Defining components of social interaction for Indian public open space

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ABSTRACT--Improving public open space is becoming one of the prerequisites for effective future of public life in cities. The potential of social interaction attributes, which are one of the predominant factors of public open space, is often neglected in India. The factors of social interaction varies according to the context due to variation in culture, demography, social norms, etc. This study examines the factors of social interaction of Public open space in Indian context for making successful Indian public open space. The research has been twofold, first, literature review has been accomplished through which factors of social interaction has been derived. Based on obtained factors, questionnaire survey has been performed over three selected sites of South Delhi. In second section, data screening has been done, followed by the Cronbach's alpha for checking reliability of each item and exploratory factor analysis using IBM SPSS plus confirmatory factor analysis using IBM Amos for confirming the validity of data. In conclusion, considering the listed factors that are users need, user behaviour and social activity are the significant components of social interaction for promoting effective Public open space in Indian context.

*Keywords--*Social interaction; Public Open Space; Indian context

I.   INTRODUCTION

Public open spaces are indispensable fraction of cities, therefore, enhancing awareness about social arenas, facilitates spaces to develop social contacts between an individual or in a group. According to Lieshout and Aarts (2008), public open spaces provides an area for the communal and social meeting. These spaces symbolises sites of sociability and social interaction, thus, their quality is used to quantity the degree of sociability in Public open space (Mehan, 2016). These spaces offers social and physical function which produces pleasure, invulnerability and welfare for public using specific place (Lynch, 1981; Matthew Carmona, Hammond, & Magalhães, 2008). Moreover, Harun and said (2009) defines that sustainable public open spaces are the vital element of cities which comprises recreational activities and social interactions.

Unfortunately, due to the uncoordinated growth of the cities, it has been observed that most of the Public open spaces of New Delhi are being neglected, hence fails to captivate the users for longer duration. It has been observed that Public open space in New Delhi is often used as transitional or connecting place. Therefore, the research aim is to examine the factors of social interaction in Public open space in context of India in order to make better understanding of social interaction in Indian Public open space which eventually could be utilised to frame future design recommendations. The study objectives will be attained through performing case studies which will be undertaken in three different public open spaces of New Delhi. The survey will be unfold in two

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steps: observations leading to questionnaire which will be further assessed by exploratory factor analysis and confirmatory factor analysis.

II.   LITERATURE REVIEW

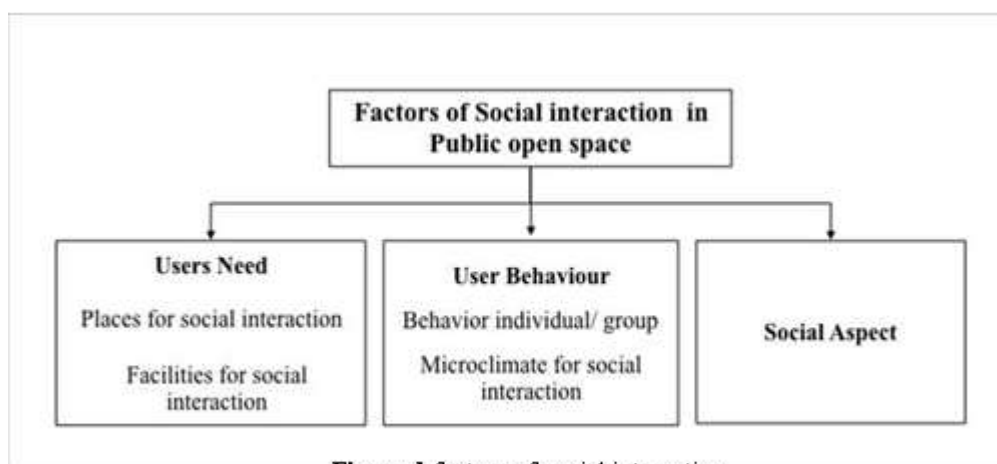### 2.1   *Social Interaction in public open space*

