FROM "INTROVERTED" TO "EXTROVERTED": THE TRANSFORMATIVE POTENTIAL IN THE ADAPTIVE REUSE OF HISTORICAL BUILDINGS IN COLOMBO

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Abstract

Buildings, similar to living organisms undergo transformation throughout their lifespan. Once a building reaches the stage of obsolescence, it is either demolished or repurposed. Adaptive reuse is a sustainable architectural approach that has been globally implemented to repurpose buildings. In Sri Lanka, this method has been implemented to repurpose historic buildings for public use. However, the majority of these buildings were originally introverted in nature, which does not align with the extroverted spatial quality required for public buildings.

The study aims to identify and assess the physical characteristics that can facilitate the transformation of historic buildings from introverted to extroverted spaces. Further, it aims to identify adaptive reuse criteria that may limit the possibility of achieving a higher degree of extroversion. The architectural visual analysis method was adapted to explore the degree of extroversion achieved in the selected case studies. Physical characteristics were analysed by comparing drawings and photographs, followed by interviews with professionals involved in the adaptation process. The interviews aimed to identify the specific factors that affect the potential for transformation in accordance with the adaptive reuse criteria.

The findings of the study suggest that the main decisive factor affecting the degree of extroversion was legislation in Sri Lanka. It also identifies the vertical plane and openings on vertical planes as critical physical attributes that determine the degree of extroversion. Furthermore, the study shows that authenticity and integrity can restrict the degree of extroversion in historic buildings.

Furthermore, this study suggests the importance of determining the new function based on the transformation potential of the historical building. In light of the above findings, this study can serve as a guide for assessing adaptations of historic buildings and their potential for transformation into future public spaces.

Keywords: adaptative reuse, Introversion, Extroversion, Transformative potential

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Introduction

The Construction industry has accounted for 38% of global greenhouse gasses, hitting its highest emission in 2019 (UNEP, 2019). According to BBC and the Environmental Protection Agency of the USA, the construction industry stands third as a major contributor to the world's overall waste generators, and 90% of construction debris is produced by demolishing existing buildings. This emphasizes the importance of adapting sustainable approaches from the initial design stages to minimize the impact on the environment.

Adaptive reuse of existing buildings approach implemented to improve the sustainability of the built environment. According to Conejos et al (2013) this approach has gained global recognition in recent times. Bullen & Love (2011) suggests that by going beyond traditional conservation methods, conservationists, architects, researchers, and other aligned professionals are giving special emphasis to the adaptive reuse of historical buildings. However, Bullen (2007) argues, that the adaptive reuse of historical buildings hinders compliance with sustainable goals, yet these shortcomings can be overlooked when weighted against their social values.

In Sri Lanka, historical buildings are now being re-purposed for public use by implementing these strategies. It is eminent when adapting historical buildings, preserving the existing spatial quality plays a significant role.

In the Sri Lankan context, many of the repurposed buildings were originally designed for private or semi-public use and had an introverted spatial quality prior to adaptation. However, to meet the functional requirements of the new public use, an extroverted spatial quality was necessary. However, it could be understood through observation that many of these adaptations were executed with a primary focus on conservation and sustainability aspects. Therefore, less emphasis was given to how the adaptation of these historic buildings impacts the relationship between the existing spatial quality of the building and the new function. Therefore, to effectively execute these types of building adaptations, it is important to understand the spatial configurations in architecture that can be applied in the adaptation process.

Many studies have been conducted focusing on conservation and sustainable strategies in the adaptive reuse of historical buildings in Sri Lanka. Yet, a gap remains in understanding how the adaptation impacts the spatial quality when confronted with any incompatibility of the new function. Hence, this study compares the spatial characteristics of the building, before and after adaptation to identify the spatial configurations and the adaptive reuse criteria that impact the possibility of increasing the degree of extroversion in adapting historic buildings for public use.

Theorizing Building Adaptation and Spatial Characteristics

Adaptive Reuse of Historic Buildings

Wilkinson (2011) states that buildings have a lifecycle similar to living organisms and are not immortal. Chan (2018) adds that buildings can become obsolete. According to Watt (1999) obsolescence measures the lack of utility or function to study the deterioration process of a building. When a building becomes obsolete and no longer fulfills its intended purpose, it can be either repurposed or demolished. Kincaid (2002) and Langston and Shen (2008) determine that the most suitable time to adapt a building is when it becomes obsolete to its original or previous function.

Adaptive reuse is an approach used in building conservation to repurpose existing buildings. According to Douglas (2006), it refers to any intervention or adaptation made to change the capacity, function, or performance of a building, to adjust, reuse, or upgrade it to suit new conditions or requirements. While there are many definitions, The Burra Charter, ICOMOS Australia (2013) defines adaptation as "changing a place to suit the existing or proposed use". Unlike other conservation approaches, adaptive reuse is not restricted to accurate restoration but allows appropriate changes and considers the building as a socio-economic system (Mengusoglu and Boyacioglu, 2016). Furthermore, the approach does not only seek to preserve the past but to also use the past in the present (Ashworth, 2011). However, according to Aydin and Yaldiz (2010), it is important to establish a balance between preserving the identity of the historic building and facilitating the spatial organization for the new function.

Adaptive Reuse of Historic Buildings in Sri Lanka

Buildings with historical significance in Sri Lanka have been repurposed by introducing new functions. In recent years, the majority of state-funded adaptations of historical buildings have converted them from private or semi-public functions to public functions.
The Antiquities Ordinance (1940) governs historical buildings in Sri Lanka, but the legislation only directly applies to the listed buildings that are published in the gazette. There are three categories:

- Protected monument: situated on private land declared as protected monuments.
- Ancient monument: situated on state lands declared as ancient monument.
- Archeological Reserves: an area declared and published the gazette.

A notable factor is that not all historically relevant buildings in Sri Lanka are listed in the gazette. When adapting a listed historical building in Sri Lanka, the interventions and legislative guidelines are reviewed on a case-by-case basis by the Archaeological Department.

Transformative Potential in Historic Buildings

In order to adapt a building, the existing structure must be capable of accommodating the new function (Kincaid, 2000; Langston and Shen, 2007). Therefore, researchers have conducted comprehensive studies to formulate adaptive reuse models that can assess the transformative potential of existing buildings.

Langston (2008) established the Adaptive Reuse Potential (ARP) model to determine the transformative potential of buildings, which Conejos (2013) further developed and introduced as the AdaptSTAR model. It is a design criterion that determines the adaptive reuse potential in the initial stages. However, Hong and Chen (2017) argue that this model generally addresses all types of buildings but does not specify the unique aspects of adaptive reuse for historic buildings.

Based on the AdaptSTAR model, the following criteria were extracted by reviewing the works of Bullen and Love (2011), Hong and Chen (2017), Wilkinson (2011), and Samaranayake (2019), with an emphasis on historic buildings. These criteria were then categorized under the five main principles of adaptive reuse of historic buildings identified by Chan (2018).

