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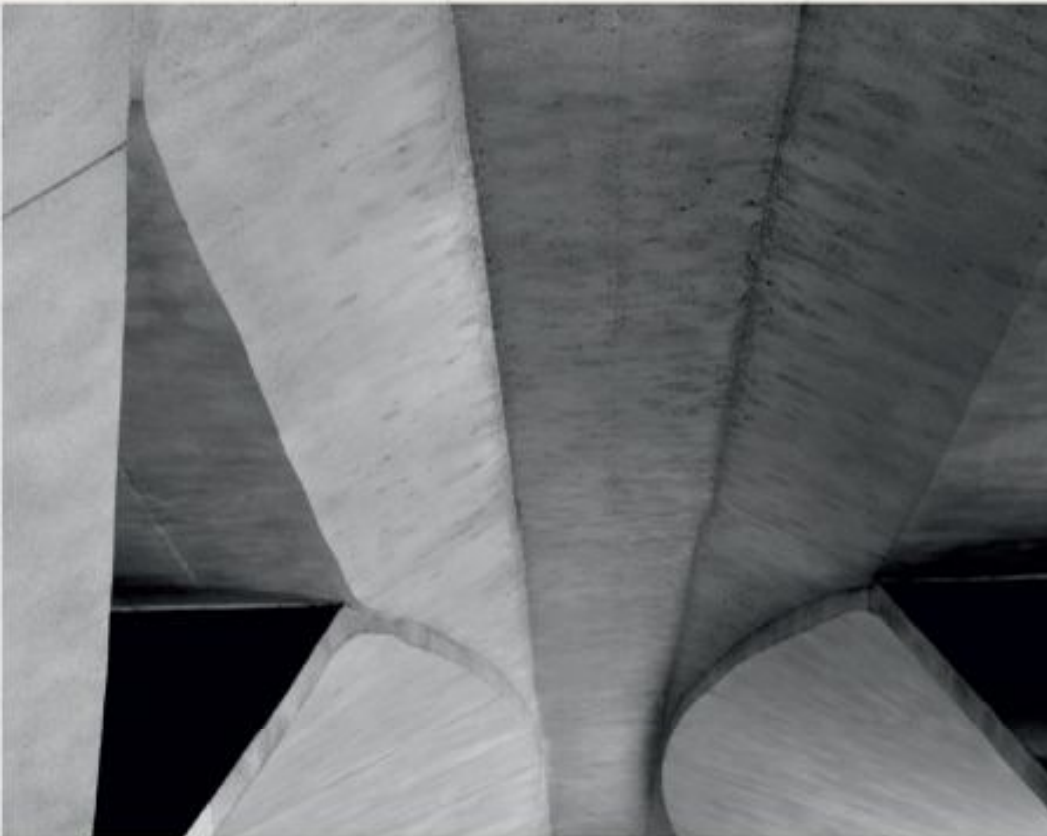
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Study of Crowding and Coping in Ladies Compartment in Mumbai Local: An Environmental Psychology Perspective

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Sonam Ambe is designer at heart who loves to analyse and explore ideas. After her Bachelors in Architecture from Sir J.J. College of Architecture, she studied the social sciences and holds a silver medal in M.Phil (2013) from IIT- Bombay. The Social Sciences have cumulated upon and moulded her approach towards user-sensitive holistic designs. Presently, Sonam teaches at School of Architecture Anjuman-I-Islam's Kalsekar Technical Campus.

Keywords: **Crowding, Environmental Psychology, Design, Coping, Mumbai local train.**

Abstract

The study of impact of built environment on People, Environmental Psychology (EP), is integral to design of 'used' spaces. People's association and positive or negative reactions to certain colours, forms and orientations are aspects of design which have not been extensively studied by most designers. From the larger purview of EP, this paper focuses on the issues of density and crowding, specifically the impact of crowding on urban female commuters travelling in the ladies compartment of Mumbai Local Trains. The paper looks at crowding and stimulus in local trains by studying the environment and design evolution of the train compartment and constructive coping mechanisms sought by the commuters.

