Revisiting Homes: The role of customs and practices during epidemics, Nagpur, India

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Abstract

The WHO officially declared the COVID-19 outbreak a pandemic on March 11. After the outbreak, people initiated immense alterations in their lives. People have started rethinking their health and fitness. Homes became places of work, personal health centres, gyms, places of entertainment etc. Within weeks of the lockdown, a new schedule was set for the family. Pandemic taught us new lessons in its own way. WHO recommended guidelines to protect from the infection, which, over the period, will become the way of life of most people.

In the past, a number of pandemics of fatal diseases have taken place. The outbreak of such diseases in the past may have empowered and transformed the ways of living. These hygiene practices got adopted into daily routine and rituals. The hygiene practices acted as defensive measures to fight the successive epidemics. The role played by the ways of living, hygiene, food habits, and rituals in the past to deal with epidemics can provide insights to cope with the current circumstances. Did the customary practices support the families to control the spread of the diseases?

Thus, the present paper analyses the spatial configuration of vernacular houses of central India through the lenses of health and hygiene. The study focuses on understanding hygiene practices, food habits as socio-cultural attributes using the 'historical interpretative method'. The paper draws conclusions on the role of the significance of spatial configuration of domestic spaces to adapt to the standard protocols particularly home quarantine using the Space Syntax Method.

Keywords: Space Syntax Method, Wada, Rituals, Epidemics.

Introduction

COVID 19 pandemic has introduced to us certain ways to combat and curtail the transmission of the dreadful virus. The World Health Organization (WHO) has recommended protocols like social distancing, wearing a mask, frequently washing hands, and staying home, to keep the disease at bay. People have accepted and termed these as the new normal. According to WHO, even after vaccination, we may have to continue to follow the standard operating procedure (SOP), which over a period may become part of our lifestyle.

There has been a spread of contagious diseases in the past when 'The Epidemic Disease Act 1897' was enforced, in Indian cities like Chandigarh in 2015 to control the spread of Dengue and Malaria and in Surat in 2018 for the spread of Cholera (Rajesh, 2016; Chandra, 2014). However, the year 2020 when 'The Epidemic Disease Act 1897' was enforced has been unusual, as the virus was superlatively contagious. This was the first major pandemic witnessed

by the modern Indian society. The houses were transformed into places of work, entertainment, healthcare, and quarantine. The designers and architects began to look at homes with a fresh perspective. Architects tried to understand the way viruses are transmitted which led to a new design paradigm.

India has witnessed devastating pandemics before; one of the major being the Bombay plaque (1896-1939), a bubonic vector spread disease that claimed 12 million lives. Another deadly and highly contagious disease that had spread in India was Smallpox, caused by variola-virus, transmitted through inhalation of oral and nasal droplets of an infected person. In 1849, Smallpox claimed nearly 13% of all Calcutta deaths. Between 1868 and 1907, there were approximately 4.7 million deaths from smallpox in India. Between 1926 and 1930, there were 979,738 cases of smallpox with a mortality rate of 42.3%. Another pandemic, the influenza flu, was witnessed in India in 1918. During the breakout of the influenza flu, the British government was reluctant to enforce any compulsory measures on the Indian public. The patients were treated at home and social distancing was the only way to control the spread. (Acharjee, 2020; Menon, 2020)

It is worthwhile to study the way houses of the 19th and early 20th century accommodated the protocols required to curtail the spread of communicable diseases. The paper focuses on the traditional houses (*Wadas)* of central India inhabited by Maharashtrian families, to understand the way spatial configuration, traditional customs and practices were aligned to fight back the epidemics.

Theoretical background

The history of pandemics reveals that cities have always been worse affected than their hinterlands. Human beings across the world are not much different when it comes to dealing with pandemics; fear, panic, acceptance, governance and rapid action have been the sequence to fight any outbreak. However, often, the high population densities and shared infrastructure are some of the reasons for the spread of the viruses. Isolation, social distancing, quarantine, and hygiene have remained the common modes to control the situation (GAHTC 2020). According to Lawrence (1987), since 1840, in countries like France, United Kingdom, and Switzerland, it became increasingly common to interpret housing and health as a unified social issue. He points out that a correlation had been established between health and housing conditions. It was realized that the urban population is more susceptible to infections than people residing in the countryside (Lawrence, 1987). According to Knudsen & Seidlein (2014), the life cycles of pathogens that cause the spread of diseases, largely occur in and around the domestic spaces. Thus, there exists a strong inter-relationship between domesticity and epidemics.

