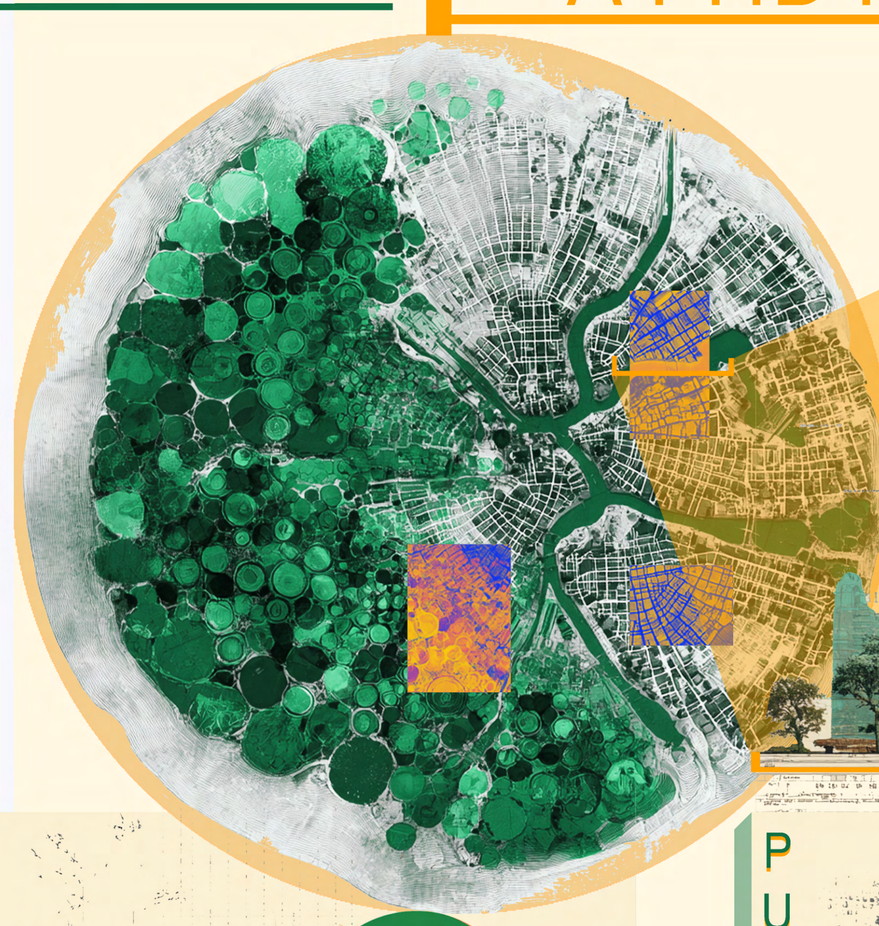
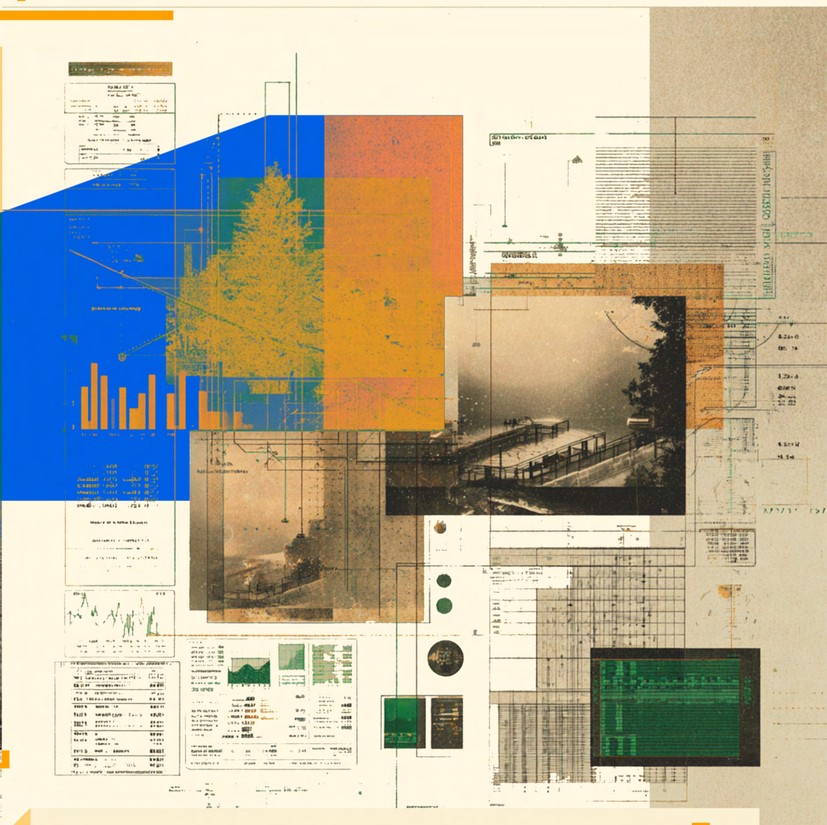
OPERATIONALISING QUALITY

A PHD RESEARCH STUDY







LIVING ORGANISM



BEHAVIOUR

ENVIRONMENT AND BEHAVIOUR
Human behaviour is inseparable from the environment that frames it. Micro-spatial conditions such as shade, enclosure, activation and texture shape how people move, dwell and feel in urban space.



