

TARO NARAHARA

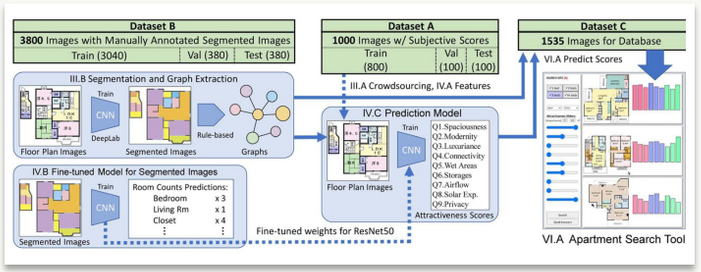
SELECTED RESEARCH AND CREATIVE WORK

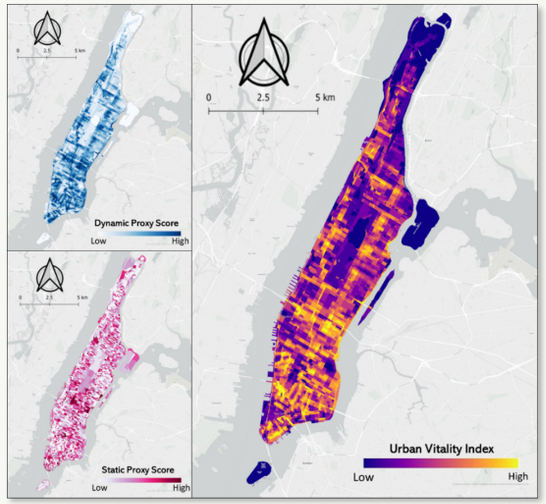
AI and computation across architecture, urban systems, and media art

SELECTED WORK / 2026

01 / RESEARCH POSITION

Understanding space.
Testing ideas. Making worlds.







UNDERSTAND

AI models for interpreting spatial organization, perception and lived experience.

EXPLAIN

Spatial data and probabilistic methods for explaining urban patterns.

TRANSFORM

Geometry, computation and generative media as instruments of design.

02 / RESEARCH · 2023

Can a floor plan be evaluated beyond its dimensions?

Learning perceived comfort, functionality and quality from architectural representations.

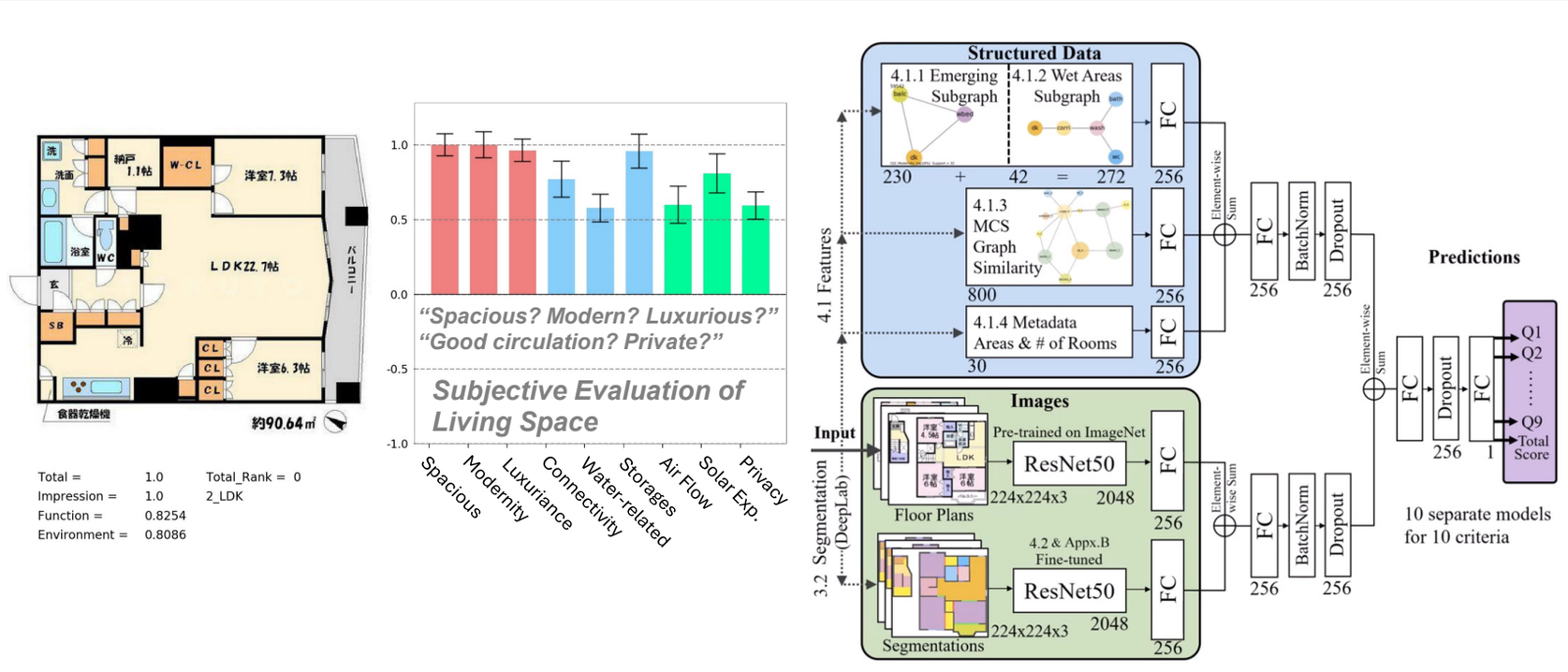


FIG. 01 | Segmented floor plans and inferred adjacency graphs contribute structural features to a multimodal network for predicting subjective ratings.

METHOD + VALIDATION

I initiated the development of a crowdsourced dataset of 1,000 Japanese apartment floor plans, evaluated by more than 3,000 participants on perceived spatial qualities, including spaciousness, circulation, and privacy.

A multimodal neural model combines the plan image with semantic segmentation, room-adjacency graphs and structured features. The resulting scores were evaluated against human judgments and tested in an interactive property-search study.

CONTRIBUTION A testable link between architectural representations and human judgments of spatial experience.

02 / RESEARCH · 2026

When visual AI misreads architectural structure

Multimodal models can recognize spatial impressions without reliably inferring connectivity and privacy.

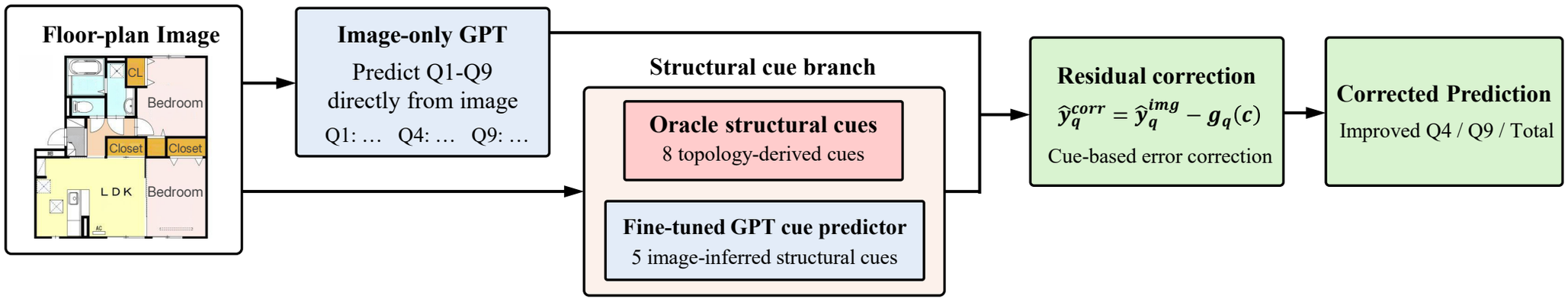


FIG. 02 | Image-only multimodal evaluation is extended with structural-cue residual correction for circulation and privacy judgments.

