

Space syntax analysis as tool to develop sustainable tourism: the case of Garli, a hamlet in Kangra district, Himachal Pradesh, India.

El análisis de la sintaxis espacial como herramienta para desarrollar el turismo sostenible: el caso de Garli, una aldea en el distrito de Kangra, Himachal Pradesh, India.

Dipanwita Chakravarty

Associate Professor, KLE Technological University, Hubli, Karnataka, India. Email:
dipanwita.chakravarty@kletech.ac.in

ABSTRACT

Human settlements have evolved through ages to arrive at the complex mechanisms they display today in terms of spatial metamorphosis. However study of spatial characteristics, are important as they signify strategic parameters for augmentation and rehabilitation of human settlements and help to identify key issues for transformation. Space syntax analysis is an approach to understand spatial characteristics through a set of analytical, quantitative and descriptive tools in different forms like buildings, cities, interior spaces or landscapes. (Hillier and Hanson, 1984, Hillier, 1996)The present paper aims to understand and implement a set of analytical and descriptive approaches to Space Syntax analysis to identify the most appropriate pedestrian walkway for sustainable tourism development in the context of a Himalayan hamlet, Garli in Kangra district of Himachal Pradesh. Building awareness about environmental degradation and the depletion of its resources was first identified in the report "The Limits to Growth" by D.L. Meadows and "Man and His Environment" by U'Thant that was published in the late 60s. These became the foundation for international discussions on sustainable development (Sustainable tourism Development, Ivona Niedziolka). In the early 1970s the first United Nations (UNEP) Conference on the Human Environment chaired by UN Secretary-General took place in Stockholm. It produced an action plan for the environment based on the global environmental assessment programme called Earth-watch, highlighting Environmental management activities and International measures to support the National and International actions of assessment and management. (Cooper, Fletcher, Fyall, Gilbert, Wanhill, 2008). It was increasingly realized that the massive environmental degradation inflicted by tourists needs to be reduced and the concept of sustainable tourism became popular which encourages tourism with minimal environmental intervention. The present paper aims to understand the basic principles of space syntax analysis considering spatial cognition through the knowledge of axial map, integration, choice and distance measures and applying this theory to delineate the most usable pedestrian walkway as a part of sustainable network, culminating in a route for heritage walk for tourism development plan. The most integrated pathway was selected after considering the connectivity value, mean depth value, control value and accessibility.

Key words Accessibility, livable cities, space syntax, walkability, community based tourism.

RESUMEN

Los asentamientos humanos han evolucionado a lo largo de los siglos hasta llegar a los complejos mecanismos que muestran hoy en día en términos de metamorfosis espacial. Sin embargo, el estudio de las características espaciales es importante ya que significan parámetros estratégicos para el aumento y la

rehabilitación de los asentamientos humanos y ayudan a identificar cuestiones clave para la transformación. El análisis de sintaxis espacial es un enfoque para comprender las características espaciales a través de un conjunto de herramientas analíticas, cuantitativas y descriptivas en diferentes formas, como edificios, ciudades, espacios interiores o paisajes. (Hillier y Hanson, 1984, Hillier, 1996) El presente documento tiene como objetivo comprender e implementar un conjunto de enfoques analíticos y descriptivos del análisis de sintaxis espacial para identificar la pasarela peatonal más apropiada para el desarrollo del turismo sostenible en el contexto de una aldea del Himalaya, Garli, en el distrito de Kangra de Himachal Pradesh. La creación de conciencia sobre la degradación ambiental y el agotamiento de sus recursos se identificó por primera vez en el informe "Los límites del crecimiento" de D.L. Meadows y "Man and His Environment" de U'Thant que se publicó a finales de los 60. Estos se convirtieron en la base de los debates internacionales sobre el desarrollo sostenible (Desarrollo del turismo sostenible, Ivona Niedziolka). A principios de la década de 1970, se llevó a cabo en Estocolmo la primera Conferencia de las Naciones Unidas (PNUMA) sobre el Medio Humano presidida por el Secretario General de la ONU. Produjo un plan de acción para el medio ambiente basado en el programa global de evaluación ambiental llamado Earth-watch, destacando las actividades de gestión ambiental y las medidas internacionales para apoyar las acciones nacionales e internacionales de evaluación y gestión. (Cooper, Fletcher, Fyall, Gilbert, Wanhill, 2008). Cada vez se comprendía más que era necesario reducir la degradación ambiental masiva infligida por los turistas y se popularizó el concepto de turismo sostenible que fomenta el turismo con una intervención ambiental mínima. El presente artículo tiene como objetivo comprender los principios básicos del análisis de la sintaxis espacial considerando la cognición espacial a través del conocimiento del mapa axial, la integración, la elección y las medidas de distancia y aplicando esta teoría para delinear la pasarela peatonal más utilizable como parte de una red sostenible, que culmine en un ruta para el paseo patrimonial para el plan de desarrollo turístico. La ruta más integrada se seleccionó después de considerar el valor de conectividad, el valor de profundidad media, el valor de control y la accesibilidad.