Table 1: Attributes of Adaptive Reuse of Historic Building

1. INTEGRITY	Minimal changes and repairs are done to the existing structure to preserve its integrity. It allows a built structure to retain its key original qualities of social and cultural significance	Chan, 2018
i. Structural Integrity	The decision to reuse depends on the physical condition unless precautionary strengthening or underpinning measures are taken	Bullen and Love, 2011
ii. Visual/ Aesthetic Integrity	This influences the preservation of the landscape and valuable façade of historic monuments of the complex	Somayeh & Pirouz (2018)
iii. Internal Layout	Whilst the character of a building a preserved, it should also satisfy the current and future requirements of the new use in in terms of internal reorganization	Bullen and Love (2011)
2. SUSTAINABILITY	Adaptive reuse consideration is given sustainable approaches by recycling and reusing built structures with careful consideration	Chan, 2018
i. Economic Return	Economic considerations determine the decision to reuse or demolish built assets	Bullen and Love (2011)
ii. Marketability	The commercial performance of building can be influenced by aesthetic appearance, operational costs, and employee productivity	Bullen and Love (2011)
iii. Infrastructure	Availability of public access, links to roads, parking and communal facilities also determines the reuse potential of existing structure	Hong and Chen (2017)
iv. Site condition	Sustainability proposition of reusing an existing built asset can be determined by the built area, plot ratio, zoning, spatial proportions, and enclosure.	Bullen and Love (2011)
3. FLEXIBILITY	It is important in buildings to allow a degree of flexibility and future modifications which could be easily incorporated and removing the constraints of specific spatial forms and purpose.	Chan, 2018
i. Functionality	Flexibility in space which determines the spatial capability to adapt according to the newly introduced function determine the potential adaptability of existing building	Conejos et al. (2013) s
ii. Residual Service Life	Buildings were frequently demolished while their components and structures have residual life cycles that might be utilised for a variety of purposes over long periods of time	Bullen and Love (2011)
iii. Internal and External Space	Longevity of a building lifecycle can cause technical issues, specifically in terms of the outside fabric and durability of finishes	Bullen and Love (2011)

4. AUTHENTICITY	New experiences in how the end user interacts with both the historical and newly constructed fabric are being created	Chan, 2018
i. Cultural Value	Reuse of historic structures preserves the social meaning of the location to a certain degree	Hong and Chen (2017)
ii. Landscaping Quality	If the landscape is historically relevant, the replace or reintroducing landscape element should be done in a sensitive manner	Fournier and Zimnicki (2004)
iii. Historical Value	Reuse may not be an economically or sustainably viable alternative, unless a building has redeeming esthetic, qualities, or a heritage value	Bullen and Love (2011)
iv. Use Value	The use value of a historical building can be determined by its functional, economic, social and political message translated by its original function	Bullen and Love (2011)
v. Facilitating Social Interaction	Internal space creates contains for adaptation but it's the requirements for human activities that contains adaptability.	Kincaid (2003)
5. MEMORY	Memory recognizes socio-cultural significance and acknowledge emotional attachment to a historic built structure	Chan, 2018
i. Location	Safety, accessibility, and commercial viability creates an attractive investment opportunity for the built asset	Bullen and Love (2011), Langston (2012), Hong and Chen (2017)
ii. Legislation	The legislation determines tangible strategies and flexibility in determining the applicability of building codes	Bullen and Love (2011), Hong and Chen (2017)

Adapting a building to a new function often requires modifications to its existing spatial quality, including historical buildings (Farrag and Abouhadid, 2018). Therefore, Aydin and Yaldiz (2010) emphasize the importance of ensuring that the building is in harmony with the new function.

As such, this study reviews the spatial characteristics of the building, with a focus on its introverted and extroverted spatial quality.

Transformation of Space

The physical manifestation of architecture can be observed through its appearance (Xhambazi, 2015). However, the built environment is subject to change due to various social, economic, and environmental factors (Xhambazi, 2015). The study considers spatial transformation to be the physical alterations made in response to the changing demands of the built environment.

The physical appearance of architecture is defined by its built form, which comprises of both horizontal and vertical planes (Hasgül, 2015). A plane delineates the boundaries of a volume and contributes to the quality of the enclosed space. A combination of horizontal and vertical planes forms a volume, which is composed of three dimensions: length, width, and depth. These dimensions are arranged to form a space that creates a zone of influence or territory (Ching, 2007).

The perception of space is formed by people's interactions with the physical elements of a space. While the physical dimensions of space must make sense, the perception of space must also be coherent as part of the whole (Carmona et al., 2010)

Introversion and Extroversion

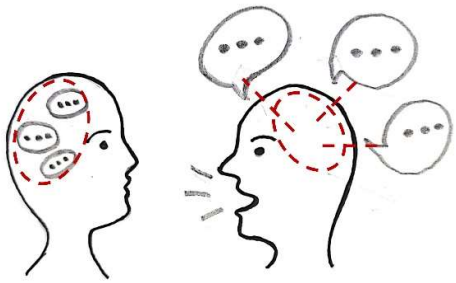


Figure 1: Introvert & Extrovert - Human psychological traits
Source: Author

The concepts of introverted and extroverted architecture are based on the psychological traits of introversion and extroversion applied to the design of buildings. Both introverted and extroverted architecture can be effective depending on the function of the building and the needs of its users. Architects often consider these concepts when designing buildings in order to create spaces that are both functional and psychologically effective. However, in psychology the terms “introvert” and “extrovert” are used to describe the personality dimensions of humans, based on the traits of human psychology (Xhambazi, 2015). According to Jung, Extroversion refers to "the act, state, or habit of being predominantly concerned with and obtaining gratification from what is outside the self," while Introversion refers to "the state of or tendency toward being wholly or predominantly concerned with and interested in one's own mental life" (Xhambazi, 2015). These terms are used to describe the "Human body," which refers to "the relations of its parts and by its actions and reactions with respect to its environment (outer) and internal milieu" (Xhambazi, 2015). When applied to architecture, the "Architectural Body" as a whole is composed of parts and elements

Introversion and Extroversion in Architecture

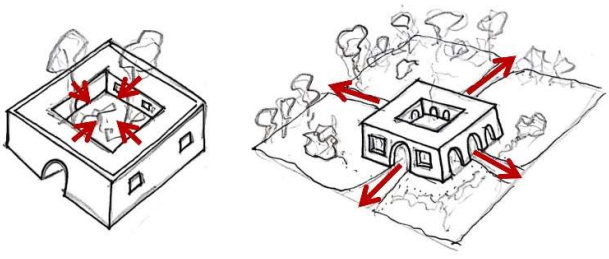


Figure 2: Introvert & Extrovert in Architecture
Source: Author

Introversion and extroversion in architecture are mainly discussed in Iranian architecture (Sadoughianzadeh, 2013). Sadoughianzadeh (2013) defines "Introvert architecture" as a spatial pattern that tends to conceal what exists or occurs inside, insisting on privacy, seclusion, and secrecy. Introverted architecture forms around a central space with limited contact with the external environment (Memarian, 1992).

On the contrary, "Extrovert architecture" is characterized by a more open spatial layout. It displays more flexibility in private/public separation due to its respective social life and spatial organization of the built environment (Sadoughianzadeh, 2013). Pirnia (1990) describes extroverted architecture as a "cage where there is a view of the outside world".

