

Embedding Preparedness in Everyday Interior Architecture: An Evidence-Derived Framework from Comparative Case Analysis

Naina Maggie Cleetus

Department of Interior Architecture & Design, UnitedWorld Institute of Design, Karnavati University, Gujarat, India

cleetusnaina@gmail.com

<https://orcid.org/0009-0000-0842-0083>

Abstract

The increasing frequency and complexity of natural hazards, climate-related emergencies, pandemics, humanitarian crises, and infrastructure failures have intensified the need for resilient built environments. Despite advances in structural resilience and emergency planning, preparedness remains largely conceptualized as an operational response activated during crises, with limited attention to how everyday interior environments can support occupants before disruption occurs. This study investigates whether preparedness can be understood as an intrinsic architectural quality embedded within Interior Architecture. Using an inductive theory-building approach, a comparative qualitative analysis of nine international architectural precedents was conducted across diverse disaster contexts, programs, and spatial scales. Each case was evaluated using a common analytical framework examining spatial organization, privacy, familiarity, autonomy, spatial control, adaptive capacity, and psychosocial outcomes. Cross-case synthesis identified six recurring spatial principles that consistently strengthened adaptive human–environment relationships. These findings form the Theory of Embedded Preparedness (TEP), which conceptualizes preparedness as a continuous environmental condition emerging through adaptive spatial systems, human–environment interaction, and psychosocial resilience. The study offers a transferable theoretical framework that advances Interior Architecture by embedding preparedness into everyday design, supporting healthier, more adaptive, and resilient interior environments before, during, and after disruption.

Keywords: Interior architecture, Embedded Preparedness, Salutogenic Design, Disaster Preparedness, Environmental Psychology, Adaptive Environments, Resilience, Behavioural Architecture.

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1. Introduction

1.1 Background and Problem Statement

The increasing frequency, intensity, and interconnected nature of disruptive events including natural hazards, climate-induced emergencies, pandemics, humanitarian crises, technological failures, and large-scale displacement have fundamentally reshaped contemporary understandings of preparedness within the built environment. Although substantial advances have been made in structural engineering, building technologies, emergency management, and resilience planning, comparatively little attention has been directed towards understanding how everyday interior environments can support occupants before, during, and after disruption. Consequently, preparedness continues to be conceptualised

predominantly as an operational function activated during emergencies rather than as an intrinsic quality of the environments people occupy every day. Over the past two decades, international disaster risk reduction policy has increasingly emphasised preparedness as a fundamental component of resilience. The Sendai Framework for Disaster Risk Reduction 2015–2030 advocates a transition from reactive emergency response towards proactive risk reduction through integrated planning, resilience building, and preparedness across multiple scales. Similarly, resilience research has shifted from viewing buildings as static physical objects towards understanding them as dynamic socio-spatial systems capable of anticipating, absorbing, adapting to, and recovering from disruption (Charlesworth & Fien, 2022; Laboy & Fannon, 2016). Despite these developments, recent disasters have demonstrated that structural resilience alone is insufficient to support effective human adaptation. Buildings may remain physically intact while occupants experience confusion, loss of orientation, diminished autonomy, heightened stress, and impaired decision-making under rapidly changing conditions. Increasingly, resilience is recognised as a multidimensional phenomenon emerging through the interaction of physical settings, social systems, and human experience rather than through structural performance alone (Laboy & Fannon, 2016; Meerow et al., 2016). Interior environments occupy a critical position within this relationship because they form the immediate interface between occupants and the built environment. Spatial organization, circulation, environmental cues, furniture systems, and opportunities for user interaction shape how occupants perceive, understand, and respond to their surroundings. Environmental psychology has consistently demonstrated that spatial environments influence cognition, stress regulation, behavioural responses, perceived control, and environmental comprehension through the affordances they provide (Gibson, 1986; Hellwig, 2015; Kim, 2021). Complementing this perspective, salutogenic theory proposes that environments promoting comprehensibility, manageability, and meaningfulness strengthen people's capacity to cope with challenging circumstances, thereby supporting health, wellbeing, and adaptive functioning (Mittelmark et al., 2022; Vinje et al., 2017). Together, these perspectives suggest that interior environments can actively support preparedness through adaptive human behaviour. However, preparedness within both policy and practice remains overwhelmingly operational. Operational measures such as planning, drills, communication, and resource stockpiling continue to dominate preparedness strategies. While these measures are indispensable, they typically become active only after disruption has occurred. Comparatively less attention has been directed towards understanding how the everyday interior environment itself might cultivate preparedness through its spatial organisation, environmental characteristics, and behavioural affordances. Consequently, architecture is often regarded as the setting within which preparedness occurs rather than as an active contributor to the production of preparedness. This distinction is particularly significant for Interior Architecture. Unlike emergency infrastructure, interior environments are continuously occupied and negotiated through everyday life. Consequently, they can embed adaptive capabilities into routine patterns of occupation long before disruptive events occur. If preparedness is understood as an environmental condition influencing perception, behaviour, autonomy, and psychosocial stability, Interior Architecture assumes a central role in cultivating resilient everyday environments rather than merely supporting emergency response. These observations reveal an important conceptual challenge. Although numerous disciplines acknowledge that environments influence human adaptation, preparedness continues to be framed primarily as an external operational process rather than as an inherent spatial capability. This raises a fundamental question that has received comparatively little attention within Interior Architecture: *Can preparedness itself be understood as a property of interior environments?* Addressing this question requires moving beyond conventional emergency response paradigms towards a broader understanding of how Interior Architecture can proactively support adaptive human behaviour through the design of everyday environments.

1.2 Preparedness Beyond Emergency Response

Preparedness has traditionally been understood as the collection of institutional, organisational, and

individual measures undertaken before hazardous events to reduce potential losses and improve response effectiveness. International disaster risk reduction frameworks emphasise preparedness through contingency planning, emergency communication systems, evacuation procedures, resource stockpiling, simulation exercises, capacity building, and governance mechanisms that strengthen societal resilience (UNHCR,2007; Gaillard et al., 2012). While these approaches have advanced disaster management by shifting attention from reactive response to proactive risk reduction, preparedness continues to be conceptualised primarily as an operational capability activated during emergencies rather than as a continuous environmental condition embedded within everyday life. This operational perspective has strongly influenced the built environment. Within architectural practice, preparedness is typically represented through emergency infrastructure including emergency exits, refuge areas, evacuation systems, fire protection, medical facilities, and temporary shelters. Although essential for life safety, these measures are generally conceived as additions to buildings rather than inherent qualities of architectural space. Consequently, everyday interior environments often remain passive in their capacity to guide behavior, support decision-making, or facilitate adaptation before disruption occurs. For Interior Architecture, this distinction is particularly significant. Operational preparedness relies on procedures, equipment, institutional coordination, and individual compliance, whereas spatial preparedness concerns environments' ability to continuously support adaptive human behaviour through spatial organisation, environmental cues, and embedded affordances. Rather than depending solely on occupants recalling emergency instructions under stressful conditions, environments can reduce cognitive demands by making appropriate actions intuitive through spatial experience. This perspective aligns with ecological psychology, which proposes that individuals perceive opportunities for action directly through environmental affordances rather than solely through conscious reasoning or prior instruction (Gibson, 1986; Norman, 2013). Recent developments in environmental psychology and adaptive architecture increasingly recognise buildings as active participants in shaping perception, movement, and decision-making through spatial organisation (Hellwig, 2015; Kim, 2021). Adaptive environments demonstrate that flexibility, transformability, and user participation enhance environmental performance (Schmidt Iii & Austin, 2016), while salutogenic theory argues that environments promoting comprehensibility, manageability, and meaningfulness strengthen people's capacity to cope with challenging situations (Mittelmark et al., 2022; Vinje et al., 2017). Collectively, these perspectives suggest that preparedness may emerge through everyday spatial experience rather than emergency procedures alone. Existing architectural research has largely focused on temporary shelters, emergency healthcare facilities, modular construction systems, deployable housing, and post-disaster reconstruction, generating important innovations in rapid assembly, structural flexibility, and humanitarian accommodation. Comparatively little attention has been directed towards understanding how everyday interior environments themselves might function as permanent systems of preparedness capable of supporting occupants before, during, and after disruption. As a result, preparedness continues to be treated as something added to architecture rather than embedded within it. Recognising this distinction represents a fundamental shift in perspective. If preparedness is understood as an environmental property rather than solely an operational process, then the role of Interior Architecture extends beyond accommodating emergency functions towards actively shaping adaptive behaviour through the design of everyday environments.

1.3 Research Gap

The growing body of research spanning disaster preparedness, resilience, environmental psychology, salutogenic design, adaptive architecture, behavioural science, and interior design demonstrates that the built environment significantly influences human adaptation during periods of uncertainty. Across these fields, scholars consistently recognise that environments shape perception, movement, decision-making, stress regulation, social interaction, and psychological wellbeing through their spatial organisation, environmental affordances, and opportunities for human engagement (UNHCR,2007; Gibson, 1986; Hellwig, 2015; Kim, 2021; Mittelmark et al., 2022; Vinje et al., 2017). However, these

contributions have largely evolved within disciplinary boundaries, resulting in fragmented understandings of how interior environments collectively support preparedness.

Within disaster risk reduction research, preparedness is predominantly examined through governance, emergency planning, institutional capacity, early warning systems, and community resilience (UNHCR, 2007; Gaillard et al., 2012). Conversely, environmental psychology demonstrates how spatial environments influence cognition, behaviour, environmental comprehension, and perceived control (Hellwig, 2015; Kim, 2021), while salutogenic research shows that environments promoting comprehensibility, manageability, and meaningfulness enhance health and adaptive capacity (Mittelmark et al., 2022; Vinje et al., 2017; Von Lindern et al., 2017). Adaptive architecture similarly emphasises flexibility, transformability, modularity, and responsive spatial systems (Charlesworth & Fien, 2022; Schmidt Iii & Austin, 2016), whereas trauma-informed design highlights safety, autonomy, familiarity, environmental choice, and psychological security as critical to recovery (Bollo & Donofrio, 2022). Although these perspectives offer valuable insights into adaptive environments, they have rarely been integrated into a unified theoretical understanding of preparedness within Interior Architecture. This fragmentation is particularly evident within Interior Architecture. Existing studies have largely focused on emergency shelters, temporary healthcare facilities, modular housing, humanitarian settlements, deployable furniture systems, and post-disaster reconstruction. However, these investigations are typically project-, typology-, or disaster-specific, focusing on immediate functional challenges rather than identifying transferable spatial characteristics that consistently support preparedness across diverse contexts. Consequently, the discipline lacks a comprehensive theoretical framework explaining why certain interior environments repeatedly perform more effectively than others in supporting preparedness irrespective of disaster type, geographical location, programme, or scale. A further limitation is methodological. Existing architectural studies frequently document or evaluate individual precedents but rarely synthesise recurring spatial characteristics across multiple cases to generate theory. As a result, preparedness remains understood through isolated examples rather than broader explanatory principles capable of informing future research and practice. Addressing this limitation requires moving beyond descriptive case studies towards comparative theory building. Rather than asking whether individual design interventions are successful within specific projects, it becomes necessary to examine whether recurring spatial characteristics consistently emerge across diverse precedents regardless of disaster typology, programme, cultural context, or geographical setting. Identifying such recurring characteristics offers the opportunity to shift preparedness from a collection of project-specific solutions towards a transferable body of architectural knowledge. Accordingly, this study adopts a comparative qualitative approach to examine nine international precedents using a common analytical framework evaluating spatial organisation, behavioural outcomes, adaptive capacity, psychosocial continuity, and interior interventions. The projects are analysed collectively as empirical evidence from which recurring spatial characteristics are identified and synthesised. Through this process, preparedness is investigated not as an assumed theoretical construct but as an emergent architectural capability derived from systematic cross-case comparison. The resulting synthesis addresses the central gap identified throughout this section: the absence of an evidence-derived theoretical framework explaining how preparedness can be intentionally embedded within everyday Interior Architecture. Rather than proposing a framework based solely on conceptual reasoning, the study allows theoretical constructs to emerge inductively from recurring patterns observed across diverse architectural precedents, establishing a stronger empirical foundation for theory development.

1.4 Aim and Research Questions

Building upon the identified conceptual, methodological, and disciplinary gaps, this study investigates whether preparedness can be understood as an intrinsic quality of Interior Architecture rather than solely as an externally activated emergency response. Using an inductive theory-building approach, the research systematically compares nine international architectural precedents to identify recurring

spatial characteristics that support adaptive human behaviour across diverse disaster contexts. The overarching aim of this study is to develop an evidence-derived theoretical framework explaining how preparedness can be intentionally embedded within everyday interior environments. By synthesising comparative qualitative findings with established knowledge from resilience theory, salutogenesis, environmental psychology, adaptive architecture, and behavioural design, the study seeks to reposition preparedness as a continuous spatial capability that contributes to adaptive, health-promoting, and resilient interior environments. To achieve this aim, the study pursues the following research objectives:

- To critically synthesise interdisciplinary literature on disaster preparedness, resilience, salutogenic design, environmental psychology, adaptive architecture, and Interior Architecture to establish the theoretical foundations of preparedness within the built environment.
- To comparatively analyse nine international architectural and interior design precedents representing diverse disaster typologies, geographical contexts, programmes, and spatial scales using a common analytical framework.
- To identify recurring spatial characteristics that consistently support occupant autonomy, familiarity, privacy, spatial control, adaptive capacity, behavioural guidance, and psychosocial continuity across multiple contexts.
- To synthesise these recurring characteristics into an evidence-derived theoretical framework capable of informing future research and practice in Interior Architecture.

These objectives are addressed through the following research questions:

RQ1. What recurring spatial characteristics consistently support preparedness across diverse architectural and interior environments designed for disruptive events?

RQ2. How do these recurring spatial characteristics influence occupant autonomy, familiarity, privacy, spatial control, adaptive capacity, and psychosocial continuity during periods of disruption?

RQ3. How can the recurring characteristics identified through comparative analysis be synthesised into a transferable theoretical framework for embedding preparedness within everyday Interior Architecture?

Rather than assuming the existence of such a framework, the study treats these questions as an open theoretical inquiry. The analysis therefore progresses inductively from empirical observation to theoretical explanation, ensuring that the proposed framework is grounded in systematic cross-case evidence rather than conceptual speculation.

1.5 Contributions of the Study

This research makes four interrelated contributions to the emerging discourse on adaptive, salutogenic, and resilient interior environments.

1.5.1 Theoretical Contribution

The principal contribution of this study is the development of an evidence-derived theoretical framework that conceptualises preparedness as an intrinsic architectural capability embedded within everyday interior environments. By identifying recurring spatial characteristics across nine international precedents and synthesising them into a unified explanatory framework, the research establishes a coherent theoretical foundation for understanding preparedness as a continuous environmental quality rather than an externally activated emergency response.

1.5.2 Methodological Contribution

Methodologically, the study demonstrates the value of comparative qualitative theory building within Interior Architecture. Rather than employing case studies solely as descriptive examples or evaluations of individual projects, it uses systematic cross-case comparison to identify recurring spatial characteristics that transcend differences in disaster typology, geographical location, programme, and

scale. This approach extends the application of comparative precedent analysis from project documentation towards the generation of transferable architectural knowledge.

1.5.3 Disciplinary Contribution

The study further contributes to the advancement of Interior Architecture as a research discipline by integrating insights from environmental psychology, salutogenic design, resilience theory, adaptive architecture, affordance theory, behavioural science, and trauma-informed design within a single conceptual framework. In doing so, it positions Interior Architecture as an active contributor to preparedness through the design of environments that support adaptive human behaviour, rather than as a discipline primarily concerned with post-disaster accommodation or emergency response.

1.5.4 Practical Contribution

Finally, the study offers practical implications for the design of future interior environments. The recurring spatial characteristics identified through comparative analysis provide transferable principles that may inform healthcare facilities, educational environments, community buildings, workplaces, humanitarian housing, emergency shelters, and other settings where long-term adaptability, behavioural support, and psychosocial continuity are increasingly important. Rather than prescribing building-specific solutions, the framework encourages designers to embed preparedness within everyday spatial experience, thereby strengthening resilience before disruption occurs. Collectively, these contributions reposition preparedness from a reactive operational strategy to a proactive architectural capability, establishing a foundation for future research and practice at the intersection of Interior Architecture, adaptive design, and disaster resilience.