Many varieties of organisms existing in the environment that cause infections and illnesses are called pathogens. When these pathogens transmit from one body into another body, they are considered as infectious agents. This is the cause of communicable diseases. According to Centre for Disease Control and Prevention (US), and the WHO manual (2018), the transmission of pathogens occurs in two ways. First is ‘direct contact’ that takes place through touch or droplets. Second is ‘indirect contact’ that occurs as airborne, vehicle-borne and vector-borne (mechanical or biologic). The diseases transmitting through ‘direct contact ‘can be successfully controlled through ‘isolation’ of the infected person or animal. The airborne diseases transmitting through ‘indirect contact’ can be controlled through modification of ventilation, filtering and treating the air. The vehicle-borne diseases are commonly transmitted through food and water. Thus, the spread of vehicle-borne diseases can be controlled by food and water handling hygiene. The vector-borne infections spread due to blood-feeding anthropods; most common being mosquitoes. The vector-borne diseases can be controlled by keeping the environment clean and dry, and by spraying repellents.

The history of contagious diseases in India during the 18th and 19th centuries shows that the outbreak of smallpox, typhus, yellow fever, cholera, plague and flu (Bombay fever) had affected a large population of the country. Amongst the contagious diseases, Cholera, Smallpox, Plague, Malaria and Influenza (Bombay Flu) outbreak were declared as epidemics. These diseases had different modes of transmissions and accordingly, the preventive measures were declared (Tumbe, 2020). The measures to break the chain of the spread of infectious diseases are to isolate the infected person, washing hands, avoiding contamination of food and water, and maintaining clean and dry spaces. (Refer Table 1)

Table 1: Epidemics in India
Source: Author

No.	Epidemic Disease	Year of outbreak	Disease Type	Transmission	Preventive measures
1	Cholera	1817	Vehicle-borne, bacterial	Water and food	Food and Water hygiene, Washing hands
2	Smallpox	1849	Virus	Touch	Isolation of infected person
3	Plague	1894	Vector-borne, bacterial	Bite of infected flea	Flea control sprays, clean and dry spaces, isolation
4	Malaria	1909	Vector-borne, bacterial	Bite of mosquito	Use of repellant sprays, use of nets, clean and dry spaces
5	Influenza	1918	Virus	Touch and droplets	Isolation of infected person, social distancing

According to the epidemiologist Deodhar (2003), domestic and personal hygiene creates barriers against infectious diseases. The Ayurveda theory of causation of disease has long been recognized in India through the ancient scriptures. Deodhar (2003) mentions that hygiene is largely a matter of human behaviour, which is determined by social traditions, customs and culture. Thus, it is important to formulate a research framework to decode the concept of hygiene as a socio-cultural attribute.

The existing data related to the customary practices of 18th and 19th centuries associated with health and hygiene in Maharashtrian families of Nagpur region is insufficient. The medical records and data on epidemics in Nagpur are also insufficient. According to a local newspaper (Lokhande, 2020), a firsthand written account of the plague situation in the city by Dr Agnes Henderson, a missionary doctor, is available at the Cambridge archive. The record mentions the 'rapid rise' of infected patients in January 1903 and mortality was highest in March 1903. The second wave of plague in the city was recorded in October 1903 and lasted until March 1904 (Lokhande, 2020).

The city has also witnessed the epidemic of Smallpox between 1868 and 1907, which is evident from the temple of *Sitalamata (*anthropogenic personification of smallpox). The historic residential core of Nagpur has four *Sitalamatamandir*. The occurrence of contagious diseases in the city during the 19th century can be confirmed by a religious ritual called *'athavi chi pooja'* performed by the Maharashtrian families. This ritual is performed by mothers to protect their children from contagious diseases.

The study of the traditional houses through the prism of health and hygiene during the outbreak of epidemics is twofold. First, it identifies and investigates the practices associated with hygiene. Second, it investigates the flexibility and distribution of different domestic activities to respond as measures during the epidemics. It is important to decode hygiene as a socio-cultural attribute. According to Rapoport (1969), and Lawrence (1987), socio-cultural

attribute is manifested into daily life of people. Daily routine, the way guests are received, patterns of cooking and eating, and rituals provide clues to understand specific cultural contexts. Analyses of everyday domestic activities provide insights into latent function which vary from culture to culture and from time to time (Rapoport,2008).

Research Methodology

The research is carried out in two parts. The part 1 focuses on rituals and routine activities related to hygiene. It was imperative to study the way families lived in the past. Thus, the paper employs the 'historical interpretative method'. The method works on gathering data using interviews and archeological sources (Groat & Wang, 2002). A questionnaire is designed to conduct the interview schedule of two historians from Nagpur and the eldest family member of the selected *Wadas*.

1. Routine activities of men and women of the family (children as a separate entity of the family is not addressed in the design of the questionnaire, as the focus was to understand the daily routine vis-à-vis hygiene. Thus the children are assumed to follow the hygiene practices as the elders of the family).
2. Entertaining of guests and visitors.
3. Pattern of cooking and eating.
4. Notion of sacred and profane and its spatial manifestation.