Meiss (2008) states that architecture is born because of the collision between internal and external forces, which define the character of the boundary or the plane. Furthermore, Venturi (1992) states that a boundary defines the point of change where "inside and outside" is formed, and the notion of "inside and outside" demonstrates a contradiction in space.

Therefore, in order to understand the spatial configuration, the following outlines spatial attributes that are derived from Frederick D.K. Ching's "Architecture: Form, Space, and Order", defining the spatial characteristics of introverted and extroverted spaces.

Table 2: Attributes of Spatial Characteristics of Introverted and Extroverted Spaces.

01. MASS AND SPACE	Form, Space and Order which identifies spatial characteristics of introverted and extroverted spaces.	Ching (2007)
i. SYMBOLIC RELATIONSHIP OF MASS AND SPACE	The mass not only determines the form of the building but also defines its relationship with the surrounding.	
a. Introvert Scheme	When a mass encloses a courtyard or an atrium within its volume creates an introverted scheme.	
b. Extrovert Scheme	When a form stands out as a distinct object, dominating its surroundings through form and topography the scheme becomes extroverted	
ii. SPATIAL ORGANIZATION	The arrangement of space areas reveals its relative importance and functional or symbolic role in a building's organization	
a. Centralized Organization	The central space is large and dominant where secondary spaces are grouped around it. This is more introverted in nature as the focus is inwards towards the central space	
b. Linear Organization	a series of repetitive spaces, which are alike in size, form, and function. Each space along the sequence has an exterior exposure.	
c. Grid Organizations	The organization of mass on the similar pattern forms grid organization. This is more introverted in nature	
d. Radial Organizations	It is a combination of both central and linear organizations. The linear spaces extending out forms an extroverted plan	
e. Clustered Organizations	Spaces are grouped by physical proximity and it is introverted in nature	

02.HORIZONTIAL PLANE	Plane directly contributes to the extroverted or introverted nature of a space, as it defines a boundary of a volume	Ching (2007)
i. BASE PLANE	A distinct separation can create a defined edge on the base plane. This can create spatial zones and without disrupting the continuity of space	
a. Elevated base plane	The scale of level change determines spatial and visual continuity. Stepping up to an elevated space could assist to express the extroverted nature or significance of the space.	
b. Depressed base plane	Lowering of a space below its surroundings could express its introverted nature or its sheltering and protective qualities	
ii. OVERHEAD PLANE	A volume of space between a horizontal plane and the ground plane is defined by a horizontal plane located overhead	
03. VERTICAL PLANES	This serves to define a shared boundary between the internal and outdoor environments by separating one space from another	Ching (2007)
i. Vertical linear elements	Vertical linear elements mark the boundaries of a space and maintain continuity with its surroundings.	
ii. Single Vertical Plane	The height of a vertical plane determines the level of visual connectivity and enclosure of a standalone plane.	
iii. Parallel Vertical Plane	which orient the space axially towards both open ends, creating a directional and extroverted space without corners.	
iv. L-Shaped Plane	An L-shaped arrangement of vertical planes creates a diagonal field of space that transitions from strongly enclosed and introverted at the corner to extroverted along its outer edges.	
v. U Shaped Planes	A U-shaped arrangement of vertical planes creates a volume of space with an inward focus and an outward orientation, growing increasingly extroverted towards the open end of the configuration.	
vi. Four planes	Four vertical planes establish the boundaries of an introverted space and influence the field of space around the enclosure	
04. OPENINGS	Openings create spatial and visual connections between spaces while weakening the enclosure of a space.	Ching (2007)
i. Opening Within Planes	Enclosed openings within a plane are defined by its surface and the definition of their edges weakens as their size increases.	
ii. Opening Between Planes	openings between planes can occupy entire walls and visually articulate the edges of adjacent planes while extending the space beyond the corner into adjacent space.	
iii. Degree of Enclosure	The number of openings in a space affects its level of enclosure, with more openings leading to a less defined and more blended space.	
iv. View – Focus of the space	The size and location of openings determining the degree of visual privacy, which can be expanded by increasing the size of the openings.	

05. CIRCULATION	create a perceptual thread linking spaces of a building or series of spaces together	Ching (2007)
i. APPROACH	Approach refers to the distant view of a building and the pathway leading to its entrance.	
a. Frontal Approach	A frontal approach leads directly to a building's entrance with a clear visual goal, either the full facade or a specific entrance.	
b. Oblique approach	The path to a building's main entrance can be redirected multiple times to lengthen and delay the approach sequence.	
ii. ENTRANCE	An entrance separates two spaces by physically linking them through an opening in the plane.	
iii. FORM OF THE CIRCULATION SPACE	The quality of circulation is determined by the form of the circulation space, defining movement, pause, rest, or view, and the boundaries define the introverted and extroverted nature.	
a. Enclosed	private corridor that connects spaces via entrances in the wall plane	
b. Open on One Side	connects spaces and offers visual and physical continuity	
c. Open on Both Sides	extends the physical space through which it passes.	

Method of Study

The study was conducted in two stages. First, the Architectural Visual Analysis method was used to compare the spatial characteristics before and after building adaptation. According to Sarihan (2021) this approach provides a comprehensive representation of heritage sites by integrating various visual analysis techniques. The method was adapted from Michael C. Abram's The Art of City Sketching, A Field Manual, which uses a combination of qualitative analysis and perceptual approaches to analyse the built environment.

The qualitative analysis involves documenting two-dimensional diagrams such as layouts, sections, elevations, details, while analysing and comparing aspects such as height, width, proportions, geometry, architectural features, and number of openings. On the other hand, the perceptual approach involves documenting the architectural compositions in perspective form (photographs, sketches) to analyse the experience, views, and character of a built composition.

In this study, both approaches were combined to analyse the spatial transformation of each case study. Primary data such as measured drawings before adaptation, proposed development plans, and photographs during the renovation were collected from the Archaeology department and Urban Development Authority. The author developed photographs and drawings of the buildings after adaptation by visiting each case study and documenting their current conditions. The documented data was then analysed through the comparative visual analysis method.

In the second phase of the study, the tabulated data was analysed against the adaptively reused criteria derived from the literature review. The researchers conducted semi-structured interviews with Principal/project architects involved in the design, resource personnel at the Archaeology department, and Urban Development Authority to identify the restrictions and

reasons behind limitations in achieving extroverted spatial characteristics. Finally, a cross-case analysis was conducted to identify the relationships between the findings.

