

# Analyzing Liminality in Transit Hubs of Ernakulam South Region Using Space Syntax

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**Abstract**—Transit hubs play a pivotal role in urban transportation systems, facilitating the convergence of diverse components within a city. The Ernakulam South region, situated in Kerala, India, is a multifaceted network of transportation modes, including trains, buses, and metros, making it a prominent transportation hub in the area while still not up to its full potential. This research explores the concept of liminality and its relevance to urban design, focusing on spaces characterized by their transitional and ambiguous nature, particularly in transit hubs where individuals are in a perpetual state of transition. Utilizing Space Syntax Analysis, an urban planning and architectural approach, this study investigates the spatial configurations of transit hubs and their influence on the experiences of commuters and visitors. Drawing from literature reviews, primary research, space syntax analysis, and surveys, this research identifies key factors impacting liminal experiences and offers recommendations for urban design improvements. The research highlights several essential design considerations, including the creation of spacious, multi-level environments with ample natural lighting and seamlessly integrating transit hub interiors with the surrounding urban context. Recommendations encompass the incorporation of art installations, retail spaces, and cultural events to transform transit hubs into lively destinations. The study underscores the significance of ensuring smooth integration with various modes of transportation, prioritizing pedestrian safety, and facilitating effortless transitions between transit systems. Furthermore, it proposes that the infusion of traditional architectural elements can imbue transit hubs with a cultural identity, turning them into symbolic gateways. This research is anticipated to contribute valuable insights to the field of urban design, resulting in the optimization of transit hubs and their adjacent areas. The aim is to create more secure, comfortable, and dynamic environments, elevating transit hubs beyond their role as mere transportation points to become vibrant communal spaces that enhance the urban experience.

**Keywords:** Transit hubs, Liminality, Space Syntax Analysis.

## INTRODUCTION

Transit hubs serve as essential intersections within urban transportation systems, where a diverse mix of people, vehicles, and activities converge. These dynamic locations are crucial not only for facilitating the smooth flow of mobility

but also for shaping the social and cultural dynamics of a city. The Ernakulam South region, located in Kerala, India, is a complex network of various transportation modes, such as trains, buses, and metros, making it a significant transportation hub in the region. The concept of liminality, originally rooted in anthropology and later incorporated into the fields of architecture and urban design, is often used to describe spaces that possess transitional qualities, characterized by a certain level of ambiguity. In the context of transit hubs, liminality can be associated with the transient nature of these spaces, where individuals are in a perpetual state of arriving and departing. Space Syntax analysis, a method originating in urban planning and architecture, scrutinizes the spatial configuration of urban environments, with the

aim of uncovering the connections between spatial structures and human actions. By employing this methodology, the intention is to attain an in-depth understanding of how the spatial layouts and configurations of transit hubs impact the liminal experiences of commuters and visitors.

## METHOD OF STUDY

The study was broken down into four parts

1. Literature reviews and case studies.
2. Primary study of Ernakulam South
3. Space syntax analysis and survey.
4. Delineating design strategy

## LITERATURE REVIEW

The literature review highlights the diverse nature of transit hubs, emphasizing their intrinsic liminality as spaces of transition and anticipation [1-2]. Urban mobility, particularly within transit hubs, has evolved beyond conventional transportation facilities, embracing social interaction and the significance of Mobility as a Service (MaaS) to enhance user experiences [3-4]. Liminal spaces often coincide with placelessness, where a lack of identity may lead to a transient, ambiguous experience [5-6]. Insights from Jane Jacobs underscore the importance of designing transit hubs with a focus on human behavior and community dynamics [7].

Steven T. Polchinski's innovative approach advocates for the integration of performance spaces, transforming transit centers into vibrant, experiential destinations (Polchinski, unpublished) [8]. The anthropological framework of Separation, Transition, and Incorporation by Arnold van Gennep provides a valuable lens for understanding commuters' transformative journeys within transit hubs [9]. The inference for the research suggests considering the unique characteristics of liminal experiences, aligning urban design recommendations with the evolving nature of transit hubs, integrating cultural and social aspects, and emphasizing seamless transportation integration to optimize user experiences in the Ernakulam South region.

### PROJECT DEFINITION

To analyze the relationship between spatial layout and liminal experiences in the Ernakulam South region, with the objective of optimizing urban design and user experiences, using space syntax analysis as a guiding frame.

