The Thin Line Between Tradition And Modernity: The Poetics Of Vernacular Dwellings Of Chittagong Hill Tracts

Dr. Dilshad Rahat Ara
Academic (Part-time)
Faculty of the Built Environment, UNSW, Sydney, NSW 2052, Australia.
Email: dilshadrara@yahoo.com.au

Mamun ur Rashid
PhD Candidate,
Faculty of the Built Environment, UNSW, Sydney, NSW 2052, Australia.
Email: m.rashid@student.unsw.edu.au,

Abstract :

Much too often 'tradition' is considered as an antonym for 'modernity'. Although this view has been contested theoretically, in the discourse of vernacular architecture, hardly any study has been undertaken based on primary fieldwork. This paper investigates some aspects of mainstream modernist design concepts as imbued in the broader vernacular of Asia, particularly Chittagong Hill Tracts. It focuses on such ideas and concepts such as modular or incremental design, standardization, flexible and temporal concept of designed space.

Keywords:

Modern and vernacular architecture, incremental form, temporal space.

Introduction

A widely accepted popular framework of study focusing on vernacular architecture does not at present exist. The prevailing methodological dilemma of theoretical approaches in the field is explicit in the recent publication of the *Encyclopedia of Vernacular Architecture of the World* (1997) edited by Oliver, which summarises an intriguing range of diverse approaches and concepts from various disciplines. It concludes:

There is no single approach to the study of vernacular architecture. As a subject, which has yet to be defined as a discipline, it both suffers from the lack of co-ordination of approaches, and benefits by the diversity of perceptions which various research directions bring to it (Oliver 2003, p 1).

The current approaches and methods suggest reviewing of vernacular architecture from broad, open-ended, diversified perspectives, but as yet there is a lack of consensus on the definition of the term 'vernacular' in architecture. There is a common assumption, even in the aca-
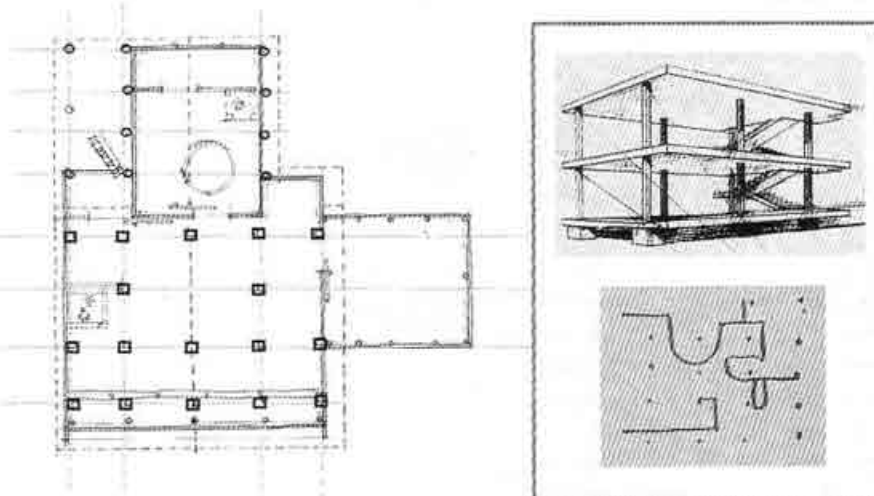

Figure 1: Modernist space – a flexible plan with freestanding pillars and movable walls.
Left: The grid of the column in a Mru dwelling; sketch Ara, PhD 2006.
Right: Maison Domino and the grid of the column in the free plan;
Tzonis, Le Corbusier: poetics, p 33; Graves, Le Corbusier selected drawings, p 22.

demic discourse, that vernacular architecture is a kind of traditional type of architecture, which is distinctive from modern architecture. In this dualist view – which is hardly contested - 'tradition' stands as an antonym for 'modernity'[1] (Bourdier 1985).This symptomatic view not only sets vernacular as a distinct category but also implies a kind of architecture which is nearly immutable, 'indeed unimprovable, since it serves its purpose to perfection'(Tzonis 2001, p 101). This notion however can be contested – not only theoretically but also practically. In this paper we look into a specific type of traditional architecture and show how it is synonymous with modern and contemporary design thoughts and practices. The findings are based on a primary fieldwork carried out in the Chittagong Hill Tracts (Ara 2006).

The five pillar construction

'One had therefore a structural system – skeleton – completely independent of the functions of the house plan. This skeleton simply carries the floor and the staircase. It is made of standard elements, combinable with each other, which permits great diversity in the grouping of houses.' (Broadbent 1973, p 47)[2]

It is well accepted that modern architecture is fine tuned to the design flexibility, which is often derived from structural sophistication (such as post and beam construction in place of load bearing construction), portability of features, compactness, standardization, prefabrication, and economy of structure – often result of a detailed technological consideration. Increasingly modern practices high-

light architecture with smart design components that can be substituted, upgraded, replaced, maintained or repaired. Frequently walls are moveable and removable, i.e., non load bearing. Often for such practice modular design is the key. Much of these tenets also define the Mru[3] architecture in the Chittagong Hill Tracts of Bangladesh. The building process is mostly standardised where most of the physical elements are first made on the ground and then assembled together on the site to give the final form.

The walls are non-load-bearing and they stand free of the structural posts parallel to the gable ends in the public space. Along the gable ends, generally five pillars are found in the *kim-tom* irrespective of bamboo or wood construction. The five poles are erected in two rows, flanking the core space of *kim-tom* in between. On the free gable end side of the *kim-tom*, a part of the floor space juts out in a cantilevered fashion, outward from structural posts, usually over steep slope side of the site. The cantilever usually varies from 1m (or less) to 1.5m approximately. The five pillar-setting divides the space more or less equally into four parts giving a flexible but precise reference to organise other built elements such as openings in the open space (Ara 2006).