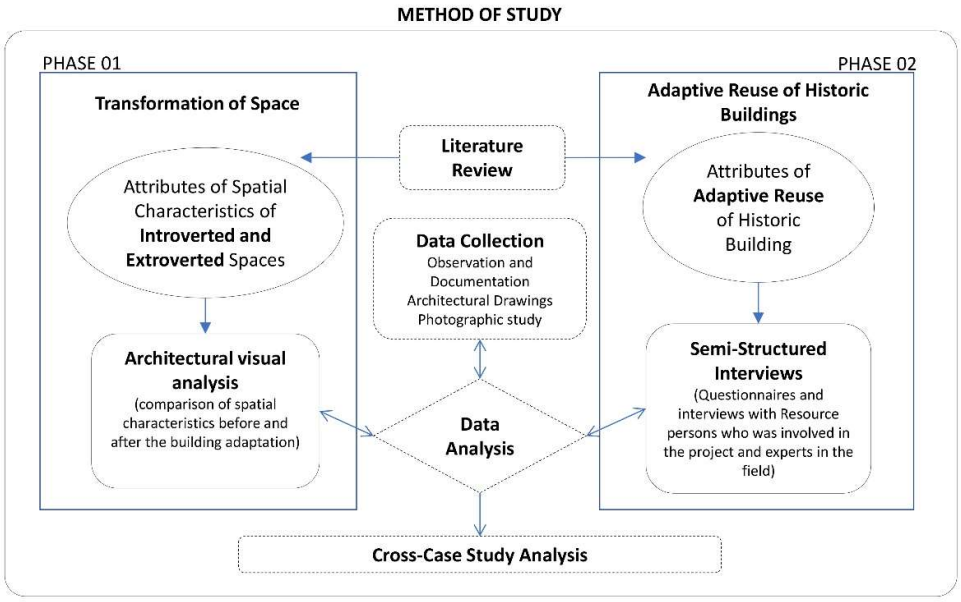


Figure 3: Method of Study
Source: Author

The study has various limitations. Time constraints led to the selection of case studies only within the Colombo city limits. Additionally, the study's scope was limited to adaptively reused colonial buildings constructed between the 17th and 19th centuries, which exhibit introverted spatial characteristics and are currently used for public functions. Another constraint encountered was limited access to original architectural drawings due to the buildings' age. Therefore, the measured drawings prepared by UDA and Archelogy department before the current adaptation were used in this study, and modifications were made to them by examining old photographs, paintings, and sketches.

Findings and Analysis

Introduction to Case Studies

- **Dutch Hospital Colombo**

The Dutch Hospital in Colombo is a 17th century hospital built during Dutch rule. The British continued to use it as hospital during their rule. Later, it housed the Colombo Apothecaries and then the Colombo Fort Police Station. It was then listed as a protected monument on 8th July 2005 under the Gazette no 1401. In 2011, the Urban Development Authority restored and refurbished the premises, changing its use to a Shopping and Dining center targeting both locals and tourists.

Figure 4: Dutch Hospital Colombo Before (left) and After (Right) Adaptation
Source: Archt. Ashley de Vos,1983 & Author,2022

Figure 5: Comparison of zoning before (Left) and after (Right) Adaptation in Dutch hospital.
Source: Modified by Author

- **Arcade Independence Square**

The present Arcade Independence square was originally built as an Asylum for mental health patients during the British rule (1875 – 1882). In 1926, after transferring the patients to the Angoda Hospital, it was used by the University College, Radio Ceylon and Public Administration Department respectively. It housed the Auditor General Department before undergoing extensive restoration and modifications to establish the current shopping complex in 2014.

Figure 6: Arcade Independence square Before (left) and After (Right) Adaptation
Source: UDA,2014 & Author,2022

Figure 7: Comparison of zoning before (Left) and after (Right) Adaptation in Arcade independence square. Source: Modified by Author

- **Trace Expert City**

Trace Expert City in Maradana was originally used as a warehouse complex during the British period. Formally known as Tripoli market square, it originally consisted of a market building and a warehouse complex. It was modified and renovated as a knowledge park with contemporary

collaborative and shared working space, multifunctional space, community space for the corporate sector and event space for the public.

Figure 8: Arcade Independence square Before (left) and After (Right) Adaptation
Source: UDA,2014 & Author,2022

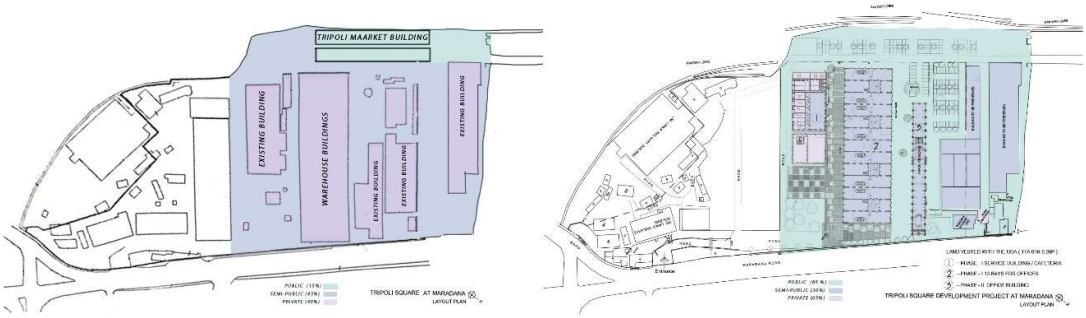


Figure 9: Comparison of zoning before (left) and after (Right) Adaptation in Trace expert city.
Source: Modified by Author

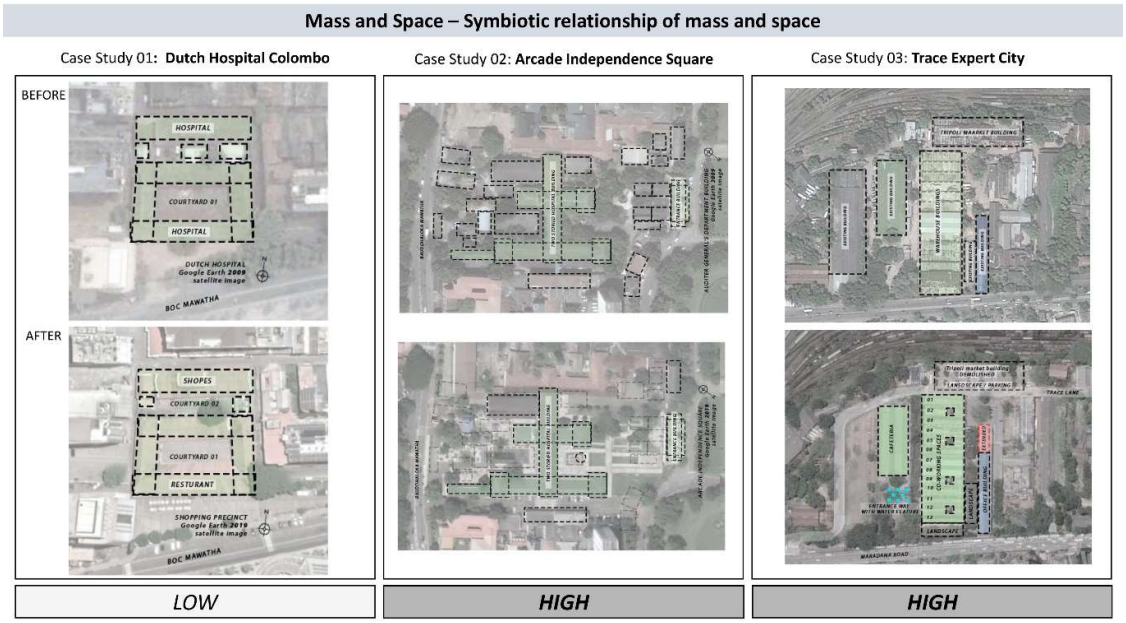
Spatial Attributes Determining the Degree of Extroversion

MASS AND SPACE:

Symbiotic relationship of the forms of mass and space

When analysing the previous layouts of all three case studies, the massing of built forms had enclosed or semi-enclosed courtyards forming an introverted scheme. The Dutch hospital remains introverted even after the adaptation. Building masses that were not part of the original scheme was demolished at Arcade Independence and buildings with poor structural integrity were demolished at Trace Expert City. Thus, making the built mass dominant in both case studies, which resulted in an extroverted scheme.

