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Evaluating Perceived Safety and Comfort in Urban Civic Spaces

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Abstract **- The urban public spaces play a vital role in the enhancement of quality of life of the urbanites. Recent studies explicitly demonstrate the fact that these limited spaces in the urban context directly impact on the physical, social, and psychological health of its users. But some of these spaces are often underused or neglected as a result of perceived danger and risk implicit by the arrangement of elements. This is common in many designed urban public spaces. This study focuses on three types of urban civic spaces as squares, plazas and forecourts which are vital on sustainable development of urban communities. Accordingly, this research intends to develop a framework to assess perceived safety and comfort in urban civic spaces. The process (literature) identified seven main attributes namely visual qualities, spatial configuration, pleasurability, inclusiveness, convenience, activities, and imageability. The 54 sub-attributes ascertained under the main attributes were scored through observations and direct user ratings. Expert weightages and significance scores obtained through the process finalizes an equation to calculate the final perceived safety and comfort levels of the urban civic spaces. Validation of this framework in the context of Sri Lanka depicted that Arcade Independence Square (Square) is more psychologically safe and comfortable for the users, followed by Echelon square (plaza) and Fort station forecourt (forecourt). The final scores produced by the developed framework reflects the current condition of the civic space elaborating the demands for improvements. The proper use of this framework will result in convivial, safer, comfortable, and user-friendly urban civic spaces.**

Keywords**: Urban, Perceived Safety, Comfort, Framework, Public**

I. INTRODUCTION

The advent concern on the scarcity of lands, environmental degradation and encroachment resulting in the loss of open spaces in urban areas has expedited the interest in exploring the significance of open public spaces (Carmona et al., 2010). The studies have revealed that urban public spaces play a vital role in the physical, social, and mental well-being of the urbanites. Historically the public spaces were developed for communication and entertainment needs of the users and to perform community functions. Although these basic functions have been shifted to the private realms or cyber space still the prevailing urban public spaces are used for functional, social and recreational activities – for gatherings, travelling, playing and relaxation (Banerjee, 2001). These public spaces are interpreted as an important arena for the growth of the individual, communities and the whole society (Mehta, 2014). The public spaces intend to promote the ability to gather, discuss and to recognize each other's presence which is crucial in the democratic societies (Arendt, 1998). Similar to the social aspects, the physical and psychological restoration effects of the urban open spaces are also frequently focussed in many studies (Hartig, 2017; Lehto, 2013; Weber & Trojan, 2018). Among various different types of urban public spaces, urban civic space is of importance for its emphasis on the sustainable social development. Civic spaces are primarily defined as 'the spaces where people of different origins and status can co-mingle without any control of a third party (Douglass, 2002; Mehta, 2014; Zakariya *et al.*, 2014). Civic spaces are frequently found in the private realms inside coffee shops, restaurants, bars, pubs and even in stores. Similarly, civic spaces can also be found in the designed open spaces (Douglass, 2002). This study is concerned with civic spaces located in the public realm of the urban context. The social interactions in these civic spaces can be either active or passive. The direct interactions with the users and the indirect interactions with strangers like a passenger and a driver (Lofland, 1998). All these interactions are of importance in assuring free use of the space.

When considering the basic functions of civic spaces and the existing urban public spaces; squares, plazas and forecourts can be directly related with the definitions of the civic spaces. Located in the midst of buildings of urban context, these are frequently used freely for passive outdoor use as seating, resting, and gathering. Squares, plazas and forecourts in the urban context primarily cater for socialization, activities promoting social cohesion, and ensuring local identity (Cidell & Lechtenberg, 2016; Kim, 2015; Memluk, 2013). The location in the midst of buildings, the visibility to the surrounding, openness, informal atmosphere and aiding navigation are some primary characteristics of these civic spaces (Douglass, 2002; Roggeband & Krizsan, 2021; Zakariya *et al.*, 2014). Squares, plazas are mentioned as the spaces which plays an important role in communication, identity and defining the character of the urban realm (Bansal, 2015; Larson *et al.*, 2016; Thomas, 2002).

It is common to experience anxiety and exclusive feelings while inhabiting these urban public spaces. Mostly, users feel threats and risks irrespective of the fact whether there is an actual threat. This feeling of a space being not safe for comfortable use can be a cause of different factors ranging from physical, environmental. socio-economic and

psychological aspects (Abrams *et al.*, 2008). This feeling of riskscan rarely bethe cause of clinical neurological origins, but mostly due to a known trigger from the surrounding environment. This negative feeling while inhabiting public spaces can be a result of unfamiliar surroundings, threats from surrounding elements or a past crime involved with the space (Dillon, 2005). Direct victimization of a prior crime is the most obvious reason for this social anxiety of an individual. But this is obviously not the case for the majority of human beings (Hale, 1996; Kawshalya *et al.*, 2020; Prieto Curiel & Bishop, 2017). These dismissive feelings can result in the public spaces being neglected or under-used (Mak& Jim, 2017). Thus, exploring the factors which leads to the perceived risk and discomfort is essential for designing safe and convivial urban civic spaces. The aim of this research is to develop a framework to assess the perceived safety and comfort in urban civic spaces.

II. METHODOLOGY

This study encompasses a mixed method approach where qualitative data were first extracted following a quantitative validation of the developed framework. The total time taken for this exercise was about two years. Figure 1 represents the steps followed in the exercise.