The five pillar set up also has certain direct technical advantages. By increasing the number of posts the roof load is more evenly distributed on the posts adding to the structural rigidity of the form. Another advantage, especially in wood constructed houses, is that by increasing the number of posts it is possible to span a larger space by trees of smaller diameters. Indeed it would have
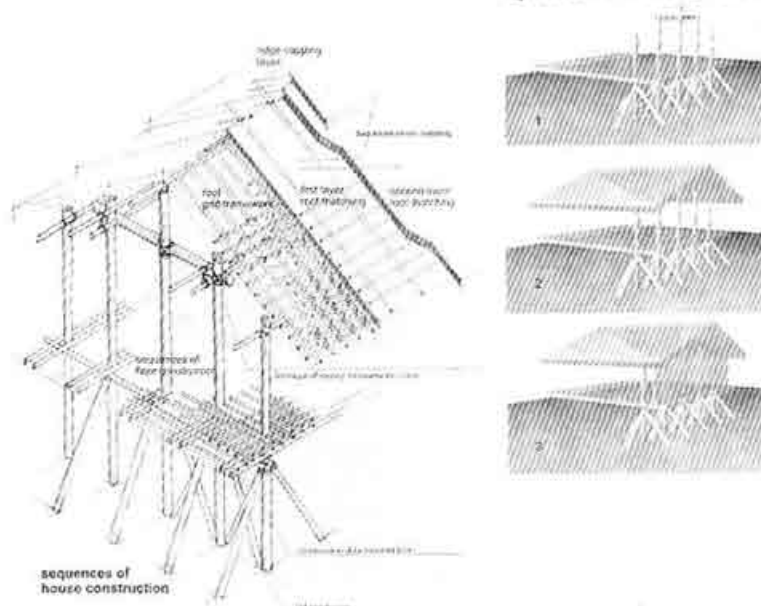

Figure 2 : Five pillar construction. Left: A regulatory framework of construction principles. Right: Construction process starts from the two gable sides where 5 structural posts in two rows stand freely from enclosing panels. This begins with finding the centre for the ridge pole on the gable side. After setting structural posts and floor, roof is added. Enclosing walls come much later in phase three. Sketch & CAD analysis by Ara, PhD 2006.
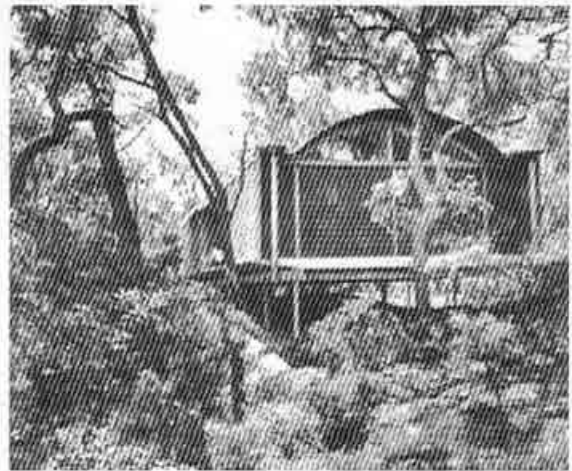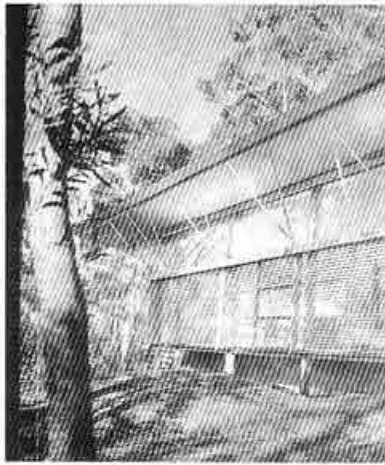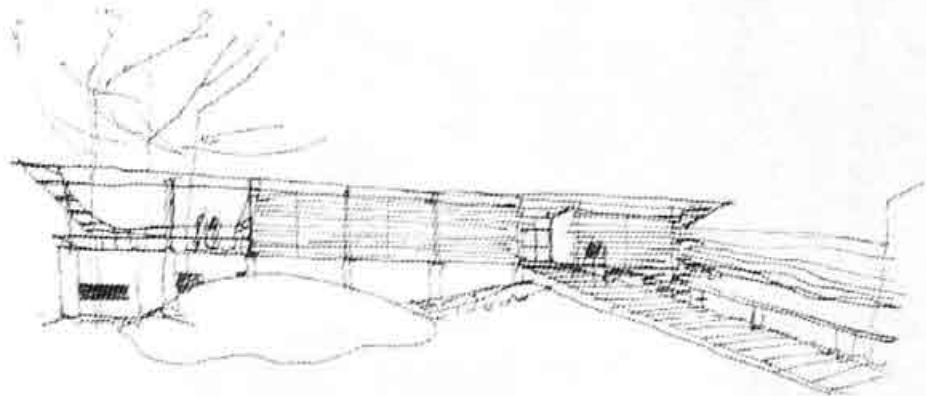
Figure 3: 'Touch the earth lightly '- a modernist approach that sustains the ecology and exhibits sensitivity to the local landscape and particulars of the site.
Top: Murcutt's sketch relating building to the site. Simpson-Lee house, NSW 1988-94.
Bottom Left: Simpson-Lee house., Fromonot, Glenn Murcutt p 206.
Bottom Right: Designing on unspoilt landscape. Ball-Eastaway house and studio, Glenorie, NSW, 1980-83.
Photo Anthony Browell.

required much wider diameter of trees to span the same open space, if number of posts were decreased. When interviewed, builders generally felt that there couldn't be any exception to this five pillar setting. However one case in rarity obscures the universality of the rule. In this case the use of 0.45m dia trees, in a three pillar setting, is an indicator that at one time when larger diameter hardwood trees were present in plenty and resources were available this type might have been present. However due to practical factors such as shortage of trees of larger diameter and constraint of resource and handling, the practice might have changed and what is widely adopted is now pronounced as a rule.