PUBLIC

PUBLIC PERCEPTION
Reflects the lived experience of a place.

EXPERT

EXPERT THEORY
How cities are thought of and should function.



EVOLVING JOURNEY

EVOLUTOIN AND ADAPTABILITY
The paradigm of urbanity itself is that environments are constantly evolving, shifting and changing in response to climate, culture and emerging technologies. Adaptation of a fixed element in a dynamically changing enviornment is a fundamental principle of urban design.



PERCEPTUAL COMFORT

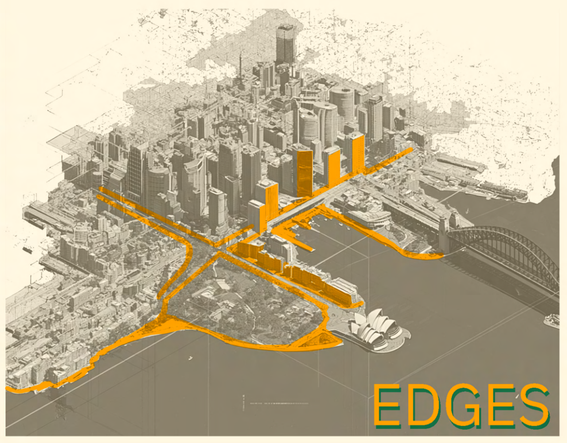
Perceptual comfort refers to the immediate, felt sense of ease, safety, and amenity that people experience when occupying an urban space. It emerges from the interaction between environmental conditions such as shade, microclimate, enclosure, and surface quality and social cues like activity, visibility, and passive surveillance.

Its importance lies in the fact that comfort fundamentally shapes how people use, inhabit, and value urban places. Environments that support comfort encourage dwell time, safety, walkability, and positive emotional engagement.

By foregrounding perceptual comfort, urban design can better align measurable spatial attributes with lived human experience, creating cities that not only function well but also feel inviting, humane, and adaptive to diverse cultural and climatic contexts.

PERCEPTUAL COMFORT OF A PLACE OFTEN RELATES TO ITS **COGNITIVE SATISFACTION**, ITS AN INTRICATE UNDERSTANDING OF HOW YOU FEEL WHERE YOU ARE AND WHY YOU BEHAVE CERTAIN WAYS.

IMAGEABILITY



EDGES are a series of linear elements, imaginary boundaries, which distinguish between characters of spaces, between different enviornments or between large portions of infrastructure.



PATHS are channels through which people can observe the precinct and place. Paths funnel movement and create an important hierarchy of streetscapes.



DISTRICTS are a a place of common character. Similar land use types, functions, typologies, environments all produce a specific type of character embedded within the urban fabric.



LANDMARKS are an external reference point to the oberserver. They are usually set apart from other adjacent built form through scale and through function.

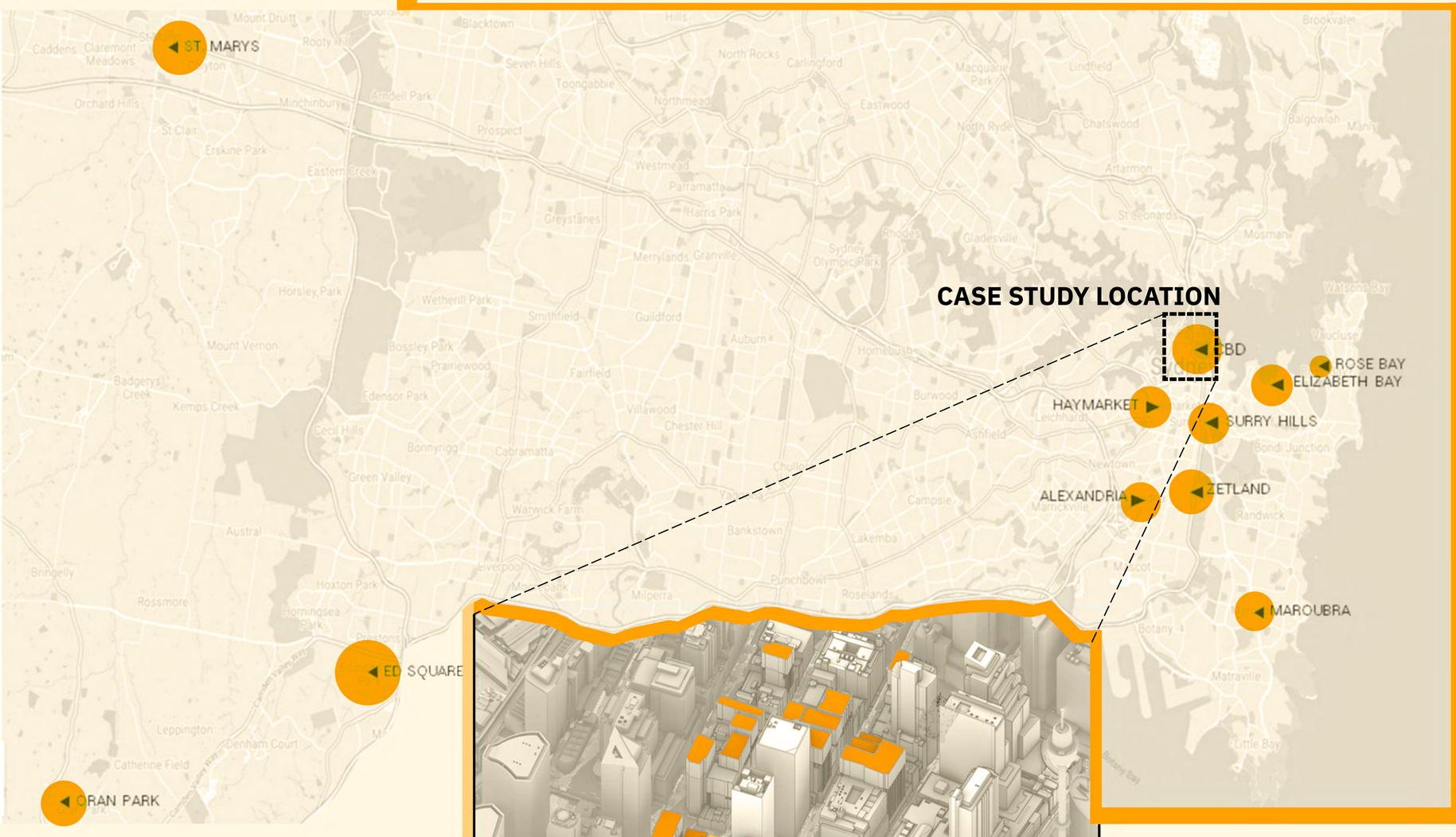
THE **IMAGEABILITY** OF A PLACE OFTEN RELATES TO ITS **COGNITIVE CLARITY**, ITS ABILITY TO BE LEGIBLE AND REMEMBERED.