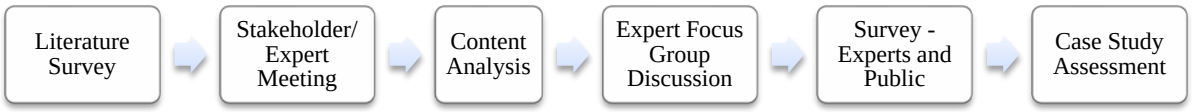

Fig. 1 Steps of Developing and Validating the Framework

A. Literature Survey

A comprehensive literature survey was carried out to explore the external stimuli which impacts on the perceived safety and comfort in the urban public realm as a whole. This was done referring the related articles, documents, reports, and journal papers in the data repositories like Scopus, google scholar etc.

B. Stakeholder/Expert Meeting

A physical meeting where the stakeholders from government and non-government organizations and the experts in the perception-based studies have gathered was held, where the current vulnerabilities in the urban public space was discussed comprehensively. The factors explored in the literature survey were rated by the stakeholders and experts based on their importance in an urban civic space. This was done with a 7-pointrating scale (1 – not important at all, 2 – very low importance, 3 – slightly important, 4 – important, 5 – moderately important, 6 – very important, 7 – extremely important). As the participants of this survey is more familiar with the aspects discussed 7-point scale is more sensitive for data recording and more accurate evaluation while remaining relatively compact (Finstad, 2010). These scores under each factor were later considered as the ‘weightage’ in the final framework.

C. Content Analysis

Data refining was carried out according to the rates provided by the stakeholders and experts. The factors were categorized into themes using a content analysis exercise. Factors with similar contents and meanings which received similar ratings were combined whenever possible. The factors were renamed as ‘sub-attributes’ and the main themes were renamed as ‘main attributes. This exercise identified two different sets of sub-attributes where some are to be evaluated based on the observations of the onsite researchers and the others to be evaluated through the user experience. As a user-perception based study this was appraised as important for the final framework.

D. Expert Focus Group Discussion

A secondary expert focus group discussion was carried out with foreign and local professionals and experts. The panel of 8 experts covered the disciplines ofarchitecture, urban designing, urban planning and landscape architecture. The explored main attributes and sub-attributes were modified, reworded, and altered according to the suggestions and comments received.

E. Survey - Experts and Public

The main attributes explored are of different importance for different sectors in urban public realm. The convenience of use may be more important in parks when compared to the streets. The researchers conducted a survey with experts and public to assess the importance of the main attributes in urban civic spaces. The participants were detailed on the difference between the other public realm sectors and the civic spaces explaining how their contribution will be used in this study.

Experts with more than 5 years of experience in the disciplines of architecture, landscape architecture, urban planning, and urban designing were asked to participate in the survey. The experts were selected through a snowball sampling method. The public were selected through convenience sampling. All the interested individuals were asked to participate in an online presentation where all the data explored so far were explained and the survey details were also conveyed. The respondents were asked to distribute a total of 100 marks among the seven attributes explored considering their importance in a civic space. They were given 2 more weeks after the presentation to submit

their responses. A total of 85 responses (35 experts and 50 public) were collected through this exerciseand the framework was developed and finalized from the responses. Consequently, the final scoring formula was developed with all the collected ratings to assess the perceived safety and comfort of urban civic spaces.

III. CASE STUDY ASSESSMENT

The field data were collected through three case studies representing aforecourt, square, and plaza. All the selected case studies are located in the Colombo Municipal Council context of Sri Lanka. The Arcade Independence Square was selected as the square for the study. It is a renovated building complex used as a shopping complex along with an outdoor space designed for resting and common use of the public. The plaza selected is the Echelon square premises, also known as Dutch hospital shopping precinct. This is one of the oldest buildings in the Colombo fort area, currently conserved as a heritage building. The seating space provides a resting and gathering space for the urban users. The forecourt selected for the study is Fort railway station forecourt. This is considered as a transportation hub in terms of railways and buses. The front of the railway station facilitates numerous activities and behaviour patterns making it a prominent landmark in the Colombo Municipal Council area. The outdoor landscape of the selected case studies was scored for their respective levels of perceived safety and comfort based on the developed framework.