### Case Study Comparative Analysis

This analysis focuses on five distinguished international transit hubs, namely, Hague Central station, World Trade Centre Oculus, Rotterdam Central station, Salesforce Transit centre and Arnhem Central station and centers around six critical parameters: passenger flow and circulation, spatial layout and design, signage and way-finding, amenities and services, multimodal connectivity, and cultural significance.

1. Spacious interiors with flexibility of movement, and the potential for incorporating multiple levels to accommodate various transit systems.
2. Blending the urban landscape with interiors seamlessly integrates transit hubs into the urban fabric, improving surroundings through expansive spaces and innovative roof designs that enhance aesthetics and natural lighting.
3. Proper signage, digital displays, kiosks for information and ticketing, and well-organized platforms based on routes optimize navigation within the hub.
4. Incorporate mixed-use spaces with retail, office spaces, public plazas, food courts, and hosting art installations and cultural events.
5. Ensuring well-integrated, seamless multimodal connectivity, prioritizing pedestrian movement and safety, and providing barrier-free access between transit systems.
6. Understanding neighborhood characters and incorporating traditional architectural features can establish transit hubs as cultural gateways into the city.

### PRIMARY STUDY OF ERNAKULAM SOUTH REGION

The primary study focuses on the Ernakulam South region's transit hubs, including the railway station, KSRTC Bus Stand, and the Metro Station, identifying various challenges. Safety concerns, poor lighting, and criminal activities render the South Overbridge region inactive during evenings. Connecting routes exhibit issues of safety and poor integration with the urban context, while the Railway Quarters route lacks adequate lighting and maintenance. The vehicular access route

towards the KSRTC Bus Stand lacks pedestrian walkways and raises safety and cleanliness concerns. Despite being a major hub, the KSRTC Bus Stand faces challenges of low maintenance, poor lighting, and improper waste management. Pedestrian movement analysis using GPS traces reveals substantial activity in the landlocked region, though concerns about reduced surveillance and criminal activities are evident. The inference underscores the necessity for comprehensive urban design solutions prioritizing safety, accessibility, and multifunctionality to address the identified challenges in the Ernakulam South transit hubs.

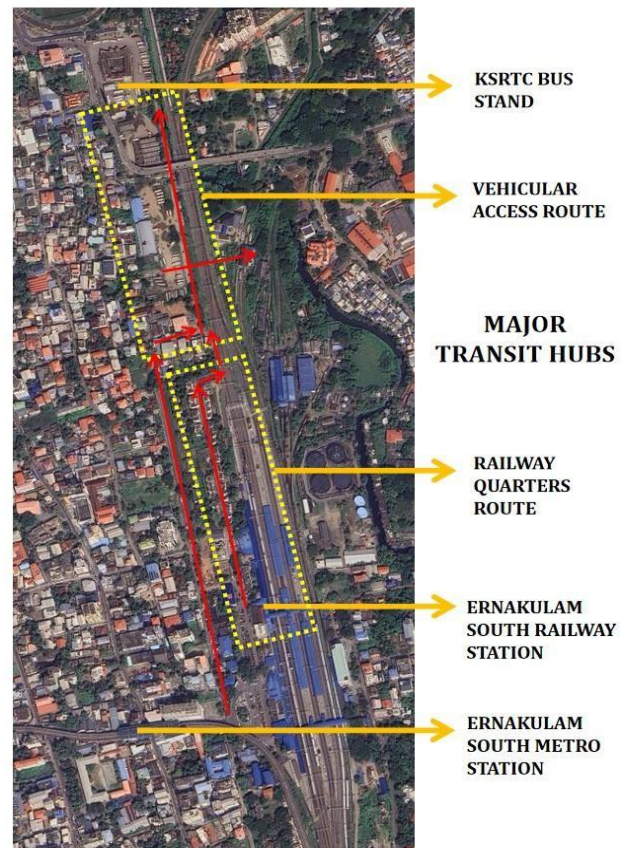


Figure 1: Map of Ernakulam South region Source: Google Earth



Figure 2,3,4: Transit hubs of Ernakulam south

Sources: <https://i.ytimg.com/vi/8zU93OYIq8Y/maxresdefault.jpg>,

<https://www.newindianexpress.com/states/kerala/2021/oct/20/kerala-transport-minister-suspendskrtc-chief-engineer-for-irregularities-in-construction-of-depots-2373622.html>,

<https://www.newindianexpress.com/states/kerala/2018/sep/16/kochi-metro-stretch-to-be-opened-by-june-2019-1872512.html>.