1.6 Structure of the Paper

The manuscript progresses inductively from problem identification through comparative analysis to theory development. Section 2 establishes the theoretical foundations of the study by synthesising literature on disaster preparedness, resilience, environmental psychology, salutogenic design, adaptive architecture, human agency, and Interior Architecture, culminating in the identification of the research gap. Section 3 outlines the research philosophy, comparative qualitative methodology, case selection strategy, analytical framework, and coding procedures used to examine nine international architectural precedents. Section 4 presents the comparative case analysis, synthesising evidence across the selected precedents to identify recurring spatial characteristics associated with preparedness. Building on these findings, Section 5 undertakes cross-case synthesis and develops the Theory of Embedded Preparedness (TEP) by identifying higher-order spatial principles and organising them into a coherent theoretical framework. Section 6 discusses the theoretical, disciplinary, and practical implications of TEP in relation to existing scholarship and outlines directions for future research. Finally, Section 7 concludes the paper by summarising the principal contributions of the study, acknowledging its limitations, and highlighting opportunities for future investigation.

2. Theoretical Foundations

The relationship between interior environments and preparedness cannot be understood through a single disciplinary perspective. Rather, it emerges through the convergence of multiple theoretical traditions within Interior Architecture. Each of these domains contributes valuable insights into how environments influence human adaptation during periods of uncertainty. However, their contributions have largely evolved independently, resulting in fragmented understandings of preparedness that privilege either operational systems or individual design strategies without establishing a coherent theoretical explanation of preparedness as an environmental capability. This section critically synthesises these complementary bodies of knowledge to establish the conceptual foundations of the study. Rather than reviewing each discipline in isolation, the discussion progressively demonstrates how recurring ideas concerning adaptation, environmental cognition, autonomy, behavioural

guidance, flexibility, and psychosocial wellbeing converge towards a common architectural question. Through this synthesis, the literature review moves beyond descriptive summary to identify the theoretical relationships that ultimately justify the need for an evidence-derived framework explaining preparedness within everyday interior environments.

2.1 Disaster Preparedness: From Operational Readiness to Spatial Capability

Disaster preparedness has long been recognised as one of the fundamental components of disaster risk reduction, representing the capacity of individuals, institutions, communities, and governments to anticipate, respond to, and recover effectively from hazardous events (*Sendai Framework for Disaster Risk Reduction 2015 - 2030*, 2015). Contemporary preparedness frameworks encompass a broad range of activities, including hazard assessment, emergency planning, evacuation procedures, communication systems, simulation exercises, resource management, institutional coordination, and public education. Collectively, these measures seek to reduce vulnerability by improving the efficiency and effectiveness of response before disasters occur. Within disaster management literature, preparedness has predominantly been framed in terms of planning, organisational readiness, institutional capacity, and emergency response systems (Twigg, 2015). The evolution of international disaster policy reflects a gradual shift from reactive emergency management towards proactive risk reduction. Earlier approaches concentrated primarily on post-disaster response and recovery, whereas more recent frameworks including the Hyogo Framework for Action (2005–2015) and subsequently the Sendai Framework for Disaster Risk Reduction 2015–2030 have increasingly emphasised preparedness as a continuous process integrated into sustainable development, governance, community participation, and resilience planning (*Sendai Framework for Disaster Risk Reduction 2015 - 2030*, 2015). This transition represents a significant conceptual advancement by recognising that preparedness extends beyond emergency response and requires long-term investment in systems capable of reducing future disaster impacts. Despite these developments, preparedness continues to be interpreted predominantly through operational mechanisms. Existing frameworks frequently evaluate preparedness in terms of institutional capacity, emergency logistics, policy implementation, warning systems, evacuation efficiency, and organisational coordination (Gaillard et al., 2012; Paton, 2017). Buildings within these frameworks are generally understood as locations in which preparedness activities occur rather than as active agents influencing preparedness itself. Architectural interventions consequently focus on emergency exits, structural integrity, refuge areas, temporary infrastructure, and compliance with safety regulations, while comparatively little attention is directed towards the everyday spatial qualities that shape occupants' behaviour before emergencies arise.

This operational emphasis has important implications for Interior Architecture. Human responses during disruptive events are rarely determined solely by prior knowledge or emergency procedures. Under conditions of stress and uncertainty, individuals rely heavily on environmental information to interpret situations, navigate unfamiliar spaces, identify opportunities for action, and regulate behaviour (Gibson, 1986; Norman, 2013). Consequently, preparedness cannot be understood exclusively as something that people possess through training or planning; it is also influenced by the environments through which they perceive, interpret, and respond to changing conditions.

Emerging scholarship increasingly recognises that preparedness should be understood as a dynamic interaction between social systems, human behaviour, and environmental conditions rather than as an isolated operational function (Paton, 2017). Nevertheless, the architectural dimension of preparedness remains comparatively underdeveloped. Although buildings are expected to withstand physical hazards and accommodate emergency procedures, relatively little theoretical attention has been directed towards understanding how their interior environments might continuously cultivate preparedness through spatial organisation, behavioural guidance, environmental legibility, or adaptive capacity. Consequently, preparedness remains conceptualised primarily as an externally activated response rather than an intrinsic environmental characteristic embedded within everyday occupation. This distinction reveals an important conceptual limitation. If preparedness is understood solely as operational readiness, the contribution of interior architecture remains restricted to supporting

emergency functions after hazards become apparent. However, if preparedness is viewed as a quality emerging through continuous interaction between occupants and their environments, then architectural space itself becomes an active contributor to adaptive behaviour. Such a perspective requires expanding preparedness beyond institutional planning towards a broader understanding of environmental capability one that recognises the role of spatial experience in shaping human adaptation before disruption occurs. This expanded understanding of preparedness naturally intersects with resilience theory, which similarly shifts attention from resisting disturbance towards understanding how complex systems anticipate, adapt to, and transform in response to change. Examining resilience therefore provides the next essential step in understanding how preparedness may become embedded within the built environment.

2.2 Resilience Theory: Beyond Resistance Towards Adaptive Capacity

The concept of resilience has undergone substantial evolution over the past five decades, expanding from its origins in engineering and ecology to become one of the central organising concepts within disaster risk reduction, sustainability, urban planning, and the built environment. Early engineering interpretations defined resilience primarily as the capacity of structures or systems to resist disturbance and rapidly return to their original state following disruption (Holling, 1973). While this perspective contributed significantly to improving structural performance and hazard mitigation, it largely conceptualised resilience as a property of physical systems, placing comparatively little emphasis on human adaptation or the dynamic relationships between people and their environments.

Subsequent developments within ecological and socio-ecological resilience fundamentally broadened this understanding. Rather than equating resilience with recovery to a previous equilibrium, resilience increasingly came to describe the capacity of complex systems to absorb disturbance, reorganise, adapt, and continue functioning under changing conditions (Folke, 2006; B. H. Walker & Salt, 2010). This shift recognised that disturbances frequently transform systems rather than merely interrupting them, requiring adaptive responses that extend beyond physical resistance. Consequently, resilience became understood as an ongoing process of learning, adaptation, and transformation rather than a singular outcome achieved after disruption. Within the built environment, these conceptual developments prompted a gradual rethinking of architectural resilience. Buildings could no longer be evaluated solely according to their structural capacity to withstand hazards; instead, resilience increasingly encompassed the ability of architectural environments to accommodate changing patterns of occupation, evolving user requirements, and uncertain future conditions (Laboy & Fannon, 2016). Adaptive reuse, flexible planning, modular construction, responsive building systems, and transformable interiors emerged as architectural strategies capable of extending the functional life and adaptive performance of buildings under conditions of uncertainty (Charlesworth & Fien, 2022; Schmidt Iii & Austin, 2016). This broader understanding has significantly advanced architectural discourse by positioning buildings as dynamic socio-spatial systems rather than static physical artefacts. Contemporary resilience thinking recognises that environmental performance depends not only on structural robustness but also on the continuous interaction between occupants, spatial organisation, technological systems, and social practices (Laboy & Fannon, 2016). In this relational perspective, resilience is not inherent within materials or structures alone; rather, it emerges through ongoing interactions among environmental conditions, human behaviour, institutional processes, and cultural practices. Architecture therefore becomes an active participant in adaptation rather than merely a container within which adaptation occurs. Nevertheless, important limitations remain when resilience is translated into architectural practice. Much of the existing literature continues to evaluate resilient buildings through measures such as structural performance, energy efficiency, infrastructure continuity, flexibility of use, or post-disaster recovery capacity (Charlesworth & Fien, 2022; Meerow et al., 2016). Although these dimensions are indispensable, they frequently privilege system-level performance over every day human experience. Comparatively less attention has been directed towards understanding how interior environments support occupants' cognitive, behavioural, and psychosocial adaptation while disruption is unfolding. Consequently, resilience is often assessed according to what

buildings can endure rather than how occupants experience and navigate those environments during periods of uncertainty. This distinction is particularly significant because human adaptation represents a fundamental dimension of resilient environments. Occupants experiencing disruption must continually interpret changing environmental conditions, make decisions under uncertainty, regulate emotional responses, maintain social relationships, and adapt their behaviour to unfamiliar circumstances. These adaptive processes are profoundly influenced by the physical characteristics of interior environments, including spatial legibility, environmental cues, opportunities for personal control, sensory conditions, and the availability of flexible spatial configurations. Yet these behavioural dimensions remain comparatively underrepresented within conventional resilience frameworks, which continue to privilege infrastructural and organisational indicators over lived spatial experience. Recent scholarship has begun to acknowledge this imbalance by emphasising resilience as a human-centred process involving learning, adaptability, participation, and agency rather than solely technical performance (Folke, 2006; Paton, 2017). Such perspectives suggest that resilient environments should not simply survive disruption but should actively support occupants in understanding, managing, and adapting to changing circumstances. This interpretation aligns closely with emerging research in environmental psychology and salutogenic design, both of which investigate how spatial environments influence cognition, behaviour, wellbeing, and adaptive functioning through everyday interaction. Recent built-environment scholarship similarly argues that resilience should be embedded within the design of the built environment itself rather than considered solely as an operational response following disasters (Mohareb & Maassarani, 2018). Accordingly, resilience provides an essential foundation for understanding preparedness but does not, by itself, fully explain the mechanisms through which interior environments influence human adaptation. While resilience establishes the importance of adaptability, it offers comparatively limited explanation of how occupants perceive, interpret, and act within architectural space during disruption. Addressing this limitation requires engaging with environmental psychology, where the reciprocal relationship between human behaviour and spatial environments has been examined in considerably greater depth. This interpretation is also consistent with Masten's proposition that resilience arises through ordinary adaptive processes embedded within supportive environments (Masten, 2001). From this perspective, interior environments become active contributors to resilience by continuously strengthening occupants' capacity to adapt to uncertainty.

2.3 Environmental Psychology: Understanding Human–Environment Interaction During Disruption

While preparedness establishes the importance of proactive planning and resilience explains the adaptive capacity of systems, neither sufficiently accounts for the mechanisms through which occupants perceive, interpret, and respond to their immediate surroundings during periods of disruption. Environmental psychology addresses this limitation by examining the reciprocal relationship between people and their physical environments, demonstrating that behaviour is not determined solely by individual cognition or external circumstances but emerges continuously through interaction with spatial settings. This perspective has significantly expanded understanding of the built environment from a passive physical backdrop to an active participant in shaping perception, behaviour, emotional regulation, and adaptive decision-making (Gifford, 2014; Hellwig, 2015). More recent resilience scholarship further conceptualises resilience as an ordinary adaptive process that emerges through supportive interactions between individuals and their environments rather than as an exceptional characteristic possessed by only a few (Masten, 2001). Early resilience research similarly recognised that positive adaptation emerges through protective environmental processes that buffer individuals against adversity rather than through individual characteristics alone (Rutter, 1987).

Environmental psychology emerged from the recognition that human behaviour cannot be fully understood without considering the environments in which it occurs. Rather than viewing behaviour as an exclusively internal psychological process, the discipline investigates how spatial organisation, environmental complexity, sensory qualities, wayfinding systems, territoriality, privacy, and perceived

control influence human experience across every day and exceptional circumstances (Altman & Vinsel, 1977; Gifford, 2014). Within architectural research, these insights have increasingly demonstrated that buildings influence not only functional performance but also cognitive processing, stress responses, social interaction, and behavioural adaptation. One of the discipline's most influential contributions is the concept of environmental affordances, introduced by Gibson (1986), which proposes that environments communicate opportunities for action directly through their physical characteristics. Affordances describe the actionable possibilities offered by an environment relative to the capabilities of its users. Importantly, these possibilities are perceived immediately rather than inferred through abstract reasoning. A clearly visible circulation path affords movement; a flexible partition affords spatial reconfiguration; accessible storage affords independent use; and intuitive visual cues afford orientation. From this perspective, behaviour emerges through continuous perception action relationships rather than through conscious interpretation alone. Interior environments therefore influence human adaptation by making certain behaviours easier, more intuitive, and more likely to occur. Norman (2013) further extended the concept of affordances within design theory by demonstrating that successful environments communicate their intended use through perceptible spatial cues that reduce cognitive effort and minimise uncertainty. Rather than requiring users to interpret complex instructions or rely exclusively on prior knowledge, well-designed environments guide behaviour through intuitive interaction. During disruptive events, when cognitive resources are often diminished by stress, urgency, and uncertainty, such environmental legibility becomes particularly important. Spatial environments capable of communicating appropriate actions through their configuration may therefore support adaptive behaviour independently of formal emergency procedures. Research on perceived control provides an additional dimension to understanding environmental adaptation. Across healthcare, workplace, educational, and residential environments, studies consistently demonstrate that opportunities for personal control over one's surroundings contribute to reduced stress, enhanced wellbeing, greater autonomy, and improved behavioural outcomes (Altman & Vinsel, 1977; Evans & McCoy, 1998; Gifford, 2014). Environmental features such as adjustable furniture, flexible layouts, personal territories, visual access, and user-controlled environmental conditions strengthen individuals' capacity to manage challenging situations by increasing predictability and reducing feelings of helplessness. During emergencies, these characteristics may become particularly significant because they enable occupants to adapt actively rather than remain passive recipients of environmental conditions. Environmental psychology has also established the importance of environmental legibility in supporting orientation and decision-making. Lynch's seminal work demonstrated that people construct cognitive maps through identifiable paths, landmarks, edges, districts, and nodes that facilitate navigation and environmental understanding (Lynch et al., 2025). Subsequent research has shown that spatial legibility significantly influences wayfinding efficiency, confidence, and behavioural performance, particularly within unfamiliar or stressful environments (Passini, 1984). During disruptive events, environments characterised by clear circulation patterns, visual continuity, intuitive zoning, and recognisable reference points reduce cognitive demands and support rapid, confident decision-making. Consequently, preparedness may depend not only on emergency information but also on the inherent clarity with which environments communicate spatial relationships. Another recurring theme concerns the relationship between environmental familiarity and psychological stability. Familiar settings reduce cognitive load because occupants possess established mental models regarding spatial organisation, expected behaviours, and available resources. Environmental familiarity has been associated with increased confidence, improved behavioural performance, reduced anxiety, and enhanced coping across healthcare, residential, and community environments (Gifford, 2014; Ulrich, 2008). Conversely, unfamiliar environments frequently require greater cognitive effort, increase uncertainty, and reduce occupants' capacity to respond effectively during periods of disruption. These observations suggest that preparedness may be strengthened through interior environments that preserve continuity with everyday patterns of occupation rather than relying exclusively on specialised emergency settings.

Collectively, environmental psychology demonstrates that adaptive behaviour is profoundly influenced by environmental characteristics extending well beyond functional performance. Spatial organisation, affordances, environmental legibility, familiarity, perceived control, and opportunities for interaction collectively shape how occupants interpret situations, regulate emotions, and respond to changing conditions. These findings significantly extend preparedness beyond operational planning by suggesting that adaptive behaviour can be continuously supported through the design of everyday interior environments. However, despite its substantial contribution to understanding human–environment interaction, environmental psychology has generally examined behavioural outcomes independently of disaster preparedness. Most studies investigate healthcare environments, workplaces, educational facilities, residential settings, or public spaces without explicitly considering preparedness as a spatial capability. Consequently, while the discipline explains how environments influence behaviour, it provides comparatively limited theoretical guidance regarding how these behavioural mechanisms might collectively contribute to preparedness within Interior Architecture. This limitation highlights the need for a broader conceptual framework capable of integrating behavioural adaptation with resilience and preparedness. The emphasis on environmental conditions that strengthen coping, reduce stress, and support adaptive functioning also reveals important conceptual parallels with salutogenic theory. Whereas environmental psychology explains the behavioural mechanisms through which environments influence adaptation, salutogenesis provides a complementary understanding of how these environmental qualities contribute to health, wellbeing, and an individual's capacity to cope with uncertainty. Examining salutogenic design therefore represents the next step in establishing the theoretical foundations for preparedness as an embedded architectural capability.

