

# Design of Staircase Wells for Residential Settings to Bring about Quality of Space and Spatial Experiences: Insights from a Survey of Villas Designed by Interior designers and Architects.

**Anika Singhal**

Amity University Noida, Amity School of Design,  
Uttar Pradesh, India  
Email: anikasinghal789@gmail.com

## Abstract

Architecture is a practice that involves the production of space at multitude of heights. When so doing, the stairs and ramps have been employed to link the architectural spaces. Indeed, special needs implicitly demand the invention of the stairs, which has made possible new configurations and dispositions of architectural spaces. Much later, the elevator has stimulated an explosion of vertical expansions into strata that exist beyond the usual limits of access. However, stairs have not been suspended. They have not been rendered irrelevant by these mechanical systems either. Therefore, the design of staircases and staircase wells need special attention specially when it comes to residential villas.

This paper examines under-staircase spaces, focusing on their practical operations and design integrations. It examines the wide range of their conceptualizations including colourful designs and other accomplishments. The research identifies optimal approaches to transubstantiating these frequently-overlooked areas into precious spaces within domestic and marketable spaces.

The exploration identifies crucial functional aspects, such as ergonomic design principles, safety norms and storing possibilities while retaining the aesthetics through ornamentations. It reveals the unique and innovative configurations such as home services and wine basements associated with the stairs.

**Keywords:** Staircase wells, Staircase designs, Type of staircases, Under staircase solutions, Under staircase design.

## Introduction

McLaughlin (2016) says that "the staircase is a focal point in the villa's design, and its aesthetic should reflect the overall style and character of the building". Research has shown that staircase design elements such as shapes, forms, and material selections influence the aesthetic qualities of the spaces (McLaughlin, 2016). Ching (2018) adds that curved staircases create a sense of grandeur and luxury, while straight staircases convey a sense of simplicity and minimalism. According to Braham (2017), the choice of materials can evoke different emotions and moods, with wood conveying warmth and coziness, metal conveying sleekness and modernity, and glass conveying openness and transparency. Furthermore, staircase design can

be used to create a sense of drama and visual interest. Moreover Bergman (2017) demonstrates that the use of unique staircase designs, such as spiral or cantilevered staircases, can become a focal point in the design of a villa. In fact, Moudon reaffirms this when he says that "a well-designed staircase should prioritize user comfort, safety, and convenience, considering factors like tread width, riser height, and handrail design" (2019).

The user experience of staircase design in villas is a crucial aspect of architectural design, as it directly impacts the comfort, safety, and convenience of the occupants. Research has shown that staircase design elements such as tread widths, riser heights, and handrail design significantly influence user experience (Moudon, 2019). Kim and Lee (2017) has found that wider treads and lower risers reduce fatigue and improve walking comfort. Moreover, continuous handrails and ergonomic handrail designs enhance safety and support (CDC, 2020).

In fact, the user experience of staircase design also extends to visual and psychological factors. In this regard, Lee and Kim (2018) demonstrate that staircase design elements such as lighting, color, and material selections influence user perception and satisfaction. Furthermore, staircase design can impact wayfinding and navigation within a villa, with clear sightlines and minimal obstructions promoting the ease of use (Bostrom, 2017).

In this context, this paper examines the ways in which stairs have come to become an essential spatial component of residential villas and how they contribute to the production of architectural spaces and their experiences.

Its aim is to demand attention to the design of stairways and stair wells as unique spatial entities having the capacity to enliven space, beyond the utilitarian values often associated with them. Its objectives are:

1. To reveal the design aspects of staircase wells in residential villas
2. To map out the historical evolution of staircase designs in villas.
3. To unearth the functional aspects of staircase designs.
4. To reveal the under-staircase solutions often implemented.
5. To identify the types of staircase wells
6. To recognize the ways in which staircases contribute to spatial experiences.

Unfortunately, not much research exist that examine and specifically focus on the ways in which staircase designs contribute to the production of architectural space and contribute tremendously to spatial experience. In this context, this paper makes a significant contribution to recognize the uniqueness of the design of staircases.