Figure 5,6,7: Views of liminal/transition zones Source: Author



Figure 8,9,10: Condition of KSRTC bus stand Source: Author

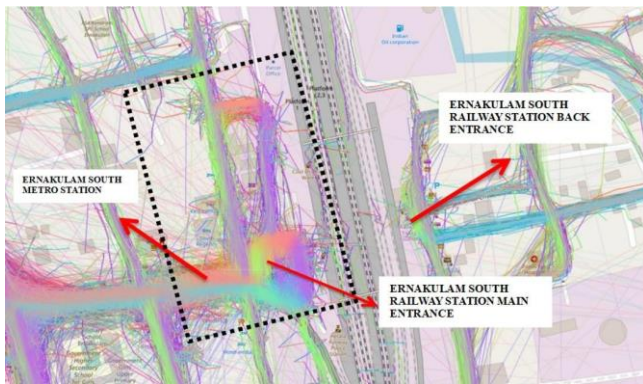


Figure 11: Public GPS traces in Enakulam South

Source: <https://www.openstreetmap.org/#map=17/9.97678/76.28893&layers=G>

### SPACE SYNTAX ANALYSIS

In the realm of urban planning, the fundamental approach of Space Syntax investigates how spatial configurations intricately shape human behavior and experiences within urban environments. Employing factors such as connectivity, integration, depth, and entropy, Space Syntax aims to comprehend the intricate ways individuals navigate and perceive their surroundings. Axial map analysis of Ernakulam South region, conducted using DepthmapX, further delves into geometric layout and spatial relationships, providing valuable insights for urban design and planning. The analysis of spatial properties in the Ernakulam South region reveals several concerning aspects. Despite moderate connectivity scores, there is a potential presence of disconnected or isolated spaces that hinder movement, with the lower limit at 1. Longer line lengths and circuitous routes (up to 943.845) can lead to inefficiencies in navigation, affecting user experiences. Some areas exhibit relatively high entropy (up to 1.584), indicating complex and unpredictable spatial layouts, which can challenge wayfinding and cause confusion. Additionally, lower integration values suggest pockets of less accessible or isolated spaces, reducing the overall efficiency of movement within the region. While moderate spatial utilization (intensity

score of 0.936) promotes comfort, overly intense spatial use (up to 2.989) in certain areas may lead to congestion and discomfort. These findings underscore the necessity for

comprehensive urban design improvements in Ernakulam South to enhance safety and user-friendly environments. Furthermore, the research delves into the psychological aspects of liminal spaces, highlighting the potential induction of uncertainty, anxiety, limited comfort, noise, navigational challenges, security concerns, and an ambiguous atmosphere among travelers. These psychological considerations contribute valuable insights for a holistic understanding of transit hub dynamics.

