

# IMPACT OF COURTYARD ARCHITECTURE ON PERSONAL WELL-BEING AND HUMAN HEALTH

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## Abstract

The many effects of courtyard design on social interaction, psychological health, and thermal comfort are examined in this study. Many aspects of courtyard design, such as shape, orientation, opening ratio, and environmental factors, are studied through a thorough analysis of the literature that has already been published. The study emphasizes how crucial courtyard design is for maximizing thermal comfort, especially in warm areas, with square-shaped courtyards and higher shading devices work well to provide shade and sustain acceptable temperatures. Examining the psychological consequences of courtyard design also reveals important social and cultural benefits. Overall, the study highlights how courtyard design has a wide range of significant effects on people's well-being. Courtyard design emerges as a key component in developing spaces that support people's physical, psychological, and social well-being by including concepts of thermal comfort, social interaction, and connection to nature.

**Keywords:** Courtyard design, Thermal comfort, Psychological well-being, Social interaction, Environmental considerations

## AVLU TASARIMININ İNSAN SAĞLIĞI VE BİREYİN İYİ OLMA HALİ ÜZERİNE ETKİSİ

### Özet

Bu çalışmada avlu tasarımının sosyal etkileşim, psikolojik sağlık ve termal konfor üzerindeki birçok etkisi incelenmiştir. Avlu tasarımının şekil, yönelim, açıklık oranı ve çevresel faktörler gibi pek çok yönü, halihazırda yayınlanmış literatürün kapsamlı bir analizi yoluyla incelenmiştir. Çalışma, özellikle sıcak alanlarda termal konforu en üst düzeye çıkarmak için avlu tasarımının ne kadar önemli olduğunu vurgulamakta; kare şekilli avlular ve daha yüksek örtüler, gölge sağlamak ve kabul edilebilir sıcaklıkları sürdürmek için olumlu sonuçlar sağlamaktadır. Avlu tasarımının psikolojik sonuçlarının incelenmesi, aynı zamanda önemli sosyal ve kültürel faydaları da ortaya koymaktadır. Genel olarak çalışma, avlu tasarımının insanların refahı üzerinde nasıl geniş bir yelpazede önemli etkilere sahip olduğunu vurgulamaktadır. Avlu tasarımı, termal konfor, sosyal etkileşim ve doğayla bağlantı kavramlarını da içererek insanların fiziksel, psikolojik ve sosyal refahını destekleyen mekânların geliştirilmesinde önemli bir bileşen olarak ortaya çıkmaktadır.

**Anahtar Kelimeler:** Avlu tasarımı, Termal konfor, Psikolojik iyi olma, Sosyal etkileşim, Çevresel düşünceler

## 1. INTRODUCTION

Spending time in nature is good for our health. It helps our bodies, minds, and emotions feel better. Being in natural places, like parks or gardens, can make us less stressed and happier (Polat et al., 2017). It also makes our brains work better. Nature can even make our bodies stronger by lowering our blood pressure, slowing our heart rate, and making our immune system stronger. It's like a medicine for our minds, helping people who feel anxious or sad. So, going outside and enjoying nature is a simple and effective way to make ourselves feel better (Horowitz, 2012). Adding plants indoors brings in real greenery, making people feel closer to nature while being inside (Smith, 2007). By seamlessly integrating natural elements such as plants and maximizing access to natural light, hospitals can significantly enhance patients' psychological and physical well-being (Totaforti, 2018).

The term "Biophilia" is defined with three pillar concepts: Nature in the Space, natural analogs, and nature of the space (Ramzy, 2015). Biophilic design principles incorporate elements such as plants, trees, and green walls to create a connection between indoor spaces and the natural world (Jung et al., 2023). Biophilic design, as a contemporary architectural approach, is a way of planning buildings that aims to bring our natural connection into cities, understanding how nature greatly affects our health and overall well-being. This design style incorporates biophilic principles, considering both organic and local aspects, to close the divide between man-made structures and our deep connection with the natural environment. The goal is to create living spaces that promote a balanced and health-oriented lifestyle (Totaforti, 2018).

