, this comment prompts the need for going further with the digital practice and extracting orthophoto drawings from the 3D model to complete the learning cycle.

Capturing and presenting personal spaces is also a delicate subject where privacy should be given top priority. Although students who mentioned their concerns are given the flexibility to choose other spaces that will not bother them at the briefing stage, one of the comments showed that some students may be staying silent during the process but admitting it later: "Unfortunately, doing such practices in my room annoyed me, because I did not want my room to be seen by others" (S23). Whether they are cultural or economical, such distress should be handled with care by the educators at every stage of the curriculum.

Taking AR methodology as a reference point, the digital surveying practice discussed in this study forms two recurring cycles that tackle the problem of implementing digital surveying tools into the curriculum. While two sets of practices are used in this case, it is obvious that increasing these cycles of research units would help to

improve the results. However, the lockdown conditions restricted the development of a more robust and extensive research experiment and limited the time spared for this set of practice. In this respect, these recommendations are compiled for future researchers:

- Students of design-based degree programs such as interior architecture have computers with technical specifications that are capable of handling diverse software that can be used as a learning interface. Smartphones have become ubiquitous tools that almost every student has. These devices are capable of doing more than we are currently using them for and their camera capabilities are in corroboration with the research of Caroti & Piemonte (2020). Educators should be more willing to integrate digital practices into their curriculum, regarding the current state of technology that students are using in their daily life.
- The nature of the online education environment requires problem solving and new skills learning via the internet. Results of this study shows that students are willing to experiment with new digital tools. Online tutorial-based learning success seems natural for a significant amount of students just like Fleischmann (2020) points out. However, the remaining students have to be supported with external resources, such as video tutorials.
- The group work requisite of conventional surveying methodology is one of the vulnerable points in digital surveying practice. The need to cooperate while doing the surveying work, brings student-student interaction both helps improve the quality of survey documents, and adds up to education. However, the desired instructor-student interaction for digital practice still requests a closer ratio such as 1:2 or 1:3 just as Mika (1999) points out for the conventional surveying education.
- Digital production tasks should be designed to incorporate more with the necessities of the surveying practice, giving due importance to the documentation stage.
- The subject matter of the practices should be selected in compliance with potential sensitivities of students. As some students may find sharing images of their habitat intimidating, these students should be given more flexibility to convince them to participate in such practices. As the main goal is the practice of digital tools, such problems can be eliminated by providing alternative themes.
- Instructors should keep the course on track considering the objectives of the course, avoiding unnecessary focus on the software or digital tools being used for surveying practices.

6. Conclusion

This action research case comprised two surveying practices that tried to compensate for the site work of the BS course that could not be done by the conventional methods due to the pandemic measures and lockdowns. As the classes were being done online in digital mediums, students are encouraged to use digital equipment and software to capture and produce 3D models of their subject space in their own living environment. Although the digital measuring and modeling process changed the order of conventional surveying by creating the model before the 2D documents, the research aimed at introducing digital technologies that are strengthening their presence in the architecture and engineering industry with an increasing pace.

The results showed the eagerness of the students to use digital tools, their ability to learn new skills through the internet and to use the necessary software to practice BS while experiencing an unexpected online education semester. The progress between the stages of AR cycles proves the students' ability of learning-by-doing and learning from their mistakes. Results also show some shortcomings of the research, such as failure to compensate the group work, falling short to integrate the documentation stage into the practice, and its limited application area in a single surveying class.

BS happens to be one of the first professional real-life experiences for new graduates, especially those who

will be employed in firms dealing with adaptive reuse projects. Interior architects deal with existing structures and spaces most of the time, and relatively, they deal more with details. Therefore, the curriculum should pay attention to building surveying it deserves, keeping in mind that BS is not an expertise area that belongs to historic preservation only, but it is also a part of contemporary architecture.

BS techniques are changing with the impact of IT developments, and these improvements should also be integrated into the curriculum. The online emergency education period due to the pandemic showed that integrating digital practices into the curriculum may not be that far away. Aiming for the future, new educational tools and material should be developed for using the advances of IT, considering the aims and objectives of the BS courses.

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The emergence of Mediterraneanism discourse in modern Turkish architecture and the special position of Cengiz Bektaş

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Abstract
This article focuses on the emergence of the discourse on Mediterraneanism in Turkish architecture of mid-20th century in relation to the precedent discussions and works by European and American architects from the earlier decades. The former attempts of the modernist architects from Mediterranean countries in associating Mediterranean vernacular cultures with modernism and their basic motives are briefly discussed in the first part of the article to be able to portray the difference of the Turkish case. The emergence of the discourse of Mediterraneanism in mid-century Turkish architectural milieus is then discussed through some articles in the prominent journals of the period, underlining its relationship with the development of mass-tourism. Cengiz Bektaş is presented as a distinct and significant figure within this context who made extensive studies on Mediterranean vernacular cultures of Anatolia and had an original approach to the issue. Following the legacy of the Blue Anatolianists, Bektaş sees the Anatolian geography as a holistic cultural landscape and its vernacular architectures as the main sources of inspiration for contemporary architects, rather than pragmatic tools to fuel tourism industry. The article displays how his truly regionalist and contextualist approach to the Mediterranean differs from earlier and contemporary discourses in Turkey and stays closer to early 20th century precedents in Europe, through a reading of his original publications from the 1970s and later decades.

Keywords
Cengiz Bektaş, Cultural landscapes, Mediterranean, Modernism, Vernacular architecture.

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1. Introduction and methodology

Mediterranean cultural geography has been a fundamental source of inspiration for modern architecture since its early period. Unlike their predecessors, modern architects have found the main source of the inspiration they get from the Mediterranean in the landscapes created by the intermingling of the nature and local architecture of the region, rather than the classical canons of ancient civilizations. We can see the influence of the cultural landscapes and local building traditions specific to the Mediterranean on modern architecture, both within its own geographical space and on modern buildings built in other locations outside the region since the end of the 19th Century. In this period, the architectural works and theoretical discourses that exhibited original approaches to the relationship between modernism and locality from within the Mediterranean region reflected the characteristics and atmospheres of the sub-regions they belonged to, -in addition to having similar aspects. This article aims to discuss the development of the Mediterranean discourse, which started to be observed in architectural literature and practices in Turkey only in the middle of the Twentieth Century, and the approaches of the architects who pioneered this field through publications in the prominent architectural journals of the period. To ensure that the example of Turkey is contextualized correctly, the preliminary part of the article is reserved to the explanation of various discourses on the relationship between modern architecture and Mediterranean local cultures, which emerged in different parts of the region in the first half of the Twentieth Century.

The later part of the article, which focuses on the Turkish context and specifically on the discourse brought forward by Cengiz Bektaş has the original motive of discussing the issue of Mediterraneanism in Turkish modern architecture. This specific topic proves to be a gap in architectural literature on Turkey even though local influences on modern architecture have been discussed in various sources. Similarly the work of Cengiz Bektaş has also been the subject of many academic writings however his specific reference to the Mediterranean culture in his writings and architecture and his close links to the Blue Anatolia movement have not been comprehensively addressed. This article aims to underline the special accent on the Mediterranean cultural geography in his architectural thinking by way of a detailed and analytical reading of his writings in journals of 1970s and a few other later publications.

The general methodology of the article is based on the interpretation of the discourses of some important 20th century architects on the relationship between Mediterranean culture and modern architecture, through their own publications. Writings of those architects who made research and fieldwork on vernacular architecture of the Mediterranean are specially focused. This methodology based on the reading and analysis of first-hand sources is also applied when discussing the approach of Cengiz Bektaş to the cultural geography of the Mediterranean Anatolia, in the latter part of the article. Bektaş is an ideal figure to be investigated by this methodology as he has numerous publications in the form of journal articles and books based on his own research and travel documentations of the Aegean and Mediterranean regions of Turkey. From among his writings, the articles published in Mimarlık magazine between 1976 and 1981 are specifically focused due to their kinship to the European precedents mentioned in the second part of the article, both in terms of content and historical context. His later books and interviews are also briefly mentioned to display the changes and continuities in his discourse on the significance of Mediterranean vernacular and landscapes and their connection to the contemporary Turkish architecture and identity. In the final part of the article, the position of Bektaş is linked to the preceding discourses of Mediterraneanism in other parts of the region in order to show his special and original position.

2. Modern architecture and Mediterraneanism

In the architectural community, the interest in the Mediterranean local culture and the discourses on this subject can be clearly observed at the end of the Nineteenth Century; however, it became widespread in the period between the two world wars. The most comprehensive literature on this subject is included in the book titled Modern Architecture and the Mediterranean: Vernacular Dialogues and Contested Identities, which was compiled by Jean-François Lejeune and Michelangelo Sabatino and arrayed the examples and discourses from different locations within a wide historical range (Lejeune & Sabatino, 2010). The first chapter of the book, which was written by Benedetto Gravagnuolo, described the emergence of a Mediterranean "myth", inspiring modern architecture in the late 19th and early 20th centuries through the journeys, documents, and discourses of some significant architects. (Gravagnuolo, 2020) Gravagnuolo drew attention to the interest shown in the Mediterranean cultural geography at the turn of the century with a series of examples ranging from the local building sketches produced by German architect Karl Friedrich Schinkel, -one of the masters of neo-classical style-, and the Viennese Joseph Hoffman, -an important representative of the Secession movement-, to the journeys of Le Corbusier around the Mediterranean and his journals. Le Corbusier has a special place concerning the relationship between the Mediterranean and modernism, due to both his pioneering and singular position in the history of modern architecture and strong ties with the Mediterranean geography. The first real acquaintance of Le Corbusier with the Mediterranean was his journey to Italy in 1907; however, he made his famous Journey to the East in 1911, where he produced a large number of sketches, notes, and photographs, which had a definitive effect on his career. In the journey covering the Balkans, Anatolia, Greece, and Italy, the young architect candidate examined and documented the settlements and landscapes housing different examples of local architecture, as well as important historical monuments and cities (Figure 1). In later years, he said the following words about this journey:

> "The site is the base of architectural composition. I learned this during the course of a long trip I made, in 1911, knapsack on my back from Prague as far as Greece and Asia Minor. I discovered the architecture related to its natural site." (Le Corbusier, 1961)

Le Corbusier's interest in Mediterranean architecture and his ideas about its possible associations with modernism were also supported by his interaction with Catalan architects at the end of the 1920s. A group of young architects led by Josep Lluis Sert tried to introduce and implement modern architecture in Spain and at the same time prove its natural relationship with the Mediterranean vernacular, within the group called GATCPAC, which they established in Barcelona in the early 1930s (Rovira & Pizza, 2006). The journal called Actividad Contemporanea (AC), which was published by the group under the name of GATEPAC and included Spanish architects, served all these missions and some of its issues included examples of local architecture from the Catalan coasts and islands. Young Catalan architects have argued that buildings in Mediterranean villages naturally possessed the principles and aesthetics of modern architecture with their simple prismatic masses, asymmetric three-dimen-

Figure 1. *Le Corbusier's sketch of a historic street in Istanbul from the Journey to the East, 1911 (Fondation Le Corbusier).*

sional compositions, and functional and economic characters. Therefore, according to them, modern architecture was Mediterranean, and the Mediterranean local building culture was modern[1]. Fernando García Mercadal, an architect from Madrid, was another representative of this debate and the GATEPAC group. Mercadal, who made observations on local architectures and produced sketches and notes through his journeys to many different Mediterranean countries in the 1920s, turned them into various publications and used them as an inspiration for his works in the following years. His book titled Sobre el Mediterráneo: Sus Litorales, Pueblos, Culturas contains the sketches of Mercadal of the local works of architecture and the poetic descriptions of the Mediterranean geography and settlements, documented throughout his travels (Mercadal, 1996) (Figure 2).

It was not only the Spanish and Catalans, who established a connection between Mediterranean vernacular and modern architecture and put forward different syntheses of these cultures during the period between the two wars and afterwards. In countries such as Italy, Greece, and Algeria, architects conducted research on local building cultures and instrumentalized Mediterranean vernacular both for producing alternative interpretations of modern architecture and creating national architectural styles. These figures included Italian architects such as Luigi Figini and Gio Ponti (Sabatino, 2010), who adapted the indispensable space types of the Mediterranean climate such as courtyard, terrace, and porch, and Guiseppe Pegano, who complied his local architectural research in the book titled Architettura Rurale Italiana, Greek architects such as Aris Konstantinidis and Dimitris Pikionis (Tzonis & Rodi, 2013), who interpreted the tectonic and plastic expressions of traditional settlements on their coasts and islands in innovative ways, and French architects such as Fernand Pouillon and Roland Simounet, who brought together modern architectural language in Algeria with archetypes and climate control tools unique to North Africa (Crane, 2010). In these early discourses and studies on the relationship between the Mediterranean and modernism, it is seen that the architects mostly focused on their own geographies and presented the local architectures within their borders as unique and special, with nationalist approaches. The integrity of the larger Mediterranean and the common aspects of its local building cultures were not discussed in the works of these architects[2].

The uniform and abstract language of early modernism, based on machine aesthetics and the strict discourse of universalism, was criticized in the postwar architectural world, and the necessity of creating more humane alternatives to modern architecture through its association with local cultures and conditions was discussed. Research on local building cultures, whose examples had been seen since the beginning of the century, became widespread in parallel with these criticisms and ethnographic studies in different disciplines in the 1960s, and the number of publications in this field increased rapidly. In this context, one of the most prominent and memorable examples is the exhibition titled Architecture Without Architects held by Bernard Rudofsky in the New York Museum of Modern Art (MoMA) and the book with the same title. Rudofsky, a traveler and researcher of local ar-

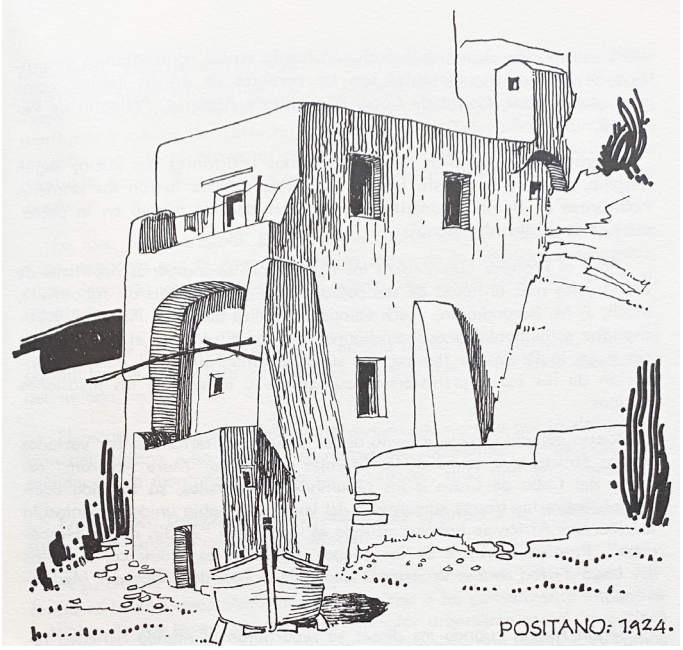

Figure 2. *Mercadal's sketch of a local building from Positano, 1924 (Mercadal, 1996).*

chitectures, used large black and white photographs to show the audience examples of vernacular building cultures from various locations around the world (Rudofsky, 1965). The presentation of these examples, which revealed the mottos of modern architecture such as simplicity and functionality in the most striking way without the need for a "heroic" architect, and which also contained a rich diversity, is recorded as a powerful critical argument in architectural history. Rudofsky's work and similar others in the post-war era showed that research on Mediterranean building cultures ceased to be appropriated solely by the architects from the region but became a significant part of the larger field of vernacular architecture studies. Villages in the Sun, a book that was the outcome of the journeys and research of Myron Goldfinger in the wider Mediterranean region was a good example of this phenomenon (Figure 3). The book that was published in 1969 with a preface by Louis Kahn, described the villages offering the most picturesque examples of local architecture on the Mediterranean coast and islands with carefully framed black and white photographs, drawings, and short texts (Goldfinger, 1969). Goldfinger also wrote opinions on how these examples of local architecture might have influenced modern architects in the introduction of the book and supported his arguments with comparative photographs of vernacular and modern buildings. Other important publications on Mediterranean vernacular architectures published in the 1960s include the Folk Architecture of the Eastern Mediterranean, where Daniel Paulk Branch compiled his observations during the journeys he made with a travel scholarship granted by Columbia University (Branch, 1966), and the L'architecture de Lumiere, where Jean Marie Bresson brought together information about examples of local buildings from all over the region (Bresson, 1976). These books contained local architectural cultures from diverse sub-regions of the Mediterranean, and both their differences and shared characteristics were portrayed with a more objective perspective, when compared to the prior research and publications by the Mediterranean architects.

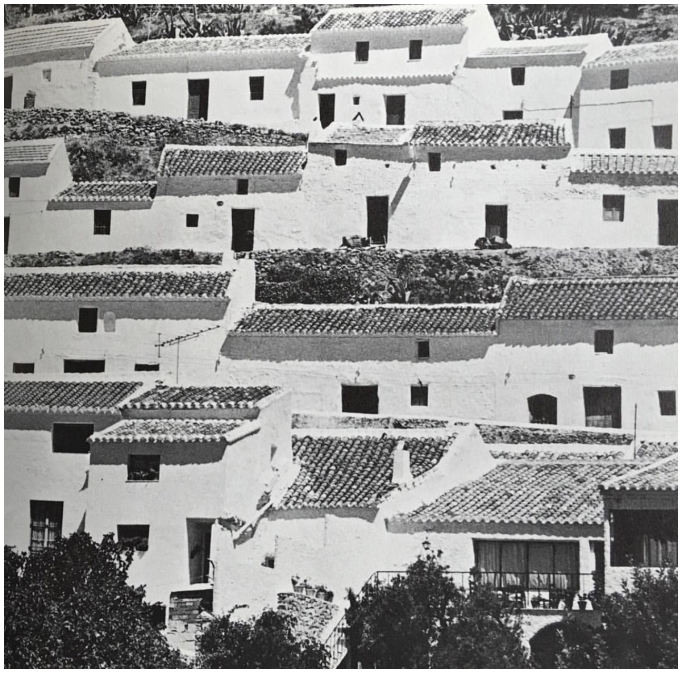

Figure 3. *The view of a Spanish village from Villages in the Sun (Goldfinger, 1969).*

3. Mediterraneanism discourse in mid-century Turkey and the special position of Cengiz Bektaş

Discourses on the relationship between modern architecture and the Mediterranean culture in Turkey, as well as the architectural works influenced by this relationship, evolved much later than other countries in the region, and with their own dynamics. With the proclamation of the Republic, it is known that European modernism was rapidly adopted in Turkey as of the mid-1920s, and action was taken to create a new face in architecture, as in many areas of social and cultural life. By the mid-1930s, Turkish architects also began to question early modernism, which claimed to have an abstract and universal language and was named as "cubist style" in Turkey, and ways of integrating this style with local characteristics started to be explored. However, unlike the Mediterranean countries mentioned previously, these efforts were nurtured by very different cultural and geographical sources in Turkey. In this period, the identification of the national identity by breaking the cultural ties of the young republic with the Ottoman Empire turned into a campaign carried

out by the state and focused on areas such as historiography and language research. The effect of this campaign on the fields of art and architecture was discussed in detail in the work of Sibel Bozdoğan (Bozdoğan, 2001) titled Modernism and Nation Building: Turkish Architectural Culture in the Early Republic. Bozdoğan explained that the "national essence", which determined the new Turkish identity, was defined through its archaic roots extending to Central Asia and its relationship with the ancient civilizations of Anatolia; the Hittites and the Sumerians. In parallel with the nationalist movements in Europe, the effort to create a national architectural style in Turkey in the 1930s and 40s continued to be strengthened and architects headed for research on folk building arts in various regions of Anatolia. However, the studies in this period were carried out under the assumption of a homogeneous Anatolian culture in parallel with the understanding of the unitary state and were not carried out in a way that emphasized regional differences such as the special characteristics of Mediterranean local architecture. The most obvious example of this is the concept of "Turkish House", which Sedad Hakkı Eldem, who carried out detailed studies and documentation on Anatolian folk culture and local architectures during this period, imagined and idealized as an "object-type" without context, as explained by Sibel Bozdoğan in "The Legacy of an Istanbul Architect: Type, Context and Urban Identity in the Work of Sedad Eldem" (Bozdoğan, 2010). Eldem, who got interested in local Mediterranean architecture and culture during his journeys to Mediterranean countries when he was young, produced sketches and unrealized projects containing modern interpretations of this culture and yet abandoned the "Mediterranean Dream" shortly and focused on the Turkish House project. Eldem argued that the Turkish House that shaped the urban fabric of the traditional settlements in the Balkans and various regions of Anatolia, was "modern" and had a transnational character, similar to what his Mediterranean colleagues claimed about their own local architectures. However, unlike his colleagues, Eldem approached the Turkish House not as part of the cultural landscape of a certain region, but as an abstract phenomenon that could be analyzed and categorized through plan types with a rational approach. Therefore, according to Bozdoğan, Eldem cannot be described as either contextualist or regionalist.

Mediterranean culture began to be discussed for the first time in the 1950s as a holistic and singular phenomenon in the Republic of Turkey by a group of intellectuals and artists, who adopted humanist thought and presented it as the reference for an alternative definition of national identity. The group that included Azra Erhat, Bedri Rahmi Eyüboğlu, and Vedat Günyol and was referred to as the Blue Anatolianists, expanded the stiff and uniform Turkish nationalism discourse of the early Republican period to cover all civilizations that existed in Anatolia throughout history and defined modern Turkish identity as a synthesis and natural extension of these civilizations (Hacıbrahimoğlu, 2012). In his article titled "Our Anatolia: Organicism and the Making of Humanist Culture in Turkey", Can Bilsel explains that, during the 1950s when the history and language theses of the early republican period were questioned, the Blue Anatolians portrayed the ancient civilizations of the Aegean and Mediterranean regions of Anatolia as not just the ancestors of the modern Turks but the whole Western civilization (Bilsel, 2007). The members of the group were inspired by Cevat Şakir Kabaağaçlı -aka the Fisherman of Halikarnas- who was exiled to Bodrum in the 1920s and established a deep connection with this geography, and made many land and sea journeys in the Aegean and Mediterranean regions of Anatolia from the 1950s to the 70s. They examined and documented local landscapes, architecture and crafts in addition to the ancient settlements that were of special interest to them, during these journeys. Among these documents, the paintings of Bedri Rahmi Eyüboğlu are of significant value, in which he visualized the Mediterranean cultural landscapes with all their vital-

ity and intertwined elements, during the legendary boat trips known as the Blue Voyage (Eyüboğlu, 2009) (Figure 4). Similarly, Azra Erhat described in her writings the picturesque image of the landscapes formed by the interaction of nature, antiquity, and folk culture in these regions and pointed out the need to support this atmosphere with modern infrastructures and to encourage tourism without deteriorating its character (Erhat, 1960; Erhat, 1962). The most important common feature in the intellectual approaches and works of the figures such as the "Fisherman", Erhat and Eyüboğlu was that they saw the Mediterranean geography as a holistic cultural landscape and drew attention to the sensitive relations of the natural and man-made elements that made up this whole. Although there were no architects among the Blue Anatolianists at this preliminary stage and it mostly consisted of writers, journalists, and artists, a strong spatial vision of the Mediterranean landscapes can be observed in their textual and visual productions. And thus, as will be explained later in the article, it is possible to speculate on their influence on the Turkish architectural milieu, albeit indirectly.

The interest in the Mediterranean culture in Turkish architectural milieus emerged around the end of the 1950s when mass tourism started to expand drastically and soon acquired an unprecedented scale. The Mediterranean has been the most important tourist destination in the world since the 18th Century when the practice of The Grand Tour became popular; however, a tourism activity that would transform the economic, demographic and physical structure of the region dates back to mid-20th Century. As Manera, Segreto and Pohl explained with numbers in their article titled "The Mediterranean as a Tourist Destination: Past, Present, and Future of the First Mass Tourism Resort Area", the tourism phenomenon reached a massive scale after the Second World War with the diversification of travel vehicles and the widespread implementation of paid holidays. (Manera et al., 2009) In addition to its natural and cultural values, the Mediterranean Region and primarily the northwest coasts and the islands were the first places to receive a share of these developments, since they were within easy reach of the European tourists with access to the above-mentioned opportunities. American aids and policies initiated right after the Second World War also had a big impact on the Mediterranean and especially on the coasts of Turkey, in becoming tourist destinations. As Begüm Adalet explained in detail in her book titled Hotels and Highways: The Construction of Modernization Theory in Cold War Turkey, Turkey entered into rapid processes concerning the development of highway networks and tourism facilities and the mechanization of agriculture, in line with the ideological and pragmatic goals of the Marshall aid package it started to benefit from in 1948 (Adalet, 2018). One of the primary objectives of the package was to turn the countries that received Marshall aids into holiday destinations for American tourists; and within this context, authorities rapidly started to produce tourism policies in Turkey at the end of the 1940s, initiated active propaganda in the press and institutions such as the Tourism Advisory Board (1949), the General Directorate of Press and Tourism (1949), and the Turkish Travel Foundation (1951) were established. The effects of these intensive activities and propaganda that aimed at developing tourism through the modernization of existing facilities and the construction of new ones on the Mediterranean coasts also became visible in Turkish architectural mi-

Figure 4. *Painting of Bodrum by Bedri Rahmi Eyüboğlu, 1950s (Eyüboğlu 2009).*

lieus, towards the end of the 1950s. In this period, the interest in Mediterranean culture, which started to emerge among Turkish architects, was formed by the realization of the potential of development based on the tourism industry, rather than the ideals of creating an alternative architectural identity with national and local qualities. Discourses about the urgent need for the development of tourism in Turkey and the making of related policies and plans started to appear in the architectural media and the writers drew attention to the inadequacy of the country in this field, despite the fact that it was located in a sub-region of the Mediterranean with significant natural and historical assets.

The first issue of Arkitekt magazine in 1960 began with the article by Zeki Sayar titled "Towards Genuine Tourism". Sayar stated in his paper, in a harsh and critical tone directed at state institutions and the Tourism Bank, that Turkey had a large tourism potential on the Aegean and Mediterranean shores, but that it had never been used. (Sayar, 1960) The countries that he had taken as reference and made comparisons were naturally Mediterranean countries. Tourists were tired of the French and Italian Rivieras, which were the pioneers of Mediterranean tourism, he added, and they could easily be directed to the Turkish coasts, as nations like Yugoslavia and Greece had already recognized this potential and taken action on. He emphasized that as rapidly as possible, comfortable tourist facilities that do not go into luxury should be erected on Turkey's beaches to accommodate European middle-class tourists. Almost all of Sayar's subsequent articles, which appeared in various issues of the journal throughout the years, were about the Mediterranean's potential tourism economy and did not contain a significant argument about the region's cultural geography or its link with modern architecture. Despite this, from the 1960s until the beginning of the 1980s, when the journal's publishing life ended, projects on the archaeology, folk crafts and local architecture of the Mediterranean and projects for touristic facilities and settlements in coastal regions increasingly appeared in its issues. These included texts by practicing architects such as Turgut Cansever, Şevki Vanlı, Ercan Evren and Cengiz Bektaş addressing various topics and historic periods associated with the Mediterranean culture and architecture. Within this context, architect Cengiz Bektaş, who had carried out the most comprehensive studies on Mediterranean vernacular cultures since the 1970s and approached the subject from a different perspective and had a special and pioneering position. Bektaş, who had a close friendship with the Blue Anatolianists, especially Azra Erhat, made many journeys to Western and Southern Anatolia, some of which were Blue Voyages with this group (Figure 5). Bektaş mentioned that he learned to look at Anatolia holistically as a "cultural geography" and the importance of Western Anatolia within the context of all world civilizations from the Blue Anatolianists. He actively documented his experiences during his journeys and published his research on local architecture, ancient settlements and cultural landscapes in different architectural magazines and books since the 1970s[3] (Figure 6) (Table 1). Before mentioning these publications, it would be useful to quote the words of Bektaş from a 9-episode series article he published in Evrensel Journal for the 100th anniversary of the birth of Azra Erhat, to express his view of the Blue Anatolianists:

> "Dear Azra!
>
> You presented us with an idea... An idea of Anatolianism... To me, it is the truth itself...
>
> I've just returned from Ephesus, Aphrodisias, Magnesia...
>
> You Anatolianists presented us not only our geography but also a cultural homeland." (Bektaş, 2015: 5,6).

In his series of articles titled "Halkın Elinden Dilinden" (Works and Words of People) published in Mimarlık Journal between 1976-81, Cengiz Bektaş depicted the landscapes in the regions he visited in Anatolia –especially on the West and South coasts– in a poetic language and presented the detailed drawings and sketches he produced about historical monuments and vernacular architecture to the reader. Bektaş, who explained the examples of "folk building arts" by associating

them with the surrounding natural elements and settlement fabric, took every opportunity in these writings to emphasize that they should be interpreted within their context and not as isolated objects (Figure 7). He mentioned that the definition of a house in Anatolia, not as part of a street, neighbourhood or cultural environment, but as an object determined by walls, floor, and ceiling, led to great failures, and he started talking about Antalya houses, in the first issue of the journal in 1978, by explaining the geographic characteristics of the region. (Bektaş, 1978a) Bektaş had a phenomenological approach as much as his regionalist approach: He described a neighborhood square with the dark shadow of the plane tree in the middle, the sound of the flowing fountain, the laughter of children, and the stone entrance of a house with the coolness and privacy offered by the walls surrounding it. He drew attention to the spatial and experiential relationships of the square, street and courtyard and the sequence they formed, which lies at the base of many Mediterranean settlements. (Bektaş, 1978b) (Figures 8, 9) As a result of this experiential approach, Bektaş also included information about the processes such as construction stories and rituals learned from local masters in the series titled "Halkın Elinden Dilinden". In an article published in the first issue of Mimarlık in 1976, he described the rituals of the old masters of Antalya, which heralded the end of a roof construction as follows:

Figure 5. *Photograph of Cengiz Bektaş and Azra Erhat with some friends from a Blue Voyage, 1981 (SALT Research, Cengiz Bektaş Archive).*

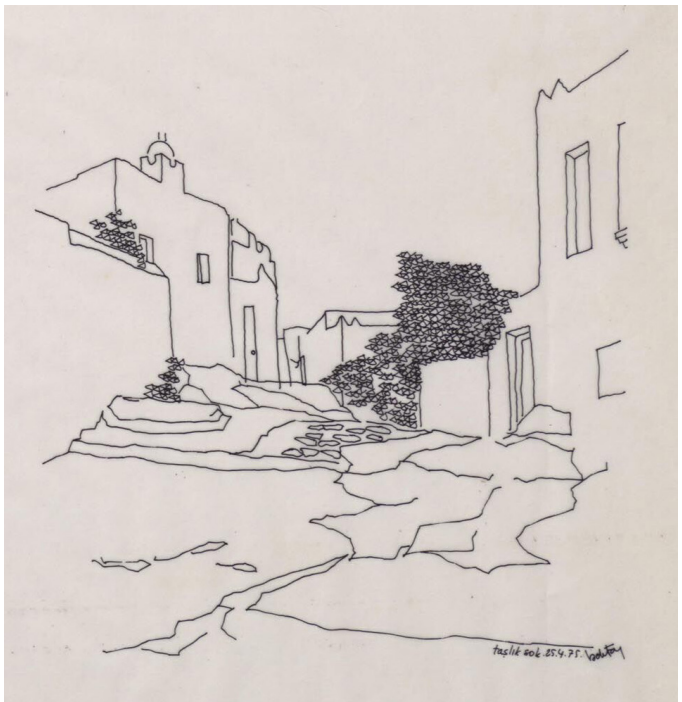

Figure 6. *Sketch of a street in Bodrum by Cengiz Bektaş, 1975 (Bektaş 1975).*

> "When the roofing was completed, the craftsmen used to rattle the incisor on a wooden board and announced to the neighbours that their work was over. Some masters were so talented that they almost made the incisor sing. Neighbour and friends who heard the rattling that turned into a music of some sort brought gifts to the masters. Gifts such as towels, shirts, handkerchiefs etc. were hung on a rope next to a flag on the roof..." (Bektaş, 1976: 9)

Bektaş added that he learned from Prof. İlhan Başgöz that this tradition went back to the Mesopotamian civilizations and once again drew attention to the continuities in time and space, within this cultural geography. According to Bektaş, who constantly emphasized historical and geographical relationships and the fact that cultures evolved by shaping each other, distinctions such as Turkish House and Greek House were also superficial. He said that the buildings in the Mediterranean Region bore the traces of the cultures and "thousands of years old" traditions that existed in that region.

> "When I encountered the paving of the entrance of a one hundred and fifty-year-old Antalya House made of small pebbles, in a settlement from thousands of years ago, I sensed the touch of a hand and a culture continuing for thousands of years. I was a little surprised and looked with a little suspicion at those who attempted to define

Table 1. *Journal articles of Cengiz Bektaş on the vernacular architecture of Anatolia (especially the Aegean and Mediterranean regions) from 1970s and 1980s*

Journal	*Year*	*Issue*	*Title*	*Topics/Regions Discussed*
Mimarlık	1976	146	Halkın Elinden Dilinden	Ortahisar (Nevşehir)
		147	Halkın Elinden Dilinden	Marmaris, Datça, Bodrum, Gökova Bay
		148	Halkın Elinden Dilinden	Bulak
		149	Halkın Elinden Dilinden	Denizli
	1977	150	Halkın Elinden Dilinden	Marmaris, Fethiye
		151	Halkın Elinden Dilinden	Tersane Island (Muğla)
		152	Halkın Elinden Dilinden	Fethiye, Kalkan, Kekova
		153	Halkın Elinden Dilinden	Şirince (İzmir)
	1978	154	Halkın Elinden Dilinden	Priştine, Antalya
		155	Halkın Elinden Dilinden	Antalya - I
		156	Halkın Elinden Dilinden	Antalya - II
		157	Halkın Elinden Dilinden	Antalya - III
	1979	158	Halkın Elinden Dilinden	Antalya
		159	Halkın Elinden Dilinden	Kayaköy-Fethiye
		160	Halkın Elinden Dilinden	Kuşadası - I
		161	Halkın Elinden Dilinden	Kuşadası - II
	1980	162	Halkın Elinden Dilinden	Kuşadası
	1981	163	Halkın Elinden Dilinden	Kuşadası
		164	Halkın Elinden Dilinden	Babadağ (Denizli) - I
		165	Halkın Elinden Dilinden	Babadağ (Denizli) - II
		166	Halkın Elinden Dilinden	Babadağ (Denizli) - III
		167	Halkın Elinden Dilinden	Babadağ (Denizli) - IV
		168	Halkın Elinden Dilinden	Babadağ (Denizli) - V
		169	Halkın Elinden Dilinden	Babadağ (Denizli) - VI
	1982	176	Şirinköy: Ya da Köyde Apartman I	Şirinköy
		177	Şirinköy: Ya da Köyde Apartman II	Şirinköy
		178	Şirinköy: Ya da Köyde Apartman III	Şirinköy
		179	Şirinköy: Ya da Köyde Apartman IV	Şirinköy
		181	Şirinköy: Ya da Köyde Apartman V	Şirinköy
		182	Şirinköy: Ya da Köyde Apartman VI	Şirinköy
		184	Şirinköy: Ya da Köyde Apartman VII	Şirinköy
	1983	189	Tirilye I	Tirilye
		190	Tirilye II	Tirilye
		191	Tirilye III	Tirilye
Arkitekt	1975	360	Halk Yapı Sanatından Bir Örnek: Bodrum'da Sivil Yapılar	Bodrum

Figure 7. *Photograph of Antalya's historic district Kaleiçi by Cengiz Bektaş, late 1970s or early 1980s (SALT Research, Cengiz Bektaş Archive).*

> this culture as national this or that and attempted to divide it with walls claiming this is Greek, that is Roman, etc." (Bektaş, 1978a: 6)

In this sense, it can be argued that Bektaş examined the local building cultures with a contextualist, phenomenological and holistic perspective and not with an analytical, typological or categorical one that Sedad Hakkı Eldem had. Nevertheless, despite this contrast, Bektaş conveyed the classification of Turkish House made by Eldem in detail in the 4th issue of the magazine in 1978 with examples from Antalya houses and by calling it "Turkey Evi" (Houses of Turkey). With this revision, it can be thought that Bektaş aimed to change the emphasis of nationalism with a regionalist approach that embraced different cultures. The book by Cengiz Bektaş titled "Türk Evi" (Turkish House), published in 1996, maintains the emphasis on cultural geography despite its name. (Bektaş, 1996) In the first chapters of the book, Bektaş describes the elements that showed continuity in the building cultures and life of Anatolia, starting from the ancient civilizations of Southeast and Central Anatolia dating back to 10,000 years yet puts a special emphasis on the Mediterranean civilizations of Western and Southern Anatolia such as Ionia, Lydia, Caria, and Lycia. According to Bektaş, these civilizations contributed to the "definition of the culture of living in Mediterranean terms". Later, he explains the contribution of Hellenistic, Persian and Ottoman cultures to the continuities in the Anatolian geography and brings the subject back to the Turkish House, underlying that this building type is actually the multicultural Ottoman House. Before going into the detailed description of this multicultural dwelling type, he feels the need to clarify why and in what context he uses this term:

> "Human beings grow with the influence of the past and contemporary artefacts of the land they live on. In short, it is the people who live on a land that is the natural heir to all the cultures that existed there. Therefore, of course, the Ottoman house in Macedonia will be called the Macedonian House by the Macedonians of today, the Ottoman house in Plovdiv will be called the Bulgarian House by the Bulgarians of today, and the Ottoman house in Greece will be called the Greek House by the Greeks of today. In reality, these are exactly the houses of the land on which they were created... When I say House of Turkey today, or if I say Turkish House since the citizens of Turkey are called Turkish, I am saying something right. But I am saying this knowing that the Ottoman way of life and culture created the term Turkish House through the common life that existed on these lands, and by considering all the regional colours as richnesses to be added to the whole." (Bektaş, 1996: 22)

As it can be understood from the quotation above, the relationship of Bektaş with the terminology of the Turkish House was not non-problematic. Both this explanation and the content of the book emphasizing the multiculturalism and historical continuity of the lifestyles in Anatolia revealed his efforts to prevent this house type from being associated with a unique national identity. In the book, Bektaş mentioned Sedad Hakkı Eldem only in the last chapter where he explained the Turkish House plan types, and although he used his categories and naming, he could not help stating that he found the classifications of the "former generations" constraining. (Bektaş, 1996: 117) The geographical and historical accounts emphasizing the Aegean and Mediterranean regions in the first parts of the book, regional archetypes such as the megaron-type houses and the atrium, and explanations about the square-street-courtyard-hall (sofa) sequence of traditional settlements largely shaped by open and semi-open spaces revealed a discourse that contextualized the type called Turkish House within the Mediterranean culture. Despite the emphasis of Bektaş on cultural geography in his articles and books and his effort to avoid nationalist discourses, his research and studies were highly focused on his own geography, similar to the approach of Catalan, Italian, and Greek architects mentioned in the first part of the article. It was not common that he discussed Anatolia as a part of the greater Mediterranean or extended the continuities he discussed about the building cultures and lifestyles to wid-

er geographical and historical contexts. Accordingly, the approach of Bektaş was similar to that of the Blue Anatolianists. Even concerning the context of Anatolian geography, his special interest in the Aegean and Mediterranean regions, similar to Blue Anatolianists, was often noticed in his publications in which he discussed these regions under the general title of Anatolia. Both the articles he wrote in the journals during the 1970s[4] and the books he published about the local building cultures of Denizli, Güre, Antalya, and Aegean islands in the following years were proof of his special interest in the Mediterranean. In conclusion, if we speculate on the effect of the Blue Anatolia movement and thus the Mediterranean culture on modern and contemporary architecture in Turkey, it can be argued that Cengiz Bektaş was a key figure in building this bridge. Furthermore, his research motivated by a sincere interest in learning the building cultures of the geography he lived in and a search for a genuine architectural identity, rather than pragmatic motives that would serve the developing mass tourism industry, are other aspects that place Bektaş in a special position and akin to his Spanish, Catalan, and Italian colleagues mentioned in the first part of the article.

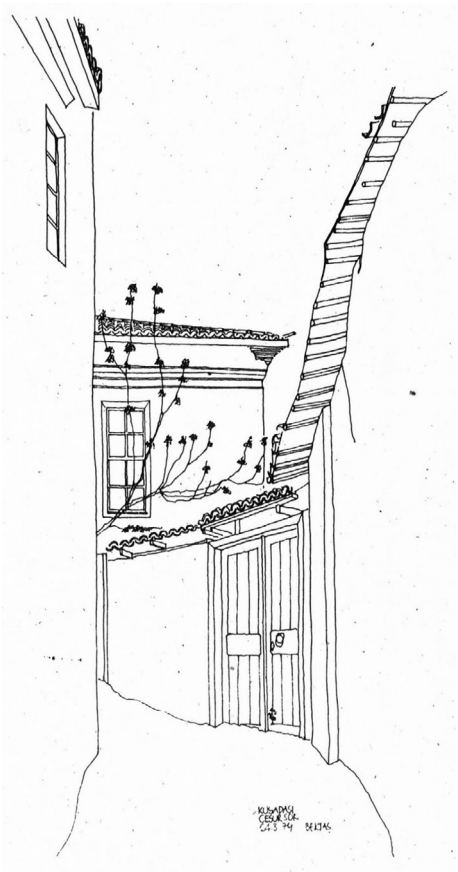

Figure 8. *Sketch of a street in Kuşadası by Cengiz Bektaş, 1974 (Bektaş 1979).*

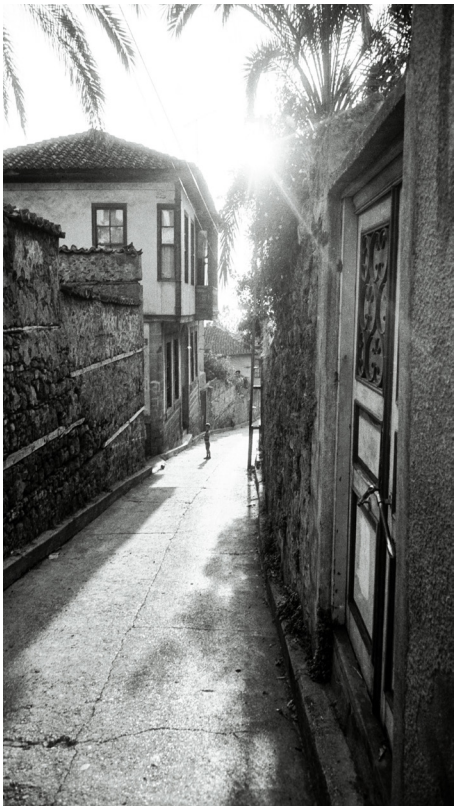

Figure 9. *Photograph of a street in Antalya Kaleiçi by Cengiz Bektaş, late 1970s or early 1980s (SALT Research, Cengiz Bektaş Archive).*

4. Conclusion

The interest of the modernist architects in the Mediterranean cultural geography and local architectural cultures since the beginning of the Twentieth Century -and especially during the period between the wars- in Europe emerged in Turkey only by mid-century and with the sole motive of serving mass tourism industry. Unlike the efforts of Spanish, Italian, French and Greek architects to create original architectures by synthesizing modernism with local building cultures since the 1930s, the Mediterranean culture in Turkey was considered a pragmatic tool to be utilized for the spread of tourism supported by the state policies and Marshall Plan that appeared in the 1950s. During this period, the discourses in architectural publications, in parallel with the general state propaganda,

presented the Mediterranean and tourism as two concepts that were completely paired. The group, which brought an alternative perspective to this understanding, were the Blue Anatolianists, which had been active since the mid-1950s and perceived the Mediterranean as a multi-layered cultural construct that could shape modern Turkish identity. Although there were no architects among the members of this group, their journeys on the Aegean and Mediterranean coasts of Anatolia, research and documentation of the cultural landscapes of these regions could be considered the first and most creative representations of the Mediterranean space in modern Turkey. Cengiz Bektaş, who had a close friendship with the Blue Anatolianists and especially Azra Erhat, adopted their culture of travel and documentation and, most importantly, their understanding of cultural geography, also had a special place within this context. In the 1970s, Bektaş published his research on the "folk building arts" of the coastal regions of Anatolia in his column titled "Halkın Elinden Dilinden" in Mimarlık Journal and revealed his holistic perspective on this cultural geography and his sincere interest shaped by the search for an original architectural identity. This research, which had a major impact on his architectural practice as well, positioned Cengiz Bektaş close to his colleagues who developed similar approaches in other corners of the Mediterranean at the beginning of the twentieth century, in addition to his special place in the history of Turkish architecture. Since the 1970s, many studies have been conducted on the local building cultures of the Mediterranean Region by academicians and architects in Turkey. A detailed classification and historiography of these studies would undoubtedly exceed the scope of this article on the emergence of the Mediterranean discourse in the Turkish architectural milieu. Nevertheless, it would not be wrong to make the following conclusive remarks. Regardless of their initial motives, the architects who are interested in Mediterranean local cultures in Turkey and aim to synthesize them with contemporary architectural practices -including Cengiz Bektaş– have mostly had the chance to implement and test their ideas on tourism facilities and summer residences and settlements until recently, for the reasons mentioned above. Although it seems difficult for the discourse of Mediterraneanism to be disconnected from the tourism industry in Turkey, which has radically transformed the coastal landscapes of Anatolia since the 1950s, it may be said that research on the vernacular cultures of this geography has been increasing and diversifying in the recent years, informing design ideas for projects with much more diverse architectural programs and critical stances, and providing inspiration for those seeking contemporary ways of inhabiting these lands.

Endnotes

[1] Documentos de Actividad Contemporánea, known by its acronym AC, was published between 1931-37. In addition to current modern projects from Spain and the world, texts and visuals about field studies on Mediterranean vernacular were included in its various issues. Detailed information on the content and history of the journal can be found in an article by Antonio Pizza, titled Contemporary Activity: The GATEPAC Magazine 1931-1937 (Pizza, 2012).

[2] One of the most significant examples of this was the discourses of Aris Konstantinidis in Landscapes and Houses of Modern Greece: God-Built (Konstantinidis, 1994) and Elements of Self-Knowledge: Towards A True Architecture (Konstantinidis, 1975). In these publications, Konstantinidis presented the local architectures and landscapes of Greece with texts that emphasized the concept of Greekness rather than Mediterranean culture and identity, including photographs and a strong emphasis on nationalism. In fact, the word, Mediterranean was almost never encountered within the texts in these books. The architectural and natural elements that could be found in many different parts of the Mediterranean region were described as phenomena specific to the Greek ge-

ography.

[3] Cengiz Bektaş recently made an interview and published a series of articles that clarified his relationship with the Blue Anatolianists, the way he looked at them and how he was influenced by them. The first of these was the interview of Burak Baş with Bektaş and published on the website Arkeofili (Baş, 2017), and the second was the nine-episode series of articles published by Bektaş on the website of Evrensel Journal due to the 100th anniversary of the birth of Azra Erhat (Bektaş, 2015).

[4] Cengiz Bektaş mostly included settlements from the Aegean and Mediterranean regions of Anatolia in the series of articles titled "Halkın Elinden Dilinden" (Works and Words of People) published in Mimarlık Journal between 1976 and 1981. The discoveries he made by going ashore with his friends and colleagues during boat trips in Gökova and Hisarönü bays and around Fethiye, the local architecture of Denizli, Şirince and Kuşadası and the detailed description of Antalya Kaleiçi spread over a few issues were the main topics that made up this series. He continued publishing articles on the landscapes and vernacular architecture of the Aegean and Mediterranean regions of Anatolia under different titles in various issues of Mimarlık in the 1980s and onwards. Moreover, Bektaş published a detailed article in the 4th issue of Arkitekt magazine in 1975, describing different house types and settlement textures in the local architecture of Bodrum. (Bektaş, 1975).