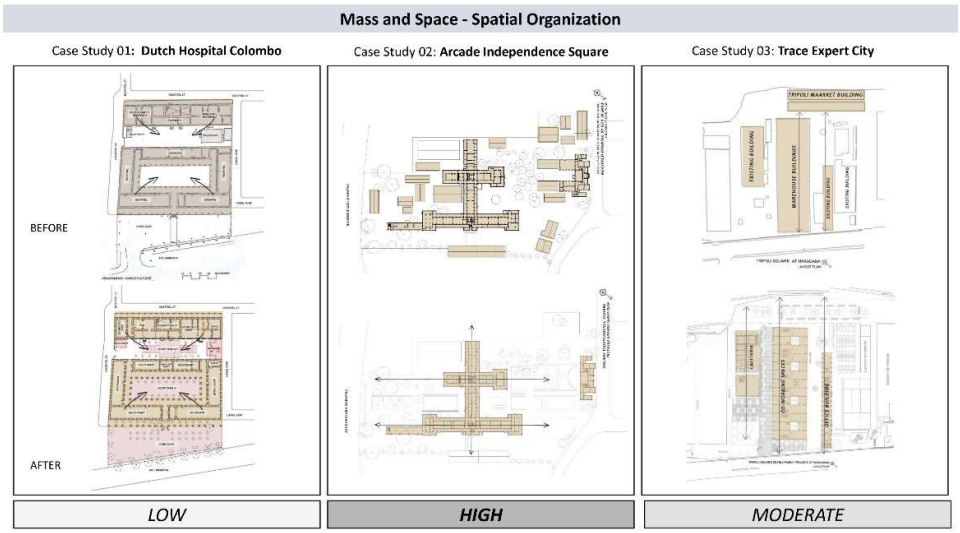
Table 3: Comparison of Symbiotic relationship of the forms of mass and space before and after Adaptation in selected case studies.



Spatial Organization

The Dutch Hospital's original spatial layout was centralized with spaces placed around a main and a secondary courtyard, implying an introverted spatial quality, which persists as there have been no changes to its built form. While the Arcade Independence's spatial organization after adaptation features radial organization with spaces of similar to size and form placed as a combination of central and linear organizations, making it horizontally extroverted. Meanwhile, Trace Expert City's initial grid-based layout was partially transformed into a semi-extroverted arrangement that better suits its current purpose by removing a perpendicular building and retaining the parallel ones.

Table 4: Comparison of Spatial Organization before and after Adaptation in selected case studies

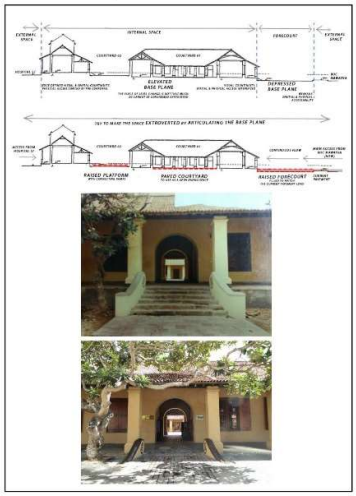
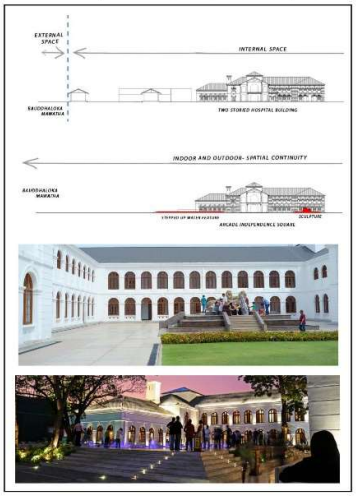
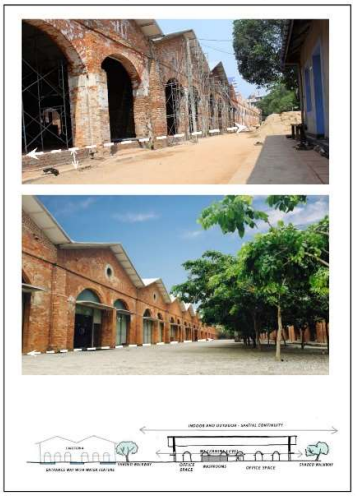


Horizontal Planes:

Base Plane

It was apparent that Dutch Hospital's forecourt had been raised up to the road level during the adaptation, resulting in a public entrance square that enabled visual continuity and smooth movement of people towards it. At Arcade Independence, the introduction of elevated base planes in semi-enclosed outdoor areas has resulted in entrance squares that are extroverted. Base planes of Trace Expert City remain at the same level, both indoors and outdoors. Additional mezzanine levels were introduced within the building volumes without disrupting the visual connectivity between the indoors and outdoors. Thus, making all three schemes horizontally extroverted.

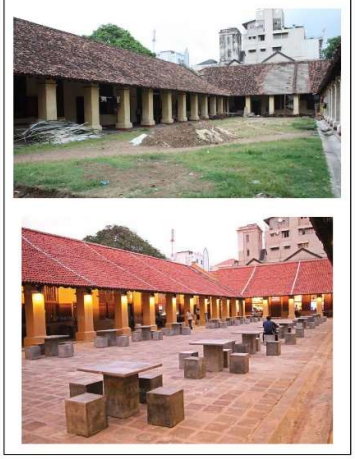
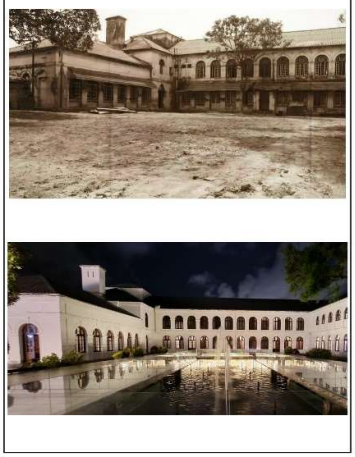
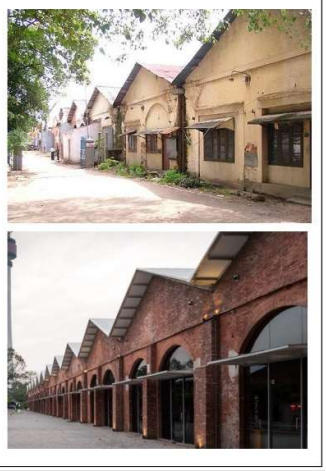
Table 5: Comparison of Base Plane before and after Adaptation in selected case studies.

Horizontal Planes – Base plane		
Case Study 01: **Dutch Hospital Colombo**	Case Study 02: **Arcade Independence Square**	Case Study 03: **Trace Expert City**
		
HIGH	***HIGH***	***HIGH***

Overhead Plane

In all case studies the Overhead plane remains unchanged except for its material. The only modifications that were evident were the introduction of skylights at Arcade Independence Square and the internal courtyards at Trace Expert City which open up the internal spaces. The formation of the roofs of the case studies denoted an introverted scheme.