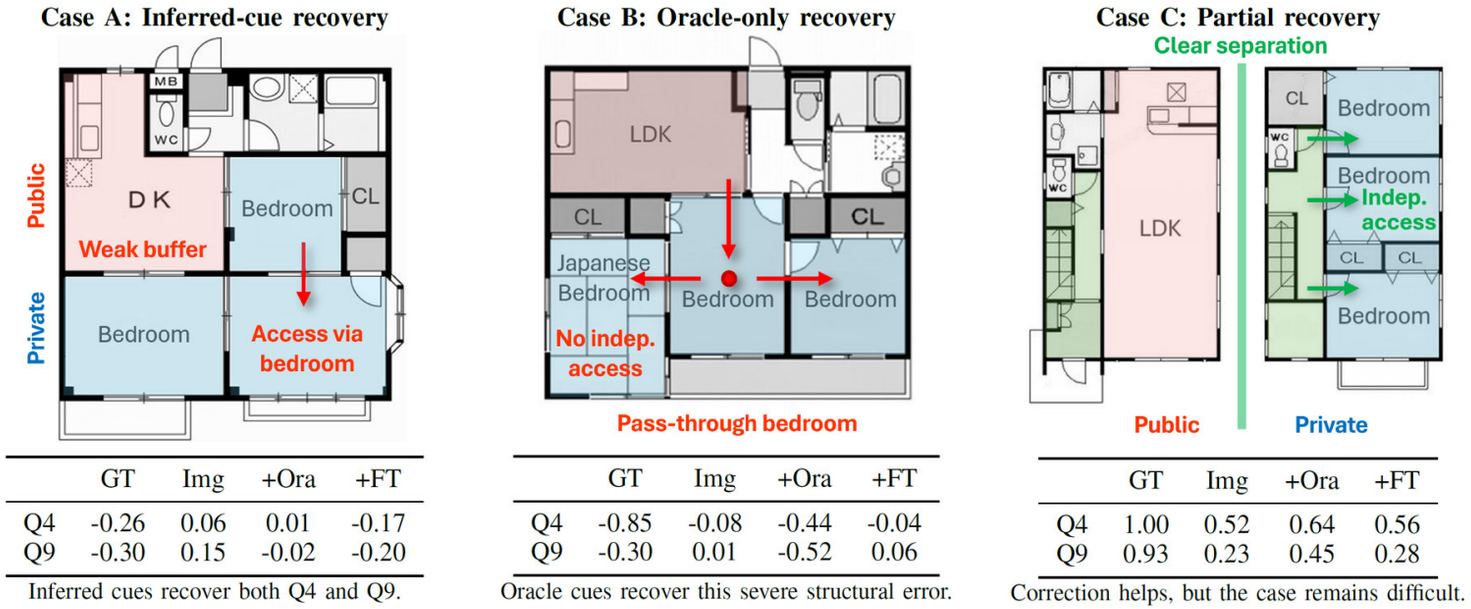
RESEARCH PROGRESSION

The follow-up study asks whether a multimodal language model can evaluate a floor plan directly from an image. Its ratings approximate human responses for several perceptual qualities, but circulation and privacy depend on access relationships that visual appearance alone may not convey. Explicit structural cues are introduced to diagnose and correct these residual errors.

02 / RESEARCH · 2026

Architectural meaning is relational

Circulation and privacy are properties of access and adjacency, not merely visual style.



	GT	Img	+Ora	+FT
Q4	-0.26	0.06	0.01	-0.17
Q9	-0.30	0.15	-0.02	-0.20

Inferred cues recover both Q4 and Q9.

	GT	Img	+Ora	+FT
Q4	-0.85	-0.08	-0.44	-0.04
Q9	-0.30	0.01	-0.52	0.06

Oracle cues recover this severe structural error.

	GT	Img	+Ora	+FT
Q4	1.00	0.52	0.64	0.56
Q9	0.93	0.23	0.45	0.28

Correction helps, but the case remains difficult.

FIG. 03 | Contrasting circulation and privacy cases expose differences between visual impression and actual room-access relationships.

INTERPRETING FAILURE CASES

Seemingly similar plans may differ sharply in functional privacy or ease of movement. Comparative cases isolate the relevant relationships—such as passage through bedrooms, independent access and spatial buffers—rather than relying on visual style. The research treats such failures as evidence about what spatial information an AI system must represent.

See MIPR 2026 for experimental setup, nine criteria, held-out results and cue-based correction.

03 / RESEARCH · 2026

Urban vitality at the scale of everyday life

Integrating street imagery, places and urban morphology to study patterns of activity in Manhattan.

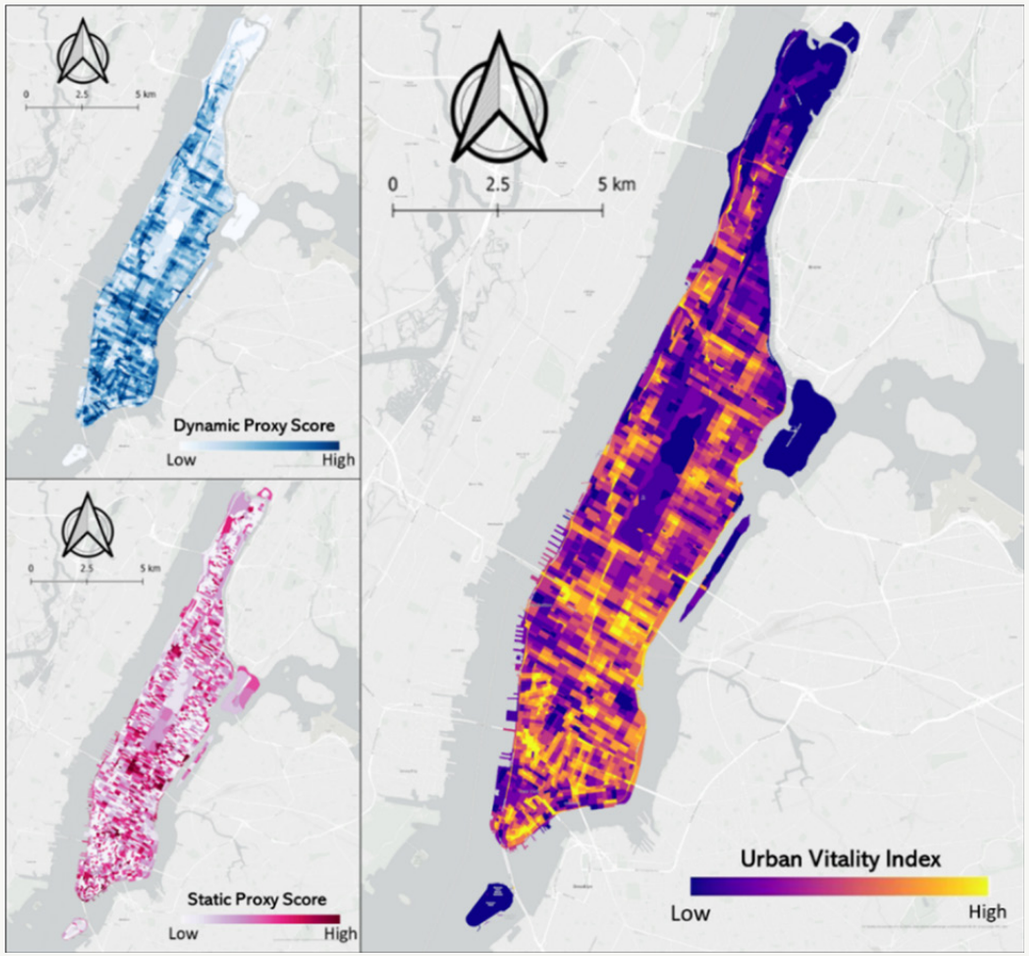


FIG. 04a | Manhattan census-block characteristics assembled from spatial data and street-level observations.

QUESTION + DATA

At the census-block scale, activity patterns can be related to both persistent urban form and transient street conditions. The study integrates points of interest, road-network measures, street-view observations and measures of demographic diversity to examine the dependencies underlying vitality. This fine-grained approach can make conventional citywide indicators more spatially specific.

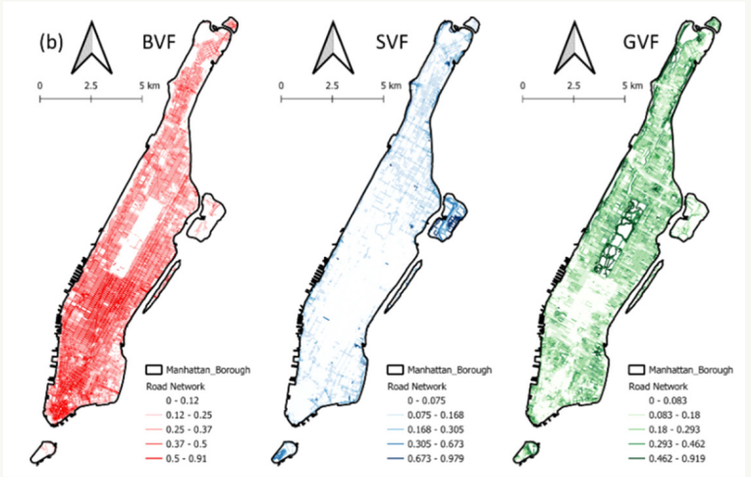


FIG. 04b | Spatial distributions of Building View Factor (BVF), Sky View Factor (SVF), and Green View Factor (GVF) along Manhattan's street network.

