# 5th International Conference on Environmental Design and Health, ICED2024







"Neuroarchitectural Design: Optimizing Patient Recovery through Spatial and Sensory Integration"

G. Oguz Atakan

Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, 7624, Pécs, Hungary (quowaao.pte@pte.hu)

# INTRODUCTION

Neuroarchitecture is an interdisciplinary research field that integrates neuroscience and architecture and focuses on how individuals interact with the built environments. Since 2000, the discipline of neuroarchitecture has grown to explain the relationship between the brain and perceived surroundings. [1]

This approach is particularly significant in healthcare settings, where the built environment plays a crucial role in patient recovery and overall well-being. By understanding how spatial and sensory elements impact human behavior and health, architects can design spaces that promote healing and comfort.

The concept of neuroarchitectural design is rooted in the idea that the physical environment can influence neurological and psychological processes. In healthcare facilities, optimizing spatial and sensory integration can lead to significant improvements in patient outcomes.

This study seeks to identify and evaluate key neuroarchitectural design elements that contribute to patient recovery. The ultimate goal is to provide actionable insights and recommendations for incorporating neuroarchitectural principles into future healthcare facility designs. Some examples of architectural and design elements that neuroarchitecture account for are: Spatial configurations, Lighting, Acoustics, Colour, Atmosphere, Scale, Way-finding, Continuity and transparency ,Access to art and nature.

To put some of these elements into perspective, one article argues that such religious monumental architecture uses features like large scale, vertical position, and high ceilings to target sensory biases and evoke awe. [2]

The asclepieia healing temples built in Ancient Greece are another example of neuroarchitecture. Their therapeutic landscapes were strategically designed to help healing and well-being, considering architectural factors such as the natural setting, the built environment, sense of place, and symbolic landscape. [3]

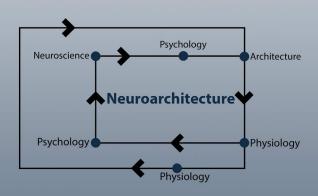


Figure 1: The Interdisciplinary Nature of Neuroarchitecture

# **METHODOLOGY**

### **Mixed-Methods Approach:**

•Combines qualitative and quantitative techniques to explore how spatial and sensory elements influence patient outcomes.

### **Literature Review:**

•Analyzed existing research, case studies, and expert opinions on neuroarchitectural design in healthcare settings.

### **Case Studies:**

•Selected healthcare facilities, such as Acıbadem Maslak Hospital in Istanbul. Focused on natural light, views of nature, soundscapes, and patient control systems.

### **Survey Development:**

•Created a 50-question survey for patients, relatives, and healthcare professionals. Topics included demographics, perceptions of the healthcare environment, and neuroarchitectural elements. Utilized Google Survey for broader data collection from patients and healthcare staff.

### Interviews:

•Conducted semi-structured interviews with architects and designers. Gathered insights on the practical challenges and benefits of neuroarchitectural design.

•Collected patient recovery metrics: length of hospital stay, readmission rates, and patient satisfaction scores. Ensured anonymity and confidentiality of all respondents.

### **Data Analysis:**

•Used statistical methods to identify trends and significant factors. Conducted comparative analysis of recovery metrics between analysis of interview transcripts to correlate qualitative insights with quantitative data.

### **RESULTS**

### **Natural Light:**

Patients in rooms with ample natural light experienced up to 20% shorter hospital stays and reduced use of pain medication. They also reported improved mood and better sleep quality. [4] [5]

Access to views of nature significantly enhanced patient recovery rates. Patients with views of nature reported lower stress levels, faster recovery from surgery and infections, and higher overall satisfaction with their care. [4] [5]

### **Acoustic Environment:**

Reducing noise levels through sound-absorbing materials and controlled soundscapes decreased patient stress and improved recovery experiences. These measures contributed to a calmer and more restful environment. [6] [7]

### **Biophilic Design:**

Incorporating natural elements such as indoor gardens, water features, and natural materials (wood, stone) into hospital design reduced stress and enhanced the healing process. Biophilic design elements created a connection with nature, supporting psychological well-being. [8]