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An analysis on hygrothermal behaviour of traditional timber framed brick infill exterior wall

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Abstract
The goal of this study is to analyze hygrothermal performance of traditional timber framed brick infill exterior wall in Turkey to investigate the physical conditions of these buildings as an input for conservation/restoration/reconstruction projects. In order to investigate hygrothermal performance of the wall assembly, numerical and experimental studies were adopted. The numerical study was examined by DELPHIN simulation tool and guarded hot box is used for the experimental study. Based on the results of literature review; the system, and layers of external wall of traditional timber framed brick infill houses in Sivrihisar were examined. Then, the wall assembly were designed for case study. The evaluation is based on laboratory measurements that are used for comparison of the numerical modelling by analysis of temperature and U-value. The results indicate that experimental study has crucial role for applicability of numerical modelling for hygrothermal performance evaluation. Notably, material variations create unexpected impacts on the wall layers. The simulated values have good agreements with measured values on the infill parts of the wall assembly. In contrast to that the differences between measured and simulated wooden parts of the wall assembly are needed to be examined. The intersection and interaction points of different materials are required to assess by experimental and numerical methods for further studies in detailed.

Keywords
Brick infill, DELPHIN, Hygrothermal performance, Guarded hot box, Traditional timber framed exterior wall.

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1. Introduction

Hygrothermal performance concentrates on air, moisture, and heat movements through building elements. Hens (2002) states that heat, air, and moisture movement have imp acts on durability and thermal quality. Vapor permeability and thermal resistance are two major factors for building façade performance (Pihelo & Kalamees, 2016). These factors are fundamental considerations for the analysis of hygrothermal performance of a wall. User comfort, durability of material and energy efficiency of buildings are directly related with hygrothermal performance (Gasparin et al., 2019). Trechsel (2001) points out that to supply comfort conditions of users it is necessary to control the relative humidity of both the space and the surface at the recommended limit values. To design a well-performed building envelope of nearly zero energy buildings, hygrothermal design criteria considering material properties are needed to be assessed (Pihelo et al., 2016). A problem about building envelope and/or its hygrothermal performance may be a reason of the undesirable biological structures, building material deterioration and energy usage increasement. Moisture accumulation in the building envelope causes physical, biological, and/or chemical deterioration based on local conditions (Nofal et al., 2001). Chang and Kim (2015) explain that mould growth has serious impacts on buildings and also users' health. Corrosion, biological growth, and freeze-thaw through a wall lead to damages of building and building materials as well in historic buildings (Gutland et al., 2021).

Hygrothermal performance is explained as thermal and moisture properties of heat, air, and moisture movement by building physicists (Kumaran, 2001). Altun (1997) claims that while thermal performance requires minimum heat loss in heating season, minimum heat gain in cooling season, ability to keep the internal surface temperature at the desired level, resistance to thermal deformation, heat storage feature, resistance to high and low temperatures; moisture performance requirements can be listed as no moisture accumulation and no physical, chemical, biological related deterioration throughout the wall. Hygrothermal performance inquires heat flow by radiation, conduction, and transport; vapor flow by vapor diffusion and liquid convection; air flow formed by natural, external, and mechanical forces (Delgado et al., 2013).

Hygrothermal performance analysis methods are main research questions of several studies. Specifically, hygrothermal simulation tools are examined in terms of their time and cost efficiency. Calculation methods are mostly applied methods comparing with laboratory and measurements depending on time and cost efficiency (Kalamees & Vinha, 2003). There are numbers of hygrothermal simulation tools. In the literature most of the studies concentrated on applicability, reliability, and validity of these hygrothermal simulation tools (Pihelo and Kalamees, 2016; Kalamees and Kurnitski, 2010; Kalamees & Vinha 2003; Zarr et al., 1995). Moreover, there are numerous research about hygrothermal simulation tools (Defo et al., 2022; Hejazi et al., 2019; Barreira et al., 2013; Delgado et al., 2013; Kalamees & Vinha, 2003). Besides, several studies cover hygrothermal performance of timber framed walls mostly concentrating on energy efficiency and moisture-related issues (Schjøth Bunkholt et al. 2021; Fu et al. 2020; Cabrera et al 2019; Liu et al. 2018; Martinez, 2017; Pihelo and Kalamees, 2016; Pihelo et al. 2016; Kalamees and Vinha, 2003; Zarr et al. 1995).

Literature review points out that hygrothermal performance of walls are rarely searched in Turkey (Çiçek, 2002; Engin, 2005; Yücel Dalkıran, 2008; Alan, 2010; Kuş et al., 2010; Umaroğulları, 2011; Samancı, 2019; Turgut, 2019). It is observed that many of these studies are comprised contemporary materials and constructions; hygrothermal performances of traditional timber framed houses in Turkey have not been analyzed yet. Beside it is seen that these studies mostly preferred to apply WUFI for hygrothermal modelling instead of DELPHIN. WUFI, as a hygrothermal simulation tool, was developed by Fraunhofer IBP (Institute

for Building Physics) in 1995. DELPHIN is a hygrothermal simulation tool, which was developed by the Institute for Building Climatology at Dresden University of Technology (Faculty of Architecture) in 1997. These are the two leading hygrothermal simulation tools in the literature. Both of them are capable for 1D, 2D and 3D modelling by using real weather file. They have their own material library for hygrothermal performance analysis. While DELPHIN creates 2D grid for calculation and considers the gravity, WUFI creates 1D grid for calculation and does not consider the gravity for analysis.

This research focuses on hygrothermal performance analysis of the traditional timber framed brick infill exterior wall in Sivrihisar, Turkey adopting numerical modelling and laboratory study. It is aimed to examine firstly the accuracy of simulation tool results by comparing laboratory study, secondly the applicability of the laboratory and numerical methods of hygrothermal performance analysis for traditional timber framed exterior walls in long term and finally collecting data about the hygrothermal performance of the wall assembly as inputs for the improvement of approaches and intervention strategies in conservation and preservation research for energy efficiency of these buildings.

2. Materials and methodology

The method of this research is conducted on three main parts: (1) a comprehensive literature review, (2) experimental study and (3) numerical study.

The first phase of the research is started with a comprehensive literature review. The purpose of this phase is to create theoretical data about the hygrothermal performance analysis and the wall specimen design. Literature review generates the theoretical knowledge about the hygrothermal performance analysis and inputs about wall assembly design criteria.

Based on the results of literature review; the system, and layers of external wall of traditional timber framed brick infill houses in Sivrihisar were examined. The ratio of wooden and infill materials of the selected façade examples in the literature are calculated to design the wall assembly as case study.

Numerical method is the most preferred hygrothermal performance analysis methods considering cost and time efficiency. However, numerical method data requires comparison with experimental method. Most of the research adopt numerical method with the experimental method by comparing data to prove the accuracy and reliability of the results. Together with the numerical analysis data, experimental method application is necessary to validate the numerical analysis results (Asdrubali & Baldinelli, 2011). Consequently, this study adopts both numerical and experimental methods for the hygrothermal performance assessment of the wall assembly.

DELPHIN was applied for the numerical analysis of the wall assembly. It is a user-friendly simulation tool that has capability of examination of hygrothermal performance, moisture-based problem, insulation proposals, thermal performance improvement etc. Furthermore, it makes analysis about the heat, moisture, air, and salt transport in building materials. Additionally, DELPHIN is one of the mostly used hygrothermal simulation tools. A study about hygrothermal simulation tools, which includes searching on Google Scholar, Web of Science, Scopus and ScienceDirect with the keyword "(program name + hygrothermal)", states that DELPHIN is the secondly most applied hygrothermal simulation tool (Yıldız, 2021).

The experimental study has two phases: (1) material properties analysis and (2) guarded hot box analysis. Material properties analysis were conducted on Istanbul Technical University Faculty of Architecture Construction Materials Lab. Thermal conductivities of brick and timber specimens were measured by Düzce Üniversitesi Bilimsel ve Teknolojik Araştırmalar Uygulama ve Araştırma Merkezi. Guarded hot box analysis was realized in the Turkish Standards Institution Construction Materials Fire and Acoustic Laboratory. In the hot box setup, the sample to be tested is placed in the designated area between the hot and cold chambers with known ambient temperatures, and it is carried out while powering the part on

the hot chamber side at steady-state air and surface temperatures. According to these measurements, the properties of the test sample about heat conduction can be calculated. Heat exchange on the surfaces of the test sample includes transport and radiation components (Turkish Standards Institution, 2002).

The research steps are visualized on Figure 1.

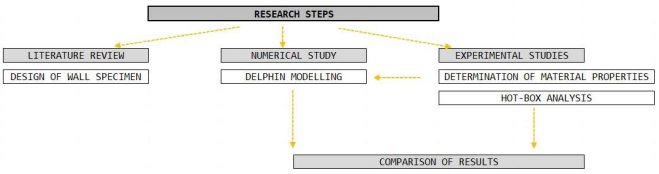

Figure 1. *The research steps.*

3. Description of wall assembly

Within the scope of the experimental study, the major phase is to design wall specimen. To investig ate the system and the layers of the traditional timber framed brick infill exterior wall in Sivrihisar, a comprehensive literature review was conducted. Specific exterior wall examples are selected to calculate the system configuration and the ratio of wooden and infill material. Afterwards, depending on this data the wall specimen is designed as 150 cm x 150 cm.

The dissertations in the preservation and restoration area were primarily examined in the analysis of the traditional timber framed brick infill exterior wall in Sivrihisar, Eskişehir. Due to the limited data in the other sources, the two resources were applied to analyze ratio of wooden and infill areas for calculation. These resources supplied required data for wall layers and drawings of façades. These drawings were re-drawn to determine wooden elements sizes and façade design.

Demberel (2012) worked on a restoration proposal in the thesis titled "The Proposal for The Restoration of Sivrihisar İbrahim Bulgurcu House". The three different parts from southeast, southwest, and northwest façades of the building, which was built with timber framed brick infill technique, were selected to make calculation for wall specimen design. The ratio of wooden area was approximately determined as 39.46% and the infill area was 60.54% on the southeast, the wooden area on the southwest was 50.99% and the infill area was 49.01%, the wooden area was 28.57% and the infill area was 71.43% on the northwest façade. While outer surfaces of the façades are not plastered, the inner surfaces are plastered (Demberel, 2012).

Figure 2. *İbrahim Bulgurcu House, Southeast façade (Demberel, 2012).*

Figure 3. *Zaimoğlu Konağı, Southeast façade (Uslu, 2003).*

Uslu (2003) studied about the restoration project of a mansion within the scope of the thesis titled "The Restoration Project of Zaimoğlu Konağı in Sivrihisar". A selected part from southeast façade of the building, which was built with timber framed brick infill technique, was examined. The wood area ratio was calculated as 40.89% and the infill area as 59.11%. While the outer surface of the façades are not plastered, the inner surface was finished with approximately 1 cm of lime

Table 1. *Data about the examined façade samples.*

	Source	Total Area of Façade cm²	Total Area of Façade Without Opening cm²	Infill Area cm²	Wooden Area cm²	Infill Area %	Wooden Area %
Examined Samples for Sivrihisar, Eskişehir	Demberel, 2012 (southeast)	114688.56	94909.04	57455.2	37453.84	60.54	39.46
	Demberel, 2012 (southwest)	145500	114720	56222.99	58497.01	49.01	50.99
	Demberel, 2012 (northwest)	84000	84000	60000	24000	71.43	28.57
	Uslu, 2003 (southeast)	270000	227388.91	134399.96	92988.95	59.11	40.89
AVERAGE						**60.02**	**39.98**

Table 2. *Data about the wall assembly.*

	Total Area of Façade cm²	Total Area of Façade Without Opening cm²	Infill Area cm²	Wooden Area cm²	Infill Area %	Wooden Area %
Wall Assembly	22.500	22.500	13224.72	9275.28	58.78	41.22

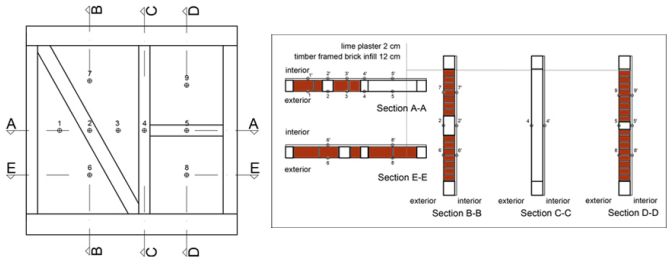

Figure 4. *The wall assembly drawings.*

plaster application on nearly 3 cm of mud plaster (Uslu, 2003).

The studied examples are explained above. The data showing results of the approximate ratios of wooden area and infill area of the selected examples are expressed in Table 1.

The results of these analysis expressing in Table1 are applied as input for wall assembly design. Even the directions of the façades are not same, these data are aimed to use to generalize the wall type for specimen design. The ratio of wooden and infill area of the wall assembly are presented on Table 2. The materials and details were determined based on the most constructed timber framed brick infill exterior wall types in Turkey in size of 150 cm x 150 cm. The layers of the wall specimen from outside to inside; timber frame brick infill 12 cm and lime plaster 2 cm.

The measurements of the wall assembly were provided with 18 thermocouples (9 thermocouples are located in cold side and 9 thermocouples are symmetrically located in warm side) placed at critical points to evaluate the intersections and interactions of different materials both vertically and horizontally. The timber frame of the wall assembly and the location of the 9 thermocouples at cold side are showed by numbers in Figure 4 on the left; layers, the sections and measurement points are placed Figure 4 on the left.

4. Experimental studies

The experimental studies of this research are based on two parts: (1) material properties analysis and (2) guarded hot box analysis.

4.1. Material properties analysis

Material properties play significant role in hygrothermal performance simulations. Hygrothermal simulation modelling influences by geometry of enclosure, boundary conditions and material properties (Delgado et al., 2013). Straube and Burnett (2001) state that outputs of hygrothermal simulation are depended on quality and availability of information, material properties, dimension (1D, 2D, 3D), time (steady-state conditions, dynamic regime conditions), climate file, construction quality. In that sense, the material properties are examined to generate accurate data for simulation phase of this study.

The laboratory analysis about bulk density, water uptake coefficient, open porosity, vapor diffusion resistance factor (μ value) and hygroscopic sorption (RH= 80%) values of the materials (brick and timber) were realized. The tested materials were randomly selected. Brick materials were purchased from a brand that makes production in Eskişehir. Timber materials were purchased from a timber company in İstanbul.

Even hygroscopic sorption values (RH= 80%) of the materials were found by the analysis, DELPHIN does not give permission to change these values on the library and they were kept as it is in DELPHIN. Therefore, the selected materials are determined depending on the closer hygroscopic sorption value (RH= 80%) found by the material properties analysis. After finding the material properties by the laboratory analysis, the similar materials of DEL-

PHIN library are edited according to these values. Other material properties seen on DELPHIN library screen were kept as they are defined.

4.1.1. Bulk density analysis

TS EN 1936 standard was applied to determine the bulk density values of the samples. For the determination of the bulk density value, the samples were dried in oven at 100°C until they reached a constant mass, and then cooled in a desiccator until they reached room temperature. The dry mass of the samples was weighed and their dimensions were measured. The bulk density of the samples is calculated with the formula below.

$$\rho_b = \frac{m_d}{a_d . b_d . l_d} = \frac{m_d}{V_d}$$

ρ_b: Bulk density of the sample (kg/m^3),
a_d, b_d, l_d: Dimensions of the dried sample (m),
m_d: Mass of the dried sample (kg),
V_d: Volume of the dried sample (m^3).

4.1.2. Water uptake coefficient analysis

TS EN 1925 standard was applied to determine the water u ptake coefficient values of the samples. For the determination of the bulk density value, the samples were dried in oven at 100°C until they reached a constant mass, and then cooled in a desiccator until they reached room temperature. The dry mass of the samples was weighed and their dimensions were measured. The samples, which were left in the room condition for one day, were weighed again. At the bottom of a container, a stand was put for the placement of the samples. Then the container was filled with water up to a height of (3 ± 1) mm and the chronometer was started. Before each weighing process, drops of water on the surface of the samples were removed for a healthy measurement. After weighing, the samples were quickly returned to the container and the same procedures were repeated at the specified time. The water uptake coefficient values of the samples are calculated with the formula below.

$$N = \frac{m_i - m_d}{A . \sqrt{t_i}}$$

N : Water uptake coefficient of the sample (kg/m^{2}s^{½}),
m_d : Mass of the dried sample (kg),
m_i : The mass of the sample that absorbed water (kg),
A : Area of surface immersed in water (m^2),
t_i : The times during which successive masses were measured (s).

4.1.3. Open porosity analysis

TS EN 1936 standard was applied to determine the open porosity values of the samples. For the determination of the bulk density value, the samples were dried in oven at 100°C until they reached a constant mass, and then cooled in a desiccator until they reached room temperature. The dry mass of the samples was weighed and their dimensions were measured. The samples, which were left in the room condition for one day, were weighed again. Afterwards, the samples were placed in the container where they were completely covered with water. And the chronometer was started. At the end of 24 hours, the saturated mass (ms) and the mass in water (mh) of the samples were recorded by weighing. The open porosity values of the samples are calculated with the formula below.

$$p_o = \frac{m_s - m_d}{m_s - m_h}$$

p_o : Open porosity of the sample (m^3/m^3),
m_d : Mass of the dried sample (m^3),
m_s : Saturated mass of the sample (m^3),
m_h : Mass in water of the sample (m^3).

The unit of open porosity is calculated as % value, but since this value is requested as m3/m3 in DELPHIN software, calculations were made by adjusting the formula accordingly. The founded value was not multiplied by 100 to have the result as m3/m3.

4.1.4. Vapor diffusion resistance factor (μ value) analysis

TS EN 12086 and TS EN ISO 12572 standards were applied to calculated water vapor diffusion resistance factor of the samples. Water vapor permeability test was realized out according to the dry cup method. CaCl2 was used as a desiccant material in the containers. The desiccator conditions used for the experiment were around 20-23°C and 95-100% relative humidity. During the experiment, the samples were weighed periodically. The water vapor diffusion resistance factor values of the samples are calculated with the formula below.

$$\mu = \frac{\delta_a}{\delta}$$

μ : Water vapor diffusion resistance factor (-),
δ_a : Water vapor permeability of air (mg/(mhPa))
δ: Water vapor permeability (mg/(mhPa)).

4.1.5. Hygroscopic sorption (RH= 80%) value analysis

TS EN ISO 12570 and TS EN ISO 12571 standards were applied for this test. The standards describe the drawing of the hygroscopic water absorption curve of building materials and products considering different relative humidity values. DELPHIN software requires the hygroscopic sorption value at 80% relative humidity. However, since there is no test condition defined for this relative humidity condition, 75% and 85% relative humidity conditions specified in the standard were provided to obtain this value, and the hygroscopic sorption value of the materials at 80% relative humidity was found by taking the average of these values.

Appropriate saturated aqueous solutions were created as described in the standard to provide the required relative humidity in the desiccator. Two different solutions were prepared separately to have two different relative humidity values in the desiccators. NACI was used to create 75% relative humidity conditions and KCl was used to create 85% relative humidity conditions.

3 samples for each material, which are prepared as 5x5x5 cm and not less than 10 g, were dried in oven at 100°C until they reached a constant mass, and then cooled in a desiccator until they reached room temperature. Weighing was carried out periodically.

The moisture content by volume, ψ, of the samples are calculated with the formula below.

$$u = \frac{(m - m_d)}{m_d}$$

$$\psi = u \frac{\rho_b}{\rho_w}$$

u: Moisture content by mass (kg/kg),
m: Mass of the sample (m^3),
m_d: Mass of the dried sample (m^3)
ψ: Moisture content by volume (m^3/m^3),
ρ_b: Bulk density of the sample (kg/m^3)
ρ_w: Density of water = 997,6 (kg/m^3).

4.2. Guarded hot box analysis

The wall assembly was constructed by 150 cm x150 cm (h x b) in the Turkish Standards Institution Construction Materials Fire and Acoustic Laboratory. The wall assembly was waited to get dry naturally. Then the wall assembly was put in drying oven for 7 days till its weight got stabilized. Afterwards, the wall assembly was kept under the room conditions for 1 day. Following, thermocouples were installed on the wall as shown in Figure 4 and the wall assembly was installed to guarded hot box between two climatic chambers. Figure 5 presents the experimental study in the laboratory.

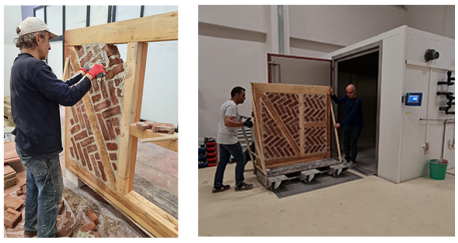

Figure 5. *Photos presenting construction and drying oven process of experimental study in Turkish Standards Institution Construction Materials Fire and Acoustic Laboratory.*

The warm climatic chamber was arranged as Twarm: 20°C, and the cold climatic chamber was arranged as Tcold: 0°C. The climatic chambers were automatically controlled to keep constant temperature value. The relative humidity of the chambers was set as 50%. The duration of the test was 143 hours.

5. Numerical modelling: DELPHIN hygrothermal simulation tool

The outputs of the laboratory measurements are applied for the validation of DELPHIN simulation tool for the hygrothermal performance analysis of the wall assembly. The measurement points for simulation are determined as same with hot box apparatus measurement points shown in Figure 3.

For simulation process in DELPHIN, a dialog for automatic discretization should be created. In this dialog, the construction is discretized as minimum element size 1 mm, maximum element size 50 mm and stretch factor 1.6. The dialog generates a grid for calculation.

5.1. Boundary conditions

Boundary conditions were arranged as same with guarded hot box analysis for comparison of the data. DELPHIN simulations were realized under the steady state conditions to compare guarded hot box analysis

with DELPHIN hygrothermal modelling. Therefore, boundary conditions were determined same as with guarded hot box analysis conditions which is advised in TS EN ISO 8990. Indoor environment was arranged as T_{indoor}: 20°C, RH_{indoor}: 50%, outdoor environment was arranged as $T_{outdoor}$: 0°C, $RH_{outdoor}$: 50%. The initial temperature was set at 20 °C and the relative humidity at 50%. The orientation of the wall assembly was arranged to 0 Deg for North and the inclination to 0 Deg for Section A-A, 90 Deg for Section B-B and Section C-C. The effect of rain and solar radiation on the walls in the south and west directions cause complicated effects for the comparison studies (Borderon et al., 2016). Because of the elimination of these effects, it is supposed that the wall assembly is facing northwards. The guarded hot box measurements were stabilized after 143 hours. Therefore, the duration of the simulation was arranged as 143 hours.

The hygrothermal performances of the wall assembly is evaluated by analysis of temperature, relative humidity, and U-value.

5.2. Material properties

Assigning materials for hygrothermal simulations has critical impacts on illustrating the real conditions. Therefore, except the lime plaster properties of used materials for wall assembly were analyzed in the laboratory and defined as presented in the headline of "4.1. Material Properties Analysis". Thereafter defining the sections of wall assembly by sizing and layers, materials were assigned to the models by editing the similar materials of DELPHIN library with determined material properties. The material properties of the assigned materials in DELPHIN is presented in the Table 3.

For lime plaster DELPHIN library was used to assign material properties. The assigned material number for lime plaster is 148 named as lime plaster (historical).

Table 3. *Material properties.*

Layer of wall specimen	Thickness (cm)	Edited material ID no in DELPHIN library	Assigned material properties determined by laboratory analysis				
			Bulk density (kg/m³)	Water uptake coefficient (kg/(m²·s$^{0.5}$))	Open porosity (m³/m³)	μ value (-)	Thermal conductivity (W/mK)
Timber	12	714	800.1306	0.0200	0.0376	164.6604	0.1823
Brick	12	686	1655.5502	2.9999	0.2956	16.5792	Cannot be measured. DELPHIN library value was assigned.

Table 4. *The summary of comparison temperature value of laboratory test and numerical modelling.*

Thermocouple no	Measured – Temperature (°C) Warm side	Simulated – Temperature (°C) Warm side	Differences	Differences (%)	Measured – Temperature (°C) Cold side	Simulated – Temperature (°C) Cold side	Differences	Differences (%)
1	19.86	13.10*	-6.76	**-34.04**	0.65	3.30*	2.65	**407.69**
2	16.06	15.42*	-0.64	-3.99	1.75	1.46*	-0.29	-16.57
		16.16**	0.10	0.62		1.43**	-0.32	-18.29
3	14.71	13.14*	-1.57	-10.67	2.93	3.3*	0.37	12.63
4	20.51	15.63*	-4.88	**-23.79**	2.25	1.56*	-0.69	**-30.67**
		16.76***	-3.75	-18.28		1.52***	-0.73	**-32.44**
5	17.26	16.76*	-0.5	-2.90	1.23	1.51*	0.28	**22.76**
		14.83****	-2.43	-14.08		1.587****	0.35	**28.46**
6	15.51	12.98**	-2.53	-16.31	3.33	3.30**	-0.03	-0.90
		13.04*****	-2.47	-15.93		3.30*****	-0.03	-0.90
7	14.97	12.98**	-1.99	-13.29	3.21	3.3**	0.09	2.80
8	15.07	12.95****	-2.12	-14.07	3.90	3.29****	-0.61	-15.64
		12.96*****	-2.11	-14.00		3.29*****	-0.61	-15.64
9	14.97	12.95****	-2.02	-13.49	1.98	3.29****	1.31	**66.16**

* The value refers to simulation of Section A-A.

** The value refers to simulation of Section B-B.

*** The value refers to simulation of Section C-C.

****The value refers to simulation of Section D-D.

***** The value refers to simulation of Section E-E.

6. Results and discussions

The evaluation includes the comparison of guarded hot box analysis and DELPHIN hygrothermal modelling. The temperature and U-value of these analysis are compared for validation of the data. U value is calculated according to the national standard of thermal insulation requirements for buildings in Turkey, TS825. The recommended U value in the standard is 0.48 W/m2K for the exterior wall in Eskişehir.

Firstly, temperature values of guarded hot box analysis and DELPHIN numerical modelling are examined. Total

Table 5. *The output of U value of the guarded hot box analysis and DELPHIN hygrothermal modelling comparison.*

	Thermal conductivity (W/mK)	U-value (W/m²K)
Wall assembly (guarded hot box)	-	1.790
Section A-A	0.210	1.200
Section B-B	0.210	1.200
Section C-C	0.210	1.200
Section D-D	0.210	1.200
Section E-E	0.210	1.200
	U-value differences between measured-simulated	-0.590
	Differences between measured-simulated (%)	-33.23

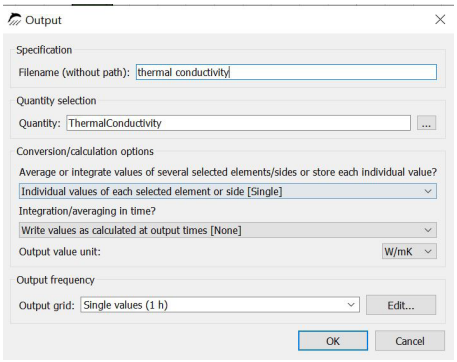

Figure 6. *DELPHIN generated thermal conductivity values as outputs of simulations.*

of 18 measurements points locating symmetrically inside and outside of the wall assembly supplies data. Figure 2 presents the detailed information about the measurement points and sections of the wall assembly. The measured and simulated values of temperature at the end of 143 hours are expressed in Table 4.

Due to the measured data of number 1 cold side is differed too much from the other measured data of cold side, this value is not regarded for data analysis to prevent misinterpretation. Except from 1 (warm side), 4 in Section A-A (warm side), 4 (cold side), 5 (cold side) and 9 (cold side), the difference between measured and simulated values is mostly around 15%.

In order to examine the data accurately, the results are evaluated by material differences and section points. Therefore, the measurement points are classified according to their materials and intersections. The first group is listed as 1,3, 6, 7, 8 and 9 measurement points which are located infill parts. The compared data of these points show

that except form measurement point 1 (warm side) and 9 (cold side), the differences between measured and simulated values are approximately 15%. The differences in measurement point 1 (warm side) -34.04%. The differences in measurement point 9 (cold side) 66.16%. On the other hand, the differences decrease in measurement point 6 and 7 on cold side as around 1-2%.

The second group is 2 and 5 locating wooden elements between infill parts. On the warm side the differences between measured and simulated values are closed to 2%. However, in measurement point 5 (cold side) the difference is 22.76%. On the cold side, the differences between measured and simulated values of 2 is between -16.57%.

The third group includes measurement point number 4 locating on the wooden stud. Except from Section C-C (warm side), the differences between measured and simulated values of 4 are between -20% and -30%. On warm side the differences between measured and simulated values of 4 (Section C-C) is -18.28%.

Following, U-values of the guarded hot box analysis and DELPHIN hygrothermal modelling are expressed in Table 5.

The U-value of the wall was measured as 1.790 W/m2K by the guarded hot box apparatus. DELPHIN generated thermal conductivity values as outputs of simulations (Figure 6).

Afterwards, U-value was calculated as 1.200 W/m2K according to the outputs. The difference between measured and simulated U values is -33.23%.

The first part of this study presents the evaluation laboratory test and numerical modelling comparison in terms of temperature and U values. It is clear that the materials intersections and interactions varying plays significant role

to examine the results. The data show that the measured and simulated values are affected directly the wooden parts. The differences of the measured and simulated values increased on these measurement points (4 and 5). In contrast to that measurement point 2 does not behave same with these two points. Here, it is assumed that the distances between wooden studs may play role for the variation. For the measurement points on infill part, it is observed that the differences between measured and simulated values are mostly closed to 10-15%. Regarding these measurement points, it may be accepted that there is a good agreement with the measured values and simulated values. Material properties of brick and its smooth surface may have effects on the data. In contradistinction to that circumstance, the differences between measured and simulated values of measurement points 1 (warm side) and 9 (cold side) are not closed to each other. The reason may depend on the gaps between infill and lime plaster. Because in these parts, a smooth and voidless surface cannot formed perfectly. Therefore, these voids may have impacts as an air circulation paths throughout the wall. In addition, workmanship has a critical role. Even the wall assembly constructed attentively, it is impossible to construct it well as assumed in the simulation. Furthermore, the differences between measured and simulated values decrease on the warm side of the wall assembly. It is assumed that lime plastered finishing layer of the warm side may act as a factor to be a smooth and voidless surface.

Within the scope of this study, material properties were assigned for the simulations by editing determined values of the selected materials in DELPHIN library. The simulation data is applied to compare guarded hot box analysis and numerical modelling. In that case, the material properties play crucial roles as being same with the constructed wall specimen and the simulated wall assembly for certain data. It gives opportunity to examine the results regarding accuracy and validation. It creates a data for analysis of hygrothermal performance of the wall assembly with same inputs by two different method application. For the further studies, this consideration is required to be applied for different types of wall assemblies to clarify the impacts of material variations, interactions, and intersections of different materials.

The results of both guarded hot box analysis and DELPHIN model show that U value of the wall assembly cannot achieved the recommended value in TS825. Considering this result, it is critical to improve the U value of the wall assembly by conserving its historical, architectural, cultural, and social values. Because of it requires a comprehensive study, insulation proposals for the improvement are not discussed in this research. Merely, it may be important to specify the beneficials of natural based insulation materials for these types of improvements. Besides, to preserve the originality and uniqueness of the outer surface the wall, it is crucial to consider insulation material application to the inside of the wall. However, moisture-based problems in the long-term requires to be analyzed in detail.

7. Conclusion

The aim of this research is to investigate hygrothermal performance of traditional timber framed brick infill exterior wall in Turkey by experimental and numerical methods. This research contributes to make discussions about the hygrothermal performances of traditional timber framed brick infill exterior walls in Turkey and also applicability of simulation tools with experimental methods. The expected outcome of this research is to generate a significant source to be applied for the conservation/restoration/reconstruction projects of traditional timber framed houses as a tool.

The results shows that experimental study has a critical to accuracy of numerical modelling for hygrothermal performance evaluation. Particularly, material variations create unexpected impacts on the wall layers. The intersection and interaction points of different materials are needed to be deeply analyzed by experimental and numerical methods.

The simulated values have good agreements with measured values on the infill parts of the wall assembly. Contrary, the differences between mea-

sured and simulated wooden parts of the wall assembly are subjected to discuss.

Application of material properties both experimental and numerical studies supply a valuable data are for further studies to both validation of numerical modelling and also long-term performance analysis. However, different types of wall assemblies with numbers of examples are needed to be examined.

The scope of this research does not include long term hygrothermal performance of the wall assembly with climatic data. However, the study is subjected to investigate the hygrothermal performance of the wall assembly with climatic data in terms of temperature, relative humidity, and U Value outputs. Especially, with this work it is expected to create a comprehensive data for moisture-based problem analysis. Additionally, field measurements of specific buildings may be applied for comparison of experimental and numerical studies.

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Rethinking the surface design: How to prevent playground related extremity injuries in children

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Abstract
Public playgrounds are specially designed spaces for children to play and develop; however, falls are significant causes of children's injury and are one of the most common mechanisms of injury in emergency departments. The study aims to survey the playground-related mechanism and incidence of extremity injuries in children and rethink the falling surface as designable equipment.
The retrospective observational study enrolled 90 children who are injured in playgrounds and visited the emergency department in Istanbul between 2019 and 2020. Later, an observational study was conducted in public playgrounds within the neighborhood boundaries of the emergency department. The results show that the most common playground equipment related to the injury is slides and the most common surfacing material is rubber. The majority of total injuries were classified as upper extremity, and wrist fractures were the predominant injury type. The result of this study shows even with impact-absorbent surfacing such as rubber, fractures occur in children who fall from a certain height. To prevent these falls, rethinking the surface as designable equipment under high play equipment may help slow the fall.

Keywords
Playground design, Child injury, Falling space, Play equipment, Surface material.

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1. Introduction

More than one billion children live in cities as a result of increasing urbanization in the world (UNICEF, 2012). According to the United Nations, 6 out of 10 children will live in cities by 2025 in developed countries (UNDP, 2000). However, the built environment limits the physical activity of children (Davison & Lawson, 2006; Duncan et al., 2005; Humpel et al., 2004; Saelens et al., 2003; Sallis et al., 1998). Unplanned urban development negatively affects child development and cities are insufficient to meet children's needs. As urban space becomes inefficient and dangerous, children needed gated areas.

According to the researches, it has been revealed that the environment guides children's development they are in during the growth period, and the behavior patterns of the children are determined by the places they are in rather than his personal characteristics (Barker, 1968; Bechtel, 1977; Wicker, 1979). Urban space and children's playgrounds are of great importance in the physical, mental and social development of the child.

Playgrounds are developed to offer child's safe play opportunities in a growingly industrialized society away from traffic and other hazards. They are special spaces to realize the activity of play and have a major role in children's social, cognitive, physical, and psychosocial development (Macarthur et al., 2000; Norton et al., 2004). Playgrounds allow children to recognize themselves and their environment, and help to develop their concentration, sense of responsibility, and social relationships in the community (Chamberlin, 1998). Since play has a great role in a child's life, playgrounds should offer a safe environment. But, if these areas are not designed with significant criteria, they can cause severe injuries and traumas that affect a child's development negatively. Although they do not result in death, they may cause lifelong disability for children.

Safety is an important design problem to be considered in children's playgrounds, and it becomes even more important in playgrounds that appeal to younger age groups. Each year, thousands of children are treated in the emergency departments for playground-related injuries. Approximately 45% have resulted in serious injuries such as severe-fractures, internal injuries, concussions, dislocations, and amputations, and among the nonfatal injuries related to playgrounds, 75%

Figure 1. *Playground equipments and surfacing types such as (1) sand (2) grass (3) dirt and (4) rubber.*

of them occur in public playgrounds (Tinsworth & Mcdonald, 2001).

Ensuring safety in playgrounds depends on play equipment, surfacing, the design of the playground and other elements (Hendricks, 2001). Surfacing has been the focus within playground designs in recent years, as it is defined as the falling space when located under play equipment. The required dimensions and the materials of the falling space differ according to the play equipment (Figure 1). The falling space does not intend to protect the child from injuries, but the surface material may increase or reduce the severity of the injury. However, even with recent impact-absorbent surfacing, such as rubber, which is widely used, playground injuries still occur on a large scale. Therefore, the falling space can be regarded as designable equipment to reduce injuries.

The aim of this study is to determine the mechanism and incidence of injuries related to playground equipment and surfacing, which causes children to be injured most, and recommend design ideas to prevent these injuries. The retrospective observational study enrolled 90 children who were injured in playgrounds and visited an emergency department in Istanbul between 2019 and 2020. Later, an observational study was conducted in eight public playgrounds to examine the equipment types and surfacing materials within the close boundaries of the neighborhood where the hospital locates.

This study centers on the interaction between public playground equipment and the surface type and children's injury and intends to propose design as a tool to prevent these injuries. The remainder of this paper is organized as follows: Section 2 introduces children's playgrounds and related studies. Section 3 gives the data and the method. Section 4 gives the results of the study under (1) extremity injuries in children related to playground equipment and surfacing, and (2) case study of playground equipment and surfacing, Section 5 discusses the results with design recommendations for falling space, and finally, Section 6 gives a conclusion.

2. Children development and playgrounds

Environmental factors affect children from their birth. For the healthy development of children, physical and social environmental factors must meet their needs (Yazıcı, 2004). Children's social environment is first formed by their families, and then by the people they interact with at school and on playgrounds. The socialization of the child is affected by spatial factors as well as individuals. Since the child is the future of society, including children in spatial designs is important for the development of the child and, therefore, for society (Tandogan & Ergun, 2008).

Play is the child's way of integrating with the world (Zengin, 2001). It is the whole of the activities that children develop in their spare time. The child discovers his own nature and abilities with the help of play (Herrington, 1998). Numerous studies indicate the importance of play in children's life. Play enables the child to recognize his emotional, physical, and intellectual potential (Yılmaz & Bulut, 2003). Play encourages children to explore, take risks, learn by doing wrong, and think creatively. Play makes learning fun for the child (Ashton & Lewis, 2001). According to Hüttenmoser and Degen-Zimmerman (1995), retardation was found in the personal and social development of children whose free movement abilities were restricted.

It is argued that children who grow up deprived of the opportunity to play outdoors have neurotic personalities in the future, as their instinctive energies are aggressive due to the suppression of their bodily and cognitive energies (Koptagel, 1978). The child needs natural play environments; natural play environments are diverse, abstract from the concept of time, and provide more freedom (Prescott, 1987). Due to the benefits of play in child development, children's playgrounds are indispensable in urban spaces.

Furthermore, certain researches indicate that the built environment restricts the physical activities of children and young people (Davison & Lawson, 2006; Duncan et al., 2005; Humpel et

al., 2004; Saelens et al., 2003). Lack of physical activity in children is considered one of the most important risks that will lead to future diseases, such as heart failure (Andersen et al., 2004). Children's playgrounds are key places that will help increase physical activity. Thus, to support these developments, they must be safe and not cause further injury.

2.1. Safety in children playgrounds

Safety is a critical design problem to be considered in children's playgrounds. It becomes even more important in playgrounds that appeal to small age groups. According to the National Program for Playground Safety (1996), most playground-related accidents occur as a result of children playing with play equipment that does not appeal to their age group. Thus, children fall from higher elements and get injured.

Falls are an important cause of playground-related children's injuries and are one of the most common mechanisms of injury in emergency departments. A growing number of researches have emerged in recent date literature on playground-related injuries. Some studies have researched the role of surface materials on safety, while different studies have searched for falls related to playground equipment. Falls are regarded as 25%-52% of all treated child injuries (Migneault et al., 2018), and 67% of playground injuries are caused by falls from equipment to the ground (Chalmers et al., 1996). Out of the 147 children who died from playground-related injuries between 1990 and 2000, 31 of them were a result of falls to the playground surface (Tinsworth & Mcdonald, 2001).

Playground-related injuries mostly depend on fall height and surface area, with 2.6-3 injury odds for fall height, and 2.3-18.2 injury odds for surfaces (Chalmers et al., 1996; Laforest et al., 2001; Macarthur et al., 2000; Mowat et al., 1998). Studies have shown that playground equipment higher than 150 cm has higher injury rates (Ball, 2002; Phelan et al., 2001; Vollman et al., 2009). Another study revealed that equipment above 200 cm has a nearly 2.56 times higher injury rate compared to equipment lower than 150 cm (Laforest et al., 2001). The same study indicates that the injury risk is similar for play equipment heights of less than 1.5 m and 1.5-2 m; however, the risk increases 1.5 times for equipment higher than 2 m (Laforest et al., 2001). Non-impact-absorbing surfaces such as asphalt and concrete have a greater risk of injury compared to impact-absorbing surfaces, such as sand, rubber, and gravel (Chalmers et al., 1996; Howard et al., 2009; Mott et al., 1997; Sosin et al., 1993). Although children's mortality rate due to a fall is unusual, the hospitalization ratio is high (Khambalia et al., 2006). Almost three million children who fall apply to the ED every year and related injuries are the second major cause of pediatric hospitalization (Committee on Injury and Poison Prevention, 2001). Suecoff (1999) showed that playgrounds in low-income areas host more hazards than high-income areas because of rusty play equipment and damaged fall surfaces.

Mott et al. (1997) stated that the risk of injury due to a fall from monkey bars was 2 times greater than the climbing frames and 7 times greater than the swings or slides. Bae et al. (2017) indicated that out of 6.110 children who were injured in a playground, 40,5% were related to slides, and 18% were related to swings. Concussions were associated with children aged 0-2 and swings, while hand and arm fractures were associated with children aged 3-7 years and climbing elements. Horizontal bars, stretched ropes, and trampolines were mostly related to foot and leg fractures.

Critical fall height for a playground is the maximum height of fall from play equipment to the ground and is measured through impact testing, which evaluates the shock-absorbing properties of surfacing material. Equipments higher than 60 cm require an impact-absorbing surface under them and the critical fall height of the surfacing must be equal to or greater than the play equipment's fall height, while the fall height should not exceed 300 cm (BS EN 1177, 2018; TS EN 1176-1).

In the United States, ASTM (American Society for Testing and Materials Standards) creates playground surfac-

ing standards for public playground surfacing to prevent severe injuries. In Public Playground Safety Handbook (CPCS, 2015) which complies with the ASTM standards, the critical fall height of different play equipment is defined. The Handbook divides playground users into three groups: Toddlers (0-2 years of age), preschool children (2- to 5-years-olds), and school-age children (5- to 12-years-olds), and it offers maximum heights for age-appropriate equipment. In general, the maximum height of equipment according to age groups is 81 cm high for toddlers, 150 cm high for 2-5 years old, and 240 cm high for 5-12 years old. Pivot points of swings should not be more than 240 cm, the same height is valid for slides. According to the handbook, some equipment is not recommended for some age groups, such as balance beams for toddlers.

In Turkey, TS EN 1176 Series standards have been accepted and published as Turkish Standards to determine the safety conditions for children's playgrounds. Accordingly, the maximum fall height for the swing should be ≤ 1500 mm, for the carousel it should be ≤ 1000 mm, and for the seesaw, it should be ≤ 1500 mm. The standards indicate that the free fall height can be up to 3000 mm with the appropriate surfacing thickness (Turkish Standard Institute, 2018).

In the context of playgrounds, the shock absorbance of a surface has gained more importance in recent years to prevent injuries caused by falls from a certain height. Shock absorbing refers to impact attenuating, which is directed to the reduction of head injuries. The maximum HIC (Head Injury Criterion) value is 1000 and the g-max value is 200 for impact protection materials on playgrounds (ASTM Standards F1292-13). A shock-absorbing surface aims to reduce head injuries as well as other playground-related extremity injuries.

There are different surface materials used in playgrounds that are shock-absorbing. Some of them are loose-fill materials such as gravel, sand, rubber mulch, and wood chips. Rubber mats, tiles, and other poured-in-place materials are unitary materials. Every material has a different shock-absorbing ability. The installation depth standards of the surfacing and height of the play equipment differ according to the ability. Some of the materials are accepted as a good fall-attenuating surface material, while others are more dangerous if the fall height within the playground is greater than a certain number of meters.

Certain studies have reported results for impact attenuation of playground surfaces. Over the years, the results of the studies differ according to material performances that improve over time. Ramsey and Preston (1990) focused on the Impact Attenuation performance of wood mulch, wood chip, sand, and gravel, and manufactured mats, asphalt, and concrete as playground surfacing. Lewis et al. (1993) aim to evaluate playground surfaces with respect to impact attenuation and resulted that wood chips were the best alternative rather than sand, grass, gravel, and synthetic mats. Mack et al. (2000) studied loose-fill playground surfaces and their result indicated that shredded rubber was better than sand, wood fibers, and wood chips; while pea gravel was the poorest. Recent studies show that bark surfacing, such as rubber mulch, is the safest material for playgrounds with high fall risk (CPSC, 2015; Davidson et al., 2013). Also, wood chips, sand, and pea gravel are no longer appropriate to use as playground surfacing because they are not accessible in compliance with the Americans with Disabilities Act. According to Public Playground Safety Handbook, grass and dirt are not recommended as surfacing under playground equipment (CPSC, 2015).

Fractures commonly occur in almost one-third of children (Cooper et al., 2004), and certain types of fractures may unfortunately have negative consequences for children's future bone health. Fractures may result in nerve damage, decreased strength, related joint suffering, anxiety, and even depression (Morzaria, 2016). It may also prevent children from certain activities for the rest of their lives, which may result in developmental delays. A study showed that children who suffered from forearm fractures had lower bone strength compared to other children,

and lower bone strength further results in future fractures from weakened bone (osteoporotic fracture) (Farr et al., 2014). Especially children over 10 years who were injured by fractures had long-term negative effects, thus suggesting not tolerating such dislocations (Zimmermann et al., 2004). On the other hand, younger children may have development problems if they suffer from growth plate injuries, and can have crooked or slightly longer or shorter arms or legs (Kruse & Dubowy, 2018).

Certain researchers have studied the relationship between psychological-behavioral characteristics and fractures in children. Stancin et al. (2001) examined child and family outcomes of pediatric traumatic fractures and observed functional limitations in children and increased family stress after the child injury, especially with lower extremity fractures resulting in more negative impact. Zheng et al. (2014) compared children hospitalized for fractures with a control group of children without fractures, and found that more children displayed more psychological and behavioral problems in the fracture group than in the control group with higher scores for restlessness, aggression, depression, and violation of discipline. A recent study demonstrated that long bone fractures result in fear of falling thus limiting participation in physical activities, anxiety about aesthetic appearance, post-traumatic stress disorder, acute stress disorder and depression, and impacting social life by restricting certain activities (Singaram & Naidoo, 2019). Considering all these long-term negative effects, it is important to prevent playground injuries.

Children's injuries and fractures are important preventable causes of morbidity and mortality (Baker et al., 2015), and long-bone fractures indicate more severe injuries (Cryer et al., 1990). Although certain studies support risky play for children's development, mental health, and physical health (Brussoni et al., 2012; Engelen et al., 2013; Sandseter & Kennair, 2011); it has also resulted in injury or even death (Brussoni et al., 2015). Therefore, safety against falls is the primary criterion to be considered in a playground design. Studies indicate that even if the surfacing material improves, the injuries continue to happen. Apart from materials, designers can produce other solutions by using design as a tool to prevent these injuries.

3. Method and case study

Two important risk factors for playground-related injury are the height of the play equipment from which the children fall, and the surface material where they fall (Chalmers et al., 1996; Macarthur et al., 2000). Therefore, this study focuses on (1) the injury type after the fall and (2) the surface material where children land. It later demonstrates a case study to further investigate public playgrounds in terms of play equipment and surface material.