The research follows a participative approach where the conclusions are drawn post interaction with commuters. Different aspects of train design like, seating, racks and bag holders, GPS announcements, etc. are highlighted and alternatives (some suggested by the commuters) are expressed. The study delves on seminal theories in crowding psychology to support the conclusions. The paper also advocates the importance of early intervention and need for study of environmental psychology in the pedagogy of architecture.

Introduction

Spaces are designed as art; designed for people, for their comfort, to increase (or decrease) their interaction and to fulfil a specific need/function. While designing by form or function we generally under-appreciate the post occupancy impact of built spaces on the users. The study of impact of Built environment on People, Environmental Psychology (EP), is integral to

design of humane spaces. This paper analyses the impact of crowding on urban female commuters travelling in the ladies compartment of Mumbai Local Trains. The paper extracts the design and its impact on individual Psychology while analysing various coping mechanisms which are internalised by the commuters.

Urban Crowding is a serious problem in many Indian cities. The development of suburbs, satellite cities and peri-urban land to accommodate the city's labour does not reduce urban pressure but simply displaces it. The location of the labour in and along the outskirts has increased pressure on the public transport system, especially the railways. The Mumbai local is notoriously known for overcrowding, congestion and the peak hour rush. The longest travel time spent daily by an average commuter from Virar, Karjat, Kasara, Panvel, etc towards the city is approximately two hours (x 2, for the return journey). These daily four hours of travelling are within high density environment and lead to stresses like stimulus overload (Baum, Davis, Calesnick and Gatel, 1982; as cited in Jain, 1987) and violation of personal space (Worchel, 1978; as cited in Jain, 1987). Professionally, Behaviour studies and Design interventions have been popularly synchronised by Final Mile behaviour architects from Mumbai. Some of their works also deal with local trains. They tackle social problems, especially death due to trespassing on railway tracks in Mumbai, through design interventions. Their neuroscience approach to minimize trespassing deaths has been successful.

The present research was conducted in the ladies compartment of Mumbai local from September 2012 to August 2013. Eight trains during morning peak hours of 0830-1000 and evening 1730-2000 were selected; three from western line, three from central and two from harbour line. Group commuters who always catch the same train were selected for the sample. The study compiles opinions and interviews of ten groups of various sizes ranging from 4-17 members and 18 other individuals who were not aligned with any group, or travelled in the same train. The methodology followed was questionnaires, casual interactions and focussed group discussions during the train journey.

The impact of built-environment and crowding on the commuters of the local train forms the main content of this research. The influence of built environment on social psychology and mechanisms of coping developed by the female commuters to overcome the stress due to crowding are studied. The arguments in the paper are derived from participative observations within the second class ladies compartments. These observations are theorised and presented

in the following scheme: Crowding and stimulus in local trains, Constructive Coping mechanisms and Environment and Design evolution of the train compartment.

Crowding and stimulus in local trains

Density can be manipulated in one of the following two ways; by manipulating either Social density or Spatial density. The social density is manipulated by varying the group size while keeping the area constant (i.e. varying the number of people) whereas spatial density is manipulated by maintaining the group size and varying the area. Although, crowding is an empirical concept of human density, high density or overcrowding may not be stressful in itself. It is a component of the stress complex comprising of noise, stimulus overload, reduced personal space, etc. It is also observed that similar densities may have different effects on individual human behaviour. Jain (1987) notes, there is consensus among researchers that crowding is a subjective state of mind with a typical stress component. It is associated with the perception of reduced physical and/or psychological space. Feeling of discomfort, perception of loss of control over social interaction, encroachment on privacy, negative perception of space, boredom, etc, are considered as characteristic features of the feeling of crowding.

