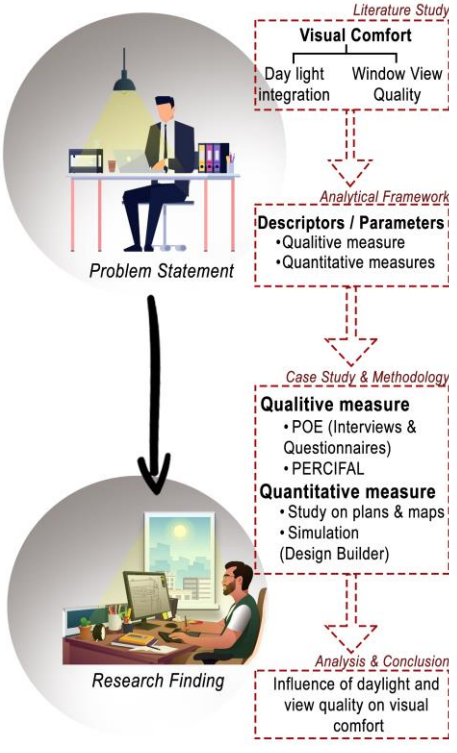
Built–Environment Sri Lanka

JOURNAL OF BUILT-ENVIRONMENT SRI LANKA, VOL. 13, NO. 2, 5-22
http://doi.org/10.4038/besl.v13i2.7680

Daylight and window view quality for visual comfort: the case of an office building in Jaffna

Delosha Thayanithy[1] and Narein Perera[2]
[1,2] Department of Architecture, University of Moratuwa

ARTICLE HISTORY
Received 01 January 2023
Accepted 02 February 2023



ABSTRACT

Architectural lighting is now simple and emotionless due to modern technological innovations, which makes it difficult to recognise the distinct character of a place. With the development of air conditioning and artificial lighting systems, architects are more inclined to adopt them than to design equivalent spaces in natural light, thus, taking advantage of ideal lighting conditions to raise the quality of space.

The major difference between artificial light and daylight is the "view", daylight integration systems offer. This is a research initiative to ascertain the perceptual influence of daylight and 'window view quality' in achieving visual comfort. With this in mind, a single case study is investigated, thereby involving like-minded respondents that engage in a similar work programme. As a limitation of scope, an environmentally rated building in a specific locality – Jaffna – is selected. Post Occupancy Evaluation forms the primary method adopted. Mapping of the space is undertaken, together with Perceptual Spatial Analysis (PERCIFAL) surveys, and correlate responses to the physically observed spaces.

Results show the occupants agree that natural light is the preferred mode of lighting for the workspace. Although the window views are deemed to enrich the working environment, the emphasis on its preference does not strongly correlate among all respondents. Conclusions are drawn on the parameters surveyed - that drive window view quality and daylight perception - to form implications for design both as individual elements and as a whole, to achieve overall visual comfort within a specific office environment.

KEYWORDS: Window View Quality, Daylight Integration, Visual Comfort, Post Occupancy Evaluation

1. Introduction

The physiological and psychological effects of living in industrialized interiors of urban contexts with less natural light and more electric light throughout the day and night are evident. The significant and obvious difference between daylight from electrical light is the view; the view outdoors when looking out of the window into surrounding (greenery / built) spaces, or at the sky. (Münch et al., 2020)
When Heschong (2021) interviewed workers about the quality of lighting in their workplaces, they reported they barely noticed when the overhead electric lighting switched off when there was sufficient daylight from the skylights. “Sure, they liked the lighting system overall, it was high quality, and it made their jobs easier, but they loved the views, and could not stop talking about the window views, and how good it made them feel at work.” (Heschong, 2021)
Several positive effects on occupants have been recorded for the qualitative window views which offer visual connections with the exterior. The positive effects are enhanced health and well-being, emotions, improved cognitive performances, ecological contentment, increased comfort level, and recovery from stress and depression. However, though window view quality has more advantages, there had been only limited design guidelines for evaluating window view quality. Further, the suggested approaches are not immediately supported by comprehensive and conclusive research findings. Thus, the cohesive definition of window view quality which could be applied to various building typologies and their occupancies is lacking. (Ko et al., 2020)
The purpose of this study is to ascertain how much a workplace's perceived comfort and contentment may be impacted by daylight integration and window view quality.
Although previous studies have attempted to assess the integration of daylight using a variety of assessment techniques, there is little consistency in the methodologies used to analyse and correlate the window views and their impacts. Further, each of these studies only addresses a portion of the complex interactions between windows, outdoor and indoor conditions, and occupants.
The main aim of the research is to prompt an academic position which will increase interest in, and understanding of the benefits, challenges, and evaluation techniques for window views.
The spatial quality of a space is not limited to the interiors among the walls; the view quality through the façade also has an impact on the occupant’s perception of the space. From this point of view, it is necessary to validate the comfort level and user perception in architecture; especially in office buildings as most hours of a working employee are spent indoors which impacts his/ her psychology and physiology.With a methodology primarily focused on POE (Post Occupancy Evaluation), the case study building selection needs to be specific, one which could eliminate the other influencing factors. In this aspect, it was decided to select a green-rated building which also incorporates the principles of sustainability, contemporary architecture, and technology. The context is Jaffna, Sri Lanka and the chosen building which is a private bank (name withheld by request) building. It consists of two different offices environments, branch, and regional offices at different levels, affording varying views and work patterns. Thus, enriching the perceptual exploration of the correlation.