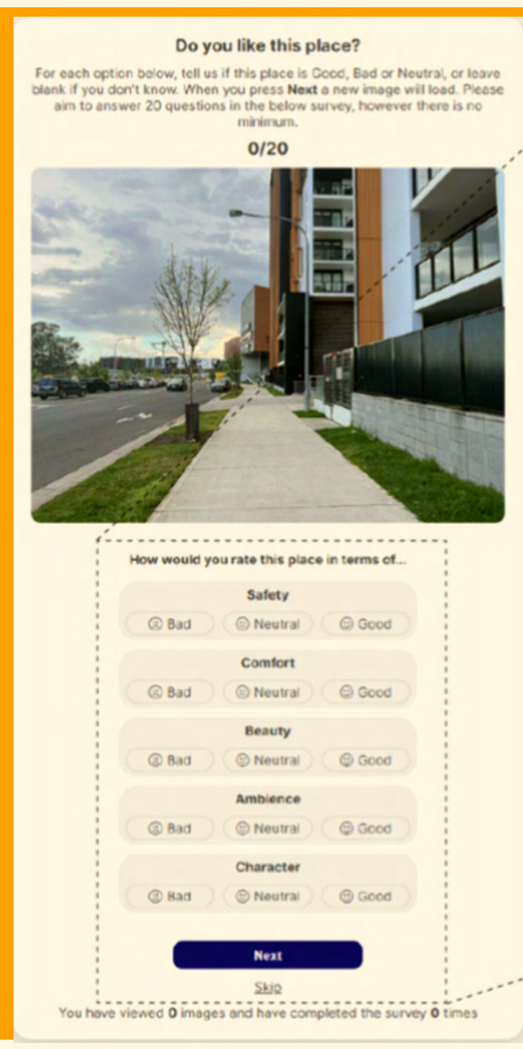
RESEARCH QUESTION

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

QUANTIFYING QUALITY

AN INTRODUCTION





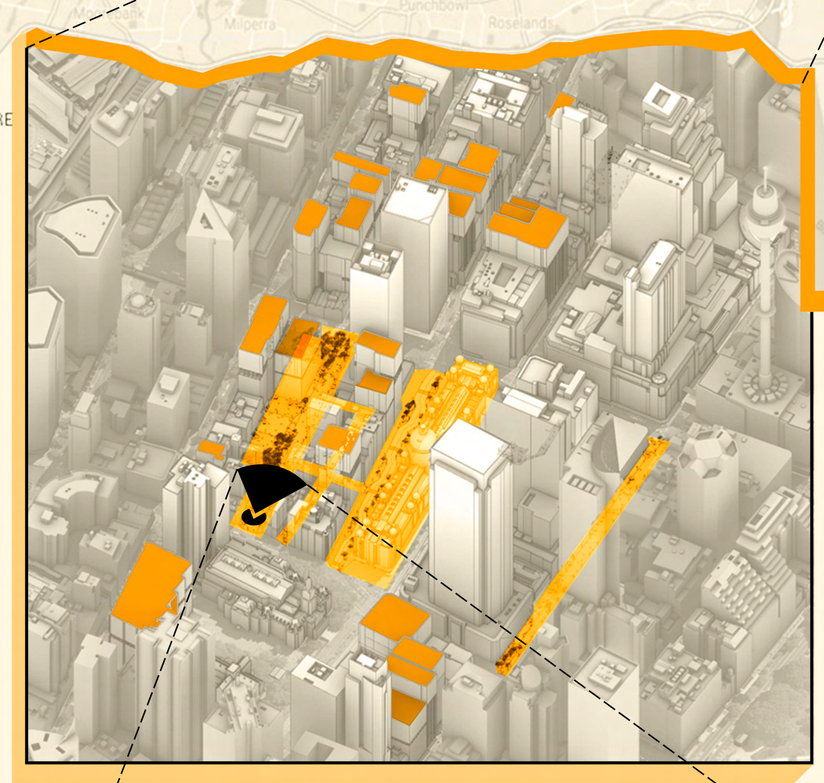
AMBIANCE

BEAUTY

COMFORT

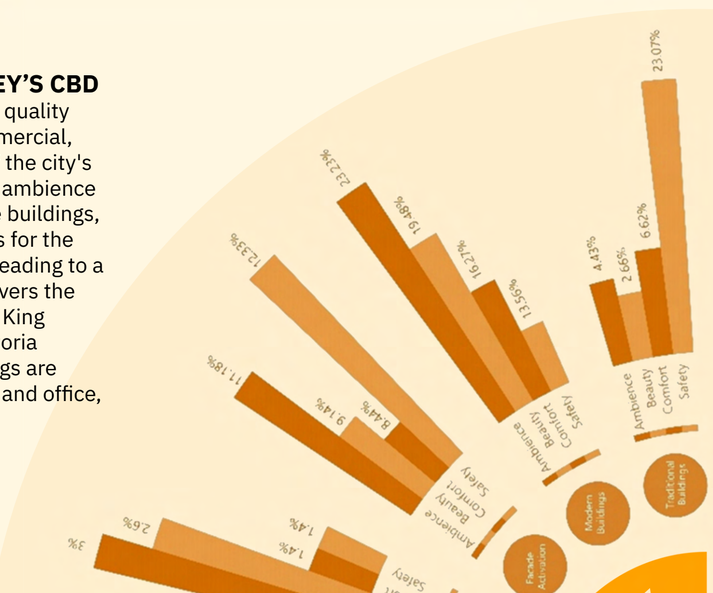
SAFETY

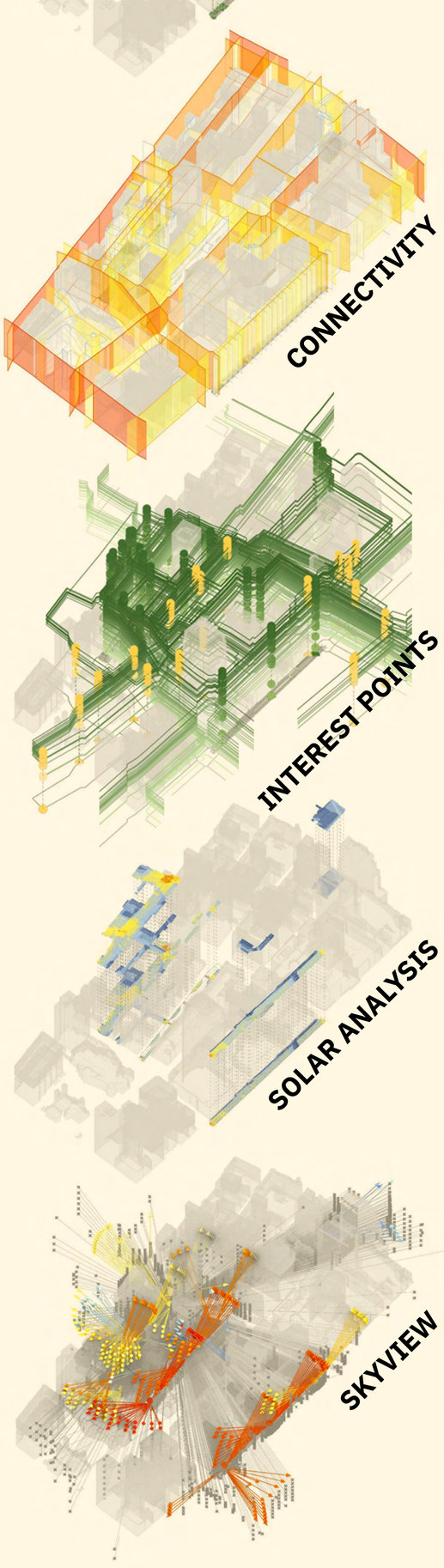




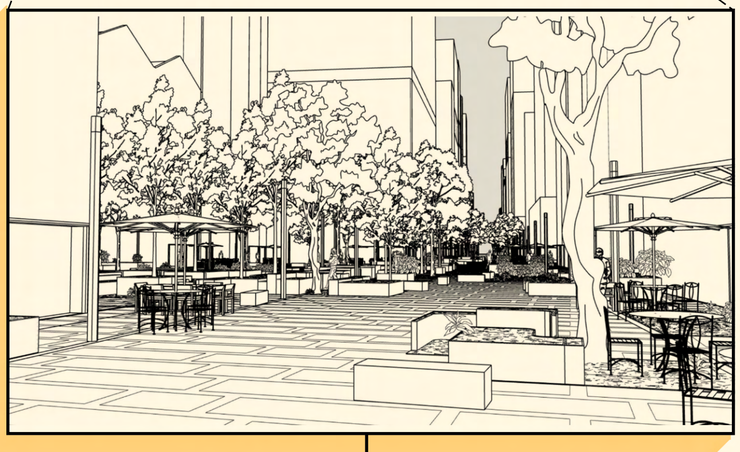
QUANTIFYING URBAN QUALITY: SYDNEY'S CBD

The site selected for the quantification of urban quality was the Town Hall area in Sydney's CBD, a commercial, tourism and financial hub that forms the core of the city's central district. Despite its vibrant and dynamic ambience and intertwined modern high-rises and heritage