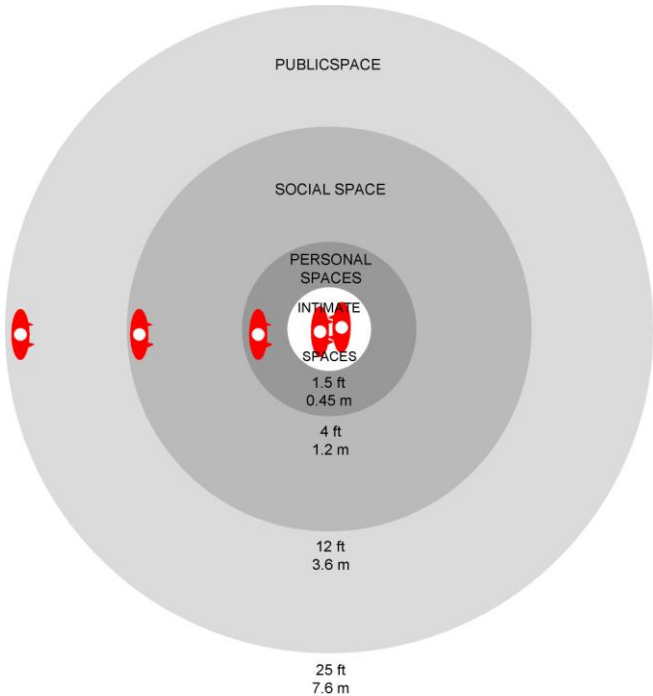


Figure 1: Personal Space Proximity Chart proximity leads to stress and commotion within.

Inside the local trains the crowding and its density lead to proximity of ‘intimacy’ (Figure 1, Hall 1966a). Although the commuters are in close physical proximity, their psychological proximity or emotional proximity is distant. The criteria of psychological proximity (social) is in conflict with the criteria of physical proximity (intimacy) (Figure 1, Hall 1966a) as the train is crowded by intimately placed strangers. This contradictory physical and psychological

A few theoretical models which explain the feeling of crowding are discussed ahead. They are the stimulus overload model and the attribution model. This paper relates the models to the conditions, feelings and emotions of female commuters in ladies compartment of Mumbai local trains.

The Stimulus Overload model (Baum, Davis, Calesnick and Gatel, 1982; as cited in Jain 1987) proposes high density as a stressor because of its potential to provide excessive stimulation to the individual. Since Individuals receive additional stimuli than they can handle, they experience crowding which may lead to confusion at the cognitive level, fatigue at physical level and escape and withdrawal at behavioural level. High density situation is a peculiar stress situation where many social and normative factors operate in the presence of other people. As an outcome, people may develop various strategies to deal with unwanted, unpredictable and unavoidable interference from others.

In the ladies compartment the stimuli are many. They range from the desire to grab the right seat for the long journey, to being able to hang out on the footboard to avoid interaction, from trying to avoid stepping on others feet to avoiding the stench of sweat of fellow commuters, etc. The acting stimuli of the 'now' are compounded by the external stresses in the routine of the commuters. These external stresses are found to be common for most of the woman commuters, especially among married working women; it is either getting to the office on time, catching the right bus in order to reach the office on time, reaching back home early enough to cook the dinner, getting back to the children and helping them with their homework, etc.

The attribution model (Worchel, et al, 1978; as cited in Jain 1987) proposes that high density is more likely to create a condition where there is violation of personal space. In this situation Worchel (1978) notes that if an individual attributes her arousal because of personal space encroachment to others, only then she would feel a sense of crowding otherwise not. Hence from observed behaviour he has suggested the importance of attribution of stress to high density, as a determinant of the feel of crowding and its negative effects. This is evident from the fact that once commuters have befriended one another the sense of crowding reduces as the crowd becomes a part of their socio-personal space. The attribution model builds on the limitations of the earlier model and focuses on the individual feeling of crowding that is relative, not on the absolute density.

Constructive Coping Mechanisms

Passengers generally cope with the stresses of crowding by socialising and interacting -some friendly, some loud and cantankerous- with fellow commuters. This section discusses the coping mechanisms adopted by women commuters in the local trains. One will realise that coping is an individual's internal response to stress and is not affected by design alterations. However, before proposing alternatives one needs to understand the problems, those being resolved by the commuters and those which are not resolved.