The part-II investigates the spatial configuration to understand the way houses would have accommodated the protocols during the spread of the diseases. One of the common protocols to break the chain of the disease is isolation of the infected member of the family. Hence, the study focuses on identifying the following:

1. The most segregated and the most integrated space; identifying the activities associated with the space.
2. Whether the selected houses have a flexible configuration to address the conventions of home quarantine.
3. The spatial configurations with regard to the choice of movement and the extent of spatial variety in the houses.
4. The role of transition spaces in demarcating the domains within the house vis-à-vis seclusion of spaces.

The paper focuses on specific properties of the spatial configuration like connectivity of spaces, movement choices, configurational flexibility, and segregation of spaces. The use of the architectural floor plans to analyze the above parameters may pose certain limitations. Firstly, the architectural plan depicts the arrangement of spaces on a single floor. Instead, a simplified graphical representation is needed to highlight the inter-relationship of all spaces within the system. Secondly, the scale of selected traditional houses in terms of built-up area and number of rooms largely differ from each other. To enable the spatial comparison of houses, the study is conducted using the 'Space Syntax Method'.

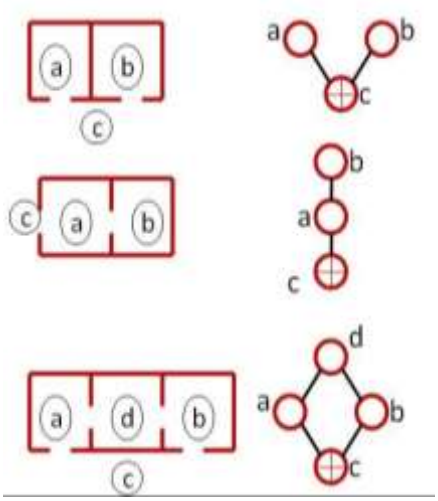


Fig. 1a: Concept of Space Syntax Method (Branch, Linear and Ring)
Source: Hillier, B (1987)

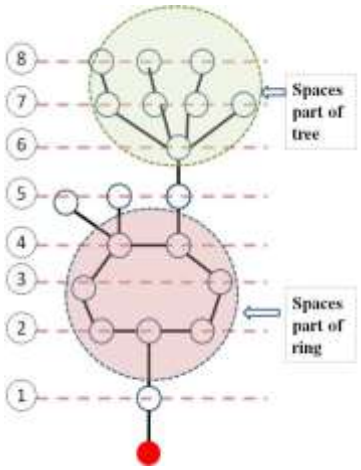


Fig. 1b: Concept of Ring
Source: Author

The Space Syntax Method is developed by Hillier and Hanson (1984). It advocates many measures which record relationships between spaces in a building. The relation of one space with reference to all other spaces within the system is termed as configuration. It is based on measurement to distinguish between different topological relationships of spaces. The mathematical notation enables to study the space logic (Lawson, 2001;Hanson & Hillier, 1967; Hanson 1998) (Fig- 1a)

The syntactic analysis using Space Syntax Method focuses on the role of transition spaces within the configuration 'Activity-Transition Ratio'. The selected traditional houses have rooms with multiple linkages–'Space-Link Ratio' and also have series of rooms which are interconnected thus formations of set of rings-'Study of Rings' (Fig- 1b). Space syntax method enables to calculate the integration values of each space to identify the most integrated and the most segregated space within the system. The mean integration value of houses is comparable with each other. The integration value of a space expresses the relative depth of that space from all others in the graph. The formula to calculate integration is:

integration value = $2(d-1)/k-2$

d- mean depth

k- total number of space in graph

Introduction to study area

Nagpur is the second capital of Maharashtra. During the British rule, Nagpur was the capital of Central Provinces & Berar. The city has a history of more than 300 years. Nagpur was part of the Gondwana dynasty (1550 A.D. to 1745 A.D.), was later conquered by the Marathas and was ruled by Raghujiraje Bhonsle. Developed during the Bhonsle period, the residential neighbourhoods followed the Maratha planning principles. Defense and security were prime aspects addressed while planning the town and the domestic spaces (Girhe, 2004). Neighbourhoods in the past had a homogenous character to form well-defined territories. Families of the same occupation, caste and class formed a neighbourhood, which was termed as '*veetal*'. (Mawale, 2000; Dongre, 1999; Kotharkar&Deshpande, 2012)

The traditional house-form of Nagpur region is called as '*Wada'*. The *Wadas* are referred by the family name. All the *Wadas* are located within dense residential neighbourhoods. The houses are enclosed within a high compound wall with multiple entrances (Fig- 3). Houses have courtyard/courtyards. Plan-form of 'Wada' had a definite spatial hierarchy-whether physical or sensory, demarcated by a series of thresholds. The thick walls

acted as boundaries between various realms of the house, permitting spatial porosity only within demarcated domains' (Gupta 2013).