buildings, Town Hall area has few green spaces and plazas for the size of its residential and transient population, leading to a sense of urban congestion. The selected site covers the superblock bounded by Kent Street, Pitt Street, King Street, and Bathurst Street, with the Queen Victoria Building (QVB) in the centre. Most of the buildings are commercial, with some mixed use (commercial and office, with minor residential).

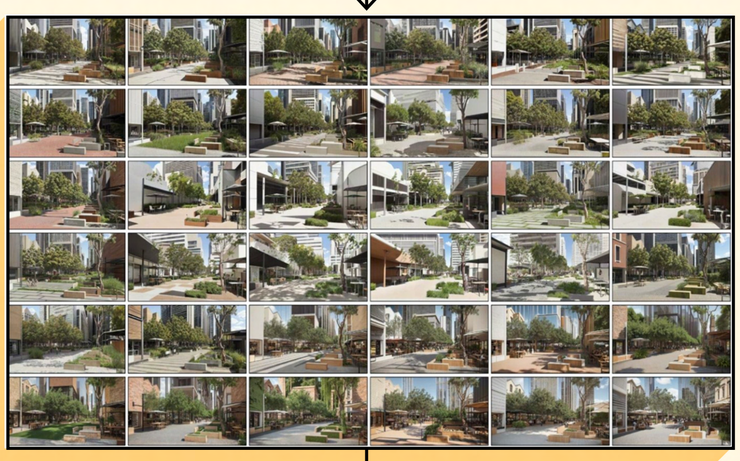




MULTI OBJCTIVE OPT.



AI GENERATOR



THE VISUALISATION PROCESS

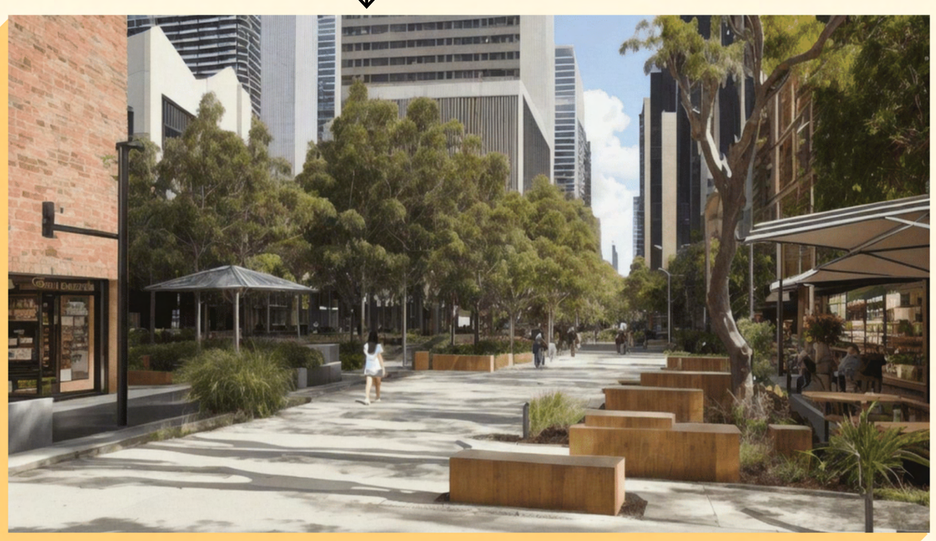
Through the use of the Open-Source AI Image Generation system Stable Diffusion, a series of views were captured using traditional digital architectural methods. With the selected solution 3D modelled, the views were captured in various display methods, such as perspectival linework.

GENERATIVE DESIGN

The generative process is capable of creating a high yield of images in a short amount of time. For example, in the span of an hour over 30 images using the same view were created, each with varying degrees of success. The images are then filtered down based on preference for particular elements in each and traditional architectural methods of collaging multiple images together creates a final outcome which communicates the desired qualities of the space.