3.1. Method

This study focused on cases of children with playground equipment and surfacing as the cause of injury. In this study, 90 children who were injured during a play in a public playground between June 2019 and December 2020 and applied to the emergency department of a Level 1 trauma center were examined retrospectively. The data was extracted from ED visits for falls in children to 18 years of age, and descriptive statistics were used to notify the frequencies of injuries. All ED visits from June 2019 and December 2020 were manually reviewed. All children who presented with a fall in a public playground were included. Subsequent visits for the same falls suffered by children with a head injury and minor bruises were excluded. Injured children were retrospectively examined by gender, age, injury-inducing factor, injury mechanism, injured body part, injury-causing playground equipment type, and surfacing material. There was no 2-year-old child and no children older than 14 years of age among the patients who were registered as playground injuries.

In the case study research, an observational technique was used at a total of eight public playgrounds present in the close neighborhoods of the emergency department. Playgrounds were

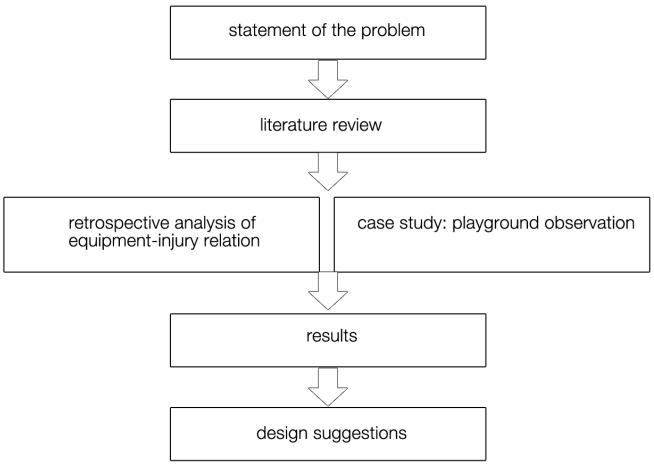

Figure 2. *The flow diagram of the study.*

examined according to equipment type and surfacing material in terms of flexibility. The playgrounds in Istanbul are not diverse and usually use the similar mass-produced play equipment. For this reason, the case study playgrounds give similar information about the general and are selected for observation (Figure 2). This study was reviewed and approved by the Research Ethics Board from the local institution.

3.2. Research area

Istanbul is the most populated city in Turkey, and it continues to receive migration from all over the country due to its economic and cultural opportunities along with health services. The problems caused by rapid population growth and unplanned urbanization are intensely experienced, and children cannot adequately meet their needs because of the decreasing amount of public green areas. As a result of population growth and urbanization, green areas lose their characteristics and are assigned different land use. An increase in traffic load makes the streets of Istanbul more dangerous for children. The social and cultural development of the child is negatively affected by isolation from the urban space.

Sancaktepe district has become a center of attraction and is one of the districts that suffered the most from the intense immigration from other cities. Sancaktepe is located on the Anatolian side of Istanbul, with Çekmeköy in the north, Kartal and Maltepe in the south, Sultanbeyli and Pendik in the east, and Ümraniye and Ataşehir in the west. The district was named "Sancaktepe" in the 2009 local elections and was formed by the merging of Samandıra, Sarıgazi, and Yenidoğan Districts in 2009. A large part of the district is located within the boundaries of the Ömerli Drinking Water Basin. Its proximity to strategic points such as Sabiha Gökçen Airport and highways has made the district spatially important.

Sancaktepe has a population density above the average of Istanbul, with its total population, and almost one-third of the population consisting of children under the age of 18 (Tepe, 2018). The district has 19 neighborhoods with 80 public parks; some of them have public playgrounds. Although public playgrounds exist numerically, their

Figure 3. *Sancaktepe District in Istanbul.*

quality is debatable. Children cannot adequately meet their needs for development, and they also experience injuries. The emergency department of the Level 1 trauma center where the study was conducted is located in the Emek Neighborhood in Sancaktepe District. Meclis, Emek, and Sarıgazi Neighborhoods are examined in terms of public playgrounds (Figure 3). Eight different public playgrounds were used for observations of surfacing materials. The types of playground equipment and surface materials are listed. Each playground had a variety of equipment different in height. Observations were recorded through photographs and notes.

4. Results

4.1. Extremity injuries in children related to playground equipment and surfacing

In total, 90 playground-related incidents were examined. Females and males equally accounted for 50% of playground-related injuries. There was one child as a toddler, twenty-three children in the 2-5 age group, and fifty-nine children in the 6-12 age group. Two children were 13 years old and five children were 14 years old. One male child was in a toddler group. In the 2-5 age group, 69% accounted for females, while 66% of children above 5 years old were males. %69 of injuries in the 2-5 age group and 83% of injuries above 5 years old were classified as an upper extremity.

The playground equipment involved in injuries was slides (35.6%), swings (18.9%), monkey bars (17.8%), teeter-totters (8.9%), and spinners (4.4%). 14.4% of all injuries occurred while running. The majority of total injuries (80%) were classified as an upper extremity (Figure 4). Wrist fractures were the predominant injury type, accounting for 27.8% of all injuries, followed by elbow fractures (22.3%), soft tissue traumas (16.7%), forearm fractures (10%), fractures of the ankle (6.7%), foot fractures (4.4%), shoulder fractures (3.3%), hand finger fractures (2.2%), thigh fracture (1.1%) and leg fracture (1.1%). Also, there are 4 children with multiple fractures, two of them have a fracture of both wrists (2.2%), one of them had elbow and ankle fractures (1.1%) and one of them had elbow and wrist fractures (1.1%).

The largest proportion of wrist fractures occurred on slides (36%), followed by swings (24%), monkey bars (16%), and teeter-totters (8%). 16% of wrist fractures occurred while running. Elbow fractures were the predominant injury type on slides (40%), followed by swings (20%) and monkey bars (20%) equally, and teeter-totter (5%). 15% of elbow fractures occurred while running. Soft tissue traumas are distributed more evenly between play equipment. They occurred on monkey bars (26.7%) and while running (26.7%), followed by slides (21%), slides (13.3%), monkey bars (6.6%), and spinner (6.6%). Forearm fractures occurred most frequently on slides (22.3%), monkey bar (22.2%), and teeter-totters (22.2%), followed by swing (11.1%), spinner (11.1%), and while

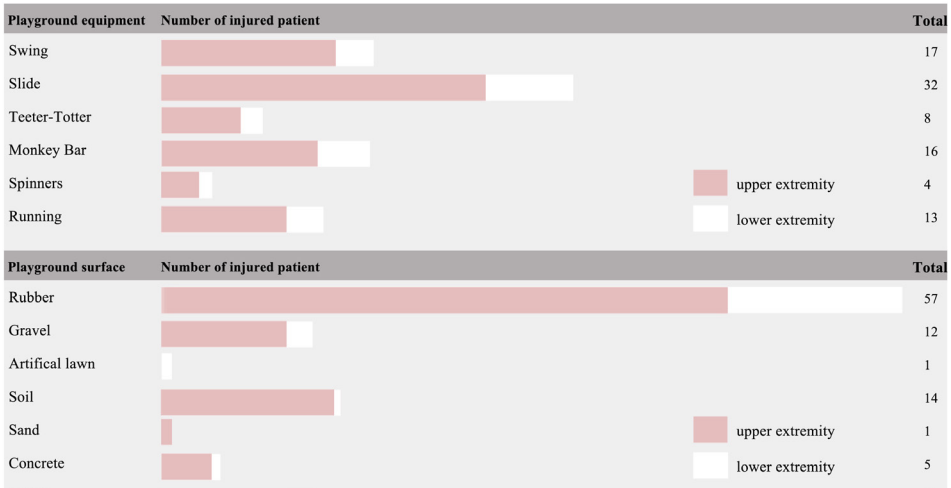

Figure 4. *The amount of injuries depending on the play equipment and surfacing.*

running (11.1%). The majority of ankle fractures occurred on a swing (33.3%) and teeter-totter (33.3%), followed by monkey bars (16.7%) and while running (16.7%). Foot fractures were the predominant injury type on the teeter-totter (50%), followed by slide (25%) and spinner (25%). Shoulder fractures occurred on slides (66.6%) and spinner (33.4%). Hand-finger fractures occurred on the slide (50%) and swing (50%). A thigh fracture occurred on the slide, and a leg fracture occurred on the swing. The playground equipment involved in both wrist fractures was the slide. The child with elbow and ankle fractures is reported to fall from the slide; while another child with elbow and wrist fractures fell from the monkey bar.

The largest proportion of injuries (57 of 90 [63.3%]) occurred on rubber surfaces followed by soil (14 of 90 [15.6%]), gravel (12 of 90 [13.4%]), concrete (5 of 90 [5.5%]), sand (1 of 90 [1.1%]), and artificial lawn (1 of 90 [1.1%]) (Figure 5). This also reflects distribution of the surface material in public playgrounds in Istanbul. The largest proportion of wrist fractures occurred on rubber (29.9%), followed by elbow fractures (21%), soft tissue traumas (12.3%), forearm fractures (10.6%), ankle fractures (8.8%), foot fractures (5.3%), shoulder fractures (5.3%), and thigh fracture (1.7%), leg fracture (1.7%), hand finger fracture (1.7%) and both wrist fractures equally (1.7%). In soil, wrist fractures (28.5%) and soft tissue traumas (28.5%) occurred equally, followed by elbow fractures (21.4%) and forearm fractures (14.2%). Reported multiple trauma injuries, including both elbow and wrist fractures have occurred on soil surface. Wrist fractures (33.3%) and elbow fractures (33.3%) were the predominant injury type on gravel, followed by soft tissue traumas (25%). Reported multiple trauma injuries, including both elbow and ankle fractures have occurred on gravel. On concrete, an elbow fracture, a hand finger fracture, a forearm fracture, an ankle fracture, and a soft tissue trauma occurred equally. The playground surface material involved in poly-trauma with both wrist fractures was sand. Lastly, the injury that occurred on the lawn was a foot fracture.

On the rubber surface, the injuries occurred most frequently on slides (40%), swing (15.9%), and monkey bar (%15.9) equally, followed by teeter-totter (14.1%), running (8.8%), and spinner (5.3%). On soil, out of 14 injuries, they occurred most frequently on a swing (28.5%) and monkey bar (28.5%) equally, followed by slides (21.5%), running (14.3%), and spinner (7.2%). Out of 12 injuries, running was the main mechanism of injury (33.4%) on gravel, followed by swing (25%) and slide (25%) equally, and monkey bar (16.6%). Running (40%) was most commonly involved in a total of 5 injuries reported on a concrete surface, followed by swing (20%), slide (20%), and monkey bar (20%) equally. Lastly, the slide was the only equipment involved in injuries on sand and lawn.

4.2. Case study of playground equipment and surfacing

As mentioned in previous chapters, injuries are closely related to the surfacing materials of the playgrounds. After the retrospective observational study in the emergency department, the purpose of the case study documentation was to determine the physical characteristics of the playgrounds in the close neighborhood, as sample public playgrounds in which

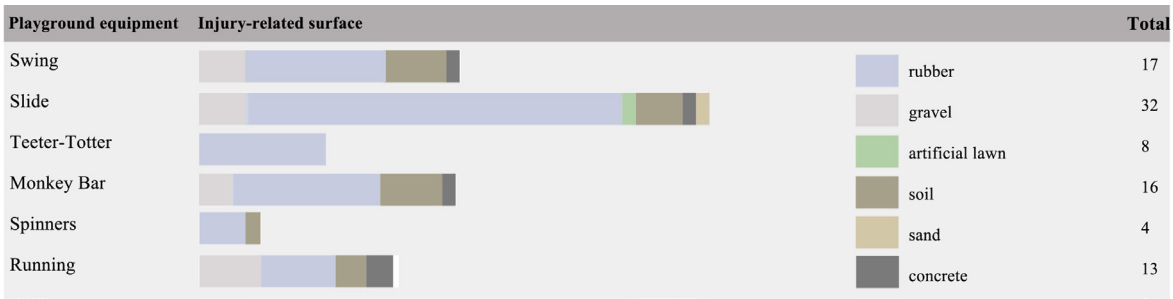

Figure 5. *The injury relation between play equipment and surfacing material.*

children were injured in.

The case study was conducted in Emek, Meclis, and Sarıgazi Neighborhoods of the Sancaktepe District. Sancaktepe has a population density above the Istanbul average and shows rapid population growth. Therefore, the safety of public playgrounds is important for densely populated districts. In total, there are thirteen parks; eight of them have public playgrounds within their boundaries (Figure 6). These public playgrounds which are located in the neighborhood of the research emergency departments are selected to examine as example playgrounds in order to show the equipments and surfacing material.

The emergency department is located in the Emek Neighborhood, with five public parks; three of them have public playgrounds. Meclis Neighborhood has five public parks, and only two of them have public playgrounds. Sarıgazi Neighborhood has three public parks and all of them have public playgrounds.

A total of eight public playgrounds were evaluated. All the playgrounds had similar mass-produced play equipment; swing, slide, teeter-totter, and climbing chain. All the equipment was

Figure 6. *Case study public playgrounds and photographs.*

made of plastic and iron material. The most abundant equipment was swings and slides, each park possessed both equipments (100%). There was no teeter-totter in one playground (12.5%). Five of the playgrounds had climbing equipment (62.5%).

All the playgrounds had rubber surfaces under the play equipment. The surrounding of the play area was hard surface (natural stone and concrete) in six playgrounds (75%), and grass (soil) in two playgrounds (25%). There was no sand, artificial lawn, or gravel in the playgrounds.

All playgrounds have similar equipment and surfacing. A composite structure, which is formed by the combination of several play equipment, is often observed in case study public playgrounds. Apart from these, no adventure playgrounds or large free spaces with creative equipment have been documented.

5. Discussion

In this study, the primary focus was to survey the mechanism and incidence of injuries and to show the relationship between play equipment, surfacing material, and traumatic extremity injury types. The safety of children's playgrounds has several factors, most importantly the type and height of the play equipment, and the ability of the surface material to absorb the energy of a child's fall.

The results show that the most seen mechanism of injury is a fall from the slide, followed by a swing, monkey bar, teeter-totter, and spinner. The play equipment with a certain amount of height is mostly involved in injuries. It is also found that the largest proportion of injuries occurred on the rubber surface, followed by soil, gravel, concrete, sand, and artificial lawn, respectively. The reason for the high rate of a rubber surface is that it is the most used surface material under play equipment in Istanbul.

According to previous studies, injuries in playgrounds are mostly associated with climbing equipment, swings, and slides; the most common injury type was falling, and the most commonly affected body part was the upper extremities (Bae et al., 2017; Migneault et al., 2018; Phelan et al., 2001). In the present study, the number of injuries from slides was nearly equal to the sum of the swings and monkey bars. The most common injury type was upper extremity injuries, similar to those shown in previous studies. The majority of the injured children had fractures due to falling, and all of the equipment was somehow involved in the injuries. Wrist fractures and elbow fractures account for almost half of the upper extremity injuries.

Since the majority of injuries were caused by falls, the impact-absorbing surface is one of the most important safety factors. The reason for the high risk of fractures among children who fall from climbing equipment is due to a lack of physical maturity and ability, and they may not have enough reflexes and muscular systems to play safely on these high structures (Migneault et al., 2018). Due to these falls, it has been studied for many years to make the surface have an injury-preventing ability. There can also be other design solutions to convert the surface from material to equipment. The results re-emphasize the insufficiency of surfacing under high play equipment in public playgrounds.

In this study, approximately one-sixth of all injuries were not related to any play equipment and occurred while running in the playground. This shows that not only play equipment but also all other furniture and surfaces on the playground should be included in the safety policies.

When the injury rate by age group is examined, it has been observed that most fall-related injuries occur in children over 5 years of age (5-14 years old). Children playing with equipment that is not suitable for their age may cause these injuries because public playgrounds usually have mass-produced play equipment where children of all ages play. Accordingly, further research is recommended on the cause of these injuries and the design of playground equipment. As a result of the study, design recommendations were developed that will provide optimum safety.

5.1. Design recommendations

Although height is significantly connected to injuries, it is a part of equipment design related to fun, which attracts children. Thus, the results from multiple viewpoints suggest an advanced surfacing to minimize the risk of injury. This led to a number of following recommendations for public playgrounds in relation to safety to guide designers and planners (Figure 7):

- Creating artificial topography, especially for slides may provide falls from height. Embankment slides might be a safer alternative for multi-age playgrounds.
- Playgrounds intend to serve children of all ages, but the importance of age-appropriate equipment in playgrounds is revealed in mentioned literature. It is highly recommended to label the equipment to give age appropriateness of the equipment to the users.
- Safety standards for play equipment that mostly cause injuries, which are slides, swings, and monkey bars, should be re-evaluated. Especially the height of the equipment can have limitations, and the surfacing can be replaced with more flexible alternatives. Thus, predominant injury types due to falls, especially wrist fractures, can be reduced.
- Rather than selecting similar mass-produced play equipment, different affordable alternatives can be used to support creative play with different surface design ideas.
- Rubber mulch is the safest surfacing according to review studies, but lead is present in recycled rubber and the health safety is still questionable. Recent work has shown that rubber mulch as a surfacing material in playgrounds offers minimal risks with a reduction in injury risk (Fawkes et al., 2021). However, there is still increasing concern about other chemical components. Alternative solutions could be healthier for children.
- Many children are reported to fall while running. For this reason, the safety of the surface material in the rest of the public playground should also be discussed along with the material under the play equipment.
- Rethinking the surface under high play equipment more flexibly may slow the fall. The falling space can be regarded as designable equipment.

Most importantly, the observations supported the previous studies' results that even if the rubber is used, the serious level of post-fall injuries shows the surfacing is not sufficient for safety. Hence, this study suggests flexible equipment, such as a trampoline play system and safety net, as an alternative surfacing under high play equipment. Bouncing systems can be included in play equipment or surface design. These systems can absorb the energy of

Figure 7. *Artificial topography and nets as prevention through design.*

a fall and can reduce the severity of a possible injury.

According to CPSC, the critical fall height of 0.2 m-depth loose-fill surfacing are 3 meters for wood chips, 2 m for wood mulch, 1.5 m for pea gravel, and 1.2 m for sand, whereas 3 meters for 0.15 m-depth shredded rubber (2015). Compared to loose-fill materials' critical heights by CPSC, trampoline systems can be an alternative impact-absorbing surfacing where there is a critical fall height higher than 3 meters. They can be installed to varying depths in order to comply with critical fall heights. There are trampoline systems that are 30 times more shock absorbent than shock pads (Oz, 2022).

On the other hand, safety nets are mash ropes designed to absorb the energy of a fall, thus preventing a possible injury. In some public playgrounds where the equipment height is greater than 2 m, designed surfaces embedded with nets can help slow the fall. According to BS EN 1263, safety nets can allow a maximum fall height of 6 meters (2014). The Standard addresses that if the fall height is greater than 2 meters, the safety nets should be larger than 35 square meters.

A limitation of the present study is that only compiled data from one selected hospital were used, thus it cannot represent Istanbul metropolitan. The number of participants could be increased. However, the results of the present study are relatively admissible as the public playgrounds in Istanbul are very similar to each other. It can be anticipated that other public playgrounds may also lack adequate safety standards. Istanbul has a population of nearly 20 million; therefore, this study may show a small part of a large ratio of the actual injured children population.

This study has several strengths. First, there is no multidisciplinary study that includes Landscape Architecture and Orthopedics and Traumatology Department, which gives data about the accidents that took place in playgrounds and their consequences in Turkey. This study aimed to make a numerical contribution. Second, it linked playground conditions and injuries, including equipment and surfacing type. Third, the study demonstrated that the rubber was not sufficiently safe under high play equipment in public playgrounds. Finally, it offered a different perspective and presented the falling space as an element that can be designed outside of the material.

Public playgrounds are used by more children at the same time, which can be a factor in most accidents and need further research. Increasing such multi-disciplinary studies conducted with the trauma department is important for demonstrating real results, thus allowing for other design solutions and contributing to the literature.

6. Conclusion

This work has shown that even with impact-absorbent surfacing such as rubber, fractures occur in children who fall from a certain height. To reduce injuries, design can offer a new approach to this problem by reconsidering the falling space, and rethinking the surface as designable space under high play equipment to help slow the fall.

The design has a role in influencing the behavior of the children to reduce injury while maintaining the fun and risk that is important for their development (Wakes & Beukes, 2012). As researches show that the risk of height-related injury is notably decreased when the height of play equipment is below 1.5 m (Ball, 2002; Phelan et al., 2001; Vollman et al., 2009; Wakes & Beukes, 2012), it is highly recommended to include play equipment below 1.5 m height in public playgrounds. Higher equipment needs advanced flexible falling spaces, which designers should focus on, as illustrated in Figure 7.

In Turkey, local governments are not obliged to comply with the standards in the recruitment of playground equipment. The control of the compliance of the equipment with the current standards can only be carried out during the purchase process, but the control of the playground elements in terms of safety requirements during and after the installation is incomplete. This is another factor that endangers the safety of playgrounds.

Children are usually brought to the hospital without stabilization of injured extremities. Moreover, some of

these fractures can be serious and need surgery treatment. It is important to avoid these falls as much as possible because they can lead to permanent disability in children.

In conclusion, the result of this study points out that the surface material is a key factor in playground safety, and to reduce the risk, the surfacing should be soft and thick enough to absorb the energy of a child's fall. A series of recommendations have been made for designers and decision-makers of playgrounds based on this research. They use some already available elements that can be interpreted as surfacing alternatives with regard to children's falling space. On the other hand, with improvements in technology, new materials could make playgrounds safer for children, and designers can also ultimately assess the opportunity to see the falling space as more flexible play equipment. Consequently, it is hoped that, with more extensive studies and inclusive and descriptive legal frameworks in the future, these recommendations will reduce injury rates.

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Spatial factors contributing to worker time management at construction sites

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Abstract
Construction delays often create cost and quality issues in time intensive urban projects. Even though, many researchers have attempted to find the factors that contribute to these delays, sufficient attention has not been paid to spatial factors and their contribution to the time management of construction workers. Thus, the aim of this study was to investigate the management of spatial factors that influence the time management of workers at construction sites. A multi-method qualitative research approach was used in the study. Semi-structured interviews and case studies were used for data collection. The empirical data collected from the interviews and case studies were analysed using manual content analysis. Spatial factors that contribute to the time management of workers at construction sites, the type of contribution they make, and the strategies that can be adopted to manage them were identified through a literature review and a set of interviews. The influence that the identified strategies exert on the time management of construction workers was determined through the interviews and the findings of the interviews were verified through the case studies. The study findings indicated the importance of introducing spatial factor management to the construction industry. Properly enforcing regulations, increasing the awareness about spatial factors, and conducting studies on spatial factor management will solve construction delays because they can increase the efficiency of construction workers. Studies that have been conducted on spatial factor management are scarce. This study can be used as a benchmark for in-depth research studies in the area.

Keywords
Construction sites, Construction workers, Spatial factors, Time management.

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1. Introduction

Inefficient time management at construction sites can cause serious consequences because it leads to waste of money, work-related disputes and arguments, and the degradation of construction quality (Owusu & Aggrey, 2020; Tafazzoli & Shrestha, 2017). Construction delays affect the economics of construction projects and lead project stakeholders to incur losses (Kumar, 2020) and only some of these losses can be compensated (Fakunle & Fashina, 2020). Therefore, finding measures that can resolve the issues has become essential (Memon et al., 2014). With urbanization, people tend to move to cities and therefore, the population density in cities seems to rapidly increase (Ritchie & Roser, 2018). Authors further state that, construction projects within and around city limits has increased as there is an urge created to build amenities such as houses, schools, restaurants and many more to facilitate this increasing population. However, only little attention is given to the spatial arrangements in urban construction projects because of the volatility and the disorganised state of these congested construction sites (Zolfagharian & Irizarry, 2014). They further state that this disregard of special arrangements could be a key factor contributing to waste and poor management of time at construction sites. Some spatial arrangements may generate shorter work-cycles than the others do (Kothiyal, 1995; Sanad et al., 2008). Little attention is paid to the contribution made by spatial factors to time management in construction sites (Bansal, 2018; Marx, 2010), especially in sites located in Sri Lanka. Moreover, the stakeholders of construction projects, such as project managers, are not aware that spatial factors can influence time efficiency in construction sites (Mamat & Zin, 2016). These spatial factors can differ from project to project (Bar & Ullman, 1996; Delbosc & Currie, 2011). Thus, the influence of spatial arrangements in construction sites on the time management of workers at the sites and the strategies that would assist in the successful management of the factors require investigation. Thus, the aim of this study was to investigate the management of spatial factors contributing to the time management of construction workers at sites with the objectives of investigating the spatial factors that contribute to the time management of construction workers at sites, how these spatial factors influence the time management of the workers, the strategies that could be adopted to manage the spatial factors, and how the identified strategies influence the time management of construction workers.

2. Literature review

2.1. Spatial factors

Spatial factors define spaces by assisting people to collect and process information about the elements and space around them (Dogu, 2000). People identify their environments by first using spatial factors partially; they also found that it has been long recognized that the underlying spatial structure of a certain space is important to configure that space (Silavi et al., 2017). Thus, spatial layout and appearance play a critical role in enabling people to comprehend and perceive that place (Fard, 2014). Previous scholars have found that spatial factors such as permeability, variety, and legibility make an environment responsive and engaging (Bentley et al., 1985; Ewing & Handy, 2009; Gomez, 2011; Herath, 2005; Khalaf & Ja`afar, 2020). Legibility, robustness, and personalization make a space interesting (Bentley et al., 1985; Herath, 2005; Khalaf & Ja`afar, 2020). Unity affects the spatial cognition of people (Gauthier & Gilliland, 2006; Rapoport, 1977; Ujang, 2012; Yeo et al., 2016). In busy environments, the spatial factors safety and imageability influence human minds (Ujang et al., 2012). Openness is a spatial factor (Gauthier & Gillilan, 2006; Ujang, 2012; Yeo et al., 2016). Scale is a spatial factor that influences people in cities (Gehl, 2010). By changing the physical characters of a space, the spatial factor comfort can be introduced into the space (Ujang, 2012). Tidiness also is a spatial factor that can influence the human mind (Ujang et al., 2012). The effectiveness of the utilization of

a construction site, therefore, can be identified only by accurately analysing the influence exerted by spatial factors on worker behaviour (Acar et al., 2020; Montgomery, 1995).

2.2. How spatial factors can influence the workers in a construction site

The structure of a physical environment can significantly affect the ability of an individual to orientate within that environment (Slone et al., 2014). Thus, the physical elements of a worksite can influence the satisfaction, anxiety, tension, productivity, and efficiency of a worker (Samani et al., 2017). Construction industry is labour intensive and the work environments in many construction sites are not satisfactory (Hashiguchi et al., 2020). In every construction project, worksite layout is developed regularly and routinely. The decisions made about worksite layout depend on the locations of temporary offices, rest and dining areas, material storage areas, cranes, access points, sanitary facilities, access routes, workshop areas, utilities, and other important facilities (Small & Baquer, 2016). The productivity of a workspace can be determined by how well the different areas in the worksite layout are being used and how efficient the workers are (Garzon, 2005). Therefore, spatial factors of construction sites, which depend on the spatial arrangements of the sites, can influence worker performance in numerous ways. The proper consideration of the spatial factors of a workspace can have a huge impact on the productivity and time management of the workers (Paljug, 2020).

2.3. Influence of spatial factors on time management in construction sites

Time management can be described as the act of planning and controlling the amount of time spent on various activities, especially those involved in improving worker productivity and efficiency (Ahmad et al., 2012). Physical environments directly influence worker performance and productivity (Kamarulzaman et al., 2011). Certain spatial arrangements can influence how one engages in different tasks and actions (Solman & Kingstone, 2019). Thus, the spatial factors of a workspace can have a huge impact on worker productivity (Paljug, 2020). For example, a legible road sign will help a person to find his/her way around while helping to determine where he/she is and minimize the time spent on getting to any given place (Stamps, 2004). Permeability improves worker efficiency by encouraging the workers to use "through movements" and manage time efficiently (Stoner, 2016). Imageability helps make a strong and useful visual image (Mohankumar, 2014). Robustness improves the adaptability of space, which will help enhance the speed, quality, and the efficiency at which the desired work would be completed (Nickl, 2020). Safety improves openness, flexibility, and interdependence required for high performance (Delves, 2020). Also, safety affects productivity by improving self-confidence and trust, and that it increases worker involvement and commitment (Clarke, 2020). An environment that has vitality is vibrant, thriving, and alive, and thus can increase collaboration, engagement, well-being, and productivity of those who work within that space (Mars Drinks, 2015). Openness also can influence time management by improving worker satisfaction and collaborative spirit (Bernstein & Turban, 2018). Comfort can create a space "healthier" because when the environmental conditions are optimum, employee health is improved and employee absenteeism is reduced, which in turn enhances employee efficiency (Ali et al., 2015). The scale of a building and the spaces within it have to be proportional to the human scale for people to feel secure (Gehl, 2010). When the feeling of security is developed in an employee, employee productivity will eventually appear to increase (Harter, 2020). Tidiness improves the ability of the workers to process information, and increases their productivity because it minimizes the time spent by workers on finding lost items and improves the mental health of the workers to help them focus on their work (Sander, 2019).

2.4. How to manage spatial factors at construction sites

Spatial factor management involves tracking, controlling, supervising, and properly utilizing the available space of an organisation to manage its physical layout and improve its space configuration (Prasad, 2019). The landmarks in the area have to be recognizable and prominent, the different sections in the area should have distinct characteristics to enable their easy identification, the access ways have to be clear with important points of interest along the paths, and the borders of different sections or access ways should have structures or features inherent to them (Ingram & Benford, 1996; Yavuz et al.,2020). A layout that encourages permeability should be well connected and should offer a choice of direct routes to any of the destinations (Essex planning officers association, 2019). To improve safety, construction sites should have proper fall protection measures (Roux, 2014). Construction sites requires to display appropriate signboards to protect employees from hazards (The American Society of Safety Professionals, 2019). Robustness can be achieved by introducing adaptable spaces that can be utilized for various uses and activities, probably at different times or according to the demand (Carmona, 2018). Comfort can be attained by providing a superior acoustic environment, maintaining optimal thermal comfort, creating a high-quality visual environment, and by providing workstations, furniture, and equipment that enhance worker performance (WBDG Productive Committee, 2018). Unity can be achieved by repeating elements, such as colours, shapes, or materials, throughout the space (Mastroeni, 2020). By allowing employees to personalize their workstations by changing their configurations to meet their evolving needs for collaboration or privacy, can improve employee efficiency (Pearce & Hinds, 2018). By improving the scale factor by having standardized heights for furniture and by considering anthropometrics when creating service route widths can improve the comfortability and safety of a workspace (Hatch Interior Design, 2021). Tidiness in a construction site can be achieved by providing designated areas to keep rubbish and waste, stacking and storing materials properly, and keeping access routes clear (Darley PCM Ltd, 2018).

2.5. Why spatial factor management is important for construction workers for improved time management at construction sites

The effect of the perception of workspace arrangement of a person on his/her overall behaviour and task achievement has drawn little attention so far (Samani et al., 2017). However, improving time management through spatial factor management is effective because it increases the speed of the workers by improving their workspace satisfaction (Revoy, 2020). Spatial factor management includes managing the layout of the worksite, location of the elements and equipment, and the flow between employee workspaces (Post, 2020). Negative workspaces create work stresses that adversely affect the health and productivity of the workers because absenteeism, demotivation, and distrust significantly increase the costs (Anderson, 2017). As a result of urbanization, populations are increasingly moving from rural areas to urban centres for livelihood purposes (Kummitha et al., 2020). With this population growth in urban areas, many construction projects are happening nowadays (Venditti, 2022) and because construction workers spend most of their time at these sites, the physical attributes of the sites can affect the health, job performance, and efficiency of the workers (Lemma et al., 2022). The productivity of employees who are satisfied with the physical environments of their workplaces is generally high (Kamarulzaman et al., 2011). The topic "construction time management" has attracted the interest of many researchers. Thus, many studies have been conducted to identify the different factors affecting time management in construction sites (Akanni et al., 2015; Bekr, 2017; Dolage & Rathnamali, 2013; Meeampol & Ogunlana, 2006; Pheng & Chuan, 2006). However, studies on the influence of spatial factors on time management in construction sites is rare (Bansal, 2018;

Table 1. *Interviewee details.*

Interviewee code	Details					
	Profession	Designation	Key role	Total experience in years	Type of buildings handled in the projects involved	Key experiences related to the area
I1	Architect	Principal Architect	Designing	21	Residential, Industrial, and commercial buildings	Design and supervision experience in 1 shopping mall, 8 apartment complexes, 5 factories,15 hotels and nearly 40 housing projects
I2	Architect	Principal Architect	Designing	27	Residential, Industrial, and commercial buildings	Design and supervision experience in 3 Hospital buildings, 2 factories,1 school building, 5 apartment complexes, 8 restaurant buildings, 18 hotels and over 50 housing projects
I3	Architect	Project Architect	Designing and site inspection	5	Residential and commercial buildings	Design and supervision experience in a factory, 1 shopping mall, 1 cinema complex, 2 religious' buildings, 2 hotels and nearly 3 housing projects.
I4	Architect	Project Architect	Designing and site inspection	12	Residential, Industrial, and commercial buildings	Design and supervision experience in a public market complex, 2 factories, 22 hotels, 2 public parks, 8 restaurants, 2 bank buildings and over 16 housing projects.
I5	Architect	Junior Architect	Support designing and site inspection	3	Residential and commercial buildings	Design and supervision experience in a school, 2 saloons, 1 apartment complex and 4 housing projects.
I6	Civil Engineer	Project Manager	Planning, executing, and monitoring of the project	11	Residential, Industrial, and commercial buildings	Engaged in 2 factories, 1 shopping mall, 2 cinema complexes, 5 hotels and over 15 housing projects.
I7	Civil Engineer	Project Manager	Planning, executing, and monitoring of the project	5	Residential and commercial buildings	Engaged in a Hospital building, 1 apartment complex, 2 hotels and nearly 3 housing projects
I8	Civil Engineer	Project Manager	Planning, executing, and monitoring of the project	3	Residential buildings	Engaged in 2 apartment complexes and 2 housing projects
I9	Mason	Skilled worker	Concreting	12	Residential and commercial buildings	Engaged in a public market complex, 2 nursery buildings, 10 hotels, 1 public park, 1 library building, 8 restaurants and over 20 housing projects.
I10	Mason	Skilled worker	Plastering	10	Residential, Industrial, and commercial buildings	Engaged in 3 factories, 1 public market complex, 1 children hospital, 2 cinema complexes, 5 hotels and over 15 housing projects.
I11	Painter	Skilled worker	Painting walls	5	Residential and commercial buildings	Engaged in a Hospital building, 1 school building, 4 restaurant buildings, 2 hotels and nearly 8 housing projects
I12	Plumber	Skilled worker	Installing pipes and fixtures	8	Residential and commercial buildings	engaged in 1 factory, 1 Hospital building, 3 apartment complexes, 10 restaurant buildings, 12 hotels and over 15 housing projects
I13	Plumber	Skilled worker	Installing pipes and fixtures	4	Residential and commercial buildings	engaged in 3 religious building complexes, 3 restaurant buildings, 5 hotels and over 12 housing projects
I14	Titanium Worker	Skilled worker	Attending to floor finishes	11	Residential and commercial buildings	engaged in 16 hotels, 10 restaurant buildings and over 30 house projects
I15	Tile worker	Skilled worker	Attending to floor finishes	4	Residential buildings	Engaged in construction of 5 hotels, 1 apartment complex and 20 houses

Marx et al., 2010). Thus, there is a need to identify and introduce the strategies that spatial factors might influence the time constraints of a construction site.

3. Research methodology

Qualitative methods can be used when studying relationships among individuals, and those between individuals and their environments, and the factors that determine the behaviours and actions of people (Gunnell, 2016). Qualitative research is a step-by-step investigation of social phenomena that occur in natural settings (Teherani et al., 2015). Qualitative multi-methods consist of several qualitative data collection techniques and the analysis of the collected data (Saunders et al., 2019). Multiple methods would be helpful if they could provide opportunities for answering research questions and evaluate the research findings (Tashakkori & Teddlie, 2003). Thus, the study adopted the qualitative multi-method because in-depth information about human behaviours, human abilities, and spatial factors had to be collected.

3.1. Semi-structured interviews

Interviews are effective in qualitative studies because they help understand the opinions, behaviours, and experiences of the interviewees (Virginia Tech University Libraries, 2018). Interviews have been long known in qualitative research as a data-collection method (Palmgren & Liljedahl, 2009). Therefore, semi-structured interviews were conducted with professionals and construction workers to identify the connections among the spatial factors in construction sites and the influence of the spatial factors on the time management of construction workers. The details of the interviewees are presented in Table 1.

3.2. Case studies

Case study surveys enable researchers to use several tools to understand the subject concerned comprehensively (Salmon, 2017). In this study, three case studies were conducted to collect the required data. Due to the limited resources and time availability, case studies had to be selected carefully. Therefore, by considering that majority of the projects happen in urban areas and the state of the disorganized spatial arrangement of these congested sites, urban residential building projects were selected considering the limited resources and within the

time available. The cases were selected from within the Colombo area which is highly urbanized and many time-intensive buildings projects were being implemented. The selected case studies were used to validate the data collected from the literature and interviews using interviews and observations. Interviews help obtain unknown and reliable information, and authoritative opinions; make serious and professional assessments of the research topic; and assess possible options (Libakova & Sertakova, 2015). Physical observations enable researchers to learn about the activities of the people under study when they are in their natural settings (DeWalt & DeWalt, 2002). In this study, physical observations were used to observe how spatial factors influence construction workers in the management of their time. Details of the selected case studies are provided in Table 2, while the details of the case study interviewees are provided in Table 3.

3.3 Data analysing techniques used

Because a qualitative approach was used in the study, manual content analysis was used for data analysis. Content analysis is used to identify patterns in recorded communication (Luo, 2021). Readers have to be informed how the results of the analysis were obtained to enable them to understand the analysis and resulting conclusions (Schreier, 2012).

4. Findings and analysis

4.1. Spatial factors influencing the time management of construction workers

Spatial factors that influence the time management of construction workers when they work in sites were identified from the literature. The findings were verified using the semi-structured interviews. The interviewees were requested to identify any additional spatial factors that could contribute to the time management of workers at construction sites. Then the identified spatial factors were confirmed using case study interviews and observations. Table 3 lists the findings.

Most of the interviewees agreed that the spatial factors identified using the

Table 2. *Details of the case studies.*

Description	Case 1	Case 2	Case 3
Type of Building	Residential	Residential	Residential
Area of the Building	2323 m^2	1487 m^2	978 m^2
Area of the exterior space	54 m^2	42 m^2	29 m^2
Total Area	2377 m^2	1529 m^2	1007m^2
Number of Floors	4	3	3
Project duration	3 years	2 years	2 years
Spatial arrangement	The building had an open courtyard in the middle around which the rest of the building was designed.	The building had an open courtyard with a pool and the simple building structure surrounded the pool area.	The building was located in a linear land and built to suit the shape of the land. It had a compact space distribution.
Respondent	Project Architect with seven years of experience in residential, industrial, and commercial building projects.	Project Architect with 10 years of experience in residential, industrial, and commercial building projects.	Project Architect with five years of experience in residential, industrial, and commercial building projects.

Table 3. *Spatial factors influencing the time management of construction workers working at sites.*

Spatial factors that can influence the time management of construction workers at sites								Way the spatial factors influence the time management of construction workers in the sites							
		Case A		Case B		Case C			Case A		Case B		Case C		
Spatial Factor	Interview Results	Interviews	Observations	Interviews	Observations	Interviews	Observations	Interview Results	Interviews	Observations	Interviews	Observations	Interviews	Observations
Legibility	✓	✓	✓	✓	✓	✓	✓	Helps identify spaces, routes, and locations	✓	✓	✓	✓	✓	✓
								Helps identify the shortest routes to increase the productivity of logistics	✓	✓	✓	✓	✓	-
								Decreases the confusions related to space identification within the sites	✓	✓	✓	✓	✓	✓
								Increases the ability of workers to issue and understand instructions	✓	✓	✓	✓	✓	✓
Safety	✓	✓	✓	✓	✓	✓	✓	Reduces accidents within construction sites and lowers absenteeism	✓	-	✓	✓	✓	✓
								Improves the confidence of the workers	✓	✓	✓	✓	✓	✓
								Improves employee trust and commitment	✓	✓	✓	✓	✓	✓
Openness	✓	✓	✓	×	×	✓	×	Improves communication among workers	✓	✓	✓	×	✓	✓
								Makes spaces flexible and adaptable for use	✓	✓	✓	✓	✓	✓
Comfort	✓	✓	✓	✓	✓	✓	✓	Creates a healthy, work-friendly environment for the workers	✓	✓	✓	✓	✓	✓
								Improves worker satisfaction	✓	✓	✓	✓	✓	✓
Permeability	✓	✓	✓	✓	✓	✓	✓	Provides a choice of the routes and increases the ability to create short cuts within the site	✓	✓	✓	✓	✓	✓
								Provides visual permeability and increases the ability to observe work	✓	✓	✓	✓	✓	✓
								Reduces traffic associated with material transportation within the site by providing alternative routes	✓	✓	✓	✓	✓	✓
Robustness	✓	✓	✓	✓	✓	✓	✓	Improves worker efficiency when the spaces have to be changed	✓	✓	✓	✓	✓	✓
								Minimizes the logistics if the adjacent spaces can be used to facilitate ongoing constructions within a certain space	✓	✓	✓	✓	✓	✓
Scale	✓	✓	✓	✓	✓	✓	✓	Creates a sense of connectedness between a worker and the site.	✓	✓	✓	✓	✓	✓
								Makes it comfortable for workers to work	✓	✓	✓	✓	✓	✓
Tidiness	✓	✓	✓	✓	✓	✓	✓	Creates a pleasant work environment	✓	✓	✓	✓	✓	✓
								Minimizes the time spent on finding lost items	✓	✓	✓	✓	✓	✓
								Increases worker ability to focus on work	✓	✓	✓	✓	✓	✓
								Creates a healthy environment, thereby lowering absenteeism.	✓	✓	✓	✓	✓	✓
Imageability	✓	✓	✓	✓	✓	✓	✓	Helps identify spaces and routes within the site without any confusion	✓	✓	✓	✓	✓	✓
Personalization	✓	✓	✓	✓	✓	✓	×	Improves worker commitment by providing the workers with a sense of ownership	✓	✓	✓	✓	✓	-
								Creates a comfortable workspace satisfying worker preferences	✓	✓	✓	✓	✓	-
Vitality	✓	×	✓	✓	✓	×	✓	Creates an interesting and encouraging work environment within the site	×	✓	✓	×	×	✓
Unity	✓	✓	✓	✓	✓	✓	✓	Creates an interesting and sequential space to work	✓	✓	✓	✓	✓	✓
								Increases visual comfortability and makes working easy	✓	✓	✓	✓	✓	✓

Table 4. *Spatial factor management strategies and how the strategies can improve the time management of construction workers.*

Spatial Factor	Management Strategy	How the strategy can improve the time management of workers at construction sites	Case A		Case B		Case C	
			Interviews	Observations	Interviews	Observations	Interviews	Observations
Legibility	Setting landmarks within the site	Enables easy identification of locations, destinations, and routes based on the landmarks within the site	✓	✓	✓	✓	✓	✓
	Setting landmarks around the site	Enables easy identification of locations, destinations, and routes by considering the landmarks that are located at a visual distance around the site	✓	✓	✓	✓	✓	✓
	Creating a network of major and minor routes	Improves travelling within the site	✓	✓	✓	✓	✓	✓
	Creating common identifiable districts (medium to large sections) with clear borders	Enables the workers to identify their locations, destinations, and routes easily	✓	-	✓	-	✓	-
	Creating attractive nodes (centers of attraction) within the site to serve as landmarks	Helps workers to identify their locations, destinations, and routes and creates a lively and encouraging work environment within the site	✓	✓	✓	✓	✓	✓
Safety	Installing fall protections, fences, and nets	Decreases the time wasted by reducing the accidents and improves worker confidence	✓	✓	✓	✓	✓	✓
	Installing sign boards and marking the site properly to protect workers from hazards by drawing their attention to potential hazards and how to avoid them	Reduces accidents which lead to project delays	✓	-	✓	-	✓	✓
	Keeping the construction site clean	Reduces unexpected injuries from accidents caused by clutter and improves work efficiency	✓	✓	✓	✓	✓	✓
Openness	Improving the view and illumination of the site, and enabling a feeling of being in the open	Makes the work environment interesting and motivational to improve worker efficiency	✓	✓	✓	✗	✓	✗
		Increases the opportunities available to collaborate and communicate with co-workers	✓	✓	✓	✓	✓	✓
	Improving surface textures	Improves the feeling of spaciousness and makes the work environment relaxing	✓	✓	✓	✓	✓	-
	Improving the space sequence	Facilitates ease of movement within the site	✓	✓	✓	✓	✓	✓
Comfort	Providing a superior acoustic environment	Increase the ability of the workers to focus on work and thereby increase their efficiency	✓	✓	✓	✓	✓	✓
	Maintaining optimal thermal comfort	Increases the ability of the workers to focus on the work	✓	✓	✓	✓	✓	✓
		Creates an attractive and interesting work environment to increase the efficiency of the workers	✓	✓	✓	✓	✓	✓
		Contributes to worker health workers to reduce absenteeism	✓	-	✓	-	✓	-
	Creating a quality visual environment	Creates an attractive and interesting work environment to increase the efficiency of the workers	✓	✓	✓	✓	✓	✓
	Providing furniture and equipment that will enhance worker comfort	Increases the ability of the workers to focus on the work, thereby increasing their performance	✓	✓	✓	✓	✓	✓
Permeability	Creating a well-connected layout which offers a choice of direct routes	Improves travelling within the site	✓	✓	✓	✓	✓	✓
		Enables the workers to feel safe and secure to make them work with confidence.						
		Supports easy communication among co-workers.	✓	✓	✓	✓	✓	✓
Robustness	Creating spaces that can be used for different activities, probably at different times of the day	Creates the work space flexible and interesting to enable workers to work efficiently and effectively.	✓	✓	✓	✓	✓	✓
	Having adjacent spaces for ongoing constructions within a certain space	Reduces unnecessary travelling, eases the logistics to decrease the time lost unnecessarily	✓	✓	✓	✓	✓	✓
Scale	Using standardized heights and ergonomic measures to design worksite furniture.	Increase the ability of the workers to focus on work, thereby increasing their performance	✓	✓	✓	✓	✓	✓
		Supports healthy postures, which help to reduce injuries and reduces absenteeism.	✓	✓	✓	✓	✓	✓
	Establishing service route widths based on anthropometrics	Makes the travelling of workers effective	✓	✓	✓	✓	✓	✓
Tidiness	Providing a designated area to keep rubbish and waste	Prevent bad smells and creates a pleasant work environment to increase worker efficiency	✓	✓	✓	✓	✓	✓
	Stacking and storing materials properly	Reduces the time spent on searching for lost items	✓	✓	✓	✓	✓	✓
	Keeping access routes clear	Eases worker travelling and material logistics	✓	✓	✓	✓	✓	✓
Imageability	Improving the identity of the site to distinguish it from other objects	Leads workers to identify their locations, destinations, and routes easily	✓	✓	✓	✓	✓	✓
	Improving the structure of the site (relationships with the large patterns of other elements)	Increases the ability of the workers to focus on work, improves the visual comfortability of the workers and increases the ability of the workers to memorize things, thereby improving the performance of the workers	✓	✓	✓	✓	✓	✓
	Improving the meaning (practical and emotional value the site offers to the observer) of the site	Creates a motivational work environment	✓	-	✗	-	✓	-
Personalization	Allowing employees to rearrange their workstations or furniture as they wish, to meet their evolving needs for collaboration or privacy	Creates a flexible and motivational work environment	✓	✓	✓	✓	✓	-
Vitality	Improving accessibility within the site	Increases the ease of travelling within the site	✓	✓	✓	✓	✓	✓
	Improving sustainability in the site	Creates an attractive and interesting work environment to increase worker efficiency	✓	✓	✓	-	✗	-
	Improving environmental quality	Improves worker health to reduce absenteeism	✓	✓	✓	✓	✓	✓
	Creating vibrant and diverse spaces and facilities	Creates a lively and encouraging work environment within the site	✗	✓	✓	✗	✗	✓
Unity	Creating a sense of cohesion in the space by repeating selected elements throughout the entire space, such as colors, shapes or materials	Makes the space visually pleasant and interesting to work	✓	✓	✓	✓	✓	✓

literature review influence the time management of workers in construction sites. According to the Case A interviewee, all factors except vitality influence time management of construction workers at sites because vitality can lead construction workers to get distracted while working. However, the observations made in Case A indicate that all the spatial factors identified from the literature, including vitality, contribute to the time management of construction workers. The interviewee of Case B did not agree with openness by stating that at times it can distract construction workers from their designated work, which the observations of Case B confirmed. Interviewee from Case C did not agree with the factor vitality by saying that when vitality is increased, unwanted behaviours and unnecessary chaos could be created within the site, negatively affecting worker efficiency. According to the observations made in Case 3, vitality contributes to the time management of workers at a site. Observations made in Case C indicate that openness and personalization do not contribute to the time management of workers.