Syntactic analysis of 10 *Wadas of* Nagpur region was carried out. The study sample consists of six *Wadas of* Nagpur, one *Wada* of Pauni (Bhandara district) and two *Wadas* of Dharti, Wardha district. Nine *Wada*s were visited for photographic documentation and measured drawings. One *Wada* (*Ahirrao-Wada*) had been demolished; its detail measured drawings were procured from Girhe (2004) and included in the study as Fig. 2 and Fig. 3. (Refer Table 2)

Fig. 2: Nagpur, Wardha and Bhandara Districts showing location of selected *Wadas*
Source: Retrieved from *http://asinagpurcircle.in/wp-content/*


Itkelwar Wada


Chitnavis Wada


Salpekar Wada


Captan Wada


Deshpande Wada

Deshmukh Wada

Fig. 3: Neighbourhood Setting of *Wadas*
Source: Author

Table 2: Introduction of selected *Wadas*
Source: Author

W. No	*Wada* Name	Location	Area (Appox.)	Scale of *Wada*	Remarks
1	Deshpande	Mahal, Nagpur	340.4	One *Chawk*	*Baithak,*, staircase located in sleeping area
2	Ahirrao	Mahal, Nagpur	1360.3	One *Chawk*	*Rangamahal*for dance performances. This *Wada* is Demolished
3	Gaikwad	Gaikwadwada, Baraswada, Wardha	1638.8	One *Chawk*	Temple within the complex, cattle shed and storage for agriculture equipment/produce
4	*Chitnavis*	Mahal, Nagpur	1113.8	Three *Chawk*	Temple within the complex, *Baithak*, Office space (*kacheri)*
5	Deshmukh	Mahal, Nagpur	677.78	One *Chawk*	*Baithak* and Music rooms

6	Itkelwar	Mahal, Nagpur	650.40	One *Chawk*	*Ganesh pooja and procession* on a large scale
7	Captan	Mahal, Nagpur	646.39	One *Chawk*	*Baithak, Ganesh* Temple
8	Mahajan	Dharti, Wardha	508.43	One *Chawk*	Cattle shed
9	Gadge	Pauni, Bhandara	464.70	One *Chawk*	Temple, *Samadhi* within the *Wada.* Cattle shed
10	Salpekar	Mahal, Nagpur	476.47	One *Chawk*	Temple and *Samadhi*

To facilitate comparison of *Wada*s with each other, seven household activities are identified, namely, entertaining guests, cooking, eating, sleeping, worshipping, cleaning and miscellaneous. Apart from household activities, some *Wadas* had allied spaces. These spaces were offices (*kacheri)*, storage for weapons, agriculture products and/or cattle-shed. All non-domestic activities are grouped under 'miscellaneous activities' (Fig. 4)

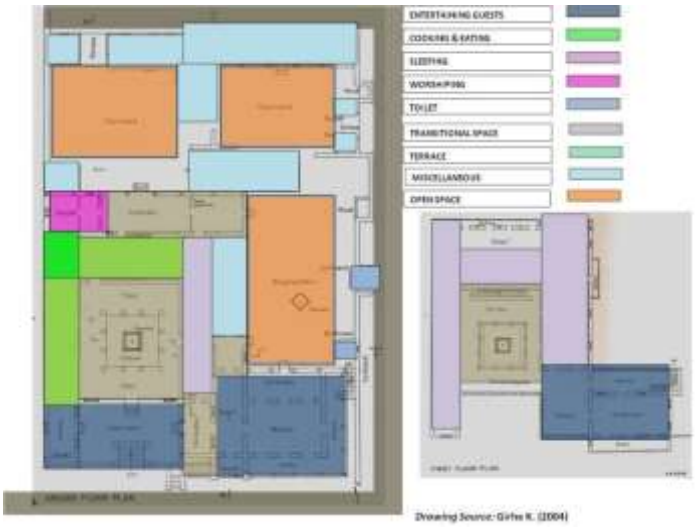


Fig. 4: Spatial Distribution of Activities (*Ahirrao Wada)*
Source: Deshpande & Kotharkar (2015)

Analysis of Part-1 (Pattern of Living)

Daily Routine

Wadas had joint families, sharing a kitchen. Men and women of the family had different daily routines, and used different spaces within the house. Men began their day with exercise, followed by bath, breakfast (*nihari*) and working in the office (*kacheri*- an office space within the *Wada*). Women's routine involved cleaning the house (sweeping and dusting). The floors of the house are periodically maintained using cow-dung. The cow-dung was acted as a disinfectant. The cleaning activity was followed by laying rangoli, bathing, *pooja* (religious rituals), and cooking. Serving food and cleaning the kitchen after each meal was done by the women. The women spent their afternoons in the central courtyard or in the semi-open space enclosing the courtyard.

Most *Wada*s had servant's quarters, with a separate access from the street. The *Wadas* had separate servants for cleaning toilets, gardening, cleaning utensils, feeding and cleaning livestock. Their movement pattern was strictly controlled (Fig. 5). Clothes were washed daily and sundried.