Jia, Hu & Narahara · Sustainable Cities and Society 151 (2026), 108010 · doi:10.1016/j.scs.2026.108010

VIEW PAPER ↗

03 / RESEARCH · 2026

From maps to interpretable dependencies

Bayesian network structure learning reveals conditional associations among urban vitality and built-environment indicators.

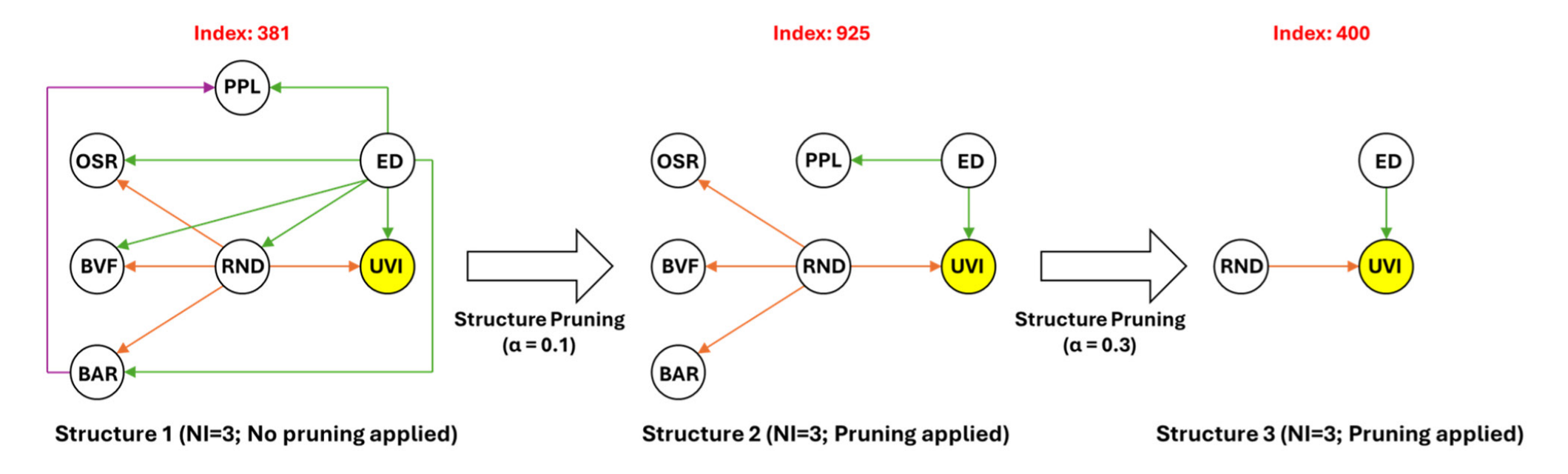


FIG. 05 | Separately fitted Bayesian networks using three discretization intervals (NI = 3) and pruning thresholds α = 0, 0.1, and 0.3. Arrows compare alternative models, not a sequential transformation.

ANALYTICAL CONTRIBUTION

Beyond mapping urban vitality, this study uses Bayesian network structure learning to examine conditional dependencies among streetscape, demographic, and urban-form indicators. Comparing selected models across pruning thresholds reveals the trade-off between structural richness and interpretability. The probabilistic framework makes individual relationships inspectable rather than treating all indicators solely as components of a composite score.

Jia, Hu & Narahara · Sustainable Cities and Society 151 (2026), 108010 · doi:10.1016/j.scs.2026.108010

03 / COMPUTATIONAL REPRESENTATION

A city is a network of spatial relationships

Measuring urban vitality, representing building–street relationships, and predicting block-level activity.

01 / DEFINE THE PREDICTION TARGET

DYNAMIC PROXY



Street-view pedestrian and vehicle counts

+

STATIC PROXY



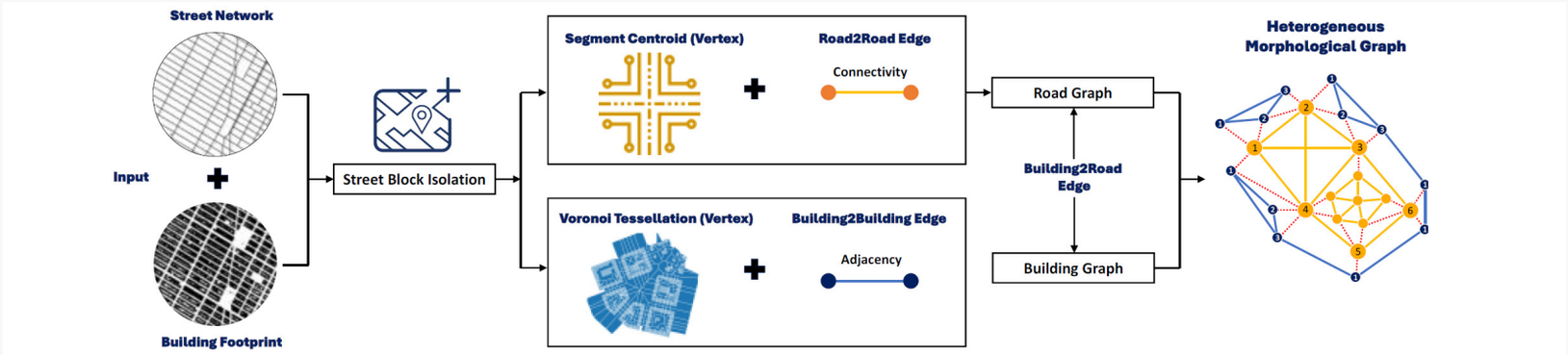
Points of interest: density and functions

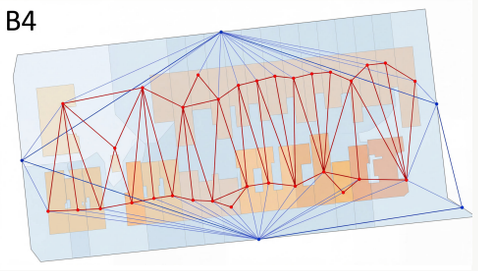
→

URBAN VITALITY INDEX (UVI)

Low / Medium / High

02 / REPRESENT BUILDING–STREET RELATIONSHIPS





ONE URBAN-BLOCK GRAPH

Buildings + roads

FIG. 06 | A heterogeneous morphological graph links building–building adjacency, road–road connectivity, and building–road spatial relations.

03 / PREDICT VITALITY BY BLOCK

Urban morphology graph + contextual features → GNN models

→

UVI class

Predicted vitality
Low / Medium / High

MODEL COMPARISON

Heterogeneous Graph Transformer (HGT): 73.5% accuracy

Outperformed four GNN baselines (61.0–62.2%): GCN, GAT, GIN, and GraphSAGE.

03 / RESEARCH · IN PROGRESS

Identifying interpretable urban-block archetypes

Newark, New Jersey · morphology, ensemble clustering and walkability.