Palabras clave Accesibilidad, ciudades habitables, sintaxis espacial, caminabilidad, turismo comunitario

INTRODUCTION

Complexity of human settlements have for centuries been a research question across a wide range of disciplines. Cities are living organisms, evolved by amalgamation of various heterogeneous subsystems. Spatial distribution of activities and human interactions constitute the physical realm of a living space which are often dynamic. During the past eleven thousand years of building cities and towns, we still fail to fully understand them. They are all different, constantly evolving, changing and growing to become "systems that have the potential to reconfigure themselves in ways that may be surprising (Department of Applied Mathematics, Faculty of Transportation Sciences, Czech Technical University in Prague. Konviktska, Czech Republic)

Urban planners today are expected to design new towns and redesign existing spaces so as to make them more inclusive, livable and sustainable. Urban development strategies of cities are evolving as they are systematically pursuing sustainable mobility, emphasizing on design of public realm, pedestrian spaces and walkability. Therefore, interest in research focused on the logic behind our movement in space is growing (7) (Jakub Matejcek, Space Syntax: A multi-disciplinary tool to understand city dynamics)

Space syntax provides a set of theories and methods for analysis of spatial configuration. It allows us to link human societies and space and to describe relations between them. Since spatial layout is difficult to change after an intervention, an analysis of existing conditions undertaken before design in conjunction with the stakeholders is always helpful (7)

Space syntax analysis was propounded by Hillier who argued that we are rich in theoretical support for the generation of urban designs, but poor in well-founded support for the prediction of

the actual performance of such designs. This has resulted in urban blight and inefficient design. Thus an analysis of movement pattern and people centric ideas will help to establish a scientific methodology (7)

1.2 The foundations of Space Syntax

Space syntax is best characterized as a set of mathematical and computational techniques to describe and analyze spatial configurations of inhabited spaces. It uses them to investigate relationships between spatial layout and variety of societal, economic and environmental phenomena. These phenomena include patterns of movement and interaction; land use and land value; urban growth and societal differentiation; safety and crime distribution. The study is based on quantifiable natural movement patterns in space which can be reduced to horizontal and vertical grid forming an axial map.

1.2.1 Axial map

Space syntax analyses spatial layouts by converting them into horizontal and vertical projections culminating in graphs. This model simplifies the reality, while preserving geometrical properties of squares, streets, or all public spaces of a city, by taking an accurate map and drawing a set of intersecting lines through all the spaces of the urban grid, so that the grid is covered and all rings of circulation are completed. This converts the nodes and edges of the city into a common language of mathematics, which can be compared and analysed.

1.2.2 Integration

Since cities are essentially nonlocal systems which investigate relationships of all lines to all others, a measure of 'integration' indicates how spatially integrated or segregated a street segment is in relation to all others. It also figures out the directional changes which highlight the access or usability of a particular street or space. The more integrated segments are highlighted in warmer colours and the segregated ones in cooler colours.

1.2.3 Choice

Often referred to as spaces in between, the measure of 'choice' shows how likely it is for one to pass through a segment on trips between all pairs of lines in the system. Choice, therefore, is an index of the potential of space for 'through-movement', as opposed to 'to-movement' which is indicated by the integration. Choice analysis of a chosen area highlights the segments that will most likely be chosen for a trip within a specified radius.

1.2.4 Distance measures

There are three main concepts to how 'integration' and 'choice' analysis of the 'axial map' are calculated. Metric, where distances are measured metrically, Topological, where distance is measured by the number of turns from origin to destination, and angular, where the distance is determined by the sum of angular turns between A and B. Complex and disaggregated forms of line analysis allowed us to report a surprising fundamental research finding: That human movement is spatially guided by geometrical and topological rather than metric factors]. Because we do not only think of the distance, but how easily geometrically it is for us to take that journey.

The principles of space syntax analysis will be applied to Garli to understand the dynamics of sustainable tourism development.