The courtyard is an element characterized as an open area, either fully or partially enclosed by walls or structures, traditionally found as a component of a castle or large house (Lea, 2008). It is a timeless architectural element that has been implemented worldwide for centuries, especially in residential structures (Markus, 2016a). It's typology in architecture has a rich history dating back thousands of years of settlements. Initially serving as a protective barrier against climate, human, and animal invasion, and now courtyards evolved as a primary architectural form (Sthapak & Bandyopadhyay, 2014). In addition to being crucial architectural features, courtyards in large buildings provide areas for living, working, and relaxing. They also serve significant socialization purposes (Becki et al., 2013).

As an open space, courtyards serve diverse purposes, including social interaction, recreational activities, and influencing the microclimate (Meir Ben- & Meir, 2000). Numerous ancient courtyards in Arab countries provide evident proof that the design evolution of courtyards has been shaped and refined through the integration of social, cultural, and environmental factors. Various design elements, including area, number of floors, orientation, exposure, types of walls, and more, have been introduced and modified to create well-oriented courtyards that effectively address human needs (Reynolds, 2002).

The design principles and layout of courtyards vary not only between different buildings but also based on the geographical location and the purpose of the courtyard. The ideal shape, dimensions, and proportions are depending on the characteristics of each climate. Significant design variables such as shape, size, area, orientation, shading devices, vegetation, land ratio, courtyard dimension ratio, form factor, perimeter ratio, and the being for water or not are playing a crucial role in influencing air movement and daylighting performance within courtyard buildings (Markus, 2016b). Among different courtyard designs, the U-form courtyard plays a significant role in microclimate performance compared to the O-form. The U-form, described as a rectangular courtyard with an east-west orientation and open towards the south, provides enhanced shading and airflow management, which are crucial for maintaining acceptable temperatures (Abdulbasit et al., 2014).

The courtyard emerges as a crucial element frequently used in buildings due to its environmental, social, and therapeutic ability (Almhafdy et al., 2016). The courtyard which using natural light and ventilation can greatly help in treating patients and providing a healthy environment for them (Mahmoud et al., 2019). In healthcare, people are realizing how the surroundings affect our behavior. Looking at nature and familiar landscapes can bring direct and indirect health benefits. Seeing landscapes, we know and like can make us feel better, happy, and more creative (Zeisel, 1984). In the realm of healthcare, an increasing awareness of the profound impact of our surroundings on behavior has emerged. The acknowledgment that direct and indirect health benefits can be derived from exposure to nature and familiar landscapes is gaining significance. This recognition underscores the potential therapeutic value of intentionally designed environments within healthcare settings, emphasizing the positive impact that natural elements can have on individuals' mental and emotional states (Naderi & Shin, 2008).

The positive impact of social interactions on well-being is multifaceted, encompassing psychological, emotional, and even physical dimensions. Engaging in social interactions provides patients with emotional support, alleviating feelings of isolation and loneliness. The sense of connection and camaraderie derived from social exchanges contributes to a more positive mental state, reducing stress and anxiety levels (Kim & Sunyoung, 2021). A well-designed healthcare facility goes beyond merely offering medical services; it becomes a holistic environment that considers the psychological, social, and emotional needs of individuals. Such facilities are envisioned as spaces that promote healing not only through medical interventions but also by fostering a supportive and uplifting atmosphere (Abdelal & Soebarto, 2019).

By integrating natural elements into architectural design, such as incorporating courtyards, we enhance the overall environment for everyone. Exploring the benefits of courtyards reveals how they contribute to a sense of relaxation, emotional balance, and overall happiness for all individuals within healthcare settings.

