

What kind of buildings stress you out?

Visual comfort in Seoul
and the future of design

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Executive summary

This study explores how the external design of buildings – specifically, the patterns and materials used on façades – either supports or undermines visual comfort in cities. Focusing on images of 78 buildings across Seoul, spanning five historical periods from the Late Joseon Dynasty to the present day, the research uses advanced image analysis tools to measure how different architectural features affect the brain.

The results indicate that specific design features – particularly repetitive façade features – can robustly predict visual stress. This relationship persists across a range of viewing distances and architectural eras, which suggests that both temporal and spatial variables contribute to sensory overload.

Traditional Korean architecture, with its visually rich, harmonious patterns, produces lower levels of visual stress than modern façades with repetitive patterns, hard lines, and high-contrast materials which are more likely to overload the visual system and contribute to discomfort, especially in dense urban areas.

Buildings from the contemporary era in Seoul show on average the highest levels of visual stress of any era since the late nineteenth century.

Overall, the findings suggest that visual comfort in cities can be influenced by specific, measurable design choices. The findings offer compelling evidence that better façade design, based on how our brains naturally process visual information, can reduce stress and enhance public wellbeing.

Using this science could produce urban environments that actively support human health and cognitive wellbeing, instead of undermining it.





I. Introduction and theoretical framework

Certain patterns can overload the visual system — triggering discomfort, fatigue, even headaches.

The built environment functions as a primary mediator of human neurophysiological experience, with architectural façades serving as critical interfaces between urban inhabitants and their visual environment (Wilkins et al., 2018). Recent advances in vision science have established clear relationships between specific spatial patterns and cortical hyperexcitability, demonstrating that certain visual configurations can induce measurable physiological stress responses including eye strain, headaches, and cognitive fatigue (Penacchio & Wilkins, 2015; Le et al., 2017). This phenomenon, termed pattern-induced visual discomfort or visual stress, occurs when the human visual system encounters spatial frequency distributions that deviate significantly from those found in natural environments, resulting in inefficient neural processing and elevated metabolic demands in the visual cortex.

Human vision evolved to process the visual rhythms of nature — not the repetitive, mid-range spatial frequency patterns common in many modern façades.

The neurophysiological basis for visual discomfort stems from the evolutionary optimization of human vision for processing natural scenes, which typically exhibit a characteristic $1/f$ spatial frequency distribution where amplitude decreases proportionally as spatial frequency increases (Penacchio & Wilkins, 2015). This spatial property facilitates efficient neural coding through sparse activation patterns, where minimal neural resources are required to process visual information. Conversely, built environments frequently present visual stimuli that concentrate energy around mid-range spatial frequencies, particularly at approximately 3 cycles per degree, creating conditions that challenge optimal neural processing and potentially trigger cortical hyperexcitability in susceptible populations (Wilkins et al., 1984; O'Hare et al., 2013).

Around 1 in 10 people are especially sensitive to visual stress — and rates are even higher in neurodiverse groups.

Individual susceptibility to visual stress varies significantly across populations, with approximately 10% of the general population demonstrating heightened sensitivity to pattern-induced discomfort (Wilkins et al., 2018). This prevalence increases substantially in neurodiverse populations, including individuals with migraine disorders, photosensitive epilepsy, and autism spectrum conditions, suggesting critical implications for inclusive design practices in urban environments (Wilkins, 1995). The cumulative impact of architectural visual stress on urban populations represents an underexamined but potentially significant public health consideration, particularly as global urbanization accelerates and architectural complexity increases through digital design technologies.

With centuries of architectural change compressed into a single cityscape, Seoul offers a rich opportunity to study how design affects the brain.

Seoul presents an exceptional research context for investigating these relationships due to its extraordinary temporal depth and rapid architectural transformation. As one of the few continuously inhabited urban centers with over two millennia of documented architectural evolution, Seoul embodies multiple layers of design approaches shaped by successive political regimes, cultural paradigms, and technological developments. This morphological diversity provides an optimal natural experiment for examining how specific architectural features influence visual stress responses across different historical contexts and construction technologies.



2. Literature review and methodological foundation

Visual stress and spatial frequency analysis

We can now measure visual discomfort using tools that analyse how building patterns diverge from natural visual rhythms.

The computational assessment of visual stress builds upon established research in vision science demonstrating quantifiable relationships between spatial pattern characteristics and subjective discomfort ratings (Wilkins et al., 2018; Penacchio & Wilkins, 2015). Fundamental work by Chatrian et al. (1970) and subsequent investigations by Radhakrishnan and Klass (2004) established the neurophysiological mechanisms underlying pattern-sensitive responses, identifying specific spatial frequency bands that trigger cortical hyperexcitability. Modern computational approaches developed by Penacchio and Wilkins (2015) have operationalized these findings through Fourier-based analysis techniques that quantify deviation from natural scene statistics, providing objective metrics that correlate significantly with subjective discomfort assessments.