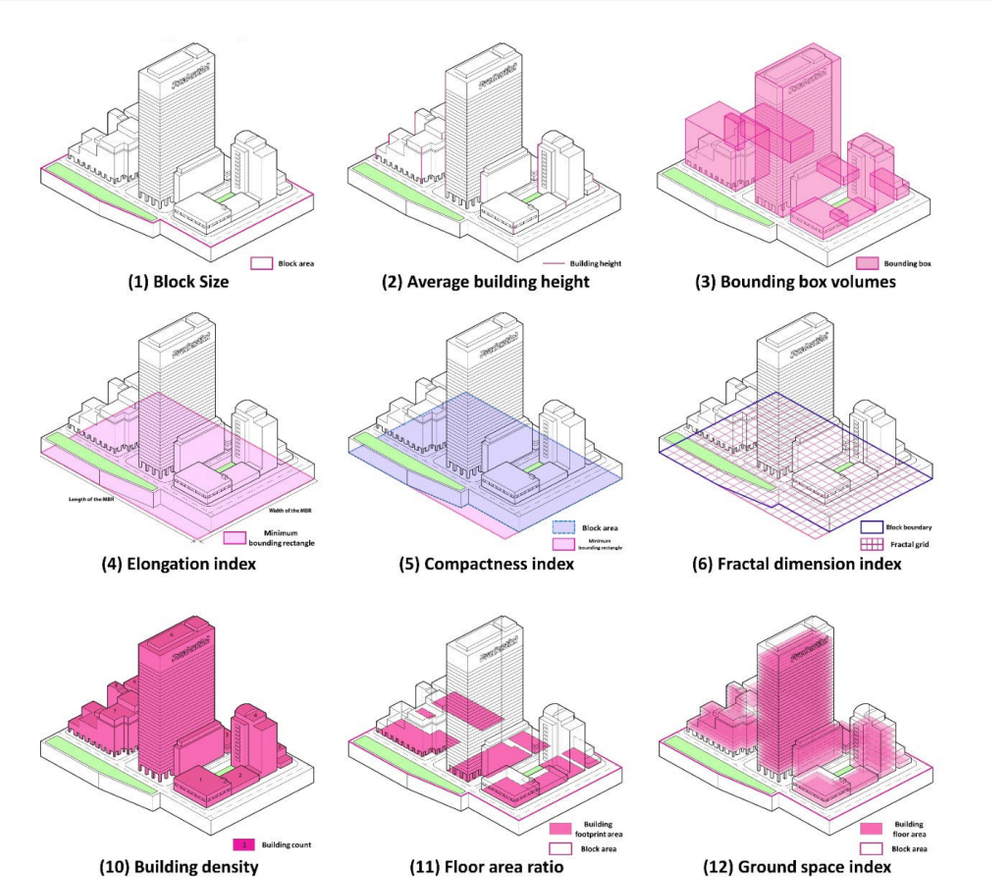


FIG. 07A | Nine selected block-morphology indicators describing built form, density, and spatial configuration.

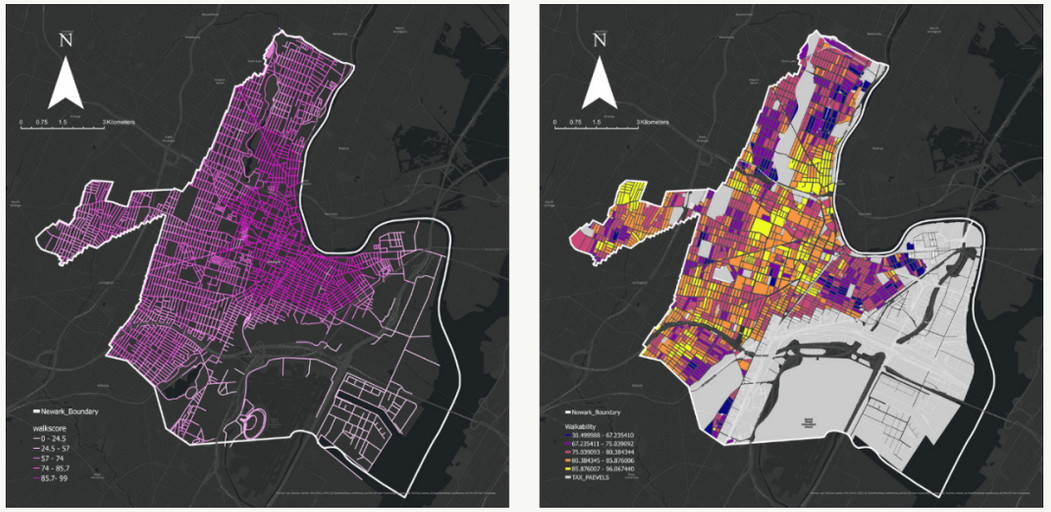


FIG. 07B | Spatial distributions of street-level (left) and block-level (right) walkability measures in Newark.

ONGOING RESEARCH

The Newark study characterizes 1,681 urban blocks using geometric, density and network indicators. Size-stratified ensemble clustering identifies recurring morphologies; XGBoost and SHAP support interpretation of their defining attributes. The resulting typologies are compared with block-level walkability.

04 / RESEARCH · 2025

Generation is not yet architectural performance

Evaluating whether AI-generated façades satisfy measurable window-to-wall targets.

GENERATED FAÇADE ALTERNATIVES

Stable Diffusion + ControlNet · Rhino massing studies · selected outputs



4-STORY 8-STORY 27-STORY

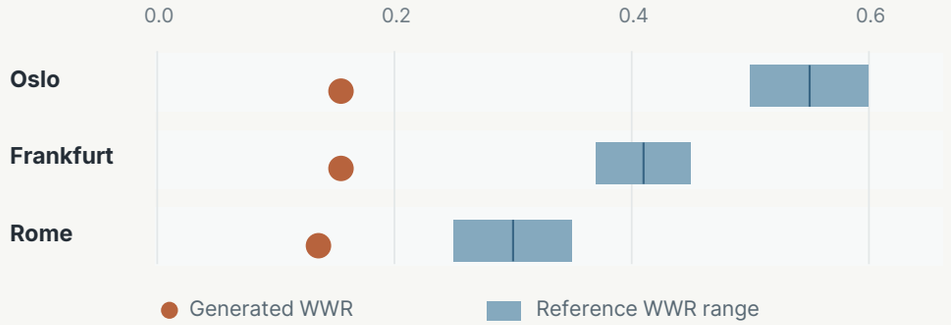
01 / EXTRACT WINDOW–TO–WALL RATIO



Generated façade Wall segmentation Window segmentation

SAM2 masks estimate the fraction of façade area occupied by windows.

02 / COMPARE WITH DESIGN TARGETS



South-facing example · benchmark ranges: Table 1; generated markers: approximate from Fig. 9

EVALUATION LOOP

Stable Diffusion/ControlNet generated 378 façade images from controlled massing studies. SAM2 window and wall masks enabled quantitative window-to-wall ratio (WWR) estimates, which were compared with climate- and orientation-specific benchmarks. SVR and SHAP examined how prompt parameters relate to the resulting WWRs, revealing a gap between visual plausibility and architectural performance targets.

04 / RESEARCH · 2026

Does the image follow the architectural instruction?

Comparing automated text–image alignment with judgments by architectural designers.

DESIGN PROMPTS / GENERATED ALTERNATIVES



PROMPT 01



PROMPT 02



PROMPT 03



PROMPT 05

STUDY DESIGN

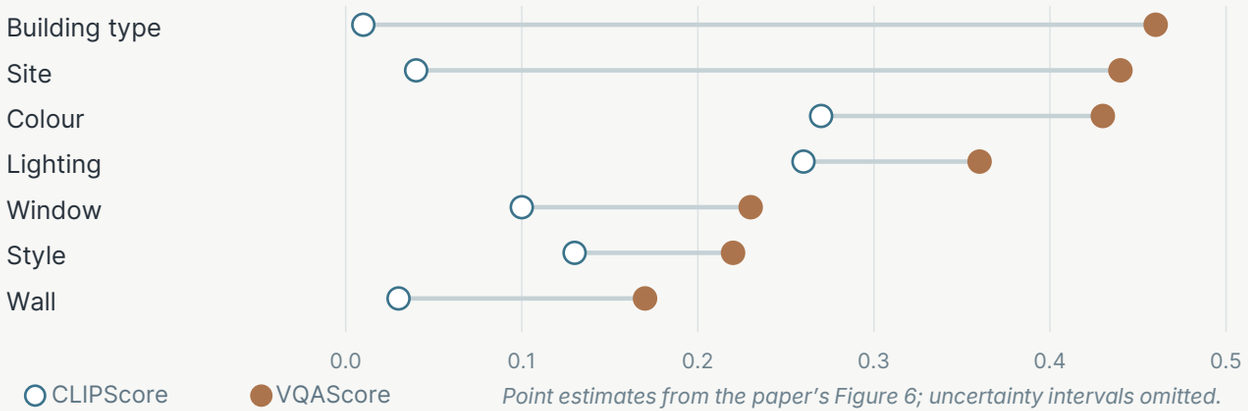
144 structured design prompts

576 generated images

Rule-based combinations of 7 architectural attributes
4 random seeds per prompt · 25 survey participants

WHICH METRIC AGREES WITH DESIGNERS?