2.0 The Context of Garli

Community based tourism development not only empowers the local community but also provides the tourist with choices according to his exploratory needs, experiential journey, cultural ethos, economic choices and also the activities he or she wishes to undertake. Village tourism can have many perspectives depending upon one's cultural background, age group, whether travelling solo, with family or in groups and the experience that one is looking for either entertainment, relaxation or adventure. (Community-Based Tourism Model: Its Conception and Use Etsuko Okazaki Kobe University, Japan) The present case provides an excellent and pristine ambience for relaxation in a splendid natural surrounding with enthralling built spaces and exceedingly warm hospitality.

2.1 Case study

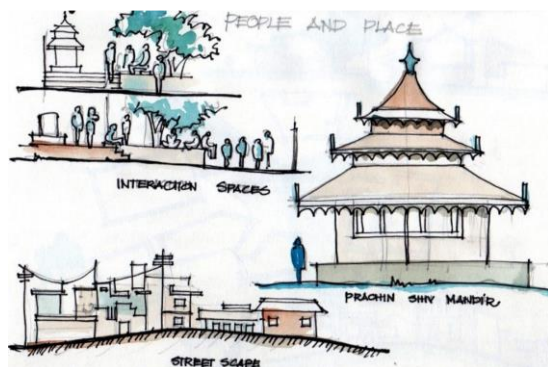
Garli is a small Himalayan Hamlet in the Kangra district of Himachal Pradesh. With a population of around five thousand the village showcases a curious amalgam of various architectural styles. Since the early inhabitants migrated from Rajasthan and settled down in Garli as wealthy traders who could hire European architects, there are many Portuguese styled Chateaus in Garli with brick jaalis, decoration at the eaves and Rajasthani chhatris.

In the later half of the sixteenth century, traders from Rajasthan migrated to Garli owing to its pristine beauty, natural security rendered by the surrounding hills and central location with respect to Delhi, Kabul and Shimla, where the trade links extended to. Soon a wealthy township came into being with neatly laid roads, state of art infrastructure, chateaus designed by European architects. Many new architectural styles were explored demonstrating curious amalgamation of Rajasthani chhatris with European column capitals, Islamic arches and Hindu corbels as seen in the Judges court Pragpur

2.1.1 Architecture and urban design The settlement grew and reached its pinnacle of glory in the late eighteen hundreds but a shift of economic base in the early nineteenth century led to its decline and people started migrating away. However, the glory and grandeur continued and many public buildings were built post-Independence. People again started coming back to the village about two decades ago and tourism base expanded. A lot of initiatives were taken for the preservation of tangible and intangible heritage and Indian National Trust for cultural heritage conservation declared it as the first heritage village of India. Each building exhibited a particular style with elements from Gothic, Portuguese, Rajasthani and Kat Khuni architecture like gabled roofs, buttresses, wooden embellishments, stained glass windows and exquisite brick jaali as in Chateau, Garli brick paneled roofs, segmental arches with exposed brick work in Government Senior Secondary school, timber and slate roofs as in most smaller residences and brick arched ceiling, segmental arches, brick staircase and huge brick entrance archway as in Navrang Yatri Niwas.

2.3 Architectural character

Garli also displays an intimate interaction with the human beings and the environment witnessed in its climate responsive aesthetic architecture, the taal or water tank being the active city centre and the major circulation corridors planned around the network of drainage channels. Mostly Bricks, wood, cement, slate and mud were used as building materials. The houses could be divided into five typologies based on these building materials. There were mansions, Government buildings, temples and local houses. The town witnessed population growth in the early nineteenth century followed by a decrease in population in the twentieth century.



Recently due to awareness adoptive reuse and growth in tourism people have started moving back on account of availability of economic opportunities. Thus the older houses display splendor and glory of its celebrated past embodied in wooden and brick houses The recent houses are relatively humble and show composite use of materials and construction techniques. The houses based on the material of construction can be divided into brick house, mud house stone house, wooden house and composite house

2.4 Street pattern The main access road bisects the town into two halves with the local roads lanes and by lanes forming an intricate network. There are many public precincts at the junction, under a tree, near a temple and at the shop front where one can catch up with the happenings of the town over a cup of tea. There are many interesting tale of trails in and around Garli.

3.0 Space Syntax analysis in the context of Garli

The settlement of Garli has a linear configuration. The path from Navrang Yatri Niwas to the Taal (Water body) and then to the city centre being the most important. The urban pattern has a network of mostly pedestrian streets crisscrossing at acute angles. The city skyline is mostly low lying with a few spires jutting out. The urban-scape consists of beautiful brick facades with elaborate fenestrations and carvings.