Fig. 5: Service courtyard (toilets, washing utensils, drying clothes) with separate entrance for servants
Source: Author

Cooking and Eating

The kitchen was a women's domain. It was located around the inner courtyard along with allied spaces like storage and serving areas. The kitchen was an auspicious space. The kitchen was accessed only after the bath and draping a special cloth termed as *sohala*. The space for cooking had provision for two to three *chulha* (stove) for cooking. The cooking activity was carried out on the floor (Fig. 6). The space for serving food was separate from the cooking area

A separate space for the storage of drinking water was provided. Water was filled in pots only after taking a bath. Women of the family served water in special containers called *phulpatra-loti*. This helped to avoid water contamination.

Daily food was served in *osari* (a semi-open space around the courtyard). Men and children were served first. The women did arranging of plates, serving of food and water. After every meal, the place was thoroughly cleaned. Women ate later, usually in the kitchen.

Fig. 6: Spaces for Cooking Activities
Source: Author

Rituals and Customs

One of the *chawks* of the houses had *tulsivrundavan* (basil plant). Rangoli was laid in this *chawk* and at the entrance gate. The lighting of evening oil-lamp, *dhoop & kapur* (camphor and incense) near the *vrundavan* was a daily ritual. This facilitated the illumination of the courtyard and to keep away mosquitoes (Fig. 7).

Fig. 7: View of Courtyards
Source: Author

The rituals associated with birth and deaths were strictly followed. With the birth of a child in the family, ten days of *riddhi* i.e. inauspicious days, were declared. Thus, there were no celebrations during this period of time. It was believed that the child and mother are susceptible to infection during this period.

Age old ritual of thirteen days of isolation (*suthuk)* was maintained by the family on the death of a family member. Family members avoided contacts with outsiders and the house was considered inauspicious by the community.

Sacred and Profane

House was considered sacred; feet were washed before entering the house. Footwear was restricted only to the entrance veranda. Kitchen was located away from the main entrance and inaccessible by outsiders. The spaces for activities; *pooja* and *cooking* were addressed as '*dev-ghar'*(*dev* means diety and *ghar* means house) and '*swapak-ghar'*(*swapak* means cooking and *ghar* means house), thus house within the house. All the other rooms are termed as *'kholi'* (room)

Guests and visitors to the house were received in the *dewankhana*. Family members or guests to the Wadas visiting from other cities had to take a bath before meeting other family members.

Separate space existed for women during their menstruation cycle. The Hindu concept of ritual pollution during menstruations was strongly practiced. Some *Wada*s had a room called '*ballantinichikholi'* to be used by the mother and her newborn child for forty days to maintain post-delivery hygiene.

Inferences of Pattern of Living

Table 3: Inferences of Part-1
Source: Author

No	Pattern of living		Hygiene Practices
1	Daily rituals	Daily bath before eating	-
		Daily cleaning of house	-
		Maintaining Cow-dung flooring	Protection from insects
		Cleaning kitchen after every meal	Disinfection of space
		Sun drying of washed clothes	Disinfection
2	Cooking & Eating	Accessing kitchen after bath , draping of *sohala*	Protect food contamination
		Storing drinking-water after bath	Protect water contamination

3	Rituals & Customs	Daily lighting of camphor and incense	Air purified
		10 days of isolation after a birth in family	Protection from infection
		13 days of isolation after a death in family	Protection from spreading of infection if any
4	Sacred and Profane	Washing hands and feet before entering the house	Protection from pathogens
		Restricted entry of guests into the kitchen	Protect food and drinking water contamination
		Visitors from outside the city to bath before meeting the family	Protection from pathogens

The study of daily routine reveals that there existed a gender based spatial separation. Most of the daytime was spent in open and semi-open spaces, which received ample sunlight and were well ventilated. These spaces may have acted as breathing spaces during the epidemics. The ritual of restricted and controlled entry of family members were imposed upon the kitchen and the water storage spaces to avoid contamination of water and food. Space for serving food in all the *Wadas* is detached from the cooking area. Food was served to the family, thus touching the utensils and contaminating it by an infected or sick family member was controlled. Food was served in the *osari* (semi-open corridor enclosing the courtyard). This space was well-ventilated and received ample natural light.

The ritual of secluding the family from the community for ten days after a birth and death in the family is one of the most relevant rituals to contain the spread of infection during an epidemic (Refer Table 3).

