DOI: 10.53469/jpce.2025.07(12).05

The Impact of Wellness-Centered Interior Architecture on Occupant Psychology and Functional Efficiency: A Post-Occupancy Evaluation of the Tahoe Residence

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Abstract: ***This study examines the influence of interior architecture on occupant wellness within high-end residential environments, with the Tahoe Residential Project serving as a case study. The research evaluates the integration of spatial planning, sustainable material selection, and human-centric design strategies in fostering physical and psychological well-being. By incorporating biophilic design principles, ergonomic spatial configurations, and environmentally responsible material choices, the study identifies key methodologies to enhance indoor air quality, optimize functionality, and elevate occupant comfort. The results address established health and sustainability benchmarks, including LEED and Well Standards, and provide a structured framework for residential building design that comprehensively supports health and wellbeing.***

Keywords: Wellness-Centered Design, Interior Architecture, Sustainable Materials, Biophilic Design, Ergonomic Space Planning, LEED Compliance, Universal Design.

1. Introduction

The design of interior spaces plays a crucial role in shaping the physical, psychological, and emotional experiences of occupants, particularly in high-end residential projects where homeowners seek sanctuaries that support their health and well-being [1]. This paper explores the intersection of interior architecture and wellness, focusing on how design strategies can enhance occupant comfort and contribute to overall well-being. Specifically, it investigates the use of biophilic principles, sustainable materials, and ergonomic solutions to create holistic living environments that promote physical and mental health.

The Tahoe Residential Project, located on a lot north of Lake Tahoe, provides an ideal case study for this exploration. Set amidst the stunning natural landscapes of the Sierra Nevada mountains, this two-story residence offers privacy on the street side while framing panoramic views of the surrounding mountain terrain on the rear side. This design ensures a sense of seclusion and safety and allows the occupants to immerse themselves in nature, fostering tranquility and a stronger connection to the natural world.

This study delves into the design strategies employed in this project, analyzing how biophilic principles, sustainable materials, and ergonomic solutions have been leveraged to create a holistic living environment that promotes the well-being of its occupants. By examining these elements, the paper demonstrates how interior architecture can contribute to the health, comfort, and overall well-being of residents, aligning with established wellness and sustainability benchmarks.

2. Literature Review

a) ellness in Interior Architecture

Research has established that interior environments significantly impact both mental and physical well-being. Kopec [2] suggests that spatial design influences cognitive function, stress levels, and overall health, demonstrating that well-planned spaces enhance relaxation and mental clarity. The application of environmental psychology in interior architecture underscores the importance of user-centered designs that cater to comfort, aesthetics, and functional efficiency [3]. In high-end residential environments, such as the Tahoe Residential Project, wellness-driven design strategies play a crucial role in optimizing occupant well-being by integrating evidence-based spatial planning and material selection.

b) LEED, WELL, and Sustainable Design

Sustainability and wellness in interior design are increasingly standardized through frameworks such as LEED (Leadership in Energy and Environmental Design) and the WELL Building Standard. LEED prioritizes energy-efficient construction, improved indoor air quality, and the use of responsibly sourced materials, all of which contribute to occupant health. The WELL Building Standard, introduced by the International WELL Building Institute, focuses on human health by integrating air, water, nourishment, light, fitness, comfort, and mental well-being into building design [4]. Studies indicate that WELL-certified buildings report increased productivity and reduced absenteeism due to their emphasis on indoor environmental quality. By incorporating these standards, residential projects can enhance both environmental responsibility and human wellness, ensuring

that material selection and spatial configurations support holistic well-being.