## 2. LITERATURE REVIEW

### 2.1. History and Shapes of Courtyard

The historical progression of courtyard architecture worldwide is demonstrated through examples from ancient civilizations. Archaeological discoveries, such as those at Kahun in Egypt dating back 5000 years, and the Chaldean City of Ur before 2000 B.C. (Oliver, 2003) (Figure 1), the features of courtyard are shaped by the unique environment and cultural context of a particular region. Courtyards, for instance, can serve as inner gardens or act as focal points within a building. The oldest instances of courtyard building are found in Sumer and Pharaonic Egypt. This architectural style later spread to Western cultures like Greece and Rome (Abdulac, 1982; Bekleyen & Dalkiliç, 2011). Moreover, the ancient courtyards in Arab countries provide evident indications that the design variations of courtyards have evolved through the integration of social, cultural, and environmental factors. Various design elements, including area, number of floors, orientation, exposure, types of walls, and more, have been introduced and refined to create well-oriented courtyards that effectively respond to human needs (Reynolds, 2002).



**Figure 1.** Ancient Courtyard Architectural Designs Across Cultures (Zhu et al., 2023)

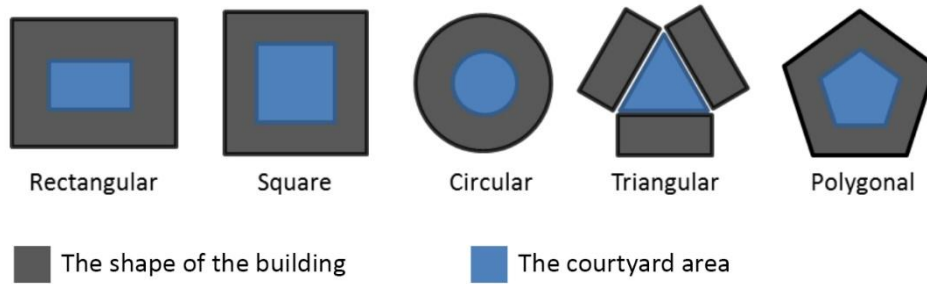
A courtyard, functioning as a space, offers not only climatic protection but also visual and acoustic benefits. During the design phase, careful consideration of courtyard geometry and material composition is essential to ensure the provision of optimal thermal comfort (Berkovic et al., 2012). While the fundamental plan of a courtyard typically is a rectangular or square shape, it is not confined to such rigidity and can adopt circular or curvilinear forms. Throughout history, this foundational courtyard plan has undergone modifications to address various environmental considerations like topography, site restrictions, building orientation, and intended function. Consequently, these adaptations have given rise to diverse courtyard shapes, including U, L, T, or Y configurations (Reynolds, 2002; Wang, 2006). Furthermore, the design configuration of a courtyard can take on different variations, including being fully enclosed (four-sided), semi-enclosed (three-sided), and, in some instances, even two-sided (Meir et al., 1995). Moreover, the orientation of a courtyard is often determined by the overall building layout. Factors such as sun location, wind direction, shading performance, and solar gain play crucial roles in influencing the microclimate conditions within the courtyard. These variables can be strategically considered to enhance the overall environmental comfort and performance of the courtyard space (Almhafdy et al., 2013).

Muhaisen, (2006) examined the impact of rectangular courtyard proportions on shading performance across four climatic locations. Optimal heights for different climates were determined, suggesting that taller walls are suitable for hotter climates, while lower walls suffice for colder ones. And found that deep courtyard forms create more internal shadow in summer, while shallow forms perform better in winter. Additionally, explored polygonal courtyard forms and their shading performance, emphasizing the significant influence of courtyard geometry and proportions on internal surface shading. However, the research presented a computer-based mathematical model that did not cover all multi-sided courtyard configurations.

Many environmental, social, and cultural elements have had a significant impact on the development and construction of courtyards. Through comprehension and implementation of these concepts, contemporary architecture may sustainably enhance the thermal comfort and microclimate efficiency of courtyard areas, ensuring their continued usefulness and flexibility as architectural components.

## 2.2. Effects of Courtyard Design

Soflaei et al., (2017) investigated how well courtyards in houses block sunlight. The research revealed that the amount of shade changes throughout the year, with the least shade in June and the most in December and January. Interestingly, courtyards that are longer than they are wide tend to have less shade and cooler temperatures. On the other hand, courtyards shaped more like squares, with a larger height compared to their width, block the sun more effectively, leading to warmer and more comfortable temperatures (Figure 2). The study also found that the courtyard's orientation is very important. As the courtyard faces further away from north, the comfort temperature goes down. In conclusion, the research suggests that designing courtyards with a square shape and a taller height compared to their width will provide better shade and improve thermal comfort in hot climates.