Urban scenes that concentrate energy at specific frequencies are more likely to cause visual stress – and we can predict this from façade design.

Le et al. (2017) demonstrated that urban scenes rating as visually uncomfortable exhibit disproportionate amplitude concentrations within two octaves of 3 cycles per degree, producing measurable increases in haemodynamic responses in visual cortical areas. These findings establish the empirical foundation for computational visual stress assessment in architectural contexts, validating the use of spatial frequency analysis as a predictive tool for neurophysiological response to built environments.





2. Literature review and methodological foundation

Architectural evolution and construction technology in Seoul

Traditional Korean façades embraced asymmetry, texture, and variation — qualities linked by science to more comfortable visual experiences.

Seoul's architectural trajectory reflects the complex interplay between traditional Korean building practices and successive waves of external influence, technological advancement, and economic development (Jung, 2013). Traditional Korean architecture, particularly during the Late Joseon period, emphasized harmony with natural surroundings through the employment of organic materials, human-scale proportional systems, and craft-based construction methodologies that generated inherent spatial variability (Hong & Yoon, 2009; Park, 2014). These traditional approaches produced façade compositions characterized by subtle asymmetries, textural richness, and non-uniform patterning that align more closely with natural scene statistical properties identified in neuroaesthetic research as conducive to positive affective responses (Pai, 2018; Kim & Yang, 2022).

Standardised design systems and prefabrication introduced rigid patterns — and with them, the seeds of visual monotony.

The Japanese Colonial period introduced systematic rationalization of building design through the implementation of Western architectural vocabularies and standardized construction protocols (Jung, 2013). This transformation established the foundation for modular construction systems and regularized fenestration patterns that would characterize subsequent developmental periods. The post-Korean War reconstruction era witnessed the widespread adoption of utilitarian design approaches prioritizing functional efficiency over aesthetic considerations, resulting in highly repetitive architectural configurations enabled by prefabricated construction technologies (Moon, 2013; Kim, 2019).

Today's digital design tools can generate extreme regularity — amplifying visual stress even in high-tech architecture.

The High-Density Urban Expansion period, coinciding with South Korea's rapid economic development, saw the proliferation of mass housing typologies characterized by systematic repetition and modular organization principles derived from industrial construction methodologies (Gelézeau, 2007). Contemporary architectural practice has embraced global design trends incorporating advanced material technologies and parametric design strategies, yet these approaches have simultaneously introduced unprecedented levels of pattern regularity through computer-aided design and manufacturing processes (Shin, 2020).



3. Methodology

Sample selection and epochal classification

Selecting from over half a million buildings, the study mapped Seoul's architectural evolution across five major eras – each revealing distinct design patterns.

This investigation employed a comprehensive stratified sampling methodology based on Seoul Metropolitan Government building registry data comprising 562,131 structures following the exclusion of auxiliary buildings under 50m² total floor area. Geographic Information Systems (GIS) analysis enabled systematic classification of the building stock into five historically defined architectural epochs based on construction year documentation. The Late Joseon Period (Early 20th century) encompassed 60,948 structures representing traditional Korean architectural heritage.

The Modernization Period: Japanese Colonial (Early to mid-20th century) included 2,944 buildings reflecting early modernization influences. The Post-Korean War Reconstruction and Industrialization Period (Mid to late 20th century) comprised 96,528 structures. The High-Density Urban Expansion Period (Late 20th century to early 21st century) represented the largest epochal category with 273,470 buildings. The Digital-Transitional Era (21st century onward) included 128,241 contemporary structures.

This map uses colors or labels to show which parts of Seoul have buildings from each major historical era, such as the Late Joseon Dynasty, Japanese Colonial period, Post-Korean War Reconstruction, High-Density Urban Expansion, and the Digital-Transitional Era.