Feeling of crowding is perceptual affective state of stress which leads to negative behavioural consequences. This demands new coping strategies to reduce the feeling of crowding. Coping refers to efforts to master, reduce, or tolerate the demands created by stress. The local train commuters have in fact found very interesting mechanisms to cope. Most of these strategies are related to increased social interaction by forming local train friends' circle, *bhajan mandali*¹, sharing food, celebrating festivals together, etc. Some individual activities like reading a book, knitting and sleeping are also fruitfully carried out during the commuting time.

Individuals have their own styles of coping. The crowding stress is generally overcome by two ways, the negative outcome of which is through catharsis², where the individual shows annoyance at the congestion and aggressively releases pent-up emotions vocally. This leads to verbal fights (rarely physical) between female commuters. The trigger for the fights is mostly the intrusion of personal space e.g. accidental stepping on feet, untied hair of one commuter overflowing on another's face, large handbags causing discomfort to others, etc.

It was observed that most of the commuters cope with the stress constructively by increasing their social circle. They seek social support from fellow commuters. This changes the commuter's attitude towards crowding and its related stresses are neutralised. The Mumbai 'local group' as most of them call themselves are small numerous groups of 5-15 commuters who generally take the same train. The women mentioned that they conscientiously try not to miss the train to ensure that they engage with familiar crowds rather than crowd of strangers. These groups share tiffin (breakfast), celebrate birthdays and festivals, cut vegetables for each other, share problems and happiness, sometimes even go on outings with their families. A 'local group' thus forms an integral part of women's support system. A crowded public space gets converted into a small social space co-occupied with friends. Such a social group is a strong entity bound by loyalty and emotions. It is observed that sometimes the members even

give up their seats to other friends as they themselves stand for the rest of the journey. When asked, most of them talked empathetically about the pains of the long journey. They also said that the favour is always returned. Thus, it may be inferred that the 'local group' is like a family where the members refer to one another like sisters. The stress of crowding is creatively tackled by positive social involvement. Those not interested in interaction cope by being self involved. Some read books or news papers, others listen to music, some talk over their phone, thus, trying to mentally move away from the crowd.

In an already crowded train, when the journey to be travelled is long, the anticipation of whether one may get a seat is also creatively reduced by 'reserving seats'. This seat reservation is an informal way in which each seated commuter is asked which station one would get down, by the commuter seeking a seat. Then the seat of the commuter who would get down the earliest is reserved by the seat-seeking-commuter. This reduces the anticipation of whether and when one will get to sit and also reduces the fights over seats as the change of occupancy becomes an organised process.

Commerce has also learnt to tap this potential market of commuters. Sale of accessories, jewellery, food items, vegetables, fruits and flowers, dress material, sarees, cosmetics, etc. create an excellent opportunity to the seller to get a convenient market of restless individuals ready to divert their attention. The commuters view this as an inviting break from the monotony of the travel. Thus, the stress of the crowding is creatively managed by the commuters and innovatively tapped by the small scale entrepreneurs.

There are some stresses that cannot be resolved by people themselves. Physiological discomfort due to heat and humidity cannot be resolved by social interaction. This lack of physiological comfort inside the compartment makes people cling near the door and hang out for some fresh air. During peak hours as many as ten women grab the handles and central pole at the door and some even hang out of the door, leading to potentially dangerous situations of falling off.

Environment and Design evolution of the train compartment

In this section I have discussed the environmental component of crowding and mapped the design of the railway compartment to demonstrate the impact of space and environment on the commuters.

Space is outlined by physical barriers, erected to restrict motion and reception of visual and auditory stimuli (Stea, 1965). The design of the local compartment has evolved from packed compartments with metal partitions to more open and interactive design which allows free passage of light and air. The visual barriers and the barriers to natural cross ventilation have both been reduced to ensure increased interaction between the commuters and improved levels of comforts. The spatial is studied here by noting the upgrades in the spatial design through the seating arrangements, location of racks to hold baggage, the height of the hanging strap and accessories within the indoor train environment.