4.2. Spatial factor management strategies and how they can improve the time management of construction worker

Strategies that can be adopted to manage the identified spatial factors were first identified from the literature. Then, several other spatial factor management strategies that can influence the time management of workers at construction sites were identified during the semi-structured interviews. The way those strategies can contribute to improve the time management of construction workers was identified from the semi-structured interviews and case studies. Table 4 illustrates the findings.

At the interviews, most of the spatial factor management strategies that were identified from the literature were confirmed and new strategies were identified. The interviewees explained how each strategy influenced the time management of workers at construction sites. Case A interviewee agreed with all the management strategies ex-

cept the creation of vibrant and diverse spaces and facilities and argued that diverse spaces could create chaos and distractions within the site. The observations made related to Case A were not sufficient to confirm the management strategies that improve the special factors legibility, safety, comfort, and imageability. All other management strategies and their contributions were confirmed by Case A observations.

The Case B interviewee did not agree with the management strategy dealing with imageability that improves the meaning of the site by stating that the construction workers are at the sites only for short periods, and that, therefore, they would not want to maintain any ownership or emotional connection with the sites, making the strategy impractical. The observations made in Case B also were not sufficient to prove the strategy. They were not sufficient to prove even the other strategies related to legibility, safety, comfort, and vitality. The strategy of creating vibrant and diverse spaces and facilities to create a lively and encouraging work environment to increase vitality was found to be impractical in Case B. Although at the Case B site, these spaces and facilities have been provided, because of lack of supervision, they were used by the workers to gather and talk unnecessarily, which had a negative influence on their efficiency.

The interviewee of Case C disagreed with the two management strategies that could be used to improve vitality. With regard to the strategy dealing with sustainability, the interviewee was of the view that introducing sustainability to the site would be profitable and interesting to the owner. However, he said that because the workers would be at the site for only short periods, they would become satisfied only after they get the facilities they require and they would not be interested in the way the facilities are operated. The interviewee stated that vibrant and diverse spaces and facilities could create chaos and distractions within sites. The observations made were also not sufficient to prove the management strategies dealing with legibility, openness, comfort, imageability, personalization, and vitality.

4.3. Discussion

4.3.1. Spatial factors that can influence time management of construction workers at sites

Twelve spatial factors that influence the time management of people were identified from the literature. Then all those factors were investigated through interviews and case studies to identify their influence on workers. Urban residential projects were selected here by considering time and resource availability of study and due to the increasing number of urban projects which are time intensive and facing disputes due to their disorganized spatial arrangement. All the interviewees agreed and the case study findings proved that legibility and safety improve time management in a work environment. At the interviews, only one interviewee disagreed with openness. One case study interviewee and two case study observations did not verify that openness influences the time management of construction workers at sites. Although one interviewee disagreed with the strategy dealing with comfort, all the case study interviewees and observations confirmed that comfort influences the time management of construction workers at sites.

Two of the interviews of semi-structured interviews did not agree with the spatial factors, permeability and robustness. Both case study interviews and observations verified that permeability and robustness influence the time management of construction workers at site. Two interviewees disagreed with scale and another two interviewees disagreed with tidiness. However, all case study interviewees and observations proved that the spatial factors scale and tidiness influence the time management of construction workers. Similarly, while three interviewees disagreed with imageability, all of the other case study interviewees and observations proved that imageability influences the time management of construction workers at sites. At the

interviews, four interviewees disagreed with personalization, whereas all case study interviewees and two case study observations proved that personalization influences the time management of construction workers.

Four of the interviewees disagreed with the spatial factor vitality. Even though all of the case study observations confirmed that vitality influences the time management of construction workers, two case study interviewees disagreed with those observations. Five interviewees disagreed that unity influence construction workers at sites. All the case study interviews and two case study observations proved that unity influences the time management of construction workers.

4.3.2. How spatial factors influence the time management of construction workers at sites

Stamps (2004) described that legibility influences the time management of construction workers by helping the workers to find their way easily by identifying their locations and minimizing the time spent on finding the way back. None of the interviewees supported the third finding of the semi-structured interviewees. I7 added that within a legible space, head workers will find it easy to give instructions and that workers will find it easy to understand the instructions given by their superiors. The interviewees mentioned that legibility influences the time management at construction sites by letting the workers to identify short routes. Safety improves the openness, flexibility, and interdependence of a person and improves his/her performance (Delves, 2020). Safety improves the time management ability of workers by improving their self-confidence, trust, and commitment and by encouraging their involvement (Clarke, 2020). However, none of the interviewees agreed with Delves (2020), while few agreed with Clark (2020). Most of the interviewees believed that safety reduces absenteeism and the accidents within construction sites and that therefore it has an impact on the time management of construction workers. All of the case study interviews and observations proved the findings.

Openness can influence the time management of workers by improving their satisfaction and collaborative spirit (Bernstein & Turban, 2018). I7 added that openness makes spaces flexible and adaptable for use. The interviewees of all three case studies agreed with this feature of openness. However, Case B observations did not reveal how communication among workers could be improved. Comfort improves worker health, thereby reducing worker absenteeism and improving worker productivity (Ali et al., 2015) and according to the semi- structured interview findings it increases worker satisfaction and improves worker efficiency; the case study interviews and observations confirmed these influences of comfort.

Permeability helps manage time efficiently and improves worker efficiency by encouraging "through movements" (Stoner, 2016). Permeability supports time management by providing the ability to control the flow of people witbhin a site, which was endorsed by a majority of the interviewees because permeability provides a choice of routes for moving through and increases the short cuts within the site (Alagamy, 2019). I6 added that visual permeability increases the ability of a worker to observe his/her work. I10 added that permeability reduces the traffic associated with material transportation within the site by providing alternative routes. Robustness improves time management by enabling adaptability, which increases worker efficiency (Nickl, 2020). Some of the interviewees were of the view that it would be convenient for the workers if adjacent spaces could be used to facilitate ongoing constructions within a given space because then the logistics would be minimized. Case study interviews and observations confirmed these interview findings.

A building scale and spaces have to be proportional to human scale for people to feel secure within the building (Gehl, 2010). Worker productivity increases along with the feeling of safety (Harter, 2020) although none of the interviewee agreed with this fact. However, a majority of the interviewees stated that scale creates a sense of connectedness between the workers and the

site. I1 believed that the optimum level of scale would makes the space comfortable for the workers enabling them to manage project time effectively. All the case study interviews and observations confirmed the above-mentioned facts about building scale and spaces. Tidiness influences time management by reducing the stress and anxiety of the workers, improving workers' ability to process information, minimizing the time wasted in searching for lost items, and improving the mental health of the workers, which would help them to focus on their work (Sander, 2019). The interviewees, however, did not agree that tidiness improves workers' ability to process information and minimize the time wasted in searching for lost items. A majority of the interviewees stated that tidiness creates a pleasant work environment which drives workers to work efficiently. I3 and I4 who were professionals explained that tidiness creates a healthy environment and that, therefore, it reduces absenteeism. I6 who was also a professional believed that tidiness minimizes the time spent on searching for lost items. The case study interviews and observations confirmed these semi-structured interview findings.

Imageability influences the time management of construction workers by improving the capacity of the workers to make a strong visual image of their work, and by increasing their ability to see and remember patterns within a space (Mohankumar, 2014). A majority of the interviewees were of the view that imageability influences the time management of construction workers because it provides them with the ability to create a mental image of the site, which will help them to identify the spaces and routes within the site easily. The case study interviews and observations also confirmed this view expressed by most of the interviewees. Personalization makes the interactions within the daily workflow and activities easy (Lehman, 2021). However, this fact was not confirmed by the interviewees. A majority of the interviewees added that personalization improves the time management of workers of construction sites by giving them a sense of ownership of the sites, which increases their commitment to work. I5 and I6 argued that personalization creates a comfortable workspace that would suit the individual preferences of the worker concerned. All the case study interviews and observations confirmed the interview findings.

Vitality makes a space vibrant and alive and has the potential to increase worker collaboration, engagement, well-being, and productivity (Mars Drinks, 2015). however, the interviewees did not agree with this fact. A majority of the interviewees agreed that vitality influences the time management of construction workers in a site because it creates an interesting and encouraging work environment within the site. This fact could not be confirmed through the case studies because only one case study interviewee and two case study observations confirmed it. Unity contributes to improve worker productivity by providing a sense of calmness, limiting chaos at the workplace, and increasing the comfort level of the work environment (Hatch Interior Design, 2021). Most of the interviewees stated that unity influences the time management of construction workers because it can create an interesting and sequential space to work. I1 and I3 argued that unity influences the time management of construction workers by increasing the visual comfortability of the workers, which makes it easy for them to work. The case study interviews and observations confirmed these interview findings.

4.3.3. Strategies that can be used to manage spatial factors and the way they influence the time management of construction workers in sites

There are management strategies, such as creating landmarks within and around the site, for the spatial factor legibility (Harten, 2018). Also creating a network of paths, identifiable districts with clear borders, and attractive nodes within the site could be used as strategies to manage legibility (Lynch, 1960). The interview findings revealed how these management strategies influence the time management of construction workers in sites. The case study findings confirmed the interview findings. strategy of installing proper

fall protections, fences, and nets ensures worker safety at sites (Roux, 2014). Another strategy that can be used to ensure worker safety at sites is to display signboards to protect workers from hazards (American Society of Safety Professionals, 2019). The semi-structured interviews revealed how these strategies influence the time management of construction workers. I8 stated that keeping the construction site clean could be used as a strategy to improve the time management of construction workers because it would reduce unexpected injuries from accidents due to clutter and improve worker efficiency. The case study findings confirmed all these interview findings.

Strategies that can be used to manage openness are improving the view, light, feeling of being in the open, surface textures, and sequence of spaces (Donnell Day Architects, 2021). Similarly, comfort can be managed by providing a superior acoustic environment, maintaining optimal thermal comfort, creating a high-quality visual environment, and providing furniture and equipment that enhance comfort. The interviewees explained how these strategies influence the time management of construction workers in sites. All the strategies that were identified at the interviews to manage comfort were confirmed by case study interviewees and observations. However, the first strategy of managing openness by improving the view, light, and the feeling of being open was not confirmed by Case B observations.

Permeability within the site can be managed by creating a well-connected layout which could offer a choice of direct routes (Essex Planning Officers Association, 2019). To manage robustness, the strategy of creating spaces that can adapt to different uses and activities, perhaps at different times of the day, can be used (Carmona, 2018). I2 proposed to arrange adjacent spaces to facilitate ongoing constructions within a certain space as a strategy to increase robustness. Scale can be managed by strategies such as the use of standardized heights and ergonomic measures in the design of site furniture and setting service route widths based on anthropometrics (Hatch Interior Design, 2021). To manage tidiness, strategies such as providing designated areas for rubbish and waste, stacking and storing materials properly, and keeping clear access routes can be used. Imageability can be managed by improving the identity of the site to distinct it from other objects, improving the structure of the site (its relationship to the pattern of other large elements), and improving the meaning of the site (practical and emotional value that the site holds for an observer) (Damayaniti & Kossak, 2015). A strategy that can be used to manage personalization is to allow workers to rearrange their workstations or furniture to suit their evolving needs for collaboration and privacy (Pearce & Hinds, 2018). The interviewees disclosed how the use of this strategy could influence the time management of construction workers in the sites. The interviewees explained how these strategies influence the time management of construction workers. The case study findings confirmed the interview findings.

Management strategies such as increasing accessibility, sustainability, and environmental quality to manage vitality (Drewes & van Aswegen, 2010). Another management strategy that has been mentioned in the literature is to create vibrant and diverse spaces and facilities (March et al., 2012). Data on how these strategies could contribute to the time management of construction workers were collected through the interviews. Case C interviewee did not agree with the strategy of increasing sustainability. Case A and C interviewees did not confirm the strategy of creating vibrant and diverse spaces and facilities, and it was not confirmed by Case B observations also. A strategy that can be used to manage unity is to create a sense of cohesion in the space by repeating certain elements, such as colours, shapes, or materials, throughout the entire space (Mastroeni, 2020). The interviewees explained how this strategy influences time management of construction workers and case study results confirmed the interview findings.

5. Conclusions and recommendations

This study reveals the influence of spatial factors on the time management of construction workers and the methods that can be used to manage spatial factors and achieve satisfactory time management at urban residential construction sites. From the literature, 12 spatial factors that influence the time management of construction workers were identified: legibility, permeability, imageability, robustness, safety, vitality, openness, comfort, unity, personalization, scale, and tidiness. The interview and case study findings indicated that all 12 spatial factors contribute to the time management of construction workers in sites.

The impact of the spatial factors on construction projects were identified from the literature review, interviews, and case studies. How the identified spatial factors influence the time management of workers in urban residential construction sites was determined through semi-structured interviews, and case study interviews and observations. Improving communication among workers to enable openness and creating an interesting and encouraging work environment within the site to enable vitality could not be fully confirmed through the case studies because some case study interviewees and observations did not confirm them. The study findings revealed the impact of spatial factors on the time management of workers in construction sites and ways that the factors influence construction projects.

Strategies that can be used to manage the identified spatial factors were first identified from the literature and the strategies that can be used to manage the spatial factors that influence the time management of construction workers in sites were identified during the semi-structured interviews. How all those strategies contribute to improve the time management of construction workers was identified through semi-structured interviews and case studies. The case study observations were not sufficient to confirm some of the interview findings. Some strategies that will help manage openness, imageability, and vitality could not be fully confirmed through the case studies because some of the case study interviewees and observations did not confirm those strategies and the way they contribute to the time management of construction workers in sites.

The study findings can be used to achieve proper time management in construction projects and reduce construction delays. Using the knowledge gained on the spatial factors contributing to time management of workers in construction sites, and their impact on the projects, a framework can be developed to determine the floor plan of a construction site to improve worker behaviour and efficiency. Knowledge gained through the study about the way spatial factors influence the time management of construction workers would contribute to fill the knowledge gap in theory. Because this study was conducted using a qualitative approach, only a small number of interviewees and three case studies were used. Thus, the study findings cannot be generalized and would be limited to the study context. However, the study findings can be used as a benchmark for future studies.

If the following recommendations could be implemented, they would ensure the effective implementation of spatial factor management strategies to reduce delays in construction projects.

- Making it mandatory to Prepare Construction Site Layout Plan by considering spatial factor management strategies: Preparing proper construction site layout with involvement of professionals who are knowledgeable on spatial factors, human psychology and human behaviour can improve the chances of creating a construction site with optimum efficiency level.
- Conducting time-to-time inspections within the site to check whether spatial factor management strategies are implemented properly throughout the process: Since Construction sites are volatile, spatial arrangement may change over time by not considering initially prepared work site layout. Therefore, time-to-time inspections are nec-

essary to keep everything in place throughout the process.
- Including necessary clauses to tender documents about spatial factor management and making it compulsory for project managers to follow those guidelines: This improves contractors' awareness about spatial factor management and makes it compulsory for contractors to implement spatial factor management strategies within site.
- Organizational level awareness programs: This is the most practical way of engaging and giving awareness about implementation of spatial factor management strategies and its consequences in construction projects to people in all the levels.
- Conducting research and development: In-depth investigations are required to gather further knowledge on the implementation of spatial factor management strategies to reduce delays in construction projects and achieve satisfactory outcomes.

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Contradicting parochial realms in neighborhood parks: How the park attributes shape women's park use

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Abstract
Neighborhood parks are significant green public spaces located in close social and geographical proximity to homes to maintain individual and public health. However, some people do not use the nearest parks, but those with other socio-spatial attributes that make them feel more "familiar". This study argues that with their facilities, amenities and design, and the surrounding land uses, neighborhood parks do not only accommodate, but also define, regulate, and originate social relations among users. Thus, the design and planning of urban public spaces play a role in the emergence and maintenance of supportive and conflictual relations that lead to familiarity. The study answers two research questions: How do the park attributes shape and mediate the interpersonal relations among the park users? How do gender differences influence the parochial realms in parks? Data was collected through field observations and in-depth interviews with 33 female users of two neighborhood parks in a populous district of Izmir (Turkey). Results state that women's park visits were related to their gendered roles and responsibilities. Yet their responses point to challenges emerging from physical and social attributes of parks and park surroundings which lead to negotiations to protect their individual or group's privacy (parochial realm) in neighborhood parks. Mainly, perceived threats to women's parochial realm are men unaccompanied by child(ren), and exposure to the male gaze. The study highlights the importance of investigating these attributes of neighborhood parks for developing research and public policies to improve women's presence and perceived safety in public settings.

Keywords
Gender, Land-use design, Neighborhood park, Park design, Parochial realm.

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1. Introduction

> *"This is a 'family' park. Not too many men come here. That is why there is nothing that women get uncomfortable. It is a comfortable family place, a place for husband and wife, a place for mother and child. This is not like Duru Park (where) the teahouses and the elderly have invaded everywhere. My house is closer to Duru Park, but I don't go there"* (Woman, 50, married with three children, elementary school graduate).

Ideally, in close social and geographical proximity to homes, neighborhood parks are significant open and green public places to maintain individual and public health (Şenol & Atay Kaya, 2021). Like the case of this female respondent, however, not everybody uses the closest parks to their home. They visit parks with other socio-spatial attributes that make them feel more comfortable there. An investigation of such park attributes is essential for urban planning and design research and policies aiming to improve women's presence and perceived comfort and safety in public settings.

Designed and legally designated as urban public spaces, parks provide settings for social relations among people with varied socio-economic and demographic characteristics. They are part of the public realm, or "the world where one meets strangers" (Lofland, 1989, cited by Wessendorf, 2013; 393). This "world of strangers" contrasts the private realm with intimate relationships. Also, public spaces can be settings of multiple parochial realms that develop by a feeling of commonality among the acquaintances, or "familiar" people, in these settings (see Hunter, 1985; Lofland, 1998; Kusenbach, 2006; McKenzie et al., 2006). Thus, the parochial realms evolve through the interpersonal relations around shared interests among the strangers who become acquaintances through their "regular" presence in those settings.

Parochial realms may be by, for instance, neighbors, colleagues (Hunter, 1985), members of civil associations, and users of cafes, stores (Oldenburg, 1989), and parks (Krenichyn, 2004). Concerning the shared benefits, the literature points to people's status within the socio-economic and spatialized web of power relations. For instance, the research about women's experiences in parks (Krenichyn, 2004), neighborhood streets (Cantek & Funda, 2003), library halls (McKenzie et al., 2006), and other public places (Day, 2000; Şenol, 2022) show that women in public settings tend to build connections with each other and exchange assistance around their gendered care responsibilities in public and private realms.

A legally "public" place can be a sociologically "parochial" space (McKenzie et al., 2006). In this study, a reconsideration of public spaces in terms of parochial realms suggests an inquiry into how the socio-spatial features of urban space affect the development of interpersonal relations in public settings. About this inquiry, more research focuses on the supportive characteristics of social relations in urban spaces. At the urban scale (e.g., Loukaitou-Sideris, 2005) and public open spaces (e.g., Whyte, 1980; Carr, et al., 1992; Giles-Corti et al., 2005), they emphasize the significance of the socio-spatial features (such as diversity of land-uses or natural and physical amenities, respectively) for creating population density or attracting more people to provide urban environments with a sense of community, comfort, and safety.

Different from the literature, this study considers both supportive and conflictual characteristics of people's daily contacts in public spaces. It explores everyday relations with a focus on gender differences in spatialized behaviors and relationships (see Şenol, 2022; Vera-Gray & Kelly, 2020). It states that given the variety of their socio-economic and demographic characteristics, people have different expectations from public spaces, which appears with distinct spatialized behaviors and relations in these settings. Public spaces become part of claimed spaces or spaces that various social groups want to change according to their expectations and needs (Nemeth, 2006; Mitchell, 2003; Low & Smith, 2006). This paper argues that the daily relations in public spaces form multiple parochial realms with contrasting socio-cultural values and perceptions about gender identities in public spac-

es. Also, recent re-urbanization processes have increased significance of public spaces as negotiated by groups with different gender, racial/ethnic, class-based, age-based, and other socio-economic characteristics. The research for park planning and design should evaluate the kind and spatial organization of park characteristics to provide public settings with less conflict among various users.

This study investigates two related research questions: How do the park attributes shape and mediate the interpersonal relations among the park users? The study examines the park attributes concerning the park amenities (for walking, resting, sitting, playing, and exercising), the kind of land uses, and the density of vehicular traffic next to the park areas. It investigates how the diversity and design of park characteristics influence the number of park users. Also, the analysis takes various users concerning their socio-economic characteristics and ways (purpose, frequency, and duration) of using parks, and thus, the variety of parochial realms in parks.

To explore the development of social relations in the parks, this paper takes "gender" as a characteristic of individuals and power relations. It asks: How do gender differences influence the parochial realms in parks? Based on biologically determined sex differences, "gender" refers to socio-culturally and politically constructed meanings of sexual identities and value systems that shape the daily experiences. One's gender identity emerges as a part of interweaving power relations shaped by various cultural and socio-demographic characteristics (Vera-Gray & Kelly, 2020; Ceccato & Loukaitou-Sideris, 2022). Influenced by their gender roles and responsibilities, women and men have distinct daily urban experiences with variations across cultural contexts (Day, 2000; Greed, 2007). Socio-cultural perceptions about women "outside" home and the physical design of public spaces can discourage women's presence in urban public spaces (Ceccato & Loukaitou-Sideris, 2022; Day, 2001). To visit and enjoy public spaces, more women deploy behavioral and spatial strategies shaped by their gender responsibilities and public settings' features, including the crowd, commercial activities, and bright areas with escape points (Şenol, 2022; Vera-Gray & Kelly, 2020).

For the study data, we had field observations of park attributes and user characteristics in 32 neighborhood parks, a user survey in four parks, and in-depth interviews with 33 women in two parks in Balçova, a populous district of Izmir (Turkey). The results show that the playgrounds, elementary schools, and daily shopping areas ease women's regular park visits to fulfill their child and family care but also their own care responsibilities. However, teahouses with male patrons and lack of seats concerning the playground threaten the parochial realms among women most of whom have concerns about the male gaze in public spaces.

The next part gives a literature review on the factors shaping parks with multiple parochial realms and women's presence in public spaces. After describing the study site and methodology, the study details its findings. The Discussion and the Conclusion points to policy implications for neighborhood park design and further research.

2. Neighborhood parks as designed public settings with multiple parochial realms

Close to home, neighborhood parks' natural and physical elements provide opportunities for recreation, socialization, and relaxation, and thus, the improvement of individual and communal well-being (Ozguner, 2011; Şenol & Atay Kaya, 2021). Shaped by the physical design, amenities, and locations of parks, and the characteristics of park surroundings, parks' socio-spatial characteristics affect the conditions for people's getting benefits from parks (for a review see, Şenol, 2022; Parra et al., 2010). Moreover, people's age, gender, income level, cultural and ethnic backgrounds, and other characteristics shape differently their activity routines (i.e., purposes, frequency, and duration of park visits) and expectations of parks. For women with children and stay-at-home spouses, parks close to

shopping areas and schools (Greed, 2007) and with playgrounds, cafes, seating opportunities, and toilets become important settings to fulfill their care responsibilities for family, child, house, or elderly and socialize with each other (Krenichy, 2003; Şenol, 2022). For children's mental, cognitive and behavioral development, parks with playgrounds, large and open fields, and seating arrangements can provide opportunities for playing and socializing with other children and animals (Giles-Corti et al., 2005). The provision of parks nearby homes and schools can ease park access for children at young ages, encouraging children's park use and physical activity (Floyd et al., 2008). Similarly, parks in neighborhoods with shopping facilities and healthcare facilities (Parra et al., 2010) and parks with walkways, seating areas, public toilets, and eateries attract the elderly (Tinsley et al., 2002).

The legal terms and urban design and planning practices consider parks as shared spaces or public spaces in Turkey. With their location, spatial design, and management, public spaces should be accessible to (or used without any hindrances by) all of any socio-economic and demographic characteristics. Any space that welcomes the presence of certain groups while denying access to others cannot be a public space (Carr et al., 1992). The research in urban studies defines public spaces as shared settings for various encounters among "strangers," that is, individuals outside intimate (i.e., family, blood, or emotional) ties (Lofland, 1989; Carr et al., 1992; Mitchell, 2003). Lofland (1989) defines the public space as a "world of strangers" due to the diversity of city inhabitants. On the other hand, the possibility of random meetings with those strangers in public spaces can lead to positive feelings towards each other (with social support, a sense of safety, personal and communal identity) and future intentions to keep using these spaces (Carr et al., 1992; Krenichyn, 2004; Kusenbach, 2006).

In the development of public spaces as social settings, the notion of familiarity has a key role. Regular visits in the same space lead to a sense of togetherness and familiarity among the users (Lofland, 1998; McKenzie et al., 2006). In neighborhoods, parks, streets (Hunter, 1985; Lofland, 1998), local stores, cafes (Oldenburg, 1989), and public libraries (McKenzie et al., 2006), familiarity among regular users can encourage supportive relations around their shared benefits during their stay. Ultimately, it can form the "third place" (Oldenburg, 1989) or the "parochial realm in these shared spaces (Hunter, 1985; Kusenbach, 2006; Lofland, 1998; McKenzie et al., 2006).

This study considers that physical and social aspects of public spaces interrelate and form public spaces as "parochial" spaces (McKenzie et al., 2006). It uses "the parochial realm" to refer to the interpersonal relations around particular common interests by public space users or those strangers who regularly visit these public places. Being in a familiar public place can encourage particularly women's sense of comfort and safety (Kusenbach, 2006; Vishwanath & Mehrotra, 2007) and development of behavioral-spatial strategies for visiting public spaces (Şenol, 2022). On the other hand, when multiple interpersonal connections develop in the same public spaces, spatial conflicts and negotiations among user groups of that space are unavoidable (Nemeth, 2006; Mitchell, 2003; Low & Smith, 2006). Next section discusses such socio-spatial conflicts that emerge regarding gender relations and women's presence in public spaces.

2.1. Women's parochial realms and conflicts in public spaces

The research about women in urban public spaces talks more about how women develop supportive relations in public spaces around their gender roles and responsibilities. Overall, traditional gendered responsibilities expect women's presence in public spaces only to fulfill their goal-oriented purposes, that is, care responsibilities for their children, family, home, or old relatives and to go to workplaces or schools (Paul, 2011; Tuncer, 2018). Additionally, women's leisure-related purposes, or "non-instrumental" activities (McKenzie, 2006), drive women to public spaces (Krenichyn,

2004; Şenol, 2022). When fulfilling their gendered responsibilities in public spaces, women also enjoy conversations with other women and deploy casual behaviors in streets, parks, public libraries, or shopping malls (Day, 1999, McKenzie et al., 2006; Cantek & Funda, 2003); Wessendorf, 2013).

However, regarding their presence in public or "outside," women face socio-cultural restrictions that dictate certain norms about women's appropriate public and collective behaviors, acts, outfits, places to visit, and so on. Reflecting an ideal female identity based on a womanhood as good housewives and mothers (Cantek & Funda, 2003; Day, 2001), gendered norms tell women to avoid public spaces unless they have goal-oriented purposes. In public spaces, they need some behavioral-spatial strategies to manage their presence (Ceccato & Loukaitou-Sideris, 2022; Paul, 2011; Şenol, 2022), for instance, by downgrading femininity with their outfits and acts and emphasizing their familial roles (Tuncer, 2014). Similarly, research in Turkey shows that female neighbors use local streets, parks, and door-fronts for their gendered multi-tasking activities, such as cleaning, cooking, child care, and organizing get-togethers with neighbors (Cantek & Funda, 2003). As another strategy, women tend to visit public spaces accompanied (by their spouse, female friends, and children) (Şenol, 2022) and identify personal spaces around some socio-cultural factors (Paul, 2011; Vera-Gray & Kelly, 2020; Ceccato & Loukaitou-Sideris, 2022).

In public spaces, both physical factors (design) and social factors (use and users) affect the fulfillment of women's need for privacy (Al-Bishawi, 2017) and strategies for maintaining their sense of safety (Ceccato & Loukaitou-Sideris, 2022; Şenol, 2022). At the urban scale, for instance, women use urban public spaces nearby the mixed land-use for shopping, childcare, and others to fulfill their multi-tasking gendered responsibilities. Similarly, a variety of land-use nearby urban public spaces increases the chances for women, children, and the elderly to use these spaces (Passon et al., 2008). This variety allows women to legitimize their presence in public besides those goal-oriented purposes, such as going to their workplace or school, dropping off or picking up children, or shopping (Paul, 2011; Vishwanath & Mehrotra, 2007). Also, the crowd created by the mixed land-use can act as a guardian to maintain women's sense of safety (Vishwanath & Mehrotra, 2007). Moreover, while public spaces with multiple sites provide women more opportunities to seek for privacy with companionship, women prefer more those locations with visible and escape points (Şenol, 2022).

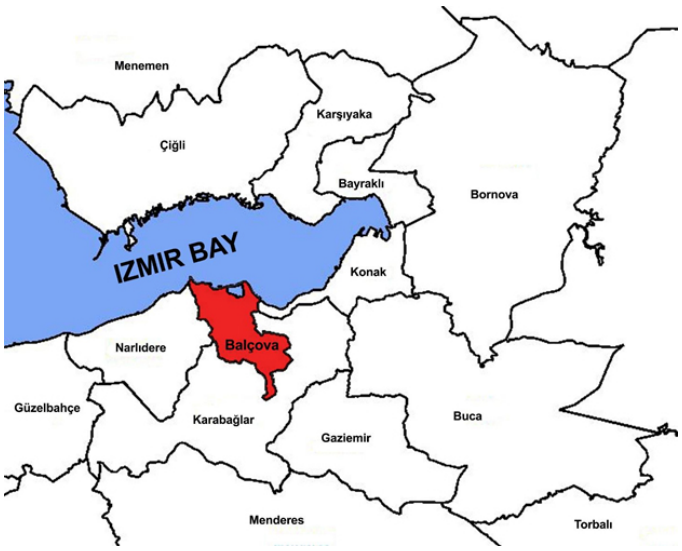

Figure 1. *Location of Balçova in İzmir.*

3. Data and methods

As the study site, Balçova (Figure 1) is a coastal district at Izmir Bay in a Mediterranean climate. It has a densely populated urban area separated from seafront by a highway to the north and surrounded by a forestry area on the hill to its south. It has 32 neighborhood parks (Figure 2).

The study has three phases each of which evolved with a decreasing number of parks. The first phase included all 32 neighborhood parks. We had field observations about park attributes and counted visitors for 30 minutes four times a week in September. We identified four parks with the highest average number of users. In the second phase, we deployed a user survey (total of 159) with an equal number of female and male adults at these four parks. Survey questions are about the

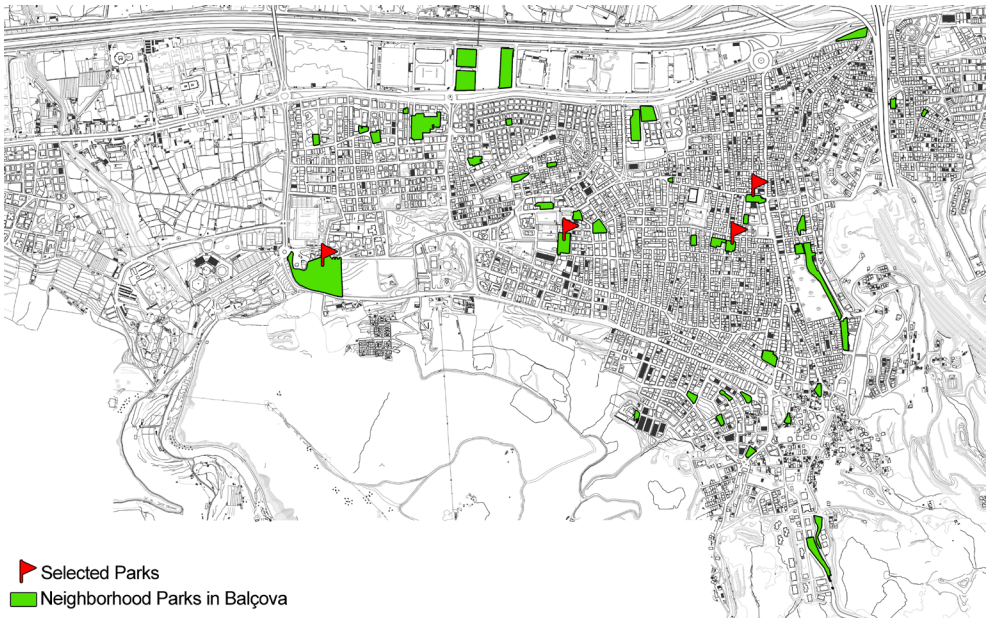

Figure 2. *Neighborhood parks in Balçova (Study sites with red flag).*

respondents' socio-demographic characteristics and park usage (frequency, duration, time, and purpose of park visits). According to the survey results, we identified "regular" park users (108 of 159 respondents), or those visiting that park at least once a week and for at least 30 minutes, and the rest as "non-regulars". Then we selected two parks with the highest and the lowest number of regular users, and a wide variety of park facilities and amenities and adjacent land-use. In the third phase, we held face-to-face interviews with 33 female users in these two parks. Interview questions focused on the respondents' experiences with and perceptions about available park attributes and other park users.

4. Findings

4.1. Four parks and their users

With the "highest" average number of users among 32 parks, three parks are in residential areas and one is in a commercial area. All four have playgrounds and sitting areas. Ercüment Özgür Park also has sports equipment, attracting more young (15-25 age) men and middle-aged women. Muhtarlık Park has the neighborhood representative's office building and young female and male respondents. Located next to an elementary school and a parking lot, S.Ersever Park has a playground and a café. It has a high number of female respondents above 56 years old and male and employed respondents between 26-55 ages.

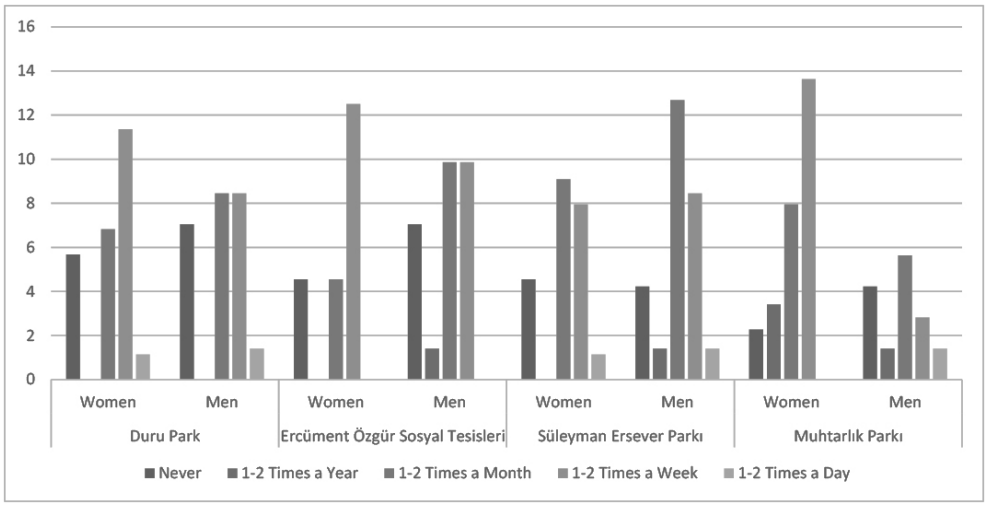

Figure 3. *Number of survey respondents across four parks according to their age and gender.*

Duru Park is in the commercial area of Balçova. It is next to an internet café, cafes, traditional teahouses (for men), grocery stores, a taxi rank, and a busy road. With a WC, it has the highest number of non-working male respondents over 56 and young women (15-25 years old).

According to the user survey, women between 26-55 years old and without paid jobs are everyday users (Figure 3). While women use parks between early morning and noon, male respondents prefer late afternoon and evening. The primary purposes for park visits are childcare (44%), leisure (25%), and socialization (19%). Female respondents come to these parks with their children or female friends, whereas a quarter of male respondents visit alone.

More female respondents (43%) encounter negative experiences in parks than men (23%). As the reason for not using parks, men report the factors concerning park design and their lack of time. Women show their family responsibilities, their "social pressure," and their sense of discomfort due to other users.

Figure 4. *Duru Park on a spring day & Suleyman Ersever Park when the school is open.*

4.2. Two parks with regular users, park amenities, and surrounding land uses

Of the four parks, S.Ersever Park and Duru Park have the highest and the lowest number of regular users (21 and 9, respectively). Both parks have a high variety of park facilities and amenities (Figure 4 and Table 1), although Duru Park is smaller (1103 m2) than S.Ersever (2271 m2).

Duru Park provides two main groups of seating opportunities. Next to a pool at the center area and shading elements, it has benches occupied more by the elderly and teahouses' male patrons. The shading element over the seats protects from the sun but not rain. The playground has two benches (Figure 5). The trees around the playground fail to create any shade for these benches.

Adjacent to Duru Park, the variety of land uses shape park user profile. More park users are older men spending time in the teahouses, young boys using internet café, or local shoppers resting for short durations. During

Table 1. *Characteristics of selected parks for interviews.*

	Duru Park	**Suleyman Ersever Parkı**
Number of Regular Park Users:	Lowest Number of Regular Users (12 users)	Highest Number of Regular Users (28 users)
Satisfaction Level of Regular Park Users:	Lowest Level of Satisfaction among Regular Users	Highest Level of Satisfaction among Regular Users
Surrounding Environment:	Commercial activities & dense traffic	Residential & education buildings & low traffic
Park Area	1103 m^2	2271 m^2
Provided Park Amenities:	* Playground, * Café (Food Kiosks) * Toilets * Seating units * Water elements	* Playground, * Café (Tea, coffee etc.) * Toilets * Seating units & tables * Water elements

warm days, teahouses' patrons shift these stores' tables and chairs to the park area. With its playground and toilet facilities, Duru Park attracts women with children too.

The surrounding of S.Ersever Park has an elementary school and more houses. Parents of young students are regular users of this park that has a café run by a private enterprise. Although this park has big trees with large shadows, the seating areas have no shade (Figure 6). It has an ornamental pool with sections. During our field observations, the pool was empty and public toilets were locked or out of service.

With similar characteristics in their equipment, floor materials, and sizes (Figure 7), the playgrounds in the two parks lack shading and instruments for climate protection. Interestingly, S.Ersever Park has walls separating the playground from the street without a significant vehicular traffic, whereas Duru Park has no physical separation from the surrounding busy roads.

Figure 5. *Duru Park seating areas.*

Figure 6. *Suleyman Ersever Park seating area.*

Figure 7. *Duru Park playground & Suleyman Ersever Park playground.*

4.3. Women's parochial realms in parks around their gendered care responsibilities

Of 33 women interviewed, those in S.Ersever Park have a higher education level than those in Duru Park (Table 2). Most respondents in S.Ersever Park are housewives. In Duru Park, more than half of those (9 out of 15) have paid jobs. All respondents are married with children, except three at Duru and one at S.Ersever Park. The average age of respondents at Duru and S.Ersever Park is 36 and 41.

For all mothers in both parks, their childcare responsibilities initially drove them to parks. They feel an obligation to visit parks as part of their motherhood responsibilities. A middle-aged woman expressed this sense of duty:

> *"As our lives are based on the needs of our children, there is not much that we can do for ourselves."* (38 years old, married with two children)

Table 2. *Survey participants' profile.*

DURU PARK				
Age	**Education**	**Work Status**	**Child**	**Marital Status**
28	High School	Housewife	1	Married
43	High School	Housewife	3	Married
50	No answer given	Housewife	3	Married
27	University	Housewife	1	Married
34	High School	Housewife	2	Married
37	No answer given	Housewife	1	Married
42	High School	Accountant	2	Married
51	University	Accountant	0	Widow
29	PhD	Landscape Arch.	0	Single
26	PhD	Research Assist.	0	Single
26	No answer given	Sales Clerk	1	Married
50	Elementary School	Shop Keeper	4	Married
30	Graduate Degree	Teacher	1	Married
35	No answer given	Working	1	Married
30	No answer given	Working	1	Married
SULEYMAN ERSEVER PARK				
Age	**Education**	**Work**	**Child**	**Marital Status**
28	High School	Housewife	1	Married
38	High School	Housewife	2	Married
42	High School	Housewife	2	Married
38	High School	Housewife	1	Married
55	Elementary School	Housewife	3	Married
53	Elementary School	Housewife	1	Married
42	High School	Housewife	1	Married
40	High School	Housewife	2	Married
45	Middle School	Housewife	2	Married
32	No answer given	Housewife	1	Married
46	University	Retired	3	Married
26	University	Teacher	0	Single
35	High School	Operator	1	Married
40	Middle School	Working	1	Married
55	University	Working	1	Married

These parks have become playgrounds within walking distance of these mothers' homes or workplaces. However, they are not necessarily the nearest locations to be a playground. Some respondents did not choose their house yard as the playground. They explain their choice of parks concerning their perception of parks as a socialization setting for their children but also themselves. Two middle-aged mothers in S.Ersever Park expressed this reasoning:

> *"House yard is different from a park. I take my children to parks so that they can socialize and have friends. Since there are no neighbor relations these days, it is also easier for me to meet with new people in parks."* (38 years old, married with two children)

> *"Both children and I enjoy more freedom in the park. I don't have to justify my presence to anyone there."* (40, married with one child)

As another reason, these talks express these non-working mothers' discomfort with the gaze at their homeplace concerned about women "going outside." When they show their childcare responsibility as a reason for their park visit, they use this also a strategy to escape from this patriarchal gaze and to socialize in parks. Women's shopping activity is another tool to justify women's park visits. In Duru Park, a young mother talks about her and other working mothers' gender responsibilities as a continuous work shifting across public and private settings. Thus, she explains her park visit with her goal-oriented, rather than recreational, purposes:

> *"Usually, women work (at their job), then go home and continue working there. I should be at the workplace at this time of the day, but today I got out early. I should have stayed home and prepared dinner, but I needed to do some shopping. When we got outside, my daughter started crying to go to the park. That is why we are here now."* (26, married with one child)

Shopping areas or an elementary school next to these two parks facilitate women's goal-oriented purposes and, thus, the social acceptance of their park visits. After accompanying children to the school next to S.Ersever Park, non-working mothers sometimes spend time here until school recess.

Their daily park visits help them to have collaborative relations with each other around childcare responsibilities:

> *"The most important thing is the comfort of children. That's why we are (in this park). We stay here during recess times to see if they have eaten well. It would have been harder to go home and come back every day. (…) If I can't come to the park, I call a friend (in the park) and ask her to take care of my child. While she brings my child to the park, I finish my daily errands."* (40, married with one child)

After school time, mothers and children stay in this park for a while. Before and after school, the "park time with other mothers" has become an event organizing non-working mothers' daily tasks:

> *"We stay in the park for at least an hour or two. We arrange our daily errands accordingly. We wake up early, and until school time, we finish most of our house chores. Coming here is also an opportunity for us to breathe."* (42, married with two children)

As children grow up, women seeking a parochial realm in parks have multiple paths. Some mothers of adolescents continue visiting their parks and meeting friends friends who are mothers with younger children. Or when the playgrounds lose appeal as children grow, mothers put effort into entertaining their children in that park or seek other parks with amenities suited more to their children's needs.

4.4. Park attributes shaping the threats and conflicts around women's parochial realms in parks

Located next to an elementary school in a residential area, S.Ersever Park has a large surface with tables and benches. Mothers come here in groups of 6 to 7 people, bring food and spend hours here. Duru Park, with a smaller coverage and in a commercial area, has more working women who visit here for the playground and shops nearby, and more men usually patrons of teahouses and an internet café. Both parks have problems with safety and hygiene conditions, limited seats, small playground areas, and a lack of climate-sensitive park design. According to female respondents, while some of these park attributes trigger spatialized social conflicts in two parks, such conflicts threaten women's supportive parochial realms, especially in Duru Park, detailed in this section.

4.4.1. How certain stores affect women's seeking for privacy in parks

More in Duru Park, women express their discomfort in the parks due to "too many men" around. They describe the neighborhood park as a "family territory" designed for the needs of women and children and welcome the presence of men in parks only under certain conditions. In the case of S.Ersever Park, they welcome only male visitors who are fathers accompanying their children and do not deploy acts of "gazing" in the park. Still, these women seem to act as a "park watch" group over the "outsiders" or the male threat and keep this park as their "family" territory:

> *"(In the park) We have male parents (…) and male teachers. There is a family environment in this park. Everyone knows each other. We know who comes here for what purpose. We can recognize an outsider immediately."* (40, married with one child)

> *"As long as men bring their children to the park, it is fine with us. However, when they come here to spend alone time in the park, it may unavoidably cause a problem. (…) There is a look, and there is a look (by men). If they annoy us with their gaze, it may create a problem."* (42, married with two children)

The quotation "there is a look, there is a look" indicates these women's perception of the male gaze (over women) as a threat in public spaces. The male gaze as the threat to women's comfort in public settings appears to be more immediate for some women in Duru Park particularly due to the surrounding land uses. When maintaining their sense of safety, a few women show the high levels of pedestrian activity around Duru Park as a good sign. However, the presence of particularly teahouses and internet cafes only with male patrons seems to discourage more women's sense of safety and comfort here, as expressed in the interviewees:

> *"Duru Park is more like the courtyard of the tea houses, food kiosks, and internet cafes."* (29, single, landscape architect)

> *"Existence of too many men in Duru Park is the only thing that worries me. I*

can't spend time there comfortably. The park and teahouses are too involved with each other." (40, married with two children)

More male users in Duru Park are the elderly who use the park daily from early morning to evening hours. A young mother describes these men as retirees "without any place to go" but the park:

"(Of these retired men,) wives kick their husbands out of the house so that they can run their house chores comfortably. So these men come to park." (34, married with two children)

Due to these older men's long stay in Duru Park, some rumors appear unavoidably about how these men gaze at women sitting at park benches:

"(Men in the park) gaze a lot, especially the older men. I heard that a woman was sitting, and an older man came and asked her if she was a widow or not, and then (he) proposed (to her). These men should go and sit in teahouses. Why do they sit in the park and occupy our space?" (53, married with one child)

None of the women experienced any threatening incident involving men in Duru Park. Still, this and similar hearsays support women's sense of discomfort about being outnumbered by men "all over the park." Some women relate their privacy concerns in Duru Park to parks characteristics with small coverage and limited seats.