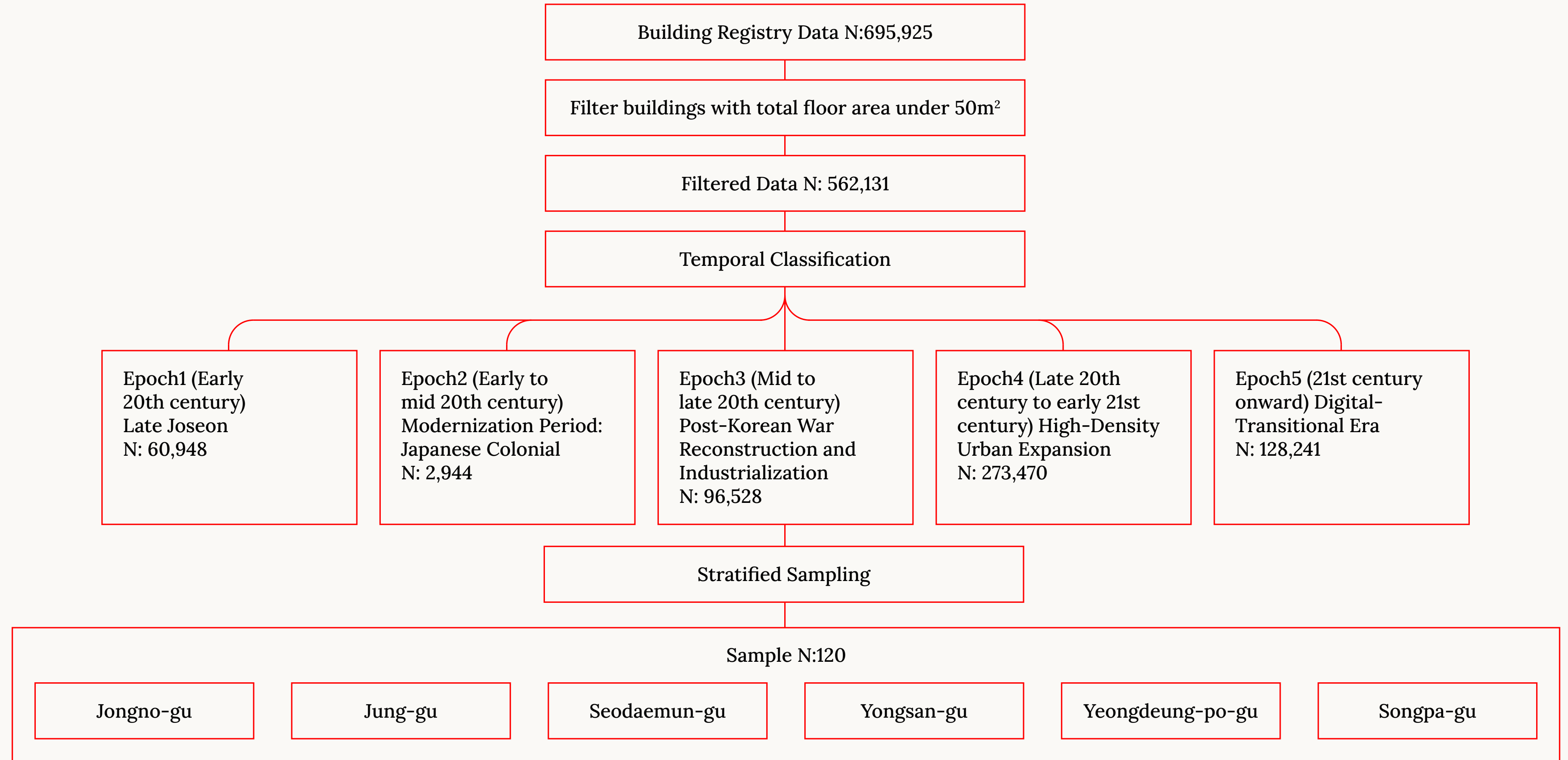
Sewoon Shopping Center, from the post-war reconstruction era



3. Methodology

Six Seoul districts were selected to capture both the city's architectural history and its evolving urban landscape.

Spatial sampling employed district-level stratification prioritizing areas with high concentrations of representative buildings from multiple epochs. Six districts were systematically selected through GIS-based analysis: Jongno-gu, Jung-gu, and Seodaemun-gu for their concentration of traditional and colonial-era structures; Yongsan-gu for post-war reconstruction typologies; and Songpa-gu and Yeongdeungpo-gu for contemporary high-density developments. This dual-layered sampling framework ensured both temporal representation and geographic diversity while maintaining practical accessibility for field documentation.





3. Methodology

Data collection protocol

Each façade was photographed at eye level, under consistent lighting, and from three distances – to capture how buildings are actually seen.

Standardized photographic documentation was implemented using professional cameras (Fujifilm X-T30 with 23mm f/2 lens) and high-specification mobile devices (iPhone 15 Pro) under controlled environmental conditions. Each selected façade was systematically photographed at three standardized viewing distances: close distance (10-15 meters), mid distance (20-30 meters), and far distance (40-60 meters). All images were captured from a fixed camera height of 1.5 meters approximating average adult eye level under consistent mid-day diffuse illumination conditions. Framing protocols minimized visual obstructions while maintaining consistent perspective and scale relationships across all samples to facilitate comparative analysis.

The final dataset comprised 78 façade images distributed across five epochs and three viewing distances. These images were selected as they offered a clear field of view, minimizing visual obstructions and ensuring unobstructed documentation of each façade's architectural features for robust comparative analysis.



Yonggung Villa, from the high density urban expansion period



4. Computational visual stress analysis

Using a tool (ViStA) developed at the University of Cambridge, the study measured the degree to which a façade's visual pattern deviates from what the brain expects in nature.