Social interaction means developing relationship between two or more person which tends to generate mutual reaction between them (Lang, 1987). Thwaites (2005) defined a strong relation between urban form and social sustainability which tends to uplifts spatial organization in Public open space. While Hillier and Hanson (1984) explained the importance of social potential with ground floor plan of a site, as it enhances the quality of social interaction with the 'beady ring structure'. Hillier and Hanson (1984) further mentioned that, the denser the element / structure / point connects with the pathways, encourages social interaction. Jacobs (1961) defined the importance of social life in cities by emphasising on the role of street life on encouraging the social interaction. In addition, Jacobs (1961) revealed that streets, footpath, the area around doorways, steps in front of houses, etc., are the vital spaces where social interaction between different household grows and eventually develops casual public contact as well as satisfaction between people living in the locality.

Moreover, Whyte (1980) elucidates that activities enhances the quality of public open space. A case study on varying attributes of design was conducted which encourages the utilisation of public open space through examining the interesting spaces where people want to do social meeting and spend leisure time with other (Whyte, 1980). The result of the study revealed that spaces like sitting areas, shaded pathways, outdoor coffee shops, spaces close to fountain/cascades are the most appealing spaces for people. These spaces strengthen the social experience in public

Table1: Deriving factors of social interaction of public open space from literature review

Design's factors influencing social interaction in public squares (Hajmirsadeghi, Shamsuddin et al. 2013)	Investigating the effective physical factors on promoting social interaction (Bahmanyar & Cheshmehghas sabani 2017)	Williams, J (2005) Designing Neighbourhoods for Social Interaction	Open Space Quality in Deprived Urban Areas: User Perspective and Use Pattern (Abbasia, Alalouchb et al. 2016)	Derived Factors of social interaction in Public open space

Behavioural & psychological • Comfort • Safety	• Sense of belonging • Sense of place • Behavior patterns (personal and grouping)	**Personal factors** • Similar values and norms		**User Behavior** • Behavior individual/ group • Microclimate for social interaction
Social Activity • Social activity type • Social contact	• Social trust • social categorization	**Informal social factors** • Social dynamic-relationship between individuals and groups		**Social activity**
Managerial Aspects • Maintenance	• Privacy • Security	**Formal social factors** • Management and maintenance	users need	**Users Need** • Facilities for social interaction
Physical Aspects • Form • Organistion • Sitting • Aesthetics	• Collaborative space • Access distance • Type and rate of referral • Territory	**Physical design factors** • Density(proximity) Division and organization of space • Quality of space , • Accessibility, • Functional surveillance	• Space quality • Spatial structure	**Places for social interaction**

Figure 1 factors of social interaction

open space (Whyte, 1980). Gehl (1996), in his book Life Between Buildings, mentioned the strong influence of human contact on the quality of public life in outdoor spaces while Kim and Kaplan (2004) recommended that there more chances of social interaction and development of sense of community if pedestrian areas and natural elements are well designed in open space. Adding to this, Abbasia et al.(2016) defined users need, spatial quality and spatial structure as the three major components for generating pattern use of Public open space. Hence increases the social interaction in Public open space. Further Kim and Kaplan (2004) states that, accessibility, organization of natural and man-made elements, comfort, etc are the major attributes for producing social interaction in Public open space. Whereas, Williams (2005) defines Personal factors, informal social factors, formal social factors and physical design factors as the major components for generation social interaction in Public open space. While Daneshpour and Charkhchian (2007), emphasis on the process of socialisation and collective life which depends upon acceptability of a place by users from different social groups, with distinctive comfort level, tangible and intangible social presence in a space. Daneshpour and Charkhchian (2007) mentioned invitation, security, utility and activity as the attributes of spatial quality in Public open space. Moreover, social interaction can assess through presence of distinctive social groups, formation of social gatherings in different hours of the day (Daneshpour & Charkhchian, 2007).

Bear and Higgins (2002) referred Public open space as a part of environment which satisfies users social need by generating activities which creates sense belonging and environment vitality. Whereas, Rafieian and Zahra (2009) identifies access and services, social security and spatial identify as an attributes to contribute in user's satisfaction in Public open space. Furthermore Hajmirsadeghi et al.(2013) suggested behavioural & psychological aspect, social activity, managerial aspects and physical aspects as the vital determinants of social interaction. While Bahmanyar and Cheshmehghassabani (2017), mentioned Behaviour patterns (personal and grouping), social trust, security, collaborative space, etc., as the dominant elements of social interaction in Public open space.