2. Background

2.1 Light and Visual Comfort

Human physiological response to electromagnetic radiation outside the 380-780 mm range, is where the visual system is stimulated (Kronqvist, 2012). Circadian rhythms are strongly influenced by light, especially short wavelengths and bright light (Cajochen et al., 2000).
The quality of a lighting arrangement that satisfies a set of requirements is usually regarded to be the definition of visual comfort. The four main components of the visual function that affect the different aspects of visual comfort are light distribution, glare, illuminance, brightness, and daylight factor. (Araji, 2008)
Visual comfort is significantly impacted by ambient brightness. This effect also extends to the brightness of the immediate surroundings of the visual activity, as opposed to being restricted to the light sources themselves (such as the windows or the lighting fixtures). The choice of the environmental brightness pattern is strictly governed by considerations of visual comfort than by considerations of visual performance in real-world situations. This alone necessitates a revolution in lighting techniques. (Hopkinson, 1963)
There is a connection between light and productivity. People's expectations are related to visual comfort and can vary over time. (De Giuli,2008)

2.2 Daylight and Perception

Daylight is considered better than electric lighting. Surprisingly, however, the difference is smaller in occupations that require job performance and observation. The fact that people prefer to sit near windows is consistent with this ongoing pattern of favouring daylight (Boyce et al., 2003). But what makes windows so attractive? One explanation is that they give people what they want. Windows can provide lighting, natural light, ventilation, noise, and other benefits, as well as views from the space being used. They provide access to data on the passage of time and weather conditions, both of which incorporate considerable variability. A study of an office worker showed that the two most important features of a window were outside views and natural light (Collins,1975; Brill,1985, as cited in Boyce et al., 2003).
According to Boyce et al., (2003), daylight is just another light source from a physical and physiological point of view. Daylight can affect visual performance depending on how you look at it. Task performance can be better or worse depending on the amount of daylight provided and whether it creates glare, shadows, or blurry reflections. (Boyce et al., 2003)

2.3 Window view quality

Window views that offer a visual connection to the outside have a variety of benefits for users (Heschong, 2021). Better health, well-being, mood, cognitive functioning, environmental satisfaction, decreased discomfort, and stress recovery is a few of these benefits. (Baranzini & Schaerer, 2011).
The idea of window view quality is indeterminate since it depends on the observer and is consequently affected by environmental factors. These factors can either be physical factors such as climate, latitude, surrounding environment, and built structures or social factors such as cultural milieu and demographics. The type of buildings will also have an impact on window view quality according to the requirement. For instance, the window view requirement for patient rooms in hospitals may differ from those for business spaces. (Ko et al., 2022)

2.3.1 View quality descriptor parameters/components

In general, the parameters which impact the view quality could be categorised as quantitative and qualitative. The quantitative metrics are as follows: width, view depth, number of layers, view fragmentation, amount of vegetation, age and gender of individuals, and weather conditions. The aesthetic quality of the things dominating the view and the composition of the vista was the qualitative measurements. Three key elements of window view quality are content, access and clarity. (Ko et al., 2022)

- Content - The term "content" describes all the visible elements through the window view. Window views with natural features, three horizontal levels (ground, landscape, and sky), faraway components and movement are frequently considered to contain superior quality. (Markus, 1967)

- Access - The quantity of the view that a person can see from their viewing location is referred to as access (Ko et al. 2021). It relies on how windows and people in the space are arranged geometrically. There is no standardised evaluation technique for determining access, despite regulations that include considering viewing angles, window distances, or the percentages of the occupied area that fulfil "sufficient view out" criteria.