"I haven't witnessed any incident. However, the male gaze is disturbing. There is not enough seating. I can't spend as long time as I want in Duru Park as in S.Ersever Park." (53, married with one child)

"No, there is no one disturbing us. However, (men) are everywhere. They use the park more than we do. I was going to sit there (the seat next to the playground), but I couldn't. A man was sitting there." (34, married with two children)

Only a few old women perceive the teahouses around Duru Park and the café in S.Ersever Park as an informal guard keeping female park users safe from threats by "strangers."

4.4.2. Social conflicts around the seating areas in parks

When expressing their discomfort in parks, women complain more about the seats' characteristics: Seats are few in number, used by "others," and have no shade and climate-sensitive materials. Women detail this complaint with references to where they sit, talk, and chat, particularly when their children are in the playground. For instance, especially in Duru Park, the limited number of seats has created a quiet battle between mothers and older women claiming the playground area:

"In Duru Park, there is no space left for children. Sometimes it isn't easy to monitor our children in this crowd. Sometimes old ladies put a table right in the playground to sit and chat. (Playground) is not a place for them to chat." (34, married with two children)

The spatial layout of benches in Duru Park is another matter of this complaint. Women ask for alternative designs that could allow women in groups to chat, study, do handcrafts, and have picnics or birthday events there:

"They put the benches in military order. The benches are too close to each other and fixed. Two rows of benches are looking face to face. Every time I walk between these rows, this layout gives me the feeling that all eyes are on me. It does not allow me to move according to what I like. So if I come here in a group of 3 or 4 people, we cannot chat properly." (26, single)

Similarly, S.Ersever Park has limited seats. Areas next to the playground, and the café in the park offers chairs and tables but only for customers. Also, some respondents criticize the café's putting furniture outside the café as an act of turning the park into a customer-oriented space and, thus, invading this public space and their fulfillment of childcare responsibilities there:

"All the tables next to the playground belong to the café. When you sit here, they make you buy something and spend money. But I have to sit there for watching my child in the playground. Otherwise, I have to sit on a (public) bench away from the playground." (42, married with two children)

Respondents in Duru Park have similar concerns about the "invasion" of this public setting by the teahouses. A woman identifies how this spatial invasion caused multiple threats to her sense of comfort and opportunities to build ties with other women in this park:

> *"Municipality designed a lawn as part of this park. But we can't use it because the teahouses invaded that part (by putting) tables and chairs. Also, with tables, they block the park entrance. To pass by, I must walk through all those (men). If this is a park, I should be able to benefit from the green and walk comfortably. I don't want to spend money on teahouses. Even if I can afford it, my friend cannot! Then I lose my friend."* (50, married with three children)

5. Discussion

This study investigates how the park attributes shape multiple parochial realms in parks. Its consideration of simultaneous park characteristics at the urban and park scales (respectively, parks' amenities, facilities, and design and the surrounding land use) contributes to the growing park research. Based on the perspectives of female users, it highlights those park attributes that influence supportive and conflicting relations in parks concerning gendered identities. Thus, the study contributes also to urban and gender studies.

Study results overall confirm that specific park attributes attract different groups and shape how female users develop daily relations that continuously negotiate women's presence in public spaces. Accordingly, our survey results with female and male respondents show that the primary purposes for park visits are childcare, leisure, and socialization. However, various park characteristics attract different age groups of women and men (Parra et al., 2010). Mothers between 26-55 years old, housewives, and working women are typical users of the parks with playgrounds nearby schools or stores, thus, with the characteristics assisting with women's traditional gender roles (Parra et al., 2010; Min and Lee, 2006). While a quarter of men visit these parks alone, most women visit accompanied by their children or female friend, a precautionary strategy by women for maintaining their sense of safety in public spaces (Şenol, 2022; Vera-Gray & Kelly, 2020).

As a contribution to the literature, the interviews with women in two selected parks detail how the gendered and park-related conditions interweave with each other and shape women's ways of building parochial realms in parks. Accordingly, married with children, most respondents in Duru Park are working women and, in S.Ersever Park, housewives. Despite this difference determining their available daytime, most women come to parks to fulfill their child, home, and family care responsibilities with the help of a playground at both parks, the school next to S.Ersever Park, and shops nearby Duru Park. Thus, like going to the workplace or school, women's park visits have (gendered) goal-oriented purposes that socially legitimize women's presence in public (Paul, 2011; Tuncer, 2014). Women's performance of their care responsibilities in both parks show the permeability between public and private spaces, as illustrated by feminist research (e.g., McKenzie, 2006; Cantek & Funda, 2003).

All female interviewees show their care responsibilities as an excuse for their "enjoyment" of parks. However, whereas more women over their 50s openly express their leisure purposes for park visits, young mothers are more reluctant to do so. Thus, rather than coming to parks for their recreational needs (Krenichyn, 2004), these young mothers state their leisure activities (such as sitting, chatting, watching, and eating-drinking together) in parks as the by-product of the fulfillment of their gendered care responsibilities there. A reason for not openly stating their leisure purposes in parks may relate to these young women's preconceived concerns about the patriarchal control over women in public spaces. Such socially learned preconceptions about female identity expect women in public only for fulfilling women's gendered goal-oriented purposes and by diminishing their femininity by acting with the roles of good housewives or mothers (Day, 2001; Paul 2011; Tuncer, 2014).

Concerning the patriarchal control over women "outside," all women at any age talk about their discomfort with the male gaze in both parks. On the one hand, triggered by the male gaze and concern about male strangers (Valentine, 1992), socially constructed fear mechanisms about public spaces make

women avoid going to public spaces or feel uncomfortable there. Similarly, in the user survey, more women express their negative encounters in parks and discomfort with other users as a reason for not using parks often. On the other hand, interviews detail that women act upon and develop specific social mechanisms to deal with the male gaze. For instance, some young mothers prefer parks (rather than house yards) as playgrounds. Although parks, too, are under the male gaze, women's regular togetherness there provides a supportive and protective setting for each woman to "escape" from the patriarchal gaze at their home place and "breath". Due to the playground and probably this defensive nature of their parochial realm in parks, all interviewees declare their neighborhood parks as a "family space," or for all women and men fulfilling their traditional responsibilities as mothers, fathers, wives, and husbands. This declaration is not necessarily to claim neighborhood parks as "women-only spaces." It also reflects women's discomfort about the continuous reminder of patriarchal threats to women, although women follow the patriarchal rules and visit parks for their gender responsibilities and act, talk, and wear as mothers and wives.

Being on guard against the male gaze, women in both parks have different ways of dealing with this concern. As a contribution to the literature, this study details how these ways differ concerning women's parochial realms developed with the help of the park attributes. Firstly, both parks within mixed-use environments (including shops and a school) and with a variety of amenities (benches, playground, WC, water features, walking paths, and shade) attract a high number of users as expected (Carr, 2003; Giles-Corti et al., 2005; Min and Lee, 2006), but not necessarily of "regular" users, or those visiting that park at least once a week and for 30 minutes or more. S.Ersever Park and Duru Park have the highest and the lowest number of "regular" male and female users. Also, female respondents stay in Duru Park for much shorter than in S.Ersever Park.

A reason for the difference between women's regularity in the two parks may relate to these women's work status. Mostly housewives, women in S.Ersever Park arrange their daily schedule to stay in this park for long hours. While the availability of seats and tables assist their coming together in groups, their regular park visits allow them a parochial realm as a safe social environment for children and their gender identity formation in public (McKenzie, 2006). Duru Park has more working women who fulfill and use their child care and shopping responsibilities in and around the park as an escape from their double shifts as working mothers. Sometimes calling a female friend with children to the park after work hours; these women cannot develop a robust parochial realm in Duru Park. Also, for working mothers, Duru Park is the nearest park and thus, the only choice with nearby shopping opportunities. In contrast, some housewives prefer walking to distant parks rather than Duru Park.

Secondly, a reason for women's discomfort in Duru Park seems to relate to the fact that women are outnumbered by (more elderly) men who sit long hours at the park seats limited in number. While more women's regular togetherness in S.Ersever Park makes them collaborate to watch over the male gaze, young women in Duru Park feel to be exposed to the male gaze. Significant for the literature, specific ways of designing park attributes perpetuate this exposure and women's incapacity to create a parochial realm there. These park attributes include certain nearby land uses and the park seats, detailed as followed.

Accordingly, women's concerns about teahouses detail how these stores interact spatially with (or "invade") the park, especially by locating their tables and chairs in the park. A similar concern about such park invasion appears with the café in S.Ersever Park. Overall, the café and teahouses too host multiple parochial realms, or third places (Oldenberg, 1989), by their customers. Also, both private enterprises compensate the problem of limited seats in these parks. Yet these stores create

a customer- (and male-oriented) space in both parks, which threatens the characteristics of parks as public spaces and with women's parochial realms.

Similarly, in two parks, certain park characteristics shape significantly women's ways for seeking privacy and comfort (with their children, friends, or just by themselves) in public. Rather than just the seats' limited number and material sensitivity to climate conditions, the layout and location of seats concerning the playground and the shade are the design features affecting women's parochial realm in parks. Alternatively, interviews suggest designing the seats and tables for women coming together while performing their multi-tasking gendered responsibilities. Also, these seats should be invisible from (the male gaze in) nearby shops but still with a view to the playground.

6. Conclusion

About the relationships between park attributes and women's parochial realms in parks, this case emphasizes the need to investigate the park attributes simultaneously at the urban and park scales. Also, based on the perspectives of female park users, this study shows how the park attributes mediate multiple parochial realms and spatial conflicts in parks. The results reaffirm that park planning and design and land use planning should be part of the research to improve women's sense of safety and presence in urban public spaces.

The results have policy implications about certain land uses nearby neighbourhood parks and the allocation of seating areas concerning the playgrounds. Accordingly, the literature discusses how parks in mixed-use areas attract more users, and these mixed-land uses are helpful to women's daily multi-tasking care responsibilities. However, it does not explore these parks' regular users. In this study, although the two parks have similar park facilities and amenities, the regularity of park visits by women in these parks differs concerning different land uses nearby. Those stores, mostly with the male patrons (e.g., teahouses and internet cafes) and their spatial configuration with the park (including entrances and windows with clear views of the playground) perpetuate women's sense of discomfort with the male gaze in parks.

Park planning and design should consider the surrounding land uses as the attraction points for certain groups whose presence may discourage park visits by others, particularly women, children, and the elderly. Park design should provide multiple recreation areas with different user profiles located according to these attraction points. Like each recreation area, the playground should have seating opportunities to enable caretakers to watch over children while enjoying their interrelations with other users. It should also be kept from surrounding stores to maintain the privacy of parents, caretakers, and children.

As study limitations, this paper considers only neighborhood parks as public spaces when investigating the kind of parochiality in public places. Future research should increase the number of parks to have more opportunities for comparing the variety of park attributes. Meanwhile, the interviews in selected parks do not include men. How male users with different characteristics (particularly the elderly who are complained about) use parks to develop their parochial realm needs to be investigated. Moreover, limited in number, the interviews are analyzed for working, non-working, old, and young women. Further research needs to discuss the park experiences of women and men in different age groups, marital and work status, income level, care responsibilities, and other socio-economic characteristics.

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An integrated framework for assessment of urban forms and their transformation

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Abstract
This paper addresses an integrated framework on the basis of different urban morphological theories: histocico-geographical approach, space syntax, and the Morpho method. It includes eleven criteria focusing on the assessment of urban forms and their transformations. These criteria are the accessibility of streets, connectivity of streets, intelligibility, synergy, street block size, plot size, building coverage, floor area ratio, block-plan size based on the town-plan or ground plan; building height and total constructed area (density of buildings) based on building fabric. Sekiz Mahalle (Konya, Turkey) is used to validate the methodological procedures of this integrated framework. The implementation of the methodology enables a strong basis for how an urban area should be transformed, and what should be followed before any interventions in the urban landscape. It is argued that this methodology can provide a smoother transition of the physical form of cities. It can play a substantial role in the preparation of municipal plans and designs in which any change is needed, balancing the conservation and transformation of morphological constituents of the urban landscape.

Keywords
Historico-geographical approach, Planning practice, Space syntax, Urban transformation, Urban form.

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1. Introduction

Urban form's transformation and change stand in cities life from the formation of the first settlements until today's contemporary urban landscapes. These changes will also continue in the future. While different elements of urban form, such as streets, plots, and buildings, undergo alterations, a set of questions come into existence for the future townscape management. While the urban landscape experiences dramatic transformations what should be protected for the future? Which characteristics of the urban landscape should be maintained? Does the transformation or change of distinct elements enhance the urban landscape, make this landscape better? Do they transfer the assets and the heritage of previous societies to future generations? While cities undergo physical changes, the planning framework needs new, more systematic, and more explicit methods and approaches to analyse, plan and design cities. A great deal has been written on the assessment of urban forms and their transformation or change. Yet, the lack of systematization and simplicity of technics gives rise not to an understanding of how to approach urban forms transformation. This paper explores an integrated framework based on three urban morphological theories, offering an explicit understanding of urban forms. This paper aims to propose an integrated guideline for physical interventions carried out in an urban area and, then, for analysing and prescribing urban forms transformation. More clearly, it pretends that the city or parts of cities under analysis should be assessed on the basis of the proposed methodology, and then, it should be addressed in regard to this framework. Following this line, it is possible that the urban character can be conserved, and then a balance between change and continuity can be established. This paper, firstly, begins with a theoretical framework addressing different urban morphological theories. Secondly, it identifies an integrated methodology for the assessment of urban form's transformation, informing planning practice and urban landscape management. Thirdly, it describes *Sekiz Mahalle* neighbourhood and then focuses on the examination of this neighbourhood. Fourthly, the discussion part addresses fundamental problems of urban forms transformation and change, how these transformations should be assessed, and how the examination of the area based on the proposed methodology can inform planning and townscape management. It ends with conclusions.

2. Theoretical framework

Urban morphological analysis gained strength after 1950s under the umbrella of different urban morphological approaches (Batty, 2007; Batty & Longley, 1994; Caniggia & Maffei, 1984; Conzen, 1960; Muratori, 1959; Hillier, 1996). While the first attempts were about to establish a scientific theoretical framework for urban morphological schools of thought, the recent efforts are about bridging the theory and practice (Barke, 2015; Bell, 2012; Çalışkan & Marshall, 2011; Holanda, 2021; Kropf, 2017; Larkham & Morton, 2021; Monteiro & Pinho, 2021, 2022; Oliveira, 2015, 2021a, 2021b; Oliveira & Monteiro, 2021; Samuels, 2019; Strappa, 2021; Ünlü, 2019; Whitehand, 2000, 2013, 2021; Whitehand & Morton, 2004). The combination of different morphological approaches and methods has recently been an important tool to operationalize theories for practice. Kropf (1993 & 1996) established a framework on the basis of the work of M.R.G. Conzen and Gianfranco Caniggia – particularly the concepts of 'plan unit' and tessuto urbano (urban tissue). The combination of these two different approaches provides a basis for a form-based zoning of France. In this way, the delineated zones play a potential role in local zoning system to maintain the existing character of the town. Griffiths et al. (2010) propose a joint framework combining historico-geographical and space syntax approaches. In their study, they related the configuration of historical street networks with the persistence of socio-economic activity in the built environment over time. They presented the configurational and historical relationship

between suburban built form and socioeconomic activities. Oliveira (2013) established the Morpho method for measuring urban forms on the basis of the historico-geographical and space syntax theories. It offers a framework for the most relevant information about cities by assessing the physical form of urban areas. Li & Zang (2021) offer another substantial attempt for a combination of historico-geographical and configurational approaches to urban morphology in order to explore their complementarities. The combination of these two approaches presents an enhanced understanding of the historical transformation of urban form for both urban areas with incremental growth and those with fast-changing urban landscapes. Recently, Monteiro & Pinho (2021) developed 'MAP' (Morphological Analysis and Prescription) integrating historico-geographical, space syntax, and process-typological approaches - specifically based on morphological regionalization, angular segment analysis, and typological process – aiming at constituting a strong tool to identify and characterize morphological zoning that can introduce an effective set of rules for urban form's transformation.

This paper is developed on the basis of the three morphological theories of urban form, benefitting from the recent researches that combine different approaches. The first is the historico-geographical approach, as the prominent approach identified within the field of urban morphology, dealing with the development process and characterization of the townscape. The second is space syntax approach which focuses on the quantitative analysis of urban form. Space syntax research began in the centre of 'Land Use and Built Form Studies' at the University of Cambridge, and it gained a new impetus at University College London, mainly by Bill Hillier & Julienne Hanson (Oliveira 2016, 2022). The third is the Morpho method which addresses the physical characteristics of the urban landscape that are more permanent in time and that can offer the most relevant information on the city's form (Oliveira, 2013, 2020). While the first two approaches directly contributed to the design of the methodology, the Morpho rather remained an inspiring method. Unlike those efforts mentioned above, the methodology in this paper aims to give a particular focus on the assessment of urban form's transformation, providing a more explicit and detailed methodology.

2.1. Historico-geographical approach

The historico-geographical approach, also referred to as the British morphogenetic approach or Conzenian approach, was developed by M.R.G. Conzen and promoted by J.W.R. Whitehand and his colleagues at the University of Birmingham. Its roots go back to the works of German geographers in the early 20th century (Fritz, 1894; Schlüter, 1899; Hassinger, 1916; Geisler, 1918). As such, this approach is probably the oldest one identified in the field of urban morphology (Kropf, 2017a; Oliveira, 2022). Morphogenetic method, the conceptualization of historical development, terminological precision and cartographic representation are the main characteristics of the approach (Conzen, 1960; Ünlü, 2021; Whitehand, 1977, 1981, 1992a, 1992b, 2001, 2016). Solid evidence of the approach can be found in the work of M.R.G. Conzen, particularly in his book on the small market town of Alnwick. Crucial concepts were proposed and developed by Conzen in this book. The first part recognises the three form complexes of townscape. In the book, the focus is only on the town plan (streets, plots and the block plans of buildings). The second part addresses the growth of Alnwick's built-up area, considering morphological periods, and the key concepts of fringe belt and burgage cycle (the life cycle of a plot held by a burgess). The third part of the book takes into account the town-plan analysis of Alnwick. Conzen identifies the geographical structure of Alnwick into four orders on the basis of plan divisions (Conzen, 1960; Oliveira, 2019a, 2019b). In 1975 & 1988, Conzen characterized the historico-geographical structure of Ludlow two times. In this

identification, he analysed the three form complexes in a hierarchical manner into distinctive morphological regions. As such, he expresses that the concept of morphological region is the climax exploration of the historico-geographical structure of the urban landscape (Conzen, 1975, 1988, 2004; Whitehand, 2009; Oliveira & Yaygin, 2020). The tripartite division or form complexes is one of the fundamental aspects of Conzen's theory for identification of the physical structure of the urban landscape (Oliveira, 2019a, 2019b). The three form complexes are distinguishable as town plan, building fabric, and land and building utilization. The town-plan is the most spatially 'encompassing' of the three form complexes. In essence, the town-plan of cities is made up of three main elements: streets, plots, and buildings (more precisely block plan of buildings). Here, streets are the methodological hallmark of space syntax. The building fabric can be distinguished by architectural characteristics, building type, age, height, construction materials. The land and building utilization is generally considered into broad categories such as commercial, residential, institutional, industrial, recreational, or urban 'fallow'. It can display the smallest scale spatial heterogeneity within the townscape (Conzen, 1960, 2004; MP Conzen, 2018).

2.2. Space syntax approach

The space syntax approach is formed as a substantial theory and method in urban morphological analyses. In the development of space syntax approach, three seminal books by Bill Hillier and Julienne Hanson became important in addition to a substantial set of seminal articles published in the 1970s. The first is 'The social logic of space' (Hillier & Hanson, 1984), the second is 'Space is the machine' (Hiller, 2007), and lastly, 'Decoding homes and houses' (Hanson, 1998). Space syntax focuses on space and on the relationships between space and movement. It offers a set of techniques for analysing space and human activity patterns in both buildings and cities. It also offers a set of theories linking space and society. Space syntax addresses where people are, how they move, how they adapt, and how they develop (Hillier & Vaughan, 2007; Oliveira, 2016). Space syntax is built on two formal ideas which try to reflect both the objectivity of space and our intuitive engagement with it (Hillier & Vaughan, 2007):

> i. "space is not a background to human activity, but is intrinsic to it.
>
> ii. human space is not just about the properties of individual spaces, but about the interrelations between the many spaces that make up the spatial layout of a building or a city. This is what we formally call the configuration of space, meaning the simultaneously existing relations amongst the parts which make up the whole. In other words, what happens in any individual space - a room, a corridor, a street or a public space - is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected".

Space syntax comprises four fundamental components, which are used in all applications, analysis of spatial relations, representations of space, interpretive models, and theories. The common feature of the approach is the focus on the topological and geometric attributes of physical form with the goal of understanding the interrelationships between different measures and attributes, the ways in which different spatial configurations affect the use of physical environments and buildings (Kropf, 2017b). Spatial configuration is a fundamental concept in the approach. In terms of space syntax, spatial configuration corresponds relations between spaces which take into account other relations (Hillier & Vaughan, 2007; Kubat et al., 2012). Several software tools are available to undertake space syntax analysis.

2.3. Morpho method

The focus of *Morpho* is on the town plan as the key element for the identification of the townscape. The method was first applied to the streetscape in 2013 by Vitor Oliveira (Oliveira, 2013). Then, it moved to the city scale, addressing not only the present form of the city but also the evaluation of planning proposals for its future development (Oliveira & Silva, 2013). The method has been used to make comparisons between

different cities (Oliveira & Medeiros, 2016; Oliveira et al., 2020). Recently, the method has been related to the socioeconomic and environmental aspects of urban areas (Oliveira, 2021). The first attempt of the method consisted of the measurement of seven assessment criteria: accessibility of the street system, accessibility of plots, age of buildings, dimensions of street blocks and plot series, alignment of buildings, the ratio of building height to street width, and finally, building use. Yet, the method focused on a reduced number of criteria associated with the characteristics of townscape and urban form elements, all related to the town plan. These are the dimension of street blocks, the spatial accessibility of the street system, the coincidence between building and plot frontages, and the density of plots (Oliveira et al., 2020).

3. Methodology

An integrated framework is proposed for the assessment of urban forms and their transformation based on historico-geographical approach, space syntax, and the Morpho method (mainly inspiring). The main goal of this paper is to constitute a strong instrument to understand townscape elements and their transformation and change based on a set of explicit criteria, and then to prescribe the physical transformation and change. The methodology provides a powerful basis to establish a balance between conservation and transformation of urban forms. The methodology is fundamentally constructed on the basis of three different urban morphological approaches and methods. The methodology is mainly constructed on the body of historico-geographical approach to urban morphology. Space syntax has been the other substantial contributor to the methodology in terms of assessing streets and their change. Finally, the Morpho method is addressed to make the methodology stronger. The methodology is firstly designed on the basis of form complexes (more precisely based on town-plan and building fabric), and then, morphological constituents (streets, street blocks, plots, and buildings); and a set of criteria, benefiting from historico-geographical approach, space syntax approach and the Morpho method. In this regard, eleven criteria are addressed for the assessment and understanding of urban forms' transformation. These criteria are accessibility of streets, connectivity of streets, intelligibility, synergy, street block size, plot size, building coverage (relation between bloc-plans and plots), floor area ratio (expresses to which extent a plot is constructed in the three dimensions), the block plan size on the basis of the town-plan; building height, and total constructed area (density of buildings) on the basis of building fabric (see Table 1). A substantial urban regeneration area within Konya, Turkey is addressed to implement the methodology.

Table 1. *Procedural framework for the methodology.*

Form complexes	Morphological constituents	Criteria	Approach/Method
Town-plan	Streets	Accessibility of streets	Space syntax approach / Morpho method
		Connectivity of streets	Space syntax approach
		Intelligibility	Space syntax approach
		Synergy	Space syntax approach
	Street blocks	Street block size	Historico-geographical approach
	Plots	Plot size	Historico-geographical approach
	Plots/Buildings	Building coverage	Historico-geographical approach
		Floor area ratio	Historico-geographical approach
	Buildings	Block-plan size	Historico-geographical approach
Building fabric	Buildings	Building height	Historico-geographical approach
		Total constructed area (Density of buildings)	Historico-geographical approach

4. The definition of *Sekiz Mahalle* neighbourhood

Urban forms are being transformed through municipal plans and a wide range of other planning instruments with the concern of physically bad conditions or new economical investments. While the main goal of these transformations is improving the quality of the physical environment, the results are generally the accumulation of capital. This creates substantial changes in the urban landscape components, namely, the-town plan, building fabric, and land and building utilization. Konya, in Turkey, is one of those cities that undergo small

and large-scale transformations. In addition to our case study, the city was exposed to many other transformations (such as Kule Site and Surroundings, Karatay District Centre, Surroundings of Old Bus Station, Meram Et Kombinasi, Caybasi District, Mevlana Cultural Centre and Surroundings, Surroundings of New Justice Courthouse, the Old Industrial Area) through urban regeneration projects and the changes in municipal plans.

Sekiz Mahalle neighbourhood is selected for making the comparison between former and actual forms to make it more relevant, and for full implementation of the methodology. It is the largest transformed area, affecting the town-plan and building fabric. The study area is enclosed by the Railway in the east, Beysehir boulevard in the south, Rauf Denktas Street in the northeast, and Beysehir ring road in the northwest (see Figure 1). The area includes Mimar Sinan, Seker Murat,

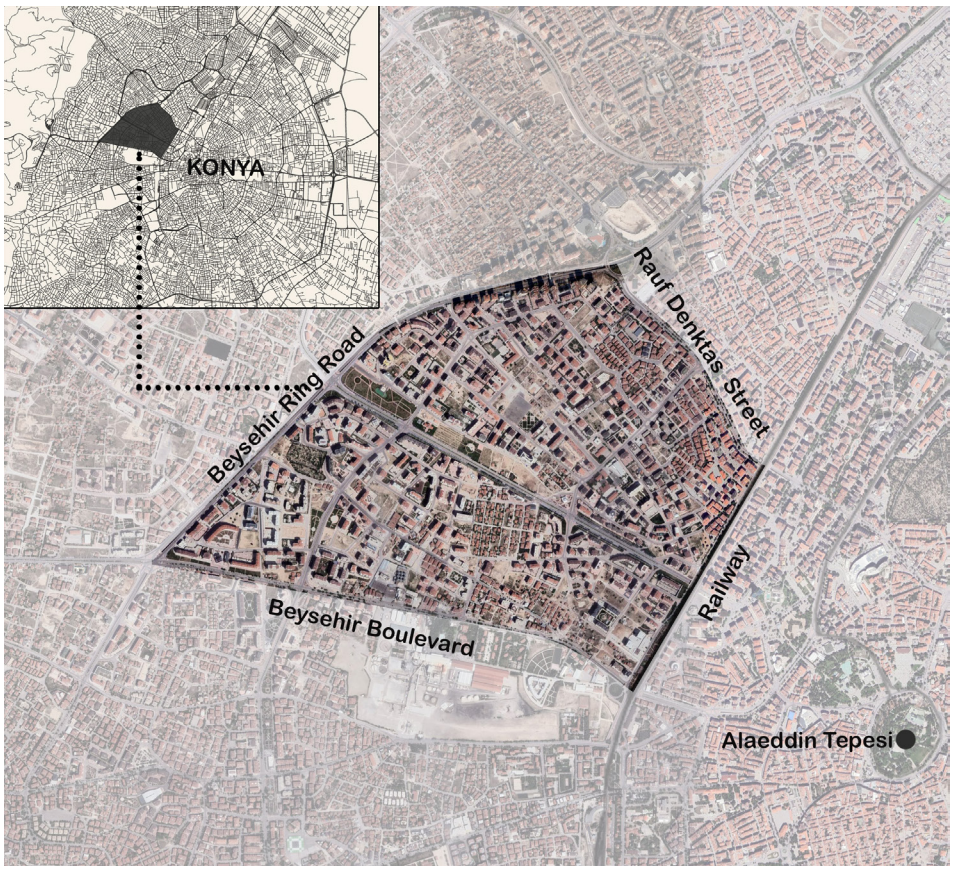


Figure 1. *The location of Sekiz Mahalle neighborhood.*

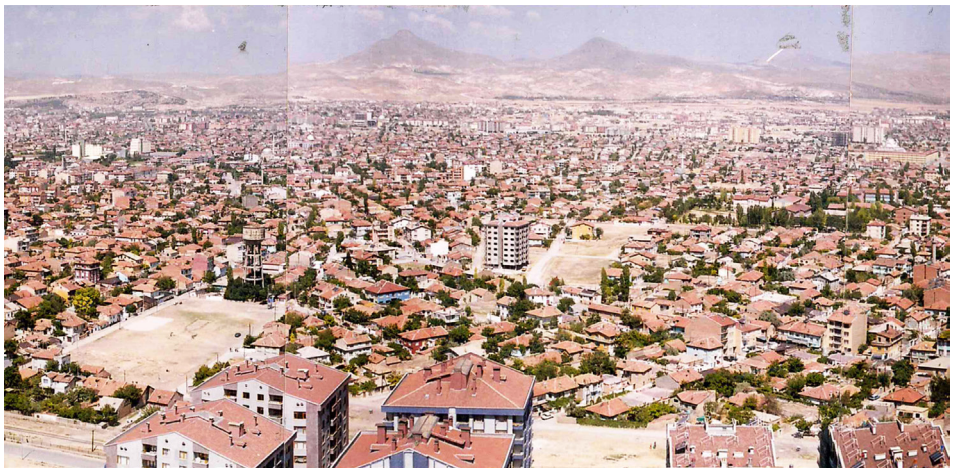


Figure 2. *Sekiz Mahalle neighbourhood in 2001 (Selcuklu Municipality Archieve, 2016).*

Selcuk, Yeni Selcuk, Haci Kaymak, Molla Gurani, Kilicarslan ve Ozlem units. The construction activities started in the 1950s in an illegal way in the study area. After the establishment of Konya Seker Fabrikasi (sugar factory), the area let in immigrants from rural surroundings. The construction of illegal houses continued until the 1990s. In the 2000s, Konya Metropolitan Municipality took a decision to transform the area through planning interventions. In this regard, the area started to transform in 2004. While the former landscape (before its transformation in 2004) is comprised of single-family houses, the current landscape consists of contemporary apartment blocks (see Figure 2 for the former, and figure 3 for the current urban landscape).

5. Morphological analyses and findings

The methodology in this paper is applied for analysing the former (2001 urban landscape which is a turning point for its transformation) and existing (2022 urban landscape) urban landscape of *Sekiz Mahalle*, demonstrating the differences between both landscapes based on firstly form complexes and morphological constituents and then, a set of criteria. All criteria identified within the methodology were applied one by one.

In this study, the axial analysis method was implemented for the initial four criteria. Although the angular segment analysis method is more commonly used than axial analysis in Space Syntax studies today, the axial analysis technique was preferred in this study for the calculation of the intelligibility criterion. In this context, the axial maps of the city were drawn by using ArcGIS software. The axial analyses were carried out by using Deptmap software, which is a special tool for space syntax analyses.

5.1. Accessibility of streets

Using space syntax, the accessibility of streets is presented through the axial global integration and axial local integration. Integration is a normalised measure of distance from each space to all others in a system. In general, it is an indicator of how easily a person can go ahead from a particular space to all others (Hillier & Hanson, 1984). Axial global integration is defined as the integration values of axial lines at the infinite radius which can be employed to symbolize a representation of integration pattern at the largest scale. Axial local integration is defined as integration values of axial lines at radius 3, which can be used to represent a localised picture of integration. (Hillier, 1996, 2007). Analysis of axial maps of *Sekiz Mahalle* reveals the accessibility of the neighbourhood increased in terms of axial global integration measurements (see Table 3). While the most accessible streets in 2001 were concentrated in the south and north of the area, in 2022 the most accessible streets are in the middle of

Figure 3. *Sekiz Mahalle neighbourhood in 2022 (Photograph by the authors).*

the area on larger scale. (see Table 2). Looking at the axial local integration, the average accessibility of streets is smoothly increased. On the contrary, the maximum level of local integration is quite increased. (see Table 3).

5.2. Connectivity of streets

Connectivity measures the number of spaces immediately connecting a space of origin (Hillier, 1984). In this application, axial connectivity is addressed to measure the connectivity values. Axial connectivity is the number of other lines with which an axial line intersects. The physical transformation of *Sekiz Mahalle* reveals a more connected street system. While the value of streets' connectivity in 2001 is 3.8, it is 4.1 in 2022 (see Table 3). Although the number of streets decreased, the level of connectivity increased. The connectivity of streets in 2001 and 2022 is presented in Table 2.

5.3. Intelligibility

Intelligibility (or axial intelligibility) is the level of correlation between axial connectivity and axial global integration values. A strong correlation, or 'high intelligibility', implies that the whole can be read from the parts, and the spatial order can be easily predictable by users (Topçu et al., 2021; Hillier et al., 1987; Hillier, 1999; Kubat, 1997; Boz & Kubat, 2021; Zhang et al., 2013). The intelligibility value of *Sekiz Mahalle* in 2022 is higher than those values in 2001. This demonstrate that the urban landscape in 2022 is more intelligible than the urban landscape in 2001 (see Table 2 and 3).

5.4. Synergy

The concept of synergy (or axial synergy) is defined as the correlation between local integration radius-3 (local integration) and radius-n (global integration). It measures the level to which the internal structure of an area rinterrelates to the larger-scale system in which it is embedded (Hillier, 1996, 2007). A high value here refers to a high relationship with a large-scale system. The synergy value of *Sekiz Mahalle* smoothly increased after its physical transformation (see Tables 2 and 3). In this regard, the correlation between local and global integration in 2001 is stronger than those in 2022.

Table 2. *Comparison of syntactic characteristics by 2001 and 2022.*

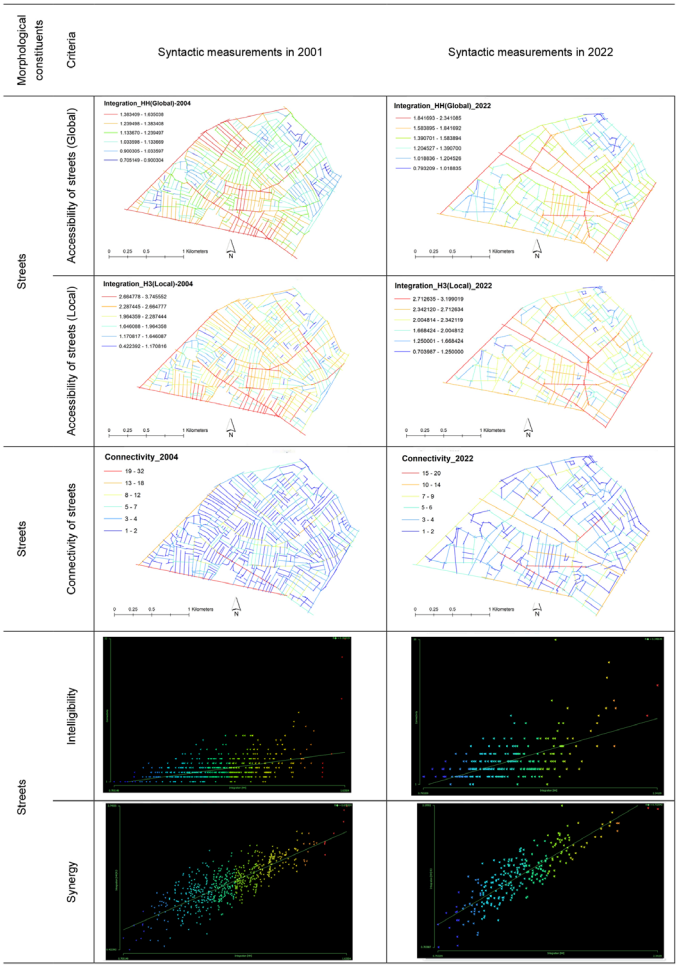


Table 3. *Comparison of syntactic values by 2001 and 2022.*

Criteria	Syntactic Values		Results
Accessibility	**2001**	**2022**	
Integration Global			
Min.	0.7052	0.7932	Increased
Max.	1.6350	2.3410	Increased
Average	1.1459	1.3708	Increased
Accessibility			
Integration Local R3			
Min.	0.4224	0.7040	Increased
Max.	3.7456	3.1990	Decreased
Average	1.9579	1.9623	Increased
Connectivity			
Min.	1	1	-
Max.	32	20	Decreased
Average.	3,8	4.1	Increased
Intelligibility	0.43	0.59	Increased
Synergy	0.82	0.86	Increased
Number of Axial lines	609	271	Decreased

5.5. Street block size

Street block is a substantial criterion that was applied into the case study, corresponding the low resolution of the urban landscape. Street block

maps are mapped on the basis of GIS with natural breaks intervals. The arrangement and organization of street blocks is presented in Table 3. While the minimum and maximum size of street blocks increase, the average is increases. This shows that a little amount of street blocks after transformation is smaller than the previous situation. Number of street block also reduces (see Table 4 and 5). Decrease in street blocks numbers and rise in the average of street blocks demonstrate that the number of streets reduces. This creates less accessible landscape.

5.6. Plot size

Plots are another important element that constitutes street blocks with their aggregation. They are also the smallest land use unit of the townscape. The arrangement of plots is examined in terms of their size. The organization of plots for both 2001 and 2022 is presented in Table 4. Looking at the plots in 2001, they mostly consist of small size. A less amount of plots is medium and large. The minimum size of plots in 2001 is smaller than those

Table 4. *Physical characteristics by 2001 and 2022.*

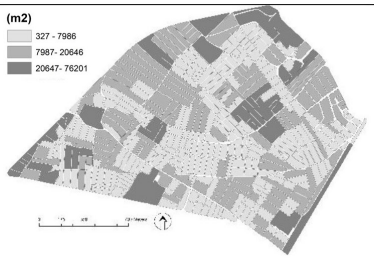
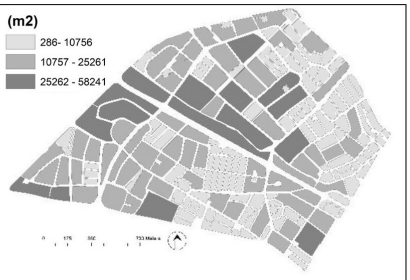
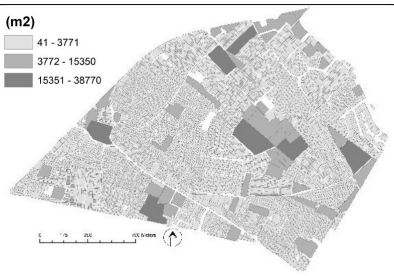
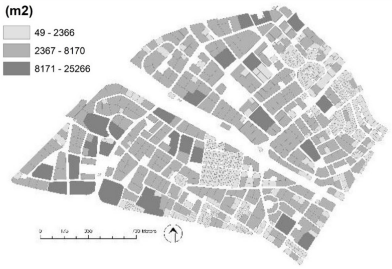
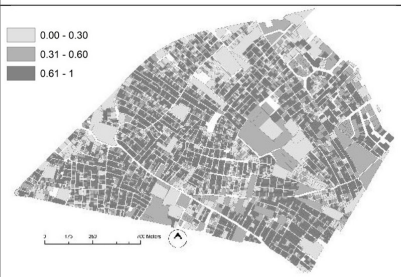
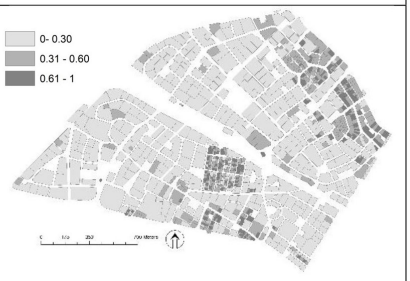
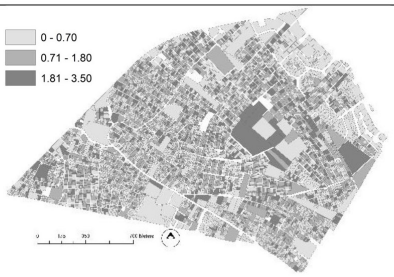
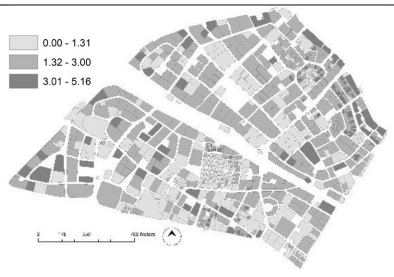
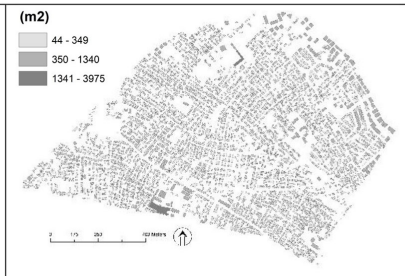
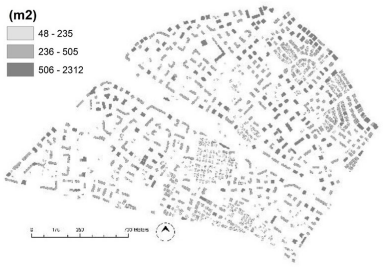
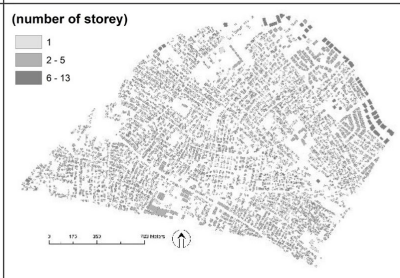
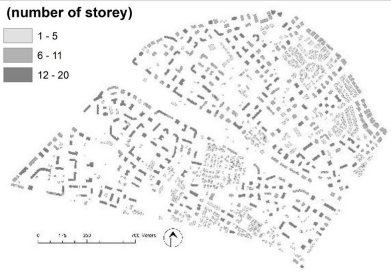
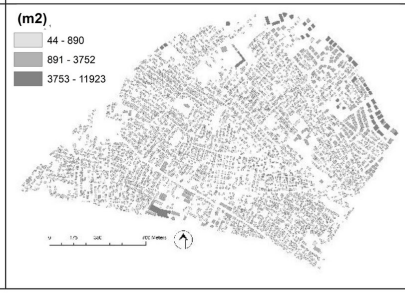
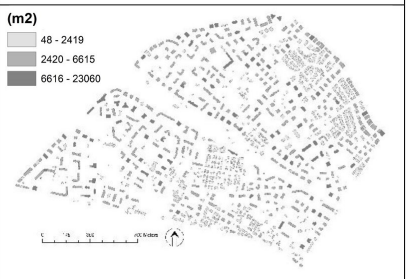
Morphological constituents	Criteria	Physical characteristics in 2001	Physical characteristics in 2022
Street blocks	Street block size		
Plots	Plot size		
Plots/buildings	Building coverage		
Plots/buildings	Floor area ratio		

Table 4 (continued). *Physical characteristics by 2001 and 2022.*

Morphological constituents	Criteria	Physical characteristics in 2001	Physical characteristics in 2022
Buildings	Blok-plan size		
Buildings (3D)	Building height		
Density of buildings	Total constructed area		

in 2022. While the maximum size of plots reduces, the average plot size is quintupled after the transformation in the urban landscape. The number of plots is quite reduced (see Table 5). In 2001, plots were comprising single-family houses. On the contrary, multi-family apartment blocks are erected on the plots after the transformation. This gave rise to the enlargement of plots.

5.7. Building coverage

Building coverage shows, to which extent a plot is covered by a building or a structure. The range value of building coverage is between zero and one. It also identifies how much of a plot is open. It provides a basic relationship between a plot and a building. The analysis of building coverage of *Sekiz Mahalle* is presented in Table 4, classifying them into three intervals based on natural breaks. While the minimum and maximum ratio of building coverage do not change, the average of this ratio decreased after the transformation of urban landscape elements or form complexes. A fall in the building coverage demonstrates an ascent in the open space, including private and public spaces.

5.8. Floor area ratio

The floor area ratio is a measure of a floor area of a building associated with the plot's size where the building is located on. The floor area ratio is comprised by dividing the total building area by the plot area. The floor area ratio is the relationship between the total area that consists of the area of each floor and the total area of the plot on which the building stands. The floor area ratio of *Sekiz Mahalle* is presented in Table 4, categorising it into three different intervals. While the minimum level of the ratio is the same for 2001 and 2022, the maximum level is quite increased. Looking at the average, the ratio is almost tripled (see

Table 5).

5.9. Block-plan size

The block plan of building is one of the most important the town-plan element. It is an area where a building stands and restricted on the ground by the lines of its comprising walls. Different types of block-plan contribute to the production of different types of the built environment. This criterion is examined in terms of block-plan size. The organization of block plans is indicated in Table 4. Looking at the analysis, the minimum and maximum block plans in 2001 are larger than those in 2022. On the contrary, their average block plans increased in 2022 due to the size of large apartment blocks. The transformation of single-family houses into multi-family apartment blocks decreased the number of building in the area (see Table 5).

5.10. Building height

Buildings are the most visible elements of the urban landscape. They represent the townscape through their scale and characteristics. In this paper, the building height is examined as an important determinant of the urban landscape on different scales. The distribution of building height is presented in Table 4, classifying them into three intervals. Building height is identified as the vertical distance between the ground level and the highest point of the building. When two different urban landscapes, before and after the transformation of the area, are compared, the maximum building height is increased in 2022. The average building height is quintupled (see Table 5).

5.11. Total constructed area (density of buildings)

The total constructed area is resembling the floor area ratio but is not precisely the same. While the floor area ratio indicates to which extent a plot is filled in three dimensions, the total constructed area expresses the total constructed area on each plot and in the area as a whole. This criterion apparently presents the area intensified after its transformation. The total constructed area of each plot is indicated in Table 4. When considering the plot scale, the total constructed area of each plot in terms of maximum size and the average quite increased. The total study area is densified in terms of the buildings constructed on (see Table 5).

To sum up, the transformation of urban forms, which are firstly on the basis of the town-plan and building fabric, secondly morphological constituents (streets and street blocks, plots, and buildings) thirdly a set of criteria, is an important fact in cities' life. In the case of *Sekiz Mahalle* neighbourhood, different characteristics of townscape are examined. On the street scale, there are 4 criteria implemented in the area. Analysis reveals that accessibility of streets, both on the global and local scale, increased after the transformation of the area. Looking at the connectivity of streets, it is clear that the street system in 2022 is more connected than those in 2001. The intelligibility value demonstrates that the correlation between axial connectivity and axial global integration of streets in 2022 is stronger than those in 2001.

Table 5. *Comparison of physical characteristics by 2001 and 2022.*

Criteria	Physical characteristics		Results
Street block size	**2001**	**2022**	
Min.	327	286	Decreased
Max.	76201	58241	Decreased
Average	7321	10594	Increased
N. of street blocks	362	210	Decreased
Plot size			
Min.	41	49	Increased
Max.	38770	25266	Decreased
Average	406	1968	Increased
N. of plot	6531	1017	Decreased
Building coverage			
Min.	0	0	-
Max.	1	1	-
Average	0.40	0.20	Decreased
Floor area ratio			
Min.	0	0	-
Max.	3.5	5.16	Increased
Average	0.60	1.75	Increased
Blok-plan size			
Min.	44	48	Increased
Max.	3975	2312	Decreased
Average	121	290	Increased
N. of buildings	6940	1543	Decreased
Building height			
Min.	1	1	-
Max.	13	20	Increased
Average	1.42	6.36	Increased
Total constructed area			
Min. (each plot)	44	48	Increased
Max. (each plot)	11923	23060	Increased
Average(each plot)	224	2404	Increased
Total constructed area	1557223	3710724	Increased

The synergy value is higher in 2022. Streets blocks as an important element of the urban landscape underwent a substantial change after their transformation. Their organization associated with streets is quite different. The average of street blocks increased. As street blocks, plots have an important difference when compared with the previous physical structure. The average building coverage decreased in relation to building heights. The floor area ratio is the other important criterion examined. The average ratio is almost doubled. Block plans as one of the most important elements of the town-plan underwent a dramatic transformation. In 2001, almost all buildings were single-family houses. On the contrary, they were replaced with large-scale multi-family apartment blocks. Building heights as the most visible element of the urban landscape is totally different from the previous physical environment. While the previous heights are generally one and two storeys, the existing townscape mostly consists of eighteen storeys. Total constructed area in terms of each plot, and the study area as a whole experienced a dramatic transformation (see Figure 4).