A similar transformation might have occurred in South China, where the *chaundau* framework of five pillar setting is also thought to be evolved in response to a shortage of timber of sufficient size to construct dwellings according to pillar-and-beam principles (Knapp 2000, p86). Although the elements of supports are separated from elements of enclosures, in the more private space – the *kimma*, the walls are tied to the structural posts and, depending upon the two general types, may be exposed outside, or stand inside the enclosures. [4]

The structural logic of the construction is also integrated with the particular function of space. The sensibility of treating cantilevered part – projecting from the five posts on gable end, with more porous slat gridwork is ingenious. This reduces dead load on the jutting part and creates a utilitarian extended floor, which can be used as an aisle for storing agricultural items. Air from beneath the floor thus flows in through the open gridwork and regulates humidity.
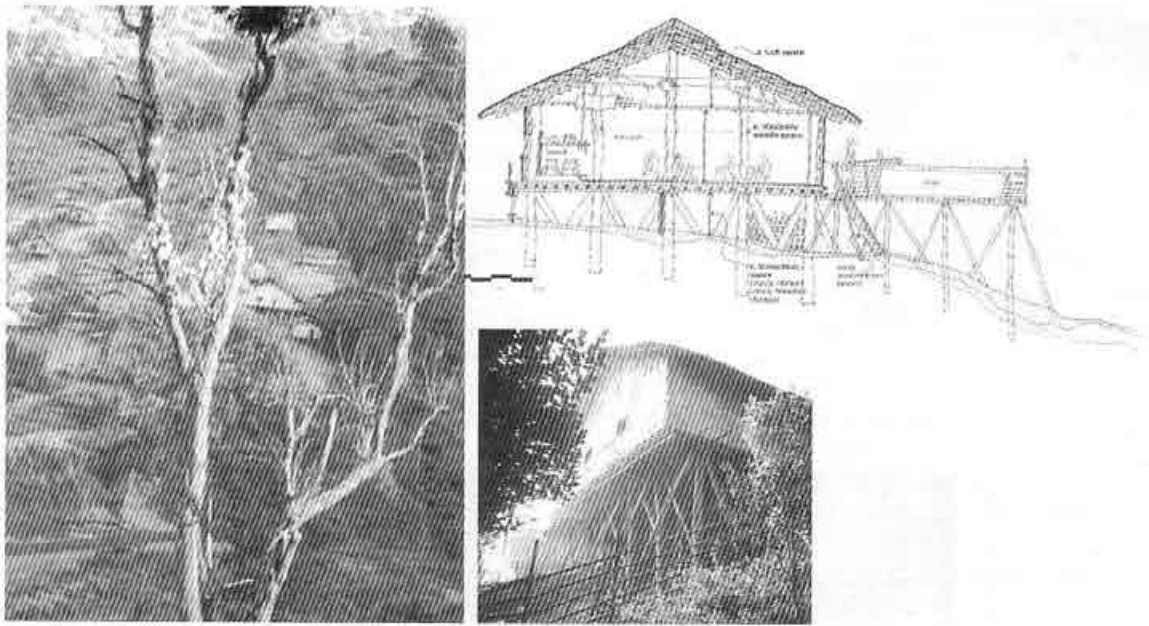
Figure 4: Left: a Mru settlement nestled harmoniously in the hilly terrain as seen from afar. Right: retaining the terrain; section showing minimum intervention into the landscape. Bandarban 2003; photo: authors.

Tectonics - structural poetics

Modern masters like architect Le Corbusier and Aalto designed to build spiritually revivifying environments in which man could live harmoniously within nature (Menin 2002, p 73, p 81). Aalto advocated that natural energy of light and air must filter into the designed spaces. He developed many different techniques for getting natural light into the interior spaces. Le Corbusier was well known for his deep concern for 'sun, space, greenery' in his designs. Australian architect and Pritzker Prize Laureate Glenn Murcutt is known for designing earth-friendly struc-

tures which are unpretentious, comfortable, and economical. He uses local materials. His design approach follows the local site, wind and the sun. He profoundly shares the aboriginal philosophy – 'touch the earth lightly'.

Similarly technological perfection in Mru architecture is derived from understanding of the locally available materials and the constraints of the site, climate and environment. These traditional design approaches don't deviate a lot from the modernist design concepts and concerns just outlined.
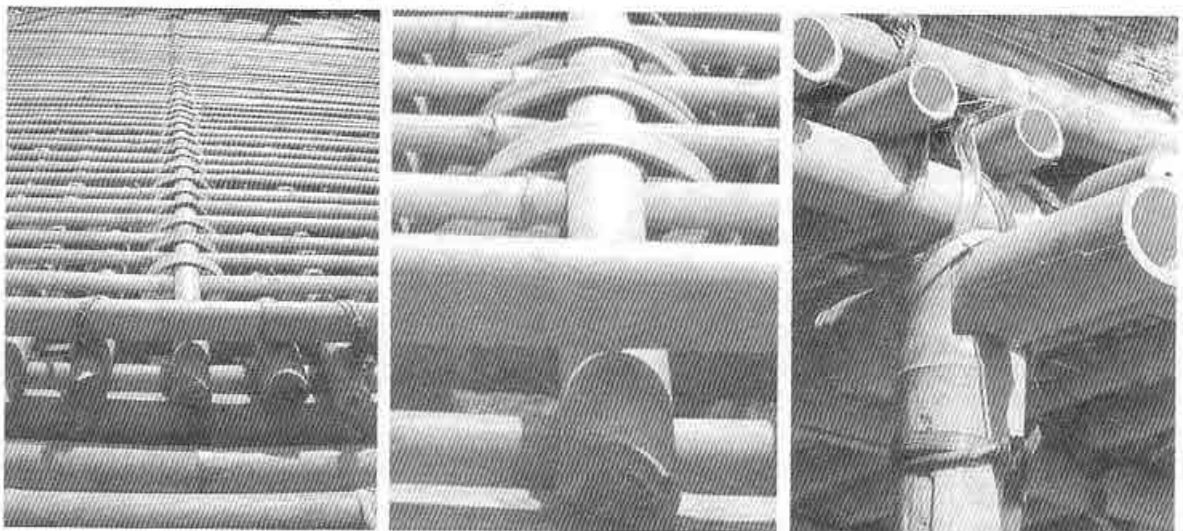