The journey for most of the travellers is longer than an hour. Hence, rather than more standing capacity, the interviewees preferred a design with more seating capacity. The commuters belong to middle and lower income class, largely working women. Their baggage includes daily Tiffin, bottles, make-up and accessories, work related books and devices, etc. Thus it is important to provide enough luggage space in the compartments to place their heavy bags. The women demanded more luggage space, specially, space to hang their bags from the bottom of the racks already provided.

In the last decade, the design of the local train compartment has become benevolent towards the comforts of the commuters. It has evolved from a compact packed compartment to a more spacious design which allows free movement of air for better physiological comfort, better visual interaction and clarity of location via GPS trackers with station-wise announcements. Other amenities like LCD screens which display features of Charlie Chaplin (mostly in harbour line trains) are provided. Some compartments are even painted in pastel pink and accessorised with mirrors. The spatial study is carried out considering each component of the design such as the seating, racks and holders, hanging straps and other accessories.

Seating: The seating arrangement in the local trains at Mumbai, unlike metro trains, is more extensively designed for seated journey. This is to accommodate the long travel time of the journey. The total capacity of the seat is three average-sized individuals plus a half seat. We will study the figure 3 for spatial analysis of seating inside the local trains. This analysis would take from Humphry Osmond's study (Figure 2) of relationship between semi fixed

Figure 2: Interaction between participants at Osmond and Sommers experiment

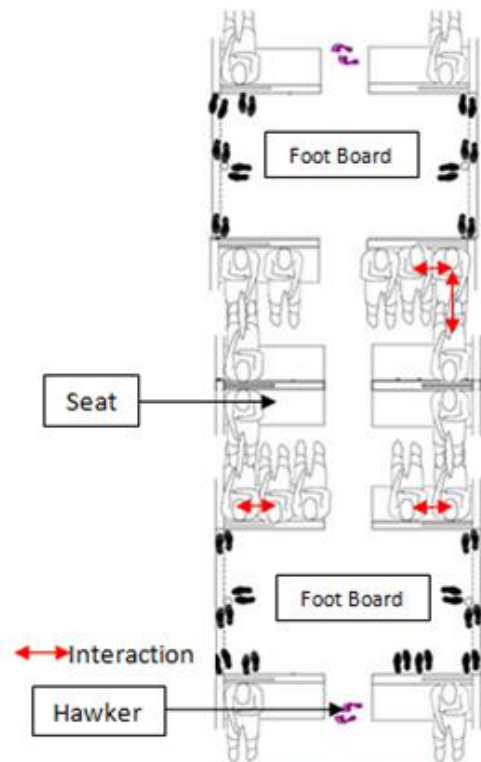
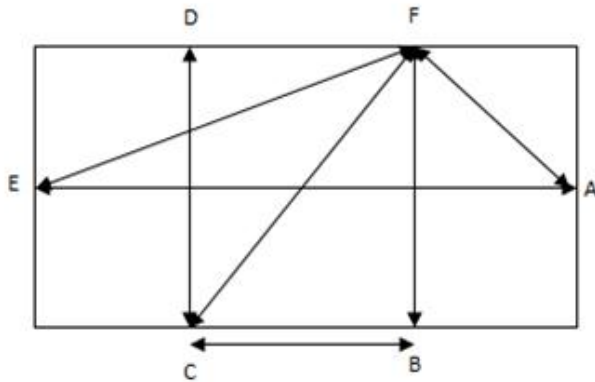


Figure 3: Seating in the local train- Non rush hour

In his study, Osmond selected a hospital cafeteria with 36 X 72-inch tables accommodating six people. As figure 3 displays, the table provides six different distances and orientations of the bodies in relation to each other. He conducted fifty observational sessions in which conversations were counted at controlled intervals. The study revealed that, F-A conversations were twice as frequent as the C-B type. These in turn were three times as frequent as the C-D. In other words the people at right angles to each other produced six times as many conversations as face-to-face situations across the 36-inch span and twice as many as side by side arrangement.