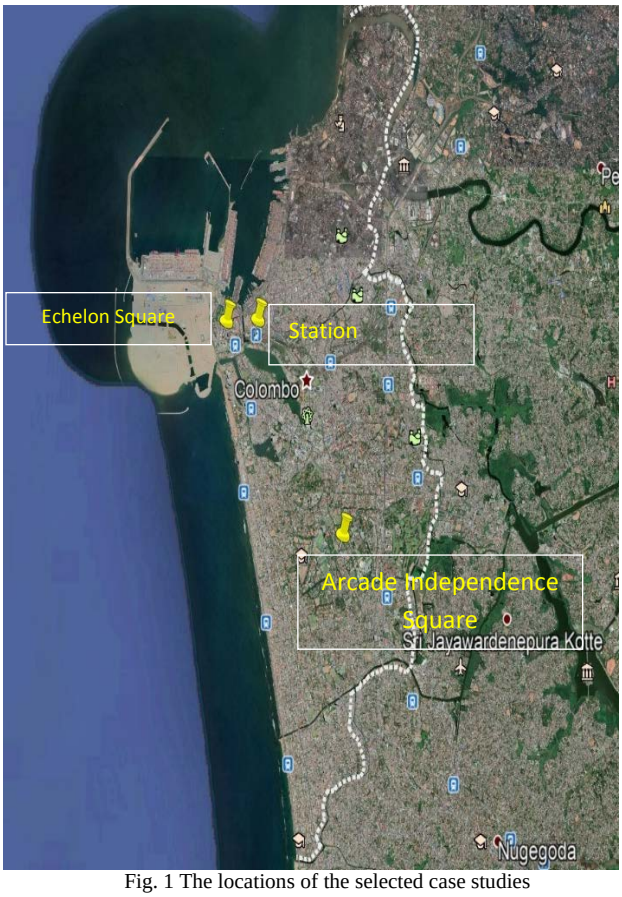

Fig. 1 The locations of the selected case studies

The research team visited the selected case studies during weekdays, weekends, holidays, and days with special functions. With these visits, the space was rated for each sub-attribute by the researcher with the opinions of four fellow researchers who accompanied in these visits. The subjective ratings were collected through a personal survey with semi structured interviews. A total of 13 questions were analysed through face-to-face interviews and the researcher recorded all the data assuring contactless communications. This was deemed as a good approach with the COVID 19 pandemic situation. The collected data was recorded and analysed.

IV. FRAMEWORK FOR ASSESSING PERCEIVED SAFETY AND COMFORT IN URBAN CIVIC SPACES

Table I represents the developed framework for assessing perceived safety and comfort in urban civic spaces. The 54 sub-attributes explored through the exercise of literature survey and expert/ stakeholder meeting was categorized into 7 main attributes through content analysis. Out of the 54 sub-attributes, 41 was assessed through observations and 13 through direct subjective ratings. For the assessment of this framework, the rating criteria used was in 0–3 scale where the absence will get zero marks and ideal conditions will get 3 marks. Less choices were e incorporated to make the scale more user-friendly, and it is easy to respond as there were only three main choices to make. More wider scales were used when more deeper insights were are needed and it was difficult for the respondents to decide on the answers (as there are more choices) unless they had a very thorough knowledge of the fact (Finstad, 2010). Apart from the 3-point rating scale, some sub attributes were measured with the dichotomous scale according to the presence and absence of the elements or qualities of elements. But instances like presence of pleasant scents, the case was different. In cases like pleasant scents, the negative state (unpleasant scents) was given zero marks where positive state (pleasant scents) was given double the mark related to the neutral state (no bad or good scents).

A. Visual Qualities

Gestalt Psychology claims that people perceive visual frames as whole and not as separate elements (Behrens, 1998). In the information processing theory, Kaplan and Kaplan (1989) forwards coherence and complexity as the immediate information extracted through the environment (Kaplan & Kaplan, 1989; Stamps, 2004). Similarly, recognition of patterns is studied as crucial in the perception as patterns are used to read the environment and detect possible threats (Mattson, 2014). The variety, order, rhythm, and density of the arrangement of elements are considered in this study as these provide the opportunity to read and understand the immediate environment. It is also determined that users prefer medium levels of diversity compared with the low and high levels (Day, 1967; Ode *et al.,* 2010). Unity and harmony are essential to provide a

coherent image to the user for the assurance of perceived safety and comfort. Thus, the responsiveness of the elements to the existing environment is assessed. The areas with cultural and historical importance should not use neon colours for lighting up the premises. This will destroy the visual appeal of the space creating more complicated feelings to the users. It is important to include these as aspects which impacts on the assurance of perceived safety and comfort for the users (Palmer *et al.*, 2013).

TABLE I FRAMEWORK DEVELOPED FOR ASSESSING PERCEIVED SAFETY AND COMFORT OF URBAN CIVIC SPACES

Main Attribute	Sl. No.	Sub-Attribute	Rating Criteria	Weightage	Measuring Criteria
Visual Qualities	01	Variety of the elements on Sidewalk	0 = None or very few 1 = Very low/ too high 2 = Low/ High 3 = Moderate	5	Ob
	02	Order and the organization of the elements	0 = Highly chaotic/ not organized at all 1 = Slightly organized 2 = Organized 3 = Highly organized	6	Ob
	03	Rhythm of arrangement of elements	0 = None of the elements show a visible rhythm 1 = one element shows rhythm 2 = two elements show rhythm 3 = more than 2 elements show rhythm	5	Ob
	04	Density of elements	0 = No elements/ too much 1 = Very low or very high density 2 = Low or high density 3 = Adequate levels of elements	5	Ob
	05	Diversity of the Architectural features	0 = Extremely high/ No diversity 1 = Very high / Very Low Diversity 2 = High Diversity/ Low Diversity 3= Adequate medium level diversity	4	Ob
	06	Variety/ Diversity of softscape features	0 = Extremely high / No diversity 1 = Very high / Very Low Diversity 2 = High / Low Diversity 3=Adequate (medium) level diversity	5	Ob
	07	Ephemeral changes	0 = No ephemeral changes (softscape) 1= Ephemeral changes present (softscape)	3	Ob
	08	Responsiveness of the elements to the context	0 = Not responsive/ inappropriate for the area 1 = Slightly responsive to the context 2 = Medium level of responsiveness 3 = Highly responsive to the context	5	Ob
	09	Responsiveness of the Nighttime lighting aesthetics	0 = Not responsive at all/ inappropriate 1 = Slightly responsive to the context 2 = Medium level of responsiveness 3 = Highly responsive to the context	5	Ob
Spatial Configuration	10	Visual Connection among spaces	0 = No connection 1 = Slightly connected 2 = Somewhat connected 3 = Adequately connected	6	Ob
	11	Physical Connection among the spaces	0 = No connection 1 = Slightly connected spaces 2 = Somewhat connected spaces 3 = Adequately connected spaces	6	Ob
	12	Day time natural lighting	0 = No lighting at all 1 = very low level of lighting 2 = Slightly adequate level of lighting 3 = Adequate level of lighting	5	Ob
	13	Night-time lighting	0 = No lighting at all 1 = very low level of lighting 2 = Slightly adequate level of lighting 3 = Adequate level of lighting	7	Ob
	14	Degree of visibility to the surrounding	0 = Not visible/ Extremely visible with no privacy 1 = Very low/ Very high visibility 2 = Low/ High visibility 3 = Adequately visible without hindering the privacy	6	Ob