Figure 5 : Work of art or innovative building technology? Photograph showing the method of clipping without nails and thongs to join loose construction members in the char. Bandarban 2003; photo: authors.
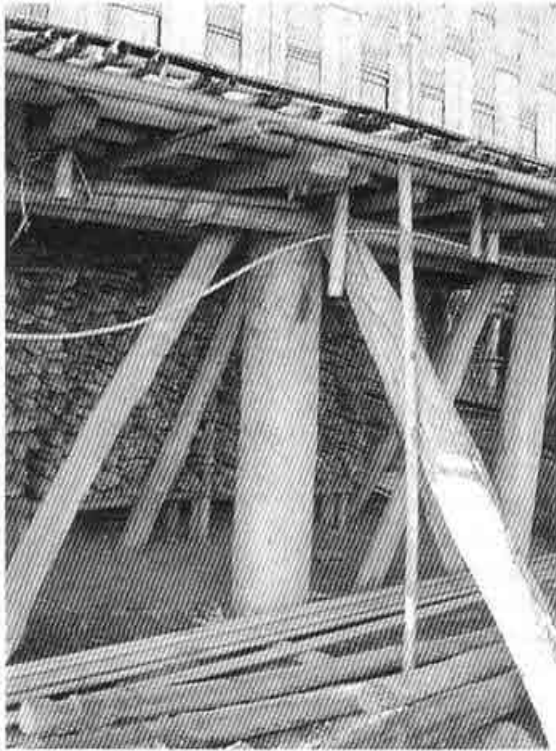
Figure 6: Stilt construction in wood. Hardwood trees with barks removed are used as posts. Bandarban 2003; photo: authors.

The bamboo is literally the stuff of life. He builds his house of bamboo; he fertilizes his fields with its ashes; of its stem he makes vessels in which to carry water; with two bits of bamboo he can produce fire; its young and succulent shoots provide a dainty dinner dish; and he weaves his sleeping mat of fine slips thereof (Lewin 1869, p 9).

In the hills, even today such wide use of the same material virtually in every aspect of life can be noted. However the use of material also has other formal implications for example on the size of the dwelling. Even though all Mru dwellings are comparatively larger than the Bangali huts or dwellings of the other ethnic groups yet depending upon the material used in structure the sizes may vary. The size of the public space – the *kim-tom*, may vary from approximately 23 [252 sft] sqm (or less), as in a bamboo built dwelling, to 60 [650 sft] sqm (or more), as in a wood built dwelling (Ara 2006). This finding is an indicator that material and its structural property in a way influences the size of the built form.

The important species of the Chittagong Hill Tracts bamboos are *Muli, Mitenga, Dalu, Orah* and *Kaltcheri* (Ishaq 1971, p 103). Lewin notes eleven types of bamboo in the CHT of which he mentions, at least five to be used in house construction (Lewin 1869, Appendix C). Selection of bamboo is dependent on the use. For example the

Burially found in plain area of the CHT is used for posts, rafters and cross beam of the house while the *Noyan Sook* – another variety is used only for making drinking tubes (Lewin 1869, p 9).

It is imperative to mention here that bamboo is a common building material in traditional construction of much of the Southeast Asia. Current researches carried out in the Southeast Asia, where approximately half of more than seven hundred species of bamboo found worldwide can be seen, also record that bamboo structures have high endurance against storm and earthquake – the climatic features very common to Chittagong hills (Dawson & Gillow 1994, pp 22-23). Bamboo as construction material has certain advantages. It is a highly organic material without any waste. It also has other interesting properties. In section, it is hollow inside and because of its hollowness it is lightweight and relatively strong at the same time. It does not require much labour as working with wood does. It can be sliced and flattened easily with simple tools. The shell can be chopped into suitable lengths. It can be split to produce half culms, and split-peeled to make binding or lashing materials. Bamboo splines can be woven to make partitions and screens. However bamboo has certain disadvantages too. Bamboo is vulnerable to buckling. And it can hardly withstand contact with wet soil. Careful details have to be worked out to solve these problems. The sophisticated technical details in bamboo which are worked out to perfection in Mru architecture exhibit how the Mru adapt their building practices to native landscape, climate, topography, available means and tools.

Stilts and framework

Oliver explains:

All buildings, whatever their function, have to meet certain physical constraints. Whether they are the outcome of a long tradition of received techniques, assembled by trial, error, and experimentation, or based on detailed mathematical calculations and the application of formulae, ultimately the basic laws of physics will determine whether they will stand up or collapse (Oliver 2003, p 69).