2.4 Salutogenic Design: From Risk Reduction to Health-Promoting Environments

Environmental psychology explains how spatial environments influence perception, cognition, and behaviour through continuous interaction between occupants and their surroundings. Yet understanding how environments shape behaviour does not necessarily explain why certain environments consistently enable individuals to cope more effectively with uncertainty, disruption, or prolonged stress. Addressing this question requires a complementary theoretical perspective that shifts attention from the prevention of illness and dysfunction towards the environmental conditions that actively support health, resilience, and adaptive capacity. Salutogenic theory provides precisely such a perspective. Originally developed by Antonovsky (1979, 1987), the salutogenic model challenged the conventional pathogenic orientation of health sciences, which sought primarily to explain the causes of disease (Vinje et al., 2017). Subsequent salutogenic scholarship has further developed this perspective by demonstrating its applicability across diverse health-promoting environments, including architecture and the built environment. Instead, salutogenesis asked a fundamentally different question: *What enables people to remain healthy despite exposure to adversity?*

Rather than conceptualising health as a binary state of wellness or illness, Antonovsky proposed that individuals continually move along a health–ease/dis-ease continuum, with their position influenced by the resources available to understand, manage, and find meaning within life's challenges. This perspective transformed health from the absence of pathology into a dynamic process of adaptation, emphasising the interactions between individuals and their environments rather than individual resilience alone. Central to this framework is the concept of the Sense of Coherence (SOC), comprising three mutually reinforcing dimensions: comprehensibility, manageability, and meaningfulness (Vinje et al., 2017). Comprehensibility refers to the extent to which environments are perceived as coherent, structured, and understandable. Manageability concerns the availability of environmental resources that enable individuals to respond effectively to emerging demands. Meaningfulness reflects the degree to which people perceive their environments as personally significant and worthy of engagement. Together, these dimensions provide a powerful explanatory model for understanding why certain environments consistently support adaptive functioning under conditions of uncertainty.

Over the past two decades, salutogenic theory has increasingly informed architectural and environmental design research. Rather than focusing solely on eliminating environmental stressors,

scholars have demonstrated that the physical environment itself can function as a Generalised Resistance Resource (GRR) by promoting orientation, perceived control, social connection, restorative experiences, and psychological stability (Dilani, 2009; Mittelmarm et al., 2022; Von Lindern et al., 2017). Within healthcare design, for example, legible circulation systems, access to daylight, opportunities for privacy, flexible social spaces, and environments that support personal autonomy have been associated with improved coping, reduced stress, enhanced recovery, and greater wellbeing. Importantly, these environmental qualities do not merely respond to illness; they actively strengthen occupants' capacity to adapt to challenging situations. This salutogenic perspective substantially broadens prevailing understandings of preparedness. Conventional preparedness frameworks typically seek to minimise risk through operational planning and emergency response mechanisms. Salutogenesis, by contrast, suggests that preparedness may also be cultivated through environments that continuously strengthen occupants' cognitive, emotional, and behavioural resources before disruption occurs. An environment characterised by clear spatial organisation enhances comprehensibility; adaptable layouts and accessible resources support manageability; familiar, dignified, and socially meaningful spaces reinforce meaningfulness. Collectively, these qualities contribute not only to everyday wellbeing but also to an individual's capacity to navigate uncertainty when disruptive events arise. Recent scholarship has further argued that salutogenic environments should be understood as relational systems rather than collections of isolated design features. Health-promoting environments emerge through the interaction of spatial configuration, materiality, sensory experience, social practices, and user agency, emphasising the continuous relationship between people and place rather than deterministic environmental effects (Mittelmarm et al., 2022). This relational understanding aligns closely with contemporary resilience thinking and reinforces the proposition that preparedness may likewise emerge through ongoing interactions between occupants and interior environments rather than through emergency infrastructure alone. Nevertheless, despite the growing influence of salutogenic design within healthcare architecture and environmental design, its application to disaster preparedness remains limited. Existing studies have predominantly examined therapeutic environments, hospitals, residential care, educational settings, and workplaces, while comparatively little attention has been devoted to understanding how salutogenic principles might inform environments intended to support adaptation before, during, and after disruptive events. Moreover, salutogenesis explains why supportive environments matter but does not fully explain how occupants activate these environmental resources through everyday interaction. That question leads directly to theories of human agency and affordances, where the reciprocal relationship between occupants and spatial environments becomes central to understanding preparedness as an emergent environmental capability.

2.5 Human Agency, Affordances and Behavioural Architecture

Preparedness cannot be understood solely as a property of environments nor exclusively as an attribute of individuals. Rather, it emerges through the continuous interaction between people and the environments they inhabit. While environmental psychology demonstrates that spatial characteristics influence perception and behaviour, and salutogenic theory explains how supportive environments strengthen adaptive capacity, neither fully explains how occupants actively engage with, modify, and appropriate environmental resources during periods of uncertainty. Addressing this relationship requires a consideration of human agency, whereby occupants are recognised not as passive recipients of architectural conditions but as active participants in the production of adaptive environments. Within contemporary architectural theory, increasing attention has been directed towards understanding buildings as relational systems that evolve through continuous interaction with their users. Rejecting deterministic interpretations of architecture, scholars have argued that buildings should be understood as dynamic assemblages whose meanings and performances emerge through occupation, interpretation, and everyday practices rather than through physical form alone (Brand, 1995; Latour & Yaneva, 2017). Architecture therefore does not prescribe behaviour directly; instead,

it creates possibilities for action that occupants continually negotiate according to changing needs, abilities, and circumstances. This relational understanding aligns closely with ecological theories of affordances. Gibson (1986) proposed that environments are perceived primarily in terms of the actions they enable rather than their isolated physical properties. Affordances therefore represent relational opportunities that arise through the interaction between environmental characteristics and human capabilities. A movable partition affords reconfiguration only if occupants are able to manipulate it; accessible storage affords independent use only if it remains perceptible and reachable; modular furniture affords adaptation only when users recognise its possibilities and can engage with it effectively. Affordances are therefore neither inherent properties of objects nor subjective interpretations alone; they emerge through reciprocal relationships between people and environments. Norman (2013) further demonstrated that successful design depends not only upon the existence of affordances but also upon their perceptibility. Users must be able to recognise available opportunities for action without excessive cognitive effort or external instruction. In architectural environments, perceptible affordances are communicated through spatial organisation, visibility, material expression, circulation patterns, environmental cues, and intuitive interfaces. During disruptive events, when stress, uncertainty, and cognitive overload may significantly reduce decision-making capacity, environments characterised by clearly perceptible affordances become particularly valuable because they support adaptive behaviour through intuitive interaction rather than conscious problem solving. Human agency extends beyond individual decision-making to encompass occupants' capacity to appropriate, personalise, and transform their environments over time. Similarly, adaptive architecture succeeds when it accommodates multiple patterns of occupation, allowing users to negotiate changing spatial requirements without undermining environmental coherence. These perspectives collectively position occupants as co-producers of environmental resilience rather than passive beneficiaries of architectural design. Within Interior Architecture, this understanding has profound implications. Conventional emergency environments frequently assume predetermined behavioural sequences in which occupants are expected to comply with prescribed procedures. Such approaches often minimise opportunities for individual interpretation, adaptation, and environmental control. In contrast, environments that acknowledge human agency provide multiple pathways for action, enabling occupants to reorganise space, access resources independently, modify environmental conditions, and establish temporary routines that restore familiarity and personal control. These qualities become particularly significant during prolonged disruptions, where successful adaptation depends not only on physical safety but also on maintaining autonomy, dignity, and meaningful engagement with everyday activities.

Recent scholarship concerning trauma-informed and human-centred environments further reinforces the importance of agency within adaptive design. Environments that offer opportunities for choice, privacy, territoriality, personalisation, and environmental control consistently contribute to reduced stress, enhanced psychological safety, and improved adaptive functioning (Bollo & Donofrio, 2022; Ulrich, 2008). Importantly, these characteristics are not merely therapeutic amenities; they function as environmental resources through which occupants actively regulate their own behaviour and wellbeing. Preparedness therefore becomes inseparable from the degree to which environments enable meaningful interaction rather than passive occupation. Collectively, these perspectives suggest that preparedness should not be conceptualised as a static environmental attribute embedded within buildings independently of their users. Instead, preparedness emerges through reciprocal relationships between spatial environments and human agency, where environmental affordances continuously support perception, interpretation, decision-making, adaptation, and behavioural flexibility. The effectiveness of an interior environment therefore depends not simply upon what spatial elements exist, but upon the opportunities they create for occupants to engage with, modify, and appropriate those environments under changing conditions. Despite these important contributions, theories of human agency and affordances remain dispersed across ecological psychology, design theory, socio-ecological resilience, and architectural practice. Relatively few studies have synthesised these perspectives into a coherent understanding of preparedness within Interior Architecture. Moreover,

while these theories explain the mechanisms through which occupants interact with environments, they provide comparatively limited guidance regarding how interior environments should be intentionally designed to support such interactions across diverse contexts of disruption. Addressing this question requires examination of adaptive interior architecture, where principles of flexibility, transformability, modularity, and responsive spatial systems are translated into tangible design strategies.

2.6 Interior Architecture as Adaptive Infrastructure

The preceding sections collectively demonstrate that preparedness cannot be explained solely through operational systems, resilient structures, behavioural responses, or salutogenic environments in isolation. Instead, preparedness emerges through continuous interactions between occupants, spatial environments, and opportunities for adaptive engagement. Translating these theoretical insights into architectural practice requires examining how Interior Architecture itself can function as adaptive infrastructurean environment intentionally designed to anticipate change, accommodate uncertainty, and continuously support human adaptation throughout everyday occupation. Interior Architecture has traditionally been understood as the organisation of interior space to satisfy functional, aesthetic, technical, and experiential requirements. Contemporary practice, however, increasingly recognises interiors as dynamic socio-spatial environments that evolve alongside changing patterns of occupation rather than remaining fixed after construction (Brooker & Stone, 2018). This perspective shifts attention from designing static rooms towards creating adaptive spatial systems capable of responding to changing environmental, social, technological, and behavioural conditions over time. The concept of adaptive architecture reflects a broader transformation within architectural thinking from permanence towards responsiveness. Rather than assuming that buildings should maintain a single predetermined configuration throughout their lifespan, adaptive architecture acknowledges uncertainty as an inherent characteristic of contemporary environments. Flexibility, transformability, modularity, reconfigurability, and multifunctionality therefore become strategies through which architecture accommodates changing programmes, user needs, and external conditions without compromising spatial coherence (Charlesworth & Fien, 2022; Schmidt Iii & Austin, 2016). Within Interior Architecture, adaptability extends beyond movable walls or modular furniture. It encompasses the capacity of interior environments to facilitate multiple patterns of occupation, support changing behavioural requirements, and enable occupants to appropriate space according to emerging circumstances. Spatial adaptability therefore operates simultaneously at several interconnected scales, including furniture systems, partitions, circulation networks, storage strategies, environmental services, lighting conditions, and spatial programming. Together, these elements influence whether environments remain functional, legible, and supportive as occupant needs evolve. Recent research increasingly demonstrates that adaptable interior systems contribute not only to functional efficiency but also to psychological resilience and environmental continuity. Flexible layouts reduce disruption by enabling familiar environments to accommodate new activities without requiring complete relocation. Modular furniture systems support autonomy by allowing occupants to reorganise their surroundings independently. Transformable partitions facilitate varying degrees of privacy, social interaction, and environmental control according to changing circumstances. Embedded storage, integrated services, and multifunctional spatial elements further reduce dependence on externally deployed emergency infrastructure by incorporating adaptive capacity directly into everyday environments (Schmidt Iii & Austin, 2016). These observations resonate strongly with recent developments in resilient and humanitarian design. Architectural responses to disasters have progressively shifted from temporary emergency provision towards systems capable of supporting prolonged adaptation. Rather than functioning solely as shelters, contemporary humanitarian environments increasingly integrate opportunities for social interaction, environmental dignity, incremental transformation, and long-term occupation (Clement et al., 2022; Hazim & Agha, 2023). Similarly, adaptive healthcare environments developed during the COVID-19 pandemic demonstrated that rapid spatial transformation could maintain operational continuity while simultaneously

supporting patient safety, staff efficiency, and psychological wellbeing. Across these diverse contexts, successful projects consistently relied not upon isolated technological innovations but upon interior environments capable of accommodating changing human requirements through embedded spatial adaptability. Importantly, adaptability should not be understood as an end in itself. An environment capable of physical transformation does not necessarily support preparedness unless those transformations remain intuitive, meaningful, and accessible to occupants. Excessive flexibility may even increase cognitive complexity if users struggle to understand available possibilities or lack opportunities to interact confidently with adaptive systems. Consequently, the effectiveness of adaptive interiors depends not only on the availability of transformable elements but also on their environmental legibility, behavioural clarity, and compatibility with everyday patterns of occupation. Adaptation succeeds when architectural flexibility remains understandable, manageable, and supportive of human agency rather than becoming an additional source of uncertainty. This distinction highlights a critical difference between adaptive architecture and preparedness-oriented interior environments. Adaptive architecture frequently evaluates success according to technical performance, spatial efficiency, or functional versatility. Preparedness, however, requires a broader understanding in which adaptability simultaneously supports behavioural guidance, environmental familiarity, psychosocial continuity, autonomy, and perceived control. In other words, adaptive environments become preparedness environments only when physical transformation consistently enhances occupants' capacity to understand, manage, and respond to changing circumstances. Viewed collectively, contemporary Interior Architecture already contains many of the components associated with preparedness. Flexible spatial systems, modular construction, embedded furniture, transformable partitions, intuitive circulation, adaptable services, environmental dignity, and user participation repeatedly appear across diverse architectural typologies. Yet these characteristics continue to be discussed independently according to project type, technological innovation, or functional performance. The discipline therefore lacks a unifying theoretical explanation capable of describing why these recurring spatial characteristics consistently support adaptive human behaviour across multiple contexts. This observation represents the culmination of the theoretical review. Across disaster preparedness, resilience theory, environmental psychology, salutogenesis, human agency, and adaptive architecture, remarkably similar spatial characteristics repeatedly emerge despite substantial differences in disciplinary perspective. Collectively, these recurring ideas suggest that preparedness may not be an isolated design objective but rather the product of deeper spatial principles embedded within interior environments. Identifying these recurring principles requires moving beyond theoretical synthesis towards systematic comparative analysis of built precedents. Contemporary Interior Architecture increasingly emphasizes lived experience, human-centered design, and the emotional qualities of interior environments as central components of spatial performance (Petermans & Pohlmeier, 2014).