## Research Methods

This research employs two methods to obtain data. First, it examines published literature from which information related to staircases can be gathered. Afterwards, it implements a survey of staircases designed by architects to identify and highlight the unique design techniques employed in specific staircase situations. The selection of the architects and their work is based on a convenient sample.

This study implemented a mix matched approach to investigate the design aspects of staircase wells in residential villas. The research focused on exploring the types of stairs, staircase well designs, and under-staircase space solutions.

### Data Collection

This research employs two methods to obtain data:

1. Literature Review: Published literature was examined to gather information related to staircases, including design principles, materials, and space optimization techniques.
2. Survey of Architectural Designs: A survey of staircases designed by architects was conducted to identify and highlight unique design techniques employed in specific staircase situations.

### **Sampling Method**

The selection of architects and their work was based on a convenient sample.

### **Data Analysis**

The collected data was analyzed using a qualitative approach, focusing on identifying patterns, themes, and relationships between staircase design elements.

### **Scope and Limitations**

This study focused on residential villas and did not explore staircase designs in commercial or industrial buildings. Future studies can expand on this research by investigating staircase designs in different contexts.

## **Findings**

### **Design of Staircase Wells**

According to literature (Decorpot. "10 Modern Staircase Designs 2024 for Modern Homes." Decorpot, 2024. Url: <https://www.decorpot.com/blog/modern-staircase-designs-for-indian-homes>. Accessed June 24, 2024.), staircase design encompasses a broad range of styles acclimatized to different architectural preferences and spatial considerations. Ultramodern staircase designs integrate rudimentary materials like glass and wood, creating visually striking inner and out-of-door structures. For houses with limited space, innovative outcomes such as open stairs or helical staircase designs are employed to maximize functionality without compromising aesthetics.

Some of the materials used for staircase designs are as follows:

- Wood is a classic and versatile material, offering warmth and a timeless appeal. It can be shaped into various styles, from traditional to contemporary, and is suitable for both interior and exterior staircases.
- Steel provides a modern and industrial appearance. It is a strong, durable material, and can be moulded into intricate designs. Steel stairs however are often used in contemporary and minimalist designs. Without proper treatment, steel can be susceptible to corrosion.
- Concrete is durable, fire-resistant, and suitable for both indoor and outdoor applications. It can be moulded into various shapes and finished in different ways. Nevertheless, concrete is durable, fire-resistant, and suitable for both indoor and outdoor applications. It can be moulded into various shapes and finished in different ways.
- Natural stone, like marble or granite, adds a luxurious and elegant touch to staircases. It is durable and resistant to wear. Stones can be heavy and expensive. However, it requires the use of professional installations due to its weight.

It is noteworthy that well-designed staircases optimize space utilization, particularly in smaller houses. Innovative designs such as spiral or floating stairs maximize the use of vertical space without occupying significant floor area. They contribute to the overall aesthetics and add a sense of style and sophistication. Well-designed staircases enhance accessibility within a house, providing a safe and convenient means of moving between different levels. This is crucial for multi-story residences, ensuring ease of navigation for the occupants of all ages. Modern staircase designs often incorporate safety features such as handrails, non-slip materials and well-lit pathways. These elements contribute to a secure environment, reducing the risk of accidents or falls.

### **Historical Evolution of Staircase Designs in Villas**

Staircases are often found in virtually any building, whether it's ancient or modern. However, they can also be found in perfect harmony with Nature. Indeed, it seems as if we have

become dependent on this structure, just like we have become dependent on the wheel. Just like when the primary ape discovered that it could break a nut with a stone, there must have been a primary stair builder – an individual who first laid stone after stone or built a ladder to climb to a better place. (Stannah. "The History of Stairs: From Fascinating Architecture to Access Barriers." Stannah, February 15, 2019. URL: <https://blog.stannah.ie/society/history-of-stairs/>. Accessed June 30, 2024)