The tourism development plan consisted of developing an experiential pedestrian walkway based on space syntax analysis. First an axial plan was developed depending upon the major network of roads with the initial and culminating points and converting it into a graphical interpretation. The most integrated and segregated streets were identified inferring from the number of trips undertaken and also the frequency with which a particular pathway was used. Also the through streets and the- to streets, which were most frequently used were identified. The entire analysis was completed by undertaking a metric as well as topographical analogy where the most likelihood of selecting a particular street, the possible number of turns taken, identification of the shortest route, and the experiential journey of walking through nature was considered. The pause points were carefully chosen depending on distance travelled, ambience offered and possible points of interests, like a potters' enclave, a home based tapestry production centre or an ancient building of historic and aesthetic significance.

A few of the ancient buildings were converted into museums show-casing local cultural and historic chronicles, craft centre and souvenir shops, beautiful home-stays or local restaurants.

3.1 The study Methodology

Heritage walks are walking trails and driving routes in urban and rural settings that are identified in most cases by maps and guidelines relating to cultural heritage. The heritage can be engineered, or it can also be cultural heritage narrative. In most cases it is in public place. The nature of the path can be seen as useful for community development, community participation, for locating community heritage, and for involvement of community in developing the path. In several countries heritage walks are self-guided but for the interpretation of features and items of historical note, tour guides are required. (Identification of Heritage Walk By Using Spatial Analysis Techniques Sureshkumar , Sai Kalyan and Vinay Kumar)

In this context the heritage walk has been identified based on spatial morphology. The various routes and spaces have been analyzed to arrive at the most optimum trail in terms of resource management, aesthetics of built space, cultural exchange, community participation and human endeavor. Similar methodologies have been adopted for heritage walk in Amritsar and Chandigarh, India

For understanding spatial morphology, the axis segmentation method was adopted and the topological relationship was analyzed with respect to connectivity value, control value, mean depth value, global and local integration values and the intelligibility value. The connectivity value (C) refers to the number of spaces connected, a higher connectivity value indicates a stronger influence on the surrounding space and better permeability. The control value is the reciprocal sum of other spatially connected values. The mean depth value indicates the accessibility of a particular space, a higher value indicating better accessibility. The following equation was used to ascertain the accessibility of a particular tourist route

$$C_i = (C + D * c) / d$$

Where C_i is connectivity value

C is control value

D is mean depth value

And d is equal to the distance traversed.

The mean Depth value refers to the shortest topological distance from all spaces. A lower mean depth value means the space is integrated and a higher denotes that the place is segregated.

3.2 Result and discussion

Spatial cognition shows how people recognize and understand the environment including environmental image, distance judgment, spatial orientation, way finding and place making. Also the tourist spatial cognition indicators have been taken as connectivity (no. of junctions/Distance), spatial permeability (decision to walk through/ no. of users), road network structure, interconnectivity and fewer dead ends, way finding , interesting pause points, spatial compactness, spatial publicity(gathering space) and overall aesthetic environment.

The Ci value of various streets were identified pertaining to these parameters in the following table

Name of street	Ci value	Connectivity or Mean depth D	Spatial permeability (C)	Interconnectivity (c)	Spatial control 1/C	Spatial compactness d= Distance traversed
Navrang road	3.2	2.1	1.2	0.8	0.8	1.2
Taalchowk	3.4	1.8	1.2	0.4	0.8	1.3
Kumharpara	2.2	1.2	1.4	0.6	0.7	0.9
Barabazar	3.2	1.3	1.3	0.9	0.75	0.8
Mahalkarasta	2.8	1.6	1.5	0.5	0.66	0.6

From the table it is seen that the average connectivity value for a location between Navrang road and Taalchowk, at Garli is around three (average of first column is 2.96) i.e. there are on an average three intersections or routes that the tourist can undertake. From the aerial map of Garli it is clear that it has a linear configuration with the main spine along the water body and tourists’ attractions such as residences palaces and temples are located along. The research focused on the ancient part of the town with thirty buildings. In the results of the space syntax analysis the colour refers to high and low values. Red refers to high values of integration and blue refers to low values of integration

The values were obtained after interpolation from the space syntax graphs shown in the figures. The points A, B, C, D,E, F and G have been identified based on the level of connection (identified by orange lines) or segregation (identified by blue lines) and based on the interpolated value the route for tourists has been worked out. If the value is greater than one, it has been included in the pedestrian walkway and if less it has been excluded Therefore, space syntax analysis paved a significant path for identifying the route of heritage walk based on peoples’ perception and cognition which has been identified in fig. 7