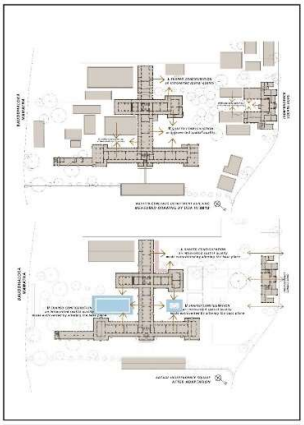
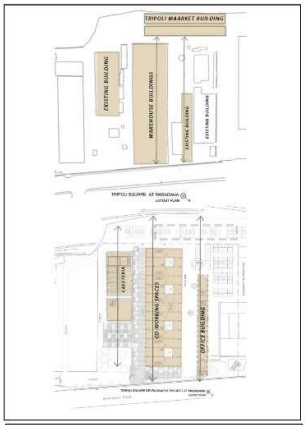
Table 6: Comparison of Overhead Plane before and after Adaptation in selected case studies.

Horizontal Planes – Overhead plane		
Case Study 01: **Dutch Hospital Colombo**	Case Study 02: **Arcade Independence Square**	Case Study 03: **Trace Expert City**
		
LOW	*LOW*	*LOW*

Vertical Planes

The Dutch Hospital is comprised of a four-plane composition resulting in an introverted layout, and it is notable that no significant modifications to the vertical planes were made during the adaptation process. Conversely, Arcade Independence and Trace Expert City exhibited noticeable alterations to their vertical planes due to the demolition of pre-existing structures. Upon comparison of the two case studies, it could be determined that Arcade Independence achieved a moderate level of extroversion as a result of the U and L-shaped configuration of the built form after the adaptation. In contrast, the parallel configuration of the overall built form at Trace Expert City facilitated a higher degree of extroversion.

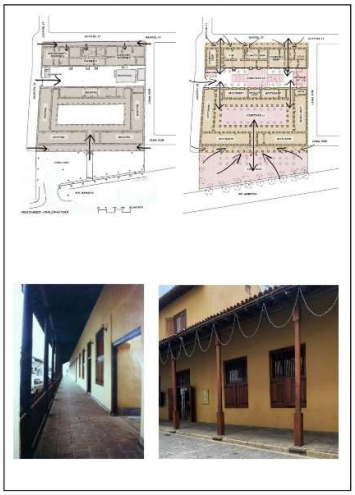
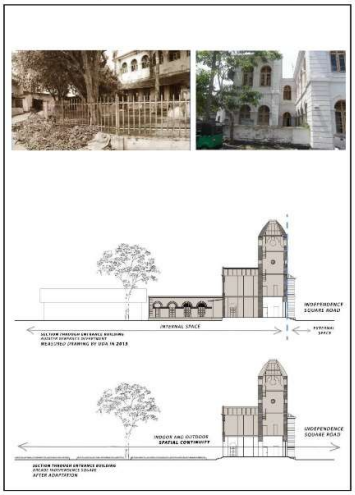
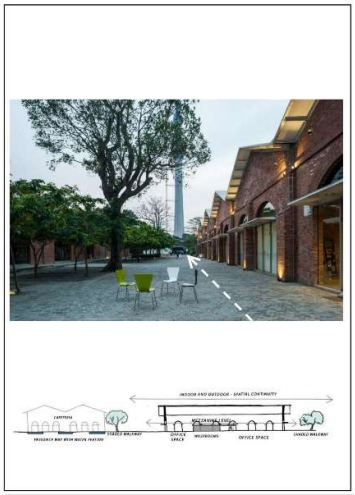
Table 7: Comparison of Vertical Planes before and after Adaptation in selected case studies

Vertical Planes		
Case Study 01: **Dutch Hospital Colombo**	Case Study 02: **Arcade Independence Square**	Case Study 03: **Trace Expert City**
		
LOW	*MODERATE*	***HIGH***

Openings

The presence of a series of similarly-sized openings with lower permeability at Dutch Hospital and Arcade Independence was indicative of an introverted spatial quality. These openings were restored to their original form, thereby preserving the introverted spatial quality of the structures. In contrast, at Trace Expert City, the size of the openings was enlarged and glazed coverings were introduced, resulting in increased permeability and an overall sense of extroverted spatial quality.

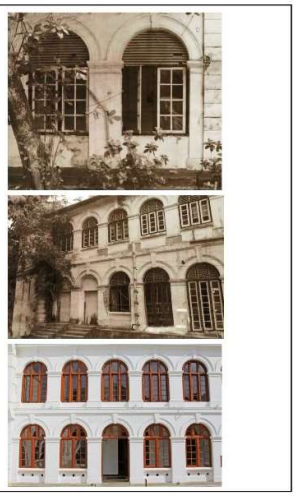
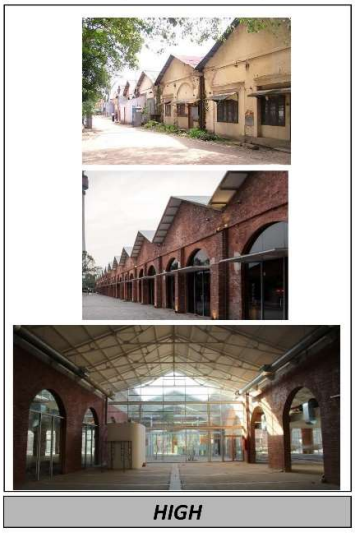
Table 8: Comparison of Openings before and after Adaptation in selected case studies.

Circulation		
Case Study 01: **Dutch Hospital Colombo**	Case Study 02: **Arcade Independence Square**	Case Study 03: **Trace Expert City**
		
MODERATE	*MODERATE*	*LOW*

Circulation

Upon analysis of the initial and current configurations, it was observed that the frontal approach of Dutch Hospital was altered to an oblique angle, resulting in an extroverted quality to the entrance. However, since no modifications were made to the internal circulation, the spatial quality beyond the entrance forecourt remained introverted. At Arcade Independence, the entrance approach was made oblique through the demolition of parapet walls and fences surrounding the periphery, adding an extroverted quality to the building. Despite this change, the interior spaces remained introverted as the internal circulation remained unchanged. Finally, at Trace Expert City, it was observed that the circulation had no significant impact on the extroverted quality of the premises.

Table 9: Comparison of Circulation before and after Adaptation in selected case studies

Openings		
Case Study 01: **Dutch Hospital Colombo**	Case Study 02: **Arcade Independence Square**	Case Study 03: **Trace Expert City**
		
LOW	*LOW*	***HIGH***

The Degree of Extroversion

After analyzing the above, it became apparent that the adaptation of Trace Expert City achieved the highest degree of extroversion while the Dutch Hospital had the lowest. Although modifications to the Horizontal Base Plane were present in all case studies, they did not significantly contribute to making the buildings extroverted. Circulation was also not found to have a significant influence on the degree of extroversion achieved in these historic buildings. Instead, the Spatial organization and Symbolic relationship of the mass and space were found to contribute to creating a sense of extroversion. Comparing Arcade Independence Square and Trace Expert City, it was evident that the built mass and spatial organization could only achieve a limited degree of extroversion. In the cases studied, modifications to the Vertical Plane were the most predominant factor influencing the degree of extroversion.