Indeed the stilt construction in the hills shows high degree of specificity to the region. Building a house on such structure reflects ingenuity of the builders to face the physical and natural constraints of the site. The dwelling is raised on wooden or bamboo stilts of varying length from uneven terrain. Foundation is never used (Dawson & Gillow 1994, p 10).[5] Inclined buttresses of wood or bamboo, brace the upright posts which makes the structure sufficiently stable to counteract any lateral sliding in case of shift of soil or earthquake and also to withstand the heavy wind load exerted on the very thick roof (Waterson 1990, p 103).[6] Such a solution gives substantial rigidity to

the structure. The CHT is a cyclone and earth quake sensitive region. Earthquakes occur frequently but the shocks are generally slight (Ishaq 1971, p 20).[7] There have been several records of earthquakes and cyclones since 1762. Landslide due to tremors is not infrequent worsened by heavy rain in monsoon season. However there is no record of any damage to the stilt built structures (Hutchinson 1906, p 3).

The structure is basically a post and tie beam system with a thatched gable roof. The roof, with a simple functional outline rests directly on posts rather than on beams. Horizontal tie beams are tied to the posts. These transverse tie beams are secured between two purlins running in the long direction (Ara 2006). Posts are free at the base, because they are not connected at the base they are able to move easily with rather than against any tremors like earthquakes. Thus any lateral sways are countered by flexibility, which allows resonance to the whole structure. In such a structure, walls are more vulnerable than the framework thus retaining the integrity of the framework to the last.[8]

Incremental dwelling

Today in contemporary design practice we increasingly put emphasis on 'smart architecture' - an architecture that almost has an organic presence which is able to grow according to the changing needs of the users:

The time factor and the fact that life is enacted in dynamic processes needs incorporating in the architectural design. A process-based architecture of this order brings about a process rather than a finished article, a set of possibilities that puts the product aspect in the hands of its users... It doesn't need to be an immaterial, virtual architecture. On the contrary, the presence of a physical, spatial structure always will be a necessary condition for potential use. It is the form that is no longer stable, that is ready to accept change. Its temporary state is determined by the circumstances of the moment on the basis of an activated process and in-built intelligence and potential for change (Hinte 2003, pp 130-133).

However this is not only hallmark of an architecture, which we narrowly define as modern architecture. This process-based incremental growth has long defined vernacular architecture, sometimes with more rigour and sophistication than generic modern architectural designs where it has been only marginally evident.

The traditional Malay house *bumbung panjang* shows a sophisticated building and additive system. The simple roof of the *bumbung panjang* is very efficient for making additions to the house. The core house is the *rumah ibu*, which is extended when addition is needed. It satisfies the need of a small family and can be big or small, depending on the family. If the family expands or resources become available a *rumah ibu* can convert to a kitchen, in which case a bigger *rumah ibu* is constructed.

Additive elements can be attached to the main block with only a distinction in roof level as in the *Serambi Gantung* or *Gajah Menyusu* addition, or they can be added with a transitional element such as *selang*[9] in the middle. Addition by a common court is also possible. Addition can happen sidewise or parallel, along the long axis or the short axis of the main structure (Yuan 1987, p 121). The Malay house achieves maximum utilisation and minimum use of resources by adoption of such incremental housing solutions. The house is not a final product but changes and grows with the inhabitants.

The connection of building modules by means of a terrace as the family expands is also found in a *Bon Thai* house. Marc Askew notes, 'This modular house form and its adaptability is also present in Thai –Yuan (northern Thai) and southern Thai houses, despite differences in design details.'(Knapp 2003, p 263) [10] When a traditional Japanese house needs to be larger, expansion takes place in two directions. The long section can be extended as in Malay house by simple addition of structural bay. A lean-to roof along the outer edge of the main roof is usually attached to the short section, if addition is needed in narrower direction. Lean-to roofs (*hisashi*) are commonly used devices for expansion to take place in a Japanese house. While in traditional Japanese types the main and extended roof are distinctly clear, in later models these are indistinguishable as the lean-to roof becomes integrated with the whole extended-roof structure (Knapp 2003). [11]

This additive quality can also be seen in traditional Chinese houses. The smallest Chinese dwelling is composed of a single *jian* (bay), which is a multi use space accommodating living, cooking, sleeping and other activities. Space has expandable qualities. Addition takes place by adding pairs of parallel columns and extending the overhead roof purlins (Knapp 1989, pp 34-35). In a typical rural Bangali house additional rooms are arranged perpendicularly to the axis of the core rectangle (as in a courtyard dwelling in northern China), thus forming a court.

The Mru dwelling also shows sophisticated additive property. The *kimma* is the core house, which expands as a basic family's needs changes. Connection of additional module such as *kim-tom* can happen with only a distinction in roof level. More modules can be added to the verandah or *machan*, similar to the Malay house, if more additional space is needed. However each extension takes place under a separate roof and the long axis of the additive blocks are always parallel to the main axis of the core house – the *kimma*.

Figure 7: Incremental dwelling: different addition possibilities in a Malay house. Addition by lean-to-roof block, addition by selang and expansion by adding similar but smaller bumbung panjang house form can be noted in the picture sequences. Yuan, The Malay house, p 120.
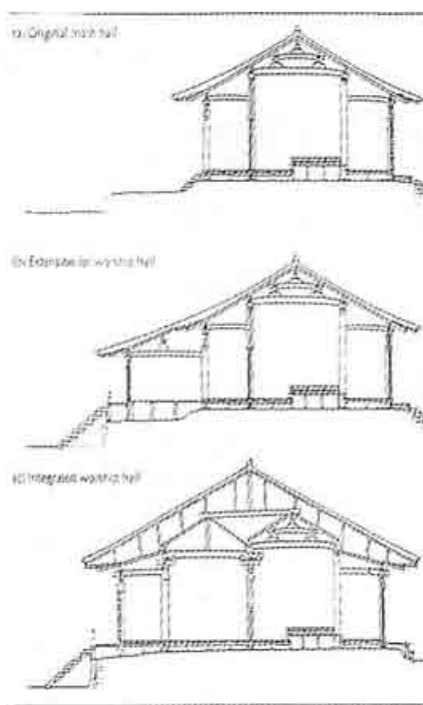
Figure 8: Process of interior space expansion by hisashi in a Japanese structure. The sequences show how the interior space was expanded while the structure of the principal hall remained in its original condition. Knapp, Asia's old dwellings, p 299.