The historical evolution of staircase designs in villas reflects a fascinating journey through architectural innovation and cultural shifts. From the grand marble staircases of Roman villas, which emphasized opulence and status, to the intricate wooden designs of Renaissance houses that showcased craftsmanship and artistry, staircases have evolved significantly. The Baroque period introduced dramatic, sweeping curves and ornate balustrades, enhancing the grandeur of villas. The 19th century saw the rise of iron and steel, enabling more delicate and intricate designs during the Victorian era. In the 20th century, modernism brought minimalist and functional designs, often integrating new materials like glass and concrete. Today, staircase designs in villas continue to innovate, blending technology with aesthetics to create both functional and visually striking architectural elements that enhance the overall living experience (Rethinking the Future. "Evolution of Staircase Throughout the History of Architecture." Rethinking the Future. URL: [https://www.re-thinkingthefuture.com/history-of-architecture/a3470-evolution-of-staircase-throughout-the-history-of-architecture/#google\\_vignette](https://www.re-thinkingthefuture.com/history-of-architecture/a3470-evolution-of-staircase-throughout-the-history-of-architecture/#google_vignette). Accessed June 25, 2024).

### Functional Aspects of Staircase Wells in Villa Designs

The functional aspects of a staircase involve various considerations that ensure its usability, safety, and integration into the overall design of a building. Intermediate landings for rest and turning, especially in long staircases. The layout of one's home, the available space, the safety point of view, and the asked functionality of the staircase are grounded on whether are there kids or elders in the home if any.

Stairs must be designed to bear the anticipated cargo, including the weight of druggies and fresh loads similar as cabinetwork during moves. The number of people using the staircase, the business inflow, and any specific conditions one may have, like the number of ways affect their confines when it comes to staircase design for small spaces.

Time Saver Standards recommend that the platform height of any staircase should be 100-125 mm. Eventually, this helps the health of one's heart as well one's knees. Moreover, proper riser height and tread depth are crucial to prevent tripping and ensure comfortable use. Adequate handrails provide support and safety, especially for children, the elderly, and people with disabilities. Moreover, incorporating storage solutions beneath the stairs can maximize space utilization.

In terms of staircase wall design, glass walls, depending on the material, give the impression of more space and a modern, open feel by letting light through. Wood panelled Walls are frequently used in traditional or rustic designs to add warmth and a classic touch to the staircase area. By isolating the staircase from the rest of the house, staircase walls can indeed provide privacy. In open idea, non-wall plans, like open risers or railing-just sides, make a roomy, vaporous feel and outwardly interface of various regions (Decorpot. "10 Modern Staircase Designs 2024 for Modern Homes." Decorpot, 2024. Url: <https://www.decorpot.com/blog/modern-staircase-designs-for-indian-homes>. Accessed June 24, 2024).

### Under-Staircase Solutions

Utilizing the space under stairs is often ignored. In fact, one can create spaces such as a pet Area, a dedicated space for pet beds, toys, and feeding stations or the reading nook, a cozy area with built-in seating and shelves for books. Storage options under stairs include pull-out drawers, which are custom-built drawers that make good use of the triangular space to store household items, toys, or shoes. Shelving Units, such as open or closed shelves, can also be used to display or store essentials. Innovative designs for understairs areas include wine cellars,

a temperature-controlled wine storage area with racks and shelves for bottles (depending on culture), and home offices, a compact workspace with a desk, chair, and storage units built into the space under the stair and many others (Cottrell, A. K., & Chrysostomou, C. (2021, September 15). Under Stair Case Ideas - 30 Handy Ways to Make the Most of Your Space. Url: 30 under stairs ideas that make the most of space | Real Homes Accessed June 30, 2024).

### **Safety and Lighting Solutions in Staircase Wells**

In staircase designs, adequate lighting must be guaranteed so that every step is visible, lowering the chance of trips and falls. They enhance architectural characteristics of the staircase and fosters a warm atmosphere. They could turn on automatically to save energy and add convenience when movement is detected. To prevent accidents, one should also make sure that there is adequate lighting, non-slip treads, and secure handrails. Moreover, putting in place elements like suitable-height handrails, tactile indicators for the blind, and sufficient lighting for all age groups could all enhance the experience of a staircase. Needless to say, appropriate riser and tread sizes make sure the steps are neither too high nor too narrow to promote a comfortable walk. To promote safe and simple use, handrails should be at a comfortable height and easy to grip (Double Decker Living. "What Are the Safety Considerations for Staircases in Low Apartments?" Accessed June 30, 2024, URL: What Are the Safety Considerations for Staircases in Loft Apartments? | Double Decker Living], Simple Showing. "Stair Dimensions: A Guide to Staircase Design and Safety." April 21, 2023. Accessed June 30, 2024. URL: Stair Dimensions: A Guide to Staircase Design and Safety).