Visual stress assessment employed the Visual Stress Analysis Tool (ViStA), a validated computational instrument developed through collaborative research at the University of Cambridge (Penacchio & Wilkins, 2015; Mitcheltree et al., 2025; Valentine et al., 2025). ViStA quantifies visual discomfort potential through comprehensive evaluation of spatial frequency distributions, contrast relationships, and deviation from natural scene statistics using advanced Fourier based analysis techniques. The methodological framework operates on the principle that visual discomfort arises from the human visual system's enhanced sensitivity to specific spatial frequencies and unnatural energy distributions across these frequencies.

The screenshot displays the ViStA software interface. It features a progress bar with three steps: 'Step 1: Upload File', 'Step 2: Calculate Vertical Field of View', and 'Step 3: Analyse File'. Below the progress bar, the 'Analysis Results' section is visible, containing a table with the following data:

Metric	Value
Peak Residual	3.8e+9
Average Residual	6.0e+8
Coefficient of Variation	9.5e-1

Below the table, there is a 'Heatmap Opacity' slider set to 50%. At the bottom, there are two buttons: 'SAVE IMAGE ANALYSIS' and a refresh icon.

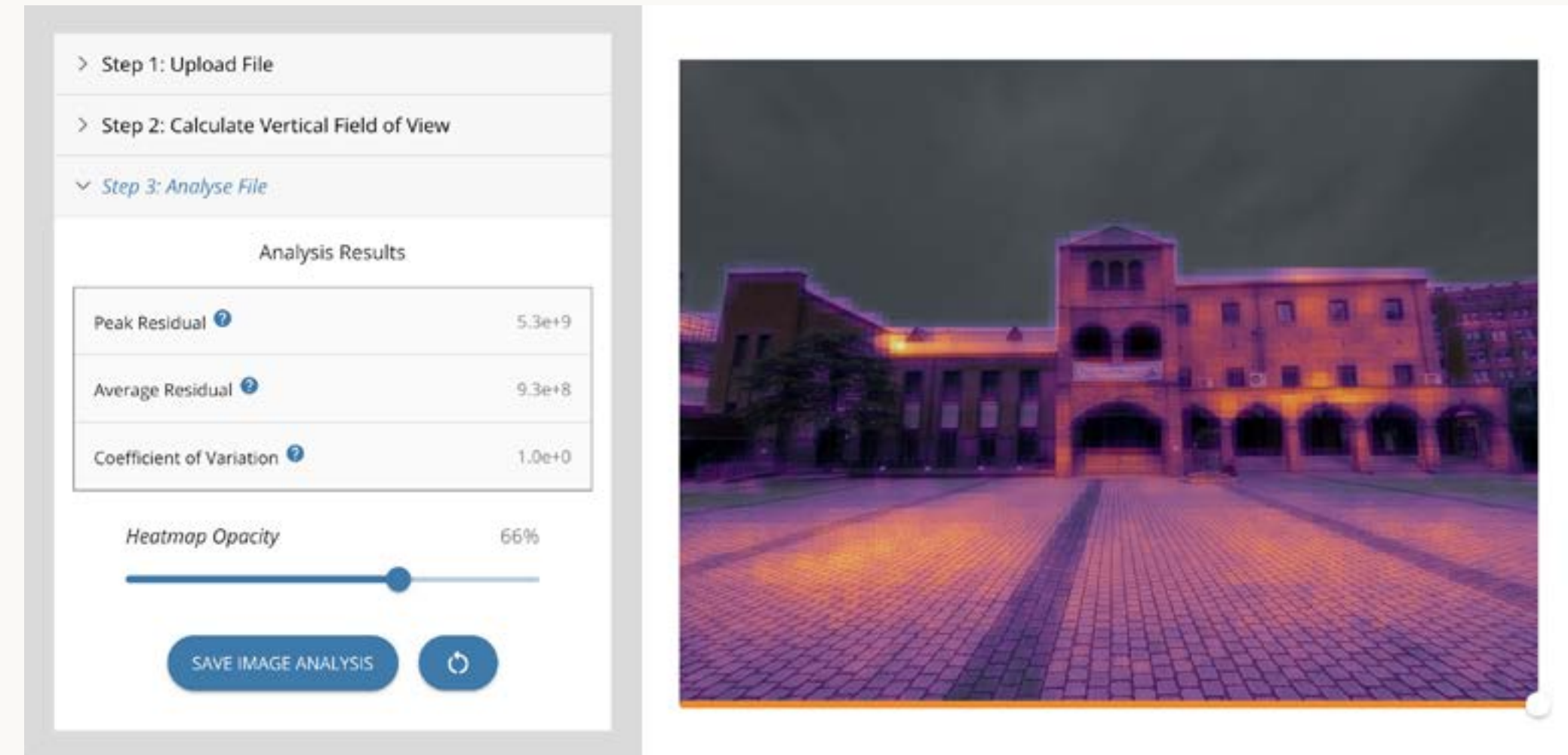




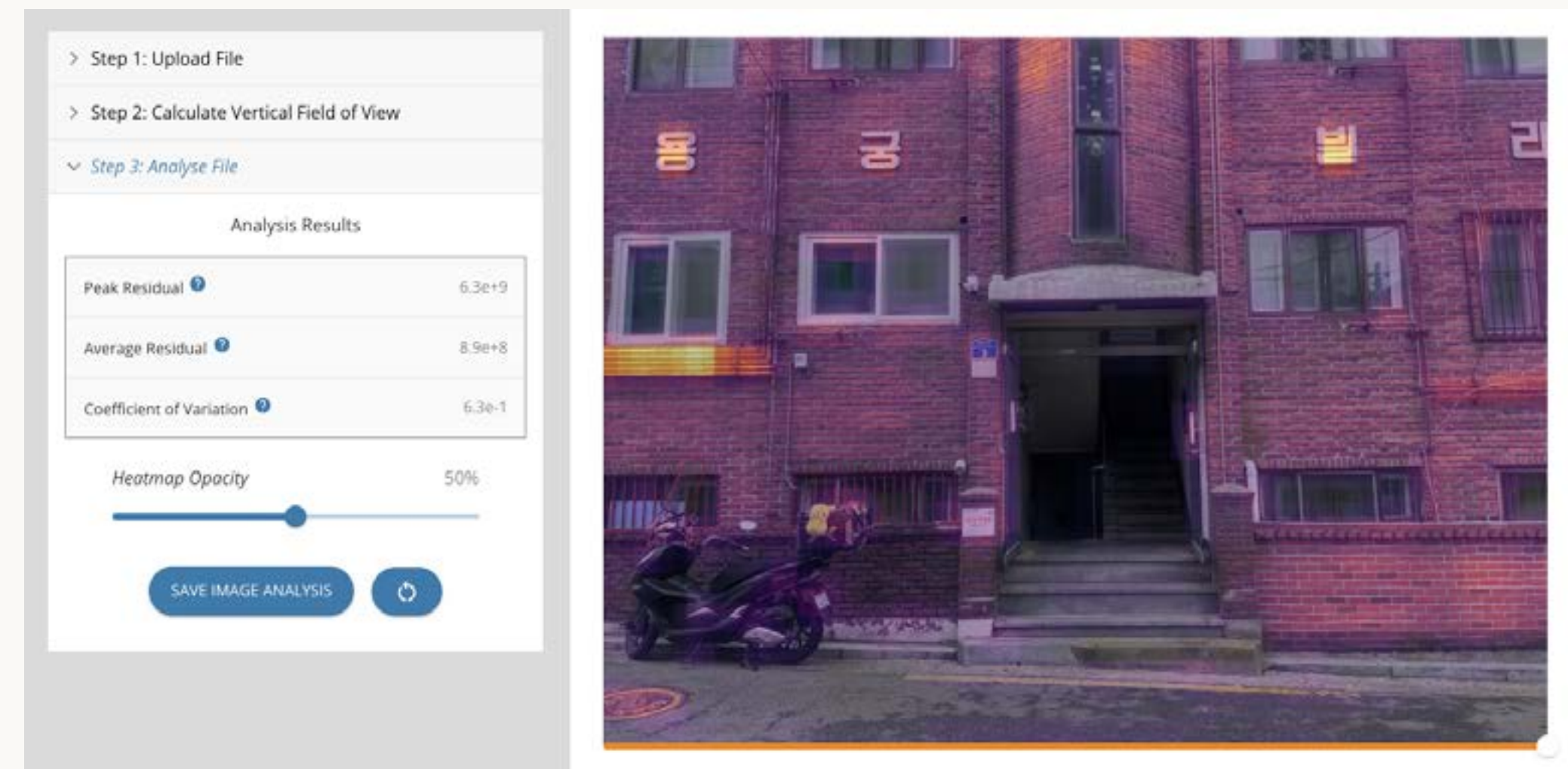
4. Computational visual stress analysis

Each façade was analysed through the lens of the human eye – zooming in on small regions to detect stress-inducing patterns.

The ViStA algorithm (Valentine et al., 2025) segments each façade image into overlapping squares representing two-degree visual fields approximating the high-acuity foveal region of the retina (Strasburger et al., 2011). These squares overlap by 50% to ensure comprehensive capture of spatial features spanning multiple regions. Each segmented region undergoes analysis using algorithms that evaluate deviation from natural image statistics, generating quantitative metrics that have been empirically linked to subjective discomfort expression and objective neurophysiological measures (Le et al., 2017).



