Quantifying the Effects of Window View Features on Occupant Satisfaction: A Multilevel Analysis of Contributing Factors

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SUMMARY
This research investigates how objective attributes (e.g., window size, view amount) and descriptive environmental qualities (e.g., naturalness, coherence, aesthetics) relate to subjective satisfaction with window views. A preliminary analysis using distribution-based scatterplots revealed that both indoor and outdoor attributes contribute to view satisfaction, with outdoor features, particularly aesthetic quality and view access, showing the strongest associations. These findings highlight the significance of both architectural design and the external environment in shaping user experience. The study emphasises the need to consider functional, physical, and perceptual qualities in evidence-based design. The results contribute to the broader discourse on daylighting and environmental quality (also considering how the view out is addressed in the LEED protocol or in the EN 17037), offering a more nuanced understanding of what constitutes a "good view" and informing strategies for designing healthier, more satisfying indoor environments.

KEYWORDS
View Quality, Daylighting, Window View,

1 INTRODUCTION

Daylighting is the intentional use of natural light within indoor environments, emphasizing its importance for human health (Aries, Aarts, and van Hoof 2015; Knoop et al. 2020; Veitch 2003) and productivity (Mardaljevic 2011; Shishegar and Boubekri 2016). Despite the recognized importance of daylighting and views in indoor environments (Heschong 2021), also included in assessment protocols such as LEED (USGBC 2024) or in the EN 17037 (CEN 2018), a comprehensive understanding of what constitutes a "good view" remains underexplored (Matusiak et al. 2024). This research has explored the interplay between objective attributes as in view access, view content and external context, and descriptive attributes, i.e., naturalness, order, complexity, upkeep/maintenance, openness, spatial definition, historical significance and subjective responses to views quality. A methodical assessment routine was carefully designed. Participants shared the view from their window and the surrounding interior and exterior based on many photos taken from different perspectives. Each participant also evaluated their view using questionnaires and narratives.

2 METHODS

The study was performed based on a methodological assessment method conducted through dedicated workshops with 207 participants in five European countries, i.e. Norway, Poland, Italy, Germany, and UK, during autumn/winter 2022 and 2023. The method's design involved a structured preparation phase that guided each participant in documenting and reflecting on a personal window view before attending the workshops. The process was organised into four distinct levels. In the first level, participants photographed their view from three angles: a postcard-style shot from their usual vantage point, a close-up daytime panoramic, and a nighttime panoramic. These photos captured the composition and variability of the view across lighting conditions. The second level focused on the interior space. Participants took photos that captured how the window related to the room layout, seating, and function, and completed a short survey on their satisfaction with features like window size, daylight access, and the amount of visible view. The third level moved outside, where the participants took two photos of the building's exterior with the analysed window marked. They evaluated the external context, such as orientation, sun protection, and nearby urban features. In the fourth level, participants wrote a narrative describing their long-term relationship with the view, followed by a content assessment including proportions of visible sky, greenery, ground, and ratings of descriptive attributes. The in-person workshops, held at the five universities throughout the academic year, offered a structured forum for presenting and evaluating views through peer discussion. Each session began with a participant, the view owner, presenting their prepared material in four stages, according to the preparation phase. After each stage, participants rated the view using a standardized 9-point Likert scale, where 0 denotes the lowest score and 9 the highest.

To structure the analysis, the various objective attributes and experiential qualities of the window views were categorized into four thematic groups: View Access, View Content, External Context, and Descriptive Attributes, as detailed in Table 1.

Table 1: Categorization of View Attributes

Category	Attributes Included
View Access	Window size, amount of view, daylight availability, relationship to room function
View Content	Percentage of visible sky, greenery, and ground
External Context	Building orientation, external sun protection, architectural surroundings, landmarks, presence of people, or movement
Descriptive Attributes	Naturalness, order, complexity, upkeep, openness, and historical significance

Analysis method

The analysis employs a distribution-based correlation approach, using normalised histograms to explore potential associations between satisfaction with window views and various environmental attributes. Instead of analysing individual-level data points, this method focuses on how often each score (on a 1–9 scale) was selected for different attributes and overall view satisfaction. By comparing these score distributions visually and through simple linear regression (i.e., fitting a line to the relationship between histogram proportions), we gain an initial understanding of which features may influence perceived view quality. The analysis method adopted here is a step prior to exploring further where these relationships will be tested while accounting for individual variability and hierarchical data structure. The analysis was done using MATLAB R2023b through the *hist* and *polyfit* commands; *polyfit* was used to derive a polynomial function (degree 1, thus linear correlation R^2) to fit a set of data points using least squares minimization, while the command *hist* was used to plot the histograms.