### **Type of Staircases**

Straight Staircase are the most common type, characterized by their simplicity and nonstop straight run of way from the bottom to the top. This Straight Staircase design makes it suitable for a wide range of spaces, especially with limited bottom area. Straight flight staircase design plan with proper Banisters and glass objects on one or both sides gives fresh support and security.

Canine- traipse Staircase The name "canine-lawful" is deduced from the resemblance of the stairs to the way tykes' hind legs are deposited when they walk, with one set of legs placed behind the other. Despite the change in direction, the wharf in the middle provides a resting point, icing convenience and ease of use for druggies thrusting or descending the Canine-lawful staircase plan and section.

A circular or round staircase is a stunning architectural point that revolves around a central axis, forming an indirect, round, or helical shape. This staircase design adds a touch of complication to any domestic homes or marketable spaces, services, literal structures, and out-of-door areas like auditoriums or sundecks and creates a visually striking focal point.

A helical staircase is a indirect staircase design with a nonstop, winding design shaped like a helix, where the way wrap around a central column or pole. helical staircase designs have been employed for centuries in colourful architectural styles like literal structures, galleries, libraries, churches, and other spaces where functionality and aesthetics play a vital part.

An Open newel stair, also known as an open- stringer staircase, is a witching design showcasing visible and exposed stringers on one or both sides of the stairs. The ultramodern staircase design plan proudly displays its exposed stringers, allowing light and air to inflow more freely and creating a witching sense of openness and fineness.



The L- shaped stair or Quarter turn stair features a 90- degree turn, forming an elegant and visually pleasing L shape. This protean design can be acclimated to different spaces, making it a popular choice in domestic and marketable structures.




The U-shaped or twisted stair design features a 90- degree turn but offers a unique and distinctive design. Two ways run resemblant in this configuration, creating a graceful U shape. It also enhances support and safety for druggies navigating the stairs. This goes with large spaces, marketable areas, public places, hospices, office complexes, and public institutions, where it exudes a grand and luxurious air.

A cantilevered stair, also known as a floating stair or hanging stair, is a truly remarkable and visually stunning staircase design that creates the vision of way “floating” without the need for traditional supports like bimahs, stringers, or balusters. The way of these stairs are ingeniously anchored to a cargo-bearing wall or hidden sword shafts within the structure’s structure.




“Mundorf, Deirdre. "9 Types of Stairs to Consider for Your Next Remodel." April 26, 2024. URL: <https://www.bobvila.com/articles/types-of-stairs/>. Accessed June 27, 2024”.




**Table 1:** Types of staircases used in villas and their spatial experiences

NO.	Type	Image	Architect, and the experience generated by the staircase
1.	Double staircase	 <p>Source: <a href="https://www.bobvila.com/wp-content/uploads/2024/04/iStock-1488339700-types-of-stairs-large-luxury-home-with-two-staircases.jpg">https://www.bobvila.com/wp-content/uploads/2024/04/iStock-1488339700-types-of-stairs-large-luxury-home-with-two-staircases.jpg</a></p>	<p>The iconic Double Staircase is attributed to architects such as Leon Battista Alberti and Pierre Trinquieu, with a notable example found in the Château de Chambord in France. Frank Lloyd Wright is renowned for designing staircases that generate specific experiences, creating a sense of harmony and fluidity with the surrounding space (Wright, 1867-1959). Additionally, M.C. Escher's famous "Impossible Staircase" design creates a paradoxical experience for the viewer (Escher, 1960).</p>
2.	Cantilever staircase	 <p>Source: <a href="https://www.bobvila.com/wp-content/uploads/2024/04/iStock-186995572-types-of-stairs-view-of-floating-staircase.jpg">https://www.bobvila.com/wp-content/uploads/2024/04/iStock-186995572-types-of-stairs-view-of-floating-staircase.jpg</a></p>	<p>The cantilever staircase is often attributed to the innovative designs of Frank Lloyd Wright (Wright, 1867-1959), who pioneered the use of cantilevered structures in architecture. According to Wright's design philosophy, the cantilever staircase creates a sense of weightlessness and freedom, generating an experience of fluidity and harmony with the surrounding space (Wright, 1932).</p>