2.7 Towards an Evidence-Derived Understanding of Embedded Preparedness

The preceding review demonstrates that no single theoretical tradition adequately explains preparedness within Interior Architecture. Disaster preparedness establishes the importance of proactive planning but remains largely operational in orientation. Resilience theory explains adaptive capacity yet focuses predominantly on systems rather than lived spatial experience. Environmental psychology demonstrates how environments shape behaviour, while salutogenic design reveals how supportive environments strengthen health and coping. Human agency explains how occupants actively engage with environmental resources, and adaptive architecture translates these behavioural principles into responsive spatial systems. Individually, each perspective contributes valuable insights; collectively, they reveal a far more significant observation. Across these diverse fields, a remarkably consistent set of spatial characteristics repeatedly appears. Environments that support adaptation are typically legible, flexible, comprehensible, and capable of accommodating changing needs. They provide opportunities for personal control, preserve familiarity during uncertainty, enable meaningful

interaction, facilitate intuitive behavioural guidance, and maintain psychosocial continuity despite disruption. Although these characteristics are described using different disciplinary vocabularies, their recurrence suggests the presence of underlying architectural principles that transcend individual theories, disaster typologies, building programmes, and geographical contexts. Despite this convergence, existing scholarship has rarely attempted to synthesise these recurring characteristics into a unified explanatory framework for Interior Architecture. Instead, they continue to be interpreted through separate theoretical lenses, limiting opportunities for cumulative knowledge development. Consequently, preparedness remains understood as a fragmented collection of operational procedures, behavioural mechanisms, therapeutic environments, adaptive technologies, and resilient systems rather than as an integrated spatial capability. This observation establishes the central premise of the present study. Rather than assuming that preparedness can be defined a priori, the research investigates whether these recurring spatial characteristics consistently emerge across diverse architectural precedents representing different disasters, programmes, cultural settings, and spatial scales. If similar characteristics repeatedly appear regardless of context, their recurrence may indicate the existence of broader architectural principles capable of explaining preparedness as an intrinsic environmental condition emerging through recurring relationships between occupants, interior environments, and adaptive spatial systems. Accordingly, the study adopts an inductive comparative qualitative methodology in which nine international case studies are systematically analysed using a common analytical framework. Each precedent is evaluated according to identical spatial, behavioural, psychosocial, and adaptive criteria, enabling recurring characteristics to be identified through cross-case comparison rather than conceptual speculation. Theory therefore follows evidence: recurring patterns observed across the comparative analysis become the basis for subsequent theoretical construction. This transition marks an important methodological distinction. The objective of the research is not to validate a predetermined theoretical framework, but to allow empirical regularities observed across multiple architectural precedents to reveal the spatial principles that consistently support preparedness. In doing so, the study positions preparedness not as an externally imposed design agenda but as an emergent architectural capability arising from recurring relationships between occupants, interior environments, and adaptive spatial systems. The following section therefore shifts from theoretical synthesis to empirical investigation. Having established why existing theories are individually insufficient yet collectively suggest a deeper architectural phenomenon, the manuscript now examines nine international precedents to determine whether these recurring spatial characteristics can be systematically identified, compared, and synthesised into an evidence-derived theoretical framework for Interior Architecture.

3. Research Design and Methodology

3.1 Research Philosophy and Research Design

This research adopts an interpretivist qualitative research philosophy situated within a theory-building paradigm. Unlike deductive investigations that seek to test predefined hypotheses, theory-building research aims to generate new conceptual understanding through the systematic interpretation of empirical evidence (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Given the absence of an established theoretical framework explaining preparedness as an embedded characteristic of Interior Architecture, an inductive approach was considered most appropriate for investigating recurring spatial characteristics across diverse architectural contexts. The study does not seek to evaluate the effectiveness of individual projects or compare building performance according to predetermined metrics. Instead, it investigates whether common spatial principles consistently recur across architecturally, geographically, and programmatically diverse precedents. The emphasis therefore lies not on identifying best practice examples, but on discovering transferable architectural characteristics capable of explaining preparedness beyond individual case contexts. Theory-building through comparative case analysis has become an established qualitative methodology for generating conceptual frameworks where existing theory remains fragmented or incomplete (Eisenhardt, 1989;

Yin, 2018). Rather than treating case studies as isolated descriptive narratives, comparative analysis enables recurring relationships, similarities, and differences to be systematically identified across multiple contexts. When similar patterns emerge despite substantial variation in programme, scale, geographical location, or disaster typology, those recurring observations provide a robust empirical basis for conceptual abstraction and theory construction. Accordingly, this research adopts a comparative qualitative multiple-case study methodology, allowing preparedness to emerge inductively from empirical observations rather than being imposed through predetermined theoretical assumptions. The methodological sequence follows four interconnected stages: comparative case selection, systematic qualitative coding, cross-case pattern identification, and theoretical synthesis. Throughout the study, theory follows evidence, ensuring that the proposed framework is grounded in recurring spatial observations rather than conceptual speculation.

3.2 Rationale for Methodological Choice

The selection of a comparative qualitative methodology was informed by the nature of the research question itself. The study seeks to understand how preparedness emerges spatially, rather than whether one architectural solution performs better than another. Such questions concern relationships, meanings, and recurring design characteristics rather than measurable causal variables, making qualitative comparative analysis particularly appropriate. Furthermore, preparedness is inherently multidimensional. It encompasses behavioural adaptation, environmental perception, psychosocial wellbeing, spatial organisation, flexibility, and human agency phenomena that cannot be adequately captured through quantitative performance indicators alone. Comparative qualitative analysis enables these complex spatial relationships to be examined holistically while preserving the contextual richness of individual architectural precedents. Importantly, the objective is not to generalise statistically from the selected cases to all disaster-related environments. Instead, the study seeks analytical generalisation (Yin, 2018), whereby recurring spatial principles identified across diverse contexts contribute to broader theoretical understanding. The resulting framework therefore represents a transferable conceptual model rather than a prescriptive design guideline for any single building typology.

3.3 Case Selection Strategy

One of the most significant determinants of theory-building quality lies in the selection of appropriate cases. Rather than choosing projects because they represent exemplary architectural design, the present study employed purposeful theoretical sampling (Eisenhardt, 1989), selecting cases that collectively maximise conceptual diversity while retaining direct relevance to preparedness within Interior Architecture. The objective was not to obtain statistical representation but to expose the emerging theory to the widest possible range of architectural conditions. Consequently, the selected precedents intentionally vary across multiple dimensions, including disaster typology, geographical location, building programme, scale of intervention, duration of occupation, and degree of spatial adaptability. Such diversity strengthens theory development because recurring spatial characteristics observed across highly dissimilar contexts are more likely to represent transferable architectural principles rather than context-specific design decisions.

The final dataset comprises nine internationally recognised architectural and interior design precedents selected through purposeful theoretical sampling. Collectively, these precedents represent humanitarian shelters, transitional housing, adaptive residential environments, emergency healthcare facilities, educational preparedness interventions, and transformable interior systems. Together, they encompass responses to displacement, earthquakes, pandemics, and emergency evacuation, providing substantial contextual diversity while ensuring that every case is supported by sufficient peer-reviewed scholarly documentation. Unlike previous studies focusing exclusively on a single disaster type or architectural programme, the present research intentionally integrates multiple typologies. This methodological decision reflects the central hypothesis that preparedness should transcend individual

disasters and instead emerge through recurring spatial characteristics applicable across diverse environments.

Inclusion Criteria

Cases were included when they satisfied the following criteria:

- demonstrated an explicit relationship to disaster preparedness, emergency response, humanitarian adaptation, or resilient interior environments;
- incorporated identifiable interior architectural interventions beyond purely structural engineering solutions;
- provided sufficient scholarly documentation to enable rigorous qualitative analysis;
- represented recognised architectural precedents published within peer-reviewed literature, academic books, conference proceedings, or reputable professional documentation;
- collectively contributed diversity in programme, geography, scale, and disaster context.

Exclusion Criteria

Projects were excluded when they:

- focused exclusively on engineering or structural resilience without significant interior spatial interventions;
- lacked sufficient published documentation to support transparent comparative analysis;
- duplicated spatial strategies already represented by stronger cases within the dataset;
- represented conceptual proposals without documented implementation or scholarly evaluation.

Rationale for Case Diversity

The nine selected cases intentionally span multiple continents, disaster typologies, and architectural programmes. This diversity serves two methodological purposes. First, it reduces the likelihood that recurring spatial characteristics are products of specific cultural, geographical, or functional conditions. Second, it strengthens theoretical transferability by demonstrating whether similar preparedness strategies emerge despite substantial contextual variation. Accordingly, diversity was treated not as a source of analytical inconsistency but as a deliberate mechanism for strengthening inductive theory construction.

3.3 Data Collection and Documentary Sources

The study employed **documentary qualitative research** using secondary data derived from peer-reviewed journal articles, scholarly books, conference proceedings, architectural monographs, professional publications, and documented project reports relating to each selected case study. Documentary research is particularly appropriate for theory-building investigations where the objective is not to measure participant responses but to interpret recurring characteristics embedded within existing architectural knowledge.

For each case, information was systematically extracted regarding:

- project context and disaster typology;
- architectural and interior design strategies;
- spatial organisation and circulation;
- furniture systems and interior interventions;
- flexibility and transformability;
- privacy and psychosocial support;
- occupant autonomy and environmental control;
- behavioural guidance and wayfinding;
- evidence of adaptive performance reported within the literature.

To ensure consistency across all nine precedents, identical categories of information were collected for every project regardless of programme, geographical location, or disaster context. This standardisation enabled direct comparison during subsequent analytical stages while preserving the

contextual specificity of each case. Where multiple scholarly publications existed for a single precedent, evidence was triangulated across sources to improve analytical reliability and reduce dependence on individual author interpretations. This approach ensured that each case was examined through a comprehensive synthesis of available academic evidence rather than a single publication.

3.4 Analytical Framework for Comparative Case Analysis

To facilitate systematic comparison across diverse architectural precedents, all nine case studies were evaluated using a common analytical framework developed through the theoretical synthesis presented in Section 2. Rather than assessing projects according to architectural style or technological innovation, the framework examines recurring spatial characteristics associated with adaptive human behaviour and preparedness. The analytical framework consists of seven principal dimensions.

Table 1. Analytical Framework for Comparative Case Analysis

Analytical Dimension	Assessment Focus	Theoretical Basis
Disaster Context	Hazard type, disruption, duration, users	Disaster preparedness
Interior Intervention	Furniture, partitions, layout, services, spatial systems	Interior Architecture
Privacy	Ability to support personal space and psychological comfort	Environmental Psychology
Familiarity	Preservation of domesticity, recognisable routines and spatial continuity	Salutogenesis
Autonomy	User control, independent use, environmental choice	Human Agency
Spatial Control	Environmental legibility, orientation, behavioural guidance	Environmental Psychology
Adaptive Capacity	Flexibility, transformability, multifunctionality	Resilience & Adaptive Architecture
Emerging Preparedness Characteristics	Recurring spatial principles observed	Cross-case synthesis

The analytical framework was intentionally developed before the comparative analysis to ensure that all cases were evaluated consistently using identical criteria. Importantly, these dimensions do not represent the proposed theory itself. Rather, they function as analytical lenses through which recurring spatial characteristics could be systematically identified and compared across multiple precedents.

3.4.1 Scoring Procedure

Although the research adopts a qualitative interpretive methodology, a structured comparative scoring system was introduced to improve analytical transparency and facilitate cross-case comparison. Each analytical dimension was evaluated using three ordinal categories:

Score	Interpretation	Operational Definition
High	Strong evidence	Spatial characteristic is explicitly integrated and consistently supports occupants.
Moderate	Partial evidence	Characteristic is present but limited in scope or effectiveness.
Low	Minimal evidence	Characteristic is absent, weakly expressed or unsupported within the documented evidence.

These scores do not represent quantitative measurements or statistical performance indicators. Instead, they function as structured qualitative descriptors that assist comparison between heterogeneous architectural projects. Final interpretations were based upon textual evidence reported within the scholarly literature rather than subjective aesthetic judgement.

3.5 Qualitative Coding and Cross-Case Analysis

Following data extraction, all documentary evidence underwent qualitative coding using an inductive comparative approach. Coding sought to identify recurring spatial characteristics rather than evaluate individual projects according to predetermined design standards.

The analytical process consisted of four sequential stages.

Stage 1: Open Coding

Each publication was reviewed independently to identify descriptions relating to spatial organisation, interior interventions, behavioural outcomes, user interaction, adaptability, psychosocial wellbeing, and preparedness. Initial descriptive codes remained closely aligned with the language used by the original authors to minimise premature theoretical interpretation.

Examples included:

- movable partitions;
- modular furniture;
- visual openness;
- incremental growth;
- embedded storage;
- user participation;
- environmental familiarity;
- adaptable layouts;
- privacy;
- intuitive circulation.

Stage 2: Axial Coding

Related descriptive codes were subsequently grouped into broader conceptual categories representing common spatial characteristics observed across multiple projects. For example:

Movable partitions

Flexible layouts

Modular systems



Adaptive Spatial Configuration

Similarly,

Privacy

Territoriality

Personal space



Psychosocial Continuity

This stage reduced the complexity of the dataset while preserving conceptual relationships between recurring observations.

Stage 3: Cross-Case Comparison

The axial categories were then compared systematically across all nine precedents.

Rather than asking *"Does this project perform well?"* the analysis asked *"Which spatial characteristics consistently recur regardless of disaster type, programme or geographical location?"* This comparative approach enabled recurring themes to emerge independently of individual project contexts.

Stage 4: Theoretical Abstraction

The final stage synthesised recurring categories into broader conceptual principles. Importantly, these principles were not predetermined. Instead, they emerged from repeated observations across multiple case studies. Only after all cases had been comparatively analysed were recurring themes abstracted into higher-order conceptual constructs that subsequently informed the development of the Theory of Embedded Preparedness. This sequence as shown in Figure 1 ensured that theory emerged inductively from empirical comparison rather than functioning as an interpretive framework imposed upon the evidence.

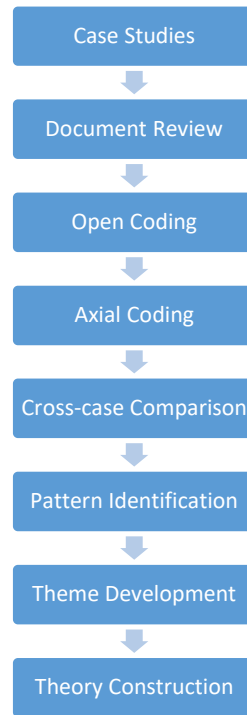


Figure 1. Analytical Process.

3.6 Ensuring Rigour and Trustworthiness

Several strategies were employed to enhance the credibility, dependability, and transparency of the research process. First, the study utilised purposeful theoretical sampling, ensuring substantial variation across geographical location, disaster typology, programme, and architectural scale. Such diversity reduces the likelihood that recurring findings reflect context-specific design decisions and instead strengthens analytical generalisation. Second, all cases were examined using a common analytical framework and identical coding procedure. Standardised evaluation criteria ensured methodological consistency throughout the comparative analysis while allowing contextual differences between projects to remain visible. Third, documentary triangulation was undertaken wherever multiple scholarly publications existed for individual case studies. Evidence was synthesised across peer-reviewed journal articles, academic books, conference proceedings, and architectural documentation to minimise reliance on single sources and strengthen interpretive validity. Fourth, the research maintained an explicit distinction between empirical observation and theoretical interpretation. Spatial characteristics were first identified descriptively, then grouped into recurring categories through comparative analysis, and only subsequently synthesised into broader theoretical principles. This staged analytical process reduces confirmation bias by ensuring that conceptual development remains grounded in documented evidence. Finally, the study follows the principles of qualitative analytical generalisation (Yin, 2018), whereby theoretical insights are derived from recurring relationships observed across multiple contexts rather than statistical inference. The resulting framework is therefore intended as a transferable conceptual explanation of preparedness within Interior Architecture rather than a universal predictive model.

3.7 Methodological Summary

Figure 2 summarises the complete methodological workflow adopted in this investigation.