Analysis of Part-2 (Spatial Configuration)

Justified permeability graphs of *Wadas* are prepared using JASS software. The main entrance gate used by family and guests is considered as 'root' for preparing the graph. Circles represent spaces and lines joining circles are physical connections between the spaces. Spaces that share the same depth from the root represent the same number of architectural steps (depth) required to reach the said spaces. (Fig. 8)

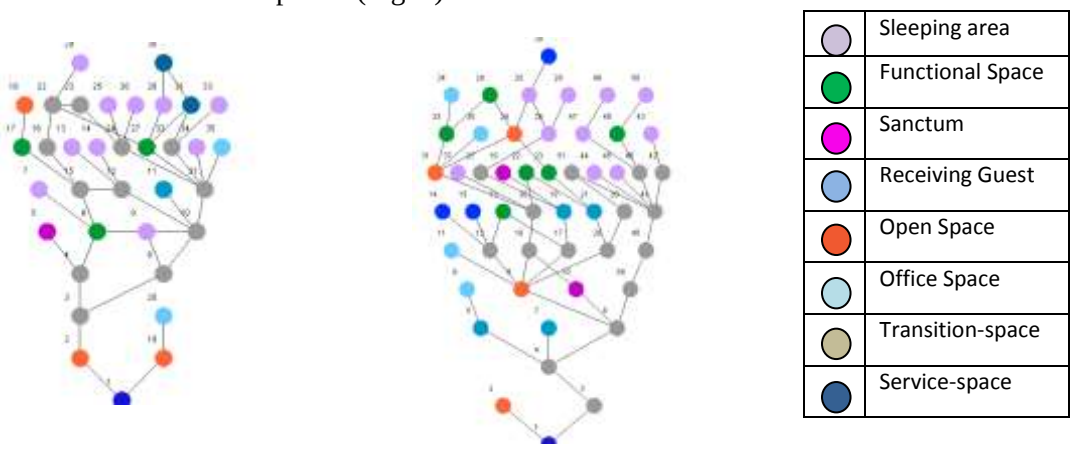


Fig. 8: Justified permeability graph of *Deshpande* and *Gaikwad Wada*
Source: Author

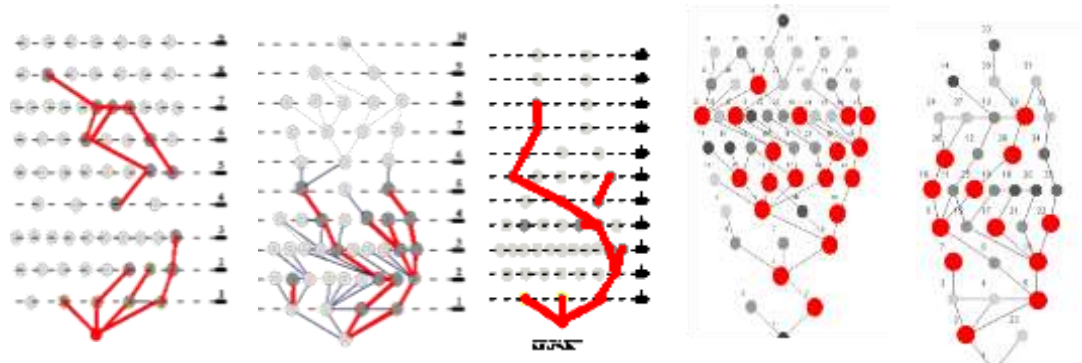
Activity- Transition Relationship

The domestic spaces within the *Wada* are divided into activity spaces and transition spaces. The mean percentage of transition spaces for the *Wada*s is 43 %. The highest percentage of transition space is 50% in *Wada* no. 1 and 9. High ratio of activity to transition space within the configuration creates a peculiar characteristic of *Wada* planning. (Refer Table-4)

Table 4: Activity-Transition Relationship
Source: Author

Wada No.	Wada Name	No. of Transition Spaces	No. of Activity Spaces	Activity-trans Ratio	Trans. spaces (%)
1	*Deshpande*	10	10	1.00	50
2	*Ahirrao*	15	22	1.46	41
3	*Gaikwad*	16	24	1.50	40
4	*Chitnavis*	17	26	1.52	40
5	*Deshmukh*	17	23	1.35	43
6	*Itkelwar*	12	18	1.50	40
7	*Captan*	14	22	1.57	39
8	*Mahajan*	14	18	1.28	44
9	*Gadge*	13	13	1.00	50
10	*Salpekar*	8	12	1.50	40
	MEAN			**1.37**	**43**

Courtyards are the common transition spaces in all the *Wada*s. They are located on the central axis of the house. The lowest percentage of transition spaces exists in *CaptanWada* i.e. 39% (Fig- 11).