To further explore the process different interpretations of the qualitative concepts was considered by having different visualisers generating images based on the same starting reference. In doing so the significance of generating a series of images and collaging the results into a single final image is emphasised, as through this process two different people, with different interpretations of the quantified quali tative data can reach final images that share the same spatial qualities.

STITCHING PROCESS



TWO DIFFERENT **IMAGES** BY TWO DIFFERENT **ARTISTS** WITH **SHARED SPATIAL** QUALITIES



CAN AI DEFINE QUALITY?

ON-GOING EXPERIMENTS

CAD RIA PAPER



CAN GENERATIVE AI RE-IMAGINE "GOOD" URBAN PLACES?

The presented research examines two empirical studies.
The first is an interrogation of a context-sensitive approach to urban quality, attempting to quantify “good” by statistically linking measurable spatial characteristics to expert and public evaluations across contrasting climatic and cultural settings.
The second examines whether AI can structurally express an operational definition of “good” by producing imageable urban scenes and adhere to desirable metric constraints.

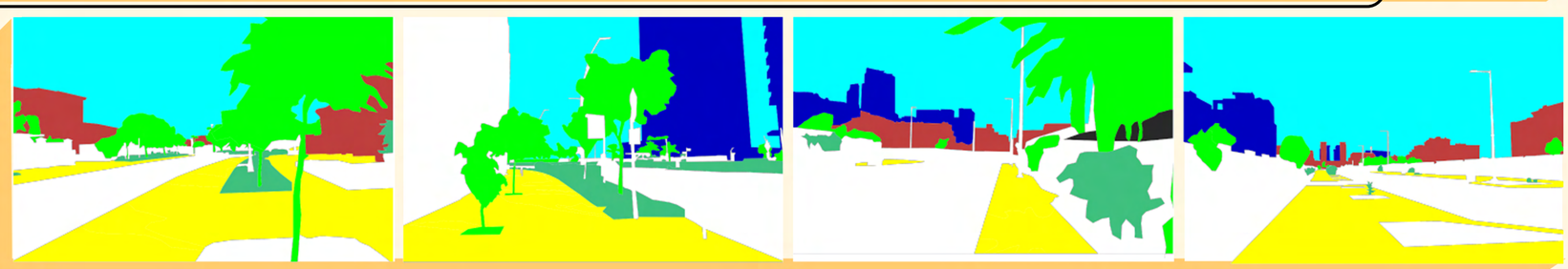
Collectively, these experiments establish whether generative AI can be reconfigured from a purely representational medium into a co-design instrument capable of understanding, evaluating and quantifying the living quality of cities.

IMPROVE

PHOTOGRAPH



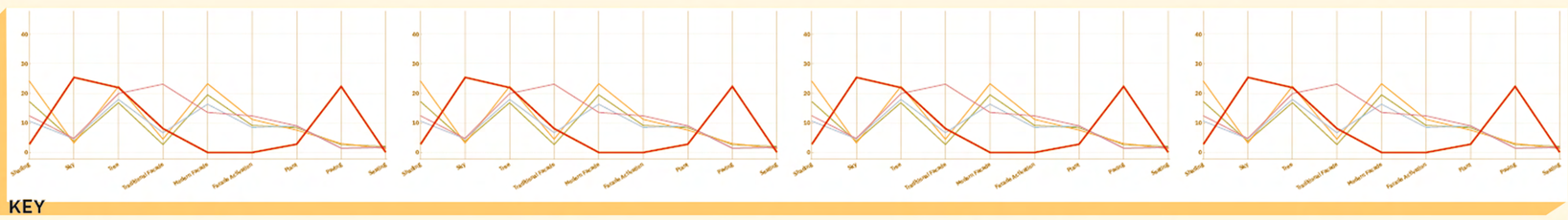
SEGMENTATION



KEY

Traditional facade · Modern Facade · Facade Activation · Sky · Tree · Plant · Seating · Paving

BENCHMARK



KEY

Ambiance · Beauty · Comfort · Safety · Image Analysis

KEY

BAD → GOOD

DEVIATION (%)

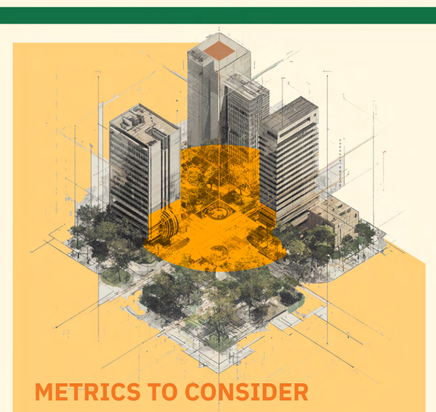
PRE-AI



POST-AI



AMBIANCE · BEAUTY · COMFORT · SAFETY



METRICS TO CONSIDER

SHADE
CANOPY
ENCLOSURE
THERMAL COMFORT
SEATING
PLANTING
AMBIANCE
SAFETY
SIGHTLINES
EXPOSURE
COMFORT
LANDMARK
SKY RATIO
BEAUTY

360° SPATIAL ANALYSIS

The primary focus in this stage of work is to enable an understanding of the global surrounding environment. Thus, 4 views captured from the same point will provide us with the optimal starting point.
Objective metrics will be registered here, ranked between 0 and 1.