ViStA screenshot showing a wide view of Coste Hall at Myeongdong Cathedral, from the modernisation period (early to mid-20th century)



ViStA screenshot showing a close-up image of Yonggung Villa, from the urban expansion period (late-20th century to 21st century)



4. Computational visual stress analysis

The study measured both the intensity and distribution of visual stress — capturing where stress peaks and how it spreads across a façade.

The analysis produces three primary metrics: Peak Visual Stress, representing maximum deviation from natural statistics at any façade location and indicating concentrated luminance contrast energy; Average Visual Stress, measuring overall contrast energy strength across the entire façade with elevated values implying higher predicted cortical response; and Coefficient of Variation, quantifying stressor distribution variability across the façade surface. This comprehensive analytical approach enables systematic comparison of visual stress potential across different architectural typologies and viewing conditions.

> Step 1: Upload File
> Step 2: Calculate Vertical Field of View
v Step 3: Analyse File

Analysis Results

Peak Residual	4.2e+9
Average Residual	1.0e+9
Coefficient of Variation	6.8e-1

Heatmap Opacity 50%

SAVE IMAGE ANALYSIS





5. Results and statistical analysis

Epochal visual stress distribution

Visual stress increased steadily over time — rising by more than a third from traditional to contemporary building façades.

Comprehensive analysis of 78 façade samples revealed significant variation in visual stress metrics across architectural epochs, with average visual stress ranging from 6.93×10^8 in traditional Korean architecture to 9.47×10^8 in contemporary digital-era buildings. Statistical analysis of temporal progression through geometric mean calculation and logarithmic transformation demonstrated a clear temporal trend with $R^2 = 0.73$, indicating that 73% of variance in visual stress can be explained by epochal progression. This finding provides strong empirical support for the hypothesis that architectural modernization correlates with elevated visual discomfort potential, suggesting systematic relationships between construction technologies and neurophysiological response patterns.

Epoch — not viewing distance — was the strongest predictor of visual stress, explaining over 70% of the variation in results.

Linear model comparison examining 'average visual stress' as dependent variable with 'epoch' and 'viewing distance' as predictors revealed that Model 1 (average ~ epoch) achieved the lowest Akaike Information Criterion (AIC = 218.83) and significantly outperformed the null model in likelihood ratio testing ($p = 0.030$). The inclusion of viewing distance and interaction terms in subsequent models failed to improve model fit (Model 2 AIC = 221.70, LRT $p = 0.57$; Model 3 AIC = 219.72, LRT $p = 0.050$), confirming epochal classification as the primary predictor of visual stress variance.

Epoch-Specific Analysis

Traditional Korean façades showed low visual stress and high variation in design — reflecting the natural complexity of craft-based construction.

The Late Joseon Period demonstrated consistently low visual stress across all viewing conditions (average: 6.93×10^8 , peak: 4.48×10^9), with the highest coefficient of variation (0.947) indicating substantial heterogeneity in visual complexity distribution. This pattern reflects the characteristic organic variability and craft-based dimensional irregularities of traditional Korean construction methodologies. Peak stress measurements remained remarkably consistent across viewing distances (Close: 4.22×10^9 , Mid: 4.62×10^9 , Far: 4.60×10^9), suggesting balanced distribution of visual stimuli rather than concentrated stress accumulation at discrete focal points.



5. Results and statistical analysis

At a certain distance, repetitive façades from the colonial era created a spike in visual stress across all building types.

The Modernization Period: Japanese Colonial era exhibited pronounced distance-dependent effects, with far viewing producing the maximum peak stress measurement across all epoch-distance combinations (7.40×10^9). This dramatic elevation indicates that systematic fenestration patterns and regularized compositions characteristic of this period create cumulative visual stress effects that amplify significantly at urban viewing scales when larger portions of repetitive façade elements enter the visual field simultaneously.

Mass housing from Korea's rapid urban expansion produced peak visual stress at close range — amplified by repetition and contrast.

Post-Korean War Reconstruction architecture demonstrated the highest close-viewing peak stress (8.34×10^9) among the first three epochs, reflecting utilitarian design approaches and material irregularities resulting from economic constraints and accelerated construction timelines. The High-Density Urban Expansion period exhibited maximum close-viewing peak stress overall (8.64×10^9), suggesting that architectural sophistication enabled by industrialized construction technologies inadvertently maximized visual stress through complex geometric arrangements and high-contrast material applications.

Today's façades may spread complexity across the entire surface — creating sustained visual demand rather than sharp stress points.

Contemporary Digital-Transitional Era architecture presented a distinctive pattern with reduced close-viewing stress (4.43×10^9) but maximum average visual stress at mid-distance viewing (11.32×10^8). This configuration indicates that sophisticated design tools enable distribution of visual complexity across entire façade surfaces rather than concentration at specific locations, creating sustained cognitive demand rather than acute stress responses.