Attribute-level agreement with human ratings · Spearman ρ



Point estimates from the paper's Figure 6; uncertainty intervals omitted.

THE FINDING

01 / TASK A — VERIFY ARCHITECTURAL ATTRIBUTES

VQAScore better follows expert judgments of building type, site, colour and lighting.

02 / TASK B — SELECT BETWEEN SIMILAR IMAGES

CLIPScore and SigLIP align better with human selections among four alternatives.

Zhang, Jia & Narahara · CAADRIA 2026, 1, 703–712 · doi:10.52842/conf.caadria.2026.1.703

05 / APPLIED COMPUTATIONAL DESIGN

Exploring alternatives across competing criteria

Sketch to Build · an intuitive performance-oriented platform for multifamily housing design.

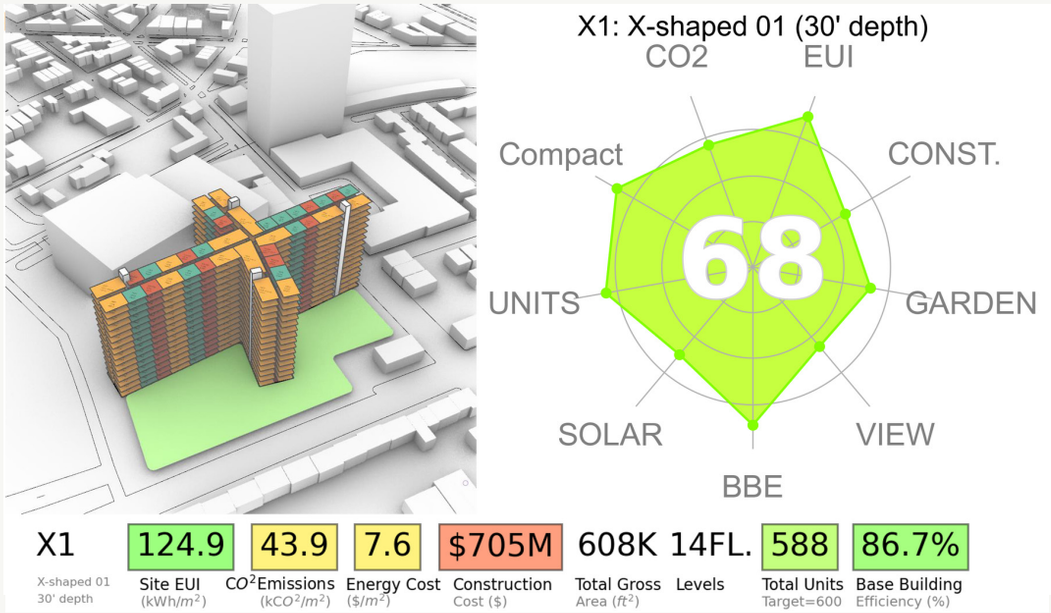


FIG. 10A | Parametric housing design and multi-criteria performance assessment.

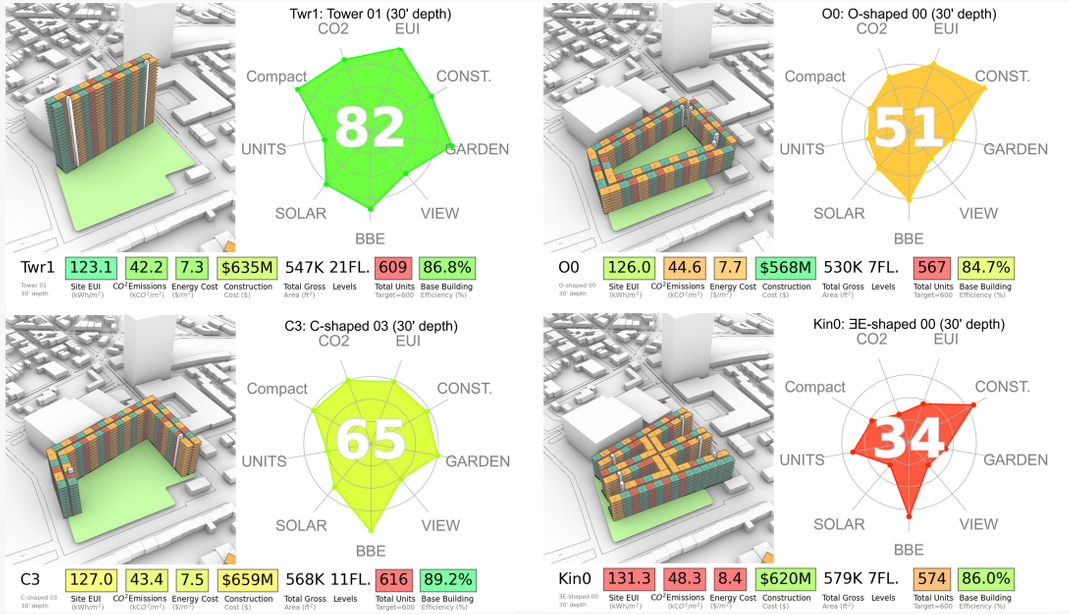


FIG. 10B | Alternative designs compared through performance-based criteria.

DESIGN SUPPORT SYSTEM

Sketch to Build integrates early-stage massing exploration with multiple, sometimes competing measures of housing performance. Alternatives are compared across energy use, carbon, cost, unit count, views and spatial configurations. The goal is to expose meaningful trade-offs and support iterative human decisions, not to prescribe a single optimal building. The work received NSF I-Corps support.

05 / RESEARCH AND PROTOTYPES

Experiencing computational space through the body

VR environments, movement, redirected navigation and tactile interaction.

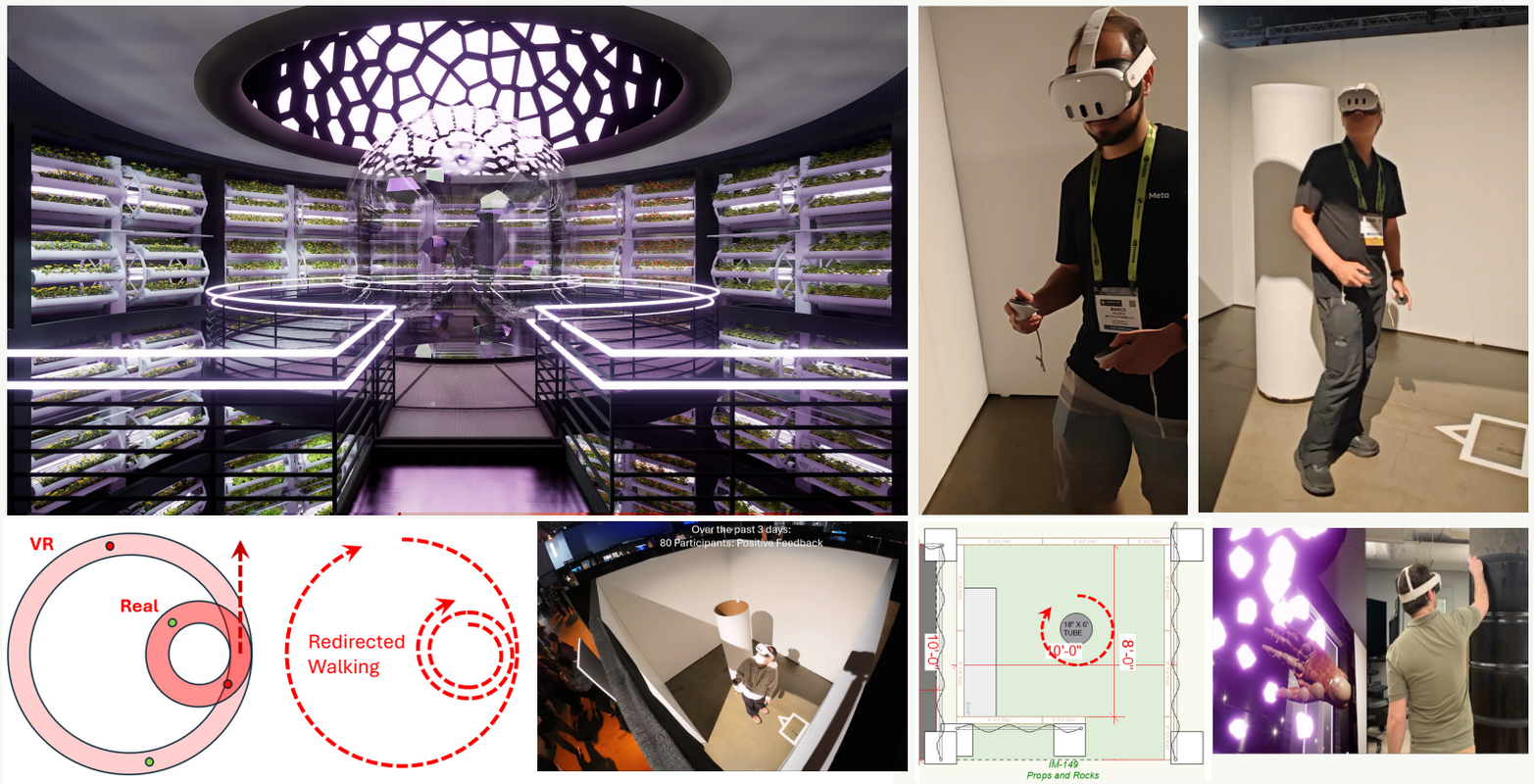


FIG. 11 | SIGGRAPH 2024 installation integrating redirected walking, virtual portals, and passive haptic interaction within a constrained physical space.