- Clarity - Clarity refers to how the outside information is visible to viewers while looking through the window (Ko et al. 2021). It depends on the optical qualities or occlusion patterns of a dynamic glazing or shading system, as well as how glazing and shade properties (Hill 1969; Konstantzos et al. 2015) vary over time in response to external stimuli (such as variations in daylight intensity and solar angles).

3. Method

This study is focused on daylight integration and window view quality, as factors that impact occupants' visual comfort in an office building environment. The research method employs two phases based on Post Occupancy Evaluation (POE) principles.
The first phase is a Pilot Survey, where the data collected is focused on establishing a detailed basis for the next phase of the study. The pilot survey also sensitises the respondents to the research objectives and the scope of the perceptual survey.
The second phase is approached as two components encompassing the two primary focus areas, daylight integration and window view quality.

3.1 Case Study – Office spaces of a Private Bank Building in Jaffna

The study focuses on the office spaces of a prominent private bank (name withheld upon request) building located in Jaffna town. The bank is selected for the characteristics listed below;

- Cultural Identity or Sense of Belonging - A building with a strong feeling of cultural identity. (tropicalbuildings.org) Therefore, a building and workspaces that readily relate to the user.
- Contemporary Design or Green Architecture – The LEED-rated design embraces sustainability and green design ideas, which are strongly represented in its appearance. (tropicalbuildings.org) The spaces incorporate passive strategies to reduce energy and increase the comfort of the users.
- Occupancy – It comprises a Branch office and a Regional office at different floor levels. Both offices include regular staff as well as various public users who utilise the space as well. The Branch office is located on the ground level while the Regional office is located on the first floor. Therefore, offers a variety of spaces that enrich the perception survey of users and parameters.

3.2 Pilot Survey

In the early stage, a pilot survey is carried out, where 40 employees responded among the 67 employees in the two office spaces. All employees, including Managers, were asked to be involved in the evaluation and fill out the questionnaire.
The preliminary questionnaire is prepared by including questions from both visual comfort perception and window view quality.
The questionnaire includes 10 questions, and they are all in simple English, as most of the respondents are not aware of the technical terms. The necessary definitions and descriptions are also provided for a better understanding.
The respondents are selected from both offices. They are advised to turn off the artificial lights close to their respective positions and respond to the questions experiencing the naturally lit environment.
The findings from the pilot survey showed that;

- Most of the employees prefer to work in a space which integrates daylight.
- Glare is the major issue for their discomfort
- Though many want to have good views from their working position, their views are very limited, and they do not prefer those views.
- As they have very limited time for their relaxation, they prefer to have good views from their seating position
- Most of them are not aware of the view quality and this survey helped them to start thinking on this topic.

3.3 Daylight Integration

The Daylight Integration study is approached as two components. The first component maps the level of illumination within the office spaces, using the simulation software DesignBuilder. DesignBuilder is an EnergyPlus-based software tool used for energy, carbon, lighting and comfort measurement and control. (designbuilder.co.uk) Thereafter, a perception survey is conducted utilising the accepted process of Perceptual Spatial Analysis (PERCIFAL), to correlate the measured illumination level and the perceived daylight quality within the spaces.

3.3.1 Mapping the level of illumination.

The illumination distribution within the spaces is mapped by utilising DesignBuilder's Radiance daylight simulation engine. The daylighting module calculates the findings for spatial daylight autonomy, annual sunlight hours, useful daylight illuminance, daylight illuminance, daylight factor, and uniformity for each zone. The output is communicated via detailed contour plots that show the amount of daylight and glare in any zone, block, or section of the entire building, which considers light reflection from all surfaces as well as light transmission from interior and external windows. (designbuilder.co.uk)

3.3.2 Perceptual Spatial Analysis (PERCIFAL)

PERCIFAL is a technique for visually evaluating space and light (Klarén et al., 2010). The insight is that 'important visual characteristics of space and light cannot be adequately described in photometric terms', which forms the basis of this methodology. The PERCIFAL approach is based on verbal-semantic explanations of direct visual observations that are then recorded via a questionnaire. The observer positions and measurements are marked on plans and elevations of the relevant space. Eight clearly defined visual concepts—light intensity, light distribution, shadows, light patches, specular reflections, glare, the colour of light, and surface colours —are utilised in PERCIFAL (Table 1) to describe the spatial light experience. The visual analysis discusses the intrinsic relationships of these experiences in the cohesive spatial context.