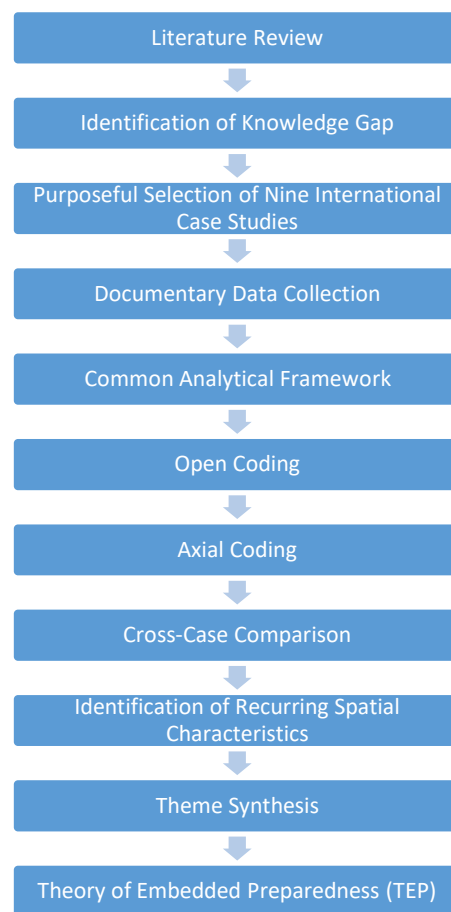


Figure 2. Methodological Workflow

4. Comparative Case Analysis

4.1 Introduction to the Comparative Case Evidence

Having established the theoretical foundations and methodological framework, the study now turns to the empirical investigation through a comparative analysis of nine internationally recognised architectural precedents. Comparative case analysis is widely recognised as an effective strategy for identifying recurring design principles across diverse spatial and socio-environmental contexts because it enables relationships to emerge that may not be evident through the examination of individual projects alone (Charlesworth & Fien, 2022; Pedgley & Şener, 2024). Rather than treating each precedent as an isolated architectural response to disaster, the selected projects are interpreted collectively to identify recurring spatial characteristics that transcend differences in geography, disaster typology, programme, construction technology, and architectural scale. The purpose of this section is not to determine which project represents the most effective architectural solution. Instead, the analysis investigates whether common interior architectural strategies consistently recur across heterogeneous disaster contexts and whether these recurring characteristics collectively demonstrate preparedness as an embedded spatial capability rather than a reactive operational measure. This perspective aligns with contemporary understandings of resilience that view adaptation as a continuous property of socio-spatial systems rather than an isolated post-disaster intervention (Holling, n.d.; Laboy & Fannon, 2016; B. H. Walker & Salt, 2010). Consequently, each precedent functions not as an independent case study but as a unit of empirical evidence contributing to the inductive development of the Theory of Embedded Preparedness (TEP). Consistent with the analytical methodology established in Section 3, each project was evaluated using an identical analytical framework

comprising disaster context, principal interior intervention, privacy, familiarity, autonomy, spatial control, adaptive capacity, salutogenic resources, and emerging preparedness characteristics. Employing a common analytical structure enhances methodological transparency while enabling meaningful comparison across architecturally and culturally diverse precedents. Such consistency is particularly important when examining preparedness, which increasingly spans humanitarian shelter, healthcare infrastructure, adaptive housing, educational environments, and post-disaster reconstruction rather than remaining confined to conventional emergency architecture (Charlesworth & Fien, 2022; Conzatti et al., 2022). Importantly, contextual diversity is treated as an analytical strength rather than a methodological limitation. The selected precedents encompass humanitarian displacement, earthquakes, pandemics, educational emergencies, housing insecurity, and community reconstruction across multiple geographical regions. Although these contexts differ substantially in scale, duration, programme, and operational objectives, they all require interior environments capable of supporting adaptation under conditions of uncertainty. If comparable spatial characteristics consistently emerge despite these contextual differences, their recurrence provides strong empirical evidence that preparedness is underpinned by transferable interior architectural principles rather than project-specific design solutions. This proposition also supports emerging discourse within Interior Architecture that views interiors as adaptive socio-spatial systems capable of mediating relationships between occupants, activities, and changing environmental conditions (Atmodiwirjo & Yatmo, 2026; Darbandi et al., 2023). Table 2 summarises the comparative analytical matrix derived from the evaluation of all nine precedents before each project is examined as an evidence profile contributing to the subsequent cross-case synthesis.

Table 2. Comparative Matrix of the Nine Case Studies

Evidence Profile	Disaster / Context	Principal Interior Intervention	Privacy	Familiarity	Autonomy	Spatial Control	Adaptive Capacity	Primary Salutogenic Resource	Emerging TEP Principle
Better Shelter	Humanitarian displacement	Modular prefabricated shelter	Moderate	Moderate	High	High	High	Manageability	Embedded Adaptability
Liina Transitional Shelter	Post-disaster housing	Expandable timber shelter	Moderate	High	High	High	High	Manageability + Meaningfulness	Incremental Adaptability
Soft Wall (Molo)	Flexible emergency interiors	Expandable textile partition	High	High	High	High	Moderate	Manageability + Meaningfulness	Behavioural Legibility
ELEMENTAL Incremental Housing	Post-earthquake reconstruction	Incremental housing	High	High	High	High	High	Meaningfulness + Manageability	Latent Spatial Capacity
Fangcang Shelter Hospitals	COVID-19	Adaptive hospital conversion	Moderate	Low	Moderate	High	High	Comprehensibility	Rapid Spatial Transformation
NHS Nightingale Hospital	COVID-19	Temporary healthcare infrastructure	Low	Low	Low	Moderate	High	Comprehensibility	Operational Adaptability
Embedded Preparedness	Everyday preparedness /	Multi-functional interior	Moderate	High	High	High	Moderate	Manageability	Embedded Preparedness

through Interior Furniture Systems	Education al & public interiors	furniture and embedded protective systems							
Paper Partition System	Emergency evacuation	Paper-tube privacy partitions	High	Moderate	Moderate	Moderate	Moderate	Meaningfulness	Psychosocial Continuity
Paper Log House	Post-earthquake reconstruction	Recyclable modular dwelling	Moderate	High	Moderate	Moderate	High	Meaningfulness + Manageability	Resource-Based Preparedness

Qualitative Assessment Criteria

To ensure methodological transparency, qualitative ratings were assigned using predefined operational criteria derived from the analytical framework presented in Section 3. Rather than functioning as numerical performance scores, these ratings provide structured comparative descriptors that facilitate systematic interpretation across heterogeneous architectural precedents.

Rating	Operational Definition
High	The characteristic is explicitly embedded within the architectural intervention and consistently supported by multiple scholarly sources, demonstrating a strong contribution to occupant adaptation, environmental resilience, and preparedness.
Moderate	The characteristic is present but limited in extent, consistency, or documented impact across the available literature.
Low	The characteristic is minimally represented, indirectly addressed, or insufficiently evidenced within the published documentation.

The qualitative assessment is therefore intended to support analytical comparison rather than quantitative measurement. Given the diversity of programmes, disaster typologies, and geographical contexts represented within the case selection, qualitative interpretation provides an appropriate means of identifying recurring architectural characteristics while preserving contextual specificity. This approach enables the comparative matrix to function as an evidence synthesis rather than a ranking exercise, thereby supporting the inductive development of the Theory of Embedded Preparedness.

Across the nine precedents, a clear relationship emerged between Antonovsky's Sense of Coherence (SOC) and the spatial characteristics identified through comparative analysis (Mittelman et al., 2022; Von Lindern et al., 2017). Projects emphasising comprehensibility consistently relied upon legible spatial organisation, intuitive circulation, and environmental clarity that enabled occupants to understand and navigate unfamiliar settings. Interventions strengthening manageability embedded adaptable resources, user control, flexible planning, and opportunities for environmental modification, allowing occupants to respond independently to changing circumstances (Hellwig, 2015; Kim, 2021). Projects fostering meaningfulness prioritised dignity, familiarity, participation, territorial identity, and psychosocial continuity, thereby reinforcing emotional attachment and sustained engagement with place despite disruption (Bollo & Donofrio, 2022; Brisson et al., 2025; Lynch et al., 2025). Importantly, these salutogenic resources rarely occurred independently. Instead, they interacted through recurring spatial configurations that simultaneously enhanced environmental understanding, behavioural flexibility, and occupant agency. This convergence suggests that preparedness extends beyond operational readiness to become a salutogenic spatial quality emerging from environments capable of supporting comprehension, autonomy, and meaningful occupation. Collectively, these recurring relationships provide the empirical foundation from which the Theory of Embedded Preparedness is inductively developed.

4.2 Comparative Evidence Profiles

The following evidence profiles synthesise the principal findings derived from the nine selected architectural precedents. Rather than presenting individual projects as exemplary design solutions, each profile is interpreted as an empirical unit contributing to the identification of recurring preparedness characteristics within Interior Architecture. The emphasis therefore shifts from describing architectural objects to analysing the spatial mechanisms through which interior environments support adaptation, continuity, and resilience across diverse disaster contexts. Collectively, these evidence profiles provide the empirical foundation from which the Theory of Embedded Preparedness (TEP) is inductively developed.

4.3.1 Better Shelter

Better Shelter demonstrates how preparedness can be embedded within the spatial configuration of emergency housing rather than being treated solely as a logistical response to displacement. Developed for humanitarian crises, the prefabricated modular shelter integrates structural stability, passive environmental performance, lockable entrances, daylight, natural ventilation and solar-powered services within a rapidly deployable housing system. While originally conceived as emergency accommodation, its significance extends beyond temporary shelter provision by supporting prolonged occupation through a recognisable domestic environment that promotes safety, dignity and everyday functionality (Conzatti et al., 2022; UNHCR, 2007). From an interior architectural perspective, the project illustrates that resilience is strongly influenced by the quality of the interior environment rather than by structural protection alone. Research increasingly recognises that displaced populations require environments capable of supporting privacy, environmental control, familiarity and opportunities for personal appropriation, all of which contribute to psychological recovery and adaptive capacity (Charlesworth & Fien, 2022; Conzatti et al., 2022). These qualities align closely with contemporary interpretations of interiority, which understand interiors as active environments mediating relationships between people, behaviour and wellbeing rather than passive enclosed spaces (Darbandi et al., 2023; Lee, 2022). The shelter also reflects broader principles of adaptive interior design through its modular organisation and capacity for spatial personalisation. Flexibility literature suggests that environments capable of accommodating changing occupant needs enhance long-term resilience by increasing user agency and reducing dependence on externally controlled interventions (Abdulpader et al., 2014; Hazim & Agha, 2023; Popov, 2016). Similarly, affordance-based theories emphasise that adaptable environments enable occupants to recognise and utilise multiple behavioural possibilities embedded within space, strengthening both environmental competence and independent action (Kim, 2021). Viewed through a salutogenic lens, Better Shelter primarily reinforces manageability by providing occupants with accessible spatial resources that facilitate environmental control, routine formation and independent daily functioning (Mittelmark et al., 2022; Von Lindern et al., 2017). Simultaneously, the shelter supports psychosocial wellbeing by preserving dignity, privacy and perceived safety qualities increasingly recognised within trauma-informed environmental design as essential for recovery following displacement (Brisson et al., 2025; Lynch et al., 2025; Owen & Crane, 2022). Consequently, Better Shelter provides strong empirical evidence for the TEP principles of Embedded Adaptability, Occupant Agency, and Psychosocial Continuity, illustrating that preparedness emerges when adaptive environmental resources are intentionally incorporated into everyday living environments before disruption occurs.

4.3.2 Liina Transitional Shelter

The Liina Transitional Shelter demonstrates that preparedness extends beyond the provision of temporary accommodation to encompass the architectural capacity for incremental adaptation over time. Rather than treating post-disaster housing as a static product, the project frames recovery as an evolving socio-spatial process in which occupants progressively transform their environments according to changing household structures, economic resources, and cultural practices. Such an approach aligns with contemporary resilience scholarship, which increasingly conceptualises adaptation as the capacity of built environments to accommodate uncertainty rather than resist it (Charlesworth & Fien, 2022; Laboy & Fannon, 2016; B. H. Walker & Salt, 2010). Unlike conventional emergency shelters that often become obsolete once immediate relief has concluded, the Liina prototype embeds future expansion within its original architectural logic. The modular timber system allows spaces to be enlarged, reorganised and personalised without requiring complete reconstruction, thereby extending the useful life of the dwelling while reducing material consumption and reconstruction costs (Félix et al., 2013). Such flexibility reflects broader discussions within interior architecture that argue adaptable environments should anticipate change as an intrinsic design condition rather than accommodate it retrospectively (Abdulpader et al., 2014; Hazim & Agha, 2023; Popov, 2016). From an interior architectural perspective, the project illustrates that preparedness is strengthened when occupants actively participate in shaping their spatial environments. Incremental modification fosters environmental ownership, behavioural familiarity and long-term agency by allowing users to determine how domestic space evolves throughout recovery. These characteristics correspond closely with theories of human agency within architecture, which position users as active co-producers of resilient environments rather than passive recipients of shelter (Cole et al., 2010; Kim, 2021). Viewed through Antonovsky's Sense of Coherence, the shelter simultaneously reinforces manageability through adaptable spatial resources and meaningfulness through opportunities for personal investment and spatial appropriation (Mittelmark et al., 2022; Von Lindern et al., 2017). The project therefore provides strong empirical evidence for the TEP principles of Incremental Adaptability, Latent Spatial Capacity, and Occupant Participation, demonstrating that preparedness is most effectively embedded within environments intentionally designed to evolve alongside the communities that inhabit them.

4.3.3 Soft Wall (Molo Design)

Soft Wall demonstrates that preparedness may emerge through highly adaptable interior systems that support continual negotiation between occupants and space rather than through permanent architectural intervention. Constructed from expandable honeycomb textile and paper materials, the movable partition enables users to create, dissolve and redefine spatial boundaries according to changing functional, social and psychological requirements. In doing so, the project illustrates that resilience can be embedded within the behavioural flexibility of interior environments rather than solely within structural permanence. Recent scholarship increasingly positions flexibility as one of the defining characteristics of resilient interiors, arguing that environments capable of accommodating changing patterns of occupation are inherently better equipped to respond to uncertainty (Abdulpader et al., 2014; Hazim & Agha, 2023; Popov, 2016). Rather than prescribing fixed spatial hierarchies, Soft Wall allows occupants to regulate privacy, visibility, territoriality and social interaction through direct manipulation of spatial boundaries. Such adaptability reflects broader understandings of affordance-based design, where environments encourage multiple forms of occupation and behavioural choice through their physical configuration (Kim, 2021). Equally significant is the project's contribution to perceived environmental control. Studies in environmental psychology consistently demonstrate that occupants who can influence their immediate surroundings experience greater wellbeing, reduced stress and improved adaptive capacity (Hellwig, 2015; Möystad, 2017).

Within interior architecture, such control is increasingly recognised as fundamental to resilience because it enables users to continually recalibrate space in response to evolving emotional, functional and social needs (Lee, 2022; Smith et al., 2012). From the perspective of interiority, Soft Wall reinforces the understanding that interior architecture extends beyond enclosure to encompass the dynamic relationships between bodies, behaviour and spatial experience (Darbandi et al., 2023; McCarter, 2016). Through a salutogenic lens, these adaptive qualities strengthen both manageability and meaningfulness, allowing occupants to understand, control and emotionally invest in their surroundings. Consequently, Soft Wall provides compelling evidence for the TEP principles of Behavioural Legibility, Environmental Flexibility, and Occupant Agency, demonstrating that preparedness can emerge through simple interior systems that maximise behavioural affordances and perceived control.

4.3.4 ELEMENTAL Incremental Housing

ELEMENTAL's incremental housing model fundamentally challenges conventional post-disaster reconstruction by positioning housing as an evolving process rather than a completed architectural product. Instead of delivering fully finished dwellings, the project provides an infrastructural framework that enables residents to progressively expand and customise their homes according to changing household needs and economic capacity. This strategy reconceptualises resilience as the ability of architecture to accommodate future transformation while maintaining continuity of occupation (Carrasco & O'Brien, 2021). The project illustrates an important shift from designing finished buildings toward designing adaptive systems. Contemporary resilience theory increasingly argues that robust environments are characterised less by permanence than by their capacity to transform while preserving essential functions (Laboy & Fannon, 2016; B. H. Walker & Salt, 2010). ELEMENTAL operationalises this principle by embedding incompleteness within the architectural strategy, thereby recognising future change as an anticipated design condition rather than evidence of failure. Such thinking parallels current discussions on adaptive reuse and long-term building transformation, which similarly advocate architectures capable of accommodating evolving patterns of occupation throughout their lifecycle (Lanz & Pendlebury, 2022a; Stone, 2020). Interior Architecture plays a central role within this adaptive model because the unfinished framework deliberately transfers spatial decision-making to occupants. Rather than prescribing fixed domestic arrangements, interior spaces become platforms for continual adaptation, reinforcing environmental agency, ownership and personal identity. Research increasingly identifies user participation as a critical determinant of resilient environments because active engagement strengthens long-term attachment, spatial familiarity and community sustainability (Cole et al., 2010; Kim, 2021). Within Antonovsky's salutogenic framework, these adaptive processes reinforce both manageability and meaningfulness, enabling occupants to understand, control and progressively shape their environments according to changing life circumstances (Mittelmark et al., 2022). Consequently, ELEMENTAL provides strong empirical evidence for the TEP principles of Latent Spatial Capacity, Incremental Resilience, and Occupant Agency, demonstrating that preparedness emerges when architecture deliberately anticipates future transformation rather than merely responding to immediate disaster recovery.