2.2 *Level of social interaction in Public open space*

Goffman (1963) broadly explained the rules, concepts and level of social interaction. Goffman (1963) further divided social interaction situations into three conditions namely encounter, situation and occasion. 'Encounter' is a situation where people meet face to face. This is described as smallest type of formal or informal interaction, mostly happens between two or three people for example meeting with friends, family, etc., while in 'situation',the environment allows the people to interact orally and expressive as well as participate in activities with other people. However, in 'occasion' people only aware about the event or conduct. Such as, going to conference, concert, etc.

Ludvigsen (2006) further, developed a framework on Goffman (1963) concept of social interaction. Distributed attention, Shared focus, Dialogue and Collective action are described as four different types of interaction. According to Ludvigsen (2006) 'distributed attention' case, people does not have central activity as well as have different foci. For instance, waling on a pathways, sitting on a benches, eating fountain in a place. While, in 'shared focus' situation, users are concentrating on a single activity. Concert is one of an example of it. Though, in 'dialogue' the interaction is a two-way. Person can interchange their views and interacting each other, like chatting with friends. Whereas, 'collective action' accommodate is similar activity with other people having similars intend.

2.3 *Factors of Social Interaction in public open space*

Many researches have given several parameters of social interaction on the basis of their study in public open space. Abbasia et al.(2016); Hajmirsadeghi et al. (2013); Bahmanyar and Cheshmehghassabani (2017); Williams (2005) are the most four remarkable study has been selected in order to formulate key factors of social interaction in public open space. Moreover, Table 1 demonstrates that users need, user behaviour and social activity are the three main factors of social interaction derived from literature review.

Figure 2: Public open space, Saket, New Delhi

Figure 2: Public open space, Nehru Place, New Delhi

2.3.1   Users need

According to Abbasia et al.(2016), it is important understand the users need and their expectations before designing open space, also equally accomplish the users need from all community. Comfort, relaxation, passive engagement and active engagement are the major components of users need in open space (Abbasia et al., 2016). Moreover, Gehl (1996) consider high-quality, functionality and safety satisfies users need in Public open space. Besides this, Physical design factors are also allusively related to users need for generating social interaction in Public open space. Williams (2005) mentioned that quality of space, division and organization of space, accessibility and security are the attributes of Physical design factors which further effects the users need. Adding to this, Hajmirsadeghi et al. (2013) form, organization, sitting and aesthetics defines the physical factors.

2.3.2   User Behaviour

Kurniasanti et al. (2018) described that Physical characteristics of a place have a direct impact on behaviour pattern which further affects the social interaction. Speller (2006); Veitch and Arkkelin (1995) mentioned that, environment of place having a capability to prevent, hinder and limit the people's behaviour. Adding to this, Speller (2006); Veitch and Arkkelin (1995) described that, 'psychological reactance' occurs when   user experiences discomfort. For instance, people may changes their route, when they sense any insecurity in a place specially in dark areas during night or changes their space to interact like chatting with friends or meditating, if finds smell or noise. Further, French (1978) stated that, architecture and quality of open space influences user behaviour to spaces which eventually hinders the social interaction.

Bell et al. (1996) mentioned a strong relationship between environment and people's behaviour. Environmental features like pollution, extreme temperature, noise, odour, crowding, traffic, etc., have determined impact on human senses which directly effects the people's behaviour and interaction between users. According to Lewis (1996), physical characteristics of place is tangibly and intangibly linked with the human behaviour. Spaces, colour, material influences visually while smell, noise, touch perceive through senses. Furthermore, (Bahmanyar and Cheshmehghassabani (2017) described, behaviour aspect as one of the predominant factor of social interaction including behaviour patterns (personal and grouping) and sense of a place. Moreover, Hajmirsadeghi et al. (2013) also consider behavioural and psychological factors as essential

component of social interaction in Public open space. While, Alexander (1977) defines behaviour pattern as a finding of current patterns as a specific connection in limited areas.

