

How can we **operationalise** a **context-aware definition of ‘good’** in **urban spaces** that aligns **public** perception with **expert** theory through the use of **generative AI**?

01 What was the purpose?

To test whether a Grasshopper-embedded AI pipeline can define urban quality conditions (i.e., describe what the place is like and how it may be experienced)

02 What was the method?

The workflow is evaluated on instrument behaviour, computed from geometry within a 3D model. AI models take care of the reasoning and defining quality, which are based on the metrics extrapolated from the 3D model.

03 What did we learn from this study?

We can use AI as a credible descriptive instrument to translate perceptual condition statements, through a combination of objective and subjective metrics, to define the quality of a space.

04 What is the final conclusion?

This experiment provides an early-stage validation that generative AI (ChatGPT + SD in Grasshopper) can be used to define perceptual qualities of a proposed urban space from measurable and visible attributes, and do so in a way that can be systematised as data + reasoning

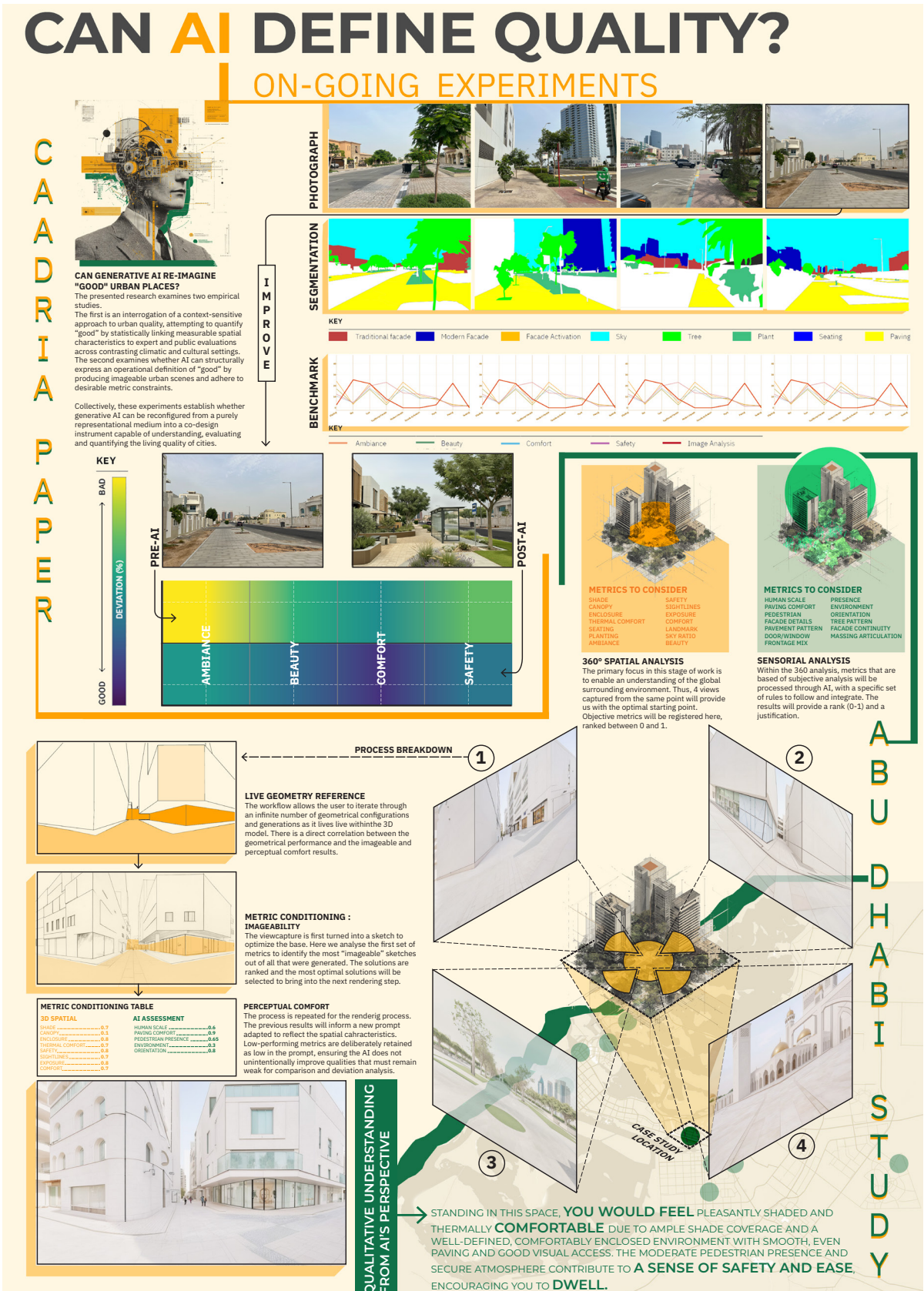
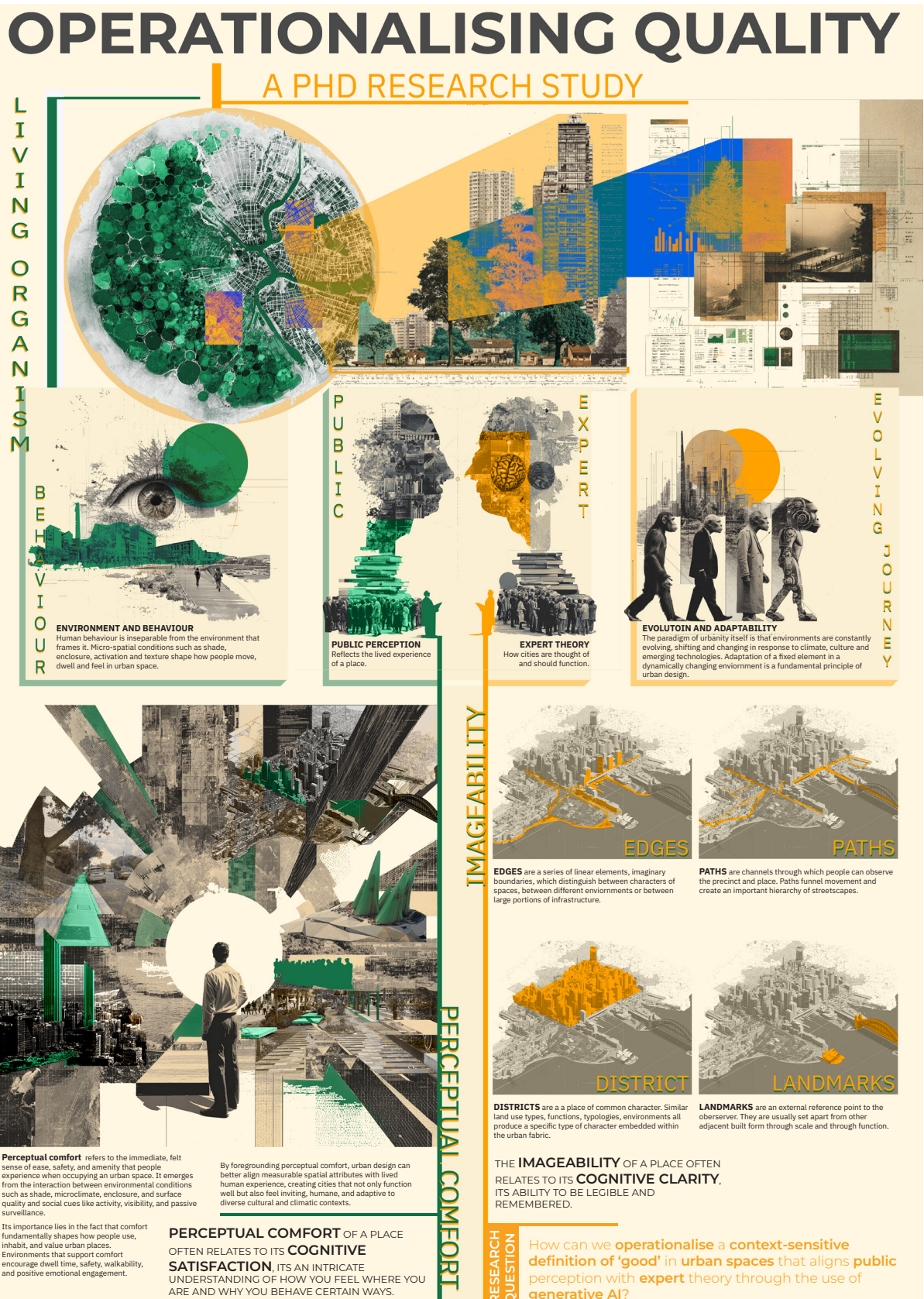
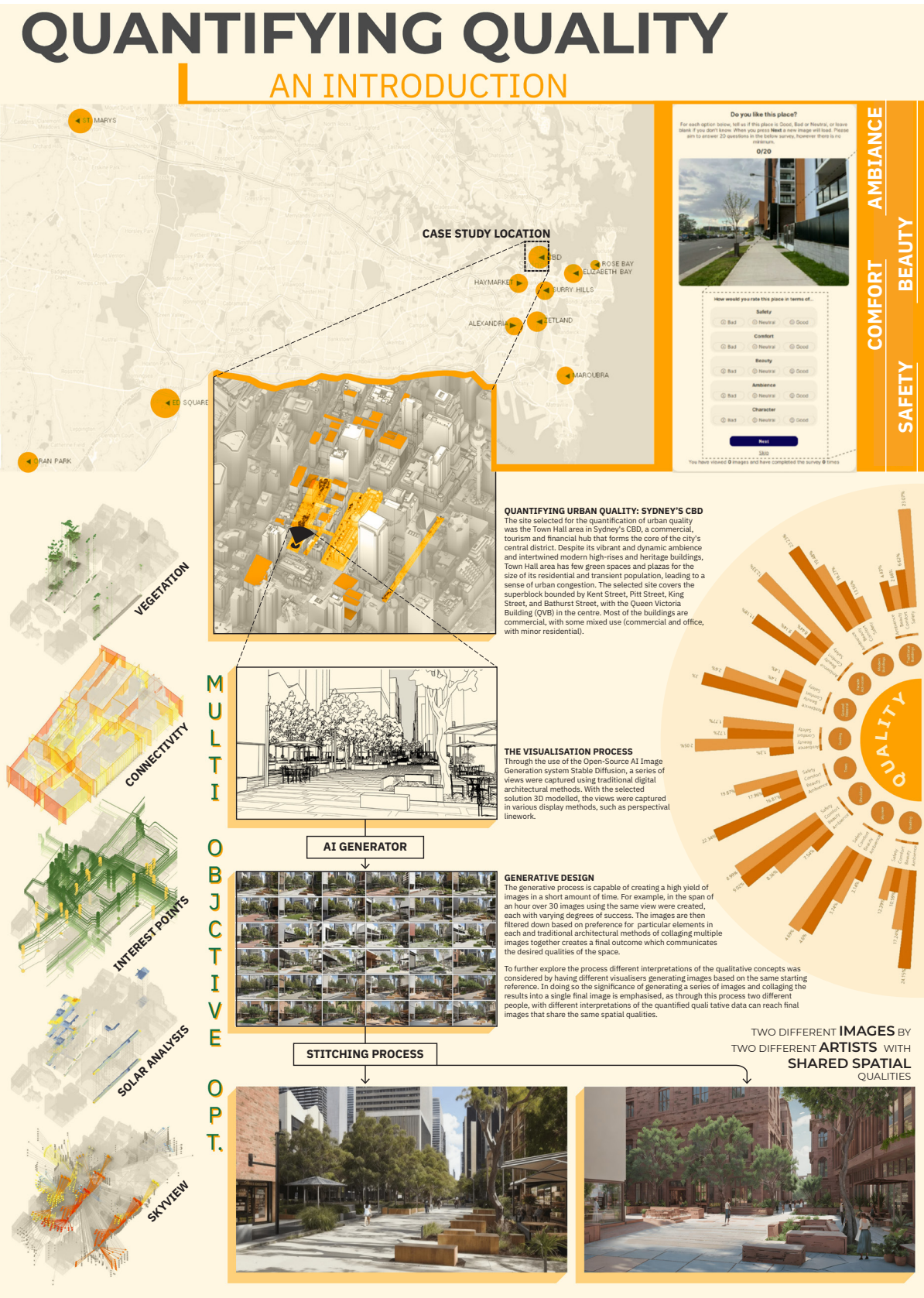
ABU DHABI RECAP