Spatial division: flexibility and multiplicity of fluid space

The traditional built environment evolved by indigenous groups greatly stresses the need to study the use of spaces, for which one needs to take into account human factors, lifestyles, cultural, social and environmental constraints. Because of cultural incongruity between 'insiders' and 'outsiders', this often turns out to be the most difficult part of observation. Indeed data on physical aspects of design can be gained more easily and accurately than use of spaces although without understanding the space, any study on architecture is limited (Yagi 1980, p 15).

One reason for looking into the culture when analysing architecture is because 'use of space is culturally determined ... it's a construct, not 'given'.' (Crouch 2001, p 259) As observed in a Japanese *minka*, 'transforming space from one function to the other in a daily cycle is a norm, supported by the fact that all necessary furniture is portable and easily stored away whenever the functions of the space change'.(Knapp 2003)[12] In a *bahay kubo*, Augusto Villalon notes, 'when night comes a sleeping mat is rolled out and the floor becomes a bed.' Space changes function as the day goes on.[13]

While describing a Malay house, Yuan explains 'Non-specialization of the use of space means that the same space is used for many different purposes at different times of the day and year. A living area can be used for sleeping at night.' (Yuan 1987, p 87) Numerous examples can be cited by studying elements of space in South-East Asian traditional societies which reveal that unlike Western houses which are predominantly designed according to the space allocation of individual and specific functional needs, a traditional space is made to manage time in order to meet different functions (Hall 1969, p 104). Multiple functions of space are intrinsic and it would be only a partial picture of a house if we associate a space to a single aspect of its multitudinous use.[14]

Possibilities of interchangeable use and the meaning of space are also observed in a Southern Chinese house. Ruan observes such flexible use of spaces and stresses that such implication is less about 'fixed distinctions between different spaces'. In a Dong house there is no distinction between bedroom and storage. Ruan describes the bedroom of a Dong house as 'left behind spaces'. In contrast to the bedroom in the Western sense he finds these spaces 'marginal spaces', 'edge spaces that are neither independent nor definite'.[15]
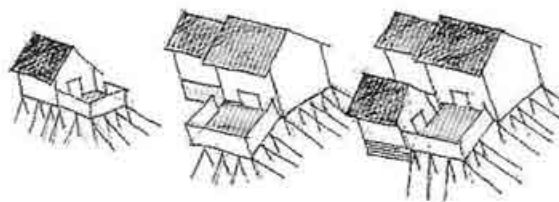
Figure 8: Process of interior space expansion by hisashi in a Japanese structure. The sequences show how the interior space was expanded while the structure of the principal hall remained in its original condition. Knapp, Asia's old dwellings, p 299.
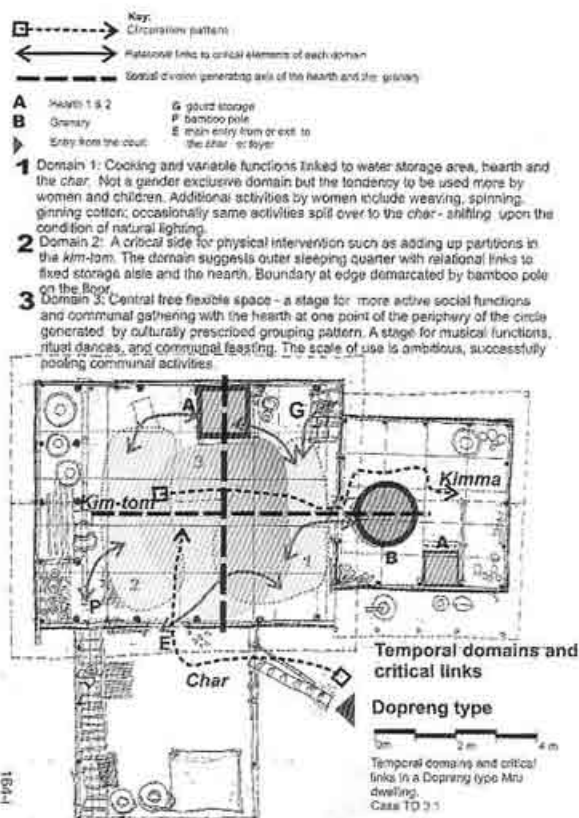

Figure 10: Fluid Space - space plays a more dynamic role inside a Mru dwelling - it changes function during different period. Sketch Ara 2006.

Similar observation can be made in a Mru house in the CHT. A *kim-tom* in a Mru dwelling is too limited in its scope to be named as a 'living room'. Löffler's initial observation on the *kim-tom* which he sees as a 'kind of a living room' becomes obscure as he adds on a list of multiple activities carried out in the same space, he elaborates, '...people cook and eat, receive visitors, and accommodate guests. Children and unmarried members of the family also sleep in the *kim-tom*.' (Löffler 1990, p 66) The point that Löffler misses is the interpretation of the dynamic role that space plays in such a dwelling. In such a dwelling space transforms one function to another when the arrangement of the equipment is changed. As detailed observation reveals, daily routine, seasonal habit and special occasions all may induce such changes. A continuing stimulus for altering the spatial configuration of the dwelling is generated by life-cycle and role changes. Inhabitants move from one space to another during different stages of life. When a Mru is married and becomes head of the household he moves to the *kimma*, older parents move to the *kim-tom*.