6. Discussion

Morphological analysis of *Sekiz Mahalle* is carried out on the basis of a set of criteria identified in the methodology. It integrates three different morphological theories and tools, namely, historico-geographical approach, space syntax approach and finally the Morpho method, by constituting an explicit and simple implementation process. As previously indicated, the Morpho method indirectly contributed to the design of the methodology. Indeed, it has an inspiring role in the identification of the procedural framework of the methodology.

The methodology provides a substantial basis for an effective preparation of municipal plans, design projects and urban renewal projects where the character of the urban landscape is not considered. Looking at the morphological analyses of *Sekiz Mahalle*, the first four criteria reveal constructive results by the comparison of the urban landscape of 2001 and 2022, focusing on the town-plan (streets in particular).

Figure 4. *Buildings in 2001 (top right and left) and in 2022 (bottom right and left).*

Syntactical analyses, which are accessibility of streets, connectivity of streets, intelligibility and synergy, confirm that a transformation in the street system reinforces the street structure. When comparing the streets in 2001 and 2022, the syntactical values of the existing urban landscape increased, and this demonstrates that the municipal plan enables a better physical environment in terms of the first four criteria just mentioned above. On the contrary, the rest of the morphological criteria implemented in *Sekiz Mahalle* presents a different aspect of the transformation practised in the neighbourhood in terms of the town-plan and building fabric (two prominent form complexes). Form complexes or the urban landscape elements are important physical elements of urban form for a society. They can keep and maintain emotional experiences and precious assets of a society. In the comparison of the 2001 and 2022 landscapes, street blocks, plots and buildings were assessed on the basis of the following criteria: street block size plot size building coverage floor area ratio block-plan size building height total constructed area (density of buildings). These criteria consist of main elements of urban form that can play a substantial role in planning proposals and a wide range of planning applications. Looking at each of these criteria one by one, it is clear that *Sekiz Mahalle* neighbourhood underwent a dramatic transformation, not taking into account the previous urban landscape elements. The street block size is an important input for plans. While small size street blocks enable a more permeable pattern, large size gives rise to an impermeable environment. A subdivision of large street blocks will enable a more permeable pattern. A soar in plot size destroys the previous organization of plots and buildings, not considering them as precious assets. Apparently, building coverage decreased. As a result of a decrease in building coverage, while the common green areas should have increased, on the contrary, the semiprivate green areas have increased. Floor area ratio and total constructed area are two criteria that refer to the density of buildings in different ways. An increase in these elements brings a dense structure and causes insufficient infrastructure. Block plans and building heights are important for referring to the building scales. Conservation or small changes of both elements contribute to the maintenance of the heritage.

Analysis of *Sekiz Mahalle* demonstrates that the interventions in the streets system, in relation to accessibility, connectivity, intelligibility and synergy, were slightly carried out in a constructive way. Yet, in terms of the other aspect, namely the rest of the criteria proposed within the methodology, there is no positive reflection. In this regard, a strong balance should be established between transformation and conservation of urban forms elements, considering the previous character of the urban landscape. This will provide a powerful basis for continuity of urban forms, focusing on the town-plan and building fabric (taking into account streets, street blocks, plots and buildings). Any transformation and any change in the previous character or traditional landscape should follow a deep exploration of the urban landscape taking as a reference this integrated methodology on the basis of different elements of urban form and different urban morphological approaches.

7. Conclusion

This paper has three substantial contributions to the field of knowledge. The main conclusion/contribution is that this paper presents an integrated framework on the basis of three urban morphological theories. The results from the case study demonstrate that while the new organization of streets presents the positive aspect of transformation, the other aspects of urban form are not sufficiently considered. This indicates why an integrated framework is important for the assessment of urban forms for their future transformations. The second contribution is that this methodology presents the importance of form complexes, with a particular focus on the town-plan and building fabric. Analysis of *Sekiz Mahalle* neighbourhood shows that when any transformation becomes existent in

an urban area, it should follow the previous structure of the townscape for conserving previous assets, and establish a balance between the change and continuity of the physical character. Moreover, this paper demonstrates the importance of streets, street blocks, plots and buildings due to their role in the structural organization of the townscape. The last substantial contribution is the potential of the methodology in planning practice, justified by its implementation in the case study. The methodology validated that the balance between the existing urban forms and the introduction of new urban forms is important for a smoother transition of forms. It is clear that urban forms transformation should be considered on the basis of an integrated framework before any decision to intervene. This paper provides a strong basis to inform planning practice based on the integration of different morphological views. It is an important instrument to develop a framework for urban forms transformation and the maintenance of forms. It is argued that an integrated framework on the basis of urban morphological tools and theories is essential in the preparation of planning proposals and new designs.

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Design guideline for life center unit for inclusive schools in Turkey

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Abstract
Supportive educational services in inclusive education (IE) are important for providing equal education rights to students with special needs and ensuring their participation in society. In Turkey, life center units, which were not included in IE legislation, were first established as a supportive educational service of inclusive schools at the primary schools and furthered throughout the secondary settings. Universal design (UD), which supports the accessibility and usability of the built environment for all, is recommended to guide the design of the IE schools. Thus, the aim of the study is to develop UD-compliant interior design guidelines for life center units by using a two-stage methodology. First, the dimensions of IE and the related physical environments in Turkey were examined. Second, periodic visits to life center units of Ankara Gökkuşağı Primary School and SERÇEV Accessible Vocational Anatolian High School were conducted by on-site observations and architectural plan reviews. The obtained data were analysed to acquire the interior space requirements, revealing the necessity of the life center unit for IE in Turkey and the need for design guidelines. The study is expected to fill an important gap in the field of interior architecture in terms of proposing a design guideline for supportive educational services in IE school environment. Moreover, the study is expected to provide a design guideline, specifically for designers, practitioners, academicians, and relevant stakeholders.

Keywords
Inclusive school, Interior architecture, Life center unit, Supportive educational service, Universal design.

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1. Introduction

The Education for All (EFA) movement, initiated by United Nations Educational, Scientific and Cultural Organization (UNESCO), states that education policies worldwide should be updated by socially integrating approaches for people with special educational needs (SEN) and promoted equal access to education (Ainscow & César, 2006; Miles & Singal, 2010; Peters, 2007). The special needs might be cognitive, behavioral, emotional, social, sensorial, and physical (De Boer & Kuijper, 2021; Education Funding Agency, 2014; Miles & Singal, 2010). Concerns about curricula for people with SEN have increased to eliminate the discriminative approach in regular education policy at the end of twentieth century (Riddell, 2007; Tomlinson, 2015). With the Salamanca Declaration (1994), inclusive education (IE) was expanded in special education practices, and the necessity of raising individuals with SEN in a student-centered education approach in mainstream schools was emphasized (Ainscow & César, 2006; Peters, 2007; UNESCO, 1994).

Studies carried out to ensure the social integration of people with SEN include education policies as well as policies that support participation in the physical environments due their learning difficulties. Thus, inclusive approach is needed for designing the physical environment of inclusive schools (Gathorne-Hardy, 2001; Li et al., 2005). Regulations such as the American Disabilities Act (ADA) and Disability Discrimination Act (DDA) gave rise to approaches that support the compensation of accessibility concerns in the built or physical environment for people with disability (Guffey, 2021; Imrie, 2012; Luck, 2000; Ostroff, 2011). Additionally, the Center for Universal Design defined "universal design" (UD) as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design", and developed "UD principles": "equitable use", "flexibility in use", "simple and intuitive use", "perceptible information", "tolerance for error", "low physical effort" and "size and space for approach and use" (The Center for Universal Design [CUD], 1997). These principles focused on the user requirements during the design process (Borowczyk, 2017; Dostoğlu et al., 2009; Edwards, 2011; Mace et al., 1996; Story, 2011). UD was also suggested by international organizations such as World Health Organization (WHO) and UNESCO in the creation of the built environment for people with special needs (UNESCO, 2009; WHO, 2001). Thus, with the UD, the necessary precautions can be taken in the built environment for people with SEN (Lid, 2014), and UD principles can be integrated into the design and application process (Imrie, 2012; Jones, 2014; Null, 2014; Story, 2011; Watchorn et al., 2014).

To provide equal opportunities in education for students with SEN, supportive facilities such as medical rooms, therapy rooms, recreation areas, social activity areas, resource rooms and exercise rooms are existed in mainstream schools (Education Funding Agency, 2014). As a special case for Turkey, the life center unit as a supportive education service was first implemented in Ankara Gökkuşağı Primary School and then included in the building program of SERÇEV (Association for Children with Cerebral Palsy) Accessible Vocational and Technical Anatolian High School. However, there is no information in the literature regarding the life center unit in inclusive schools in Turkey. Thus, this study focuses on the design of life center unit. The aim of the study is to develop a design guideline that implements UD principles for developing design solutions appropriate to user's needs for life center unit's interior spaces. Accordingly, the methodology of the study has two stages. First, a comprehensive review of the literature regarding IE, legal legislations, e.g. regulations, legal decisions and agreements, and the design guidelines for the physical environment of inclusive schools published by the Ministry of National Education (Milli Eğitim Bakanlığı [MEB]) in Turkey are reviewed. Second, the life center unit of the Ankara Gökkuşağı Primary School and SERÇEV (Association for Children with Cerebral Palsy) Accessible

Vocational and Technical Anatolian High School in Ankara in Turkey were exemplified to collect data from the site visit. According to the collected data, the spatial requirements of the life center unit were determined and associated with the UD principles to create an inclusive and holistic design guideline. Thus, this study is expected to provide a design guideline, specifically for designers, practitioners, academicians, and relevant stakeholders, in order to guide the design process of life center unit.

2. Legislation for IE in Turkey

The 'Children with Special Educational Needs Law' adopted in 1983 in Turkey is the first comprehensive initiative specific to students with SEN. IE in Turkey has gained importance since the 1990s (Yazıcıoğlu, 2018). With the Decree Law on Special Education No. 573 in 1997, another step was taken for the education of those students (Kargın, 2004; Sucuoğlu, 2004; Yazıcıoğlu, 2018). IE was also handled as a separate section in the 'Special Education Services Regulation' in 2000 (Kargın, 2004; Sucuoğlu & Kargın, 2014). These initiatives and updates reflect the effort to expand and develop legal dimensions of IE in Turkey (Akkok, 2001).

IE in Turkey is practiced considering three inclusion types: Full-time, part-time and reverse inclusion (MEB, 2013; Sakız & Woods, 2015; Yazıcıoğlu, 2018). Full-time inclusion allows students with SEN to continue their education with their peers without SEN in the same classroom and school environment. Part-time inclusion is for the participation of students with SEN in some classes or extra-curricular activities together with their peers without SEN. Reverse inclusion is implemented through the education of students with SEN in the same class as their peers, or by opening a separate class for the other students in the same school (MEB, 2013). On one hand, the common type of IE in Turkey is the 'full-time inclusion model' (Yazıcıoğlu, 2018). On the other hand, the first attempt regarding the 'reverse inclusion model' was initiated by SERÇEV in 2006 at Ankara Gökkuşağı Primary School, and this practice continued with SERÇEV Accessible Vocational and Technical Anatolian High School in 2017 (Yazıcıoğlu, 2018).

Durak and Erkılıç (2012, 36) stated the criteria for meeting standards of IE in Turkish schools as follows:

(1) Individualized education program (IEP)[1] for students with SEN,
(2) Cooperative teaching methods,
(3) Participation of families,
(4) Educational adaptations,
(5) Additional supportive services,
(6) Provision of multiple means for achieving knowledge in an effective education environment,
(7) School facilities, learning resources, curriculum and professionals centered around students' capabilities and needs,
(8) School-centered supportive services and facilities,
(9) Additional community facilities and community involvement.

Individualized education program (IEP) helps students with SEN to have extra support in their education (De Boer & Kuijper, 2021; MEB, 2010; MEB, 2013; Sakız & Woods, 2015). It is essential to provide the necessary support training services by determining where, how, by whom and how long these behaviors will be taught by a team including the families of the students with disabilities (MEB, 2013). Support services determined by the IEP are important in terms of providing life skills to students with SEN and improving their academic and social skills in IE. Support services, which are a requirement of the student-centered education approach of inclusion practices, can be diversified into medical rooms, therapy rooms, multi-perception rooms, social skills development areas, recreation areas, social activity areas, and family, exercise and resource rooms.

Supportive educational services, which can provide equal education opportunity to students with SEN with their peers, are required for IE to be successful (Sucuoğlu, 2004). Additionally, these services have an important role for contributing to the social and academic development of students with SEN by taking part in IEP (Kargın, 2004; Sucuoğlu & Kargın, 2014). In the

Special Education Services Regulation (2018), the supportive educational service is defined as the consultancy service provided by the expert staff to the individuals with SEN, in line with their educational needs, to their families, teachers and other staff at the school (MEB, 2018). In this sense, the Ministry of National Education determined the procedures and principles regarding "practice house" to provide life skills for individuals with SEN in 2017 (MEB, 2017). What is meant by independent life skills is the acquisition of personal hygiene, eating habits, dressing skills and indoor and outdoor life skills of individuals with SEN (MEB, 2016). It is aimed that all students benefit from the education that will be given in the 'practice house' (MEB, 2017). Although there is no definition of a life center unit, which was included in the building programme with the SERÇEV Accessible Vocational and Technical Anatolian High School, this space is a support service unit with the aim of providing life skills to students with SEN.

3. Regulations for the physical environment of IE schools in Turkey

While the legislations for IE in Turkey are updated (Sakız & Woods, 2015), there are still uncertainties in IE practices. These uncertainties because of implementation of IE practices cause problems in designing the appropriate physical environment (Erkılıç & Durak, 2013; Sakız & Woods, 2015; Yazıcıoğlu & Kargın, 2018). On the contrary, IE needs its own practices for designing inclusive school environments.

Inaccessible buildings are one of the barriers within the educational system that has to be considered in IE (UNESCO, 2001), which is necessary for all people with special needs to support equal access and use of the physical environment to ensure the right to equal education. It is important to determine the type of user, type of use, period of use and spatial requirements (Table 1) to be able to define equal usability in schools that provide IE (Durak, 2010; Erkılıç & Durak, 2013).

In Turkey, 'The Arrangements to be Made in School Buildings for the Physically Disabled Circular No: 2009/90' published in 2009 includes the precautions to be taken for students with SEN to continue in the same environment with other students (MEB, 2009). This circular contains the dimensions of corridor, classroom, toilet and garden arrangements in inclusive school buildings and guidelines regarding the standards published by the Turkish Standards Institution (TSE). It is also expected to ensure the color, light, material, and orientation in compliance with physical environment in inclusive schools.

In the guide titled 'Why, How, What for Mainstreaming Education at Our Schools? A Guide Book for School Principals, Teachers, Parents' published by the Ministry of National Education in 2010, 14 design criteria regarding the physical environment in IE schools have been determined under

Table 1. *Spatial requirements in inclusive schools in Turkey (Durak, 2010, 128).*

user type	**1.** students **2.** teachers, advisors, therapists, other staff **3.** parents, caretakers **4.** local community	**Spatial Requirements:** **1.** formal learning spaces **2.** informal learning spaces **3.** non-specialist spaces **4.** spaces for medical treatment **5.** spaces for guidance and counseling **6.** spaces for therapy **7.** storage spaces for medical equipments **8.** teachers', advisors' and therapist's room **9.** family room for waiting, meeting and training activities **10.** ICT-enabled meeting room for face to face and teleconference interviews **11.** waiting hall, lobby, cafeteria and spaces for personal care **12.** easily controllable, specialized or multipurpose spaces used after school hours with separate entrance
type of use	**1.** curriculum-based use (educational activities) **2.** rehabilitation facilities (medical facilities) **3.** collaborative use (cooperative teaching, cooperation between general education teacher and parents/ caretakers, advisors, special education teachers and learning assistants) **4.** additional community facilities (community based facilities, performing vocational training, music, sports and arts activities, conferences)	
period of use	**1.** during school hours **2.** out of school hours	

the section of 'What arrangements in physical and environmental aspects are required for schools where inclusion education is offered?' (MEB, 2010). It was also emphasized that the regulations for students with SEN should be considered when designing the physical environment. On the other hand, there was no information in the guide about the spaces and equipment that should be included in the building programme of IE schools.

In the '2015 Minimum Design Standards for Educational Buildings Guide', the criteria that guide the design of inclusive schools have been determined, but the spatial requirements were not determined (MEB, 2015). Under the title of 'Design Standards for the Disabled' in the same guide, it was declared that the physical environment for people with SEN should meet the access standards of the legislations such as Building Regulations, Administrative Regulations complying with the principles of its following sections, 'Law on the Disabled' (no. 5378), the Accessibility Guide of Educational Institutions prepared by Special Education Guidance and Counseling Services and the ADA Standards. Additionally, it was also expected to follow the regulation on 'The Establishment, Working Procedures and Principles of Project Modification Commissions for the Use of Disabled People in Buildings'. The proposed criteria supported uniformity in the design of IE school's spaces and standardized the user profile. Contrary to this, the ergonomic needs of students at different education levels differ, such as in 'Standard Equipment Guide for Special Education Schools' (MEB, 2020). Equipment names, features and visuals of the equipment for the spaces in special education schools were determined with the dimensions, materials and pictures. On the other hand, there is no information regarding the user profiles or dimensions and features of the spaces. In the '2015 Educational Buildings Minimum Design Standards Guide', there is information for architectural design regarding building elements such as walls, ceilings, floors, doors, windows, and environmental aspects such as acoustics, heating-ventilation, and lighting. Additionally, suggestions were given in terms of wayfinding, graphic elements and materials, and colors at school design. On the other hand, the suggestions are mainly related to architectural design, and information about indoor spaces is limited. Shortly, the aforementioned regulations[2] published by MEB define spatial requirements, user profiles and needs in general.

Due to the limited information about the physical environment of IE schools in Turkey, more holistic information is needed for design of IE schools (Erkılıç & Durak, 2013). In other words, providing holistic information for design process under the design guidelines will facilitate the designers in the design process. In this sense, it is important to develop design guidelines for IE schools in terms of minimizing the problems and difficulties in the application process and use (Ergenoğlu, 2014). In this sense, UD can provide physical solutions to the spatial problems appropriate to all user type (Erkılıç, 2012) and guide inclusive design in the IE school environment.

Within the scope of UD principles, considering the interior elements will help to minimize the problems and difficulties that may be encountered in the design, application, and use stages of IE schools and supportive educational services. Thus, life center unit in Turkey might increase the spatial quality by finding solutions of accessibility and usability problems with the help of UD compliant design criteria (Gülbahar & Cordan, 2018).

4. Method

In this study, developing a design guideline for interior spaces of life center unit as a supporting educational service in IE schools in Turkey was aimed. The field study was conducted in two inclusive schools, which was programmed and built according to IE, in Ankara, and multiple research techniques were used for data collection and analysis.

4.1. Materials and instruments

The data was collcted to develop a design guideline for interior spaces of the life center unit in accordance with UD principles, which focused on

Table 2. *Data collection procedures.*

	Ankara Gökkuşağı Primary School	SERÇEV Accessible Vocational and Technical Anatolian High School
2015	• On-site observations (recording physical traces of space requirements with photography, field notes recorded by the researcher)	• Architectural plan reviews
2017	• On-site observation (recording physical traces of space requirements with photography, field notes recorded by the researcher)	• On-site observations (recording physical traces of space requirements with photography, field notes recorded by the researcher)
2019	-	• On-site observation (recording physical traces of space requirements with photography, field notes recorded by the researcher)

creating solutions for user diversity and more than one type of usability (Luck, 2000). In the first stage, the needs for use, user and IE environment were revealed by the literature review on IE, legal legislation and design guidelines on IE schools in Turkey in order to discover the role and the requirements of life center unit in IE schools. In the second stage, the site visits to life center units were conducted in the Ankara Gökkuşağı Primary School and SERÇEV Accessible Vocational and Technical Anatolian High School. Besides the architectural plan reviews, the schools were visited in different periods with the presence of SERÇEV officials and school administrators. Accordingly, the physical traces were recorded through photography technique for observing the physical/spatial requirements and equipment needs of life center unit and taking notes at site. Thus, the information regarding the spatial requirements, type of user and use, and period of use was collected from the site-visits to develop the design guidelines of the life center unit.

4.2. Case study

Ankara Gökkuşağı Primary School, the life center in Turkey, was visited in 2015 and 2017, and SERÇEV Accessible Vocational and Technical Anatolian High School, which was the first life center included in the building programme in Turkey, was visited in 2017 and 2019 for collecting data (Table 2). These IE schools have two-story and U-shaped buildings.

While classrooms were located on one side of the ground floor of Ankara Gökkuşağı Primary School, there were special education classrooms and supportive educational services including life center unit on the other (Figure 1). Additionally, the dining hall, canteen, teachers' room and counseling service located on the ground floor. All spaces on the ground floor have a direct access to the outside. The special education kindergarten, sports hall, multipurpose hall, family room, library, and administrative rooms located in the first floor. During the site visits of Ankara Gökkuşağı Primary School accompanied by SERÇEV official in 2015, the information was acquired that the life center unit was added to building programme later for gaining fundamental life skills such as personal care, eating habits, in-home and out-home abilities for students with SEN. Physical traces were recorded to analyze the plan schema and document the interior space of the life center unit via photography technique (Figure 1).

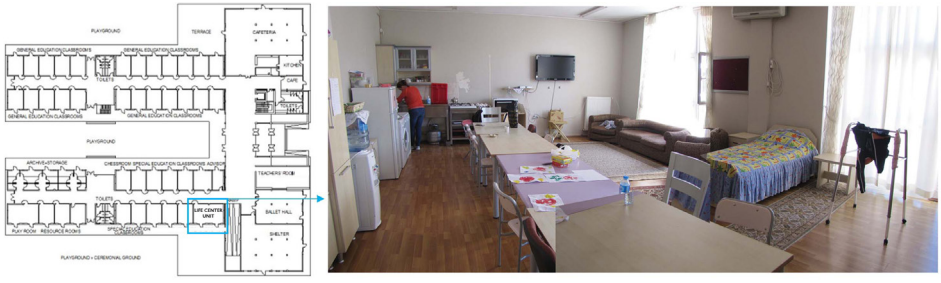


Figure 1. *Ankara Gökkuşağı Primary School life center unit in 2015.*

SERÇEV Accessible Vocational and Technical Anatolian High School was also visited in 2015 when the building was under construction. At that stage, architectural project of building was investigated. The building was two-story, and each story had separate entrance. On the ground floor, the conference hall, library, dining hall, labs, ateliers, family room, infirmary and counseling service were located. On the first floor, the administrative offices, teachers' room, sports hall, general classrooms, special education classrooms, resource rooms and life center unit were located. The plan of the life center unit included three rooms: life center, kitchen, and practice room. In addition, life center unit has also a separate entrance from outside. The architect[3] of the project stated that "the life center unit was designed to create a '1+1' house experience to gain fundamental life skills for students with SEN (Figure 2).

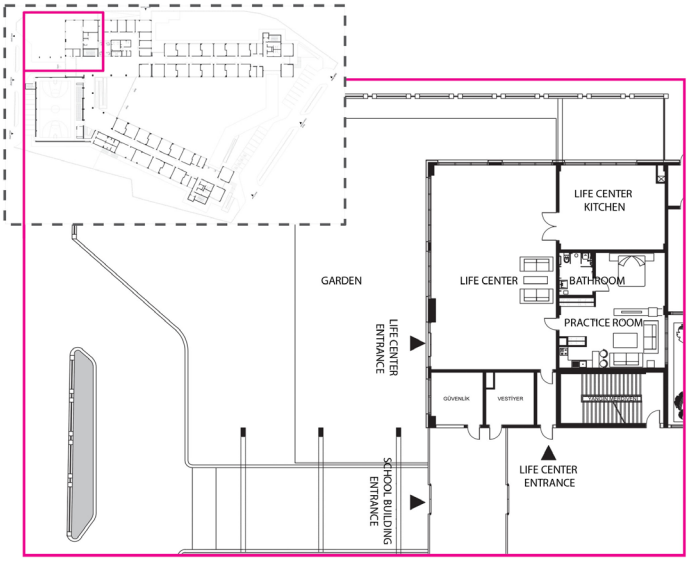


Figure 2. *SERÇEV Accessible Vocational and Technical Anatolian High School life center unit's plan.*

Figure 3. *Ankara Gökkuşağı Primary School life center unit in 2017.*

During the site visit to Ankara Gökkuşağı Primary School in 2017, the spatial organization of the life center unit was made as a '1+1' house plan typology considering different functions (Figure 3).

The first site visit to the life center unit of SERÇEV Accessible Vocational and Technical Anatolian High School was conducted with SERÇEV officials in 2017. This life center unit was designed within a similar approach to that of the Ankara Gökkuşağı Primary School. The interior space is recorded by photography technique and processed into plan (Figure 4).

SERÇEV Accessible Vocational and Technical Anatolian High School, which starts education in 2017-2018 academic year, was visited again in 2019, and physical traces for indoor spaces are recorded by photography technique (Figure 5). Additionally, the information about users and type of use in the life center were provided by school authorities through informal interviews (Gülbahar, 2017).

5. Results

This study confirmed previous results[4] regarding expectations for a life center unit. Data were collected from observations of site visits to the life center units of Ankara Gökkuşağı Primary School in 2015 and 2017 and to SERÇEV Accessible Vocational and Technical Anatolian High School in 2017 and 2019. The results revealed that the life center unit contributed to the education of students with SEN and raised the empathy of other students and stakeholders in inclusive schools.

In addition to the users and period of use, the study results also revealed

that the life center units of two schools spatial and functional changes and transformations over time (Figure 6). During the first site visit to Ankara Gökkuşağı Primary School in 2015, the life center unit had an open plan layout that was arranged without boundaries between different functions (Figure 6a). The furniture and equipment also represented the fundamental functions of a common house. During the site visit to Ankara Gökkuşağı Primary School in 2017, the life center unit had changed according to user needs in terms of the spatial organization of a 1 + 1 house plan, and the wet spaces were separated from the other functions (Figure 6b). The spatial arrangement in Ankara Gökkuşağı Primary School was called a "practice room" in SERÇEV Accessible Vocational and Technical Anatolian High School (Figure 6c). On the other hand, the appropriate distance for use did not consider kitchen furnishings in the practice room (see Figure 4a). The kitchen furnishings were rearranged to create free space for users in 2019 (see Figure 5a). Although there were practice room, kitchen, and life center spaces (Figure 6c) in the plan of the life center unit of SERÇEV Accessible Vocational and Technical Anatolian High School, only the practice room, which had fixed furnishing in the kitchen and bathroom areas, would be used as the life center unit in light of the information gathered from the site (Figure 6d). Additionally, the other spaces except the practice room, will serve as a canteen in the school, according to the information provided by informal interviews (Gülbahar, 2017). Although both schools were designed with two entrances, one from inside and one from outside the main building, the regulations were made for SERÇEV Accessible Vocational and Technical Anatolian High School, which cut the connection of the life center unit with the garden and reduced its use for users (Figure 6d).

In light of the data collected, the findings about the life center unit were summarized and categorized by definition and spatial requirements, as shown in Table 3.

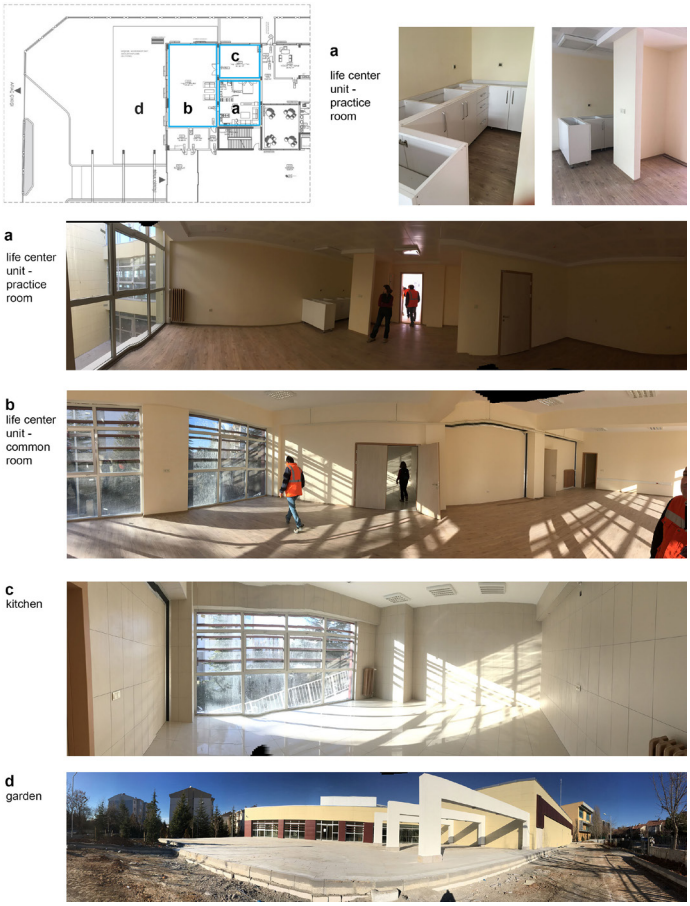


Figure 4. *SERÇEV Accessible Vocational and Technical Anatolian High School life center unit in 2017.*

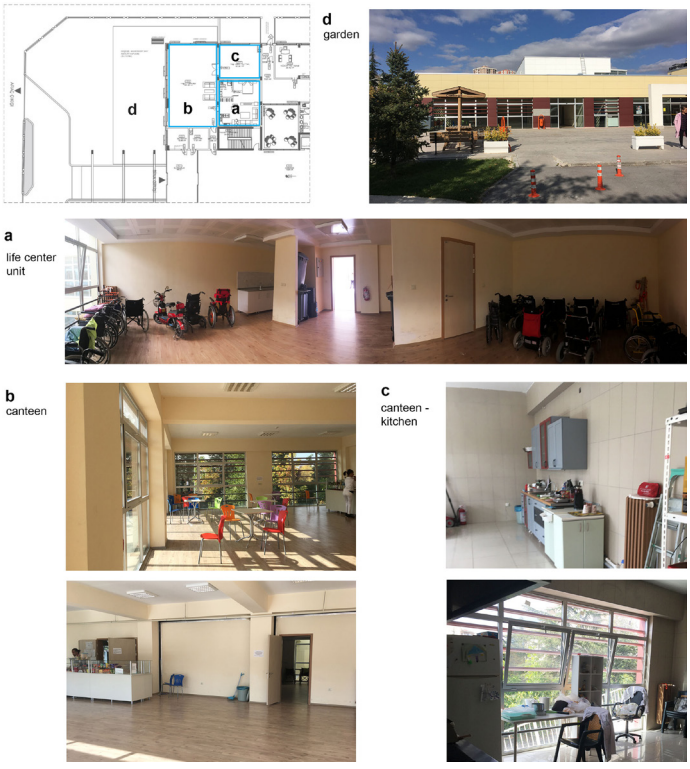


Figure 5. *SERÇEV Accessible Vocational and Technical Anatolian High School life center unit in 2019.*

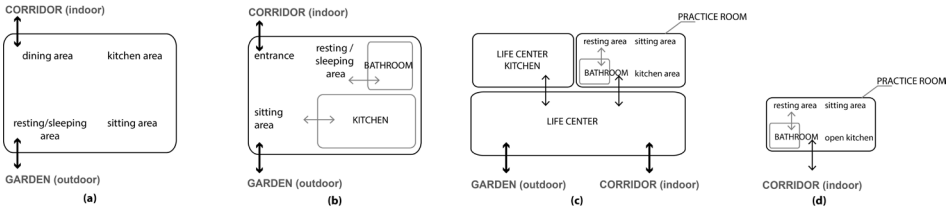


Figure 6. *Progression of life center unit's spatial layout; (a) Ankara Gökkuşağı Primary School, 2015; (b) Ankara Gökkuşağı Primary School, 2017; (c) SERÇEV Accessible Vocational and Technical Anatolian High School, 2017; (d) SERÇEV Accessible Vocational and Technical Anatolian High School, 2019.*

5.1. Defining indoor spatial requirements for life center units

Although there are no legal regulations or design guidelines specifying a space as a life center unit, the benefits and necessity of a life center unit for students with SEN in the building program of IE schools were confirmed by the study results. On one hand, adding the life center unit to the building program of SERÇEV Accessible Vocational and Technical Anatolian High School after Ankara Gökkuşağı Primary School confirms that this place is considered a support service unit in IE schools. On the other hand, the purpose and content of the life center need to be defined in terms of use type, user type, use period, and spatial requirements in collaboration with all stakeholders.

Although the life center unit is for all user groups and for different uses due to the multi-stakeholder and collective structure of IE, the students with SEN are primary user group of the life center unit. The prevailing spatial requirements of a life center unit is a 1 + 1 house plan for providing life skills for students with SEN, who mostly have neurological and muscle problems. Spaces requiring expertise, such as medical, therapy, sensory, and resource rooms, are also needed, as well as spaces for parents and the garden to support the learning activities in and out of the curriculum. In light of the study results, the spatial requirements of the life center unit are defined considering the study of Durak (2010)[5] for the design of inclusive schools.

UD principles eliminate accessibility and usability problems that people with special needs may encounter in inclusive school environments. In this sense, the fact that life centers unit in inclusive schools prioritize user needs coincides with UD principles. Thus, the design requirements related to the type of use, user, and space can also be defined in line with UD principles:

- When evaluated in the context of equitable use—a transcendental principle that compromises when other principles are provided (Durak, 2010)—the life center unit should also meet the needs of other users, especially parents. Thus, the use of the life center unit should be

Table 3. *Findings for life center unit.*

Definition of life center unit	• The life center unit should gain life skills and provide a home atmosphere for students with SEN. • The life center unit should encourage social improvement of students with SEN. • The life center unit should raise awareness of other users in accordance with students with SEN and their needs.
Spatial requirements of life center unit	• The life center unit should have a particular space for assistive equipment for students with SEN. • The life center unit should be accessible for students with SEN. • The life center unit should provide a direct exit to outdoor spaces. • The life center unit should provide ergonomic furniture, product, and equipment for students with SEN because most of them have neurological and muscle diseases.

defined to provide equal use for all users.

- The life center unit should be adaptable to the needs of users with different abilities and preferences and should have a flexible plan for the spatial and functional transformation of the life center unit over time according to the principle of flexibility in use.
- The user-friendly approach, which responds to various special needs in the use of equipment/product and space, is an important factor in life center unit design regarding the principles of simple and intuitive use and perceptible information. A variety of pictorial, verbal, and tactile directions covering different abilities should also be considered in spatial use, and current technological developments should be used.
- Minimizing the dangers and negative consequences of activities in the life center unit comes to the fore regarding the principle of tolerance for error. Accessible and easy use should also be provided for students with SEN by the use of assistive equipment/product in space, and taking necessary warnings to the users to minimize the situations that may create accident risk, taking safety precautions due to the garden connection, which can be used especially during non-school hours.
- The physical abilities of the users of the life center unit should be considered in the design of the life center regarding the principles of size and space for approach and use and low psychological effort. In this sense, users should be allowed to meet their needs comfortably and efficiently with minimum physical effort to use both spaces and equipment/product. Appropriate dimensional decisions should also be made for spatial use, while anthropometric and ergonomic requirements should be taken into account to comfort the mobility of users and the use of assistive equipment/product.

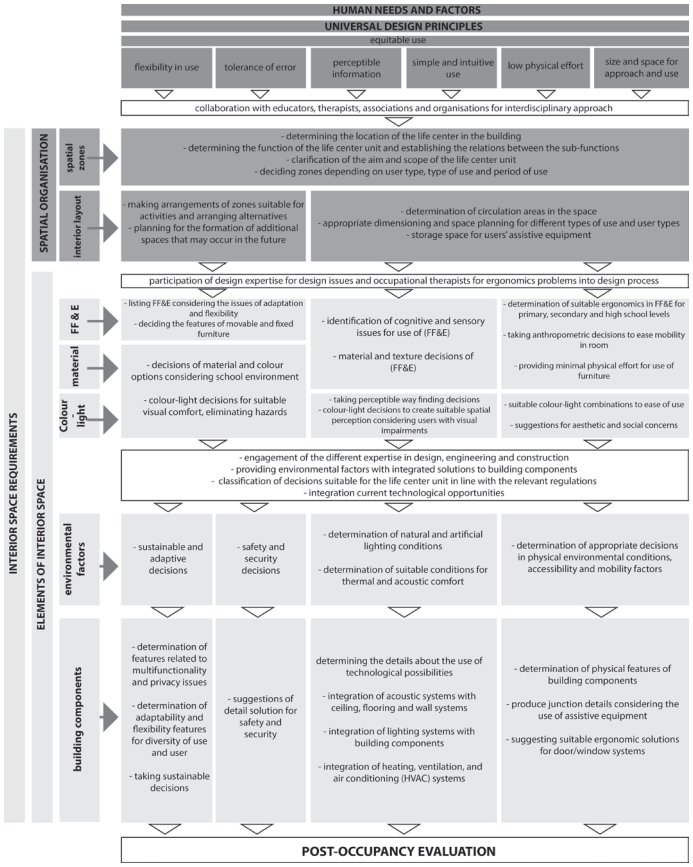
Each government tries to develop education strategies that embrace people with special needs by making updates to their educational policies (Tomlinson, 2015). Thus, spatial requirements for the physical environment of inclusive schools might differ from country to country. "Designing for disabled children and children with SEN: Guidance for mainstream and special schools" (Education Funding Agency, 2014) is an example bulletin for the design of inclusive schools consisting of user requirements to understand both the needs of students with SEN and their capabilities, and design approaches and technical details detailed separately for spatial requirements in inclusive schools of different education levels. In Turkey, there is no design guide that can be considered in the design of inclusive schools. This makes it difficult for stakeholders in the design of IE schools to meet the spatial requirements of the life center unit. Therefore, a design guideline is needed to guide designers according to ever-changing user needs and physical/spatial requirements.

5.2. Developing design guidelines for life center units

The proposed design guideline for the life center unit, which is based on disciplinary collaborations and is regarding interiors, is grouped under 'user needs and factors' and 'interior space requirements.' The relationship between these requirements defined on the x and y axes should be considered in the design process (Table 4).

- The initial steps in the design process of the life center unit should be undertaken with the participation of stakeholders, such as educators, physiotherapists, and associations involved in IE, to identify the physical/spatial, user, and product-based requirements of the life center unit.
- User needs and factors have been associated with the principles of UD under the principle of 'equitable use.' Equitable use is evaluated as a key principle that encompasses the other principles, and is accomplished when other principles are achieved in the design of the life center unit. The establishment of these relationships acts as a control mechanism in the design process. Thus, it will be possible to respond

Table 4. *Design guideline for life center unit.*



to future needs in terms of both spatial and user requirements and to develop flexible and adaptable design proposals.

- Interior space requirements are grouped under the 'spatial organization' and 'elements of interior space'. While interior elements are grouped under building components, environmental factors and color/light, materials, furniture, fixtures and equipment (FF&E) , and spatial organization are grouped under interior layout and spatial zones. In the design process, spatial organization should first be optimized to determine elements of interior space using interdisciplinary communication between designers and other participants in IE. Spatial zones should be determined according to the type of use and user, and the period of use regarding the placement of the life center in the school building. The interior layout should be determined by planning functions and allowing alternative options for these arrangements as well. Design decisions regarding color/light, material, FF&E should be made with the collaboration of designers and subject-related specialists. Occupational therapists should be consulted regarding ergonomic solutions for students with SEN. The design of environmental factors, such as acoustic comfort, lighting, thermal comfort, safety, and the design of building components, such as floors, ceilings, and walls, should be done in cooperation with design, engineering, and construction expertise.
- After a certain use period, design guidelines should be kept current with a post-occupancy evaluation. Thus, over time, innovations in education, the use of space, the needs of users, and technological developments will be reflected in life center unit designs.

6. Conclusion

Designing school environments that are appropriate to UD principles allow inclusive school environments for meeting diverse user's need. Furthermore, it allows inclusive schools for encouraging the social and academic success of the student with SEN. In this regard, spatial, use, and product-based requirements of inclusive schools should be determined and their solutions should be developed. The existence of the life center unit as a new support service space in IE schools in Turkey is important in terms of identifying a spatial and cultural need. Although the life center unit is recommended as a place where students with SEN gain independent living skills, it has uncertainty in terms of spatial needs, type of use and user, and period of use. While the design guidelines, regulations and legal legislation regarding IE in Turkey give an idea about an inclusive physical environment of the mainstream schools, the information and explanations that will guide the design process for the design of IE spaces are insufficient.

Considering UD principles in the development of the proposed design guide for life center units in IE schools will help students with SEN in the

decision process affecting the design of the life center unit. The design of user-friendly spaces will also be supported by including all stakeholders in design process of the life center unit. The design guideline, which emerged as a reflection of the socio-cultural, socio-political and socio-economic situation in Turkey, will contribute to the dissemination and design of supportive educational service, such as life center units in IE schools, with the help of the interior architecture discipline and its knowledge. This study will also contribute to the development of disciplinary collaborations and future studies among designers, academics, practitioners and all stakeholders of IE.

Acknowledgements
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Endnotes

[1] In the regulations, any spatial requirements regarding special needs were defined as "disabled." This definition has a segregated expression for students with SEN. Therefore, the language of the regulations should meet the UD principles in order to eliminate discrimination.

[2] Individualized Education Program, Individualized Education Programme or Individual Educational Plan (IEP) is an academic and social support which is applied to students with SEN considering their individual skills. In this plan/program, the way of educational support is described how it is applied by the stakeholders of IE to meet the educational requirements of the students with SEN.

[3] Information was collected from the seminar by architect Gökhan Aksoy.

[4] Besides the informal interviews were conducted to understand the user type, type of use and purpose of life center unit with the officials and administrative staff, the survey was done with the families of students with SEN in Ankara Gökkuşağı Primary School in the previous study (Gülbahar, 2017). According to the survey results, families stated that the life center unit contributed to the individual development of students with SEN. Additionally, the existence of life centre as a supportive space in IE schools was positive (Gülbahar, 2017).

[5] Durak (2010) determined the spatial requirements in IE environments in 12 categories and type of uses in four categories. In this study, we used six spatial requirements (1, 2, 7, 9, 11, and 12) and three type of uses (1, 3, and 4) of aforementioned study.

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The "configurational analysis" for the study of medieval mosques in al-Maghrib al-Aqṣà: The case of the Qaṣba mosque in Marrakesh

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Abstract
The present paper attempts to present an analytical method that is suitable, and of great interest, for the study of historical buildings that are still in use or those that do not permit the undertaking of a stratigraphic analysis of their walls. Despite having been conceived almost four decades ago, this method is now being consolidated with the establishment of a set of guidelines that should be considered for its application. Furthermore, this working model has been defined thanks to its experimentation in a specific case study, the Qaṣba mosque in Marrakesh, where it was possible to recognize the twelfth-century Almohad foundational configuration as well as some of its later transformations. Finally, as an example, the results of this study are presented in order to show the capacity of the method as well as to demonstrate the characteristics of this building, a masterpiece of medieval religious architecture in the Islamic West.

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Keywords
Islamic architecture, Mosque, Morocco, Medieval, Configurational analysis.

1. Introduction: Chronology and typology

It has been a traditional practice to deal with historic buildings as if they were immutable structures, except in cases where transformations were evident or reflected on written sources. In fact, historical texts have been the main element determining the dating of medieval buildings over the last century, defining their main phases even in cases where numerous alterations had occurred. Of course, such sources of information are always necessary, but they cannot be relied upon exclusively, since it is the material culture which provides the most reliable data through scientific analysis.

Having said that, there are intrinsic several factors that complicate considerably the material study of the mosques in al-Maghrib al-Aqṣà. On the one hand, their functional continuity means that they are still in use today and, thus, their maintenance is focused on users' comfort. On the other hand, the lack of documentation and archaeological monitoring during the restoration work precludes any kind of stratigraphic analysis. As a result, the Moroccan religious heritage does not allow for any solid archaeological and architectural study, thus discouraging any musealisation and affecting conservation. For the case of al-Qarawiyyīn mosque in Fez a relevant archaeological excavation was undertaken in the year 2006 on the southeast sector (Ettahiri, 2007; Ettahiri, 2014), but after that no archaeological attention was paid to the stratigraphic details of walls and arcades.

Over the last decade, numerous refurbishments have been carried out in the historic centres of Moroccan cities, including interventions in their main congregational mosques. However, we could state there is no collaboration between architectural projects and research. Any kind of initiative for documentation or scientific research is sometimes even blocked by those entities involved in the project.

This hostile panorama represents a serious problem for the study of medieval religious heritage, its evolution and, ultimately, the definition of archetypes. Consequently, it also leads us to maintain traditional dating and to consider buildings, to a large extent, as monophasic structures, which in turn leads to the establishment of erroneous typological patterns, namely specific features of a particular time and society.

In this sense, defining a typology based on a building that has been spatially altered and which contains several phases, is an absolute mistake, as each phase responds to a different conception and planning, even if the most advanced phase may be influenced or conditioned by the previous one(s). It is therefore incoherent to define a specific typology -that is related to historical and social context- by considering a collage in which elements from different periods overlap. The historic building is a multi-typologised object (Caballero, 2009, 12-14).

Typology, as in the case of stratigraphy, is a method specific to archaeology, distinguishing in each stratum materials that belong to their own moment of formation. Thus, the chronological arrangement of materials or types, based on stratigraphic sequency, allows typologies to be established. Thereby, building typologies are based on their own components and characteristics: building materials and masonry; constructive forms and structures; singular elements such as openings, finishes, mouldings, or decoration, as well as tool traces (Parenti, 1988). Hence, the discovery of new types calls for the continual updating of typologies and the creation of more detailed ones. However, the absence of stratigraphy complicates the diachronic order of types, which is why we depend on comparison with typologies that have already been chronologically located.

Nevertheless, as far as the Maghrebi mosques are concerned, the literature of the last century does not always seem to have integrated the theoretical formulations outlined above. Thus, an attempt has been made to constitute a set of models that aim to characterise the morphological and spatial patterns of each period, including their possible evolutions and variants, but in many cases, these models are based on asynchronous approaches in which projects from different phases are intermingled.

Despite this outlook, an exceptional case can be recognised for the Almohad context (12-13th centuries) in which the main compositional guidelines of this period can be found. Although it has never been the subject of an exhaustive archaeological analysis, conservation work on the Tinmal mosque in the 20th century revealed its foundational configuration. For this reason, the Tinmal mosque came to constitute a schematic model that has served to express the essence of mosque design during the Almohad period, being the others a derivation or evolution of it. However, this consideration is independent of its chronology, as it is not the oldest Almohad mosque.

2. Configurational analysis

Even when the general or partial dating of a building is unknown, and it is impossible to carry out a stratigraphic wall analysis because its masonry is not visible, it is still possible to make a provisional analysis based on objective observations and inferences (Mannoni, 1998, 83). Even before resorting solely to written sources and present styles, the building still offers opportunities to be analysed archaeologically in a non-destructive way, through configurational analysis. This, according to the meaning of the term "configuration", aims to recognise the arrangement of the parts that make up a building and give it its particular form and properties.

To this effect, a comprehensive morphological examination of the building as a unit and as an ensemble of multiple structures is carried out to identify homogeneous organisations and anomalies. Finally, these observations are to be put in relation to archetypes and typologies already known from other local and regional buildings, so that common configurations can be recognised. Nevertheless, this analysis has its limitations, and it is almost impossible to provide a detailed order of phases, but a tentative sequence will allow us to identify the main transformations. In fact, these preliminary formulations could be demonstrated and completed in the future by means of a wall stratigraphic analysis.