2.3.2   Social activity

Gehl (1996) elucidate recommended social activity as one of the essential factor for generating social interaction in Public open space. According to Gehl (1996) social activities happens in the presence of people which ultimately leads to social interaction. Williams (2005) defined social aspects in to two different groups namely formal social factors and informal factors. Formal social factors includes Management and maintenance while informal social factor concerns social dynamic-relationship between individuals and groups (Williams, 2005). Moreover Bahmanyar and Cheshmehghassabani (2017), classifies social aspect as social trust and social categorisation.

On the other hand, Hajmirsadeghi et al. (2013) considered social activity as one of the social aspect in Public open space for encouraging social interaction which includes type of the social activity and social contact. Vosoughi (2009) states social trust as the major component for developing sustainable social relationships. While, Vosoughi (2009) asserts that sociability increases the possibility of social interaction in a place.

III.   METHODOLOGY

3.1   Study Area

The study requires reviews from users about their social interaction preferences in Public open space. Thus, the site to be similar in size with different spatial organization as well as possess distinctive context, in order to get varied response from user of different culture, age and income group. Therefore, the study has taken three Public open spaces of New Delhi namely; Saket, Nehru Place and New Friends Colony. These Public open spaces are the part of district centre which also constitute commercial, offices, health centre, etc., which provides site with similar size and character of city yet possess different design spaces and context as to get contrasting responses from the users.

3.2   Data Collection

The study has employed quantitative method. The main objective of the questionnaire is to derive the most suitable factors of social interaction in Indian context. Therefore, 19 questions were designed, which investigates the preferences of users regarding derived factors of social interaction in Public open space. The questionnaire is based on the Likert scale ranging from 1 to 5 "highly disagree to highly agree," including three different factors with 19 items. Before proceeding to survey, a pilot study has been done with 19 samples in order to validate the questionnaire. The pilot study substantiates the scale while recommended to delete few questions as it was showing low factor Loading. Further, the results of data collection specify the preferences of users in terms of social interaction of Public open space in selected study area.

3.2   Sample size

Israel (1992) sample formula for finite population has been adopted for calculating sample size as Delhi has a finite population of 2,733,752 (2011 census). Therefore, as per Israel (1992) recommendation, 400 samples are

required in case of population more than 100,000. Therefore, 461 samples are collected from three different Public open space of New Delhi i.e., 154 from each site. Further, for sample collection systematic sampling with time interval timing is used in which, every fourth visitor is counted and requested to answer the question from each spot in every 10 minutes of every hour, while through observation, spots are finalised. The samples collected are almost equal in terms of gender and age.

3.2 Data Analysis

The data analysis has been accomplished in three stages. Firstly, data screening has been done by using IBM SPSS, determined missing values, outliers and normality followed by analysing Cronbach's alpha value of each construct. According to Cronbach (1951), value of alpha more than 0.7 are considered as acceptable. From Table 2 it can be examine that all the items are above the required 0.7 value of Cronbach's alpha. After data screening, Exploratory factor analysis has been performed using Varimax rotation on IBM SPSS in order to validate the items of each construct through factor loading of each item. Hurley et al.(1997) stated that, factor loading below 0.5 are recognise and removed from the construct. Consequently, out of 21 questions, 1 item from User's need and 1 from user behaviour construct are removed. Thus, total 19 items lie under acceptable range.

At last, confirmatory factor analysis has been done on IBM AMOS, in order to analyse effective factors of social interaction in Public open space, and verify the correlation between each factor as well as to derive the factor loading of each item and construct. Confirmatory factor analysis is one a kind of structural equation modelling using multivariate technique to analyse the inter-related dependence concurrently. Byrne (2016); Child (1990), this includes relationship between latent, observed, unobserved variables and constructs. Hair. et al. (2010) defined Validity is a tool to measure what it is claimed to measure. The validity of a model can be analysed through model