In this analysis, there are no strict universal cutoffs for what counts as a "strong" or "weak" coefficient in an exploratory analysis, but here's a rough guide for interpreting the slope values from fitted line:

- > 1.0 → Strong linear association
- 0.6–1.0 →Moderate to strong association
- 0.3–0.6 →Mild to moderate association
- < 0.3 → Weak or negligible relationship.

These thresholds help interpret *relative strength* across the variables, not statistical significance.

3 RESULTS & DISCUSSION

Our preliminary results (see Figures 1(a) and 1(b)) show that various attributes significantly contribute to satisfaction with the view. The figures present the results of a preliminary distribution-based correlation analysis examining how participant' responses to environmental attributes relate to their overall satisfaction with the window view. The x- and y-axes in these plots represent normalised histogram scores. For each of the seven indoor-related attributes and the six outdoor-related attributes, the x-axis shows the proportion of participants who selected each score (from 1 to 9), while the y-axis shows the proportion of participants who selected each score for "overall satisfaction" with a view. Since the data is plotted as fractions (i.e., how often each score was chosen relative to the total number of responses), the values fall between 0 and approximately 0.4, depending on the distribution. Each point in the scatter represents a score level (1–9), and its position reflects how frequently that score was selected for a given attribute (x-axis) and satisfaction with the view (y-axis).