The pattern of interaction can similarly be drawn for the arrangement at the local compartment where seating is replicated like the table arrangements, unlike the seating in the metro trains which are more linear, hence, less interactive. The interaction between side by side seats is far more than the face to face interaction and there is a tendency of familiar commuters to choose seats next to the one another rather than face to face seats, even when better seats (Window seats, seats which are not the 4th seat) are offered. Thus one may say

that the across-the-table seating arrangement as seen presently, offers a more interactive environment, thus, encouraging communication between the commuters.

The crowding is intensified during rush hours. The interactions vary from the standing commuters to the seated commuters. The standing commuters largely interact within circular radius. They may also interact with the seated commuters. Once a 'local group' is formed through continuous interactions the members tend to prefer clustered group positions like the one depicted by dotted red line (from Figure 4). Interactions within these grouped seats also follow Osmond's observations. However in this case positions E and A (from Figure 2) are taken by the standing passengers.

After discussion with the commuters, a set of permutations and combinations (Figure 5) are worked out to see alternative seating patterns and its impact on the carrying capacity of the compartment and the resulting psychological implications. Plan A is the existing seating layout. It is modified (Plan B) to increase the central aisle width. This ensures an increased standing capacity and more comfortable seating by reducing the distance between seating to 350 mm from the present 600mm. The reduction of space between seats ensures that standing commuter would not clutter the space. This will reduce chaos between the seats, improve interaction and open up the central aisle for comfortable two-way movement.

Some commuters suggested that local trains should follow the metro model of seating. Metro model (Plan C) of seating is perpendicular to the direction of movement of the train, it is seen to increase the seating capacity. As the doors face one another the congestion and standing

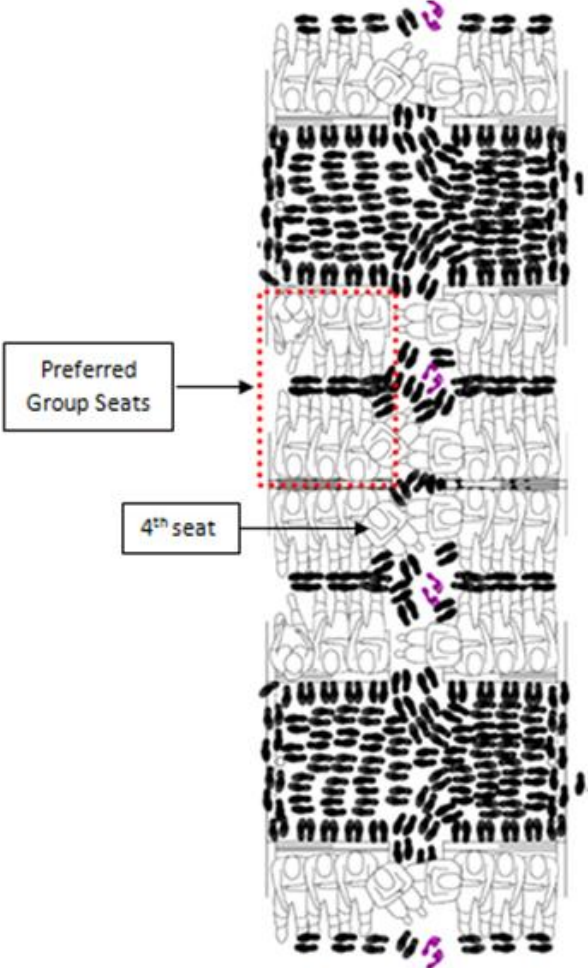


Figure 4: Seating in the local train- Rush hour

capacity at the door is less. Instead, some commuters suggested that the doors can be staggered/ widened to increase the standing capacity at the door. Although it increases the seating capacity, it is not suited for long journeys as the perpendicular direction of motion will tend to confuse and disorient the commuter. Hence another alternative (Plan D) is suggested. Plan D takes from both plan B & C. It takes the good features like staggered door for more standing capacity, face to face seating for interaction, creation of two aisles for unidirectional movement and metro type continuous seating.