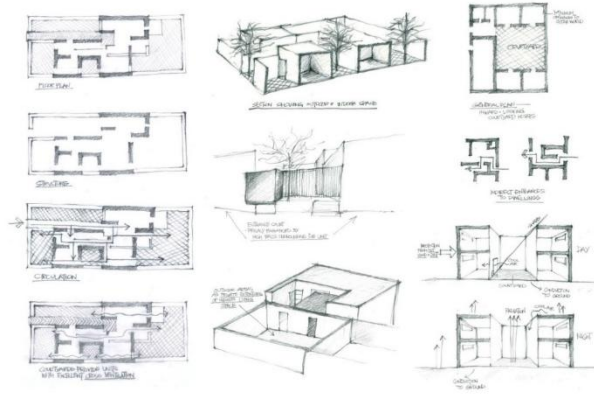
**Figure 2.** Examples of various courtyard types and their designs (Verma & Bano, 2023)

Martinelli & Matzarakis, (2017) explored how the shape of a courtyard, specifically its height compared to width (H/W ratio), affects thermal comfort in different climates. The research found that taller courtyards (higher H/W ratio) create more balanced temperatures year-round. This is because they provide shade in the summer, keeping things cooler, and limit heat loss to the sky at night, reducing the need for heating. However, the ideal H/W ratio depends on the climate. Colder climates benefit more from the extra sunlight exposure of shorter courtyards (lower H/W ratio), while hotter climates are better off with the shade provided by taller courtyards (higher H/W ratio). The study also acknowledged that courtyards can influence the thermal comfort of buildings surrounding them. Although not directly investigated here, taller courtyards may reduce heat gain in winter for buildings facing them, but this might also come at the cost of reduced heat gain in the summer.

Guedouh et al., (2019) in their study explored how courtyard buildings in hot, dry climates can offer both natural light and protection from excessive heat. Researchers compared different courtyard designs with conventional buildings through simulations and real-world measurements. They found that deeper courtyards provided cooler indoor temperatures but sacrificed natural light. Conversely, larger courtyard openings brought in more light but compromised thermal comfort. However, some courtyards achieved a good balance, particularly those with a moderate opening ratio (around 50%). The study concludes that deep courtyards with a moderate opening ratio are best suited for hot, arid regions. This design offers both good natural light and comfortable indoor temperatures for building occupants.

Abdulkareem, (2016) investigated that in hot, arid climates, courtyards offer a clever strategy for keeping cool. These spaces integrate design and occupant behavior to achieve thermal comfort. Shading, thermal mass

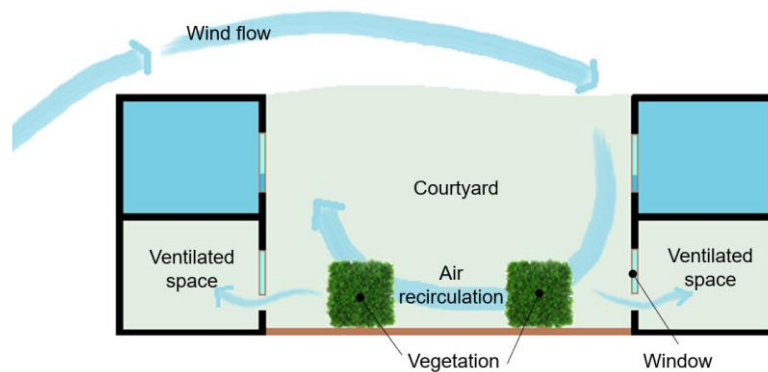
materials, windcatchers, and even strategically placed plants all work together to manage heat. Residents can further enhance this microclimate by moving to cooler areas of the house throughout the day and using tools like shade elements or water features (Figure 3). While courtyards are effective, they may require modern air conditioning systems in extreme heat. The key takeaway is that traditional designs offer valuable lessons. By understanding these principles, modern architects can create energy-efficient and sustainable buildings that improve upon the past.