Ahirrao Wada *Chintavis Wada* *Captan Wada* *Gaikwad Wada* *Gadge Wada*

Fig. 9: Distribution of Transition Spaces
Source: Author

A pattern exists within the configuration for location and use of transition spaces. These spaces defined the domains within the house. The transition spaces are linked to each other to form a series. The activity spaces branch out from the series of transition spaces. Transition spaces separate the set of allied activities from other activities. It retains the identity of each activity. The toilets are completely detached from the house and are accessed through an outdoor space. Sleeping areas are separated from the other activities by locating on the upper floors, accessed through a staircase. Figure 11 shows the way transition spaces are interconnected and also illustrate their distribution. (Fig. 9)

Space Link Ratio

The highest Space-Link Ratio (SRL) is observed in *Wada* no. 8 (0.907) and the lowest Space-Link Ratio is observed in *Wada* no. 2 (0.706). The mean Space Link Ratio (SLR) is 0.799. *Wada*s can be grouped into two categories; first, higher than the mean link ratio and the second category is the lower than mean link ratio. Out of 10 *Wada*s, 5 *Wada*s have a lower link ratio. Lower SLR provides a multiple movement choice, which forms the spatial characteristic of *Wadas.* (Refer Table-5)

Table 5: Space-Link Ratio in *Wadas*
Source: Author

Sh.No.	Family Name	Con. total	No of Links	SLR (Space Link Ratio) Spaces/(Links +1)
1	*Deshpande*	30	39	0.750
2	*Ahirrao*	48	67	0.706
3	*Bharas*	49	57	0.845
4	*Chitnavis*	68	82	0.819
5	*Deshmukh*	47	62	0.746
6	*Itkelwar*	34	41	0.810
7	*Captan*	47	63	0.734
8	*Mahajan*	39	42	0.907
9	*Gadge*	33	41	0.786
10	*Salpekar*	24	26	0.889
	Mean			**0.799**

Rings

The presence of sets of interconnected spaces in *Wada*s form rings within the configuration. The highest number of rings i.e. 20 are present in *Wada* no 2 (*AhirraoWada)* and *Wada* no 7 (*CaptanWada)*. The least numbers of rings are present in *Wada* no. 1, 8, 10 and they present the existence of interrelationships of a number of spaces within the ring. The number of rings and the number of spaces in a ring shows a constant relationship in all the *Wadas.* An increase in the number of rings increases the total number of spaces as part of the ring. (Refer Table 6)

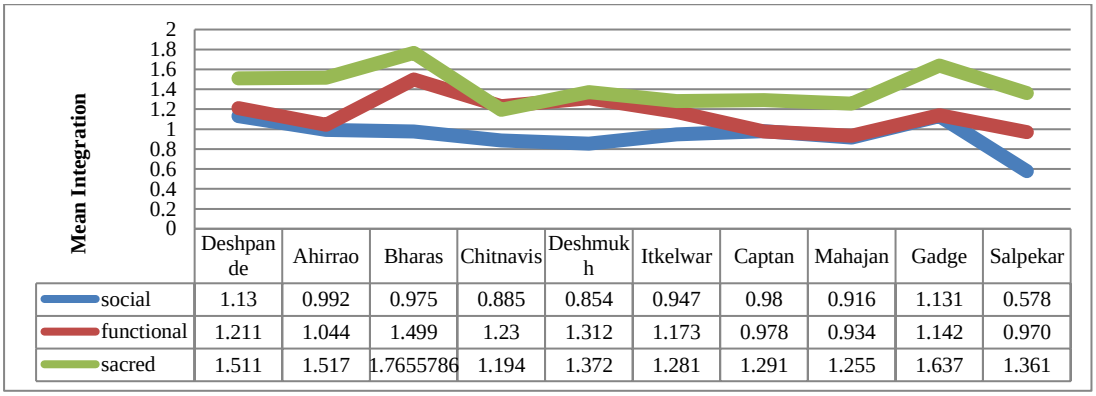
Table 6: Pattern of Rings in Wadas
Source: Author

Wada No.	Wada Name	Rings	Spaces in ring	Convex spaces	% of Spaces within Ring
1	*Deshpande*	4	16	30	53.3
2	*Ahirrao*	20	25	48	52.1
3	*Gaikwad*	6	14	49	28.6
4	*Chitnavis*	14	23	68	33.8
5	*Deshmukh*	15	25	47	53.2

6	*Itkelwar*	7	18	37	48.6
7	*Captan*	20	28	47	59.6
8	*Mahajan*	4	7	39	17.9
9	*Gadge*	12	27	33	81.8
10	*Salpekar*	4	8	24	33.3
	MEAN	**10.6**			**46.2**