	15	Relative scale of the elements	0 = No elements in the surrounding 1=Too high/ too low 2= high/ low 3 = Adequate height with the human scale	4	Ob
	16	Accessibility	0 = No access at all 1 = Slightly accessible 2 = Accessible but not adequate 3 = Highly accessible	4	Ob
	17	Perceived Openness/ Enclosure of the space	0 = Fully open/ closed 1 = too high/ too low (openness/ enclosure) 2 = high/ low (openness/ enclosure) 3 = Perfectly balanced openness/ enclosure	7	Sr
	18	Perceived scale of the surrounding	0 = No elements in the surrounding 1=Too high/ too low 2= high/ low 3 = Relatively adequate height	5	Sr
Pleasurability	19	Greenery and water features	0 = Both vegetation and water absent 1 = vegetation present - minute percentage/ no water/ low water 2 = vegetation - high percentage/ water low 3 = vegetation and water present high percentage	5	Ob
	20	Visibility of the sky	0 = Sky is not visible/ no obstructions to sky visibility 1 = very low visibility/ very high visibility 2 = low visibility/ high visibility 3 = Adequate visibility	4	Ob
	21	Scenic backgrounds	0=not scenic at all 1 = Slightly scenic 2 = Scenic 3 = highly scenic	4	Ob
	22	Pleasant scents	0 = unpleasant scents/ aromas present (very noticeable) 1 = neutral (no pleasant or unpleasant scents) 2 - Presence of pleasant scents	5	Ob
	23	Pleasant sounds	0 = very uncomfortable sounds making it difficult to stay 1 = No special sounds from nature (pleasant), not uncomfortable as well 2 = Pleasant sounds are available	4	Ob
	24	Aesthetics in the elements	0 = absent/ No aesthetics at all 1 = No specific aesthetics but visually attractive 2 = present but barely noticeable 3 = noticeable aesthetics	3	Ob
	25	Perceived attractiveness of the space	0 = Not attractive at all 1 = Slightly attractive 2 = Interesting 3 = Very attractive	5	Sr
	26	Perceived interestingness of the space	0 = Not interesting at all 1 = A bit interesting 2 = Interesting 3 = very interesting	5	Sr
Inclusiveness	27	People in the vicinity	0=No people at all/ Extremely high number of people present (most of the time) 1 = Very low/ very high number of people present (most of the time) 2 = Adequate number of people present (only at active/ rush hours) 3 = Adequate number of people present (most of the time)	6	Ob
	28	Diversity of the users	0 = No diversity at all 1 = presence of diverse people	4	Ob
	29	Direct surveillance	0 = No surveillance cameras 1 = very low/ very high surveillance 2 = adequate amount of surveillance (no disturbance to privacy)	6	Ob

	30	Indirect Surveillance	0 = blank walls/ no permeability to façade at all 1 = very few number of active facades/ too much active facades 2 = Adequate number without disturbing the privacy	6	Ob
	31	Perceived trustworthiness of the users	0 = Not looking trustworthy at all 1 = Looks somewhat trustworthy 2 = Looks trustworthy 3 = Looks highly trustworthy	5	Sr
	32	Perceived ability for comfortable usage	0 = Not comfortable at all 1 = Slightly comfortable 2 = Comfortable 3 = Highly comfortable	4	Sr
Convenience	33	Seating and shelters in the vicinity	0 = No shelter or seating spaces 1 = Shelters and seating spaces present	5	Ob
	34	Sanitary facilities	0 = absent 1 = present	4	Ob
	35	Physical condition	0 = Not maintained at all/ deserted like 1 = very slightly maintained 2 = maintained and clean but not adequate 3 = very high maintenance and very clean	5	Ob
	36	Visual stability of the elements	0 = not comfortable at all 1 = seems slightly comfortable 2 = Slightly comfortable 3 = Comfortable	4	Ob
	37	Safety features	0 = No safety features 1 = presence of safety features (wherever needed)	5	Ob
	38	Proper boundary with the outside environment	0 = No demarcation at all 1 = Presence of Demarcations (but not adequate) 2 = Presence of proper demarcations within the premises	3	Ob
	39	Parking facilities	0 = No parking facilities 1 = Presence of Parking facilities for the civic space	4	Ob
	40	Visual comfort with glare and reflectance	0 = uncomfortable 1 = comfortable (no discomfort)	3	Ob
	41	Perceived cleanliness and maintenance	0 = Not cleaned at all 1 = Slightly cleaned 2 = Cleaned 3 = Very clean	5	Sr
	42	Perceived comfort from external stimuli	0 = Not comfortable at all 1 = Slightly comfortable 2 = Comfortable 3 = Highly comfortable	5	Sr
	43	Perceived microclimatic comfort	0 = Not comfortable at all 1 = Slightly comfortable 2 = Comfortable 3 = Highly comfortable	6	Sr
Activities	44	Range of activities and behaviours	0 = No diversity in the activities present/ high diversity 1 = Adequate level of diversity of activities	4	Ob
	45	Amenities for meaningful activities	0 = absent (no bus stops, vendors, shops etc) 1 = present (bus stops, vendors, shops etc present)	6	Ob
	46	Visual access to the activities	0 = No visual access at all 1 = Very low visual access 2 = Medium level visual access 3 = High visual access	5	Ob
	47	Clear demarcations among different activities	0 = absent of clear demarcations 1 = presence of clear demarcations	4	Ob
	48	Perceived safety and comfort from activities in daytime	0 = Not safe at all 1 = Slightly safe 2 = Safe 3 = Very safe	7	Sr
	49	Perceived safety and comfort from activities in nighttime	0 = Not safe at all 1 = Slightly safe 2 = Safe 3 = Very safe	7	Sr