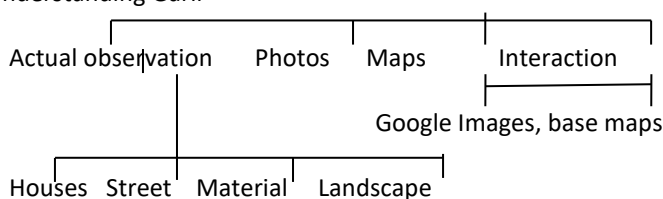
Origin and genesis were studied via maps chronological analysis, local stories and interviews

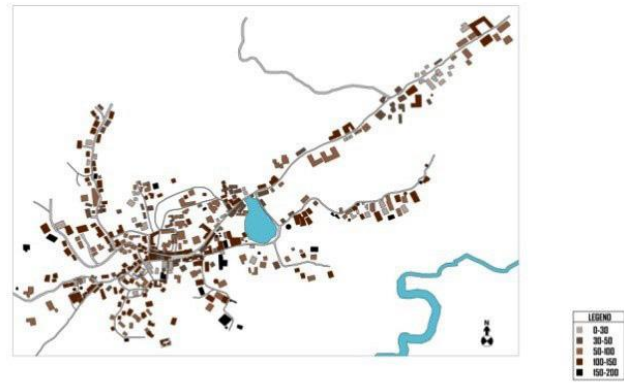
Architectural character and housing was studied through analysis of various styles, identification of characteristic elements, primary survey, study of material and construction techniques

Street pattern was identified via maps, following popular trails, actual on site observation and understanding spaces and activities.

The people and their culture were understood through stories, festivals, interviews and getting involved in their activities. The methodology adopted was as follows

Understanding Garli



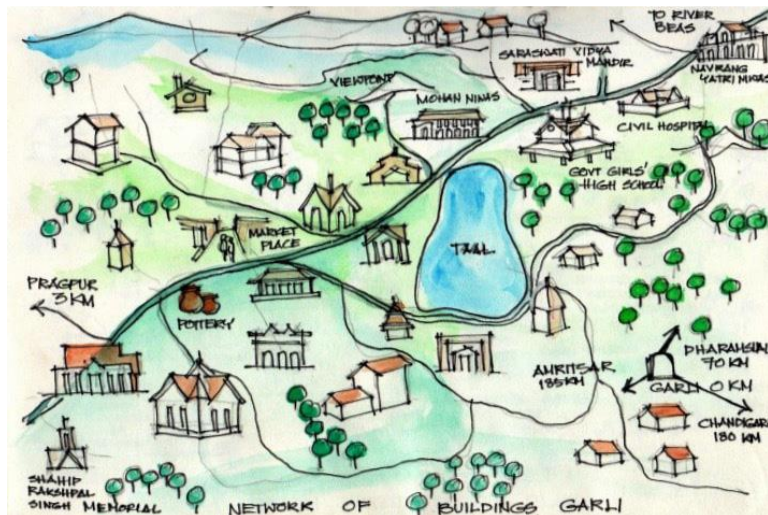


PLAN SHOWING AGE OF THE BUILDINGS IN GARLI.

While executing the study it was realized that the population density of Garli is fairly low and there is a lot of potential for adaptive reuse of old structures and tourism development. People who had migrated from Garli years back are coming back as economic rejuvenation is slowly happening. The traditional crafts like patchwork and pottery are in demand and exploratory tourism is slowly catching up in India. People are travelling to have a different cultural experience rather than luxury

3.3 Conclusion Space Syntax analysis can be adapted as a significant tool to identify people oriented spaces and can be used for a variety of purposes including sustainable development, urban rejuvenation, design of public space, understanding livability and walkability and many other concepts of Neo-urbanism with case specific approach and adopting proper methodology

3.4 The Augmentation Plan Thus quiet and tranquil Garli with its beautiful natural setting may provide a great architectural experience if the vacant houses along the identified heritage walk based on space syntax analysis, with inputs from their owners can be converted to earn revenue like homes for staying, museums and craft hubs. .The local community is indeed eager to welcome tourists. The houses in good condition which were



vacant were identified and their ownership pattern was studied. The age of structure and structural condition was studied and houses which were structurally sound but were not under litigation were identified for adoptive reuse. The three houses that were identified were Navrang Yatriniwas which is already being used as a guest house, Mohan Niwas which the owner wanted to convert in a luxury condominium cum arts centre and the mystery house which would be

converted into a museum showcasing Garli.