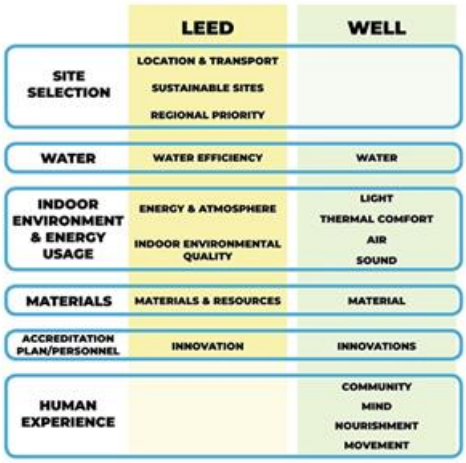

Figure 1: Comparison between LEED and WELL Source [5]

c) Biophilic and Human-Centric Design

Biophilic design principles enhance well-being by incorporating natural elements into built environments. Kellert [6] asserts that exposure to natural components—such as daylight, greenery, and organic materials—positively impacts stress reduction, cognitive function, and emotional resilience. A study by Browning et al. [7] further indicates that biophilic elements in residential spaces improve mood regulation and increase occupant satisfaction. In high-end residential architecture, these principles are particularly relevant, as access to natural vistas, optimized daylighting strategies, and the use of nature-inspired materials contribute to a more restorative living environment.

d) Ergonomics and Functional Design

Universal design theories advocate for accessibility, usability, and ergonomic efficiency in residential architecture. Steinfeld and Maisel [8] emphasize the importance of adaptable design elements that accommodate diverse user needs, ensuring barrier-free movement and enhanced functionality. Research suggests that ergonomic furniture and millwork—such as soft-close cabinetry, height-adjustable surfaces, and optimized circulation patterns—enhance user experience and physical well-being [9]. In luxury residential projects, these elements are frequently customized through high-end millwork and FF&E (Furniture, Fixtures, and Equipment) selections that seamlessly merge aesthetics with ergonomic comfort.

e) Indoor Air Quality and Material Selection

The selection of materials in interior spaces directly influences indoor air quality and occupant health. Low-VOC (volatile organic compound) finishes, FSC-certified wood, and antimicrobial surfaces contribute to reduced toxin exposure and improved air purity [10]. A comparative analysis by Liang et al. [11] demonstrated that eco-friendly materials significantly decrease indoor air pollutants, leading to enhanced respiratory health and overall well-being. The Tahoe Residential Project integrates these principles by prioritizing non-toxic materials that align with both LEED and WELL standards, creating a healthier indoor environment.

f) Social Interaction and Psychological Well-Being

Spatial planning plays a pivotal role in fostering social engagement and psychological wellness. Open-concept layouts, flexible communal spaces, and intuitive furniture arrangements encourage interaction and connectivity among occupants [12]. Research indicates that spaces designed to facilitate both privacy and communal engagement contribute to a balanced living environment, reducing feelings of isolation while promoting relaxation [13]. In luxury residential settings, customized layouts and FF&E arrangements are tailored to support a seamless blend of individual retreat and social interaction, fostering an environment conducive to both well-being and personal fulfillment.

g) Summary of Key Findings

This literature review underscores the complex interplay between interior architecture and occupant wellness, demonstrating how design decisions impact both physical and psychological health. By integrating biophilic design principles, sustainable material selection, ergonomic planning, and wellness-oriented spatial configurations, residential projects can significantly enhance well-being. The Tahoe Residential Project exemplifies the application of these strategies, aligning with global wellness benchmarks to create a holistic living environment. These insights will inform the research by evaluating how these design strategies can be further optimized within high-end residential spaces, ensuring that wellness remains a central tenet in luxury interior architecture.