5. Results and statistical analysis

Viewing distance effects

Visual stress peaks when façades are seen from afar — but it's mid-range viewing that reveals the full weight of pattern complexity.

Analysis of visual stress variation across viewing distances revealed complex relationships between observer proximity and stress manifestation. Far viewing distances produced highest peak visual stress (5.97×10^9) and greatest variability ($\text{CoV} = 0.996$), suggesting that accumulated visual complexity from multiple façade elements amplifies stressor indicators when buildings are observed within broader urban contexts. Mid-distance viewing demonstrated highest average visual stressor levels (9.06×10^8) with moderate variability ($\text{CoV} = 0.829$), indicating consistently elevated overall visual complexity at intermediate viewing ranges where façade details achieve optimal perceptual resolution while systematic patterns become apparent.





6. Discussion and implications

Neurophysiological optimisation in traditional architecture

Centuries of craft-based architecture may have unconsciously refined buildings to match what the human brain finds easiest to process.

The empirical demonstration that traditional Korean architectural typologies consistently produce a low potential for visual stress provides quantitative validation for established architectural discourse emphasizing the neurophysiological benefits of craft-based construction methodologies and organic material variation (Pai, 2018; Kim & Yang, 2022). The statistical alignment between traditional façade characteristics and natural scene distributions suggests that vernacular construction practices may have inadvertently optimized built environments for human visual comfort through evolutionary trial-and-error processes spanning centuries of architectural refinement.

Irregular textures and natural materials don't just look beautiful – they help the brain process what it sees with less strain.

The stability of visual stressor distribution across viewing distances in traditional architecture substantiates how non-uniform surface textures and irregular materiality promote perceptual richness while maintaining neurophysiological coherence. These findings support neuroaesthetic research indicating that visual irregularity, material tactility, and moderate complexity elicit positive affective responses, particularly in environments dominated by natural irregularities and tactile material diversity (Campagna & Chamberlain, 2024; Okamoto et al., 2013; Bilgic & Wells Ebbini, 2024).





6. Discussion and implications

Systematic repetition and cumulative stress effects

Repetitive façades — from colonial to contemporary — consistently overload the brain, no matter how modern the technology.

The consistent elevation of visual stressors associated with systematic repetitive patterns across multiple historical periods establishes fundamental relationships between modular construction methodologies and neurophysiological response patterns. Colonial-era fenestration systematization, post-war prefabrication techniques, and contemporary curtain wall assemblages all demonstrate similar stressor amplification effects when multiple architectural elements undergo simultaneous observation, indicating that repetitive building configurations inherently challenge efficient neural processing regardless of their technological sophistication or aesthetic intentions.

When repetition scales up, so does visual stress — affecting not just buildings, but the feel of entire neighbourhoods.

The distance-dependent amplification of stressors in repetitive systems reflects the cumulative nature of pattern-induced discomfort, where increasing numbers of repetitive elements entering the visual field simultaneously compound individual stressor contributions. This finding has significant implications for urban design practice, suggesting that architectural decisions regarding façade patterning extend beyond individual building performance to influence broader environmental quality and public health outcomes at neighborhood and district scales.





6. Discussion and implications

Contemporary technology and optimization potential

Today's design tools offer precision — but when complexity is unchecked, they risk replacing stress spikes with sustained visual fatigue.

The complex, visually uncomfortable patterns exhibited by contemporary architecture reveal both the potential and limitations of digital design technologies for neurophysiological optimization. While sophisticated computational tools enable unprecedented control over visual pattern distribution, current applications often prioritize aesthetic sophistication over human comfort considerations, resulting in sustained visual complexity that may contribute to cognitive fatigue despite reduced acute stress concentrations.

Polished façades and vast glazing may look sleek — but without care, they concentrate visual stress instead of diffusing it.

The “corporate aesthetic amplification” effect characteristic of contemporary commercial architecture, distinguished by extensive implementation of high-polish surfaces and large-scale glazing systems, demonstrates how technological advancement can inadvertently compromise visual comfort through material choices that concentrate rather than distribute visual energy. However, the reduced peak stressor measurements in contemporary façades indicate significant potential for technology-enabled optimization through informed application of neurophysiological principles in design practice.



6. Discussion and implications

Implications for architectural design practice and urban policy

Designing for comfort means going beyond style — drawing on evidence to bring neurophysiological insight into everyday practice.

These findings necessitate fundamental reconsideration of standard architectural design protocols, particularly regarding material selection, pattern organization, and scale-responsive design strategies. The empirical validation of specific traditional features as neurophysiologically beneficial provides objective criteria for selective integration of beneficial design characteristics into contemporary practice, moving beyond purely stylistic considerations toward evidence-based human-centric design approaches.

In dense cities, repetitive façades aren't just a design issue — they're a public health concern that policy can no longer ignore.