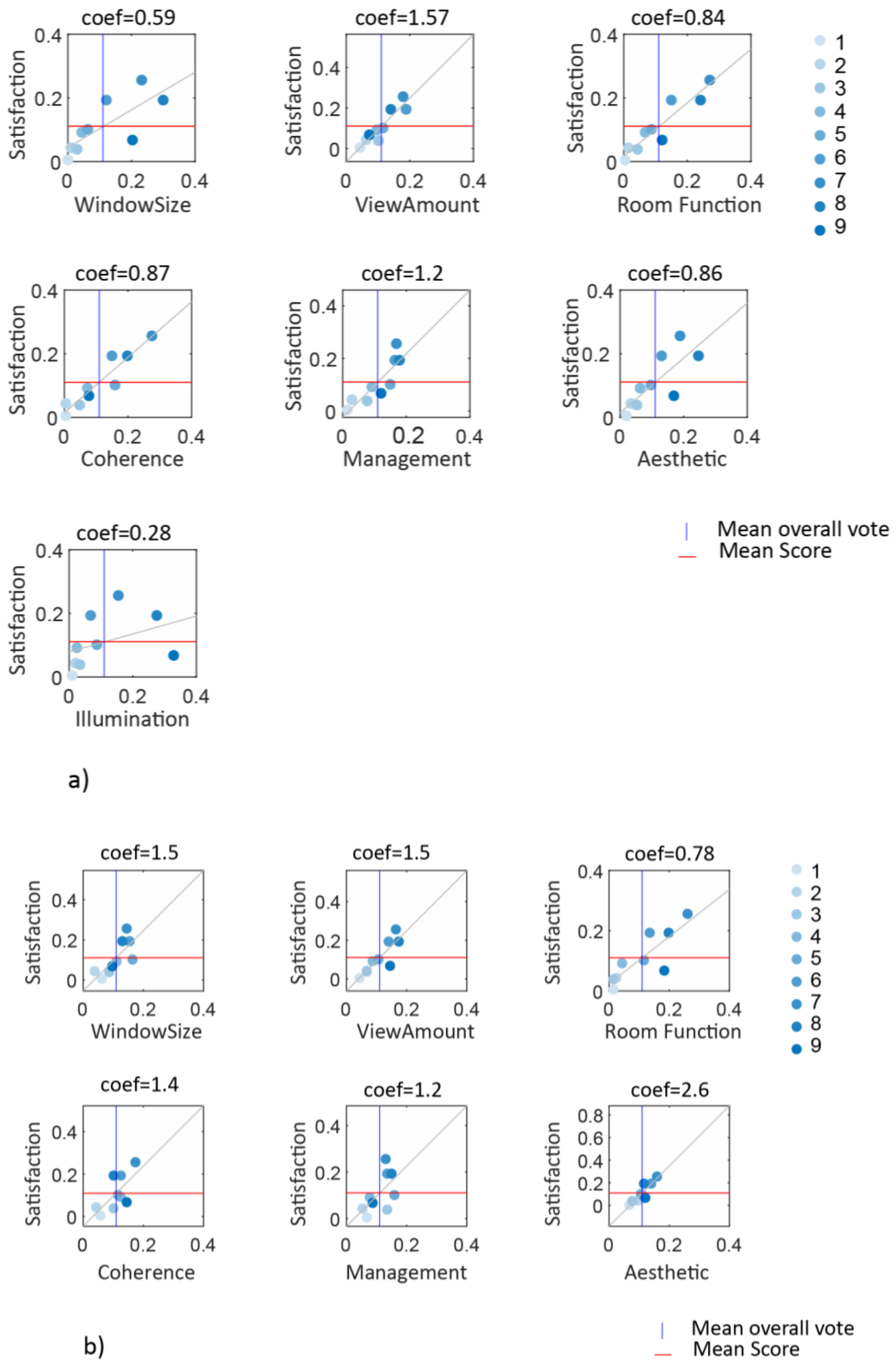

Figure 1. Scatterplots including the fitted line showing the relationship between normalized response frequencies for satisfaction (x-axis), with (a) seven indoor-related descriptive attributes, and (b) six outdoor-related descriptive attributes.

The figures also show the best-fitting correlation line, the average normalised histogram scores shown in a red horizontal line, and the average overall satisfaction vote shown in a vertical blue line. This approach allows the plots to show how the distribution of responses for each feature aligns with the distribution of satisfaction scores, rather than comparing raw individual ratings directly. Figure 1(a) focuses on indoor-related attributes, including window size, view amount, room function, coherence, management, aesthetics, and illumination. Among these, the highest associations with view satisfaction were observed for View Amount (coef = 1.57), Management (1.20), and Coherence (0.87), suggesting these indoor qualities align well with how participants perceive the quality of their view. Aesthetic (0.86) and Room Function (0.84) also showed moderate-to-high associations. In contrast, Window Size (0.59) showed a lower but still positive relationship, while Illumination (0.28) appeared to have little alignment with view satisfaction scores.

Figure 1(b) presents the same analysis applied to outdoor-related attributes, such as visible nature, green quality, openness, and aesthetics of the outdoor scene. Notably, Aesthetic had a very high coefficient of 2.6, indicating a strong alignment between how aesthetically pleasing the outdoor view was perceived and participants' satisfaction ratings. Window size and view amount also showed high coefficients (both 1.5), suggesting that visual access and breadth of view are key contributors to satisfaction. Coherence (1.4) and management (1.2) retained strong relationships, consistent with the indoor results. Only Room Function showed a more moderate correlation (0.78), indicating a weaker alignment relative to the others. The results show that several outdoor-related characteristics show higher associations with view satisfaction than those associated with indoors.Moreover, these findings indicate that both indoor spatial qualities and outdoor scene characteristics play meaningful roles in shaping how participants evaluate their views. However, outdoor-related factors—especially aesthetic quality—appear to exert a stronger influence overall. These preliminary results provide a valuable foundation for the future steps, where these relationships will be tested while accounting for individual variability and hierarchical data structure, possibly to be discussed in the frame of documents such as the LEED or EN 17193.

4 CONCLUSIONS

These findings emphasize the multifaceted nature of view quality, underlining the need to consider physical, functional, and aesthetic factors when designing spaces to optimize user satisfaction. In detail, the outdoor-related attributes—especially aesthetic quality and the amount of visible view—showed the strongest alignment with overall satisfaction, suggesting that what lies beyond the window plays a critical role in how users perceive their indoor environment. These insights contribute to the broader field of daylighting, supporting the design of spaces that foster health and well-being in buildings. Moreover, the relevance of landscape and urban planning can be emphasised, as they directly shape the external qualities—such as aesthetic value, openness, and greenery. These attributes appear to be most influential for view satisfaction. This preliminary analysis provides an initial exploration of potential associations between participants' satisfaction with window views and specific environmental attributes. By visualising how the distributions of scores align—using normalized histograms and correlation plots—we have identified which attributes appear to have stronger relationships with perceived view quality. While this method does not account for individual differences or hierarchical structure in the data, it offers valuable insight into overall trends and helps inform model development. In order to overcome the limitation in the analysis the future steps we will apply the Linear Mixed-Effects Modelling (LMM) approach to perform the aforementioned statistical tests and to portray a more comprehensive model where the mixed effect of the features can be identified while accounting for individual variability.

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