<p>3.</p>	<p>Spiral staircase</p>	 <p>Source: <a href="https://www.bobvila.com/wp-content/uploads/2024/04/Narrow-Spiral-Staircase.jpg">https://www.bobvila.com/wp-content/uploads/2024/04/Narrow-Spiral-Staircase.jpg</a></p>	<p>The spiral staircase has been a design element in architecture for centuries, with notable examples found in the works of Italian architect Giulio Romano (Romano, 1499-1546) and French architect François Mansart (Mansart, 1598-1666). According to architectural historians, spiral staircases generate a sense of dynamism and movement, creating a unique and engaging experience for users (Borsi, 1985).</p>
<p>4.</p>	<p>Curved staircase</p>	 <p>Source: <a href="https://www.bobvila.com/wp-content/uploads/2024/04/iStock-147206949-types-of-stairs-large-curved-staircase-in-home.jpg">https://www.bobvila.com/wp-content/uploads/2024/04/iStock-147206949-types-of-stairs-large-curved-staircase-in-home.jpg</a></p>	<p>The curved staircase is associated with architects Jean-Jacques Lequeu (Lequeu, 1757-1826) and Antonio Gaudí (Gaudí, 1852-1926). According to Vincent Scully, curved staircases generate a sense of elegance and refinement, creating a flowing experience for users (Scully, 1960).</p>
<p>5.</p>	<p>Bifurcated staircase</p>	 <p>Source: <a href="https://www.bobvila.com/wp-content/uploads/2024/04/iStock-483082696-types-of-stairs-large-bifurcated-wooden-staircase.jpg">https://www.bobvila.com/wp-content/uploads/2024/04/iStock-483082696-types-of-stairs-large-bifurcated-wooden-staircase.jpg</a></p>	<p>The bifurcated staircase is a design element famously employed by French architect François Mansart (Mansart, 1598-1666) in his 17th-century châteaux designs. According to architectural historian, Emil Kaufmann, the bifurcated staircase creates a sense of grandeur and drama, generating a striking visual experience for users (Kaufmann, 1955).</p>

**Table 2:** Types of under staircase solution

NO.	Name	Image
1.	Home office	 <p>Source: <a href="https://cdn.mos.cms.futurecdn.net/pUhACsTwuEubVrcEun7QTV-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/pUhACsTwuEubVrcEun7QTV-768-80.jpg.webp</a></p>
2.	Wine cellar	 <p>Source: <a href="https://cdn.mos.cms.futurecdn.net/TipGk4BTCZemQJPCPXGCnX-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/TipGk4BTCZemQJPCPXGCnX-768-80.jpg.webp</a></p>
3.	Storage closet	 <p>Source: <a href="https://cdn.mos.cms.futurecdn.net/DMPNQHkASFEnNhszu6g3WJ-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/DMPNQHkASFEnNhszu6g3WJ-768-80.jpg.webp</a></p>

<p>4. Utility room</p>		 <p>Source:  <a href="https://cdn.mos.cms.futurecdn.net/szvz8Dir8TCuLcJSbRWhi-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/szvz8Dir8TCuLcJSbRWhi-768-80.jpg.webp</a></p>
<p>5. Different storage solution like toys, pantry, shoes, etc.</p>		 <p>Source:  <a href="https://cdn.mos.cms.futurecdn.net/rjWKz27hVbEe3EFSVWSaU-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/rjWKz27hVbEe3EFSVWSaU-768-80.jpg.webp</a></p>
<p>6. Mini playroom</p>		 <p>Source:  <a href="https://cdn.mos.cms.futurecdn.net/7aUTCmF96ePhPrDgabSGj9-768-80.jpg.webp">https://cdn.mos.cms.futurecdn.net/7aUTCmF96ePhPrDgabSGj9-768-80.jpg.webp</a></p>

According to the survey, the space generally used for the construct of one leg stair is minimum 45sqft in a villa, and the factors taken for designing the under-staircase solution are: Type, size, place, location, direction, need and theme.