3. Space Planning Strategies for Wellness

Building on insights from the literature review, this section explores the implementation of wellness-centered space planning strategies in the Tahoe Residential Project. The approach integrates customized millwork, strategic FF&E (Furniture, Fixtures, and Equipment) selection, and the use of biophilic and sustainable materials to enhance spatial efficiency, ergonomic functionality, and psychological well-being.

a) Millwork and Storage Optimization

To reduce visual clutter and enhance mental clarity, the project incorporated custom millwork solutions that seamlessly integrate storage while maintaining aesthetic harmony. Key strategies included:

- **Integrated Storage Systems** – Floor-to-ceiling cabinetry with concealed compartments was designed to minimize visual distractions, promoting a sense of order and tranquility.
- **Ergonomic Enhancements** – Features such as soft-close hardware, pull-out shelves, and height-adjustable

compartments were integrated to improve accessibility and support universal design principles.
- **Sustainable Material Selection** – FSC-certified wood and low-VOC finishes were prioritized to enhance indoor air quality, aligning with LEED and WELL building standards.

Figure 1: Kitchen design for tahoe project
Source: Authors own processing

b) FF&E Selection for Comfort and Functionality

The selection and arrangement of furniture played a key role in enhancing user comfort, social engagement, and spatial efficiency:

- **Optimized Furniture Layouts** – Seating arrangements were strategically planned to encourage both social interaction and individual relaxation, maintaining fluid circulation paths.
- **Wellness-Focused Materials** – Hypoallergenic upholstery, OEKO-TEX-certified textiles, and non-toxic adhesives were selected to minimize allergen exposure and improve indoor air quality.
- **Adaptive FF&E** – Modular seating, height-adjustable tables, and multifunctional furniture were integrated to provide flexibility for different user needs and activities.

4. Sustainable and Wellness-Oriented Material Selection

Material selection plays a critical role in promoting sustainability and occupant well-being in residential environments. The Tahoe Residential Project prioritizes environmentally responsible and health-conscious materials, aligning with LEED and WELL certification standards to enhance indoor air quality, durability, and overall comfort.

a) Ethically Sourced Wood and LEED Compliance

The project integrates FSC-certified wood, ensuring responsible forestry practices while minimizing environmental impact. Studies suggest that exposure to natural materials, such as wood, supports cognitive restoration and stress reduction by reinforcing a biophilic aesthetic [14]. Additionally, wood surfaces finished with low-VOC (volatile organic compound) coatings improve indoor air quality by reducing harmful off-gassing.

b) High-Performance Surface Materials

The selection of durable and low-maintenance surfaces contributes to both sustainability and hygiene. A comparative analysis of Dekton countertops versus traditional stone highlights key benefits in longevity, maintenance, and health impact:

- Dekton Countertops vs. Traditional Stone – As a sintered stone material, Dekton offers superior resistance to stains, scratches, and thermal shock. Unlike porous materials such as granite and marble, it eliminates the need for sealing, reducing chemical treatments and improving long-term sustainability.
- Impact on Indoor Air Quality – The integration of antimicrobial and non-porous surfaces minimizes allergen buildup and bacterial growth, significantly enhancing hygiene. Research indicates that antibacterial coatings on high-touch surfaces can reduce microbial contamination in residential settings.

c) FF&E Material Choices

Furniture, fixtures, and equipment (FF&E) selections prioritize occupant health, longevity, and sustainability.

- Hypoallergenic and Sustainable Fabrics: Organic textiles such as GOTS-certified cotton, linen, and hemp ensure that fabrics are free from harmful substances. Wool-based upholstery naturally resists dust mites and mold, promoting better indoor air quality.
- Non-Toxic Paints and Finishes: Low- and zero-VOC paints and finishes from brands like Benjamin Moore Natura and ECOS Paints prevent indoor air pollution while offering high durability.
- Ergonomic and Durable Selections: Upholstered seating features natural latex cushions and soy-based foam, providing long-lasting comfort without the harmful emissions of conventional polyurethane foams. Sustainably sourced, FSC-certified case goods ensure both durability and environmental responsibility.