EMBODIED SPATIAL EXPERIENCE

Immersive research addresses a dimension often overlooked in image-based design evaluation: space is experienced through the moving body. Originating in a faculty–student design studio collaboration, Props and Rocks explores how redirected walking, virtual portals, and passive haptic cues alter the relationship between physical boundaries and perceived scale. The project was developed into an interactive installation exhibited at the SIGGRAPH 2024 Immersive Pavilion.

My contribution: All VR programming, system implementation, and technical integration for the final exhibited installation.

SIGGRAPH 2024 Immersive Pavilion · Faculty–student collaboration · doi:10.1145/3641521.3664404

VIEW PAPER ↗

06 / BUILT WORK · TOKYO, 2000–2003

Architecture as an engineered assembly

Mori Art Center Entry Structure · Gluckman Mayner Architects



FIG. 12A | Completed entry structure at Mori Art Center, Tokyo.



FIG. 12B | Cable-net shell and glass-support details.

BUILT PROJECT + ROLE

The Mori Art Center entry structure in Tokyo brings together a two-way cable-net shell, glazing, custom metal connections and a demanding public interface. Developed within Gluckman Mayner Architects in collaboration with engineers and fabricators, the project required coordination between architectural geometry, buildability, tolerances, codes and aesthetic intent. Role: project architect, from design through completion.

Mori Art Center · Architects: Gluckman Mayner; engineering: Dewhurst McFarlane and Partners

06 / BUILT WORK · FABRICATION

From computational geometry to fabricated detail

3D geometric modeling, cable-net coordination, and custom glass connections.

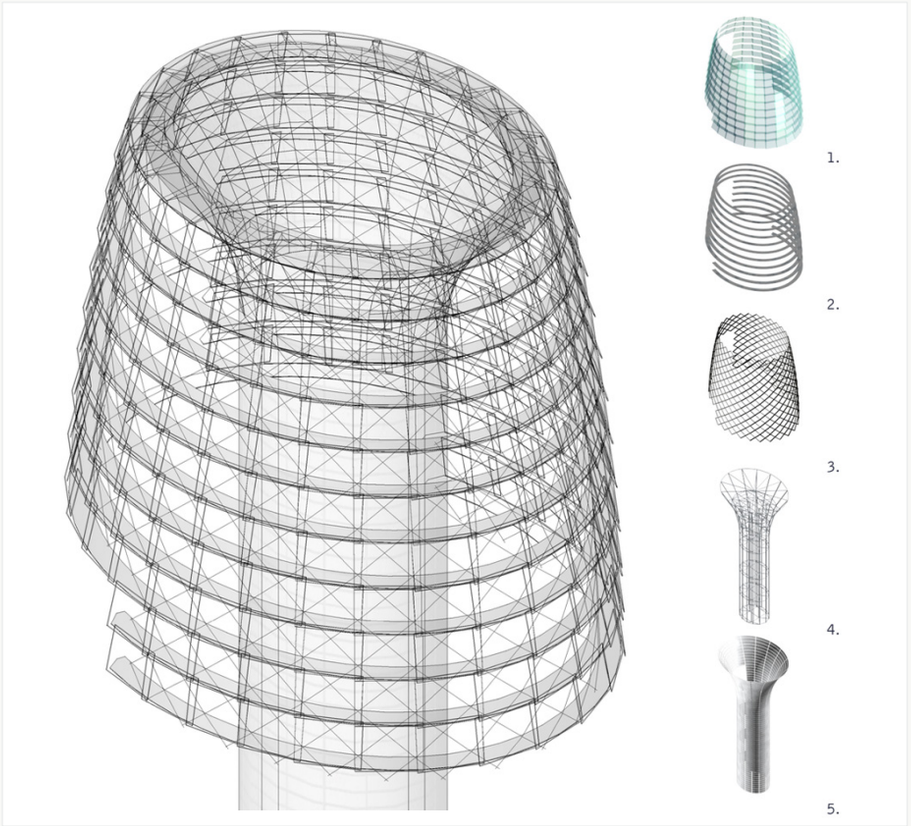


FIG. 13A | 3D wireframe and geometric layers of the entry-shell system.

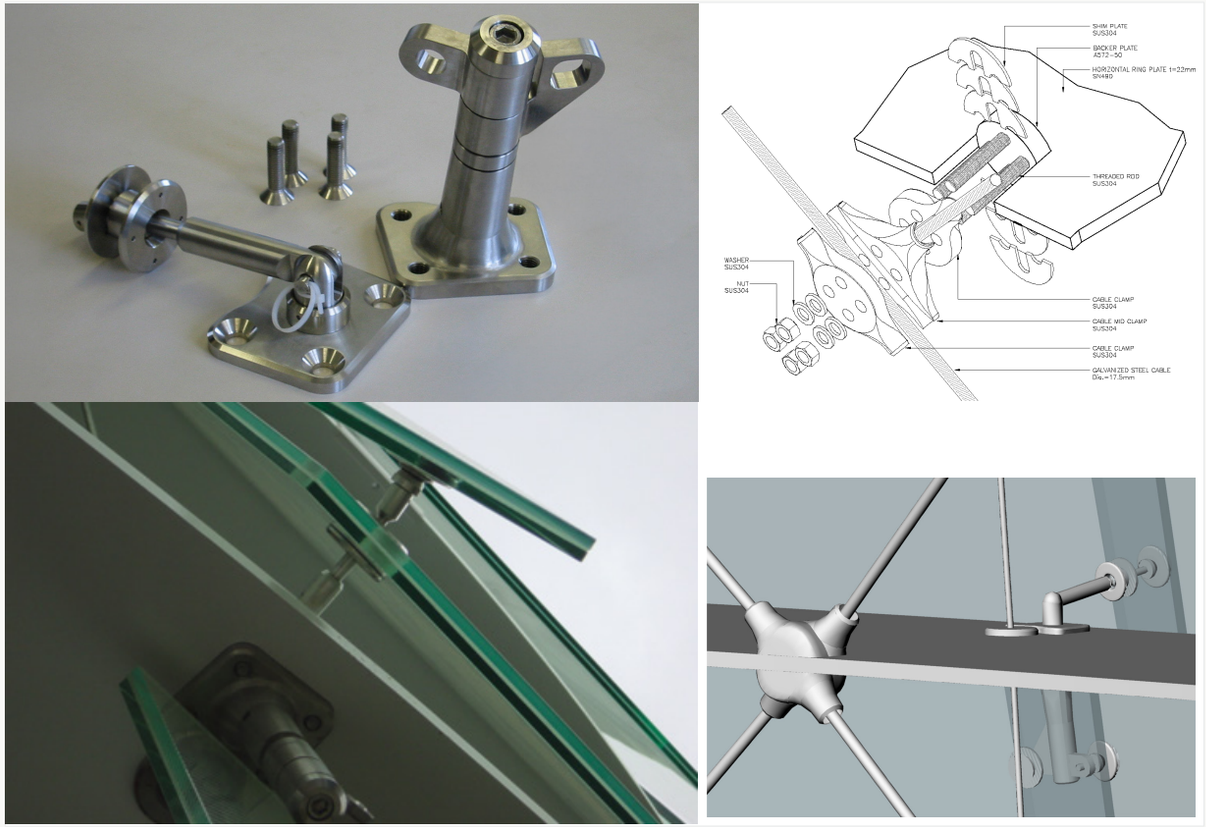


FIG. 13B | Fabricated connection hardware, detail studies, and installed glass supports.