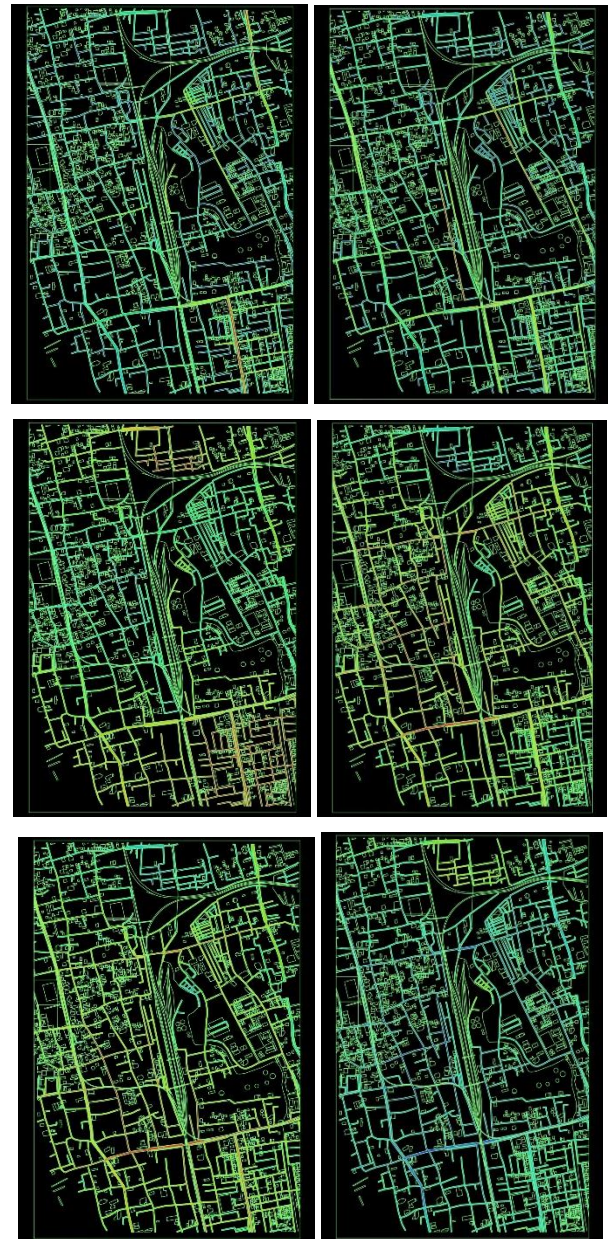


Figure 12, 13, 14, 15, 16, 17: Connectivity, Line length, Entropy, Integration(HH), Intensity, Mean depth Source: DepthmapX

**Table 1: Axial Map Analysis**

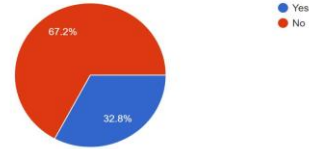
Attribute	Mini	Avg	Max
Connectivity	1	142.453	875
Line length	7	90.403	943.845
Entropy R3	0.168	1.249	1.584
Integration (HH)R3	1.317	5.324	12.988
Integration (P-Value) R3	1.317	5.324	12.988
Integration (TEKL) R3	0.649	0.857	1.039
Intensity R3	0.085	0.936	2.989
Harmonicmean depth R3	3.918	330.686	1941.06
Mean depth R3	1.433	2.438	2.973
Node count R3	16	1420.22	6200
Relativised entropy R3	1.071	2.153	3.555
Entropy	3.104	3.578	3.942
Integration (HH)	0.847	1.528	2.231
Integration (P-Value)	0.847	1.528	2.231
Integration (TEKL)	0.741	0.776	0.801
Intensity	0.266	0.438	0.635
Harmonicmean depth	16.83 9	339.061	1085.35
Mean depth	6.564	9.341	15.648
Node count	32752	32752	32752
Relativised entropy	2.754	3.345	4.116

Source: DepthmapX

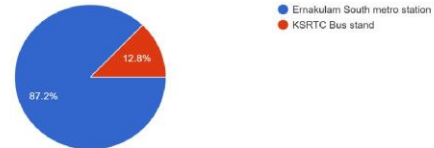
**COMMUTER SURVEY**

The survey conducted in Ernakulam South, encompassing a diverse demographic of 125 individuals, consisting of 14 questions, unveiled crucial insights into transit hub users' perceptions and experiences. Predominantly aged between 20-40, respondents represented varied occupations and local residents, emphasizing the comprehensive nature of the findings. While the majority acknowledged the importance of transit hubs, concerns were raised regarding poor connectivity between the railway station and bus stand. Evening commuters favored the metro station for its accessibility and safety. Overall, respondents rated the transit hubs as fair to poor in safety, comfort, and aesthetics. Issues like criminal activities and the deteriorating condition of the KSRTC bus stand highlighted the pressing need for improved security, maintenance, and facilities. Drainage problems, particularly during heavy rains, were also noted. The survey underscored awareness of illegal activities, emphasizing the necessity for safety enhancements. Reactions to an image of Swami Vivekananda road at night indicated a strong consensus among respondents for improvements such as increased pedestrian movement and better lighting. In summary, the survey revealed a unanimous call for substantial enhancements in transit hubs and their surroundings.