The following is a work plan outline that we propose to develop this type of analysis, which we have been able to draw from our experience in the study of the Qaṣba Mosque in Marrakesh:

-*Architectural survey.* The fundamental basis for this analysis is building planimetry. First, it constitutes the support on which the observations will be plotted, but its elaboration also represents a preliminary analytical process. The vectorisation process of plans, elevations and sections makes it possible to recognise irregularities and raise questions in advance, as it involves the walls' graphic and cartesian relationship. For this reason, it is considered advisable to carry out an architectural survey of one's own. However, in those cases where this is not achievable, the planimetry to be used should be meticulously revised and suitably updated.

-*Historical graphic material.* Since these are generally buildings that have undergone numerous interventions until the present time, historical cartography and photographs, when available, should be consulted in order to recognise all those elements or alterations that are the result of contemporary actions and, therefore, can be easily classified in the group of more recent transformations.

-*Urban context exploration.* Although the urban fabric also evolves, it is generally more rigid than buildings, insofar as it is a circulation system subordinated to the set of constructions that make up the city. In fact, to a large extent, its transformation is directly conditioned by the mutation of all the adjacent buildings (houses, shops, mosques, and other public facilities such as baths). This means that the surrounding street plan contains a variety of layouts that have necessarily interacted with the different historical phases of the building and may, therefore, reflect details of its previous configuration. Naturally, these observations will focus on the communication between public and interior space (accesses), although other constructive, geographical, and delimiting elements (walls, irrigation channels) also come into discussion.

-*Elemental analysis*. This is the main component of this method, based on morphological, architectural, and ma-

terial aspects that should serve to recognise: discontinuities, sets of differentiated structures, divergences between exterior and interior surfaces of walls, types of masonries, types of openings, structural and compositional conflicts, and irregularities continuously repeated. In particular, we believe that these are the points that should be considered:

-Spatial characteristics (recognition of configuring axes, orientations, distributions, organisations, sectorisations and groups).

-Structural characteristics (layout of bearing walls, pillars, columns, and roofing systems).

-Material characteristics (materials, masonry, floors, roofs).

-Main elements distribution (domes, arches, entrances, windows, fountains).

-Decorative programme distribution (plasterwork, carpentry, domes).

-Complementary elements (hydraulics, furniture, specific functions).

This point constitutes the main basis of this method for revealing the diachronic process of the building. As indicated above, without recognising these alterations, one could fall into the error of determining the whole as a system of elements and spaces that respond to a single configuration and, therefore it would define an adulterated typology. On the contrary, it is an ensemble that brings together numerous phases that start with the foundational configuration, continue with various reconfigurations, adaptations, transformations, destructions and, finally, ends up with the present-day maintenance or abandonment. In addition, the incorporation, when appropriate, of pre-existing elements should not be omitted, as these, although alien, may have influenced its layout.

-Typological definition. Once the previous exploration has been carried out, it is possible to establish synthe-

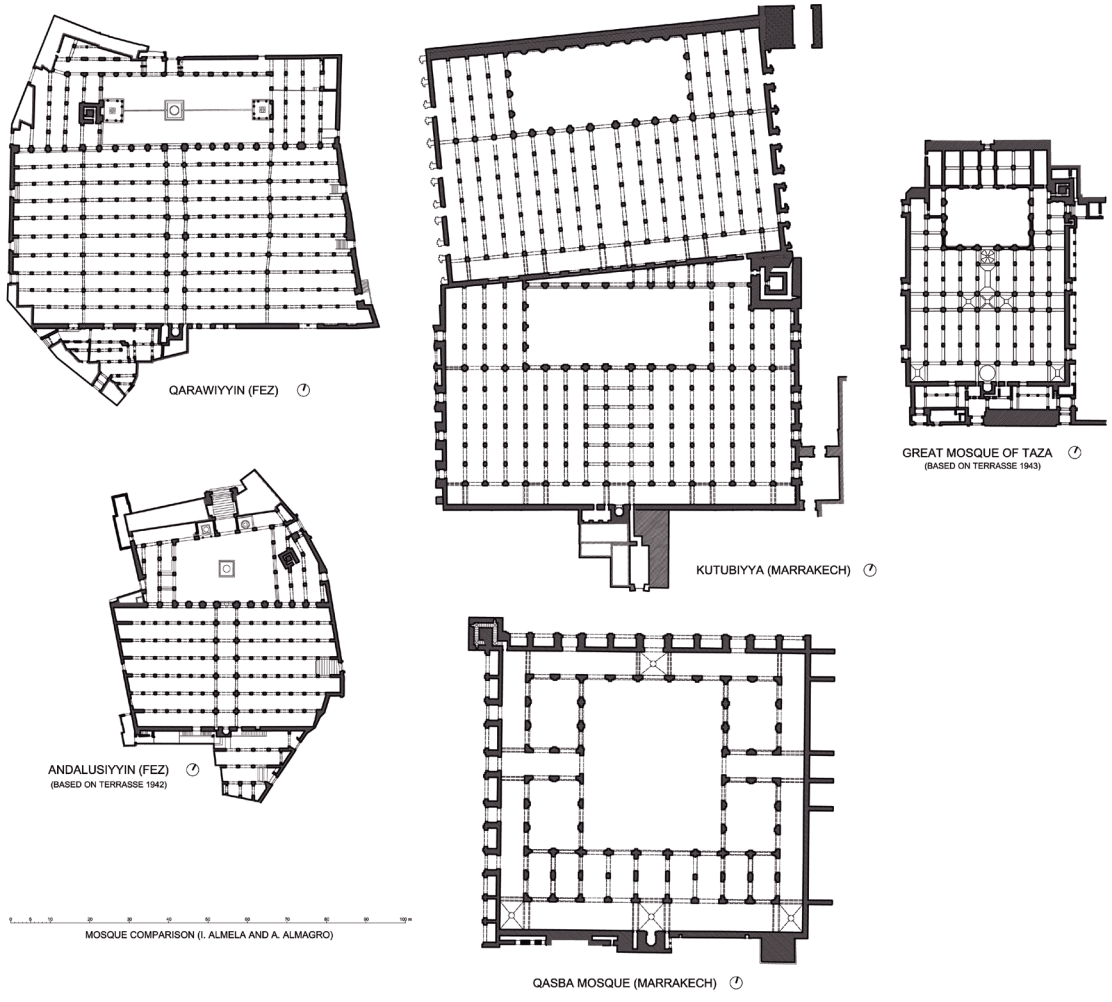

Figure 1. *Comparative plan: al-Qarawiyyīn, al-Andalusiyyīn, Kutubiyya, Great Mosque of Taza and Qaṣba Mosque in Marrakesh (Author).*

sised ideas and recognise some of the configurations that assemble and shape the current building. In this way, the consonance and coherence of elements can associate them to the same moment and facilitate their relative dating. Thus, even if each configuration offers fragmentary and incomplete information, they can be associated with typologies already known in the region. In this sense, for this step to be sufficiently guaranteed, the examples that determine the typology must also offer rigorous analysis results. And finally, the configurations that have been recognised in the building can enrich the general picture of chronotypologies and even define subtypes.

3. The Moroccan Mosque landscape

Nonetheless, configurational analysis is more effective for mosques that have undergone major historical transformations, that is to say, those that are older and predate the 13th century. Among the most prominent cases found in al-Maghrib al-Aqṣà, we can highlight five that are widely known: the al-Qarawiyyīn Mosque (Fez), the al-Andalusiyyīn Mosque (Fez), the Kutubiyya Mosque (Marrakesh), the Great Mosque of Taza and the Qaṣba Mosque (Marrakesh).

The enlargement of mosques is, indeed, a frequent occurrence in the Islamic world, as it is largely subject to the demographic and urban development of cities. The most representative example in the Islamic West is the Mosque of Cordoba itself, whose archaeological excavations began at the end of the 19th century and has continued throughout the first third of the 20th century (Ricardo Velázquez Bosco and Félix Hernández Giménez) until today. As a result, there is a recognised consensus on its evolutionary process consisting of five phases relating to the Umayyad period (8th-10th centuries), starting from an embryo whose architectural codes, orientation and structural design were later reproduced to generate a solution that was as harmonious and homogeneous as possible. In this manner, the oratory underwent three extensions, which involved the relocation of the qibla wall to the south on two occasions, while the courtyard was extended twice (Creswell, 1979, 138-166; Fernández, 2015).

Nevertheless, among all the mosques we have listed, al-Qarawiyyīn (Fez) offers the most attractive picture, since it has constituted the main religious centre of the city by irradiating its cultural reputation beyond Fez. Although the early medieval origin of the building still inspires many unknowns, written sources and some archaeological evidence reveal it was founded in the mid-ninth century, thus evidencing Idrisid phases and materials (Terrasse, 1968, 9-10; Ettahiri, 2007, 103-106; Ettahiri, Fili and Van Staëvel, 2012, 157-160; Ettahiri, 2014, 118-120). However, one of the most remarkable aspects of this mosque is precisely that it has been highly regarded by governors and sovereigns during the Middle and Modern Ages. This special consideration led to several of them to add their own interventions, extensions, and reparations to the building, thus leaving their mark on this glorious and respected monument (Figures 1 and 2). The studies carried out so far have revealed a clear evolution of the building, which has considerably increased its surface area. A first extensive enlargement of the prayer hall took place at the end of the 10th century by the Zenata dynasty, which ruled the territory at the expense of the Cordovan caliphate. This intervention included the renovation of the courtyard and the construction of the minaret (Terrasse, 1968, 12; Ettahiri, 2014, 118-119). Subsequently, the Almoravid ʿAlī b. Yūsuf carried out a second extension to the south, between 1130 and 1144, resulting in the addition of three aisles, the relocation of the qibla wall, the creation of the funerary mosque, and the redecoration of the axial aisle, which was provided with a succession of muqarnas vaults (Marcos, 2015, 172-180; Almagro, 2020, 178-181). Finally, in the 17th century the Saʿdian sultans incorporated some renowned structures such as the two pavilions in the courtyard, the retreat hall, a library, and an external dome (Almela, 2021, 233-258).

Since its medieval origins, the city of Fez was formed by two isolated nuclei separated from each other by the river, an aspect that was further enhanced

Figure 2. *Qarawiyyīn Mosque. View of the roofs with the different extensions (Author).*

by the construction of a congregational mosque for each of them. Thus, the second mosque, known as al-Andalusiyyīn (Fez), was built approximately at the same time as al-Qarawiyyīn, but occupying the central position of the eastern nucleus (Terrasse, 1942, 19). Regarding its evolution, the only research work worth mention is the one carried out by Terrasse, who recognised two phases: the Idrisid foundation and the Almohad reform. From his exploration, the mosque retains around the axial aisle a rather unique typology of pillars, consisting of a lobed section of four attached stone columns (Figure 1). This detail is somewhat consistent with al-Bakrī's description (11th century) and contrasts with the square or rectangular pillars of brick masonry typical of Almoravid-Almohad mosques. In fact, the rest of the al-Andalusiyyīn Mosque has this second type of support, which is attributed to the Almohad extension, although the details of this intervention still require profound study.

The third example, perhaps the best known one, represents an icon of Almohad architecture in the Islamic West. The Kutubiyya Mosque in Marrakesh was founded between 1147 and 1158 by ʻAbd al-Mu'min, founder of the dynasty, in the newly conquered Almoravid capital. However, this mosque consists of two major historical phases, which are adjacent to each other and basically consist of a duplication of the building (Figure 1). The first one was erected parallel to the old Almoravid fortress (Qaṣr al-Hajar) and had its own minaret, which was attached to one of the fortress towers (Almagro and Jiménez, 2022). At a second time, before 1163, the same sovereign undertook the construction of a second mosque next to the first one and following the same spatial scheme, although on this occasion its layout was rotated to amend the orientation (Figures 3 and 4). This phase constitutes the present mosque and includes an imposing new minaret. It has been considered sometimes that the abandonment of the first mosque occurred in order to erect a second one that was correctly oriented, although many scholars differ (Basset and Terrasse, 1932, 102-104; Deverdun, 1959, 183-184; Villalba, 2015, 142-144). In this sense, recent studies have shown that both phases coexisted and should therefore be understood as an extension that doubled the surface area of the oratory and erected the famous minaret (Almagro and Jiménez, 2022).

In addition to the al-Qarawiyyīn Mosque, the Great Mosque of Taza represents a type of mosque whose evolution has been marked especially by the process of enlargement. In this case we depart from an Almohad foundation that was undertaken by ʿAbd al-Muʾmin (1130-1163) around 1142, but this one may have been subsequently extended and renovated in 1291-92 by the Marinid sultan Abū Yaʿqūb (1286-1306). Boris Maslow has already outlined the evolution of the mosque in these two phases and he showed the

Figure 3. *Kutubiyya Mosque (Marrakesh). View of the old qibla with connecting bays between both phases (Author).*

Figure 4. *Kutubiyya Mosque (Marrakesh). Top view of the two juxtaposed mosques (Author).*

characteristics of the extension by means of an illustrative plan (Maslow, 1937, 17). However, despite his proposal seems to be sensible, the details and layouts are less so, as they lack a more archaeological approach. On his part, Terrasse proposed the same transformation in a later monographic work, trying thus to rely on some observations and data extracted from the Marinid foundational inscriptions (Terrasse, 1943, 23-34). The first phase (Almohad mosque) had nine aisles, the depth of which is uncertain, and a courtyard of 4 x 5 bays provided with porticoes on the east and west sides (Figure 1). A second phase (Marinid reform) added four more bays to the south, shifting the qibla and creating a new cross aisle provided with three *qubba*-s and a new mihrab. The extension consisted of prolonging the Almohad aisles while maintaining their width and reproducing the T-shaped layout. In addition, a battery of galleries was added to the north of the courtyard. The scope of the Marinid work suggested by Terrasse was largely based on the typological differentiation of arches. However, a concordance between the two was respected, for example, in the width and continuity of the aisles, as well as the height.

Finally, the last Moroccan example to be listed is the Qaṣba mosque in Marrakesh. This building was erected by the Almohad caliph Abū Yūsuf Yaʿqūb al-Manṣūr in the last third of the 12th century in order to dispose of a congregational mosque within the walls of the Qaṣba that was able to issue the *khutba* apart from the other congregational mosques of the capital city: the Kutubiyya and the ʿAlī b. Yūsuf mosques. As it will be seen in detail below, this building underwent a major transformation that took place three centuries later and caused alteration on its spatial organisation.

As for the later mosques that were built during the Marinid-Wattasid period (last third of the 13th century to mid-16th century) and the Saʿdian period (mid-16th century to mid-16th century), it cannot be said that they did not undergo significant alterations, as we insist that the Moroccan landscape has yet to be studied; however, an examination of several prominent mosques from these periods reveals that the same foundational planning has been maintained.

4. The Great Mosque in the Qaṣba of Marrakesh

The Qaṣba Mosque in Marrakesh -also known as the Mosque of al-Manṣūr (Jāmiʿ al-Manṣūr) because of the ruler who founded it-, belongs to the group of great Almohad mosques and its foundational design forms an intermediate link between the typologies at the Kutubiyya and the Great Mosque of Rabat (Hassan Mosque). However, the original design of the mosque is very distorted and has undergone several transformations that have given it its present rather anomalous shape.

Shortly after inheriting the rule of the empire, the caliph Abū Yūsuf Yaʿqūb al-Manṣūr (1184-9) undertook the construction of the Qaṣba in 1185, occupying a plot to the south of the city of Marrakesh. The new congregational mosque was built between 1185-89 in the public sector of this new Qaṣba, thus representing a point of contact between the caliph and the people. Despite this, it is unclear whether its construction was completed during this period, although it did undergo a later modern alteration and successive interventions, the most recent of which was the restoration carried out between 2012 and 2013. It should also be noted that the city in which it is located experienced an intense period of decadence during the 15th century, from which the mosque was certainly not exempt. As such, the building that can be observed today has most likely undergone various transformations that have given it its current state, generating great interest in what its original design was and what the 16th-century Saʿdian restoration consisted of.

To this day, all architectural and archaeological approaches to the study of this mosque have recognised the exceptionality and rarity of its plan, even though its form maintains fundamental compositional elements of the prototypical Almohad mosque (Basset and Terrasse, 1932, 274-310; Marçais, 1954, 211; Deverdun, 1959-66, 232-236; Ew-

ert and Wisshak, 1987, 179-211; Villalba, 2015, 168-177). Among the existing studies, the most outstanding is the one by Ewert and Wisshak in *Madrider Mitteilungen*, although their contributions have not been widely considered in subsequent research because it is the only study they published on this mosque and it was written in German. In addition to the plans, elevations and sections they provide, their main contribution is the survey they carried out at the foot of the pillars in two of the minor courtyards, which was carefully recorded by writing and drawing of sketches. This documentation represents to this day a valuable source of archaeological information, if not the only one. For this reason, we have incorporated this data throughout our analysis. However, contrary to what our analysis has determined, these authors were inclined to consider the structure of the present mosque as the original Almohad structure, corresponding only to later transformations some minor changes such as roofs, redecorations and coatings.

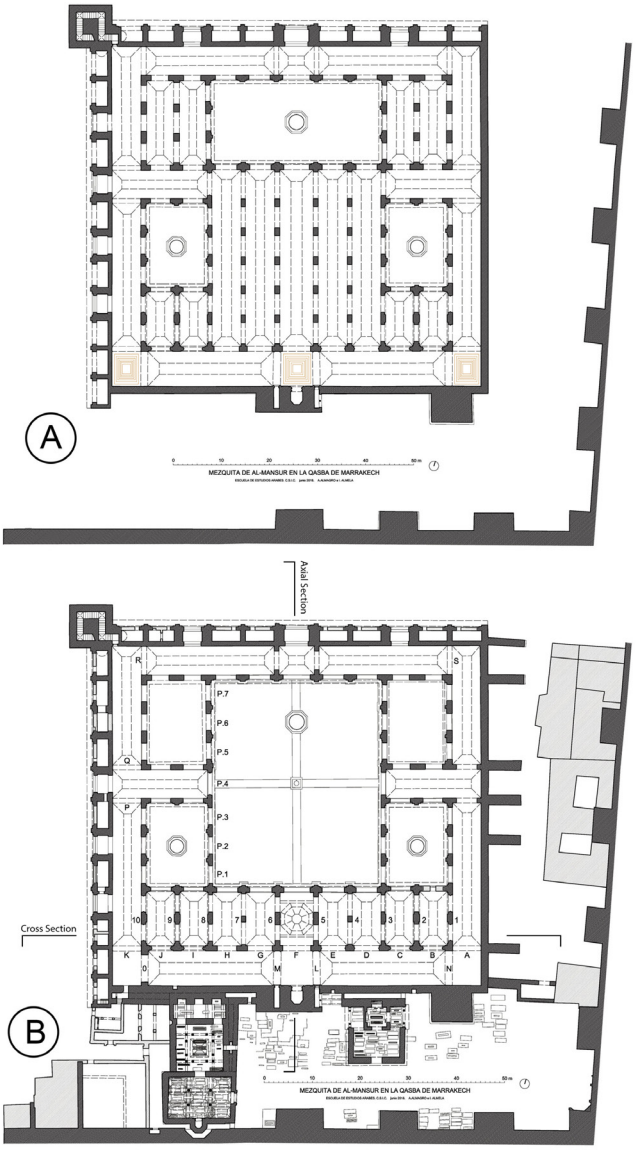

Figure 5. *Qaṣba Mosque (Marrakesh). A. Almohad-Foundational phase (12th century); B. Current state (Author).*

Despite this, most of the studies carried out to this day have not paid sufficient attention to the evolutionary and diachronic aspect of the building, disregarding the existence of a major architectural transformation, and neglecting to investigate the characteristics of the original building. Fortunately, during 2018 we were able to carry out a new architectural survey of the mosque that allowed us to undertake a detailed analysis of its structure and identify its radical historical transformation (Almela, 2020).

For the time being, the method of analysis described above has only been applied to this mosque, where it has been possible to recognise some characteristics of the Almohad foundational building and its subsequent evolution. To do this, we have delimited four major areas of the building in which the main traces of its transformation are concentrated: the central courtyard, the minor courtyards, the hydraulic structure, and the arcades of the prayer hall. But it is worth mentioning that most of the irregularities are repeated symmetrically to the longitudinal axis of the mosque, which shows that the mosque has always functioned as such, both in its initial configuration and in its subsequent alterations. In the case of the prayer hall arcades, however, not all anomalies follow this symmetrical layout.

The inaugural Almohad phase (Figure 5A) consists of an eleven-aisle building that was arranged with the usual integrated T and E plan and dominated by a developed longitudinal axis, while it was provided with a large courtyard in the northern sector and two minor courtyards inserted within the large prayer hall. In addition, the three *qubba*-s located next to the qibla wall may have been covered with muqarnas vaults, of which the one at the western end still survives. This was

a mosque with a much larger covered area if we compare it to the present-day building and it was originally organised in a quite different way. The interior would have had only three courtyards, two minor ones corresponding to the two courtyards in the southern half of the present building, while a major courtyard would have occupied the northern part of the present central courtyard. All these courtyards have been equipped with fountain until the present day. The largest courtyard also has two underground cisterns.

Regarding the major courtyard of the present mosque (Figure 5B), it is the most revealing space since it presents notable differences that are symptomatic of its main transformation. First, we find that on the east and west side fronts there is a very noticeable inequality between its northern and southern halves (Figures 6 and 7). The northern one shows a sequence of three arches very well defined as a courtyard façade with double-ring arches, *alfiz* (a rectangular moulding that encloses the outward side of an arch) and pi-

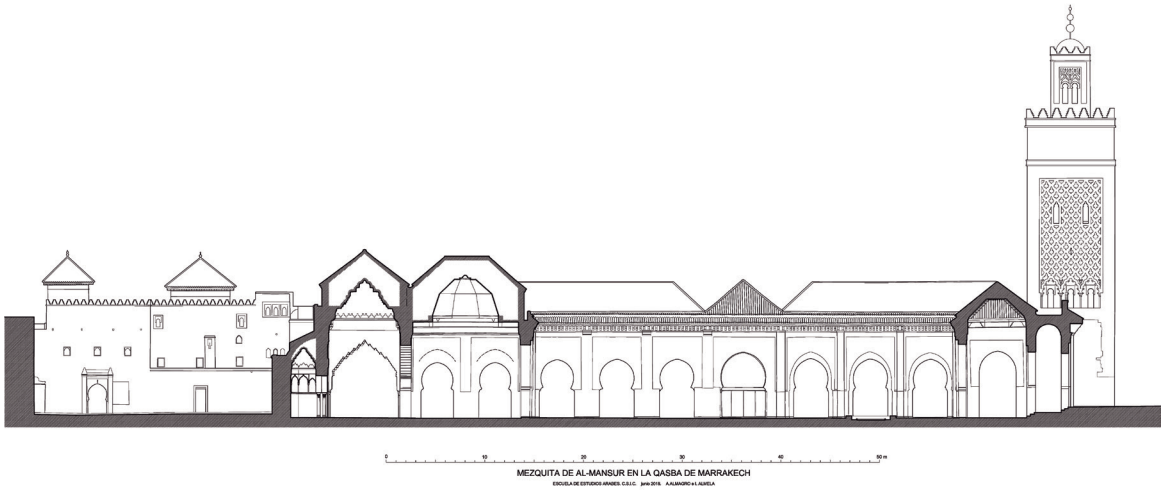

Figure 6. *Qaṣba Mosque (Marrakesh). Longitudinal section (Author).*

Figure 7. *Qaṣba Mosque (Marrakesh). View of the mosque from the minaret (Author).*

lasters attached to the pillars. By contrast, the southern one, including the central opening, consists of a plain face of simple arches, typical of an interior arcade. Furthermore, if we consider the pilasters, it can be observed that the one that separates P4 from P5 is slightly displaced towards the jamb of arch P5 (Figure 8). All of this evidences how the major courtyard was originally 3 x 5 arches with its dominant axis perpendicular to the longitudinal axis of the mosque, although it was later extended to the south by removing four bays of the prayer hall.

As for the four minor courtyards, the two located in the northern sector have a simple, undressed façade on all four sides with pointed horseshoe arches and a shallow *alfiz*. On the other hand, the two ones located in the southern sector have four elevations with double-spiral arches, *alfiz* and pilasters, namely the usual façade treatment in Marrakesh's medieval architecture. Furthermore, these four minor courtyards are arranged around the large central courtyard and are related to it by means of the arcades themselves, with no intermediate roofed space that isolates them or gives meaning to the presence of the arcades (Figure 5B). Regardless of the archetypes and building typologies, it is contrary to architectural logic to place two juxtaposed courtyards separated by an arcade. If we contrast the two faces of the arcades that stands between the major courtyard and the minor courtyards, it is possible to observe that the pillars are arranged in opposite ways on either side. In other words, in the northern sector, the major courtyard has a façade treatment, while in the two minor ones this is not the case. And in the southern sector, just the opposite occurs.

In this way, it is revealed how the southern sector of the mosque, which consists of a prayer hall and two minor courtyards, had a wide-span transverse aisle juxtaposed to the qibla wall and a sequence of perpendicular aisles between which the two courtyards are integrated. The only difference with respect to the present mosque is precisely the extension of the five central aisles with the addition of four bays to the north. As for the two minor courtyards in the northern sector they are not original. In fact, this point would also be accounted for in the surveys of Ewert and Wisshak, where it was found that the pillars located in the centre of the north and south sides of both

Figure 8. *Qaṣba Mosque (Marrakesh). Main courtyard. Sequence of arches (P3, P4, P5) in the west side front.*

courtyards had been flattened (Ewert and Wisshak, 1987, 184-185), in other words, the central arcade that compartmentalised the former aisles may have been removed.

Likewise, the water supply of a mosque is an element whose layout is guaranteed to be maintained over time, which is why it contributes to the understanding of the foundational building. On the one hand, the mosque has four fountains, two in the central courtyard and two in the minor southern courtyards. In the central courtyard, a small modern marble bowl is located in the centre, exactly in the crossing of the two axes, while another large circular marble bowl, slightly recessed, is centred in relation to the longitudinal axis of the building in the northern part of the courtyard (Figure 5). The significance of this is precisely its centred position with respect to the transversal axis marked by bay P6, which would correspond to the Almohad courtyard. On the other hand, the two minor courtyards located to the south, allegedly original, accommodate a type of central marble fountain similar to the previous one. In short, the location of these three low fountains centred on the three courtyards contributes to the consideration of these last as part of the foundational project.

Regarding the T-shaped layout, it emphasises the transverse and central aisles, both of which are wider than the rest, especially the transverse one, whose dimensions are unusual (7.28 m as opposed to 4.77 m in the Kutubiyya). As is customary in Almohad architecture, the transverse aisle would have had an odd number of *qubba*-s, corresponding to the three domes of today, although two of them were rebuilt at a later date. As for the central aisle, it would be most logical to think of a continuous wooden roof. Moreover, this longitudinal axis extends to the northern front where the main doorway and a carpentry *qubba* are located. The second E-shaped layout adds the two lateral aisles that extend along the east and west sides respectively. These aisles are slightly wider, but not as wide as the two aisles that form the T-shape.

Meanwhile, the prayer hall has a wide variety of arches, generally arranged symmetrically, although there are several peculiarities and anomalies. Regarding the composition of the arcades and their ornamentation, several Almohad capitals have been identified on the small columns attached to some of the pillars in the transverse aisle, which suggests that the whole archery belongs to that period. This detail is especially interesting since allows for the recognition of a particular feature of the Almohad building, namely the use of transposed arches in the interior of the building. In general, this architectural solution is only implemented in façades either external walls or courtyards, but at the Qaşba mosque it has been possible to recognise it implementation for two ornamentally more distinguished sectors located to the south of the minor courtyards (arcades 1-3 and 8-10). The lower arch ends with a slightly pointed horseshoe, while the arch behind it is poly-lobed (Figures 9 and 10). Likewise, the intermediate arcades 2 and 9, which divide the two distinguished sectors into pairs of aisles, have a thickness greater than normal, in such a way that they invade the space for the alfiz of arches B, C, I and J. This detail makes us think that they were widened.

On the other hand, the pairs of aisles headed by arches D-E and G-H distort the symmetry. The first pair, located to the east of the longitudinal axis, features large poly-lobed plasterwork arches, similar to the ones lining B, C, I

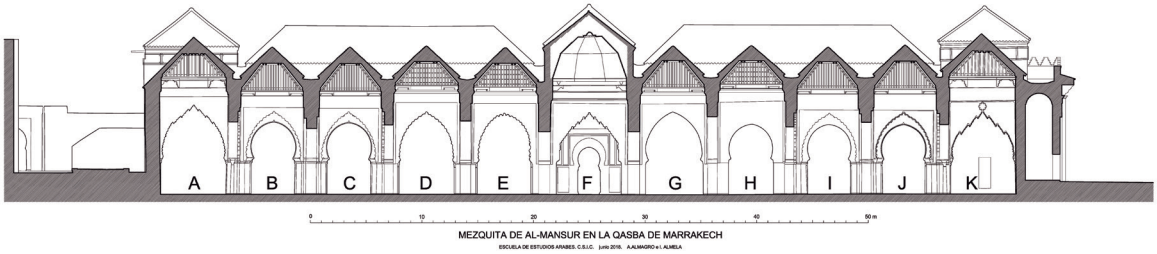

Figure 9. *Qaşba Mosque (Marrakesh). Cross section through the prayer hall (Author).*

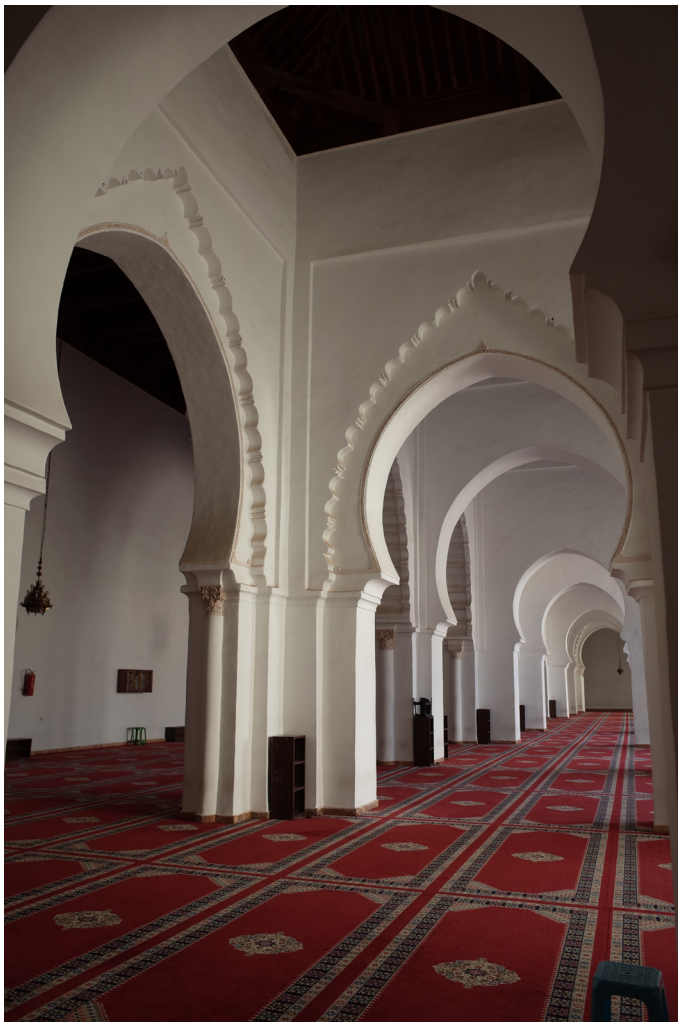

Figure 10. *Qaṣba Mosque (Marrakesh). Prayer hall. Different types of arches preserved in the aisles.*

and J. In turn, G is a slightly larger arch with a tumid design and H is a slightly pointed horseshoe arch. As for G, it coincides perfectly with the geometric profile of the poly-lobed arch D, which suggests that G is the structural arch that resolves this bay and lacks of the plaster finishing that defines the ornamental poly-lobed arch (Figure 9). As for H, it is the most discordant feature and, given the absence of data, it is only possible to think that it corresponds to a later alteration of the arch, perhaps to reinforce it, as it is much coarser than the rest.

Moreover, it is possible to recognise a possible reinforcement in an ensemble of arches such as those in the central aisle (5-6), the *maqṣūra* (F, L, M) and the western *qubba* (O). In the first case, this is evident, since the traces of older and larger arches have been embedded by new arches of smaller span. As in the case of the aforementioned arches of the *maqṣūra* and the western *qubba*, their massive condition and their deformations suggest that they were strengthen.

Following on with the configuration of the Almohad foundation mosque, it should be mentioned that at the intersection of the two main aisles, that is to say at the midpoint of the transverse aisle, we can find the most prominent space in the hall, the *qubba* adjoining the mihrab (Figure 5). This is formed by three large arches and the qibla wall in which the mihrab's opening and a prominent façade are located. The mihrab façade is complemented by two lateral openings for the *almimbar* and the imam's vestibule, which are also integrated underneath the side arches. On a lower level, a collection of 12 marble columns flanking the openings and the façade were arranged, most of which are spolia pieces, some of Umayyad Caliphate origin. Above this level, there is a very elaborate composition with various decorative elements and ornamental devices.

The last element to highlight in the prayer hall would be the western muqarnas dome, the only one among three that might have survived, and which has several characteristics that differentiate it from the other two, but at the same time resemble Almohad examples. The noteworthy features of this dome include the use of a rectangular base without transitional friezes, the composition around two distinct axes of symmetry, the crowning with a triple little dome, the significantly larger format of *adaraja* (muqarnas piece), as well as the use of an auxiliary mesh of thick *medina*-s (set of narrow pieces that make up a structural network inserted in the assembly of the dome).

With respect to its external composition, the mosque is enclosed to the south and east by two thick walls that are completely blind except for small openings, while the other two fronts, north and west, border the public space and were treated as a monumental façade. This design consisted of a double membrane with a narrow intermediate bay compartmentalised into modules that opened outwards through large tumid arches that are ploughed through by pointier arches.

Some of these modules accommodates the gates of the mosque which are integrated alternately, three on the northern side and four on the western side. The system used for the construction of the mosque is based on the use of rammed-earth walls for the internal membrane and the compartmentalisation of the modules. The exterior façade, on the other hand, is entirely built with brick masonry, which is used to unify the arch's two rings and the pilasters. As for the barrel vaults that cover each module, they were built by means of a first vault that worked as a lost formwork and on which a second structural vault was built.

Such a mosque could not be devoid of a large minaret, although its scale did not compete with that of the Kutubiyya. In the Qaṣba Mosque, the tower is located outside the northwest corner of the building and consists of two volumes. Its main characteristics are the use of brick for its construction and the design of the façades with *sebka* (decorative motif of interlacing vegetal and architectural elements in form of rhombus) squares whose pattern varies from one side to the other. In this case, the glazed tilework is quite more remarkable than in the Kutubiyya minaret.

After a long period of decline since the Almohad collapse, Marrakesh was settled by the Saʿdians in the 16th century, when Sultan ʿAbd Allāh al-Gālib (1557-74) undertook an urban reform of the city that also affected the Qaṣba. Regarding the Mosque of al-Manṣūr, its reform was of particular significance after an incident involving a gunpowder explosion during his reign, which apparently affected the transverse aisle next to the qibla, causing serious damage to the domes. Furthermore, this sector of the Qaṣba became particularly important for the Saʿdians, as the dynasty's funerary complex was erected behind the qibla wall.

Evidence of this intervention includes several elements located in the cross aisle next to the qibla wall, the redecoration of some spaces, and finally, the consolidation of its plan with a large, roughly square central courtyard around which four other minor courtyards are placed adjacent to it. Of these, the two most northerly ones may have been created at that time to enhance the symmetry of the plan. This operation involved the elimination of a large part of the aisles, which may have already been ruined, and reduced considerably the roofed area.

The 16th-century intervention is evident in the transverse aisle next to the qibla, where two of the muqarnas domes (the central and eastern ones) may have been remade according to Saʿdian typology. Nevertheless, the written sources only mention the renovation of a single dome, so it cannot be ruled out the possibility that one of them is later to ʿAbd Allāh al-Gālib or even corresponds to the Alawid period.

Regarding the ornamentation, the Saʿdian project envisaged a comprehensive redecoration of the entire mosque, which, however, does not seem to have been completed. Along the cross aisle and the two western aisles there is the usual repertoire of false arches, geometric friezes, ataurique borders, rosettes and epigraphic bands. However, among all the Saʿdian decorative work, the intervention on the mihrab façade and niche is noteworthy, where the craftsmen took advantage of the pre-existing Almohad composition but added a repertoire that followed the patterns of the Saʿdian mihrabs of Marrakesh.

The refurbishment was also quite certainly extended to the roofs and ceilings of the mosque. Among the diverse set of wooden ceilings; the design of those located in the northern aisle, the western lateral aisle and the transverse aisle between the minor courtyards is indeed similar to the wooden frameworks located in the Saʿdian mosques of al-Muwāssīn, Bāb Dukkāla and Sīdī Abū al-ʿAbbās mosques (Almela, 2021: 77, 114 and 200).

Later on, the mosque underwent further alterations during the Alaouite period and especially during the reign of Sultan Muhammad III (1757-1790). The wooden dome in the central aisle most certainly dates from this period.

5. Conclusions

As a final conclusion, we can point out that configurational analysis represents an alternative methodology

for the archaeological study of historic buildings, being part of the archaeology of architecture and constituting a non-destructive tool. As such, it is a solution for the study of buildings, in our case the Maghrebi mosques, allowing to further our knowledge of them when it is impossible to carry out archaeological interventions, and especially when there is a lack of coordination between documentary research and conservation, or restoration works. As a provisional resource, its results may in the future be cross-checked or confirmed by more definitive archaeological approaches.

Regarding the Qaṣba Mosque in Marrakesh, it has been possible to confirm that the Almohad building underwent several transformations throughout its history. The most relevant result of its configurational analysis is the identification of its foundational typology, which is radically different from the present-day building. Its design could be recognised as an intermediate link between the typologies of the Kutubiyya and the Great Mosque of Rabat. The inaugural phase responds to a building with eleven aisles; with the usual T and E-shapes integrated; presided over by a developed longitudinal axis; with an oblong-shaped major courtyard in the northern sector; and two minor courtyards inserted within the large prayer hall. In addition, the three *qubba*-s located next to the qibla wall may have been covered with muqarnas vaults, surviving today the one located at the western end.

The subsequent decay and successive interventions are difficult to distinguish without an exhaustive archaeological study, although it is worth noting the 16th-century alteration under the Saʿdian dynasty. Evidence of this can be detected in several points such as the cross aisle next to the qibla wall, the redecoration of some spaces, the consolidation of its ground plan provided with a roughly square central courtyard, and the four minor courtyards placed adjacent to the major one. This last operation involved the elimination of a large part of the aisles and a considerable reduction in the roofed surface area.

Acknowledgment
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A proposal for an ideal life: Domestic architecture and social organization in *Filarete's Libro Architettonico*

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Abstract
During the Renaissance period, the search for an ideal life, ideal society and ideal individual became the core components of the humanist vision of antiquity. Italian Renaissance period architects pursued their search for the "ideal city", which was the clear representation of an ideal life, both in theoretical narratives and in architectural practice. Antonio di Pietro Averlino, known as Filarete (c.1400-69) created the ideal city "*Sforzinda*" dedicated to his long-term patron, the Duke of Milan, Francesco Sforza (1401-66), in his treatise written between 1461-64. Firstly, the study focuses on the ideal city concept manifested both in the theoretical and practical aspects highlighting Filarete's *Sforzinda* and its main characteristics in the framework of Renaissance treatises. Filarete's depiction of ideal architectural orders by their "quality" gives insight into his portrayal of domestic architecture. The study aims to point out analytically how Filarete aligns domestic architecture with the social stratification by *qualità* and *decorum* principles adapted by the Renaissance architects following the Vitruvian tradition: the architectural characteristics as well as the decoration of the houses that reflect the social rank of the owners and their role in the society in the context of the 15th century Italy. Inspired by Antiquity, Filarete's approach to domestic architecture is thoroughly discussed while taking into consideration the reflection of contemporary Renaissance practices in his designs. The study will seek to re-read Filarete's treatise through domestic architecture which has the potential to evaluate the social stratification of the Renaissance.

Keywords
Architectural treatises, Domestic architecture, Filarete, Renaissance, Social stratification.

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1. Introduction

> "../I told you that it is the architect's duty to conceive the building with him who wishes to build. I have already conceived this city with my lord and have examined it many, many times with him, thought it about it myself, and decided on it with him. Then I gave birth to it, that is I made a line drawing of it for him [showing] the foundations and he was pleased…/ In this way anyone who reads this book will see and understand the city with its buildings measured and proportioned according to their necessary quality, form and modes and in relief." (Filarete, Book II, fol. 11v).

In the *Quattrocento*, the search for an ideal life, ideal society, and ideal individual became the core components of humanist vision of antiquity. The image of the urban space started to change due to the increasingly prominent ruling class in the society, and artists and architects were the actors in meeting the new needs of this new elite. Harmony, human proportions, and symmetry were used as the prominent architectural features during this change in the urban experience. In this framework, the priority given to the remaking of a new and rational city is remarkable. Italian Renaissance period architects pursued their search for the "ideal city", which was the clear representation of an ideal life, both in theoretical narratives and in architectural practices. As Martines (1988) pointed out, the first architectural treatises in the 15th century were the significant tools to show the architects' conception of "urban space as a totality" and the concretization of ideal cities originating from a wish to control.

The first text on architectural theory in the 15th century was Alberti's (1404-72) *"De re Aedificatoria"*, presented to Pope Nicholas V in 1452, in which the ideal city was described as a perfect organism for a civilized and ideal life acquired through the ideal architect. Attributing the most importance and dignity to the city, Alberti proposed a set of rules applicable to all cities (Choay, 1997). After Alberti, his contemporary Florentine sculptor, medalist and architect Antonio di Pietro Averlino- who used, later on, the name of Filarete (c.1400-69) - lover of virtue-[1] contributed to the notion of "ideal city" in his complex treatise. Leonardo da Vinci (1452-1519) created an ideal city set upon two levels- the upper one was dedicated to the upper class of the society whereas the lower one was reserved for the production related activities of the lower classes in his set of notebooks - *Codex Atlanticus.*

In addition to ideal city imaginations in theoretical works, "ideal squares" were portrayed as a representation of an ideal city during Renaissance. The *Urbino Panoramas*, dating back to the second half of the 15th century, represent three ideal squares of ideal cities based on mathematical principles and ideal human proportions (Krautheimer, 1994). Architects became the master of the organization of the new cities and thus the ideal city concepts in architectural practice can be noted in the transformation of small Italian cities such as Pienza, Urbino and Mantua according to the new cultural *gusto* with the financial and intellectual help of the ruling elite (Balchin, 2008).

The transformation in the urban space reflected the upper social class demand and the Renaissance treatises on architecture were set upon a strict hierarchy in the society, accordingly they were "class-conscious" as defined by Martines (1988, 273). From this framework sprang the fictional ideal city named *Sforzinda* with proportioned buildings according to their necessary qualities in Filarete's treatise as indicated by him in the opening citation. The *decorum* principle which was articulated in Vitruvius's treatise echoed in Alberti's treatise and manifested itself as *"qualità"* in Filarete's architectural treatise.[2] The architectural orders and the construction of *Sforzinda* with its buildings and its social organization were based on a hierarchical system, for which he chose to use the term *"qualità"*.

It is possible to observe the most obvious traces of social, cultural, and economic changes in urban life and social structure in domestic architecture. Domestic architecture designed in accordance with the social stratification not only reflected the social structure

on architecture, but also revealed the social order and the imagined lifestyle by the Renaissance architects. Thereby, this study aims to analyze the domestic architecture in the fictional ideal city – *Sforzinda*- in Filarete's treatise with its decorative elements and social organization in the social, cultural and political context of the fifteenth century Italy. Through an analytical examination of the text and illustrations, this study aims to contribute to the history of domestic architecture in the Renaissance period by interpreting Filarete's domestic architecture in relation with the *qualità* principle while discussing his interpretation of antiquity into his era.

2. Filarete and his "*Libro Architettonico*" (1461-64)

Filarete started working in Florence, probably as a goldsmith and later in Rome as a sculptor, where he exhibited his innovative style in the prestigious commission of the bronze doors of old Saint Peter's Basilica at the court of Pope Eugene IV between 1433-1445 (Hub, 2012; Glass, 2012; Glass, 2013). In 1451, Filarete started to work under the patronage of Duke of Milan, Francesco Sforza in his prestigious projects as *Duomo's* dome, *Castello Sforzesco* and *Ospedale Maggiore* in which he aimed to consolidate his influence. However, his Florentine architectural style did not gain widespread acceptance during his work under the Duke for fifteen years, neither in Milan, nor in Northern Italy where late Medieval style still dominated. Filarete could not complete any of these projects because of conflicts between the local aristocracy, local master builders and craftsmen (Welch, 1995). In the first years of the 1460s when his involvement with Milanese projects arrived at a breaking point due to the cultural and formative differences between him and Lombard architects, he dedicated himself to his architectural treatise, which he referred as *"Libro Architettonico"* (Giordano, 1998).

Filarete's treatise was never printed but circulated as manuscripts. Filarete dedicated the first edition of his treatise to his patron, Duke Sforza. The second version of the treatise that reached today in its entirety is the copy (codex *Magliabecchianus)* dedicated to Piero de' Medici in 1464 which became part of his library (Spencer, 1965). Significantly, the XXVth Book provides a comprehensive outlook on Piero de' Medici's study, in his words "*studietto*" in the *Palazzo Medici*, Florence (Enginsoy Ekinci, 2006, 123-124). Furthermore, the XXVth Book includes the architectural commissions of Cosimo de' Medici and his sons Piero and Giovanni whose completion dated to 31 January 1464 (Spencer, 1965).

Filarete's treatise shows many differences from Alberti's treatise which is composed after the Vitruvian model in both form and content. The chapters, referred as separate books *(libro),* are untitled except for Book III, titled *"De aedificatione urbis"*. This particular title may indicate the true aim and essence of the treatise which is "to construct a new city". The treatise starts by Filarete's desire to write a book, his own works and then includes the structure of the treatise in three parts: the first part including the origin of measure, the building and its sources and the qualities of a good architect, the second part including the construction of a city with its buildings, squares and streets and the third part including the reconstruction of buildings according to ancient architecture (Filarete, Book I, fol. 2r). Filarete's non-systematic narrative is found throughout the books, in which topics often overlap or interlace with each other. The construction of *Sforzinda* starts in Book IV, even though the city is mentioned in Book II, and it lasts until the end of Book XII. In Book XII, a new and suitable site is found for the harbor city after site exploration process. Interestingly, the "Golden Book" (*Libro d'oro),* which contains the history of King Zogalia (an anagram for Duke's son Galeazzo Maria Sforza) of an ancient town called *Plusiapolis* ("rich city" in Greek) is discovered during the excavation (Whittemore, 2009). The content of the Golden Book, written in Greek, is decoded thanks to a translator whose name is an anagram of Filarete's Greek humanist friend Francesco Filelfo (1398-1481).[3] Accordingly, it is discovered that the book was written for a future, virtuous king. So, the dis-

covery of the Golden Book with rich architectural details becomes a crucial point in the treatise and a reference for the reconstruction of *Plusiapolis*. The stages of construction of *Sforzinda* and *Plusiapolis* are told in an interwoven way until Book XXII. Filarete clearly points out that he wants to take ancient Greek architecture as reference in the physical context of Lombardy, where Gothic was still the predominant style (Balchin, 2008). During the interrelated construction of *Sforzinda* and *Plusiapolis*, the social, economic, and educational organization of the "new city" are outlined during the narrative.