Table2: Exploratory Factor Analysis for social interaction in Public open space

Factors/ Construct	No. of items	Attributes/ Indicator	Factor loading	Cronbach's Alpha
		Social Interaction		
User's needs	8	Like to interact in groups or with people	0.668	0.914
		Intimate seating areas with multifunctional spaces	0.646	
		Proper street furniture for lively atmosphere	0.705	
		Well-defined space with proper sit-outs	0.70	

				1	
		Space encouraging chances for making friends		0.697	
		Diversity in physical forms, elements, and furniture		0.716	
		Well maintained toilets, dust-bins, barriers, water		0.725	
		Sufficient Street lightings and cameras		0.722	
User behavior	7	Interact in groups or with strangers of other groups		0.733	0.905
		Visit with friends/family/groups.		0.709	
		Interact near well maintained and shaded pathways		0.728	
		Spend time near cascades/ fountains		0.713	
		Spend time/ play/ interact near shaded areas		0.738	
		Interact where no noise/smell in surrounding		0.731	
		Feel comfortable while visiting at night		0.676	
Social activity	4	Like to do social meeting		0.718	0.840
		Chose to do walking, reading, relaxing, mediating		0.707	
		Participate in events like concerts, exhibitions, festivals		0.717	
		Offers activities such as playing sports, jogging, etc.		0.705	

fitness indices.

This comprises CMIN (likelihood ratio of chi square), GFI (goodness of fit index), CFI (comparative fit index), NFI (Normed Fit Index), AGFI (Adjusted Goodness-of-Fit Index), RMSEA (Root Mean Square Error of Approximation), RMR (Root Mean Square Residual). Joreskog and Sorbom (1986), recommended the value of CMIN below 5.

IV.   RESULTS

Prior to exploratory factor analysis, outliers are identified and deleted from the dataset. The data demonstrate the normal distribution as Bollen-Stine bootstrap has been performed for Multivariate normality and it shows the significant result (p value = 0.257 bootstrap), which is more than the required value of 0.05 (Byrne, 2016). The data covers total 461 respondents comprising 219 female (49.6%) and 224 male (50.6%). Whereas, the age groups are unevenly distributed following 0-18 (15.8%), 18-30 (44.2%), 31-50 (29.1%) and 50 above (10.8%). The maximum number of visitors are from age group 18-30 years.

However, exploratory factor analysis reveals that the values of each item are remarkably under acceptable range, which is about 0.7 value as suggested by (Hurley et al., 1997). The factor loading of users need are 0.74, 0.73, 0.77, 0.75, 0.76, 0.77, 0.78 and 0.76, while user behaviour have 0.74, 0.75, 0.76, 0.76, 0.78, 0.78 and 0.73. On the other hand, social aspects factor loading includes 0.78, 0.74, 0.74, and 0.75.

The outputs of confirmatory factor analysis verifies that all the factors have considerably high correlation with each other. The required value of correlation should be 0.7 value (Hurley et al., 1997) . This confirms that all the adopted factors of social interaction are suitable in Indian context. The relation of a users need with user behaviour is 0.96, with social aspects is 0.94. Moreover, user behaviour with social aspects is 0.99. Further, the confirmatory factor analysis model reveals that all the three factors have high factor loading comprises; users need is 0.93, user behaviour is 0.99 and social aspect is 0.95.

4.1   *Validity and Reliability of components of social interaction model*

The validity of measurement model of components of social interaction has been verified through goodness of fit and badness of fit indices. The goodness-of-fit indices which are as follows: chi-square value (x^2 /df) of 1.363, Goodness of Fit (GFI) = 0.950, Adjusted Goodness of Fit (AGFI) =0.936, Standardised Root Mean Square Residual (SRMR) = 0.021, GFI, Normed-Fit Index (NFI) = 0.962, CFI = 0.986 and Root Mean Square Error of Approximation (RMSEA) = 0.034. While badness of fitness is accessed by Standardised Root Mean Square Residual (SRMR) = 0.021, which is acceptable.