Racks and bag holders: The heavy hand bags carried by the women are placed on horizontal racks above the seats. With an increase in the number of passengers these racks can be supplemented by additional hooks and clamps for hand bags. Passengers also innovate in interesting ways, like, hanging their extra

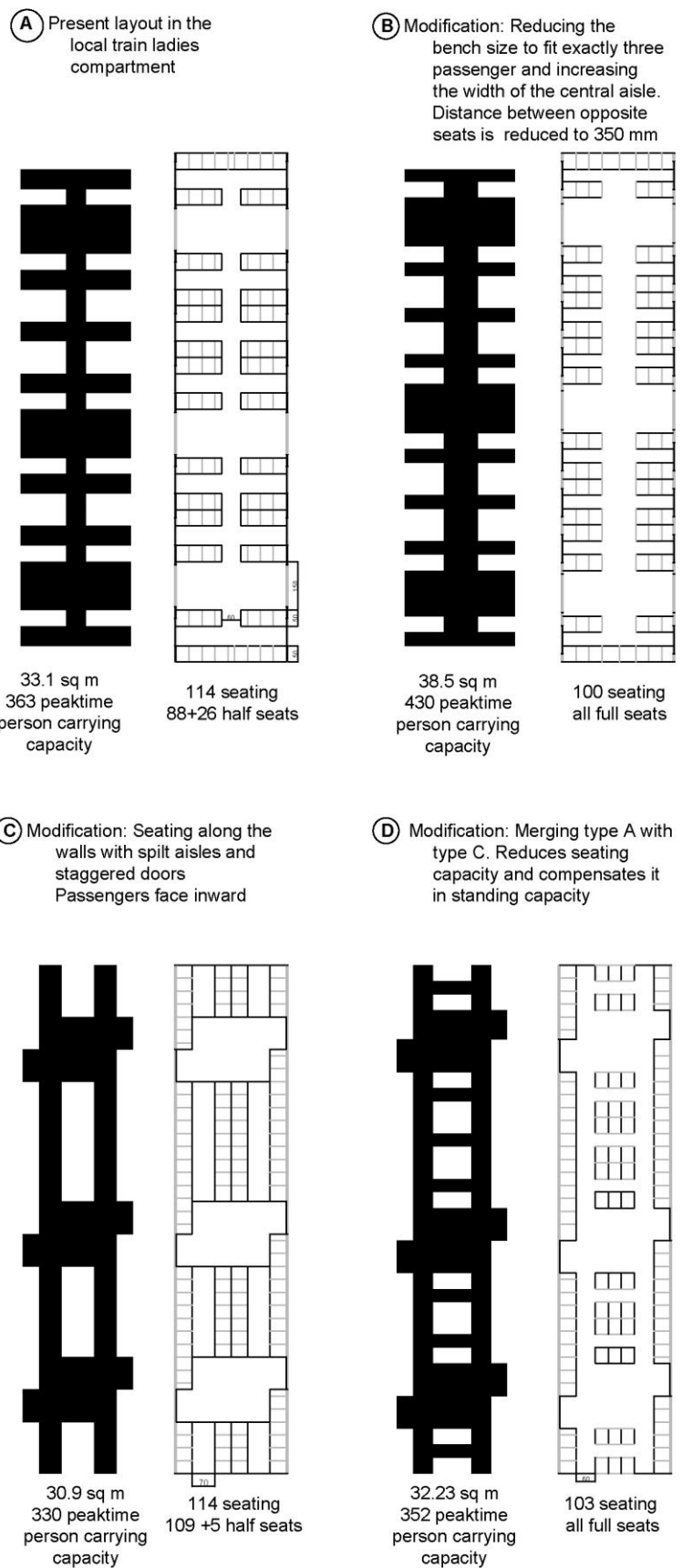


Figure 5: Alternatives to seating arrangement

luggage by tying the strap of the bags to horizontal rods of the compartment partition, etc.

The motion of the train and the act of balancing in the congestion makes the standing journey difficult. Hence, the racks and bag holders are always comforting design additions. The bag holders or hooks free the hands of the commuters from carrying the load for long journeys, thus reducing their physical stress.