Table 1: Material Selection and Wellness Benefits by Author

Material	Properties	Wellness Benefits	Application	Certifications
Wood	Sustainable, durable, natural aesthetics	Promotes well-being, reduces environmental impact	Wall panels, millwork, furniture	FSC (Forest Stewardship Council)
Dekton (Engineered Stone)	Heat-resistant, non-porous, durable	Antimicrobial, sustainable, long-lasting surface	Countertops, backsplashes	NSF, Greenguard, EPD
Upholstery	Low-VOC, non-toxic, fire-resistant	Enhances indoor air quality, reduces allergens	Seating, soft furnishings	Greenguard, Oeko-Tex, Cradle to Cradle
Low-VOC Paints	Non-toxic, reduces off-gassing	Enhances indoor air quality, minimizes respiratory issues	Walls, ceilings	Green Seal, Greenguard
Recycled Glass	Non-porous, durable, antimicrobial	Prevents bacterial growth, sustainable alternative	Countertops, backsplashes	Cradle to Cradle, NSF
Clay Plaster	Breathable, absorbs humidity, non-toxic	Regulates indoor humidity, enhances air quality	Walls, ceilings	LEED, Living Building Challenge
Wool Carpets	Hypoallergenic, natural moisture regulator	Improves air quality, softens acoustics	Flooring, area rugs	Cradle to Cradle, Greenguard
Terrazzo	Recycled content, durable, low maintenance	Reduces material waste, long lifespan	Flooring, countertops	LEED, NSF
Smart Glass (Low-E, Electrochromic)	Adjustable transparency, UV protection	Controls glare, optimizes daylight exposure	Windows, partitions	ENERGY STAR, LEED, Cradle to Cradle

5. Impact of Interior Architecture Decisions on Family Wellness

Interior architecture shapes the way occupants experience and interact with their environment. The Tahoe Residential Project prioritizes design strategies that enhance well-being through thoughtful space planning, accessibility, and social connectivity.

1) Mental and Emotional Well-Being

- Biophilic Design Elements: Maximizing daylight access, integrating indoor greenery, and using organic textures create a restorative atmosphere that supports mental well-being.
- Visual Harmony and Stress Reduction: A cohesive design language, intentional spatial arrangement, and clutter-free environments promote relaxation and enhance cognitive comfort.

2) Physical Health and Accessibility

- Universal Design Principles: Barrier-free layouts with wide circulation paths, curbless showers, and strategically placed storage enhance ease of movement for all users.
- User-Centric Functionality: Adjustable surfaces, ergonomic furniture, and intuitive layouts ensure comfort while supporting long-term usability.

3) Social Interaction and Daily Functionality

- Flexible and Adaptive Spaces: Open-concept layouts foster family connection, while adaptable partitions and multifunctional furniture allow for privacy and evolving household needs.
- Strategic Space Utilization: Thoughtful furniture placement and zoning strategies create intentional gathering areas while maintaining fluid movement throughout the home.

6. Conclusion

This study underscores the pivotal role of interior architecture in enhancing occupant wellness within high-end residential environments. Through a detailed examination of the Tahoe Residential Project, it has been demonstrated that biophilic design principles, sustainable material selection, and ergonomic spatial planning significantly contribute to physical and psychological well-being. The findings align with LEED and WELL standards, reinforcing the importance of environmentally responsible design strategies in fostering healthier indoor environments.

The integration of natural elements, such as daylight, greenery, and organic textures, promotes cognitive restoration and reduces stress levels. Additionally, universal design principles and ergonomic enhancements ensure accessibility, ease of movement, and long-term usability for diverse occupants. By prioritizing low-VOC finishes, hypoallergenic textiles, and antimicrobial surfaces, the project successfully enhances indoor air quality, creating a living environment that is both aesthetically refined and functionally optimized.

As the demand for wellness-centered residential design continues to grow, interior architects must adopt evidence-based design strategies that holistically address occupant health. Future research could explore the quantitative impacts of these strategies on well-being, further validating their long-term benefits. Ultimately, this study provides a structured framework for designing high-end residential interiors that not only elevate luxury living but also foster a healthier, more sustainable, and wellness-oriented lifestyle.

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