METRICS TO CONSIDER

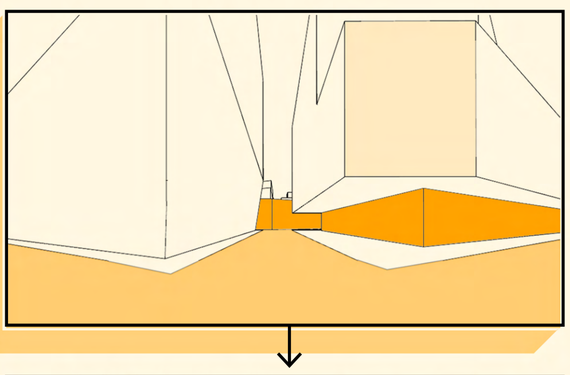
HUMAN SCALE
PAVING COMFORT
PEDESTRIAN
FACADE DETAILS
PAVEMENT PATTERN
DOOR/WINDOW
FRONTAGE MIX
PRESENCE
ENVIRONMENT
ORIENTATION
TREE PATTERN
FACADE CONTINUITY
MASSING ARTICULATION

SENSORIAL ANALYSIS

Within the 360 analysis, metrics that are based of subjective analysis will be processed through AI, with a specific set of rules to follow and integrate. The results will provide a rank (0-1) and a justification.

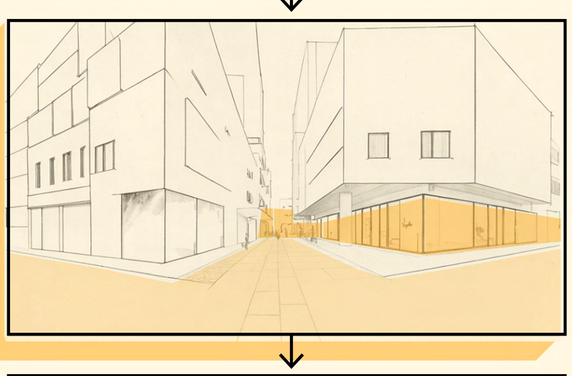
ABU DHABI STUDY

PROCESS BREAKDOWN



LIVE GEOMETRY REFERENCE

The workflow allows the user to iterate through an infinite number of geometrical configurations and generations as it lives live withinthe 3D model. There is a direct correlation between the geometrical performance and the imageable and perceptual comfort results.



METRIC CONDITIONING :
IMAGEABILITY

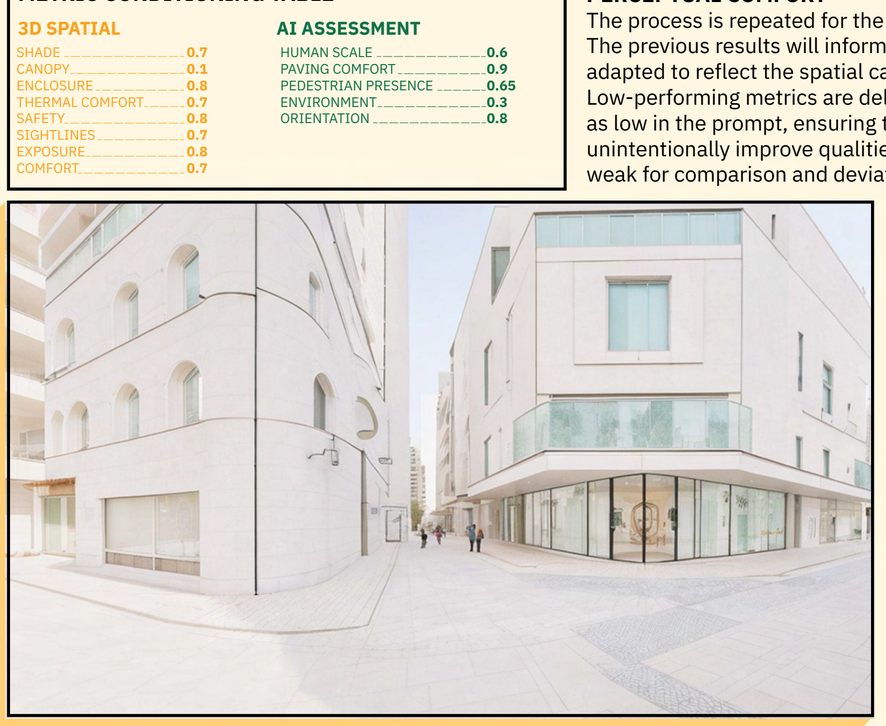
The viewcapture is first turned into a sketch to optimize the base. Here we analyse the first set of metrics to identify the most “imageable” sketches out of all that were generated. The solutions are ranked and the most optimal solutions will be selected to bring into the next rendering step.