Imageability	50	Past records of incivilities/ crimes	0 = presence of past records of crime 1 = absence of past records of crime	6	Ob
	51	Landmarks, focal points, and contrast	0 = absent (No landmarks) 1 = present (landmarks present)	5	Ob
	52	Visual weight of the scene	0 = no visual weight/ extremely high visual weight 1 = very low/ very high levels 2 = low/ high levels 3 = medium levels/ adequate levels	4	Ob
	53	Perceived legibility of the space	0 = Not legible at all 1 = Slightly legible 2 = Legible 3 = Very high legibility	6	Sr
	54	Perceived image of the space	0 = Very bad image 1 = Nothing special 2 = Good image 3 = Very good image	6	Sr
Ob – Evaluated through observations Sr – Evaluated through subjective ratings of the users					

B. Spatial Configuration

Appleton's Prospect Refuge theory claims that people are more comfortable and feel safe in spaces which allows them to observe the surrounding without being noticed by the others (Appleton, 1975). Ensuring the ability to see without being seen intends the ability to use the space with pleasure (Ramanujam, 2007). Based on this principle the visual connection, lighting levels, visibility to the surrounding and perceived openness and enclosure are assessed. The perfectly balanced criteria is used as the highest rating as it assures balanced levels of prospects and refuges (Kawshalya & Dharmasena, 2019). The Jacobs concept of 'eyes on street' theory documented that being in the people's line of vision makes spaces more comfortable for use (Yokohari *et al.,* 2006). With this theory as the foundation, it is further disclosed that any space which affords escape routes are perceived as safe by the users (Baran *et al.,* 2018). Proper accessibility is important in places like squares and plazas which are defined spaces in the midst of urban buildings. The spaces in between should be connected adequately confirming the safety without obstructing the privacy of the users. The scale of the surrounding elements is important in the open spaces. The scale is used to evoke different feelings of the users in designing spaces (Nasar, 1997). It is documented that human feel more secure and comfortable in spaces similar to the size of themselves (Mehta, 2014).

C. Pleasurability

The biophilia hypothesis claims that people are attracted towards the natural and living components like trees and water (Kellert & Wilson, 1993). Based on this fact the presence of greens and water features were added as sub-attributes. The visibility of sky in the background is an important feature assessed as an indicator of thermal assessment (Zeng *et al.,* 2018). Thermal comfort directly impacts on the perceived comfort of the users. The stimuli perceived through sensory organs are important in the comfortable use of the space. Thus, the visual attractiveness of the space, comfort from sounds and scents are assessed in the framework (Elsheshtawy, 1997; Porteous, 1996; Stamps, 2004). Enhanced visual aesthetics are assessed for the scenic quality of the backgrounds and the additional aesthetics in elements like designed seating, lighting, tree gratings etc. (Mace, 1962). Along with these peoples' perception of the attractiveness (visual aspect) and interestingness (related to all active senses in perception) of the spaces are assessed.

D. Inclusiveness

The Jane Jacobs concept of 'eyes on street' or co presence claims that more people using the space will ensure more natural surveillance promising the perceived safety of the users (Ceccato, 2019; Jacobs, 1961). The diversity of people recreating is also essential as people feel anxious and uneasy when there are only males, women, or elderly in the space. These types of vulnerable groups attract more attention making it difficult to use the space with ease (Hung & Crompton, 2006; Maas *et al.,* 2009). Apart from these, direct surveillance from surveillance cameras, security officers are also important for perceived safety and comfort. Direct surveillance in gathering and resting spaces should be provided without hampering the privacy of the users.

E. Convenience

The concepts like sense of place and place making describes the idea of making public spaces physiologically comfortable, sociable, convivial and healthy for the use of people (Boros & Mahmoud, 2021; Stedman, 2002). The satisfaction from thermal and physical aspects results in achievement of cognitive and aesthetic needs of human beings yielding to the better use of the space(Maslow, 1954). The infrastructure for resting, shelters, physical condition of the space, safety features and parking facilities are assessed to fulfil the physiological aspects which finally results in the psychological safety and comfort (Muderrisoglu & Demir, 2004). The presence of sanitary facilities is important in the use of public spaces like parks,

squares and plazas where people relax and gather (Hung & Crompton, 2006; Mak & Jim, 2017). The visual comfort from stable structures onsite, reflectance and glare are also important for the perceived comfort of the users. The perception of comfort from the external stimuli like traffic, weird scents and sounds are expected to be assessed with the subjective ratings of the users. Similarly, the user perspective of the microclimatic comfort of the space is also assessed.