Besides, Filarete used vulgar Italian in dialogue form in his treatise as opposed to Alberti who wrote in Ciceronian Latin. The stages of construction of the perfectly geometrical city dedicated to his patron, Francesco Sforza are depicted in detail through meticulously written dialogues between Sforza, the Duchess and his son, Galeazzo Sforza. As Onians (1971, 104-114) pointed out, the narrative dialogue form of the treatise could be associated with Plato's group of dialogues: "*Timaeus*", "*Critias*" and "*Laws*".

In addition to the imaginative narrative, illustrations were used as indispensable part of architectural creation and also as a means of enticing his patron. Filarete utilized illustrations to express his designs by saying that "in architectural matters it is difficult to make oneself without resorting to drawings" (Book VI, fol. 40v; Carpo, 2001) unlike Alberti who did not include illustrations in his normative treatise. Moreover, Filarete expressed his thought process and architectural creation with *fantasia* and the product as *invenzione*. Interestingly, he also adopted an analogy between procreation (architect as the mother and patron as the father) and architectural creation (Enginsoy Ekinci, 2013). The architectural creation starts by producing a concept in the architect's mind, and then the transferring of the concept into architectural drawing is expressed as giving birth. A representation with a three-dimensional model along with illustrations is told to be the next step followed by the actual construction of the new city (Book II, fol. 11v). Even though the illustrations tend to display more the "*fantasia*" of the architect, Filarete's illustrated treatise has a significant importance in the historical progression of the use of illustrations in later architectural treatises of Renaissance theoreticians such as Francesco di Giorgio (1439-1502), Serlio (1475-1554) and Palladio (1508-80).[4]

Furthermore, throughout the treatise, Filarete tries to explain his architectural style and legitimize it in the eyes of his patron. The Gothic style is defined as "modern style" *(modo moderno)* which needs to be avoided whereas the "ancient style" (*modo antico*) is promoted during the construction of *Sforzinda* and *Plusiapolis* in the dialogues between the Duke, Duchess, and their son. So remarkably, Filarete appeared as the first Renaissance architect to disapprove Gothic style by expressing that it is necessary to return to the forms of antiquity: "../ I seem to see again the noble buildings that were once in Rome and those that we read were in Egypt. It seems to me that I have been reborn on seeing those noble buildings" (Book XIII, fol. 100r). The use of "*rinascere a vedere*" phrase clearly indicates the rebirth of ancient buildings in Filarete's time (Hub, 2011).

3. The layout of *Sforzinda*

In the treatise, after establishing the narrative of the origin of the architecture, human proportions, the conception of the building and the responsibilities of the architect and the patron, Filarete presented the so-called "*Averliano* design": the drawing of fictional city named *Sforzinda* for the Lord which implicitly stands for his patron- Francesco Sforza.

An ideal site noted as salubrious and fertile in the vicinity of *Inda* valley where *Sforzindo* river flows was chosen for the ideal city (Book II, fol. 13v). After choosing the best site, providing the necessary materials and organization of all craftsmen and masters, Filarete depicted the founding ceremony of *Sforzinda* in a very detailed way in Book IV. The founding ceremony took place on 15th of April 1460 with the presence of Sforza family, eight notable men and the architect himself (Book IV, fol. 24v-25r). As anoth-

er example of Filarete's multi-layered storytelling, he described a "bronze book" *(libro bronzo),* a book within a book, including the "records of this our age and the deeds of worthy men", of which his prestigious works such as the bronze doors of Saint Peter's Basilica in Rome, *Ospedale Maggiore* in Milan, the Church of Bergamo are listed, to be placed in the foundation (Book IV, fol. 25v). In addition to this list of his own works, Filarete mentioned writing another bronze book, which could easily be interpreted as *"Libro Architettonico*". This all imaginary and very detailed founding ceremony stresses Filarete's clear intent of writing a treatise to leave his immortal mark in accordance with the idea of fame *(fama)*[5] in Renaissance, and also to glorify his great patron, Duke Sforza. An explicit example of the importance given to fame can be noted during the description of the responsibilities of the architect and the patron where Filarete expressed that there were two ends for an architect to create a building, which were the purpose of utility and the fame that the architect would gain (Book II, fol. 8r).

The city of *Sforzinda* has a stellar plan composed of two overlapping squares. As Spencer (1965, 25) stated, the star-city shape of *Sforzinda* does not have a progenitor. Although the stellar form is used for the first time for an ideal city, circular form adapted by Filarete reflected Milan's circular plan with radial streets in the chronicle of Fiamma (ca. 1330) (Günther, 2009, 60; Whittemore, 2009, 55). In parallel with Alberti's circular and polygonal plan schemes for cities, of which the polygonal scheme is put forward for security reasons, Filarete's plan is based on Renaissance urban planning principles with geometric forms and symmetry (Alberti, Book IV, 1988). As a result of the new military technologies in the 15th century, the polygonal scheme for ideal cities was favored by many Renaissance architects such as Francesco di Giorgio who experimented with its different variations in his treatises on architecture (Merrill, 2013). Throughout the Renaissance, fortress-citadel was taken as a physical model for an ideal city, of which Palmanova, commissioned by Marc'Antonio Barbaro against Turkish threat, served as a realized ideal city (Pollak, 2008; Howard, 2013).

Sforzinda's general layout prompts the thought of a castle, therefore a fortress-city in which the octagonal form represents the fortification of the city, and the circular form represents the moat. The defense function of the city is highlighted by the star-shaped perimeter walls, circular towers at the intersection points of the squares, and the circular moat surrounding the city. As Whittemore (2009, 52) pointed out the idealized geometry of the city can be interpreted as a reflection of architecture reinforcing "seigneurial rule", the existing political structure in Milan. It is also considered that the central plan of *Sforzinda* and its central-plan churches played an influential role on the Renaissance architects such as Bramante and Da Vinci. Spencer (1958, 14-16) pointed out influence on Leonardo da Vinci's central-plan churches which can be noted in Da Vinci's notebooks and Bramante's plans for St. Peter's Cathedral.

In this layout, eight streets and eight canals radiate from the center of the city to the intersection points

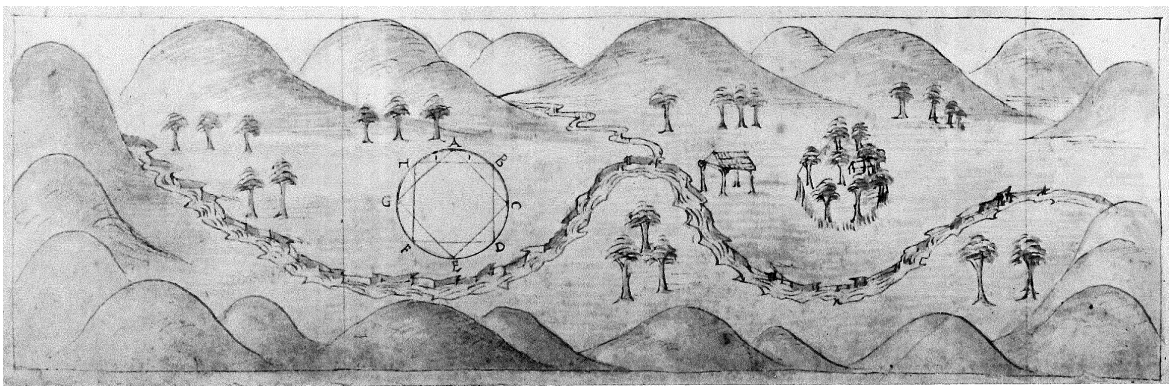

Figure 1. *Site of Sforzinda (Filarete, 1965, Book II, fol. 11v).*

of the two squares. Günther (2009) discussed the construction of *Sforzinda* and compared it with the existing conditions in Italian city-states in his article "Society in Filarete's *Libro Architettonico* between Realism, Ideal, Science Fiction and Utopia". The main city square located at the center of *Sforzinda*, surrounded by the Cathedral, the Ducal Palace and the Episcopal Palace, constitutes the "economic, social and spiritual" core. The organization of the main square appears to be the reflection of the hierarchy of power in the ideal city as a concretization of what was common for Milan with the figures of authority and public institutions in the 15th century (Günther, 2009, 59). In the north and south of the main square, the two interrelated market squares include public buildings of *Sforzinda* such as *Palazzo della Ragione, Palazzo del Podesta', Palazzo del Capitano* and the mint, customhouse, magazines, guild houses, the butcher's mall, the prisons house, baths, brothels, etc.

As referred by Garin (1965), the perception of class distinctions in the architectural treatises originated from the interest in ancient texts on political theory by authors such as Aristotle (Politics) and Plato (Republic).[6] Also, Ackerman and Rosenfeld (1989) pointed out that the separation of different classes of society was a common notion during Renaissance in theoretical works in their article "Social Stratification in Renaissance Urban Planning".[7] This notion can be observed in Alberti's two concentric rings of walls to differentiate the noble class from the lower classes of the society. Similarly, in *Sforzinda* the main piazza hosts the palaces of the most noble people of the society such as the Duke and the Archibishop. The guilds are located according to their status; the noble guilds and merchants, bankers and goldsmiths are located close to the main square (Book XX, fol. 163v,164r). As for the social stratification, Filarete designated five social classes in a hierarchical order: poor, artisan, merchant, gentleman, and prince, after Alberti's division of society with the ruler, tyrant ruler, gentleman, and the working classes. A similar kind of social hierarchy, including

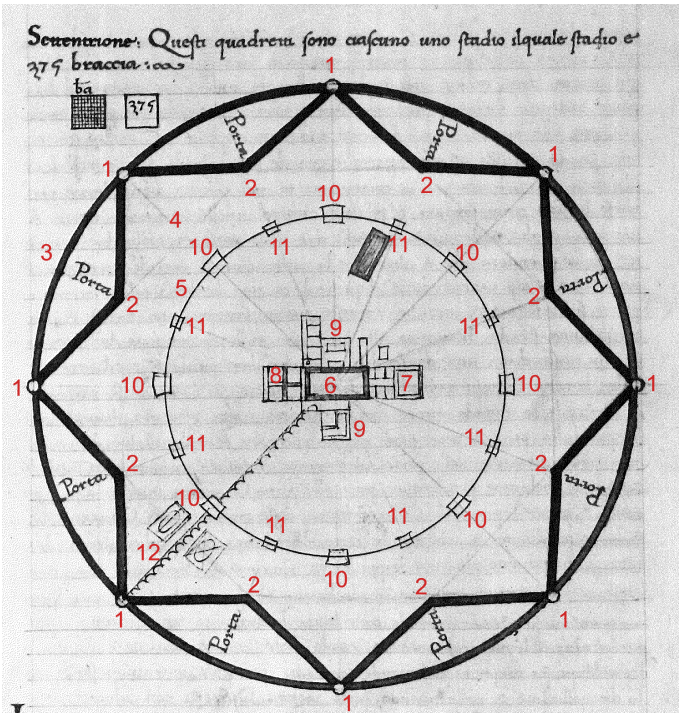

Figure 2. *General Layout of Sforzinda 1. towers, 2. gates of Sforzinda, 3. moat, 4. sixteen roads leading to the city center, 5. Circular road, 6. main square of Sforzinda, 7. Cathedral, 8. Ducal Palace, 9. Market squares, 10. Churches, 11. Secondary market squares, 12. Aqueduct (Filarete, 1965, Book VI, fol.43r, organized by author).*

farmer, artisan, merchant, gentleman, prince and tyrant prince categories, can also be observed in Francesco di Giorgio's treatises (Kruft, 1994).[8] Although the location of the citizens according to their work and social class in the city remain schematic, the reason behind Filarete's separation could be also interpreted as a reflection of Renaissance Italy (Günther, 2009).

In addition, the advice from the King *Zogalia* of the ancient kingdom mentioned in the Golden Book to the prince, lay a clear analogy which points out the social stratification during Renaissance. The King creates a remarkable analogy between a wall made of different stones and a kingdom composed of different social classes:

"A dominion is like a wall made of many kinds of stone…/The large, dressed, exterior stoned that hold up the wall are gentlemen, persons of goodwill, and virtuous men. The columns are the captains and the men at arms. The other stones are the soldiers. The bricks are the people. The fill of the wall is the people of the territory. The skin is the artisans. You can thus

understand that this wall is composed of all different kinds of stones. If any of them are lacking, you can see this would cause great damage to its beauty and use.../So it is necessary for you maintain and preserve all your people according to their quality." (Book XX, fol. 168v,169r)

As evident from the text, the ideal city is composed of different social classes all of whom reside in harmony. Each class has specific roles for serving the society and is associated with the *qualità* – a term applied by Filarete through architectural orders.

4. Ideal architectural orders and the *qualità*

The systematization of the orders in the 15th century was a common notion following Vitruvius's text and ancient ruins (Payne, 1999). Filarete's classification of orders differs from the Vitruvian tradition, which hierarchically includes Doric, Ionic and Corinthian orders, as well as Alberti's classification of Tuscan, Doric, Ionic, Corinthian and Italic orders. Alberti's opinions on the proportional classification of orders point at the Italic order, which is the combination of Ionic and Corinthian orders, as the most preferable (Alberti, 1988, Book VII, VI). Interestingly, Filarete noted only the Doric, Ionic and Corinthian orders, following the Vitruvian tradition, with their measurements derived from the proportions of man: head associated with the capital and body associated with the shaft of the column. Remarkably, such a formulation made him the first Renaissance theoretician to define anthropometry (Kruft, 1994). Onians (1973) presented a critical analysis on how Filarete formulates a new theory between architecture and man in his article "Filarete and the "qualità" architectural and social". The distinctive feature of Filarete's classification of architectural orders is that he established an intrinsic relationship between the human proportions and architectural orders using a new term – "*qualità*" in architectural context instead of using Vitruvius's *genera* or Alberti's *species* (Onians, 1973, 116).

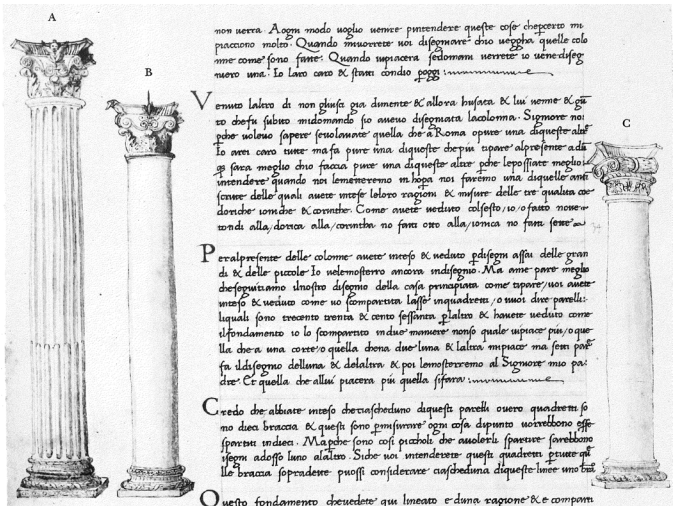

Figure 3. *Classification of architectural orders (Filarete, 1965, Book VIII, fol.57v).*

Although the orders were the same with Vitruvian tradition, his definition of three measures (*misura*) -physical types of men- large, small and medium (Book VIII, fol. 56r) differed in their characteristics. Accordingly, he specified Doric columns as large (*misura grande*), having 9:1 ratio (capital:total height of the column), Corinthian column as medium (*misura mezzana*) having 8:1 ratio and Ionic column as small (*misura piccolo*) having 7:1 ratio. Furthermore, whereas the Doric was described as the least decorated and male order in Vitruvian tradition, it was interpreted as the most ornate and perfect order in Filarete's treatise by relating its origin to Adam (Book I, fol. 3r). Onians (1990, 162-3) suggested that this difference in attributing a new characteristic to Doric order could be associated with his reinterpretation of Vitruvius from a Christian point of view.

In parallel to the intense need for strict rules for a well-defined and organized social hierarchy, Renaissance architects associated the orders with social stratification. Alberti characterized the architectural orders by creating a social model in which the Doric is associated with the working class of architecture while Corinthian is associated with upper-class (Onians, 1990, 154-56). Filarete developed an analogy between the quality of orders and the quality of men in society more explicitly. Accordingly, Doric order was used in buildings with decoration for the upper class of the society *(gentili),* the

medium order *(mezzani)* Corinthian (both useful and with adornment) was assigned to the middle class, and the Ionic as the smallest order was assigned to the lowest class of the society *(piu' infimi)* which served the requirements of the lord (Book VIII, fol. 56v). It was also added that the lowest order, Ionic "is used in the buildings in places where the greatest weight is to be supported" representing the idea of the lowest class supporting the needs of the society.

Additionally, an analogy between a person's clothing and the buildings, pointing out that the buildings should have decoration in accordance with the social position of the owner and that a person should dress in conformity with his/her social class, was established in the treatise (Book VII, fol. 48v). This feature makes Filarete the first Renaissance architect to create an analogy between the ornament of a building and the clothing by the *qualità* (Onians, 1973, 128). Filarete, then, adapted this principle of qualities in his classification of domestic architecture in *Sforzinda*.

5. Classification of domestic architecture in *Sforzinda*

Renaissance architects and humanists tried to interpret domestic architecture by pursuing ancient *domus* and villa by means of ancient literature such as Cato's (234-149 BC) *"De Agricultura"*, Varro's (116-27 BC) "*De re Rustica*", Columella's (4-70 AD) "*De re Rustica*", Horatius's (65-8 BC) poems on the virtues of the ancient villa, Pliny the Younger's (61-c.113 AD) letters on *Villa Laurentum* and *Villa Tusc*i (Burns, 2012). The discovery of *Villa Laurentum* mentioned in the *Epistulae*, the letters of Pliny the Younger (61-c.113 AD), by Guarino (Guarini) Veronese before 1419 gave insight to ancient Roman culture and probably had an impact on villa designs during Renaissance period (Ağır, 2010, 1-2).

As Pagliara (1986, 55) emphasized, Vitruvius's book had a distinct place as one of the primary sources on domestic architecture by providing "the current need for specific and precise rules". Despite the difficulty in transforming this textual material into practice, the *decorum* principle which required the design of a house according to the social status of its owner played an important role in Renaissance domestic architecture (Pellachia, 1992). Vitruvius expressed that the houses that belong to different social classes should be designed "under the subject of propriety *(decorum)*" (Book VI, Chp. 5). In addition to the principle of *decorum*, Pellachia (1992, 379) underlined Vitruvius's clear emphasis on the location of atrium in the entry sequence in the town houses and following the peristyle in the country houses. As for the atrium's relation to divisions of the society; atrium was described as a public space that needs to be designed according to the social status of its occupant: "Hence, men of everyday fortune do not need entrance courts (*vestibula*), *tablina* or *atriums* built in grand style, because such men are more apt to discharge their social obligations by going round to others than to have other come to them." (Vitruvius, Book VI, Chp. 5).

In Alberti's treatise, the house was described as a miniature city with its public and private functions and Vitruvius's concept of *decorum* manifests itself indicated as "the poor will have different requirements from those of the wealthy. For the poor it is necessity that governs the size of the dwelling, whereas the rich are seldom satisfied or able to limit their greed" (Book V, Chp. 14). Alberti differentiated housing types as city and country; however, the city houses are not differentiated according to different social classes. The separation of the noble class and the servants performing production related activities is apparent in his treatise, which could be traced in Filarete's treatise as well. Regarding the significance of atrium, Pellachia (1992, 388) pointed out Alberti's interpretation of atrium as the "bosom of the house" (Book V, Chp. 17) and him being the first Renaissance theoretician to interpret the atrium as a colonnaded courtyard.

In comparison to other 15th century Renaissance architects, Filarete's classification of domestic architecture of *Sforzinda* is the most clear crystallization of the relationship between the social stratification and architecture. Onians (1973) demonstrated the

relationship between *qualità* and man while providing an insight for the domestic architecture. Extending Onians' above-mentioned article on the theme of *qualità*, the paper seeks to use domestic architecture with the spatial composition, proportions, and qualities of orders, as well as decorative elements, as a tool to understand the sociology of the period.

5.1. Ducal palace

The most noble and ornate domestic building described in *Sforzinda* is the Ducal Palace located in the main square, which is designed for the public appearances similar to the Visconti reign and Sforza regime (Günther, 2009, 60-61). The approximate locations of the housing typologies, except for the Ducal Palace and the Archiepiscopal Palace, are not specified, neither in the text nor in the illustrations in the treatise. The Ducal Palace is designed in Doric order in approximately 2:1 ratio (length:width), 330 braccia in length and 160 braccia in width.[9]

The round-arched portico, elevated by six steps, resembles the portico of Brunelleschi's *Ospedale degli Innocenti* although he criticized it for its long staircase while describing *Sforzinda* Hospital in the treatise (Book XI, fol. 80v). The rational and symmetrical façade of the palace with Doric columns on *piano nobile* includes three towers on both corners and one in the middle of the façade imposing the owner's prestige.

The palace is divided into two parts which belong to the Duke and Duchess, though neither in the narrative nor in the drawings of the treatise it is clear which square block belongs to the Duke and which to the Duchess. The palace is divided into two courts with a portico on all sides. Two large porticoed courtyards with fishponds and fountains in the middle are located in the rear part of the palace and the stables are placed at the back of the gardens. The spaces on the basement level are used as service spaces in accordance with Alberti's separation of the levels in domestic architecture.

As for the decoration of the Ducal Palace, the decorative elements are in harmony with the artistic approach of the Renaissance period, which includes the application of mythological and historical figures from the literary works of Dante, Petrarca, and Bocaccio into painting. Filarete emphasized that the Ducal Palace would be honorable with its beautiful floor and vaults decorated with gold stars and planets in blue sky (Book IX, fol. 67r) in conformity with the use of allegories, representative figures and astrological paintings in Renaissance (Burckhardt, 2005).The choice of using gold and ultramarine color obtained from *lapis lazuli*, considered special and precious in 15th century Italy, reflects Filarete's principle of *decorum*, designing in accordance with the social classes. The predominance of fame in Renaissance reveals itself here as Filarete included the paintings of all the astrologers and mathematicians who had contributed to these sciences (Book IX, fol 67r). A detailed list of painters and relief artists is also included which is clearly significant from two perspectives; as a way of promoting the artists who did not use modern style (Gothic) and as the rec-

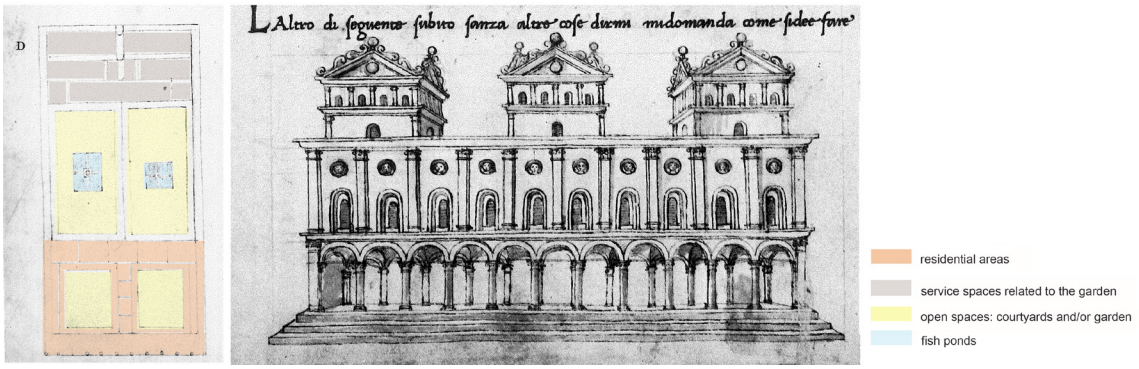

Figure 4. *Spatial organization of the plan and facade of the Ducal Palace (Filarete, 1965, Book VIII, fol. 57v-58v, organized by the author, 2022).*

ognition of the artist's *genio*.

Another important aspect is the correlation of the noble virtues with architecture: the principle of virtue, tracing Platonic, and Aristotelian doctrines as the link to an ideal society governed by an ideal ruler, is exalted.[10] The four cardinal Aristotelian virtues "Justice", "Temperance", "Prudence" and "Fortitude" are chosen to be painted over the door of the Council Room in the part of the palace that belongs to the Duke. In overall description, the Ducal Palace, which is depicted in Book VIII right after the narrative of the Cathedral and the proportion of orders, is defined by its usefulness and beauty in the treatise.

5.2. The archiepiscopal palace

The Archiepiscopal Palace, built for the archbishop, the canons, and the priests, is located in the main square of the city. The palace is described after the Ducal Palace in Book IX in the narrative showing the significance and the ranking of its owner in the society. The palace is designed in Doric order in 2:1 ratio with a plan of 160x320 br. which shows that Filarete's hierarchy of the proportions rank the archbishop slightly below the Duke and above the gentleman.

The palace which has an entrance from the rear façade of the Cathedral of Sforzinda, is designed as a square form with two gardens on the front and back facades: one for the archbishop and the latter for the canons. The emphasis on the sewer system engaged in the walls and the latrines leading to the aqueducts shows Filarete's concern for sanitation which he applied in the *Ospedale Maggiore* in Milan.

Similar to the Ducal Palace, the palace is located on three steps and the

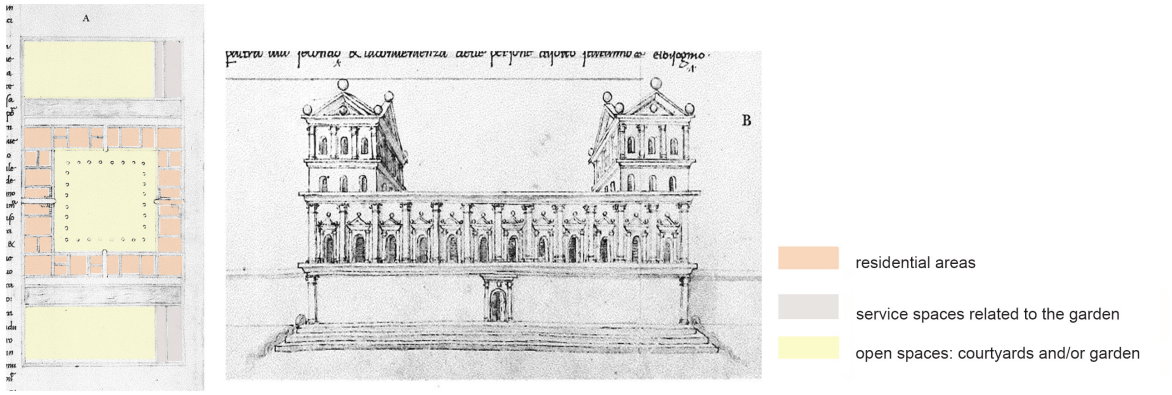

Figure 5. *Spatial organization of the plan and the facade of the Archiepiscopal Palace (Filarete, 1965, Book IX, fol. 66r, organized by the author, 2022).*

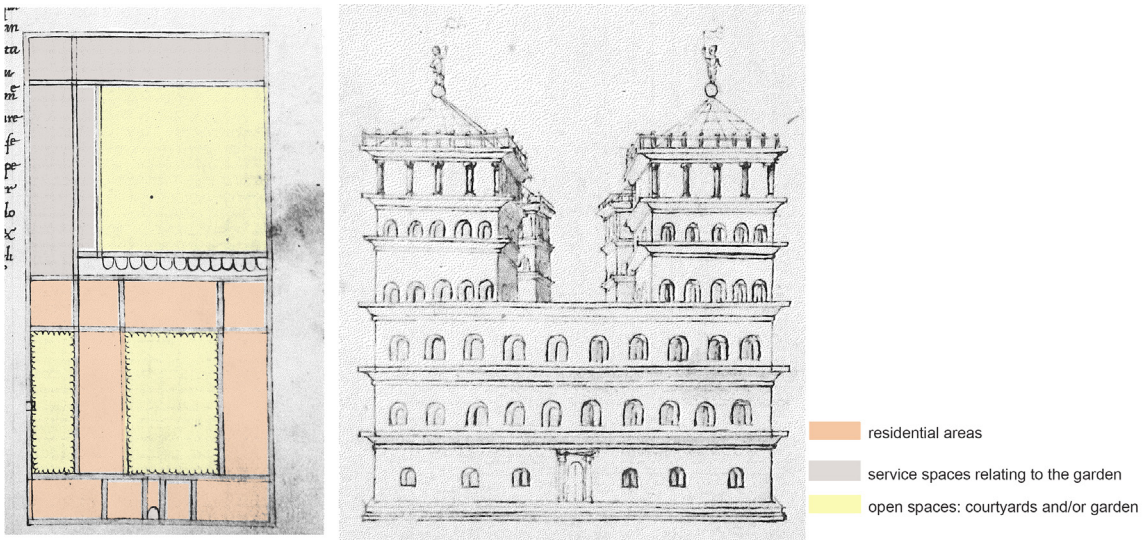

Figure 6. *Spatial organization of the plan and the facade of the Nobleman's House (Filarete, 1965, Book XI, fol. 84r-v, organized by the author, 2022).*

piano nobile is emphasized with adornment and architectural orders. However, Filarete's principle of *decorum* suits his decision of the number of towers: the Archiepiscopal Palace has two towers while the Ducal Palace has three towers. The decoration of the palace is not underlined however, it is described as a "beautiful building" (Book IX, fol. 66v, 67r).

5.3. Nobleman's house

The nobleman's house is described in the narrative after the public buildings of *Sforzinda* such as *Palazzo della Ragione*, *Palazzo del Podesta*', the market squares, the churches and the hospital in Book XI. The house with the dimensions of 200x100 br. has the quality of Doric order with a proportion of 1:2 in plan. The proportion of nobleman's house is slightly less than the Ducal Palace with Doric order creating a hierarchy within the same order that belongs to different categories of nobility.

The house is accessed through the main entrance in the middle axis of the building. It consists of two square blocks; the front one corresponds to the residential part, while the rear square block corresponds to the garden and stables. As Filarete pointed out, the four towers on the corners serves for greater beauty and provided harmony with the form and quality (Book XI, fol. 84v, 85r). The façade is composed in a rational order and symmetrical layout with round arches, cornices that separate the levels reflecting the ancient style which he referred as "Florentine architectural style". However, the towers located on the corners reflected the functional continuity of medieval architectural tradition in Northern Italy where the corner towers were used as a prestige element in public and private buildings. The overall organization of the façade except its towers resembles contemporary Florentine palaces such as Palazzo Strozzi.

On the ground floor, two porticoed courtyards are designed for the convenience of the house; the left courtyard is designed for the domestic requirements of the house and is surrounded with kitchen, storerooms, and servants' quarters. The large garden at the rear façade of the residential unit is designed with a loggia and includes stables and a wood storage. The corresponding spaces of family quarters and visitors' quarters are not clear as there is an incoherence between the narrative and illustrations. Moreover, a space dedicated to literary *gusto* and defined as a "space for writing, keeping books or other pleasant things" on the *piano nobile* appears especially noteworthy (Book XI, fol. 84v, 85r).

The sanitation is also highlighted providing a sewer system like the Archiepiscopal Palace. Supporting this idea, the attention given to convenience and usefulness can be observed in the forefront whereas the explanations about the façade and decoration of the house are very limited. The nobleman's house is painted with representative figures from noble, ancient stories like the decoration of the Ducal Palace. Although Doric order is used in the Ducal Palace, Archiepiscopal Palace and the nobleman's house, the nobleman's house is described in a hierarchical order under the others, with its elevation from the ground level with two steps, the lack of *piano nobile* and its decorative program.

5.4. Merchant's house

During the Renaissance, the new powerful social status of merchants and bankers sought a lifestyle that was reserved only for the nobility in previous periods, through their palaces which conveyed their social significance (Valtieri, 1988). Appropriately, Filarete classified the merchant's house as the second quality in his codification of orders. Spencer (1965) stated that the house belonging to a second social class should have Corinthian proportions, although it is not stated in the treatise. However, Onians (1973) has pointed out that its dimensions of 50x 150 br. with a proportion of 1:3 does not stand close to Corinthian.

The house is depicted together with the houses of the artisan and the poor man classes in Book XII. The right and left wings attached to the dwelling are designed with loggias which are utilized as the shops and merchandise display. The functions of the residential unit, which is attached to the

courtyard, are organized in a hierarchical way; service functions such as the quarters for servants, kitchens, and storerooms are located on the ground floor, and halls, bedrooms, and guests' quarters are on the first floor.

Similar to the above-mentioned houses, the merchant's house has a large garden at the rear side of the dwelling attached to the stable. Moreover, the house seems to have all the convenience that it needs such as a sewer system, latrines, and fireplaces. However, although as a second-level house, it is defined as "beautiful", the descriptive details of the façade and decorative elements are limited. In general, the house is designed according to its quality with its architectural elements such as corner towers and decoration which shows the merchant's social rank as a class with prestige.

5.5. Architect's house

An impressive narrative embraces the readers during the depiction of the house of the architect[11] who built the city depicted in the Golden Book during the construction of *Plusiapolis* in Book XVIII. It is noteworthy that Filarete portrayed the architect's house supporting the distinction of the "architect" from stone-mason indicated in Alberti's treatise for the first-time during Renaissance (Kruft, 1994).

The house has a rectangular plan with dimensions of 34x102 br. and has the characteristics of Corinthian order used in the design of the merchant house with a ratio of 3:1, one square for the residential unit and two squares for the garden. This classification of the Architect's House enhances the social class of the architect to the merchants' level, above the artisan's (Alberti, 1988).

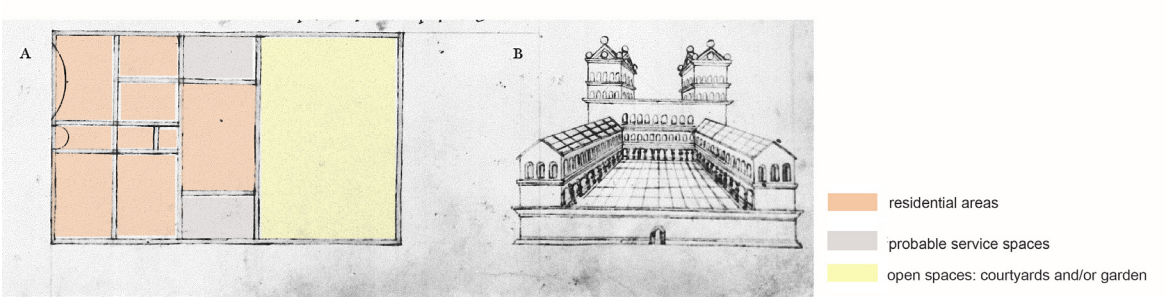

Figure 7. *Spatial organization of the plan and facade of the Merchant's House (Filarete, 1965, Book XII, fol. 86r, organized by the author, 2022).*

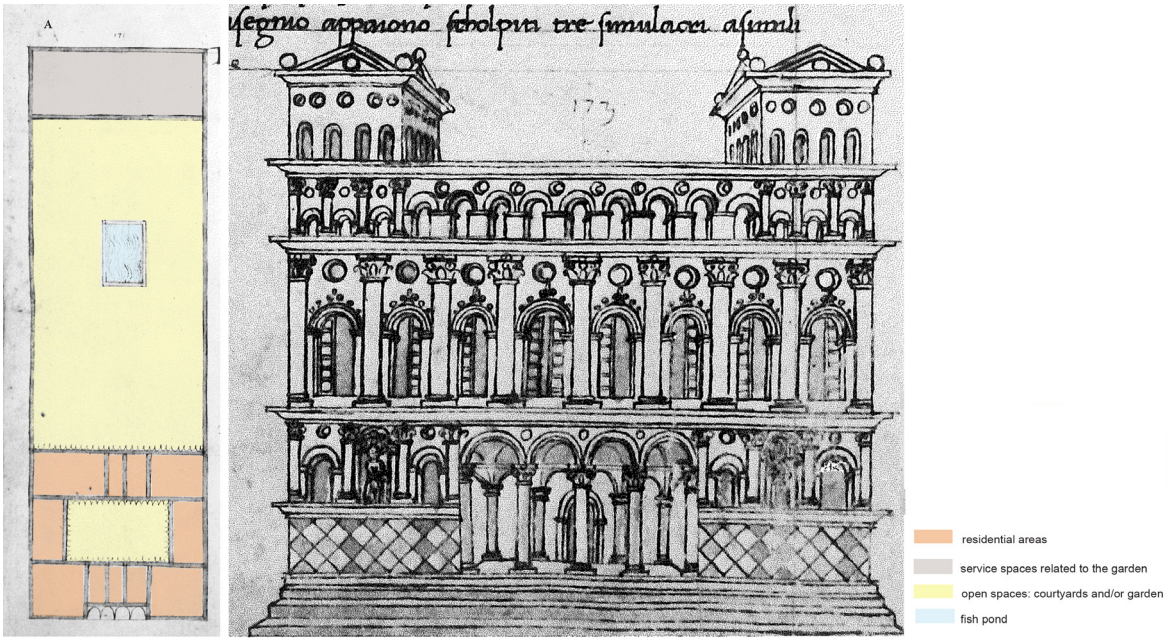

Figure 8. *Spatial organization of the plan and facade of Architect's House (Filarete, 1965, Book XVIII, fol.150v, organized by the author, 2022).*

The architect's house is raised on three steps which is significant because it is a feature only used in the most noble buildings. A four-arched portico marks the entrance. As another important feature of the main façade, the *opus reticulatum* brickwork till the half of the ground level emphasized by a cornice bears resemblance to the façade of Alberti's *Palazzo Rucellai* (1446-51). The horizontality of the façade creates contrast with the towers at the corners of the house adding power to its occupant.

The main entrance opens to an atrium surrounded by a portico. As the core of the residential part of the plan, it can be interpreted as a reflection of ancient domus/villa. The garden which is twice the size of the residential unit has a pond in the center and behind the garden, service spaces are located. The size of the courtyard and the garden can be interpreted as a reflection of the importance attributed to architect's house regarding the social stratification in the society.

Unlike the other above-mentioned typologies, in which principles of usefulness and convenience come at the forefront, the Architect's House is depicted primarily by it is beauty and decorative elements. Moreover, on the interior of the entrance of the house, the inventors of architecture, sculpture, and other sciences are portrayed in chronological order with a painting of their invention in their hands. As Fane-Saunders (2009) pointed out, the emphasis on the allegory of fame used in the decorative program traces back to Pliny the Elder's (AD 23/24–79) *Naturalis Historia*. Extraordinarily, the first order in the list of notable men with virtue is dedicated to the architects. By including this list of notable men, Filarete enhances his understanding of virtue which is linked with the skills, competence, and inventions of the artists (Book XV, fol. 114r-v; Morrison, 2015).

The details of the Architect's House such as the elevated entrance like the Ducal Palace, its Corinthian proportions like the proportions of Merchant's House, its ornate façade with the adorned *piano nobile* with Corinthian columns and rich decorative program indicate that the architect belongs to a social class in between the noblemen and the merchants. The social class attributed to the architect corresponds to the emergence of the Renaissance architect as a practitioner of the liberal arts attaining to the level of the intellectual under the patronage of noblemen, merchants and bankers (Kostof, 1986).

5.6. Artisan's house

Even though the artisans started to be recognized during the Renaissance period which can be observed in Filarete's list of artisans in the treatise, the social class of the artisan among the lower classes is associated with the lowest quality of orders: Ionic (Book IX).[12] The house has a rectangular plan with dimensions of 30x50 br. and with a height of 30 br. with the proportions of the house which is supposed to be Ionic with 1:1414 show slight difference (1:1.7) (Onians, 1973, 120).

Similar to the houses pertaining to the upper classes, approximately half of the plan is arranged as a residential unit and the other half is designed as a large inner courtyard. As indicated in the text, the artisan's working space and living spaces are separated and the courtyard is surrounded by service units. Filarete also pointed out that the hall on the upper floor is designed as a cantilever so that it acts as a roof for shops on the ground floor based on the principles of functionality and convenience emphasized in the narrative. Filarete's deliberate choice of not including any illustrations and giving limited information pertaining to this housing typology is in accordance with his hierarchy of the *qualità* of architectural orders and with the artisan's social status.

5.7. Poor man's house

In comparison to the other houses that belong to higher social ranks, Filarete deliberately chose not to put emphasis on the poor man's house. The dimensions of the house are indicated as a square either 10x10 br. or 12x12 br. by making its rank sub-Ionic (Onians, 1973). Since this type of housing is associated with solely the idea of shelter, organizing it in a

useful way is recommended excluding any architectural refinement (Book XII, fol. 86v). The house of the lowest social class is described only textually without any illustrations.

6. Evaluation on Filarete's domestic architecture: a utopia or a representation of the society?

It is clear that as the layers of Filarete's treatise unfold, the ideal city *Sforzinda* depicts an ideal society and ideal government through ideal architecture. By using various analogies, metaphors, and stories in the narrative of the treatise with the help of the illustrations, Filarete creates his ideal city, in which the architectural values emerge out of the political, social and cultural climate of its time. Among scholars, while Onians (1990, 158) considers the treatise coming "directly out of the reality of the 15th century Italy", some other interpret the fictional character of the treatise as a utopia. Choay (1997, 175) on the other hand, believes that Filarete's *Sforzinda* is not a utopia to be remodeled after, but instead it aims "to illustrate an approach and the application of a method". Similarly, for Olivato (1973, 145), Filarete's urban vision which takes into account the practices of the society is perfectly realizable. Therefore, it is possible to argue that Filarete's clear motivation for convincing his patron to receive architectural commissions and for receiving fame through his inventive ideas is the triggering factor for creating his fictional, yet "realizable" ideal city, which clearly defines societal ranks through domestic architecture.

The analytical examination of both texts and illustrations related to domestic architecture shows us that in the plan typologies of the houses that belong to different social classes in *Sforzinda*, the plan is divided into almost equal spaces of housing units with courtyards and a large garden surrounded by service spaces. Remarkably, the use of this typology seems to be a result of Filarete's acknowledgment of ancient Roman culture and architecture. The similarity can be associated with the discovery of ancient Roman villas that Pliny the Younger mentioned in his letters, which appealed to Renaissance architects and patrons (Ağır, 2010; Burns, 2012). As referred by Pellachia (1992) earlier, the porticoed courtyards bear remarkable importance in the spatial progression of domestic architecture as they appear to be in the center in Filarete's designs of the Ducal Palace, Archiepiscopal Palace and the Architect's House.

Furthermore, it seems that Filarete developed a scheme for housing in accordance with social classes in the 15th century Italy derived from ancient Roman architecture: a *villa* type housing for the upper social classes and *insula* for the lower class. Filarete's perception of the poor man's house with minimum level of comfort borrows from the Roman *insulae.* What is also remarkable is that *decorum* becomes a basic design criterion that reveals itself in the spatial organization of the plan, the height of the façade and decoration.

Moreover, domestic architecture in the treatise also reflects some stylistic features of the Middle Ages such as towers. Here, Filarete's proposal for *Casa del Duca* in Venice which he designed between 1458-59, as a commission from Duke Sforza, appears as an interesting example. The palace is referred in the treatise as "a house in a marshy place" in Book XXI and designed in ancient style together with local elements, in this case with Venetian elements (Schofield&Sebregondi, 2007). Yet, his proposals of housing typologies especially bear resemblances to contemporary buildings in Florence such as *Palazzo Rucellai* and *Palazzo Strozzi* as mentioned before.

The analyses of Filarete's domestic architecture, which show his interpretation of antiquity, the choice of architectural elements in alignment with the social hierarchy and the reflection of contemporary Renaissance practices in his designs, reveal the novel approach of the study to contribute to the literature. Filarete's remarkable portrayal of domestic architecture shows clear alignment with social stratification during the Renaissance period: the architects` emerging social status lays in between the top of the society, the nobility, and the -almost- insignificant lower classes of the artisan and the poor. Moreover, Serlio's categorization

of the domestic architecture for all the social classes for the first time in Renaissance and Palladio's villas with the *decorum* principle seem to take inspiration from Filarete's portrayal of domestic architecture. Filarete's multi-layered treatise, which shows the *fantasia* of the motivated architect with illustrations, plays a prominent role in the recreation of the social, political, cultural aspects, contributing to the notion of ideal city during Renaissance.

Acknowledgement
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Endnotes

[1] Filarete- *phil-arete*-means "lover of virtue" in Greek. Filarete's interest in the "east" and his knowledge of Greek manuscripts owed most probably to the Greek humanist and scholar, Francesco Filelfo (1398-1481) who lived in Constantinople serving John Paleologus VIII (1392-1448) as a secretary between 1420-27 (Onians, 1971, 104-114; Hayes, 2011, 196).

[2] "If, therefore, houses are planned on these principles to suit different classes of persons, as prescribed in my first book, under the subject of propriety *(decor),* there will be no room for criticism; for they will be arranged with convenience and perfection to suit every purpose (Vitruvius, Book VI, Chp. 5, III).

[3] As many scholars have pointed out, Filarete showed an interest in working under the patronage of the Sultan Mehmet II which can be observed through a letter from Filarete's friend Filelfo to George Amiroutzes (1400-70), a Greek scholar in the imperial court (Eslami, 2014, 157). However, there is no specific information concerning the realization of his intention to work in Constantinople or his whereabouts until his death in 1469. Regarding Filarete's plans to visit Istanbul, see P. Tigler, *Die Architekturheorie des Filarete*, Berlin, 1963, 6; J. Onians, "Alberti and FILAPETH: A Study in Their Sources," *Journal of the Warburg and Courtauld Institutions, 34* (1971) 96-114; K. Hayes, 2001, Filarete's Journey to the East. In S. Bozdoğan & Ü. B. Çopur, (Ed.), *ACSA International Conference on Oriental-Occidental: Geopraphy, Identity, Space*, (168-171). Turkey: İstanbul, March 16-20.

[4] For the evolution of illustrations in treatises, see M. Carpo, (2001). *Architecture in the Age of Printing. Orality. Writing, Typography, and Printed Images in the History of Architectural Theory*. (S. Benson, translator) Cambridge, Massachusetts: the MIT Press; Waters, M. J. (2012). A Renaissance without order: Ornament, Single-sheet Engravings, and the Mutability of Architectural Prints, *JSAH, 71*(4), 488-523.; A. Payne (1999). *The Architectural treatise in the Italian Renaissance. Architectural Invention, Ornament and Literary Culture*, Cambridge University Press.

[5] Along with humanism, the idea of the individual's success and the artist's reputation-fame which can be traced back to the literary sources of Dante, Boccaccio and Petrarca in the 14th century became more predominant. (Pfisterer, 2009)

[6] Aristotle created the social divisions according to the common needs: the lowest class provide the food, the craftsmen meet the needs of the society, soldiers defend, and the ruling class provide justice (Ackerman&Rosenfeld, 1989, 33).

[7] Ackerman&Rosenfeld (1989, 36) indicated that there were no signs of social segregation by social class clearly stated by Renaissance theorists neither in Rome nor in Paris.

[8] The social hierarchy defined by the Renaissance architects reached to a new level with Serlio who based his domestic architecture on all the existing classes in the society (Rosenfeld, M. R., 1996).

[9] The *braccio* (sing.)- *braccia* (pl.) is the measurement derived from the dimension of a man's arm and used during the Renaissance period in Italy. The measurements of the *braccio* differ from different parts of the Italian states. The Milanese *braccio* mentioned in the treatise is 59,49 cm.

[10] As an early example of associating

virtues with good government, good ruler, the Sienese painter Lorenzetti's "Allegory of Good and Bad Government" painting, located in the Sala dei Nove in the *Palazzo Pubblico,* Sienna, these fresco panels (late 1330s) reflect Aristotelian virtues (Skinner, 1987).

[11] The name of the architect who built the city in the Golden Book, found during the construction of the port city *Plusiapolis* of *Sforzinda,* is "Onitoan Noliaver", an anagram of Filarete's real name Antonio Averlino.

[12] Significantly, in the narrative of the school for boys "*Archicodomus*" in Book XVII, the artisans are entitled to teach their arts to the students as well as the instructors from the liberal arts.

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