# **Patient Control and Personalization:**

Allowing patients to control their environment, such as adjusting room temperature, lighting, and sound levels, enhanced their comfort and sense of control. This empowerment led to improved mental well-being and faster recovery. Integrating technology that enabled patients to monitor their health metrics, such as heart rate and blood pressure, provided real-time feedback and promoted active participation in their own care, reducing anxiety and improving outcomes. [7] [8]

### **Overall Patient Satisfaction:**

Survey responses indicated that patients in neuroarchitecturally designed environments had higher satisfaction scores, averaging 9.0 out of 10, traditional and neuroarchitecturally designed facilities. Thematic compared to 7.0 in traditional settings. Comparative analysis showed a significant reduction in average length of hospital stay, from 10 days in traditional environments to 8 days in neuroarchitecturally designed settings.

### CONCLUSION

The integration of neuroarchitectural design principles in healthcare settings significantly enhances patient recovery and satisfaction. Key elements such as natural light, views of nature, acoustic treatments, and biophilic design contribute to a healing environment that promotes physical and psychological well-being. Allowing patients to control their environment and providing comfortable, home-like furnishings for both patients and their chaperones further improves recovery outcomes. Empirical data from surveys and case studies support these findings, demonstrating reduced hospital stays and higher patient satisfaction in neuroarchitecturally designed facilities. These insights underscore the importance of incorporating evidence-based design principles in future healthcare facility projects to optimize patient care and support.

Comparison of Patient Recovery Metrics in Traditional vs. Neuroarchitecturally Designed Environments. This graph illustrates that neuroarchitecturally designed environments significantly improve patient recovery metrics, including shorter hospital stays and higher patient satisfaction scores.

# Readmission Rate (%) ■ Recovery Rate (%) ■ Satisfaction Score (%) ■ Lengt of Stay (days)

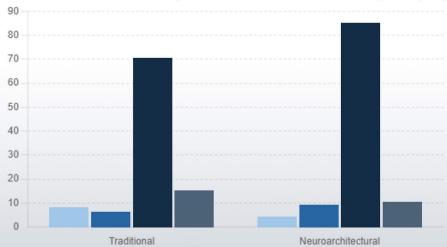


Figure 3: Comparison of Patient Recovery Metrics in Traditional vs. Neuroarchitecturally Designed Environments

# **SURVEY DATA RESULTS**

The survey collected ratings on various aspects of the hospital environment from patients, doctors, and healthcare staff.

Overall Experience: The majority of respondents rated their overall experience highly, with most giving a rating of 4 or 5.

Views of Nature: Over 60% of respondents rated the importance of views of nature as 5, highlighting its significant impact on patient well-being.

**Natural Light:** Ratings indicated that natural light greatly affects mood, with a high percentage giving it a rating of 4 or 5.

Patient Control: The ability to control room temperature and environment was rated highly, reflecting its importance for patient comfort and satisfaction.

Healing Gardens: The availability and importance of healing gardens received high ratings, emphasizing the value of biophilic design elements in healthcare settings.

Figure 2: Survey Results of Patient Experience and Environment

# REFERENCES

- 1. Eberhard, J. P. (2009). Applying Neuroscience to Architecture. Neuron, 62(6), 753–756.
- 2. Joye, Y., & Verpooten, J. (2013). An Exploration of the Functions of Religious Monumental Architecture from a Darwinian Perspective. Review of General Psychology, 17(1), 53-68.
- 3. Gesler, W. M. (1993). Therapeutic Landscapes: Theory and a Case Study of Epidauros, Greece. Environment and Planning D: Society and Space, 11(2), 171–189.
- 4. Ugreen.io. (2021). Neuroarchitecture: A Comprehensive Guide for Architects.
- 5. PLOS ONE. (2021). The Role of the Physical Environment in Stroke Recovery. Evidence-based Design Principles from a Mixed-Methods Multiple Case Study. PLOS ONE, 16(1), Article e0280690.
- 6. CMBA Architects. (2021). Hospital Design's Role in Patient Comfort and Recovery. Blog
- **7.** Critical Care. (2021). Creating the ICU of the Future: Patient-Centered Design to Optimize Recovery. Critical Care, 25(1), Article 13054-019-2616-1.
- **8.** City, Territory and Architecture. (2021). Applying the Benefits of Biophilic Theory to Hospital Design. City, Territory and Architecture, 8(1), Article 0076-1.