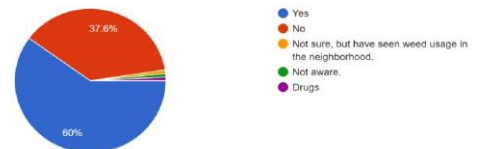
Do you think the Ernakulam South railway station is well connected with the KSRTC bus stand?  
125 responses



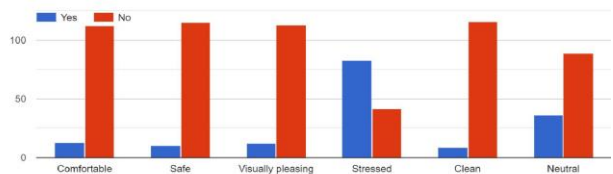
Would you prefer going to the metro station or the bus stand from the railway station at night for further commute?  
125 responses



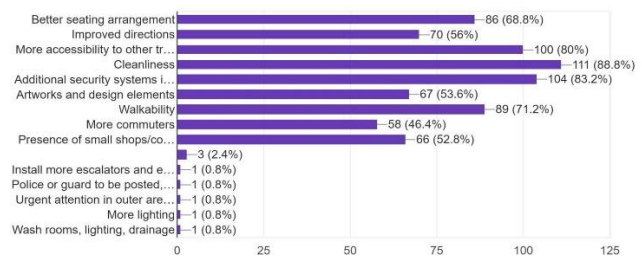
Have you heard of any illegal activities taking place in this region?  
125 responses



What is your overall emotional and psychological reaction when viewing this image?



What improvements or changes would you suggest to enhance the spaces in the transit hubs of Ernakulam South Region?  
125 responses



**Figure 18, 19,20, 21, 22, 23: Some of the survey results**  
Source: Google Forms

## FINDINGS

**Separation, transition and incorporation:** In the context of transit hub design and user experience, the principles of separation, transition, and incorporation play a pivotal role in enhancing the overall functionality and appeal of these critical urban spaces. Beyond establishing a dedicated zone for separation and demarcating a hub's unique identity, it is essential to consider the seamless integration of technological solutions. Implementing smart wayfinding systems, for instance, can provide real-time information to commuters, easing uncertainties associated with spatial distances between hubs. Transition zones, which currently rely on visual cues, could benefit from the integration of digital interfaces or mobile applications, offering personalized navigation assistance for pedestrians and autorickshaw users. The promotion of cycling as a sustainable mode of transportation presents an opportunity for innovative solutions. In addition to dedicated cycle tracks, incorporating smart bike-sharing programs with app-based reservations and real-time availability updates can encourage more commuters to embrace cycling despite environmental challenges. To address concerns related to Kerala's climate, covered cycle stations with climate control features, like misting systems or shaded areas, can further enhance the feasibility and comfort of cycling within the liminal zones. Expanding the cultural integration aspect during the incorporation phase involves not only static elements like art and sculptures but also dynamic cultural experiences. Incorporating local music, interactive installations that respond to user presence, and periodic cultural events within these transit spaces can contribute to a vibrant and ever-evolving sense of place. Moreover, leveraging technology, such as augmented reality (AR) applications that provide information about local culture and history, can deepen the connection commuters have with the cultural identity of Kerala.

**Integration with Metro Station:** To foster integration between Ernakulam South Railway Station and the nearby metro includes a skywalk with travelators for seamless rail-to-metro transitions can be proposed. Concerns arise about the impact on existing commercial activities beneath the metro. To address this, the skywalk can be integrated with current commercial spaces, creating a mixed-use area with improved vendor kiosks and restaurants. Properly designated spaces can accommodate autorickshaws without disrupting road traffic. While the skywalk serves upper-level metro commuters, ground-level movements are also vital. Well-designed at-grade crosswalks would prioritize pedestrian convenience at street level, ensuring effective connectivity distinct from vehicular traffic.

**Multimodal Connectivity:** It is facilitated by Mobility as a Service (MaaS), transforms transportation integration. Commuters can seamlessly plan, book, and pay for their entire journey through a dedicated app, simplifying travel across various modes like trains, buses, and metros. This integration streamlines the travel experience, reducing the need for

multiple tickets and enhancing overall transit efficiency. To align with micromobility trends, bike-sharing programs like MyByk enhance accessibility. Integration into the broader MaaS platform allows easy incorporation of cycling into multimodal journeys. Upgrading autorickshaws to e-rickshaws and introducing charging stations at stations present sustainable transport solutions. Kochi's Open Mobility Network (KOMN), launched by Kochi Metropolitan Transport Authority (KMTA), stands as a MaaS platform, uniting diverse elements on a single open network for comprehensive and collaborative mobility solutions but was delayed by Covid.