GEOMETRY TO FABRICATION

My 3D modeling work supported the coordination of the cable-net geometry, glazing, and custom metal connections, linking digital design to the fabrication and construction of the Mori Art Center entry structure.

07 / CREATIVE PRACTICE

Architecture beyond the built

Computational modeling and generative media extend architectural inquiry beyond conventional building proposals. Through speculative imagery, film, and large-scale projection, I explore spatial organization, scale, perception, and temporal transformation as materials for design.



FEATURED IMAGE / ASAI ARCHITECTURE IN PERSPECTIVE 39 · THEMATIC AWARD 2025



INFINITE DIALOGUE

Projection mapping on the Tokyo Metropolitan Government Building
2026 · Tokyo, Japan

Audience Award
Highest number of audience votes
TOKYO LIGHTS 2026

WATCH THE ORIGINAL FILM

Site-specific moving-image work · Directed and created by Taro Narahara

07 / SITE-SPECIFIC PROJECTION · 2026

A moving image negotiated with a fixed facade

The building is an active spatial condition—not a neutral rectangular screen.



FIG. 14A | Projection responding to the building's geometric structure.



FIG. 14B | Human faces integrated into the architectural façade.



FIG. 14C | Building-scale projection viewed from above.

CONCEPT

Infinite Dialogue uses the actual geometry of the Tokyo Metropolitan Government Building as a framework for moving images. The façade's symmetry, window grid and vertical rhythm inform compositions that transform over time, creating a dynamic relationship between the projected imagery and the existing architecture.



FILM STILL / INCREMENTAL URBAN GROWTH



EXHIBITION VIEW / 2026

Shenzhen–Hong Kong Bi-City Biennale of Urbanism / Architecture (UABB)

THE ARCHITECTURE OF OBSESSION

Experimental architectural film · 2025

Architizer Vision Awards 2025
Special Mention / Video — Experimental

Drawing on incremental, self-organizing urban growth, the film imagines buildings accumulating into vast, interconnected structures. Individual acts of construction develop into a collective spatial order beyond any single architect’s control.

WATCH FILM ↗

Film still and exhibition photograph · Original work by Taro Narahara

07 / CREATIVE PROCESS

The architectural system precedes the generated image

Rules, geometry and sequencing remain authored—even as AI transforms materials and motion.

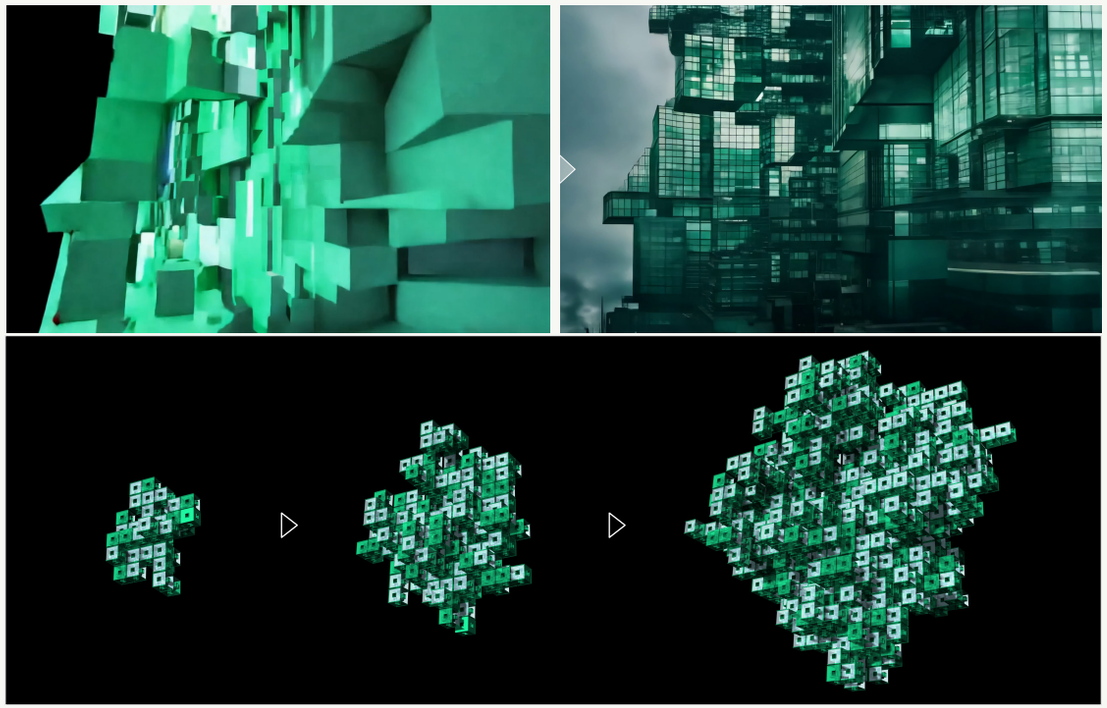


FIG. 15A | Procedural geometry establishes spatial rules and structural repetition.

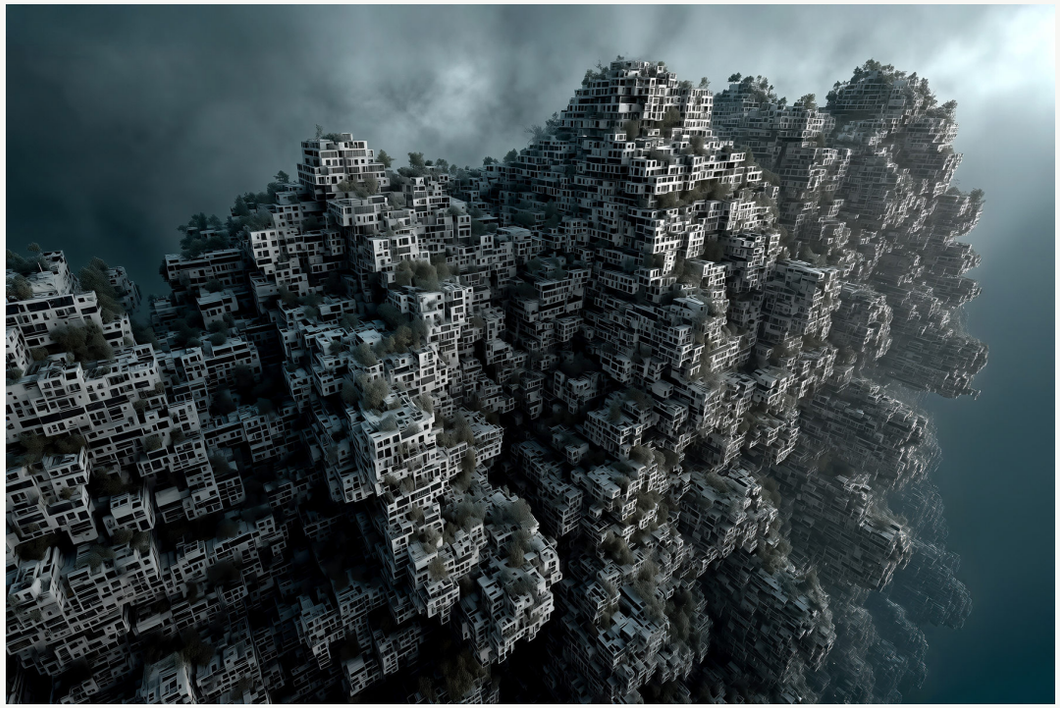


FIG. 15B | AI-assisted transformation develops cinematic material, atmosphere and movement.

AUTHORSHIP + SEQUENCE

The film begins with a procedural spatial system authored in Rhino and Python. Rule-based assemblies establish repetition, aggregation and transformation; AI-assisted image and video synthesis extends their material qualities and motion. Through selection, editing and sequencing, the geometric logic becomes an architectural narrative across media. The emphasis is on continuity of authorial control, not on any single software tool.

WATCH FILM ↗

07 / EXHIBITIONS AND COMMISSIONED MEDIA

Experimental work in cultural and institutional contexts

Independent speculative work alongside site-specific and commissioned architectural communication.



FIG. 16A | Metabolist-inspired experimental imagery.