House	Structural Condition	Ownership	Occupancy
Mohan Niwas	Good	Clear	Occupied
Yatri Niwas	Good	Clear	Occupied
Mud House	To be Augmented	Litigation	Unoccupied
Conice House	Satisfactory	Litigation	Unoccupied
Mystery House	Good	Clear	Unoccupied

Based on space syntax analysis and land use pattern, structural condition, ownership and occupancy houses were identified along with the proposed trail for heritage walk.

The journey starting from north would witness amalgamation of Rajput and colonial style in Navrang Yatriniwas, Gothic architecture in Garli Girls' school and Civil hospital, intricate wooden carving and colonial cantilevered balconies in Mohan Niwas, Portuguese architecture and brick jails in Chateau Garli and, many curious residential structures in mud and concrete undergoing transformation culminating in the mystery house as a museum. The pause points will be the taal for a refreshing cup of coffee and after the heritage walk local lunch could be at the market place beside the potters' enclave. Nature enthusiasts can enjoy a nature trail through the rivulets culminating in the famous viewpoint of Hanuman Tekri photographing wildlife and listening to the sounds of forest.

For the tourism development plan the site seeing places in and around Garli like the second century BCE Masroor caves, where an unfinished Shiva temple had been erected on a picturesque setting and the magnificent Kangra fort that witnesses the rich history of India including the conquest of Alexander, the rise and fall of the Khaljis and Mughals, the colonial supremacy and the celebrations of Independent India all can be heard through the mesmerizing voice of Roshan Seth that takes one into an in situ journey through history.

REFERENCES

- Broadman Philip, Patrick Geddes: Maker of the Future, Introduction by Lewis Mumford (Chapel Hill, The University of North Carolina Press 1944)
- Chaudhuri, Nirad C The Autobiography of an unknown Indian, 1951 Bombay: Jaico publishing House)3rd imp,1969.
- Dutta Krishna and Robinson, Andrew Rabindranath Tagore: The Myriad –Minded Man (Bloomsbury) 1995.
- Fraser Bashabi. The Tagore- Geddes Correspondence, Centre for South Asian Studies, Edinburgh University published by Viswa -Bharati, Kolkata
- Leabharlann Naiseanta, The Learning Zone, National library of Scotland, nah-Alba Papers
- Yabing Xu 1 , John Rollo 1,* , David S. Jones 1 , Yolanda Esteban 1, Hui Tong 2 and Qipeng Mu Towards Sustainable Heritage Tourism: A Space Syntax-Based Analysis Method to Improve Tourists' Spatial Cognition in Chinese Historic Districts
- Lal Atul, Reference literature on Garli
- Boyd, Stephen. "Cultural and heritage tourism in Canada: Opportunities, principles and challenges." *Tourism and Hospitality Research*.2002; 3(3):211-233.
- Barto, J. Rachel Hine, and J. Pretty. "The health benefits of walking in green spaces of high natural and heritage value." *Journal of Integrative Environmental Sciences*.2009; 6(4):261- 278.
- Leask, A., and Fyall, A. *Managing world heritage sites*. 1st ed. Routledge: New York; 2006: 109-120.
- Henderson, Joan. "Heritage, identity and tourism in Hong Kong." *International Journal of Heritage Studies*. 2001; 7(3)
- Vryonis, Panagiotis, et al. "A Historical Mortars Study Assisted by GIS Technologies." *International Conference on Transdisciplinary Multispectral Modeling and Cooperation for the Preservation of Cultural Heritage*. Springer, Cham. 2018; 532-540.

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<http://dx.doi.org/10.7770/safer.v11i1.2964>

Mckercher, Bob, Anne Hardy, and Jagannath Aryal. "Using tracking technology to improve marketing: insights from a historic town in Tasmania, Australia." *Journal of Travel & Tourism Marketing*. 2019; 1-12.

Persai Prashant, and Sunil Kumar Katiyar. "Development of Information Evaluation System for Smart City Planning Using Geoinformatics Techniques." *Journal of the Indian Society of Remote Sensing*. 2018; 46(11):1881-1891

Chakravarty Dipanwita "Empowered Neighbours, happy Neighbourhood" an analogy of Sir Patrick Geddes and his concepts in the Context of Garli , Himachal Pradesh presented in International conference on revisiting Patrick Geddes held in Indore in September 2019 supported by DST.

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