F. Activities

The place making theory emphasizes the importance of activities in creating a better public space (Burgess, 1979). Activities which are meaningful will bring forth this enhancement of public spaces ensuring the safe use of the space (Mehta, 2014). Meaningful activities ameliorate the level of sociability as people can easily be a part of the space through them (Whyte, 1980). The amenities like bus stops, vendors and shops are considered as the amenities which promote the meaningful activities. The visual link to these activities from any point in the square/ plaza is important in assuring the safety of users in case of any emergency (Oldenburg, 1989). Clear separations between different types of activities convey the message of proper use of the space and this further assures the extension of activities in the marked boundary. The user ratings are obtained for the perceived safety levels for the use of space with activities in both daytime and night-time.

G. Imageability

Lynch claims that the strong visual images creates a memorable experience for the users (Lynch, 1960). The imageability or the memorability of the space directly affects the psychological satisfaction of the users (Sundilson, 2002). Presence of landmarks and visual weight of a scenery creates a coherent image of the space making it more legible for the users (Coeterier, 2002; Hammitt *et al.*, 2006). The past record of crime also impacts on the safety levels onsite and the long-term image of the space. Similarly, the ability to read the space and the overall image of the space is assessed with the subjective ratings of the exercise.

V. RESULTS AND DISCUSSION

The survey conducted with the experts and public produced in the following results (Table II).

TABLE II SUMMARY OF SIGNIFICANCE SCORE RESULTS FROM EXPERTS AND PUBLIC

Attribute	Experts			Public			Average		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Visual Qualities	35	14.63	3.789	50	15.09	2.504	85	14.90	3.086
Spatial Configuration	35	14.94	3.447	50	14.87	2.803	85	14.90	3.065
Pleasurably	35	12.91	3.258	50	13.62	2.191	85	13.79	2.672
Inclusiveness	35	13.74	4.182	50	14.90	2.026	85	14.43	3.131
Convenience	35	15.09	3.081	50	17.16	3.522	85	16.30	3.483
Activities	35	14.06	4.379	50	12.08	2.257	85	13.27	3.343
Imageability	35	13.51	3.906	50	11.62	3.022	85	12.40	3.519

An Independent sample t-test was conducted to examine the differences between experts and public across the seven attributes. The results depicted a significant difference between the responses of experts and public in spatial configuration assessment $t(83) = -4.177$, $p < 0.000$, Cohen's $D = .022$, inclusiveness assessment $t(83) = -2.287$, $p = .027$, Cohen's $D = .353$ and imageability assessment $t(83) = 3.132$, $p = 0.002$, Cohen's $D = .541$. The effect size calculations represent that the statistically significant difference between two groups can be considered small. Thus, the average of the means is considered in the final score calculation of the framework. These values signify the importance of the seven attributes in the evaluation of civic spaces when compared with the other urban public spaces. The figures show that convenience is most expected ($M = 16.30$, $SD = 3.483$) while imageability is least expected ($M = 12.40$, $SD = 3.519$) for the assurance of sense of safety in an urban civic space. The average mean value is referred as 'significance score' for each main attribute with all the collected data, the following equation was developed for the calculation of the final score. Here the sum of scores for all sub attributes were calculated with the expert weightages obtained under each sub attribute and significance scores (from both experts and public) obtained for main attributes.

$$\begin{pmatrix} \boldsymbol{PsychologicalSafety} \\ \boldsymbol{andComfortScore} \\ (\boldsymbol{UrbanCivicSpaces}) \end{pmatrix} = \sum \left\{ \frac{\begin{pmatrix} Applicableratingfor \\ thesub-attribute \end{pmatrix}}{\begin{pmatrix} Totalratingforthe \\ sub-attribute \end{pmatrix}} \times \frac{\begin{pmatrix} ExpertWeightagefor \\ sub-attribute \end{pmatrix}}{\sum \begin{pmatrix} Expertweightagesfor \\ sub-attributesunder \\ themain-attribute \end{pmatrix}} \times \begin{pmatrix} Averagesignificance \\ scoreforthemain \\ attribute \end{pmatrix} \right\}$$

The collected data were recorded and inserted into the above formula for the final calculation of the scores. The subjective ratings for the 13 sub-attributes obtained from the onsite users of the selected case studies were assessed with their respective average scores. A total of 98 responses were collected where 35 responses were for Arcade square, 33 responses for Echelon square and 30 responses for Station forecourt. The analysis results for the selected case studies are represented in Table III.