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- 1 - Before AI can operationalise “good,” it must first demonstrate it can define urban quality conditions in a way that is grounded (evidence-based) and repeatable (instrument-like).
- 2 - AI can generate a descriptive quality profile that is consistent with the spatial features visible/measurable in the input, and is stable across repeated runs.
- AND
- AI can correctly explain its definition by linking claims to specific metrics and visual evidence.
- 3 - A design-integrated AI system that can translate between measurable/visible attributes and human-legible quality descriptions, with explicit rules, traceability, and reliability tests.



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- Separation between definition and evaluation
 - Design integrated workflow
 - Dual-metric structure for assessment
 - Adaptable metrics for different audiences
 - Scale-aware set up

- Cons:
- Reliance on visual representation
 - Doesn’t yet account for meaning/memory/attachment of place OR benchmarks
 - Context sensitivity currently manual
 - Indicative, NOT predictive
 - Needs further testing (location change, quality change, reliability)

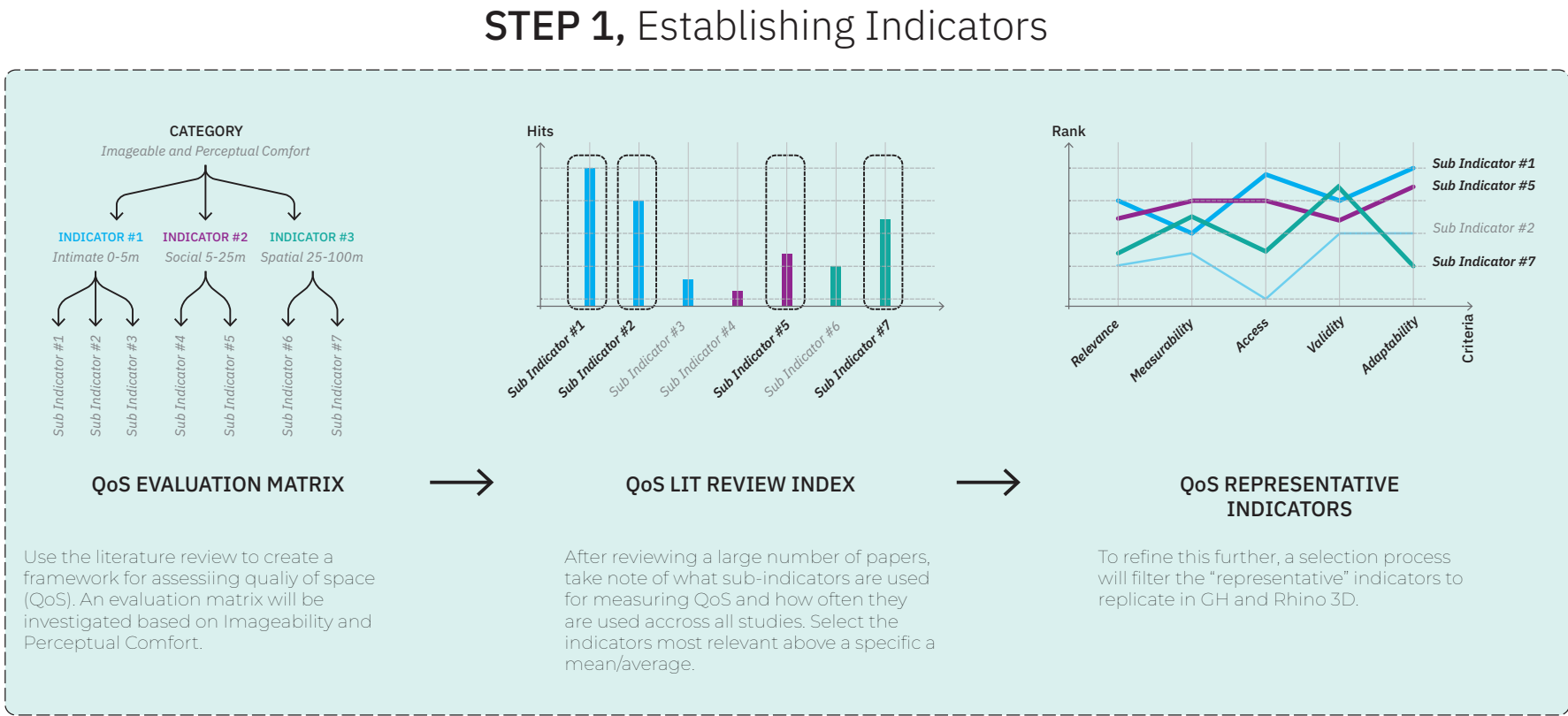


Figure 6. Deviation analysis comparison between the Abu Dhabi images and the AI-modified images.

OBJECTIVE	SCALE	METRIC	ASSESSMENT METHOD	RANK
IMAGEABLE	INTIMATE	Façade Detail	AI ONLY	AI RULE#1
		Pavement Pattern	AI ONLY	AI RULE#2
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		Human Scale	AI ONLY	AI RULE#8
	SOCIAL	Thermal Comfort	3D ONLY	
		Paving Comfort	AI ONLY	AI RULE#9
		Pedestrian presence	AI AND 3D	AI RULE#10
		Safety	3D ONLY	
	SPATIAL	Sightlines	3D ONLY	
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		Comfort	3D ONLY	
		Orientation	AI AND 3D	AI RULE #12

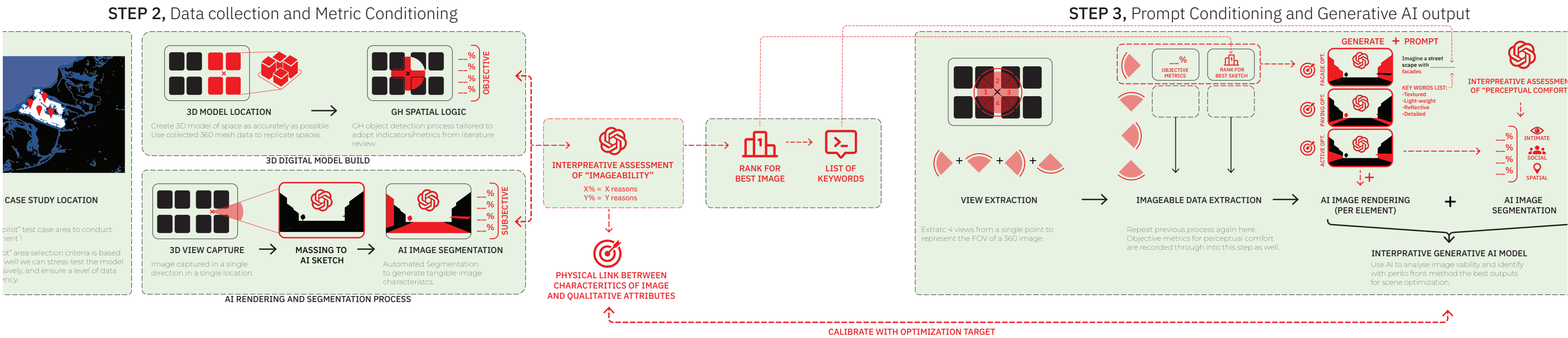
IMAGEABLE RULES
AI RULE #2 – Pavement Pattern Score higher when pavement shows clear patterning, textural variation, or visually rich surfacing. Score lower when pavement appears monotone, patchy, or poorly defined.
AI RULE #3 – Doors and Window Density Score higher when human-scale openings such as doors and windows are frequent, well distributed, and active. Score lower for long blank walls or sparse openings.