Urban planning policy must acknowledge the cumulative health implications of architecturally driven visual stress, particularly in high-density environments where repetitive façade systems can create challenging visual conditions at multiple scales simultaneously. The development of visual stress assessment protocols for design review processes represents a critical opportunity for integrating public health considerations into architectural regulation and approval mechanisms.

What works at one scale can fail at another — façade design must consider how people actually see buildings as they move through cities.

The distance-dependent activation of visual stress effects requires implementation of context-sensitive design strategies that consider anticipated viewing conditions and pedestrian movement patterns. Architects must evaluate façade designs across multiple observational scales, recognizing that features optimized for close-range viewing may create problematic conditions at urban scales and vice versa.



7. Study limitations and future research directions

Photos of facades can't fully capture how stress unfolds as people move through the city.

This investigation acknowledges several methodological constraints that limit comprehensive applicability of findings. The reliance on static image analysis fundamentally fails to capture the dynamic nature of visual stress experience during movement through urban environments, potentially underestimating or mischaracterizing actual neurophysiological responses under real-world conditions. The standardized lighting conditions employed during documentation do not account for substantial variations in illumination throughout diurnal cycles, seasonal changes, or artificial lighting effects that significantly influence visual perception and stress characteristics. This current study does not consider the impact of colour and colour combinations.

For the tools of this study to work in practice, we need human studies linking predicted stress to real physiological responses.

The unisensory assessment approach, focusing exclusively on visual stimuli, neglects multisensory environmental experiences that influence overall perceptual comfort, including acoustic, thermal, and tactile factors that contribute to comprehensive environmental stress responses. The computational methodology requires validation through subjective assessment studies with human participants to establish direct correlations between predicted stress levels and actual physiological responses, representing a critical gap in empirical validation that limits immediate clinical and practical applications.

The future lies in real-time stress analysis – built into the design software architects already use.

Future research priorities should include comprehensive human subject studies incorporating physiological measurements such as haemodynamic responses, electroencephalography, and eye-tracking assessments to validate computational predictions under controlled experimental conditions. Longitudinal studies examining temporal exposure effects and individual susceptibility variations across diverse population groups would provide essential insights for developing personalized design guidelines and identifying vulnerable populations requiring enhanced protective measures.

Embedding visual stress analysis into design software could make brain-friendly architecture part of everyday practice.

The development of real-time visual stress assessment tools integrated into standard architectural design software represents a promising direction for embedding neurophysiological considerations into routine practice workflows. Dynamic assessment methodologies incorporating movement simulation and temporal exposure modeling would significantly enhance the practical applicability of visual stress analysis for comprehensive urban environmental evaluation.



8. Conclusion

Our findings

Visual stress isn't tied to any one architectural style or period - it's shaped by how buildings are designed at the most fundamental level, including their patterns, materials, and forms.

This study uses computational methods to show that certain architectural design features are key drivers of visual stress in urban environments, regardless of their historical or stylistic origins. It finds that traditional Korean architecture reliably supports visual comfort because its features statistically align with patterns found in nature. These results offer quantitative evidence for applying related design principles in contemporary buildings, not just for how they look but because of how they support the brain and the human body.

Repetitive architectural patterns consistently amplify visual stress - across time, technologies, and building types.

This finding points to a deep link between how buildings are constructed and how our bodies respond to them, especially when patterns are repeated excessively. It calls for an approach to building design that recognises how repetition can affect mental and physical wellbeing. While the digital age offers powerful tools for creating more visually complex designs, it also brings with it a risk of using those tools in ways that may induce more stress for the passers-by.

Digital tools can reduce visual stress - but only if we use them with human wellbeing in mind.

This research offers evidence-based guidance for investors, clients, architects and planners seeking to design with people's wellbeing in mind. It can inform objective tools that could be used during the development process to evaluate how different design choices will affect the brain and body. As cities grow and digital tools make buildings more complex, these human-centred, science-backed approaches will be vital for promoting health and wellbeing in increasingly dense urban environments.

This study lays the foundation for a new kind of design - one that actively supports the brain and nervous system.

It opens up a meaningful opportunity to align digital innovation with design principles rooted in how the brain works. The findings provide early evidence that paying close attention to how specific features, forms and patterns affect our nervous system can help shape cities that promote, rather than undermine, our mental and physical wellbeing.



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The Humanise campaign is sparking a global movement calling for more joyful, engaging and human buildings and cities. Inspired by Thomas Heatherwick's book *Humanise: a maker's guide to building our world*, the campaign shines a light on how dull, soulless buildings are bad for our brains, our economy, and the planet – and how what surrounds us can shape us, connect us, and bring us joy. Because human beings need human buildings.

Find out more and join the movement at humanise.org

The logo for Humanise, featuring a stylized white icon of a person with arms raised, followed by the word "HUMANISE" in a bold, white, sans-serif font.