**Pedestrian friendly approach:** Enhance pedestrian access between the railway station and bus stand by introducing a dedicated pathway along the tracks, directly connecting to Swami Vivekananda Road. This efficient route offers a quicker connection, with extensions to the bus stand for improved street quality and safety. Introduce modular buildings along the pathway for commercial purposes, enhancing activities and ensuring surveillance. Safety measures include railings and buffers to separate the walkway from the railway track. Transforming this stretch into an urban boulevard improves street conditions, while integration with St. Joseph UP School creates a vibrant and inclusive community space. Address the poor state of the road to the bus stand through proper leveling and paving, contributing to enhanced connectivity, aesthetics, and functionality.

**Urban integration:** Improve urban integration between the railway station and the South Railway Overbridge by addressing key issues. Regulate vegetation and install proper lighting to deter criminal activities. Repurpose vacant lands for exhibition areas and parks to revitalize the space, and develop the area under the metro for commercial use and food stalls. Extend pedestrian movement toward the South Railway Overbridge, connecting to SA Road for a more cohesive urban environment. Implement active surveillance to reduce criminal activities and introduce mixed-use activities to enhance connectivity and transform the area into a safer, dynamic urban space.

**KSRTC bus stand:** Revitalize the deteriorating KSRTC bus stand through urgent infrastructure upgrades. Strategically zone waiting areas, providing clear signage for easy identification of designated bus stops. Enhance passenger experience with comfortable seating, charging ports, and workstations. Diversify the space with retail shops and food courts, prioritizing natural lighting, efficient drainage, sanitation, safety, and barrier-free access. By prioritizing these improvements, the KSRTC bus stand can become a modern and functional transportation hub, ensuring user satisfaction.

**Ernakulam Junction Railway station:** Remodel with spacious interiors for flexible movement during peak hours. Introduce more circulation systems like escalators and elevators for barrier-free access. Ensure well-maintained ticket vending machines and ongoing renovations incorporate

digital displays. Consider platform height increase, upgrade waiting areas, and provide amenities such as sanitation facilities and workspaces. Moderate advertisements and announcements for efficient travel information. Implement incoming and outgoing passenger segregation, additional facilities like lounges and dorms, and incorporate traditional architectural features. Ongoing renovations, including multilevel car parking and residential tower upgrades, aim to comprehensively improve the station.

**Breathing spaces:** Liminality, the transitional phase between different transit modes, often induces a certain level of discomfort or disorientation among commuters. Addressing this challenge involves incorporating designated breathing spaces, providing areas where commuters can pause, relax, and recalibrate. These spaces serve as temporary respites, allowing individuals to catch their breath, both figuratively and literally, amid the hustle and bustle of transit. By integrating these designated areas, the overall commuting experience becomes more accommodating and considers the well-being of passengers navigating the transitional phases between various modes of transportation.

## CONCLUSION

In conclusion, the proposed guidelines for the transformation of transit hubs in the Ernakulam South region, informed by a comprehensive analysis of space syntax and user perceptions, offer a nuanced approach to addressing the liminality inherent in these crucial urban spaces. By strategically integrating spatial design interventions, such as skywalks for seamless rail-to- metro transitions, fostering multimodal connectivity through Mobility as a Service (MaaS), and enhancing pedestrian-friendly pathways, the recommendations aim to alleviate the challenges identified in both the spatial and human dimensions. The concepts of separation, transition, and incorporation emphasize the need for distinct hub identities, smooth transitions between modes of transportation, and the infusion of local cultural elements to create a unique sense of place. The proposed revitalization strategies for specific hubs, including Ernakulam Junction Railway Station and the KSRTC bus stand, underscore the commitment to modernization, user comfort, and overall urban well-being. In the context of analyzing liminality in transit hubs, these guidelines envision a transformative future for the Ernakulam South region, where well-designed spatial configurations and thoughtful user experiences converge to create dynamic, culturally rich, and highly functional urban transit environments.

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