TABLE III FINAL RATINGS FOR THREE CIVIC SPACES, ARCADE INDEPENDENCE SQUARE, ECHELON SQUARE AND FORT STATION FORECOURT

Sl. No.	Attributes Assessed	Measurement Criteria	Arcade Square		Echelon Square		Station for ecourt	
			Rating	Score	Rating	Score	Rating	Score
	Visual Qualities							
1	Variety of the elements on Sidewalk	Ob	3	1.73	2	1.16	1	0.58
2	Order and the organization of the elements	Ob	3	2.08	3	2.08	1	0.69
3	Rhythm of arrangement of elements	Ob	3	1.73	3	1.73	1	0.58
4	Density of elements	Ob	3	1.73	3	1.73	1	0.58
5	Diversity of the Architectural features	Ob	2	0.92	2	0.92	1	0.46
6	Variety/ Diversity of softscape features	Ob	3	1.73	2	1.16	1	0.58
7	Ephemeral changes	Ob	1	1.04	0	0.00	1	1.04
8	Responsiveness of the elements to the context	Ob	2	1.16	2	1.16	1	0.58
9	Responsiveness of the Nighttime lighting aesthetics	Ob	3	1.73	3	1.73	3	1.73
	Spatial Configuration							
10	Visual Connection among spaces	Ob	3	1.79	3	1.79	3	1.79
11	Physical Connection among the spaces	Ob	3	1.79	3	1.79	3	1.79
12	Day time natural lighting	Ob	2	0.99	3	1.49	3	1.49
13	Night-time lighting	Ob	3	2.09	3	2.09	2	1.39
14	Degree of visibility to the surrounding	Ob	3	1.79	1	0.60	2	1.19
15	Relative scale of the elements	Ob	3	1.19	2	0.79	3	1.19
16	Accessibility	Ob	3	1.19	3	1.19	3	1.19
17	Perceived Openness/ Enclosure of the space	Sr	2.49	1.73	1.97	1.37	1.27	0.88
18	Perceived scale of the surrounding	Sr	2.31	1.15	2.36	1.17	2.03	1.01
	Pleasurability							
19	Greenery and water features	Ob	3	1.97	1	0.66	1	0.66
20	Visibility of the sky	Ob	2	1.05	1	0.53	2	1.05
21	Scenic backgrounds	Ob	3	1.58	1	0.53	1	0.53
22	Pleasant scents	Ob	1	0.99	1	0.99	0	0.00
23	Pleasant sounds	Ob	1	0.79	1	0.79	0	0.00
24	Aesthetics in the elements	Ob	2	0.79	3	1.18	0	0.00
25	Perceived attractiveness of the space	Sr	2.54	1.67	2.24	1.47	1.27	0.83
26	Perceived interestingness of the space	Sr	2.14	1.41	1.67	1.10	1.37	0.90
	Inclusiveness							
27	People in the vicinity	Ob	2	1.86	2	1.86	1	0.93
28	Diversity of the users	Ob	1	1.86	0	0.00	1	1.86
29	Direct surveillance	Ob	1	1.40	1	1.40	1	1.40
30	Indirect Surveillance	Ob	0	0.00	1	1.40	2	2.79
31	Perceived trustworthiness of the users	Sr	2.46	1.91	1.61	1.25	0.97	0.75
32	Perceived ability for comfortable usage	Sr	2.03	1.26	2.06	1.28	2.43	1.51

	Convenience							
33	Seating and shelters in the vicinity	Ob	1	1.66	1	1.66	0	0.00
34	Sanitary facilities	Ob	1	1.33	1	1.33	1	1.33
35	Physical condition	Ob	3	1.66	3	1.66	2	1.11
36	Visual stability of the elements	Ob	2	0.89	1	0.44	2	0.89
37	Safety features	Ob	1	1.66	1	1.66	1	1.66
38	Proper boundary with the outside environment	Ob	2	1.00	1	0.50	1	0.50
39	Parking facilities	Ob	1	1.33	1	1.33	1	1.33
40	Visual comfort with glare and reflectance	Ob	0	0.00	0	0.00	0	0.00
41	Perceived cleanliness and maintenance	Sr	2.46	1.36	2.73	1.51	1	0.55
42	Perceived comfort from external stimuli	Sr	1.89	1.05	1.73	0.96	0.97	0.54
43	Perceived microclimatic comfort	Sr	2.00	1.33	2.03	1.35	1.20	0.80
	Activities							
44	Range of activities and behaviours	Ob	1	1.61	1	1.61	1	1.61
45	Amenities for meaningful activities	Ob	1	2.41	1	2.41	1	2.41
46	Visual access to the activities	Ob	2	1.34	3	2.01	1	0.67
47	clear demarcations among different activities	Ob	1	1.61	1	1.61	3	4.83
48	Perceived safety and comfort from activities in daytime	Sr	2.63	2.47	2.55	2.39	0.73	0.69
49	Perceived safety and comfort from activities in nighttime	Sr	2.54	2.38	1.91	1.79	0.63	0.59
	Imageability							
50	Past records of incivilities/ crimes	Ob	1	2.76	1	2.76	0	0.00
51	Landmarks, focal points, and contrast	Ob	1	2.30	1	2.30	1	2.30
52	Visual weight of the scene	Ob	2	1.22	1	0.61	2	1.22
53	Perceived legibility of the space	Sr	2.06	1.89	2.48	2.28	2.13	1.96
54	Perceived image of the space	Sr	2.60	2.39	2.30	2.11	1.40	1.29
	Final Scores			81.75		72.66		58.22
Ob – Evaluated through observations Sr – Evaluated through subjective ratings of the users								

According to table III Arcade Independence Square has scored highest (81.75) while echelon square has scored second (72.66) and fort station forecourt the scored third (58.22). A summary of the scores under each main attribute for all the three case studies (Figure 2) represents the variation of the scores among the three cases.