**Figure 3.** Sketches of a traditional courtyard (MO, 2010)

### 2.3. Psychological Effects of Courtyard Design

Fu et al., (2022) highlight that the courtyard house offers numerous social and cultural advantages. It furnishes indoor private spaces, facilitates domestic activities and leisure pursuits, and enriches the house environment through features like solar shading, internal gardens, and thermal insulation. Acting as a natural ventilation source (Figure 4), the courtyard profoundly impacts inhabitants' physical well-being and contributes to stress alleviation through gardening activities. Furthermore, houses featuring internal courtyards, with inward-facing windows, offer noise reduction benefits and bolster psychological well-being. Notably, the study uncovers a widespread preference for courtyard houses among Kuwaitis, with many attributing positive effects on both physical and psychological well-being to this architectural style.



**Figure 4.** The courtyard with natural ventilation and vegetation (Sun et al., 2021)

Amirbeiki & Ghasr, (2020) explores the health benefits of nature exposure in open spaces, focusing on its impact on stress reduction and promoting positive emotions. It underscores the importance of regular connection with natural elements, particularly green areas and water, for psychological well-being. Blue elements, such as water pools and the perpetually bright sky, plays a significant role in restoring students' emotional well-being. Students go beyond the physical, perceiving the color blue as a symbol of infinity, creating a sense of openness and freedom with spiritual dimensions. Moreover, students report enjoyment and heightened positive emotions when interacting with natural elements in central courtyards, aligning with research showing a link between physical pleasure and student well-being. Central courtyards, prioritizing connection with nature, are preferred by students not only for reduced stress but also for fostering positive emotions and spiritual experiences.

Salameh et al., (2020) delves into the influence of school courtyards on student satisfaction, focusing on three crucial aspects: Courtyard Area and Services, Courtyard Environmental Comfort, and Courtyard Noise. The findings underscore the significance of thoughtfully designed school courtyards as invaluable assets that enhance student motivation, mental and physical health, and foster a strong sense of community within the school environment. Courtyard Area and Services exhibited a consistently positive impact across all dimensions of student satisfaction, while Courtyard Environmental Comfort emerged as the most influential predictor of overall student satisfaction, particularly when designed with effective airflow. Surprisingly, Courtyard Noise also had a positive influence on student social interaction within the courtyard.

Karaşah, (2023) conducted a study to evaluate courtyard landscape design as a living space. This study examined five different concepts: shopping plazas, residential plazas, sports clubs, small hotel plazas, and educational building plazas. The study found that courtyard designs provide a natural connection and avoid trapping people between buildings. Adopting a biophilic design approach, which emphasizes the relationship between humans and nature, is crucial in urban areas. Even small urban spaces, such as squares, must include green and blue infrastructure elements to contribute to the urban ecosystem and create more livable spaces.

### 3. DISCUSSION

The discussion section presents a comprehensive exploration of the impact of courtyard design on thermal comfort, psychological well-being.

Studies by Guedouh et al., (2019); Martinelli & Matzarakis, (2017); Soflaei et al., (2017), shed light on the intricate relationship between courtyard design and thermal comfort. Soflaei et al., (2017) found that courtyard shape and orientation significantly influence the amount of shade and temperature variations throughout the year, suggesting that square-shaped courtyards with taller heights provide better shade and thermal comfort in hot climates. Martinelli & Matzarakis, (2017) corroborate these findings, emphasizing the importance of the height-to-width ratio (H/W ratio) in achieving balanced temperatures year-round. Additionally, Guedouh et al., (2019) highlight the potential of deep courtyards with moderate opening ratios to offer both natural light and comfortable indoor temperatures, particularly in hot, arid regions. Abdulkareem, (2016) further underscores the effectiveness of traditional courtyard designs in mitigating heat through strategic elements like shading and thermal mass materials, offering valuable insights for sustainable building practices.