Table 10: Influence of physical attributes on degree of extroversion

		Dutch Hospital Colombo		Arcade Independence Square		Trace Expert City	
Physical/ Spatial Attributes		Degree of Extroversion		Degree of Extroversion		Degree of Extroversion	
Mass & Space	symbiotic relationship of mass and space	○	LOW	○	HIGH	○	HIGH
	Spatial Organization						
	Central	○					
	Linear			○			
	Grid					○	
	Radial			○			
Horizontal planes	Base Plane	○	HIGH	○	HIGH	○	HIGH
	Elevated base plane	○		○		○	
	Depressed based plane	○					
	Overhead Plane		LOW		LOW		LOW
Vertical Planes	Single vertical elements	○	LOW		LOW		HIGH
	Single vertical plane						
	Parallel vertical planes					○	
	L – shaped plane			○			
	U- shaped plane			○			
	Four Plane						
Openings	Open within space - size of the opening		LOW		LOW	○	HIGH
	Openings between Plane					○	
	Vertical Opening	○		○		○	
	Skylights			○			
	Window wall					○	
	Degree of enclosure					○	
	View- the focus of the space					○	
Circulation	Approach		MODERATE		MODERATE		LOW
	Frontal	○					
	Oblique	○		○		○	
	Entrance						
	Form of Circulation Space						
	Enclosed						
	Open on One Side						
	Open on Both Side					○	

It was discovered that the approach to adaptive reuse and the importance placed on preserving the buildings' historical value had limited the possibility of achieving greater extroversion in the buildings. The following will discuss the factors that influenced these restrictions.

Influence of Adaptive Reuse Criteria in Determining the Degree of Extroversion

Integrity

Since the original structure of the Dutch Hospital was deemed to be in good condition, there was no need for any precautionary strengthening measures. However, due to the substantial thickness of the walls, it proved to be challenging to widen the openings as desired, and consequently, the opening sizes had to be retained. This posed a significant factor to consider with regards to the structural integrity of the building. Furthermore, preserving the historical and architectural characteristics of the Dutch Hospital was deemed to be of utmost importance, given its status as a listed historical building. Consequently, any potential increase in the degree of extroversion was restricted by the visual and aesthetic integrity of the building.

During the interviews conducted for the Arcade Independence and Trace Expert City building adaptations, significant differences were observed. At Arcade Independence, the design intention was to preserve the British architectural characteristics of the asylum complex, which was inherently introverted in nature. As a result, the visual and aesthetic integrity of the building constrained the degree of extroversion that could be achieved.

Conversely, at Trace Expert City, the market building was found to be in a weak condition and had to be demolished. The walls of the warehouse were reconstructed, and the openings on the exterior plane were increased during the building adaptation process. The design intention was to retain the essence of the industrial aesthetic rather than to preserve the building in its original

form. Therefore, the degree of extroversion achieved through adaptive reuse was not restricted by structural or visual/aesthetic integrity.

Table 11: Comparison of degree of extroversion vs. Integrity

Physical/ Spatial Attributes		DUTCH HOSPITAL COLOMBO						ARCADE INDEPENDENCE SQUARE						TRACE EXPERT CITY					
		Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation
			Base Plane	Overhead Plane					Base Plane	Overhead Plane					Base Plane	Overhead Plane			
Degree of Extroversion		LOW	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	HIGH	HIGH	LOW
INTEGRITY	Structural Integrity																		
	Visual/ Aesthetic Integrity																		
	Internal Layout																		

KEY
ADAPTIVE REUSE CRITERIA **AFFECTING** THE DEGREE OF EXTROVERSION
ADAPTIVE REUSE CRITERIA **NOT AFFECTING** THE DEGREE OF EXTROVERSION

Sustainability

It was observed that the marketability of the architectural aesthetics had an impact on the decision to retain the building envelope profile due to the historical value and aesthetic appearance of all three case studies. As the Dutch Hospital was a listed building and the aim of the Arcade Independence was to preserve its architectural aesthetics as an asylum, both were restored to their original appearance. In contrast, only the essence of the architectural aesthetics was retained for marketability purposes at Trace Expert City. Consequently, Trace Expert City achieved a higher degree of extroversion after adaptation compared to the other two buildings.

Table 12: Comparison of degree of extroversion vs. Sustainability

Physical/ Spatial Attributes		DUTCH HOSPITAL COLOMBO						ARCADE INDEPENDENCE SQUARE						TRACE EXPERT CITY					
		Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation
			Base Plane	Overhead Plane					Base Plane	Overhead Plane					Base Plane	Overhead Plane			
Degree of Extroversion		LOW	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	HIGH	HIGH	LOW
SUSTAINABILITY	Economic Return																		
	Marketability																		
	Infrastructure																		
	Site condition																		

KEY
ADAPTIVE REUSE CRITERIA **AFFECTING** THE DEGREE OF EXTROVERSION
ADAPTIVE REUSE CRITERIA **NOT AFFECTING** THE DEGREE OF EXTROVERSION

Flexibility

Upon analyzing the layouts of the buildings, it was apparent that the spacious layout of Dutch Hospital provided the flexibility required to adapt to the new function. As a result, the sub-criteria under flexibility did not influence the degree of extroversion. However, at Arcade Independence, the internal circulation path along the building's periphery restricted further extensions, limiting the flexibility and subsequently restricting the degree of extroversion achievable.

Conversely, the original warehouse buildings had an open layout with minimal internal partitions, providing ample flexibility to accommodate the new function. Therefore, the flexibility sub-criterion did not have any influence on the degree of extroversion achieved.

Table 13: Comparison of degree of extroversion vs. Flexibility

Physical/ Spatial Attributes		DUTCH HOSPITAL COLOMBO						ARCADE INDEPENDENCE SQUARE						TRACE EXPERT CITY					
		Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation
			Base Plane	Overhead Plane					Base Plane	Overhead Plane					Base Plane	Overhead Plane			
Degree of Extroversion		LOW	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	HIGH	HIGH	LOW
FLEXIBILITY	Functionality				■						■		■			■			
	Residual Service Life					■													
	Internal and External Space	■			■		■				■	■	■						

KEY
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Authenticity

In order to maintain the cultural and historical significance of the Dutch Hospital, as it is a listed building, its building mass, vertical planes, openings, and circulation elements were preserved in their original form. This was done to retain its social meaning and restrict any degree of extroversion that may compromise its authenticity. Similarly, at Arcade Independence Square, the original asylum characteristics were also preserved as it was the only asylum built during the British period, and the adaptation of the building was heavily influenced by its historical value.

At Trace Expert City, the exterior of the building was preserved to reflect its historical relevance, while modifications were made to the interior to accommodate its new function. The preservation of the exterior can be attributed to the influence of both its historic and use value.