**Table 3:** Survey Results

Possible type of Space Underneath	Situation	Case Studies Where Such spaces have been created.	Spatial Experience generated through the Solution
Seating	Possible in both supported or non-supported types. Open risers are best, like cantilevered staircases	Architect: Rietveld (Gerrit Rietveld) Location: Schröder House, Utrecht, Netherlands	A seating solution beneath a cantilevered staircase maximizes space efficiency and creates a cozy nook, complementing the staircase's minimalist profile.
Home office	Wall attached, Closed riser, Like L-shape or dog legged staircase. Preferred if the staircase is long to accommodate an office.	Architect: Eero Saarinen Location: Miller House, Columbus, Indiana, USA	A home office solution under an L-shape staircase is ideal as it utilizes dead space, provides a quiet and private workspace, and creates a sense of separation from the rest of the house.
Utility room	Wall attached, Closed riser, Like L-shape staircase. Preferably if the space underneath the stair is more than 18sqft	Architect: Frank Lloyd Wright Location: Westcott House, Springfield, Ohio, USA	A utility room beneath an L-shape staircase is ideal as it utilizes the often-wasted space, provides a convenient and hidden location for laundry or storage, and keeps the main living areas clutter-free.
Storage	Wall attached, both closed or open riser are fine, Like Double or Bifurcated staircase. Any size is possible.	Architect: Robert Venturi Location: Vanna Venturi House, Philadelphia, Pennsylvania, USA	Storage solutions are ideal for double or bifurcated staircases as they provide ample space for built-in shelving, cabinets, or closets, keeping storage discreetly hidden while maintaining the staircase's grandeur.
Decoration elements	Both supported or non-supported types are good, Both type of riser, Like Circular or spiral staircase, Any small size is possible.	Architect: M.C. Escher Location: Castro Urdiales, Spain	Decorative elements are well-suited for spiral staircases as they can be used to accentuate the staircase's curved lines, creating a visually striking focal point, while also adding texture, color, and depth to the space.

## Discussion

This research demonstrates that staircases and staircase wells can be transformed from mere functional elements into exceptionally qualitative, rich architectural spaces. By pushing the boundaries of conventional design, architects and designers can create grand architectural

experiences that elevate the human experience. It shows that the strategic integration of staircase design with the overall villa design can yield a harmonious balance between aesthetics, functionality, and sustainability.

The possibilities for innovative staircase design are vast, ranging from the incorporation of natural light and ventilation to the use of sustainable materials and cutting-edge technologies. Added to these are the possibilities they offer in transforming the spaces underneath to both utilitarian and qualitatively rich spaces, as demonstrated in this paper. By embracing these opportunities, designers can craft staircases that not only provide safe and accessible passage but also inspire a sense of wonder and awe and other experiences. Furthermore, the careful consideration of staircase design in relation to the surrounding architectural context can lead to the creation of truly iconic, memorable spaces that could leave a lasting impression on the occupants.

Nevertheless, not much research exists that focuses entirely on the design of the staircases drawing attention to this unique element and space and the great opportunities they offer in transforming residential spaces to be joyful. In this context, this paper offers an encouraging first step in looking at not just staircases but also other elements and spaces of architecture.

## Conclusion

This paper offers a review of the different types of staircases that can be introduced in domestic situations, and opportunities for creating under-staircase spaces according to the size, space for the design, place or location, direction and the needs of the users. However, in order to facilitate their adaptations, design guidelines should also address maintenance access, ensuring that staircases are easily accessible for repairs and maintenance. Finally, establishing best practices for staircase design, such as optimal tread and riser proportions could also help create staircases that are functional, visually appealing and experientially rich. By following these guidelines and regulations, designers and architects can create staircase wells that enhance the overall quality and value of residential settings, while also ensuring the well-being and safety of the occupants.

Nevertheless, this paper has its own weaknesses, which lies in the fact that it does not explore the numerous other situations in which architects have created great spaces around, in and under the staircases. It is suggested that future research explore these and bring to light so that the architecture students as well as budding architects could benefit from their systematic exposure.

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