METABOLIST STUDY / 2025

An AI-assisted architectural study responding to the legacy of Japanese Metabolism. Selected for the Shoto Museum of Art open-call exhibition; Excellence Award.

RELATED FILM ↗



FIG. 16B | Commissioned architectural moving-image work.

INSTITUTE OF SCIENCE TOKYO / 2026

A commissioned promotional film developing the image of a university-centered network of research, industry and urban life.

WATCH FILM ↗

08 / COMPUTATIONAL DESIGN EDUCATION

Teaching computation as a way to formulate questions

From parametric systems and performance analysis to AI-assisted architectural design.

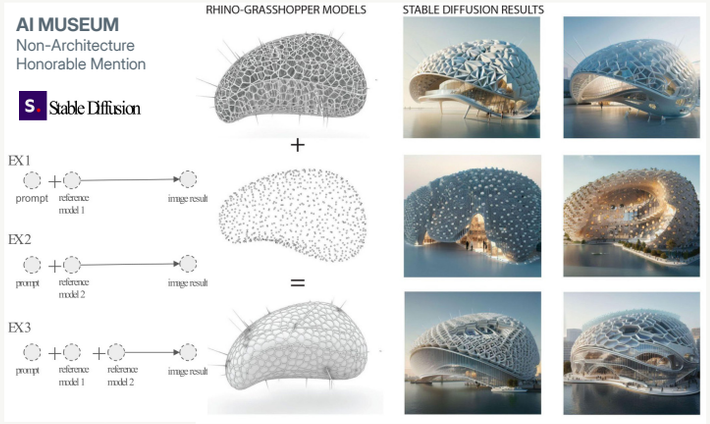


FIG. 17A | AI-Augmented Parametric Design Exploration

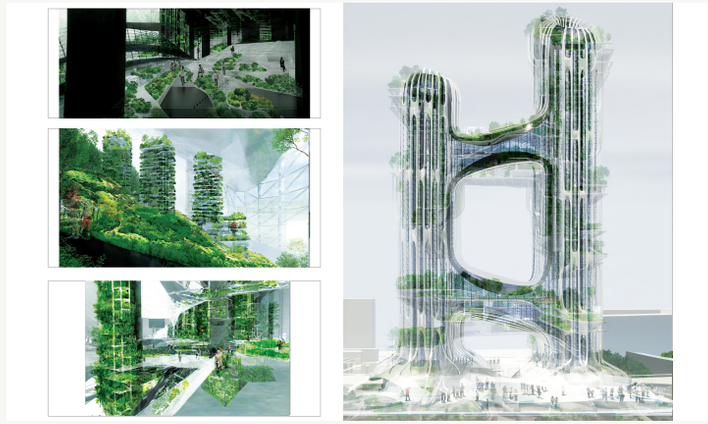


FIG. 17B | AI-Assisted Sustainable High-Rise Design

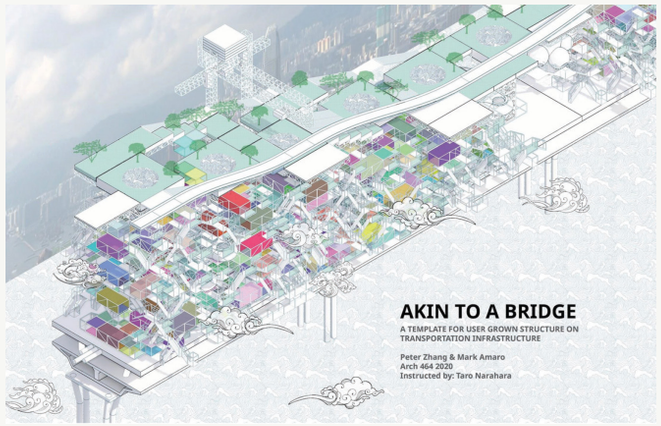


FIG. 17C | Rule-based urban growth on a Hong Kong bridge.

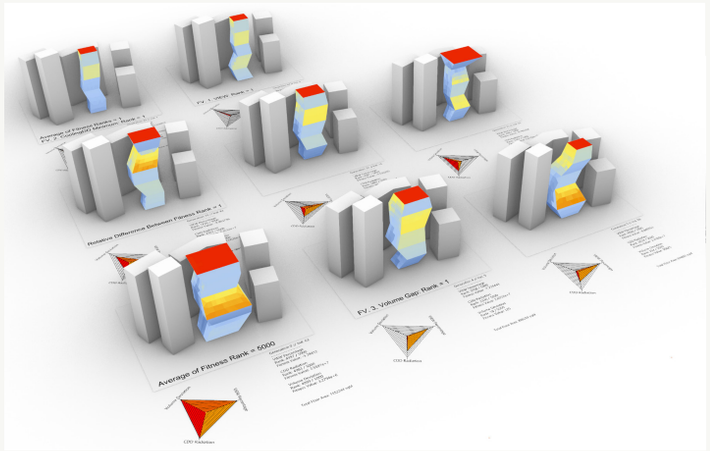


FIG. 17D | Multi-objective design optimization.

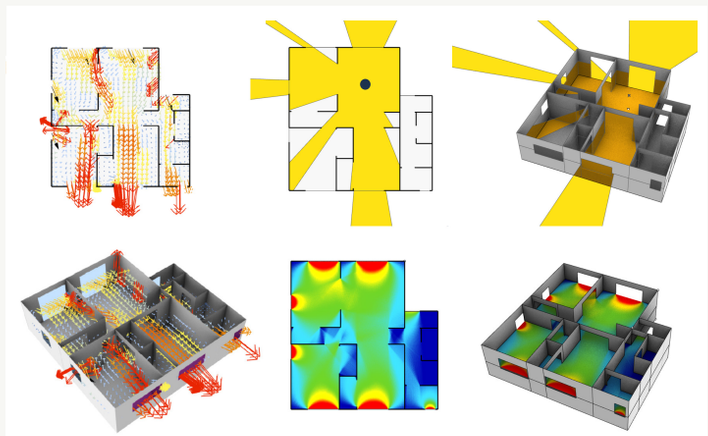


FIG. 17E | Computational modeling and performance analysis.

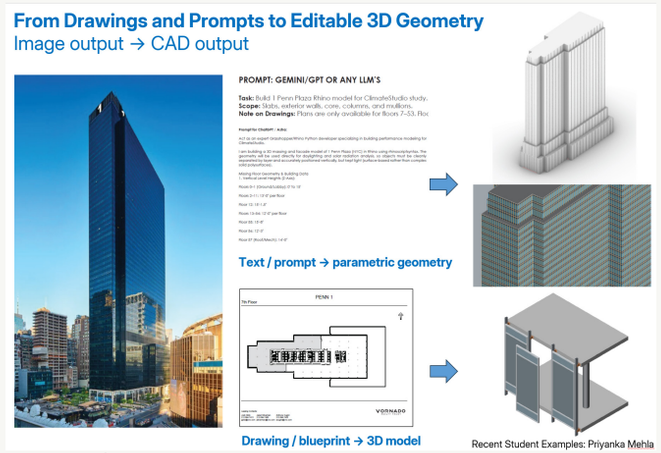


FIG. 17F | Drawings and prompts to editable 3D using AI.

PEDAGOGICAL APPROACH: Students turn design questions into parameters and computational models, test alternatives through simulation and AI, and critically evaluate the results. These selected exercises and student projects connect algorithmic thinking, performance analysis, and design judgment.

Selected research / Creative recognition

Research in computation and spatial intelligence is pursued alongside independent work in architectural moving images and site-specific media.

SELECTED PEER-REVIEWED RESEARCH

2026 · URBAN VITALITY

Sustainable Cities and Society, 151, 108010 · DOI

2026 · MLLM SPATIAL EVALUATION

IEEE MIPR 2026 · DOI

2023 · SUBJECTIVE SPACE EVALUATION

IEEE Transactions on Multimedia, 25 · DOI

AWARDS / EXHIBITIONS

2026 · AUDIENCE AWARD

TOKYO LIGHTS / 1minute Projection Mapping Competition · Infinite Dialogue

2026 · FINALIST

Architizer Vision Awards · Video: Experimental · Infinite Dialogue

2026 · EXHIBITED

Shenzhen–Hong Kong Bi-City Biennale · The Architecture of Obsession

2025 · SPECIAL MENTION

Architizer Vision Awards · Video: Experimental · The Architecture of Obsession

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