Table 1 Questionnaire structure to analyse daylight quality				
Index		Question	Scale Point	
			1	7
Indoor Environment Quality (IEQ)	Light level	Asses the light level of your working space	A dark space	A bright space
	Light distribution	Is the space, at eye-level, even light or has differences of darkness and brightness?	Very even distribution	Very big differences
	Shadows	Is the space characterized by contrasts from shadows? (The level of strength of the shadows you see)	Not strong shadows	Strong shadows
	Light Patches	Is the space characterized by strong contrasts created by light patches from windows and/or light sources?	No contrasts	Strong contrasts
	Specular reflection	Is the space characterized by specular reflections?	Not at all	Very much so
	Glare	Are you disturbed by glare in the space?	Not at all	Very much so
	Surface colour	Do you experience the space's surface colours as warm or cool?	Warm	Cool
	Visual perception of objects, people, and text	How does the light affect your perception of the shape of objects in the room?	Greatly obstructs	Greatly facilitates
		How does the light affect your ability to perceive people's facial expressions?	Greatly obstructs	Greatly facilitates
		How does the light in this space affect your ability to read the sample text given in the handout from a standard reading distance?	Greatly obstructs	Greatly facilitates
			0	1
	Colour of light	Do you experience the light as having a uniform colour or can you spot clear variations?	No, could be able to spot clear variations	Yes, having the uniform colour
Well-being	The ambience of the space	Your experience of the working space based on light quality	Open-ended – Analysis will be done by using the 'Word Cloud" Method	

The condition of the indoor environment is evaluated based on the occupant's responses, which are scored on a seven-point scale. The survey used two different scale types: Type 1 bipolar scales, which have better results in the middle and range between two opposed ends. Type 2 unipolar scale, with the worst option at one end and the best option at the other.

There are two categories for the subjective assessment of the state of the interior environment.

- Indoor Environment Quality
- Well-being

3.4. Window View Quality

3.4.1. Window View Quality Parameter Survey

The Window View Quality parameters, as detailed in Section 2.3.1, are categorised into three main divisions based on the literature analysis, Content: Access, and Clarity. The evaluation and scaling criteria are detailed in Table 2.

Table 2- Questionnaire structure to analyse window view quality

Parameter	**Index**	Questions	Scale Point		Notes
Content	Cloudiness	Cloudiness of the sky on the survey day	0	Clear sky without clouds	Depends on the weather condition of the survey day
			0.5	Partly cloudy	
			1	Cloudy	
	Sun	Whether the sun is visible or not	0	Cloudy (Not visible)	Depends on the weather condition of the survey day
			1	Clear sky with sun	
	Visible layers	How many layers are visible	1	Several	Several view layers are visible. The layers are Landscape, Buildings / Plants, Sky
			2	Two layers	
			3	Three layers	
	Greenery		0	No greenery elements	Greenery in the perspective to what extent (grass, bushes, single trees, or forest)
			0.5	About 10-50% of the view is greenery	
			1	More than 50% is greenery	
	Dynamic elements	Dynamic (movable) elements visible through the window	Multiple answers	People, Vehicles, Animals, Birds, Clouds, None	Movable things need to be marked. Multiple choices are possible
	Aesthetical quality	Rate the aesthetical quality of dominating buildings, trees, or the whole landscape.	1-7	1-Very Poor 7- Very Good	The following qualities are necessary for aesthetical quality: Age, upkeep, moderate complexity, and historical significance of buildings and trees. Landscapes should be coherent, readable, moderately complicated, and mysterious.
	Composition of visible elements	Evaluate the composition of visible elements by the balance between the existence of view and obstructing elements.	1-7	1-Very Poor 7- Very Good	Use two criteria to evaluate: the balance of the top-down, left-to-right, and the existence of view-obstructing items.
Access	Direction of working position	The direction of your chair/workspace with respect to the adjacent window.		Facing the window Facing opposite the window Window at your right	The exact position of the working chair with respect to the adjacent window