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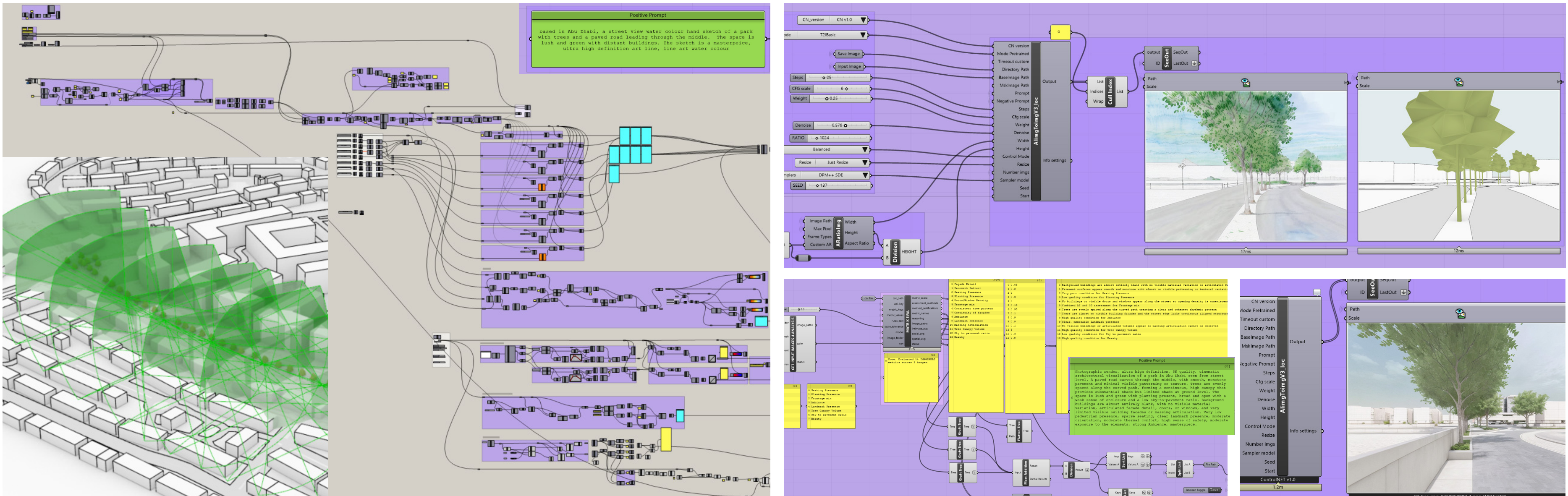
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