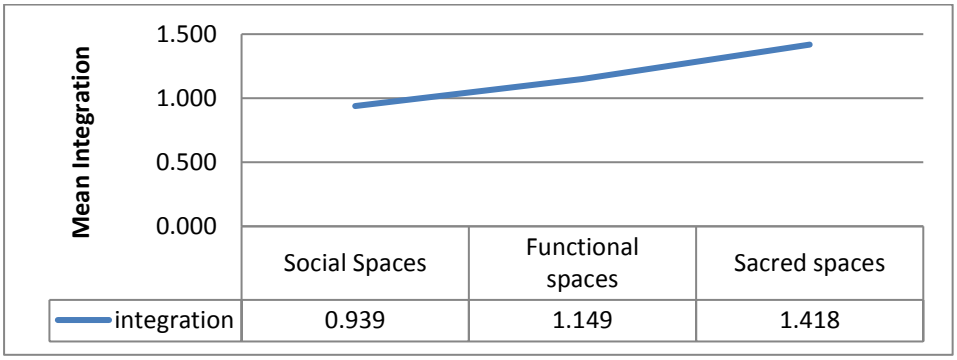
Integration value of Domains

The mean integration values of social, functional and sacred domains are 0.93, 1.14 and 1.41 respectively. Comparison of Integration value of three domains of the *Wada*s reveals a pattern (Fig.10 and Fig. 11)



	Deshpande	Ahirrao	Bharas	Chitnavis	Deshmukh	Itkelwar	Captan	Mahajan	Gadge	Salpekar
social	1.13	0.992	0.975	0.885	0.854	0.947	0.98	0.916	1.131	0.578
functional	1.211	1.044	1.499	1.23	1.312	1.173	0.978	0.934	1.142	0.970
sacred	1.511	1.517	1.7655786	1.194	1.372	1.281	1.291	1.255	1.637	1.361

Fig. 10: Integration Values of Domains of *Wada*
Source: Deshpande & Kotharkar, 2015



	Social Spaces	Functional spaces	Sacred spaces
integration	0.939	1.149	1.418

Fig. 11: Mean Integration Distribution of Domains
Source: Deshpande R & Kotharkar R, 2015

Independence of the size and number of spaces forming the domains in all the *Wadas*, shows that most integrated are the social domain followed by the functional domain. Most segregated is the sacred domain. The order of the mean integration is least for social spaces, followed by the value of functional spaces and highest were the sacred spaces (Fig. 10 and Fig.11).

Inferences of Spatial Analysis

Wadas are characterized as multi-linked spaces. This creates compactness within the system. Further to counter-balance compactness with the presence of series of transition spaces to separate and retain the identities of each activity. The number of transition spaces in the selected *Wadas* is as high as 50% to the total number of spaces within the houses.

The transition spaces are connected as a continuous chain. Thus, the movement within each set of activities is controlled by the transition spaces. Transition spaces are an interwoven set of open, semi-open and enclosed spaces, which act as the spine of the house. It contributes to the formation of domains with distinct boundaries. The pattern facilitates isolating a domain, instead of a single space to be isolated. The pattern of transition spaces positively contributes to control spaces and segregate different activities.

Traditional houses have a series of interconnected spaces (Mean Space-Link Ratio is 0.799) to form multiple movement patterns within the system. An array of movement choices creates the flexibility of spaces to be isolated. Thus, the houses can have multiple sets of isolated spaces.

The study of the integration value of domains provides clues to the pattern of living. Most integrated spaces are social spaces used by men of the house. The integration value of social spaces facilitates control of other spaces of the house. Next in order of integration are the functional spaces i.e. the eating and sleeping, which are used exclusively by the family members, and are accessed through the inner courtyard. The serving area and cooking areas are separate. Thus, syntactically, kitchen is the most segregated space in all the selected houses.

Conclusion

Major shortcomings identified of the houses are the shared toilets. The bathroom and water closet spaces are separate. Toilets are located in the backyard (for the practical purpose of services) and are shared by the entire family. An independent study is needed to understand the way the family coped the spread of infection due to common toilets.

According to part II; all the *Wadas* indicate similarities in the configurational properties. The distribution of integration values of domains display a pattern in all the *Wadas*. *Wadas* are thus a ‘genotype’ to fulfill the social, cultural and functional needs of families in the past. As the houses represent a higher degree of flexibility, they are spatially equipped to accommodate protocols during an epidemic. Isolation has been the most reliable measure to curtail the spread of direct or indirect transmissions. The configurational properties and the customary practices provide clues to the way a house hosted the changes as per the protocol required to curtail the spread of an infection.

The house as a sacred place expresses the inherent ritual of excluding the negative and unwanted outside, thus, substantiating the mundane activity of removing shoes before entering into the house. The study divulges that hygiene practices were integral facets of living. Certain customary practices focused on controlling the transmission of infections through direct touch. The hygiene practices also focused on curtailing the spread of vehicle-borne transmission of infection. Although the findings suggest that some of the rituals did aid to control the air-borne and vector-borne diseases, it needs a substantial study to evaluate the inferences.

The issues like the role of ventilation, use of toilets by an infected family member, disposal of waste, health of livestocks etc. needs to be addressed to complete the inventory of health and domestic spaces during epidemics. Research on vernacular architecture vis-à-vis health, particularly in India, is in the preliminary stage. However, such research can provide an opportunity to look at vernacular architecture beyond its physical attributes and draw design clues for present-day architecture.

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