				side Window at your left side Not adjacent to any window	
	Distance	Minimum distance between your chair/workspace to an adjacent window		The assistance	Assistance should be given to the respondent to fill this. Measurements gained from the plans.
	View width	Horizontal view angle measured from the eye level of the working position		Below 30 degrees 30-degree - 60 degree 60 degree - 90 degree 90 degree - 120 degree Above 120 degrees	The assistance should be given to the respondent to fill this. Measurements gained from the plans.
	View depth	The distance from the window to the most distant visible element		0 - 1 km 1 - 2 km 2 - 5 km Above 5 km	The assistance should be given to respondents to fill this. Measurements gained from the plans.
		The distance from the window to the closest building.		0 - 100 m 100 - 200 m 200 - 300 m Above 300 m	Assistance should be given to the o respondent to fill this. Measurements gained from the plans.
Clarity	Window material	Which materials are used in the windows		Glass / Timber / Aluminium	No need to mention the window frames.
	Fragmentation	Fragmentation of the view by window mouldings or splitting of the view into more than one view.	0	Not fragmented	Most of the views are fragmented because of the louvres and double skin
			1	Fragmented	

A limitation of the selected building envelope is its double skin; most of the windows are covered by louvres. Therefore, the views are fragmented in most situations. However, the participants are asked to consider an unobstructed view when responding to the questionnaire.

3.4.2. Observational Mapping

The employees need relaxation time during work hours for their well-being. The accepted understanding is that spaces with good views could encourage the employees to move from their position and spend time for mental relaxation as well as physiological well-being.

As a means to correlate the window view quality and the perception of respondents, who occupy varying places of the office space, the users are requested to -

- sketch individual movement paths during their free time for mind relaxation. (Mapped on layout diagrams given as handouts).
- mark their favourite viewpoints and view directions on the same layout.

3.4.3. Analysis Protocol

The analysis of data collected from the two phases of the research method focuses on correlating the perception of the users and the measured/mapped elements of the office spaces

4. Results and Discussion

4.1. Daylight Integration

4.1.1. Mapping the level of illumination.

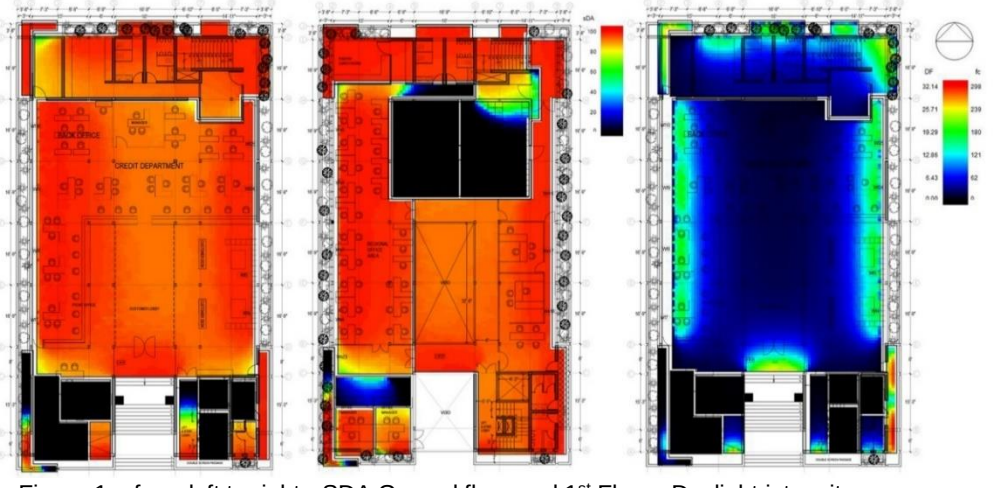


Figure 1 – from left to right - SDA Ground floor and 1st Floor. Daylight intensity – Ground floor

The results of the simulation, utilising DesignBuilder as detailed in section 3.3 above, demonstrate that both spaces considered receive sufficient daylight. In a scenario where the simulation assumed the external second skin of louvres was deemed to be open, the illuminance level received into the working spaces was more than adequate. The Spatial Daylight Autonomy (SDA) analysis shows that for more than 80 per cent of the time, the daylight levels are above the target illuminance within the physical space. (Figure 1) The illuminance mapping shows a uniform distribution of light within the space, although the east and west façade edges, which include the windows, are seen to be brighter. The areas that do not receive natural light are vaults and protected spaces. The objective is to now correlate the perception with that of the simulated.