METRIC CONDITIONING TABLE

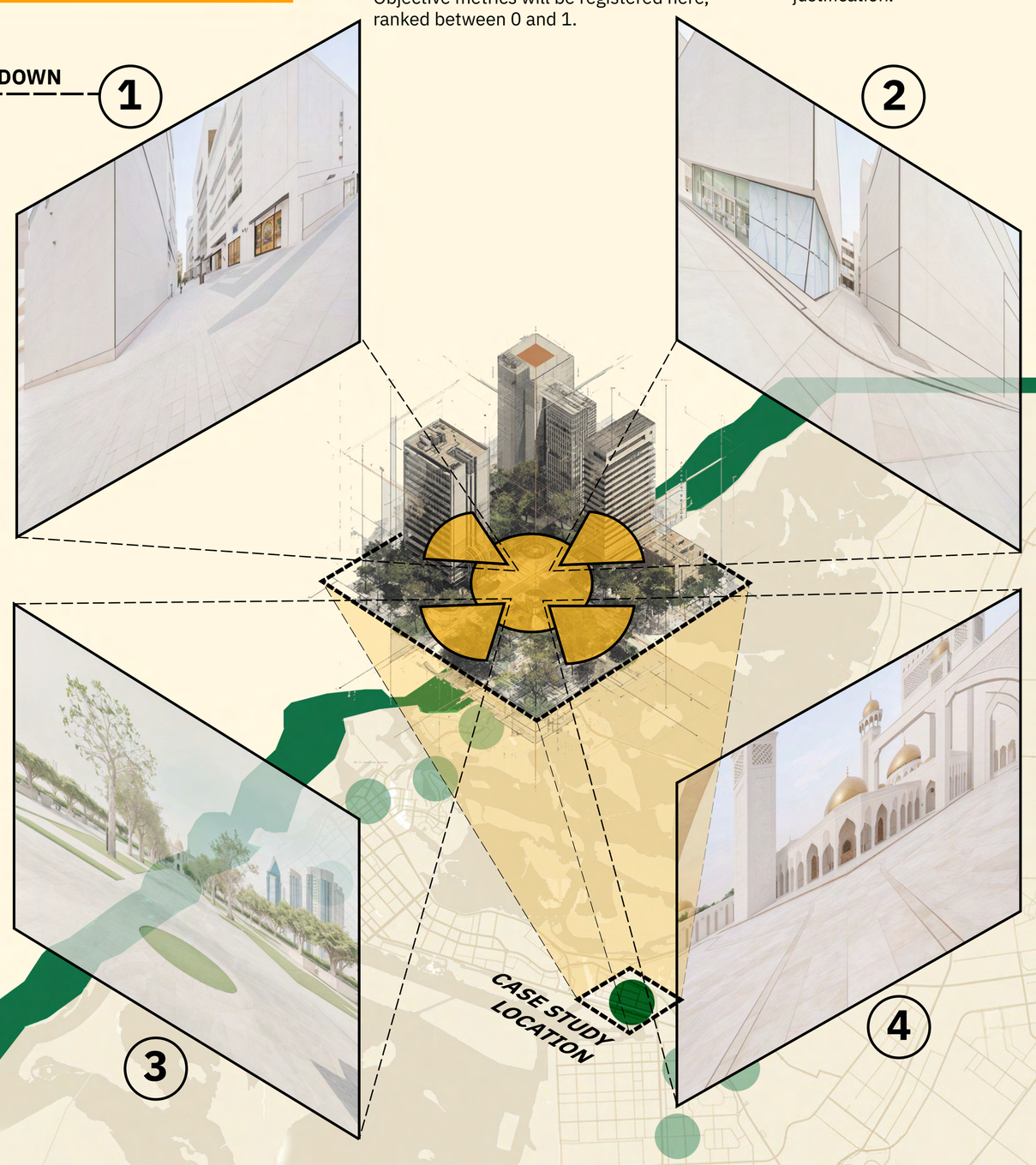
3D SPATIAL		AI ASSESSMENT	
SHADE	0.7	HUMAN SCALE	0.6
CANOPY	0.1	PAVING COMFORT	0.9
ENCLOSURE	0.8	PEDESTRIAN PRESENCE	0.65
THERMAL COMFORT	0.7	ENVIRONMENT	0.3
SAFETY	0.8	ORIENTATION	0.8
SIGHTLINES	0.7		
EXPOSURE	0.8		
COMFORT	0.7		

PERCEPTUAL COMFORT

The process is repeated for the renderig process. The previous results will inform a new prompt adapted to reflect the spatial cahracteristics. Low-performing metrics are deliberately retained as low in the prompt, ensuring the AI does not unintentionally improve qualities that must remain weak for comparison and deviation analysis.



QUALITATIVE UNDERSTANDING FROM AI’S PERSPECTIVE



STANDING IN THIS SPACE, **YOU WOULD FEEL** PLEASANTLY SHADED AND THERMALLY **COMFORTABLE** DUE TO AMPLE SHADE COVERAGE AND A WELL-DEFINED, COMFORTABLY ENCLOSED ENVIRONMENT WITH SMOOTH, EVEN PAVING AND GOOD VISUAL ACCESS. THE MODERATE PEDESTRIAN PRESENCE AND SECURE ATMOSPHERE CONTRIBUTE TO **A SENSE OF SAFETY AND EASE**, ENCOURAGING YOU TO **DWELL.**