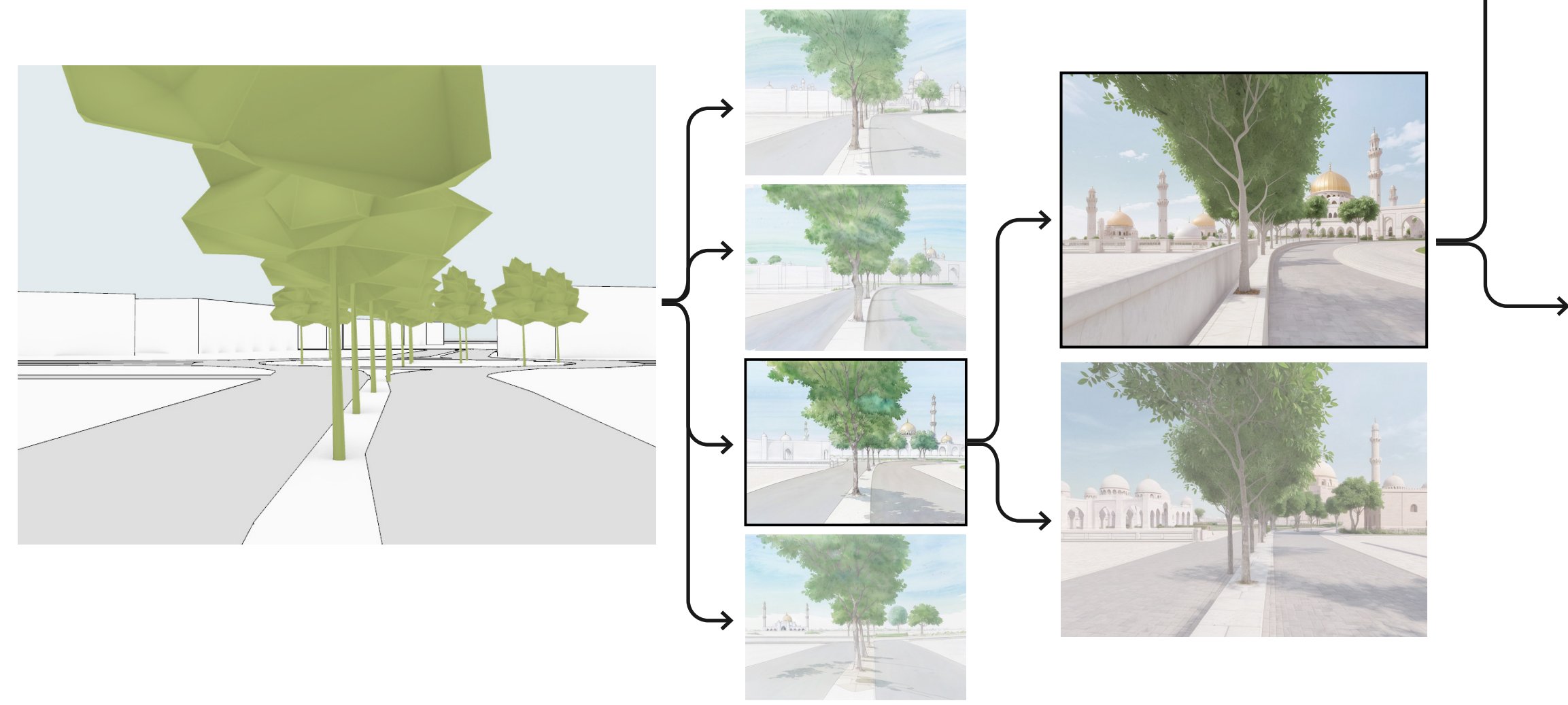
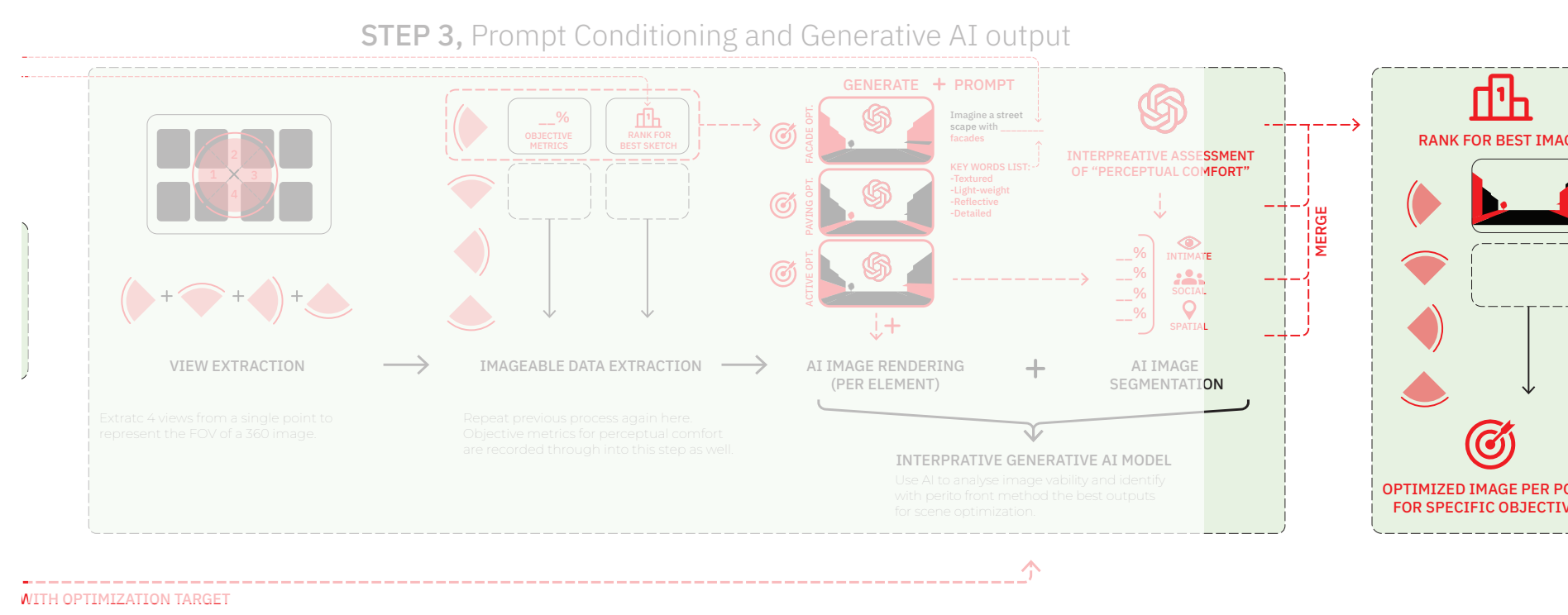
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03 What did we learn from this study?