4.2. Perceptual Spatial Analysis (PERCIFAL)

4.2.1. Spontaneous total experience of the office space

Results were retrieved from the 'Word Cloud Generator' by analysing the open-ended answers. The overall experience of the employees regarding the light quality based on their answers confirms they are satisfied with the amount of

natural light integration in their working spaces. They perceive the space as a good working environment as they are aware of the green building concept as well. The word “natural light” takes precedence.

4.2.2. Light level

The perception study results show that most respondents feel the high light level in their working environment. (32% see it as very bright). (Figure 2) This corresponds to the simulation results, where the illuminance level range of both spaces is between 62 to 180fc. (Figure 1) This exceeds the accepted illuminance level for an office space. The louvre layer, in practice, will reduce the measured illuminance level within the space, yet the perceived levels are still deemed high.

4.2.3. Light distribution at the eye-level

The results of the simulated and the perceived are seen to strongly correlate, showing an even distribution. The exception is the window edges, yet the phenomenon does not impact the users’ perception.

4.2.4. Space characterised by contrasts from shadows

The results show that most occupants feel fewer contrasting areas. Therefore, it had a minimum impact on users’ visual comfort.

4.2.5. Light patches

Most of the respondents perceived fewer contrasts by light patches, though there is a tendency for direct sunlight penetration, as the building orientation is North-South. Due to the adjustable louvres, the discomfort caused by light patches of direct sunlight is minimised.

4.2.6. Specular Reflection

Responses (35.8%) show most of the spaces are free from specular reflections. In very few spaces the specular reflections might be caused by wall paint and furniture, yet the user perception of it is minimal.

4.2.7. Glare

Glare is a problem faced by the occupants, as almost all the windows and fenestrations are facing East-West directions and the illumination intensity within the space. Though the installed adjustable louvre skin helped many to reduce glare, in some instances, due to the improper functionality of those louvres, occupants experience discomfort. The responses do not show a definite pattern as seen for other parameters.

4.2.8. The colour of light

The results show that a higher percentage (80.6%) of the occupants perceived the colour of light as uniform. The reason for this would be the even placement of windows in the working areas. Generally, it is difficult to perceive a variation in the colour of daylight.