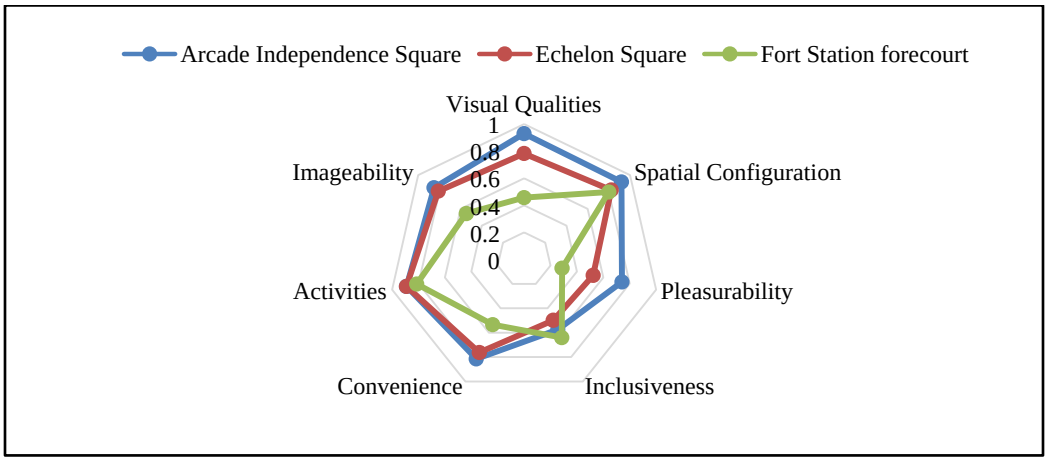

Fig. 2 Variation of Scores of three case studies (Arcade independence square, Echelon Square and Station forecourt) among the seven main attributes

The radar chart (figure 2) represents the variation of the scores in three case studies across seven main attributes. Arcade Independence Square has scored highest in all other attributes except Inclusiveness. The station forecourt has scored highest in this attribute. The station forecourt is functioning all day with numerous people using the space for buses as well as for trains. These functions made this forecourt one of the busiest spaces in Colombo with lots of 'eyes on the street' with direct and indirect surveillance. The convenience of Fort Station forecourt is the lowest due to absence of seating spaces and shelters along with other amenities for comfortable use. The meaningful activities in both Arcade and Echelon square have similar scores conveying the idea that both are situated in a similar context with priority to similar activities. People use these two spaces mainly for resting, gathering and for the adjacent shopping areas. Imageability is lowest in the fort as a result of history woven with the space with many other incivilities and protests frequently happening in the space. The visual qualities are also rare in the case of station forecourt due to the prominence provided for the adjoining activities with the design. The spatial configuration of fort station forecourt and echelon square are similar as both these spaces are one straight land plot which allows the connection between the spaces adequately with proper visibility to the surrounding. Pleasurability is highest in Arcade with all the greenery, water features, and other aesthetic elements.

VI. LIMITATIONS OF THE STUDY

The proposed framework is primarily based on literature review of previous research on psychological safety and comfort in urban contexts. The discussions and weighting process must have been biased to the expertise of a particular expert/ public. Thus, there might be a chance that the final figures reflect subjective values of an individual. The selected cases under the civic spaces had its own merits and demerits since the classification was based on a literature basis but selected on the availability in the Sri Lankan context. The selected case studies might not reflect the perfect combination of the characteristics of squares, plazas, and forecourts.

The variety of randomly selected individuals has not been even considered for the study which might cause more complications. Replication of the framework will need a direct input from an expert with a background of perception and behaviour-based studies or better if that individual is directly involved in psychology or sociology disciplines. Several recent incidents like COVID 19 pandemic might affect the experience of open public spaces as a result of common use of these spaces. The developed attributes have been chosen covering a large range of themes so that any other specialities and differences can be addressed within these seven main attributes. Each sub attribute developed may also cover a large area of factors which is not mentioned in the study. As an example, if the arrangement of light poles is rhythmic, then it can be included under rhythmic arrangement of elements. Similarly, many other visual aspects of elements can be included in the broad sub-attributes introduced. Hence the developed framework can be understood as more welcoming and open-ended to include various other aspects depending on the context of use. Evaluating these spaces with multiple researchers during various different time frames can enhance the quality of results yielding better outcomes.

VII. CONCLUSION

This paper intends to develop a framework for empirical evaluation of the urban public civic spaces. The developed framework has gone through a thorough evaluation and validation process with the experts and stakeholders making it more comprehensive, and practical. A comprehensive literature survey following a stakeholder/ expert discussions and a content analysis yielded a framework with 54 sub-attributes categorized under 07 main attributes. The seven main attributes are namely visual qualities, spatial configuration, pleasurability, inclusiveness, convenience, activities and imageability. The 54 sub-attributes were divided into two categories based on their method of evaluation as attributes measured through observations and through direct user ratings. The weightages given by the experts for all the attributes express the difference of importance of each in the context of civic spaces in assuring the perceived safety and comfort of the users. The framework is developed to include as many aspects as practical yet keeping it simple for evaluation.

The observational rating of the spaces is to be done by a researcher or a similar individual with a background of perception and behaviour-based studies and urban design. The expert scores for the importance of main attributes were also taken as the significance of these will vary with the purpose and function of the urban realm elements. Thus, special scores considering the character of civic spaces were obtained. With all these scores, an equation was developed to assess the urban civic spaces. Three types of urban civic spaces as squares, plazas and forecourts were then assessed using this developed framework. The three selected case studies; Arcade independence square, Echelon square and Fort station forecourt reflects the categories of square, plaza, and forecourts respectively. The final data analysed showed that in the context of Sri Lanka, the station forecourt is of least psychological safety and comfort while Arcade independence square is of highest perceived safety and comfort. The designing processes often overlook the most important requirements of the users. The consideration of the psychological safety and comfort in designing can result in better outcomes.

The use of this developed framework can easily assess the perceived safety and comfort levels in urban civic spaces. The proper use of this framework can help to gain more insights into the current status of the civic spaces and the aspects which need more attention. With the direct inputs of the users onsite, this framework captures the values and norms of the users reflecting their satisfaction with the

current conditions. This framework provides insight into urban civic spaces based on the psychology of the users foreseeing to develop, alter or redesign the current public spaces to be more convivial, safer, and comfortable.

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