We can use AI as a credible descriptive instrument to translate perceptual condition statements, through a combination of objective and subjective metrics, to define the quality of a space.

- 1 - If objective metrics and AI-assessed metrics disagree, the system must detect and reconcile. This mismatch detection becomes one of the most important “instrument validity” outcomes.
- 2 - The quality definition is only meaningful if: claims are tied back to metric values, and those metric values correspond to visible/measurable features.
- 3 - Next steps include:
 - accuracy of feature detection,
 - coherence of metric-to-claim reasoning,
 - repeatability/stability of outputs.
 - industry relevance and usefulness
 - visualising results

Are we really making a better place?



METRIC	SCORE	REASONING
0 Shade at ground	0 0.1	0 Very little shade; most areas remain exposed
1 Canopy density	1 0.8	1 Strong tree canopy volume providing substantial cover
2 Enclosure	2 0.1	2 Highly open/exposed with little sense of boundary
3 Human Scale	3 0.63	3 Tall monumental domes and towers dominate while limited entrance detail and long walls reduce human level articulation
4 Thermal Comfort	4 0.5	4 Mixed thermal comfort; relief is intermittent
5 Paving Comfort	5 0.95	5 Smooth continuous paving with clear joints appears even unobstructed and comfortable for walking
6 Pedestrian presence	6 0.075	6 Very limited presence cues; space reads empty; Wide paved walkway and plaza appear empty of pedestrians suggesting limited pedestrian presence
7 Safety	7 0.8	7 Strong safety cues with good oversight and legibility
8 Sightlines	8 0.1	8 Highly restricted sightlines with limited visibility
9 Exposure to elements	9 0.5	9 Mixed enclosure; boundaries are present but inconsistent
10 Environmental response	10 0.9	10 Continuous street trees and planted areas provide abundant shade while open sky suggests good ventilation
11 Comfort	11 0.1	11 Very low condition indicated for Comfort
12 Orientation	12 0.705	12 Mixed condition indicated for Orientation; Curving path clear edges aligned trees and repeated domes provide strong visual direction and legible orientation

AI SUMMARY

I would feel mostly exposed to the sun with limited shade and only intermittent thermal relief. The space would feel highly open and somewhat empty, with little sense of boundary or human-scale detail, as tall monumental domes and towers dominate while long, minimally articulated walls reduce intimacy. Walking would feel physically comfortable due to the smooth, even paving, but the very limited presence cues and apparent lack of pedestrians would make the area feel underused and somewhat isolating despite strong safety cues, good oversight, and clear legibility. Orientation would feel mixed but generally manageable: curving paths, aligned trees, and repeated domes would give me clear visual direction, yet restricted sightlines and inconsistent enclosure might occasionally make the space feel confusing or disjointed. Overall, I would experience low comfort, a strong sense of exposure and emptiness, but with a clear understanding of how to navigate the space.

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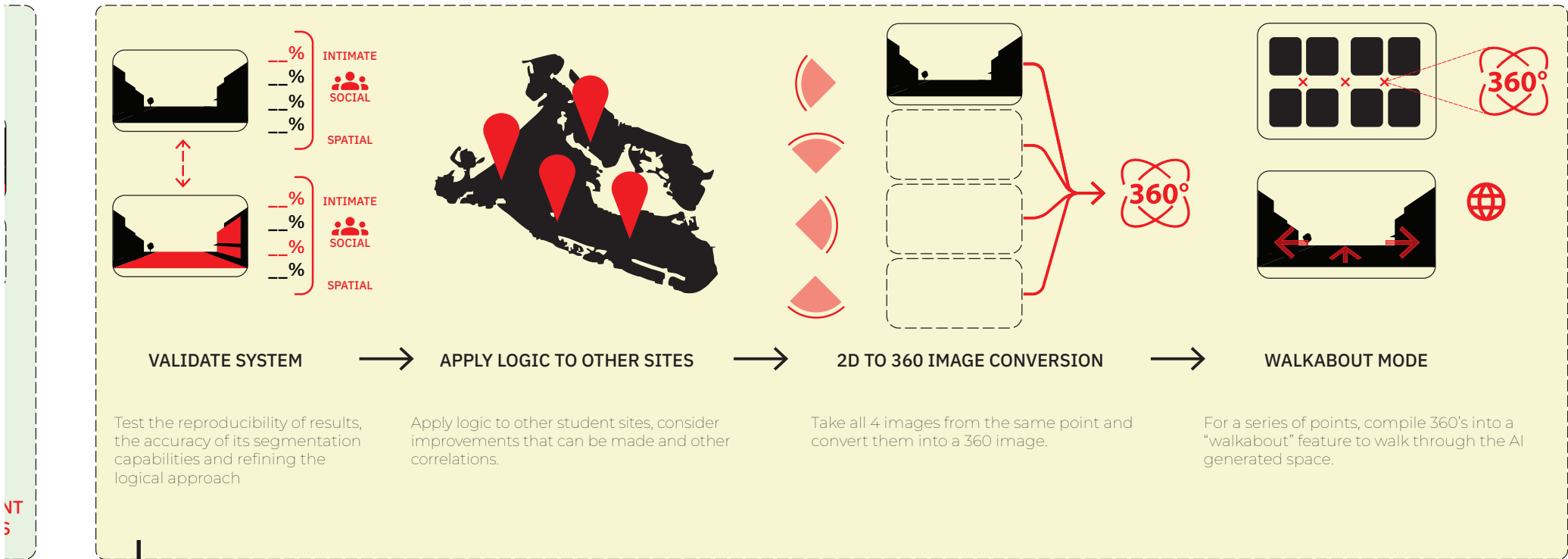
This study demonstrates the feasibility of using generative AI as a descriptive instrument for defining perceptual urban quality from design representations based on visible and measurable attributes.