Moreover, as per Joreskog and Sorbom (1986); Lei and Wu (2007); Schreiber. et al. (2006) recommended values Goodness of Fit (GFI), Normed-Fit Index (NFI), Adjusted Goodness of Fit (AGFI) and Comparative Fit Index (CFI) are also under satisfactory range. Therefore, this substantiate that the collected data fits to measurement model. Hence, the outcomes prove that all the derived components of social interaction namely;

Figure 4: Structural equation model showing result of confirmatory factor analysis between factors of social interaction in Public open space

Table 3: Showing model fitness indices of confirmatory factor analysis between factors of social interaction in Public open space

Goodness of fit measures	χ^2 test statistics/df	GFI	CFI	NFI	AGFI	RMSEA	RMR
Recommended value	≤ 3.00 [a]	≥ 0.90 [b]	≥ 0.90 [b]	≥ 0.90 [b]	≥ 0.90 [b]	≤ 0.08 [c]	≤ 0.1 [c]
Structural model	1.525	0.950	0.986	0.962	0.936	0.034	0.021

Note: N = 461; GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit Index; CFI = Comparative Fit Index; NFI = Normed Fit Index; RMSEA = Root Mean Square Error of Approximation; RMR = Root Mean Square Residual
Source: [a] (Jöreskog and Sörbom 1986), [b] (Bagozzi and Yi 1988), [b] (Anderson and Gerbing 1988), [c] (Browne and Cudeck 1993)

users need, user behaviour and social activity are distinctly recommended in Indian Public open space

V.   DISCUSSION

Through analysing results of survey, it can be deduced that users need, user behaviour and social activity are three main components of social interaction in Indian Public open space. Moreover, figure 4 depicts that, users behaviour and social activity are highly related with each other having correlation of 0.99, which is supported by Chen. et al. (2011) by solemnly affirming that presence of people direct affects the behaviour pattern of users. On the other hand, the results of the study reveal that social activity is showing high correlation having correlation of 0.96 and 0.94 respectively. This reinforces the findings of Hajmirsadeghi et al. (2013) which proves that there is a positive relationship between activity types with user need and perception in a space. Moreover, among all the three attributes of social interaction; user behaviour have highest factor loading, therefore have strong influence on social interaction, followed by social activity and user need (Figure 4).

Further, Table 2 elucidates the results of principal component extraction method having 19 items extracted from literature review, manifest the three attributes of social interaction. Users need refers as a first attribute, comprising 8 items. The results reveal that all the items have similar factor loading 0.73-0.78. This implies that all the items of user need have similar level of significance. Among eight items, 'well maintained toilets, dust bins, barriers and water' have highest factor loading of 0.78 followed by 'proper street furniture' and 'diversity in physical form, elements and furniture' having 0.77 factor loading. On contrary, 'seating area with multifunctional space' have lowest factor loading of 0.73, which depicts lesser influence on user need.

While, the factor loading of user behaviour is between 0.73-0.78 among seven items. The figure 4 demonstrates that item 'spend time/play/interact near shaded area' and 'interact where no noise and smell in surrounding' have highest factor loading of 0.78. Therefore, have higher impact on user behaviour. However, 'feel comfortable while visiting at night' is having lowest factor loading of 0.73. Consequently, has lower impact on user behaviour. Furthermore, social activity contains four items. Out of which, 'like to do social meeting' have highest influence on social activity, with factor loading of 0.78 whereas 'choose to do walking, reading, relaxing, meditating' and 'participate in concert, exhibitions, festivals' have lowest influence on social activity with a factor loading of 0.74.

VI.   CONCLUSION

The research has evidently define the factors of social interaction of Public open space in Indian context. The output of the research reveals that user behaviour has highest factor loading with a value of 0.99 which implies that it is one of the predominant factor of social interaction, hence , extreme emphasis should be given while designing Indian Public open space, followed by social activity having 0.95 factor loading and user's need with 0.93 value.

In conclusion, it is recommended that user behaviour, Social activity and user need are the major components of social interaction in Indian Public open space as they are demonstrating a high correlation as well as factor loading. In addition to this, well maintained toilets, dust bins, barriers and water; places to spend time/play/interact near shaded area with no noise and smell in surrounding are the most desired needs of the user

for social interaction in Public open space followed by the diversity in form , elements and furniture with well fitted placement of street furniture, well maintained shaded pathways, attractive fountained / cascade with places offer activities like jogging, playing sports etc.

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