Table 14: Comparison of degree of extroversion vs. Authenticity

Physical/ Spatial Attributes		DUTCH HOSPITAL COLOMBO						ARCADE INDEPENDENCE SQUARE						TRACE EXPERT CITY					
		Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation
			Base Plane	Overhead Plane					Base Plane	Overhead Plane					Base Plane	Overhead Plane			
Degree of Extroversion		LOW	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	HIGH	HIGH	LOW
AUTHENTICITY	Cultural Value	■		■	■	■	■			■	■	■							
	Landscaping Quality																		
	Historical Value	■		■	■	■	■			■	■	■	■			■			■
	Use Value	■		■	■	■	■			■	■	■	■			■			■
	Facilitating Social Interaction					■					■		■						■

KEY
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Memory

The Dutch Hospital, situated in the historic Colombo fort, was subject to legislative restrictions under the Antiquities Ordinance as it was a listed building. These restrictions limited the modifications that could be made during its adaptation, and its location also made it

commercially viable, attracting investment opportunities. Therefore, preserving the building in its original form was a critical factor, which further restricted the potential for transformation.

In contrast, the Asylum and warehouse complex at Arcade Independence Square and Trace Expert City were not listed buildings, which meant that legislative restrictions did not significantly affect the potential for transformation. At Trace Expert City, the location presented a challenge to achieving a high degree of extroversion due to the considerable difference in levels between the road and the site. However, the location aided its adaptation in a positive manner as the new function, which was more of a semi-public nature.

Conversely, the prime location of Arcade Independence Square posed a challenge as the exclusivity of its new function did not support the intended public functions in its adaptation. This serves as a significant example for the importance of determining a new function that complements the historical value of the building during the process of repurposing a historical structure.

Table 15: Comparison of degree of extroversion vs. Memory

Physical/ Spatial Attributes		DUTCH HOSPITAL COLOMBO						ARCADE INDEPENDENCE SQUARE						TRACE EXPERT CITY					
		Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation	Mass & Space	Horizontal planes		Vertical Planes	Openings	Circulation
			Base Plane	Overhead Plane					Base Plane	Overhead Plane					Base Plane	Overhead Plane			
Degree of Extroversion		LOW	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	LOW	LOW	MODERATE	HIGH	HIGH	LOW	HIGH	HIGH	LOW
MEMORY	Location																		
	Legislation																		

KEY
- ADAPTIVE REUSE CRITERIA **AFFECTING** THE DEGREE OF EXTROVERSION
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Adaptive Reuse Criteria Restricting the Potential to Achieve Extroverted Nature in a Historic Building

The above cross-case analysis indicates that most of the restriction in relation to adaptive reuse criteria was evident at Dutch Hospital. Through the interviews, it was identified that this was due to the building being listed under the gazette. The Arcade Independence Square had a moderate level of restrictions. The design intension to preserve the original character of the building was found to be the reason behind the restrictions. However, the above also indicates that the modifications at the Trace Expert City had minimal restrictions. As it was not a listed building and the intention of the design was to only retain industrial aesthetics rather than restore them, the building was able to achieve a higher degree of extroversion.

In addition, the above identifies Visual/Aesthetic Integrity, Marketability, Historical Value and Use Value as sub-criteria influencing the degree of extroversion achieved at each Historical Building in this study.

Table 16: Comparison of adaptive reuse criteria with physical attributes and degree of extroversion

Physical/ Spatial Attributes		Degree of Extroversion	Adaptive Reuse Criteria affecting the degree of extroversion																		
			INTEGRITY			SUSTAINABILITY				FLEXIBILITY			AUTHENTICITY					MEMORY	
			Physical (Long Life)			Economic (Location)				Functional (Loose Fit)			Social (Sense of Place)					Political (Context)	
			Structural Integrity	Visual/ Aesthetic Integrity	Internal Layout	Economic Return	Marketability	Infrastructure	Site condition	Functionality	Residual Service Life	Internal and External Space	Cultural Value	Landscaping Quality	Historical Value	Use Value	Facilitating Social Interaction	Location	Legislation
Dutch Hospital Colombo																			
Mass & Space		LOW	■	■		■	■	■				■	■		■	■		■	■
Horizontal planes	Base plane	HIGH																	
	Overhead plane	LOW	■	■		■	■						■		■	■		■	■
Vertical Planes		LOW	■	■		■	■			■		■	■		■	■			■
Openings		LOW	■	■		■	■				■		■		■	■	■		■
Circulation		MODERATE	■	■		■	■	■				■	■		■	■			■
Arcade Independence Square																			
Mass & Space		HIGH																	
Horizontal planes	Base plane	HIGH																	
	Overhead plane	LOW		■			■						■		■	■			
Vertical Planes		LOW		■			■			■		■	■		■	■	■		
Openings		LOW		■			■					■	■		■	■			
Circulation		MODERATE		■	■					■		■			■	■	■		
Trace Expert City																			
Mass & Space		HIGH																	
Horizontal planes	Base plane	HIGH																	
	Overhead plane	LOW		■			■			■					■	■		■	
Vertical Planes		HIGH																	
Openings		HIGH																	
Circulation		LOW		■			■	■	■						■	■	■	■	

KEY
■ ADAPTIVE REUSE CRITERIA **AFFECTING** THE DEGREE OF EXTROVERSION
ADAPTIVE REUSE CRITERIA **NOT AFFECTING** THE DEGREE OF EXTROVERSION

Conclusion

Adaptive reuse of historic buildings is a complex field of research that requires expertise from various disciplines such as architecture, engineering, economics, and urban planning. While there are several commonly explored areas of research, including sustainability, conservation, design, economics, social impact, and regulations. It is evident in this research the limited focus given in the Sri Lankan context to the relationship between functionality and spatial quality of building adaptation. Therefore, transformation of introverted historic buildings into extroverted public spaces was found to be challenging due to the limited number of successful examples, the complexity of the transformation process, preservation and conservation concerns.

The study found that the degree of extroversion achievable through the transformation of spatial quality varies depending on which plane of the building is adapted. Vertical planes and openings on the vertical planes allow for the highest degree of extroversion, while the horizontal base plane allows for a minimal degree of extroversion. Authenticity and integrity criteria, such as historical, use, and cultural values, as well as visual/aesthetic integrity, were significant factors limiting the degree of extroversion achievable through adaptive reuse.

The potential for adaptive reuse to transform the spatial quality of a historical building in Sri Lanka is dependent on legislation, with more restrictions for buildings listed as Protected Monuments under gazette notification. The study suggests that the transformative potential and the categorization under Sri Lankan legislation should be taken into account when introducing a

new function to a historical building. It is also important to consider the spatial attributes and their relationship with adaptive reuse potential criteria when transforming a building from introverted to extroverted.

Considering the current crisis faced by Sri Lanka and the world due to limitations in resources, this study can contribute to the knowledge base in adaptive reuse of historical buildings. It can assist in determining the transformative potential of a historic building from an introverted to an extroverted structure by introducing an appropriate public function after assessing the existing spatial qualities. The findings can contribute as a guideline for future adaptive reuse of historical buildings in Sri Lanka.

Further research of this study area can explore several directions, including analysing user experience to identify areas for improvement, investigating strategies for community engagement, exploring effective methods for stakeholder engagement, and examining the social and cultural impact of adaptive reuse projects. Through exploration of these areas, researchers can contribute to a deeper understanding of how to successfully adapt historic buildings into engaging public spaces.

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