4.3.5 Fangcang Shelter Hospitals

The Fangcang Shelter Hospitals established during the COVID-19 pandemic demonstrate how preparedness can emerge through the rapid interior transformation of existing building stock rather than through the construction of purpose-built emergency facilities. By converting convention centres, sports arenas and exhibition halls into large-scale healthcare environments, the Fangcang model

illustrates that the resilience of a building is determined not only by its structural characteristics but also by the adaptability of its interior organisation. This shift from permanent infrastructure to transformable spatial systems aligns with contemporary resilience theory, which emphasises adaptive capacity as a defining characteristic of resilient environments (Charlesworth & Fien, 2022; Laboy & Fannon, 2016; B. H. Walker & Salt, 2010). Published evaluations consistently identify interior planning as the principal determinant of the hospitals' operational effectiveness. Standardised ward modules, clearly defined functional zoning, segregated circulation routes, adaptable service infrastructure and infection-control strategies enabled rapid deployment while maintaining clinical safety and organisational efficiency (Chen et al., 2020; Hwang & Kim, 2022; Ji et al., 2022; Marawan et al., 2022). Rather than introducing resilience through new construction, the project demonstrates how existing spatial infrastructure can be reorganised through modular interior systems to accommodate entirely different programmes under extreme temporal constraints. From an Interior Architecture perspective, Fangcang illustrates that preparedness resides in the latent capacity of interior environments to support rapid functional transformation while maintaining environmental legibility. Although personal privacy was necessarily limited within the emergency context, the carefully organised spatial hierarchy reduced cognitive complexity for patients and healthcare workers by establishing predictable circulation, intuitive zoning and consistent visual organisation. Research on environmental psychology and healthcare design suggests that such spatial clarity reduces uncertainty and supports effective decision-making under conditions of stress (Hellwig, 2015; Kim, 2021; Lee, 2022). Within Antonovsky's Sense of Coherence, these characteristics primarily reinforce comprehensibility, as occupants are better able to understand, navigate and utilise environments whose spatial organisation remains coherent despite operational complexity (Mittelmark et al., 2022; Von Lindern et al., 2017). Consequently, Fangcang Shelter Hospitals provide strong empirical evidence for the TEP principles of Rapid Spatial Transformation, Behavioural Legibility, and Operational Adaptability, demonstrating that preparedness can be embedded within adaptable interior systems capable of rapidly reconfiguring existing buildings during public health emergencies.

4.3.6 NHS Nightingale Hospitals

The NHS Nightingale Hospitals further reinforce the proposition that preparedness can be embedded within the adaptive potential of existing interiors rather than solely within specialised healthcare infrastructure. Developed during the COVID-19 pandemic, the rapid conversion of exhibition centres into intensive-care facilities demonstrated how modular interior planning, logistical coordination and spatial standardisation could dramatically expand healthcare capacity within exceptionally short timeframes (Hwang & Kim, 2022; Proudfoot et al., 2021). Unlike conventional hospital design, where architectural permanence often dictates spatial organisation, the Nightingale model prioritised operational flexibility. Standardised bed modules, adaptable service distribution, clearly organised circulation networks and scalable ward layouts enabled healthcare functions to be deployed rapidly while maintaining infection-control requirements and clinical workflows (Ji et al., 2022; Marawan et al., 2022). This capacity for organisational transformation illustrates broader discussions within resilience literature, which increasingly define resilient environments by their ability to accommodate unforeseen functional demands through adaptable spatial systems rather than fixed architectural programmes (Charlesworth & Fien, 2022; Pedgley & Şener, 2024). From an Interior Architecture perspective, the Nightingale Hospitals demonstrate that preparedness extends beyond emergency construction to encompass the capacity of everyday buildings to undergo rapid spatial reconfiguration without compromising operational coherence. The project therefore supports emerging discussions surrounding adaptive reuse, where the long-term resilience of buildings depends upon their ability to support multiple future occupations throughout their lifecycle (Lanz & Pendlebury, 2022b; Stone,

2020). Although opportunities for personal privacy, environmental ownership and individual control were necessarily constrained by the emergency context, organisational clarity remained central to the project's success. Legible circulation, consistent spatial hierarchy and standardised environmental organisation reduced operational uncertainty for healthcare professionals working under unprecedented pressure. Within a salutogenic framework, these characteristics primarily reinforce comprehensibility, illustrating how spatial coherence functions as a critical resource for adaptive performance during crisis (Mittelmark et al., 2022; Von Lindern et al., 2017). Accordingly, the NHS Nightingale Hospitals contribute strong evidence for the TEP principles of Operational Adaptability, Behavioural Legibility, and Rapid Spatial Transformation, demonstrating that preparedness can emerge through interior systems deliberately designed for organisational flexibility and future functional change.

4.3.7 Embedded Preparedness through Everyday Interior Elements

The concept of embedded preparedness extends beyond specialised emergency facilities by demonstrating that ordinary interior elements can function as active components of disaster readiness when protective capacity is intentionally integrated into everyday environments. Rather than treating preparedness as a separate layer of emergency infrastructure, this approach embeds adaptive functions directly within furniture, fixtures and interior systems that occupants routinely use. Such integration reduces behavioural disruption during emergencies by ensuring that protective resources remain familiar, immediately accessible and intuitively understood within daily patterns of occupation (Pedgley & Şener, 2024). Recent research increasingly argues that resilient environments should communicate appropriate actions through their physical organisation rather than relying exclusively on procedural instruction. Affordance-based design proposes that spatial elements inherently suggest possible behaviours through their configuration, allowing occupants to respond rapidly under conditions of stress without excessive cognitive processing (Kim, 2021). Similarly, universal design principles emphasise that environments become more resilient when functions remain visible, intuitive and easily interpretable during routine use as well as emergency situations (Lidwell et al., 2003). At the scale of Interior Architecture, this perspective represents an important conceptual shift. Furniture and interior components are no longer viewed as passive objects supporting everyday activities but as active spatial agents capable of enhancing preparedness through behavioural guidance, environmental familiarity and immediate accessibility. Psychologically resilient furniture can simultaneously support everyday occupation while strengthening occupants' sense of safety, continuity, and emotional stability during disruptive events (Sweet, 2018). This interpretation aligns closely with emerging resilience literature, which increasingly positions preparedness as a distributed property of interior environments rather than a characteristic confined to specialised emergency infrastructure (Charlesworth & Fien, 2022; Pedgley & Şener, 2024). Within Antonovsky's Sense of Coherence, embedding protective functions into ordinary interior elements primarily strengthens manageability, as occupants are better able to understand and utilise environments that integrate adaptive resources into familiar routines (Mittelmark et al., 2022; Von Lindern et al., 2017). Simultaneously, the continuity between everyday use and emergency function reinforces behavioural confidence by reducing uncertainty during crisis. Accordingly, this evidence profile supports the TEP principles of Embedded Preparedness, Behavioural Affordance, and Occupant Agency, demonstrating that preparedness can be designed into ordinary interior environments through intuitive, user-centred spatial systems rather than relying solely on specialised emergency interventions.

4.3.8 Paper Partition System (Shigeru Ban)

Shigeru Ban's Paper Partition System demonstrates that preparedness encompasses not only physical protection but also the preservation of dignity, privacy and psychosocial wellbeing within emergency environments. Developed for evacuation centres following major disasters in Japan, the lightweight modular partition system introduces temporary spatial boundaries within large communal shelters, enabling displaced families to regain a degree of personal territory despite the highly constrained conditions of emergency accommodation. Research consistently identifies the absence of privacy, territorial definition and environmental control as major contributors to psychological stress within emergency shelters (Conzatti et al., 2022, UNHCR 2026). Trauma-informed design scholarship similarly argues that environments supporting safety, predictability, dignity and personal choice contribute significantly to emotional recovery following displacement (Bollo & Donofrio, 2022; Brisson et al., 2025; Owen & Crane, 2022). Rather than representing merely a low-cost partition system, Ban's intervention demonstrates how modest interior modifications can fundamentally reshape the psychosocial quality of emergency accommodation. From an Interior Architecture perspective, the project illustrates that interior interventions frequently exert disproportionate influence on occupant wellbeing because they directly regulate visibility, territoriality, social interaction and perceived control. By introducing semi-private family spaces, the Paper Partition System restores behavioural boundaries that support emotional regulation, family cohesion and personal identity despite minimal material intervention. These qualities resonate with broader discussions of interiority, where psychological experience emerges through spatial relationships rather than architectural permanence alone (McCarter, 2016; Perolini, 2011). Within the salutogenic framework, the intervention primarily strengthens meaningfulness, as the restoration of dignity, familiarity and social continuity enables occupants to maintain meaningful relationships with both people and place during displacement (Von Lindern et al., 2017). Simultaneously, the provision of recognisable territorial boundaries enhances perceived safety, which trauma-informed literature increasingly identifies as foundational to recovery (Lynch et al., 2025). Consequently, the Paper Partition System provides strong empirical evidence for the TEP principles of Psychosocial Continuity, Behavioural Legibility, and Trauma-Informed Interior Design, illustrating that preparedness also depends upon environments capable of sustaining emotional wellbeing alongside physical protection.

4.3.9 Paper Log House (Shigeru Ban)

The Paper Log House extends Shigeru Ban's humanitarian design philosophy by demonstrating that preparedness is strengthened when post-disaster reconstruction simultaneously supports material recovery, community participation and psychosocial resilience. Originally developed following the Great Hanshin-Awaji Earthquake, the project combines recyclable paper tubes, locally available materials and community-led construction to produce rapidly deployable housing that balances affordability, environmental responsibility and long-term habitability. Unlike conventional emergency shelters designed solely for immediate occupancy, the Paper Log House enables occupants to participate directly in the rebuilding process. Contemporary resilience literature increasingly recognises participation as a critical determinant of adaptive recovery because involvement in reconstruction strengthens environmental ownership, local capacity and long-term resilience (Charlesworth & Fien, 2022; Pedgley & Şener, 2024; B. H. Walker & Salt, 2010). Rather than treating communities as passive beneficiaries, the project positions rebuilding as a collaborative spatial practice that restores agency alongside shelter. The project also illustrates the importance of resource resilience within Interior Architecture. The use of recyclable, locally sourced and easily assembled materials demonstrates how preparedness can emerge through resource-efficient construction systems that remain accessible under disrupted supply conditions (Clement et al., 2022; Łatka et al., 2025). Such

strategies align with broader discussions on durability, adaptability and circular material systems within resilient interior architecture (Celadyn, 2024; Lanz & Pendlebury, 2022b). Equally important is the project's contribution to meaningful occupation. By enabling residents to reconstruct recognisable domestic environments through active participation, the Paper Log House reinforces familiarity, identity and emotional continuity following disaster. Salutogenic theory suggests that such opportunities for participation and environmental ownership strengthen both manageability and meaningfulness, supporting long-term psychological recovery alongside physical reconstruction (Mittelmark et al., 2022; Von Lindern et al., 2017). Accordingly, the Paper Log House provides compelling empirical evidence for the TEP principles of Resource-Based Preparedness, Participatory Rebuilding, and Psychosocial Continuity, demonstrating that preparedness is strengthened when resilient material systems, community agency and meaningful interior environments are intentionally integrated within post-disaster reconstruction.

4.5 Comparative Synthesis of the Evidence

Taken collectively, the nine architectural precedents reveal a consistent pattern that transcends differences in programme, disaster typology, geographical location, and construction technology. Although each project responds to a distinct context from humanitarian displacement and post-earthquake reconstruction to pandemic healthcare and educational preparedness their underlying architectural strategies converge around a shared objective: enabling occupants to adapt effectively to changing conditions through the design of the interior environment. Across the precedents, preparedness was repeatedly associated with environments that integrated flexibility, environmental legibility, user agency, psychosocial support, and opportunities for future adaptation. These qualities emerged regardless of whether they were achieved through modular shelters, transformable partitions, incremental housing, adaptive reuse, integrated furniture systems, or emergency healthcare conversions. The recurrence of these characteristics across diverse contexts suggests that preparedness cannot be understood solely as an operational response to disaster but rather as an enduring spatial capability embedded within the design of interior environments. Furthermore, mapping the case studies against Antonovsky's Sense of Coherence demonstrates that architectural preparedness consistently reinforces one or more salutogenic resources. Environments characterised by clear spatial organisation enhanced comprehensibility, adaptable and user-controlled environments strengthened manageability, while projects preserving dignity, familiarity, and participation contributed to meaningfulness. Importantly, these salutogenic resources rarely occurred independently. Instead, they interacted through recurring spatial relationships that collectively supported adaptation, resilience, and continuity during disruption. Rather than representing isolated design strategies, these recurring observations provide the empirical basis for identifying higher-order principles that explain how preparedness emerges through Interior Architecture. The following section therefore moves beyond individual precedents to synthesise these patterns into the Theory of Embedded Preparedness (TEP), demonstrating how adaptive spatial systems, human–environment interaction, and psychosocial resilience collectively redefine preparedness as an intrinsic property of the built environment rather than solely an operational emergency response.

5. Cross-Case Synthesis and Theory Development

The comparative evidence presented in the preceding section demonstrates that preparedness cannot be adequately explained through individual architectural projects or isolated design interventions. Although the nine precedents differ substantially in disaster typology, programme, geographical location, construction systems, and temporal contexts, they repeatedly exhibit comparable spatial characteristics that support adaptation, continuity, and resilience. These recurring patterns suggest that preparedness is not an attribute of particular building types but rather an emergent property of interior

environments intentionally designed to facilitate adaptive human–environment relationships. Importantly, these observations did not arise from a priori theoretical assumptions or predetermined design categories. Instead, they emerged inductively through systematic comparison across the selected precedents using a common analytical framework. The recurrence of similar spatial characteristics across diverse contexts provided the empirical basis for identifying higher-order themes that extend beyond individual projects and collectively explain how preparedness is embedded within Interior Architecture. Rather than treating adaptability, privacy, familiarity, autonomy, or spatial organisation as independent design variables, the comparative analysis indicates that these characteristics consistently interact to produce environments capable of supporting occupants before, during, and after disruption. Preparedness therefore emerges not through isolated architectural features but through integrated spatial systems that simultaneously strengthen environmental comprehension, user agency, and psychosocial continuity. This synthesis forms the conceptual foundation from which the Theory of Embedded Preparedness (TEP) is developed.

5.1 Emergent Spatial Patterns

Cross-case comparison revealed that despite considerable variation in architectural form and disaster context, the selected precedents consistently converged around several recurring spatial characteristics. These characteristics were not associated with particular construction technologies or emergency programmes but instead reflected common relationships between occupants and interior environments that enhanced adaptive capacity across multiple contexts. The first recurring observation concerned the deliberate incorporation of adaptability within the architectural environment. Whether expressed through modular shelter systems, incremental housing, transformable partitions, or adaptive reuse strategies, successful projects consistently anticipated change by embedding adaptive capacity within their spatial organisation rather than merely responding to disruption after it occurred. Adaptation was therefore embedded within the spatial organisation itself, enabling environments to accommodate evolving functional, social, and environmental requirements without fundamental reconstruction. A second recurring pattern involved the capacity of occupants to exercise meaningful agency within their environments. Across humanitarian shelters, residential projects, and educational interventions, preparedness was strengthened when users could organise, personalise, or modify their surroundings according to changing needs. Rather than functioning as passive recipients of emergency infrastructure, occupants became active participants in shaping their environments, thereby reinforcing autonomy, environmental competence, and long-term resilience. The analysis further highlighted the importance of spatial legibility. Projects characterised by clear circulation, intuitive spatial organisation, identifiable functional zones, and accessible environmental cues consistently reduced uncertainty during periods of disruption. This relationship was particularly evident within emergency healthcare environments, where organised interior planning supported efficient movement, operational coordination, and rapid environmental understanding despite highly dynamic conditions. Equally significant was the recurring contribution of psychosocial continuity. Across the humanitarian and post-disaster housing precedents, architectural interventions supporting privacy, dignity, territoriality, and familiar domestic routines consistently enhanced emotional wellbeing and social stability. These observations reinforce growing evidence within salutogenic and environmental psychology literature that psychological recovery depends not solely upon physical protection but also upon environments capable of sustaining identity, belonging, and everyday life. Finally, multiple projects demonstrated the value of designing for future transformation. Rather than optimising interiors exclusively for present requirements, several precedents intentionally incorporated latent opportunities for expansion, modification, or alternative patterns of occupation. Such environments remained adaptable long after their initial deployment, suggesting that preparedness is strengthened when architecture accommodates uncertainty as an anticipated condition rather than an exceptional circumstance. Collectively, these recurring observations indicate that preparedness emerges through consistent spatial relationships rather than isolated architectural interventions. To better understand these relationships, the recurring

patterns were synthesised into a series of higher-order conceptual themes representing the principal dimensions of embedded preparedness.