This change of space allocation during life-cycle change is not something unique to the Mru community. A *Minangkabau* house, as observed by Cecilia Ng, is built as women's domain. Space is allocated according to different roles; women move from sleeping near the central post into the *anjuang* when they marry and then through separate apartments until they end their reproductive life and come to sleep in the *pangkalan* on the opposite side of the central post (Fox 1993, p 21). The dominant use of certain space is also flexible in a Mru dwelling as in many other traditional dwellings; in the winter the *machan* [16] becomes more active as activity shifts towards the outside whereas in the rainy season the active role of the same space ceases. Hence space is often ambiguous and heterogeneous in such layouts.

Perception of boundary

The use of architectural elements to create bounded and organized spaces is not a universal scheme (Waterson 1990, p 91). In Japanese traditional houses the spatial conception of wall differs markedly from Western architecture where it is more dominant. In the absence of heavy walls territorial claims are made through various symbolic expressions, such as by varying heights and differences in the materials used to finish a floor. Delimitation of space takes place by varying ceiling heights, changes in material finishes, placement of columns and beams and even by a mat. In such architecture 'boundaries are created implied through a traditional code system and without the need to be defined by the explicit physical presence of wall'. [17]

Such definition of space enclosed not by physical bound-

Two tiered storage racks above the hearth

Pressed clay wall

Cane frame behind clay layer

Pressed clay floor
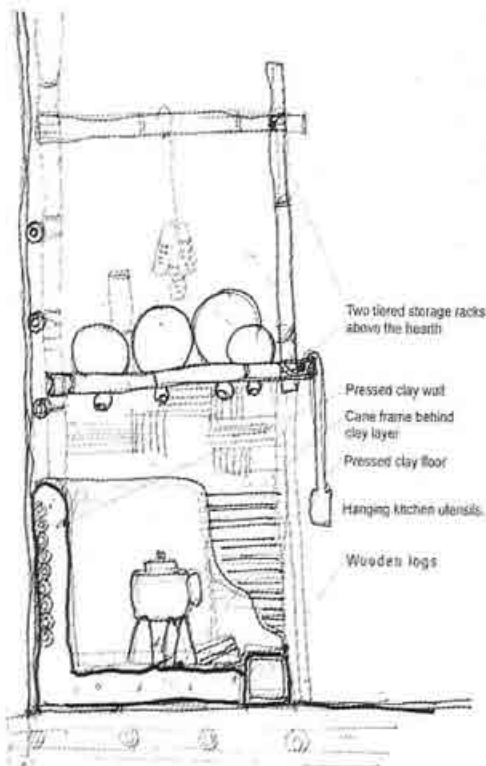
Hanging kitchen utensils

Wooden logs

Figure 11: the hearth is built integrally with the main construction. it is geometrically defined by a rectangular volume, punctured by suspended planes arranged in two levels with the squarish bracketed frame and the stove, on the floor. Bandarban 2003; sketch: authors.

Figure 12: A bamboo headrest demarcates a sleeping space in the kim-tom. Bandarban 2003; photo: author.

aries such as walls, but by mere 'suggestion' is not something unique to the South-East Asian traditional architecture. While documenting the Nuna villages - a traditional village in Africa, a similar observation is made by Bourdier. The uncovered cooking areas are set up in the open space, as Bourdier notes, 'they are not clearly defined by walls, but simply suggested through a zone of packed earth'. (Bourdier 1985, p 57)

In the West walls create individual rooms for the personal privacy of individual family members, but privacy in this sense does not exist in a traditional Japanese house. Instead individual space is suggested by a code that all family members respect and obey. Life within a *minka* takes place in one large space under one expansive roof that was shared by members of the family, with at the same time the possibility of seclusion via occasional and temporary compartmentalization of the greater space in order to serve different daily needs. [17]

In a single room, within a *bahay kubo* privacy is a function of eye contact: One "disappears" or becomes "no longer present" by simply looking away.[18] When one is within the space but outside eye contact, one is within a private space. As Waterson cautions the concept of privacy can prove to be completely different in many South East Asian societies. The Western lens can be fatal when reading into such concept, which is very much rooted in the social and cultural conventions of the dwellers (Waterson 1990, p 170). In many of these societies physical walls are non-existent simply because there is no need to have a wall, as social conventions quite adequately construct a non-physical wall through which privacy is retained.

Conclusion

Vernacular architecture is elusive and difficult to define. It is demonstrated in this paper that any boundary between tradition and modernity is fluid and complex. Part of this 'gray-boundary' definition is a result of the fact that tradition is not, and never was, a static concept, rather it is a perfected practice, which is always contested, transformed, invented, and finally progressed over time. Perhaps approaching tradition in this light would help us to redefine vernacular architecture - highlighting 'similarities' rather than 'differences' - from modern architecture. Starting from here, this paper demonstrates that the architecture of non-institutionalised simple communities (where designer, builder and user is the same) requires alternative avenues of enquiries, however alternatives do not necessarily suggest contrasting themes to contemporary approaches – it merely stresses a problem approach, without pre-assumption of architectural terms and issues. In contrast to the generic assumption, the concept and definition of 'space' and 'structure' is often found to be dynamic and temporal in regional architecture (such as

that of the architecture of the CHT). Rudofsky's observation that what we call 'audacious 'primitive' solutions often anticipate our cumbersome technology' (Rudofsky 1972), calls for a fresh viewpoint where tradition can't be highlighted as an antonym for modernity. This paper brings to light that there are many features in vernacular built environment, which are essentially 'modern' (such as concepts and practices towards minimalist designs, modular architecture, tactile and temporal/fluid architecture etc). Indeed many of the defining criteria for modernist designs (e.g. Le-Corbusier's 'five points of architecture')[19], which are considered as radical breaks by some, reveal by a closer investigation that such factors often rest on inspiration from much older vernacular forms where social, cultural, spatial and physical and technological logic and aesthetics of dwellings frequently fuse into one complex definition.