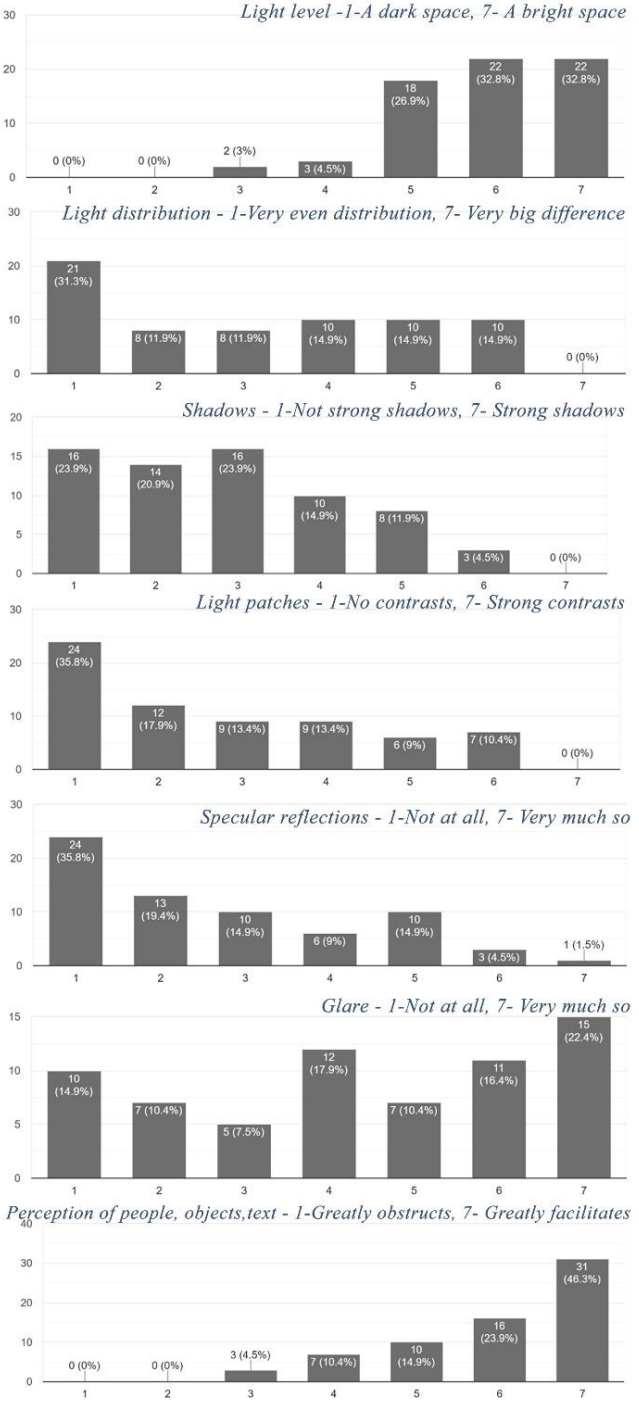


Figure 2 – Analysis of perceptual parameters

4.2.9. Surface colours

The results show that the occupant's neither feel the warmest colour nor the coolest colour. This intermediate perception could be because of the diffused daylight and the light reflection on the interior walls. The interior walls are applied with white and light grey colour shades, which gives uniformity to the visual experience. The white surfaces of the walls serve as a background for other surfaces, such as files, people, their attire, and activities. The participants saw this as a positive because it allows the area to set the stage for the users' activity.

4.2.10. Visual perception of objects, people, and text

The graphs clearly show that daylight facilitates the occupant's ability to perceive the shape of the objects, and people's facial reactions as well as read the text comfortably. A significant percentage (94%) of the occupants experienced the best perception level, in both office spaces.

4.3. Window View Quality

4.3.1. Content Factors.

Figure 3 – visible view layers - from left to right – one layer, two layers, and three layers.

- Cloudiness - As the survey was undertaken in the month of October, due to the rainy season the sky is perceived as an overcast sky. However, the results show a percentage (17.9%) perceive a clear sky from their perspective.
- Sky with or without sun - With a primarily overcast sky, the Sun is not deemed to be visible at the time of the survey (80.6%).
- Visible Layers – results show that most of the occupants can see only two layers (The building layer and the sky). Most of the occupants are unable to see the landscape as the building is elevated from ground level. Only a few occupants from different positions can see three layers. (Figure 3)
- Greenery - The results show that most participants can see only about 10-50% of green plants in the landscape they viewed. This could be evident in the following photographic study as well (Figure 3). Very few occupants perceived their views as not containing green plants. However, there are no views devoid of greenery in observation.
- Dynamic elements - Most occupants can see moving clouds and birds. Only a few can see the movement of people through the windows. Many noted that they could not see any dynamic elements through windows.

- Aesthetical quality of dominating buildings, trees, or the whole landscape - Diverse answers are received for this question. Comparatively 50% of the employees are satisfied with the views. But very few agree they have very good views. Most of them are not satisfied with their view elements.
- Composition of the elements visible - Comparatively, a higher percentage of the occupants perceive the composition of the visible elements as good. As it is an urban context, they can see the composition of buildings, trees, and sky.

4.3.2. Access Factors

- *Direction of work position* - The results show most of the users are seated facing away from the windows. (40.3%) This is deemed a limitation for their window views. (Figure 4)
- *Minimum distance between the chair to the adjacent windows* - The survey demonstrates most of the users are capable of a visual connection with the outdoors as 94% of them are seated less than 10m from the windows.
- *View width* – 65.7% of the occupants have a view width that exceeds 90^{o}. Thus, many opportunities for creating views.
- *View depth* – Similarly, 56.7% of the users can see beyond a view depth of 1km.

4.3.3. Clarity Factors

- Window Material - All windows are glass. In some instances, they are fixed tempered glass. However, all the windows are transparent and there is no obstacle caused by material aspects for views.
- Fragmentation of view - Due to the louvres and the double skin most of the views are fragmented, yet the louvre spacing is wide enough to overcome perceptual views towards the outdoors.

4.4. View Quality perceptual analysis

Results show 50.7% of the occupants have a frequent view through windows. A similarly large percentage of respondents rarely see (41.8%) and very few see at least once a day. None of them states as ‘never see’. When interviewing them, most respondents mentioned that “the lack of time and workload are the reasons for not spending time for window views” (sic).