Table 3. Emergent Spatial Themes Derived from Cross-Case Synthesis

Recurring Spatial Characteristics	Evidence Across Cases	Higher-Order Theme
Modular systems, incremental growth, adaptable layouts	Better Shelter, Liina, ELEMENTAL	Embedded Adaptability
User modification, environmental control, participation	Soft Wall, ELEMENTAL, Psychologically resilient furniture, Better Shelter	Occupant Agency
Clear organisation, intuitive circulation, identifiable zones	Fangcang, NHS Nightingale, psychologically resilient furniture	Behavioural Legibility
Privacy, dignity, familiarity, territoriality	Better Shelter, Paper Partition System, Paper Log House	Psychosocial Continuity
Domestic identity, recognisable routines, environmental familiarity	Liina, ELEMENTAL, Paper Log House	Environmental Familiarity
Expandability, future modification, multifunctionality	Liina, ELEMENTAL, Better Shelter	Latent Spatial Capacity

The six higher-order themes identified through comparative synthesis should not be interpreted as isolated architectural characteristics. Instead, they represent interconnected dimensions of preparedness that repeatedly emerged across the analysed precedents irrespective of project scale, geographical location, or disaster context. Their recurrence across diverse architectural settings suggests that preparedness is fundamentally relational, arising through the continuous interaction between spatial organisation, occupant behaviour, and environmental adaptation. Importantly, each theme also demonstrates a close conceptual correspondence with Antonovsky's Sense of Coherence. Spatial legibility contributes to comprehensibility by enabling occupants to understand and navigate their environments. Occupant agency, embedded adaptability, and latent spatial capacity reinforce manageability by increasing opportunities for environmental control and independent adaptation. Psychosocial continuity and environmental familiarity strengthen meaningfulness by preserving identity, dignity, and emotional attachment to place. These relationships indicate that preparedness is not solely an operational objective but also a salutogenic environmental condition that emerges through the reciprocal interaction between occupants and adaptive interior environments.

Recurring Spatial Patterns



Theory of Embedded Preparedness



Adaptive Spatial Systems	Human-Environment Interaction	Psychosocial Resilience
Embedded Adaptability	Occupant Agency	Environmental Familiarity
Latent Spatial Capacity	Behavioural Legibility	Psychosocial Continuity



Embedded Preparedness **(Preparedness as an intrinsic property of Interior Architecture)**

Figure 3. Cross-case synthesis illustrating the inductive emergence of the Theory of Embedded Preparedness (TEP). Comparative qualitative analysis of nine international architectural precedents identified recurring spatial characteristics that were synthesized into six higher-order themes.

These themes collectively form the Theory of Embedded Preparedness, demonstrating that preparedness emerges through the continuous interaction between adaptive spatial systems, human–environment relationships, and psychosocial resilience rather than through isolated emergency interventions.

5.2 Theory of Embedded Preparedness (TEP)

The comparative synthesis demonstrates that preparedness is not adequately explained through conventional disaster management paradigms that primarily emphasise emergency response, infrastructure provision, or post-event recovery. Instead, the evidence indicates that preparedness emerges through the continuous interaction between occupants and interior environments designed to anticipate change, facilitate adaptation, and sustain psychosocial wellbeing. Across all nine precedents, preparedness consistently functioned as an intrinsic environmental quality rather than an external emergency intervention. Drawing upon these findings, this study proposes the Theory of Embedded Preparedness (TEP) as a new theoretical framework for understanding preparedness within Interior Architecture. TEP defines preparedness as the inherent capacity of interior environments to continuously support adaptation, environmental understanding, occupant agency, and psychosocial continuity before, during, and after disruption through spatial characteristics intentionally embedded within the built environment. Unlike conventional preparedness models that conceptualise preparedness as a sequence of plans, procedures, or emergency resources activated during crises, TEP positions preparedness as a latent architectural property that exists prior to disruption. Within this framework, preparedness is not introduced into buildings during emergencies; rather, it is designed into everyday environments through spatial organisation, environmental affordances, and adaptive interior systems that remain continuously available throughout the building's lifecycle. This theoretical shift fundamentally reframes the role of Interior Architecture within disaster resilience. Rather than functioning as a discipline primarily concerned with post-disaster accommodation or temporary emergency interventions, Interior Architecture becomes an active contributor to long-term preparedness by shaping environments that enhance people's capacity to understand, manage, and meaningfully engage with changing conditions. Consequently, preparedness becomes inseparable from the everyday experience of occupation, extending beyond physical protection to encompass psychological resilience, social continuity, and adaptive environmental performance. The inductive analysis further indicates that embedded preparedness is not governed by a single architectural characteristic but emerges through the interaction of six complementary spatial principles. These principles collectively explain how adaptive environments are created and why certain interior interventions consistently support resilience across diverse disaster contexts.

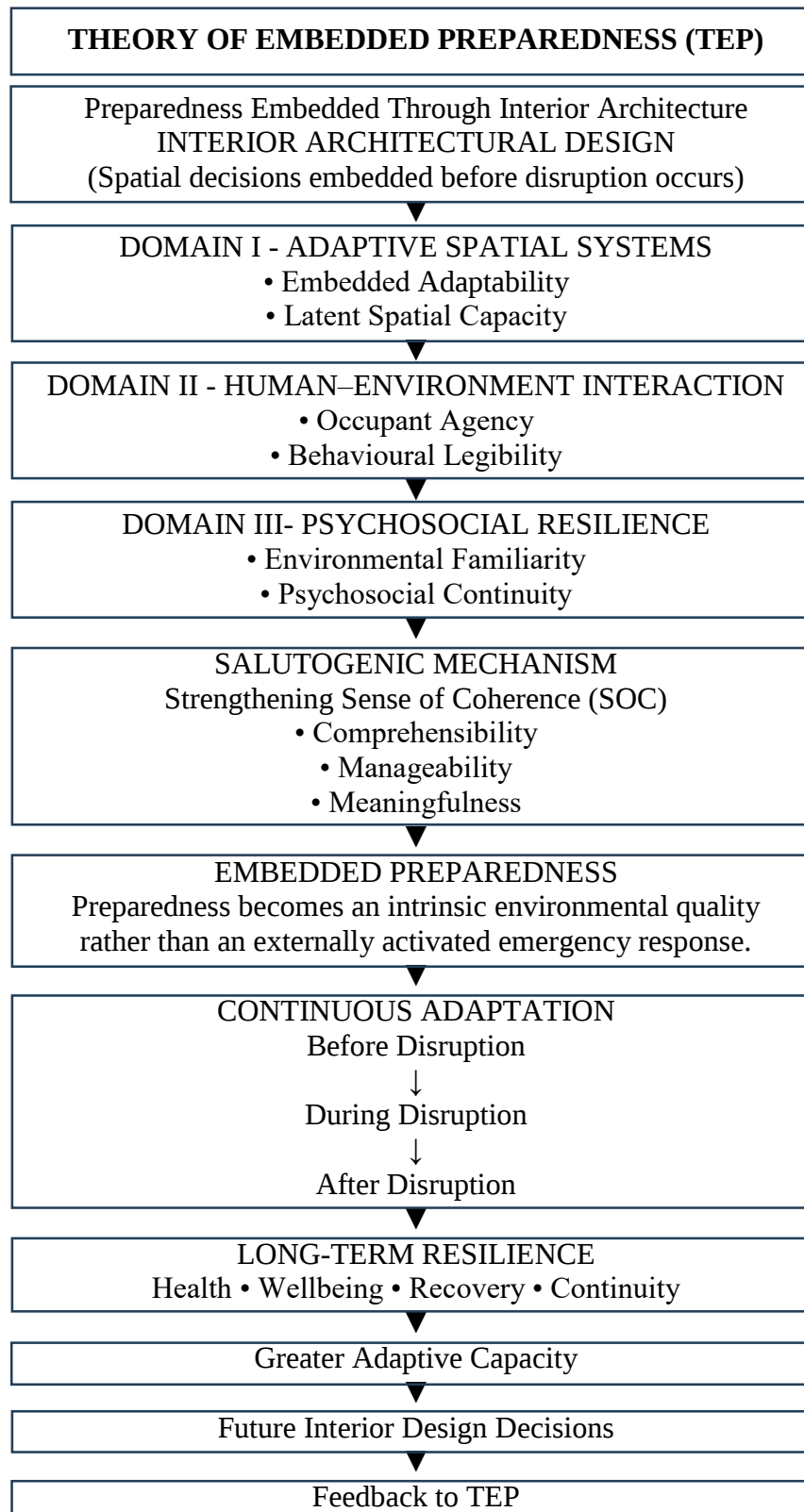


Figure 4. Theory of Embedded Preparedness (TEP)

5.3 Domains of the Theory of Embedded Preparedness

The comparative synthesis identified six interrelated principles that collectively constitute the Theory of Embedded Preparedness. Rather than functioning independently, these principles operate across three complementary domains representing the physical environment, human–environment interaction, and psychosocial resilience. Together, these domains explain how preparedness emerges

through Interior Architecture as an integrated environmental condition rather than a collection of isolated design strategies.

5.3.1 Domain I - Adaptive Spatial Systems

The first domain captures the architectural capacity of interior environments to anticipate change and accommodate evolving patterns of occupation without requiring fundamental reconstruction. Across the analysed precedents, successful environments consistently incorporated adaptability within their spatial organisation, allowing buildings to respond effectively to uncertainty while maintaining functional continuity.

Embedded Adaptability

Embedded Adaptability refers to the deliberate integration of flexible, modular, and reconfigurable spatial systems within the architectural environment. Rather than treating adaptation as an exceptional response to crisis, embedded adaptability enables environments to accommodate changing functional, social, and environmental requirements through design strategies incorporated prior to disruption. This principle was consistently observed across Better Shelter, Liina Transitional Shelter, ELEMENTAL, Fangcang Shelter Hospitals, and the NHS Nightingale Hospitals, where adaptability was achieved through modular planning, incremental development, or adaptive reuse rather than through temporary emergency modifications.

Latent Spatial Capacity

Latent Spatial Capacity describes the intentional provision of unrealised spatial potential capable of supporting future adaptation. Unlike conventional architectural efficiency, which often optimises environments for predetermined functions, latent spatial capacity recognises uncertainty as an inherent condition of contemporary buildings. By incorporating opportunities for expansion, reconfiguration, multifunctionality, or future modification, interior environments remain capable of responding to changing occupant needs long after initial occupation. Evidence for this principle emerged most strongly within ELEMENTAL's incremental housing strategy, Liina Transitional Shelter, and Better Shelter, where adaptability was embedded within the spatial framework itself rather than added retrospectively. Collectively, these principles establish preparedness as a property of the architectural environment, demonstrating that resilient interiors are characterised not by fixed solutions but by an enduring capacity for transformation.

5.3.2 Domain II - Human–Environment Interaction

While adaptive environments provide opportunities for change, preparedness ultimately depends upon the ways occupants perceive, understand, and actively engage with those environments. The second domain therefore explains how Interior Architecture strengthens preparedness by supporting environmental comprehension and meaningful user participation.

Occupant Agency

Occupant Agency refers to the capacity of individuals to modify, personalise, and actively participate in shaping their environments. Across the comparative precedents, preparedness consistently increased when occupants exercised meaningful control over spatial organisation, environmental conditions, or patterns of occupation. Rather than positioning users as passive recipients of emergency infrastructure, adaptive interiors encouraged participation, decision-making, and environmental ownership. This relationship was particularly evident within Soft Wall, ELEMENTAL, Paper Log House, and Better Shelter, where user interaction formed an integral component of architectural performance.

Behavioural Legibility

Behavioural Legibility describes the extent to which spatial organisation communicates its intended use clearly and intuitively, enabling occupants to understand, navigate, and respond effectively during both routine activities and disruptive events. Legible environments reduce uncertainty by providing clear circulation, recognisable functional zones, and intuitive behavioural cues. The principle emerged consistently within Fangcang Shelter Hospitals, NHS Nightingale Hospitals, and Psychologically resilient furniture, where organised spatial systems improved operational efficiency and reduced

cognitive burden during emergencies. Together, these principles demonstrate that preparedness depends not solely upon environmental flexibility but also upon occupants' ability to understand and utilise adaptive environments effectively.

5.3.3 Domain III – Psychosocial Resilience

While adaptive environments and meaningful human–environment interactions establish the physical and behavioural foundations of preparedness, the comparative analysis further demonstrates that preparedness ultimately depends upon the capacity of interior environments to sustain psychological wellbeing, social continuity, and a sense of belonging during periods of disruption. Across the analysed precedents, environments that preserved familiarity, dignity, identity, and opportunities for social connection consistently supported more positive adaptive responses than those designed solely for functional efficiency. This domain therefore recognises preparedness as both a spatial and psychosocial condition, extending beyond physical protection to encompass the human experience of occupying interior environments before, during, and after disruption.

Environmental Familiarity

Environmental Familiarity refers to the incorporation of recognisable spatial characteristics, domestic routines, and culturally meaningful environmental cues that enable occupants to maintain continuity despite changing external circumstances. Rather than recreating identical physical environments, familiar settings support orientation, reduce cognitive stress, and reinforce occupants' sense of identity during periods of uncertainty. This interpretation aligns with human-centred approaches to Interior Architecture that recognise meaning, experience, and emotional engagement as fundamental dimensions of interior space (Petermans & Pohlmeyer, 2014). Across the comparative precedents, familiar spatial organisation repeatedly emerged as an important contributor to adaptive capacity. Better Shelter, Liina Transitional Shelter, ELEMENTAL, and Paper Log House all incorporated domestic spatial qualities that enabled occupants to re-establish everyday routines while adapting to new environmental conditions. These findings are consistent with environmental psychology literature, which recognises familiarity as an important contributor to psychological comfort, environmental attachment, and resilience during displacement and recovery (Scannell & Gifford, 2010). These findings are further supported by evidence demonstrating that supportive interior environments positively influence psychological wellbeing, stress reduction, and environmental comfort, particularly during periods of uncertainty (Boehm & Kopec, 2016). Integrating these strategies within everyday interior environments also aligns with evidence demonstrating the contribution of interior design to health, wellbeing, and supportive environmental experience. Integrating these strategies within everyday interior environments also aligns with evidence demonstrating the contribution of interior design to health, wellbeing, and supportive environmental experience (Boehm & Kopec, 2016). Within the salutogenic framework, environmental familiarity primarily contributes to meaningfulness by preserving continuity between past experiences and future adaptation. Consequently, preparedness is strengthened when Interior Architecture intentionally incorporates spatial characteristics that sustain identity and belonging throughout the disaster lifecycle.

Psychosocial Continuity

Psychosocial Continuity describes the capacity of interior environments to preserve dignity, privacy, social relationships, and emotional stability despite disruption. Unlike conventional approaches that prioritise physical shelter alone, the comparative evidence demonstrates that preparedness also depends upon environments capable of supporting normal patterns of everyday life under extraordinary circumstances. Projects such as the Paper Partition System, Better Shelter, and Paper Log House consistently illustrate how relatively modest interior interventions can substantially improve privacy, territoriality, social interaction, and psychological wellbeing within emergency accommodation. Rather than functioning solely as physical barriers, these interventions facilitate emotional recovery by enabling occupants to retain control over personal space and maintain social

relationships during displacement. This observation is consistent with trauma-informed environmental design research demonstrating that privacy, perceived safety, and environmental control contribute significantly to psychological recovery following disruptive events (Bulaj et al., 2025). From a salutogenic perspective, psychosocial continuity reinforces both manageability and meaningfulness, as environments supporting dignity and social connection improve individuals' capacity to cope with uncertainty while sustaining positive emotional engagement with place. Accordingly, preparedness extends beyond physical resilience to include environments intentionally designed to preserve human wellbeing throughout periods of disruption. Collectively, Environmental Familiarity and Psychosocial Continuity establish the psychosocial dimension of the Theory of Embedded Preparedness, demonstrating that resilient interior environments support not only survival but also the restoration and continuation of everyday life.