Notes:

1 Bourdier reiterates: The concept of tradition cannot be merely opposed to that of modernization without falling prey to the pitfalls of binary dualist thinking. See Bourdier and Minh-ha, 'foreword' in *Drawn from African dwellings*.
2 Le Corbusier on Domino cited in Broadbent, *Design in architecture; architecture and the human sciences*, p 47.
3 From an ethno-linguistic point of view Chittagong hill tracts (CHT) is the most complex region of Bangladesh. Eleven indigenous ethnic groups, collectively known as the *jhumias* live in the CHT area. The present paper focuses on the architecture of the Mru (the largest of the smaller ethnic groups). The findings are based on a primary fieldwork (2002-2003) carried out in the Bandarban region of the Chittagong Hill Tracts, where architecture of the Mru is predominant.
4 For location of *kimma, kim-tom* see figure 10.
5 It is more common in Indonesia to find traditional stilt houses resting on flat foundation stones. In Malaysia also stilts rest on a base.
6 In South-East Asia, builders in some areas, mainly North and South Nias use diagonal posts as well as vertical ones. The V shaped floor supports resist seismic activity and offer greater support to the structure, especially when the weight of the heavy roof is a factor. Here also non-load bearing bamboo panels act as screens to enclose the interior living space.
7 Several earthquakes have been recorded since 1762. As the region falls within the cyclonic belt of the Bay of Bengal cyclonic storms are also frequent.
8 On similar logic of construction see Knapp, *The Chinese house*, p 41.
9 *Selang* is a covered walkway. The two blocks remain distinct in roof line with a slightly lower roof of the *selang*.
10 Askew, *"Ban Thai": House and Culture in a transform-*

ing society', in Knapp, *Asia's old dwellings: tradition, resilience, and change*, p 263.
11 Naonori, 'Japan's Traditional Houses', in Knapp, *Asia's old dwellings: tradition, resilience, and change*, p 298.
12 Naonori, 'Japan's Traditional Houses', p 312.
13 Villalon, 'The Evolution of the Philippine Traditional House', in Knapp, *Asia's old dwellings*, p 215.
14 Many contemporary architects now opt for 'mobile spaces' in their design – on tight sites designs call for compact layouts where multiple functions can be carried out in one space with movable partitions and panels.
15 Ruan, 'Pile-Built Dwellings in Ethnic Southern China', in Knapp, *Asia's old dwellings*, p 365.
16 The elevated open floor which is extensively used for drying and washing and for other domestic   purposes. This is written as *tsar* in Löffler's book.
17 Naonori, 'Japan's Traditional Houses', p 307 & p 310.
18 Villalon, 'The Evolution of the Philippine Traditional House', p 208.
19 E.g. his fascination for 'piloti' can be linked to the uncovering of lake dwellings on the lake of Zurich roughly around the middle of the nineteenth century.

References :

Ara, Dilshad R, 2006, 'The architecture of the hill people Mru: the stilt dwellings of the Chittagong Hill Tracts', PhD, University of Melbourne.

Broadbent, G, 1973, Design *in architecture; architecture and the human sciences*, London, p 47.

Bourdier, J-P, and T T Minh-ha, 1985, *African spaces: designs for living in Upper Volta*, New York.

Crouch, D P, & J G Johnson, 2001, *Traditions in Architecture: Africa, America, Asia, and Oceania*, New York.

Dawson, Barry, & John Gillow, 1994, *The traditional architecture of Indonesia*, London.

Fox, J J [ed], 1993, *Inside Austronesian Houses: Perspectives on Domestic Architecture*, Canberra.

Fromonot, F.O, 2003, *Glenn Murcutt: buildings + projects 1962-2003*, London.

Graves, M, 1981, *Le Corbusier: selected drawings*, New York.

Hall, E T, 1969, *The hidden dimension; man's use of space in public and private*, London.

Hinte, Ed van etal, 2003, *Smart Architecture*, Rotterdam,

Hutchinson, R H S, 1906, *An account of the Chittagong Hill Tracts*, Calcutta.

Ishaq, Muhammad [ed], 1971, *Chittagong Hill-Tracts* [Bangladesh District Gazetteers], Dacca [Dhaka].

Knapp, R G, 2003, *Asia's old dwellings: tradition, resilience, and change*, New York.

Knapp, R G, 1990, *The Chinese house: craft, symbol, and*

the folk tradition, New York.

Knapp, R G, 2000, China's old dwellings, Honolulu.

Knapp, R G, 1989, China's vernacular architecture: house form and culture, Honolulu.

Lewin, T H, 1869, The Hill Tracts of Chittagong and the dwellers therein; with comparative vocabularies of the hill dialects, Calcutta.

Löffler, L G, & C-D Brauns, 1990, Mru: Hill People on the Border of Bangladesh, Boston [1986].

Menin, Sarah and Flora Samuel, 2002, Nature and space: Aalto and Le Corbusier, New York.

Oliver, Paul, 2003,Dwellings: the vernacular house world wide, London.

Rudofsky, Bernard, 1972, Architecture without architects: a short introduction to non-pedigreed architecture, London.

Tzonis, Alexander, 2001, Le Corbusier: the poetics of machine and metaphor, London.

Tzonis, A., L. Lefaivre & B. Stagno, 2001, Tropical archi-tecture: critical regionalism in the age of globalization, New York.

Waterson, Roxana, 1990, The living house: an anthropol-ogy of architecture in South-East Asia, Singapore.

Yuan, L J, 1987, The Malay house: rediscovering Malaysia's indigenous shelter system, Pinang.

Yagi, Koji [ed], 1980, Indigenous settlements in southwest Asia [Process Architecture 15], Tokyo.