Hanging strap: Many commuters complained about the hanging strap. According to them, the pivoted strap which hangs from a chain, is responsible for most of the fights in the train. Due to moment of inertia the commuter tends to drag the chain ahead when the train takes to a sudden halt. The fights start as the commuters end up falling on one another and stamping on each other's feet when this happens. Most of them believe that a rigid suspended grab bar would be better. However, the prime problem to be resolved is difference of direction- Moment of inertia is in the direction of the motion of the train and the door opening and orientation of people at the door is perpendicular to the motion. Unless this is resolved, no change of hang strap design will be suitable enough.

Other Accessories: The railway authorities have installed many technological devices in the compartment to make the journey more comfortable. Due to the extreme amount of congestion, confusion and stress inside the compartments sometimes passengers miss their alighting stations. To avoid this, GPS announcement systems are installed inside the train which intimate the passengers about the forthcoming station and the last stop of the journey. This reduces stress due to anticipation. Passengers however requested a directional signage or announcement to confirm on which side the next stations platform would come. Some train compartments also have LCD screens which display silent movies, anti tobacco/alcohol messages, promotionals, quiz contests and prizes. These screenings divert the attention of the commuters and calm down the arousal of the passengers.

Conclusion

The overcrowding in the local trains creates stress. The improved designed environment and the social mechanisms of coping have helped reduce stress due to the crowding. The first attempt necessary to be made is to reduce spatial crowding by dispersing the crowds. The Mumbai Railway does it by segregating trains as fast trains (which halt at specific stations) and slow trains (which halt at all stations). However the peak hour rush is not completely reduced. The railways also increased the number of coaches from 9 → 12 and now from 12 →

15. But the crowding in the local trains from 0830-1030 in the morning and 1730-1930 in the evening continues to be high density. Hence one may say that the strategic attempt to reduce crowding is to make people 'feel' less crowded.

This is where the design of the indoor environment becomes crucial. Recommendations like the ones given below may be adopted to make the journey more comfortable.

- ✓ Rearrangement of railway seats by increasing the width of the central aisle and increasing the standing capacity at the aisle(see figure 5) and/or
- ✓ Providing extra luggage space under the seats and/or
- ✓ Providing multiple hooks on the luggage rack to hold more hand bags and/or
- ✓ Air conditioning the train compartments to maintain cooler temperature to reduce physiological stress of the commuters.

The commuters have themselves come up with creative ways of tackling the crowding conditions. The local train group is a unique socio-psychological strategy of coping. A boost to these groups could be given in the form of concessional group monthly and quarterly passes. Since most of the group members board and alight from nearby stations, this concessional pass system could be effectively implemented. This will contribute as an economical incentive to the group. This may encourage others to join a group or form new groups thus, increasing the familiarity of the crowd.

Hence, in cases like Mumbai, where the density cannot be controlled by simple spatial upgrades both environment psychology and socio-psychology needs to be studied intensively to ensure a holistic solution to the problem of crowding. Environmental psychology and its applications range from shopping/mall designs for increased sales to factory or workspace designs for more productivity. The influence of spaces on the emotions of the user needs to be verified by a post occupancy survey of designed environments to help us learn from precedents. The study of the discipline of psychology is crucial to the pedagogy of architecture and young learners should be introduced to it early in the education of architecture.

Acknowledgement

I thank my new friends in the train who helped me with the survey by sharing their experiences and opinions with me. I would like to thank my psychology professor at IIT-B, Prof. Meenakshi Gupta for introducing me to environmental psychology. I would also like to thank Ar. Vijay Panchal for his insights.

Notes:

¹ *Bhajan Mandalis* are a group of working men who on their way to office sing songs in God's praise, mostly in Marathi, in the gents compartment. They use manjiras and kartals to add music to the songs.

² A catharsis is an emotional release. According to psychoanalytic theory, this emotional release is linked to a need to release unconscious conflicts. For example, experiencing stress over a work-related situation may cause feelings of frustration and tension. Rather than vent these feelings inappropriately, the individual may instead release these feelings in another way, such as through physical activity or another stress relieving activity (Cherry, 2014)

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