5.4 Integration of the Theory of Embedded Preparedness

The Theory of Embedded Preparedness should not be understood as a collection of independent design principles. Rather, the comparative analysis demonstrates that preparedness emerges through the continuous interaction of adaptive spatial systems, human–environment interaction, and psychosocial resilience operating simultaneously within interior environments. Each domain contributes a distinct yet interdependent function that collectively strengthens occupants' capacity to anticipate, understand, manage, and adapt to disruption. Adaptive Spatial Systems provide the physical framework through which environments accommodate change over time. Human–Environment Interaction enables occupants to interpret and actively engage with these adaptive environments through agency and behavioural understanding. Psychosocial Resilience ensures that environmental adaptation also preserves dignity, familiarity, identity, and emotional wellbeing. Together, these domains reinforce Antonovsky's Sense of Coherence by strengthening comprehensibility, manageability, and meaningfulness across multiple scales of occupation. Importantly, the theory conceptualises preparedness as a continuous architectural condition rather than a discrete emergency intervention. The comparative evidence demonstrates that environments intentionally designed with embedded preparedness remain adaptable throughout their lifecycle, supporting routine occupation under normal circumstances while simultaneously enabling effective responses during periods of disruption. Preparedness therefore becomes an intrinsic environmental quality that continuously evolves through everyday interaction between occupants and interior space. This theoretical perspective represents a significant departure from conventional disaster preparedness models, which predominantly emphasise operational planning, emergency infrastructure, or post-event recovery. By positioning preparedness as an embedded property of Interior Architecture, TEP establishes a new conceptual framework that integrates adaptive spatial design, salutogenic theory, and disaster resilience into a unified understanding of how built environments contribute to long-term human wellbeing.

6. Discussion

The Theory of Embedded Preparedness (TEP) proposed in this study extends existing understandings of disaster preparedness by repositioning preparedness as an intrinsic characteristic of Interior Architecture rather than an externally activated function of emergency management. While previous research has significantly advanced knowledge on resilience, salutogenic environments, adaptive architecture, and humanitarian shelter design, these bodies of literature have largely evolved in parallel. By integrating these perspectives, TEP provides a unified theoretical framework that explains how interior environments can continuously strengthen adaptive capacity, psychosocial wellbeing, and environmental resilience throughout the disaster lifecycle. The comparative analysis demonstrates that preparedness does not emerge from isolated emergency interventions but from the cumulative interaction of adaptive spatial systems, human–environment relationships, and psychosocial resilience. This represents a conceptual shift from preparedness as an event-driven activity to preparedness as a continuous environmental condition embedded within everyday interior environments. Consequently, Interior Architecture assumes a more proactive role in disaster resilience by simultaneously

contributing to anticipation, adaptation, response, and recovery, rather than functioning primarily after disasters occur.

6.1 Positioning TEP within Existing Theoretical Frameworks

The Theory of Embedded Preparedness builds upon, while extending, several established theoretical traditions within architecture, environmental psychology, and disaster studies. Rather than replacing these theories, TEP integrates their complementary contributions into a coherent framework centred on Interior Architecture. This represents a significant departure from conventional preparedness frameworks, which have largely emphasized planning, governance, emergency resources, and institutional readiness rather than the spatial characteristics of everyday environments (Twigg, 2015). Antonovsky's Salutogenic Theory provides the principal conceptual foundation for understanding how environments promote health through the Sense of Coherence (SOC), comprising comprehensibility, manageability, and meaningfulness (Vinje et al., 2017). Previous applications of salutogenesis in architecture have primarily focused on healthcare environments, therapeutic landscapes, and wellbeing-oriented design. The present study extends this perspective by demonstrating that salutogenic resources also function as mechanisms of disaster preparedness. Across the analysed precedents, environments characterised by spatial legibility, user agency, environmental familiarity, and adaptive capacity consistently strengthened one or more dimensions of the Sense of Coherence, thereby enhancing occupants' ability to anticipate, interpret, and cope with disruption. TEP therefore positions salutogenesis not only as a framework for health promotion but also as a theoretical mechanism through which preparedness emerges within Interior Architecture. This broader interpretation reflects subsequent developments in salutogenic research, which increasingly position the built environment as an active contributor to health and adaptive capacity. Similarly, resilience theory has traditionally conceptualised resilience as the capacity of systems to absorb disturbance, reorganise, and continue functioning following disruption (Holling, 1973; B. Walker et al., 2004). Within architecture, resilience has largely focused on structural robustness, infrastructure, and post-disaster recovery. The findings presented here broaden this perspective by demonstrating that resilience is equally dependent upon the adaptive qualities of interior environments that facilitate everyday behavioural adjustment, environmental comprehension, and psychosocial continuity. In this respect, TEP complements resilience theory by shifting analytical attention from buildings as physical systems to buildings as lived environments that continuously support human adaptation. The theory also contributes to adaptive architecture by extending concepts of flexibility, transformability, and incremental development beyond questions of functional performance. Buildings capable of learning, adaptation, and long-term transformation remain more responsive to changing social and functional demands (Brand, 1995; Till & Schneider, 2016). The present findings reinforce these observations while demonstrating that adaptability also functions as a preparedness strategy. Across multiple precedents, flexibility consistently enhanced occupant agency, environmental control, and long-term resilience, rather than merely accommodating changing spatial requirements. TEP therefore reframes adaptive architecture as a proactive mechanism of preparedness rather than solely an operational design strategy. Environmental psychology likewise provides important insights into person–environment relationships through concepts such as place attachment, territoriality, privacy, and environmental identity (Scannell & Gifford, 2010). The comparative evidence demonstrates that these psychosocial qualities contribute directly to preparedness by sustaining familiarity, continuity, dignity, and emotional stability during disruption. Rather than treating psychological wellbeing as a secondary outcome of emergency design, TEP positions psychosocial resilience as a fundamental dimension of preparedness. Collectively, these relationships demonstrate that the Theory of Embedded Preparedness does not replace existing theoretical perspectives but instead synthesises them into an integrated explanatory framework that positions Interior Architecture as an active contributor to disaster preparedness. Recent research further supports this transition towards preparedness-oriented design, arguing that adaptive built environments must increasingly anticipate uncertainty through flexible spatial strategies embedded within everyday architecture.

6.2 Contribution to Interior Architecture Theory

Perhaps the most significant contribution of this study is the repositioning of Interior Architecture from a discipline traditionally associated with spatial quality and post-occupancy experience to one that actively shapes disaster preparedness through everyday environmental design. Existing preparedness frameworks have predominantly focused on policy, governance, logistics, emergency planning, and engineering resilience, with comparatively limited attention given to the architectural characteristics that enable people to adapt before disruption occurs. This position is consistent with contemporary Interior Architecture scholarship, which increasingly recognizes interiors as active socio-spatial systems capable of shaping environmental relationships, wellbeing, and social resilience rather than merely configuring enclosed space (Trogal et al., 2018). The comparative analysis demonstrates that interior environments contribute to preparedness through far more than physical protection. Adaptive spatial systems, intuitive environmental organisation, opportunities for occupant participation, and environments that support familiarity and dignity collectively enhance people's capacity to anticipate, interpret, and respond to changing circumstances. Preparedness therefore becomes embedded within everyday patterns of occupation rather than remaining dormant until activated by emergency procedures. This interpretation supports emerging built-environment resilience research advocating the integration of preparedness into routine architectural decision-making rather than limiting resilience to post-disaster reconstruction (Mohareb & Maassarani, 2018). This reconceptualization substantially expands the scope of Interior Architecture. Rather than responding only after crises occur, designers become responsible for creating environments that continuously cultivate adaptive capacity throughout the building lifecycle. In doing so, preparedness becomes inseparable from the broader objectives of health promotion, environmental quality, user wellbeing, and long-term resilience. Furthermore, the six principles identified through comparative synthesis provide an operational vocabulary through which designers, researchers, and educators can evaluate preparedness within interior environments. Unlike conventional design guidelines that emphasise isolated technical interventions, these principles collectively describe preparedness as an emergent spatial quality arising through the interaction of physical, behavioural, and psychosocial dimensions. Emerging Interior Architecture research similarly highlights the growing importance of adaptive, user-centered, and resilient interior environments capable of supporting changing patterns of occupation and environmental uncertainty.

6.3 Implications for Practice and Design

The findings have significant implications for architectural practice, humanitarian design, healthcare environments, educational facilities, and public infrastructure. Rather than treating preparedness as a specialised consideration limited to emergency facilities, the Theory of Embedded Preparedness suggests that adaptive capacity should become a routine design objective across diverse interior environments. Design strategies such as modular planning, flexible spatial organisation, incremental development, intuitive circulation, opportunities for personalisation, and environments that support privacy and familiarity can be incorporated into everyday projects without compromising routine patterns of occupation. Such interventions simultaneously enhance everyday user experience while increasing environmental responsiveness during future disruptions. Integrating these strategies within everyday interior environments also aligns with evidence demonstrating the contribution of interior design to health, wellbeing, and supportive environmental experience (Boehm & Kopec, 2016).

For humanitarian architecture, the theory suggests that emergency accommodation should extend beyond minimum shelter provision to environments that actively support dignity, autonomy, psychosocial recovery, and long-term adaptation. Similarly, healthcare facilities may benefit from interior systems capable of rapid functional transformation while maintaining environmental clarity and user wellbeing. Educational environments, workplaces, and public buildings likewise present opportunities to embed preparedness through adaptable furniture systems, multifunctional interiors, and spatial configurations capable of accommodating changing patterns of use. Accordingly,

preparedness should be recognised not as an exceptional design requirement but as a fundamental criterion of interior architectural quality.

6.4 Implications for Research

The Theory of Embedded Preparedness also establishes several directions for future research. First, the six theoretical principles proposed here require empirical validation across broader geographical, cultural, and building contexts to examine their applicability beyond the case studies analysed in this investigation. Comparative studies incorporating post-occupancy evaluation, behavioural observation, user experience, and mixed-method research designs could further refine the relationships identified through this qualitative synthesis. Second, future research should investigate the operationalisation of the theory through measurable design indicators capable of informing professional practice and building assessment. The development of preparedness assessment tools, design frameworks, and performance metrics would facilitate the practical implementation of TEP across diverse interior environments. Finally, interdisciplinary collaboration among Interior Architecture, environmental psychology, public health, disaster management, and resilience science offers considerable potential for expanding understanding of how adaptive environments influence long-term human wellbeing. Such investigations may further establish preparedness as a measurable architectural attribute that simultaneously contributes to resilience, health promotion, sustainability, and quality of life.

7. Conclusion

This study investigated how Interior Architecture can contribute to disaster preparedness beyond conventional emergency management frameworks. Through a comparative qualitative analysis of nine international architectural precedents spanning humanitarian shelters, healthcare environments, educational interventions, and post-disaster housing, the research identified recurring spatial characteristics that consistently supported adaptation, environmental understanding, occupant agency, and psychosocial wellbeing across diverse disaster contexts. Rather than interpreting these characteristics as isolated design strategies, the comparative synthesis demonstrated that they represent interconnected dimensions of a broader architectural phenomenon. Building upon these findings, the study proposes the Theory of Embedded Preparedness (TEP), which conceptualises preparedness as an intrinsic environmental quality intentionally embedded within Interior Architecture through adaptive spatial systems, human–environment interaction, and psychosocial resilience.

The study makes three principal contributions to scholarship. First, it extends disaster preparedness research by reframing preparedness from an event-driven emergency management activity to a continuous architectural condition embedded within everyday environments. In doing so, it broadens traditional preparedness discourse beyond emergency planning towards preparedness as an embedded architectural condition (Twigg, 2015). Second, it expands salutogenic theory by demonstrating how Antonovsky's Sense of Coherence provides the underlying mechanism through which interior environments enhance adaptive capacity before, during, and after disruption. Third, it establishes Interior Architecture as an active contributor to disaster resilience by identifying six interrelated design principles Embedded Adaptability, Latent Spatial Capacity, Occupant Agency, Behavioural Legibility, Environmental Familiarity, and Psychosocial Continuity, that collectively explain how preparedness can be intentionally designed into the built environment. This perspective aligns with resilience research that conceptualises adaptation as an ongoing environmental process rather than an exceptional response to crisis (Masten, 2001). Beyond its theoretical contribution, TEP offers practical relevance for architects, interior architects, designers, humanitarian organisations, healthcare planners, educators, and policymakers. By embedding preparedness within routine spatial design rather than treating it as a specialised emergency function, the theory encourages environments that simultaneously support everyday wellbeing and long-term resilience. This perspective has the potential to inform architectural practice, professional guidelines, post-occupancy evaluation, resilience assessment frameworks, and future policy concerned with adaptive and health-promoting built environments. The study is not without limitations. The proposed theory is derived from a qualitative

comparative analysis of nine international precedents and therefore emphasises analytical depth rather than statistical generalisability. Although the selected cases encompass diverse disaster types, geographical regions, building programmes, and scales of intervention, further empirical research is required to examine the applicability of TEP across different cultural, climatic, and socio-economic contexts. Future investigations incorporating post-occupancy evaluation, longitudinal studies, behavioural observation, mixed-method approaches, and quantitative assessment could further validate, refine, and operationalise the proposed theoretical framework. Ultimately, this research argues that preparedness should no longer be understood solely as a matter of emergency planning, infrastructure, or post-disaster recovery. Instead, preparedness can be reconceptualised as a spatial condition cultivated through everyday Interior Architecture. By embedding adaptability, environmental legibility, occupant agency, environmental familiarity, and psychosocial continuity within the built environment, Interior Architecture becomes capable of supporting continuous human adaptation across the entire disaster lifecycle. In doing so, the Theory of Embedded Preparedness offers a new conceptual foundation for designing healthier, more resilient, and more adaptive interior environments that sustain both everyday life and future uncertainty.

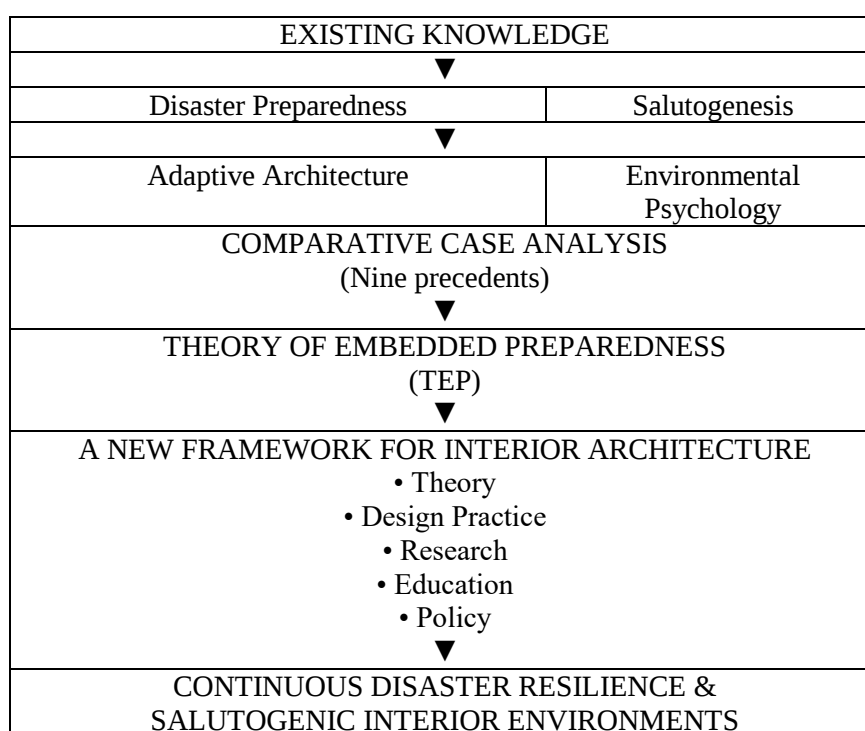


Figure 5. Overall contribution of the study. The Theory of Embedded Preparedness (TEP) integrates insights from disaster preparedness, salutogenesis, adaptive architecture, and environmental psychology into a unified theoretical framework for Interior Architecture. Developed through the comparative qualitative analysis of nine international architectural precedents, TEP conceptualises preparedness as an intrinsic environmental quality that informs theory, design practice, research, education, and policy, ultimately contributing to continuous disaster resilience and salutogenic interior environments.

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Conflicts of Interest

The author declares no conflicts of interest.

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Credit author statement

Naina Maggie Cleetus:

Conceptualization

Methodology

Investigation

Formal analysis

Data curation

Visualization

Writing – original draft

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