These questions ended with diverse answers. One-third of the total respondents mentioned that they like the views while few mentioned they do not like the view. As the adjacent window views are not satisfactory, most of the employees tend to go to different positions inside the office to experience the good views. They mostly do this in their free time or during lunch hours. Figure 4 shows the favourite viewpoints. However, most of the people who responded with negative responses mentioned that they do not have enough time for breaks from their routines. Especially the branch office employees are always occupied with customers until 3 pm and from 3 pm to 5.30 pm they are rushed to finish the daily accounts. This shows they are running on a tight schedule, without even

considering their health and well-being.
Further, questions were asked to ascertain the perceptions of respondents on the view factor. (See section 3.4.2) A higher percentage of respondents believe that the view of the outdoors influences their mental well-being and increases their productivity at work. Most of the remaining percentage is not aware of this factor. This shows the lack of knowledge among people on the advantages of window view quality.
The results show that many prefer both natural light and good views for a better visual experience. Some are not sure about it. Only a few are unsure of this idea. The questions on the respondents' preferred view from their working positions and the reason for those preferences show the preference for green landscapes and green plants. Some other interesting results are vehicles, colourful buildings, nice streetscapes, birds, moving elements and water bodies. This also shows the interest of respondents in the window views.
The results of the reasons they mentioned are mostly about the mind. 24 respondents mentioned 'Mind'. The mentioned reasons are, a refreshing mind, stress relief, mental well-being, relaxation, pleasant, positive vibes, and a calm environment. This analysis is evident in the perception of view quality in the respondents' minds.

4.4.1. Mapping of movement for relaxation and the positions of favourite windows

Figure 4 – layout of office floors with corresponding views out (see section 3.4.2)

Each respondent was asked to mark their movement path and note their favourite viewpoints in the given plan layouts. It was observed that users responded enthusiastically to this part of the question.
In comparison the most desired view D with the least desired view H, it is clear that view D has more content. It is composed of various elements including dynamic elements and contains three visible layers.
It is clear from responses that the most desired views are View O and View N respectively. As mentioned in the above discussion, here too both views have quality content. The three visible layers, the composition of buildings and plants, and dynamic elements are the major difference compared with other views. Also, the view is not fragmented here. So, the clarity of the view also matters.
The interesting fact in this survey is, some of the regional office employees mentioned that their favourite view is from the washroom (View T). As one employee said, “We don’t have the best view from this office space. I personally like the view from the male washroom, as that view contains more greenery it pleases me”. (sic) The other most desired view is ‘View U’ from the pantry (lunchroom).

5. Conclusion

The case study analysis highlights that most of the occupants perceived the space as visually comfortable in terms of daylight integration. However, the lack of good views influences the perception of the visual experience of the occupants. Therefore, it is evident that visual comfort is not solely dependent on the light quality or light level, thus reinforcing established knowledge. Visual connection with other spaces and outdoors is deemed essential for a person to feel comfortable within a space.
The findings present clear implications for design, where the placement of fenestration, and view windows, needs to be in consideration of all aspects that impact the users of a space. The office environment poses unique challenges, where layouts that utilise space efficiently are essential. The layout of workspaces that afford opportunities for views out, albeit within their view angles from their workspaces or when they can take respite at selected times, is important. The view window can be in different forms, for instance, horizontal, clear-storey or sky-light forms that allow unique views, that adhere to the parameters highlighted in this research. The form of the space and the building envelope needs to be shaped to allow holistic application.
The study is focused on a particular typology of space – the office environment. As a limitation of scope and to explore the perceptions of a specific user, a bank office environment was selected. Future research needs to encompass further typologies that reinforce this line of thinking. Thus, highlight the importance of natural light in the architectural environment, reinforcing the importance of creating contended users within a space, ensuring physiological and psychological well-being.

Acknowledgement

We express our sincere gratitude to Archt. Shayan Kumaradas and the Management and Personnel of the private bank in Jaffna, for their positive response pertaining to their participation and sharing of project data.

Disclosure statement
No potential conflict of interest was reported by the authors.

Funding
This work was not supported by funding sources.

ORCID
Delosha, T. - 0000-0003-0708-0835
Perera, N.G.R. - 0000-0001-9093-1367

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