- AI can define perceptual quality in a structured and repeatable manner
- Visible spatial features can be translated into qualitative descriptions
- Objective and AI-assessed metrics can be meaningfully combined
- Reasoning can be explicitly traced from metrics to conclusions
- Quality definition can be embedded directly within the design workflow

Limitations:

- Prompt is manual, needs segmentation
- Low detail sketch limits accuracy
- Workflow is complex and timely
- Behaviour is indicative rather than predictive
- Not “true” 360, cultural and climate needs to be claibrated.

STEP 4, Validate System, Scale and Visualise Solutions

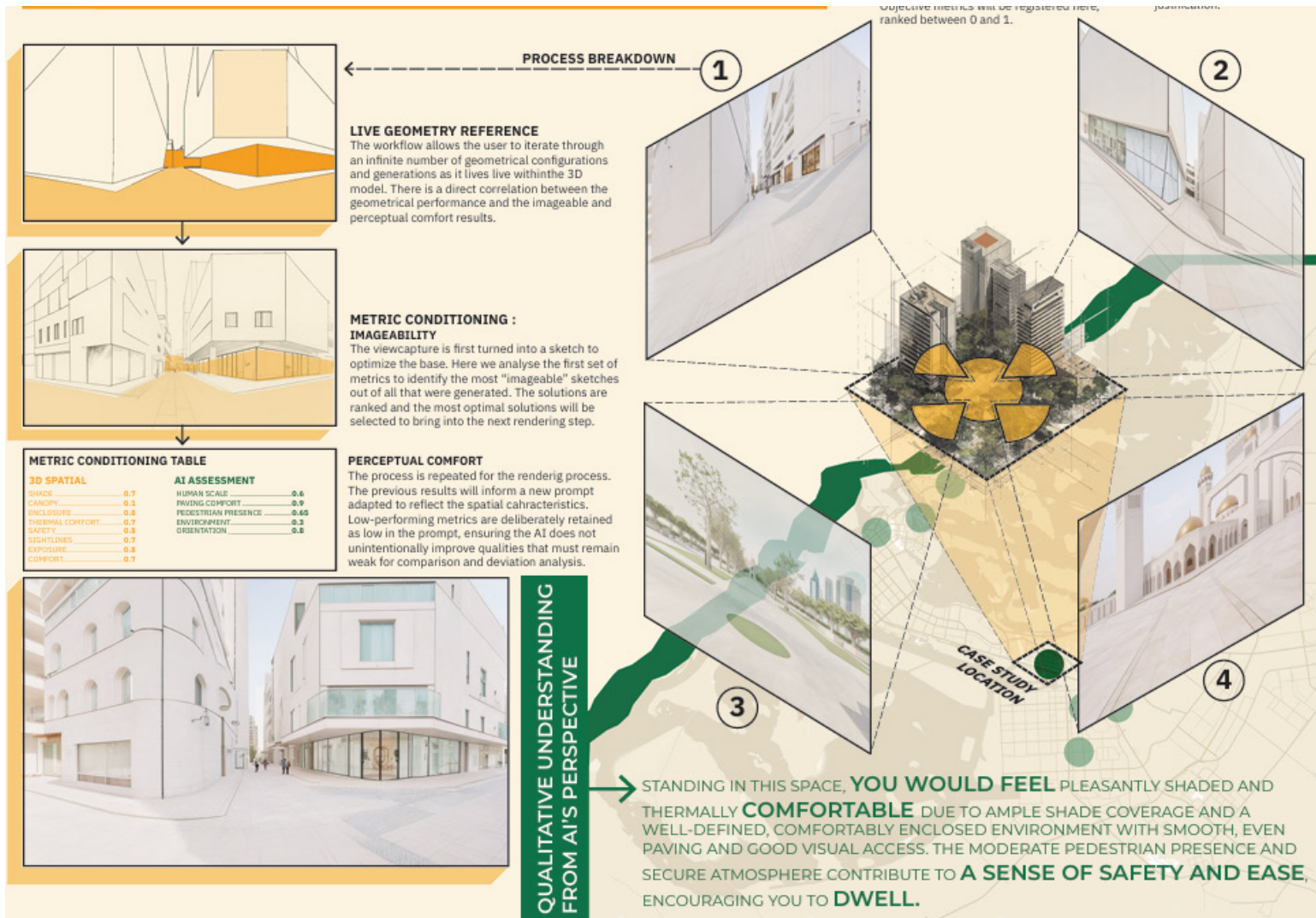


01 Is it repeatable?

Test repetitive capabilities of AI conclusions - is it viable?

02 Is it accurate?

Is the segmentation true to its analysis?



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