Psychological effects of courtyard design, as discussed by Amirbeiki & Ghasr, (2020); Fu et al., (2022), reveal the profound social and cultural advantages of courtyard houses. Fu et al., (2022) emphasize the role of courtyards in providing private spaces, facilitating leisure activities, and promoting stress alleviation through gardening. Additionally, Amirbeiki & Ghasr, (2020) highlight the therapeutic benefits of nature exposure in central courtyards, fostering positive emotions and spiritual experiences among students. These findings underscore the preference for courtyard houses and central courtyards among individuals, attributing their positive effects on physical and psychological well-being to the connection with nature and communal spaces.

Furthermore, the influence of school courtyards on student satisfaction, as explored by Salameh et al., (2020), highlights the significance of thoughtful design in enhancing student motivation, mental health, and community engagement. The positive impact of Courtyard Area and Services, Courtyard Environmental Comfort, and Courtyard Noise on student satisfaction underscores the importance of considering these aspects in school courtyard design. Particularly noteworthy is the surprising positive influence of Courtyard Noise on student social interaction within the courtyard, suggesting that acoustic elements play a crucial role in fostering a sense of community and belonging among students.

### 4. CONCLUSION AND SUGGESTION

In conclusion, the exploration of courtyard design reveals its multifaceted impact on both physical comfort and psychological well-being. Studies examining the thermal properties of courtyards emphasize the importance of factors such as shape, orientation, and opening ratio in optimizing thermal comfort, particularly in hot climates. Square-shaped courtyards with taller heights, along with deep courtyards featuring moderate opening ratios, emerge as effective solutions for providing shade and maintaining comfortable indoor temperatures. Traditional courtyard designs, incorporating strategic elements like shading and thermal mass materials, offer valuable insights for sustainable building practices.

Moreover, the psychological effects of courtyard design underscore its significant social and cultural

advantages. Courtyard houses are found to provide private spaces, facilitate leisure activities, and contribute to stress alleviation through gardening. Central courtyards, in particular, foster positive emotions and spiritual experiences among individuals, emphasizing the therapeutic benefits of nature exposure.

In educational settings, school courtyards play a crucial role in enhancing student satisfaction, motivation, and mental health. Thoughtfully designed courtyards, considering aspects such as area, environmental comfort, and noise, contribute to a sense of community and belonging among students.

Additionally, incorporating plants in yard areas not only improves the visual appeal but also helps to create a healthier environment. Plants provide actual greenery to cities, giving people a sense of connection to the natural world that can enhance their mental well-being and lower their stress levels. When green features like plants are added, and natural light is maximized, courtyards can become peaceful places in the middle of busy cities. This integration supports biophilic design principles, fostering a harmonious relationship between indoor and outdoor spaces while promoting a sense of calm and vitality.

Overall, the discussion demonstrates the diverse and profound effects of courtyard design on human well-being. By integrating principles of thermal comfort, social interaction, and connection with nature, courtyard design emerges as a fundamental element in creating environments that promote physical, psychological, and social well-being for individuals across various contexts.

While this study highlights the multifaceted impact of courtyard design on well-being, further research opportunities exist to expand our understanding:

1. **Quantify the impact:** While the current study explores the relationship between courtyard design and well-being, future research could quantify these effects. This could involve conducting user studies in courtyards with varying designs to measure factors like thermal comfort, stress levels, and social interaction.
2. **Explore specific building types:** The current study provides a general overview. Future research could delve deeper by focusing on specific building types, such as hospitals, office buildings, or residential high-rises. This would allow for a more targeted analysis of how courtyards can optimize well-being in these contexts.
3. **Integrate with new technologies:** The study focuses on traditional design elements. Future research could explore how new technologies, like smart building systems or bioclimatic design principles, can be integrated with courtyards to further enhance well-being and energy efficiency.
4. **In-depth study of the plants used in the courtyard:** Further research should focus on comprehensive examination of the best way to include various kinds of plants into courtyard layouts. Examining the particular advantages of a variety of plant choices is essential for improving biophilic relationships and environmental sustainability in urban settings. Research should focus on appropriate plant species for the area, clever irrigation methods, and how these factors work together to improve thermal comfort and air quality.

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