QUANTIFYING QUALITY

The pursuit to define what makes a great public space

2024 Urban Design Awards Winner

May 2024

A Research Project by SJB x UTS

Quay Quarter Lanes, SJB and ASPECT Studios. Photo by Rory Gardiner

SJB acknowledges the Traditional Custodians of the lands, waters, and skies, and their perpetual care and connection to Country where we live and work. We support the Uluru Statement from the Heart and accept its invitation to walk with Aboriginal and Torres Strait Islander people in a movement of the Australian people towards a better future.

We believe that inequity enshrined in our society continues to significantly disadvantage our First Nations colleagues, friends, and community. Following the referendum, we are personally and professionally recommitting our support of Aboriginal and Torres Strait Islander people. We will continue to strive for (re)conciliation by acting with integrity and passion, in an effort to address this imbalance in our country and create lasting generational change.

AUSTRALIAN URBAN DESIGN AWARDS

Winner

2024 Australian Urban Design Awards
Leadership, Advocacy and Research
Local and Neighbourhood Scale

SJB Architects

Gadi Country
Level 2, 490 Crown Street
Surry Hills NSW 2010

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NSW Nominated Architects

Adam Haddow 7188
Emily Wombwell 10714
John Pradel 7004
Jonathan Tondi 11981
Nicholas Hatzianagnostou 9380

University of Technology Sydney

School of Architecture
Faculty of Design
Architecture and Building

702-730 Harris Street
Ultimo NSW 2007

uts.edu.au

WHY QUANTIFY QUALITY?

The current approach to quantifying the quality of public space is largely limited to a few metrics or driven by an individual opinion. Quantifying Quality seeks to democratise this process by drawing upon community opinion, applying a bespoke process that refines a design solution based on crowd sourced data.

OBJECTIVES

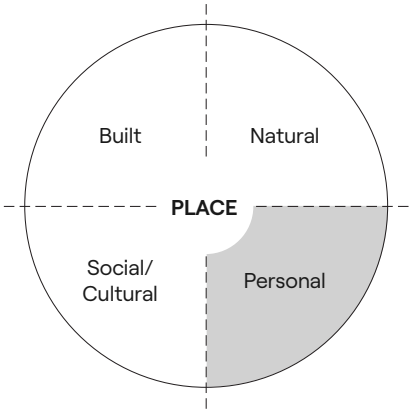
01
Understand the variables that define the quality of place by using correlations between quantitative and qualitative data sets.

02
Design using these correlations and variables to create places that are responsive to community opinion.

03
Demonstrate that there are multiple variables to consider in the assessment of the built environment.

Everybody knows the value of a great public space. Places where celebrations are held, social and economic exchanges occur, friends run into each other, and cultures mix to form a rich tapestry of the community. When public spaces are successful, they can serve as the backdrop to significant events of many lives.

Public spaces are at the confluence of environmental, social, and economic drivers and can be measured in success by the qualities of the built form, natural systems, social and cultural values, and waht it means personally to those that use them.



Attributes of 'Place'

Built form, natural systems, and social/ cultural infrastructure can be easily measured, leading to the current approach of evaluating public space based on limited metrics such as direct sunlight, sky view, and tree canopy coverage. However, the personal experience or 'meaning' of a place is a considerably more important characteristic, but is, until now, a very difficult thing to measure, and therefore poses limited scope in evaluation.

'Meaning' is largely subjective, sometimes subconscious, and unique to each individual. Current approaches to community engagement are limited and not able to fully track how their inputs make a meaningful change to the output.

So if the 'meaning' of a place is an important characteristic to measure, how do we ensure that it can be captured in the design process, democratising the outcome so that the design solution chosen is based on community input?

Quantifying Quality presents an alternate approach to the evaluation and design of public space by doing just that, democratising the design process, enabling community input to shape the output. By correlating qualitative data via community engagement (meaning), with quantitative data (physical form and activity), we can determine the most valuable aspects, or dominant factors, that define the quality of public space.

The intent is to establish a process that could be adopted by local Councils, State Government, developers, or designers, during the exploratory phase of a project, without the need for major investment in community engagement plans. Quantifying Quality is scaleable and flexible enough to apply to multiple scenarios.

The outcome of such an application is the design of the built environment that is more responsive to local communities, designed for a place (or community) - based outcome.

Quantifying Quality is a collaborative research project between SJB and the University of Technology Sydney (UTS). It has been partially funded by an Innovations Connections Grant.

“JUST SO I UNDERSTAND THIS RIGHT, ARE YOU SERIOUSLY TRYING TO SAY THAT YOU CAN DEFINE THE QUALITY OF A SPACE FROM AN IMAGE?”

This question was posed by an audience member at a recent seminar on the use of data-informed design processes at UTS.

The answer is **yes**. This report will explain why.

PROCESS

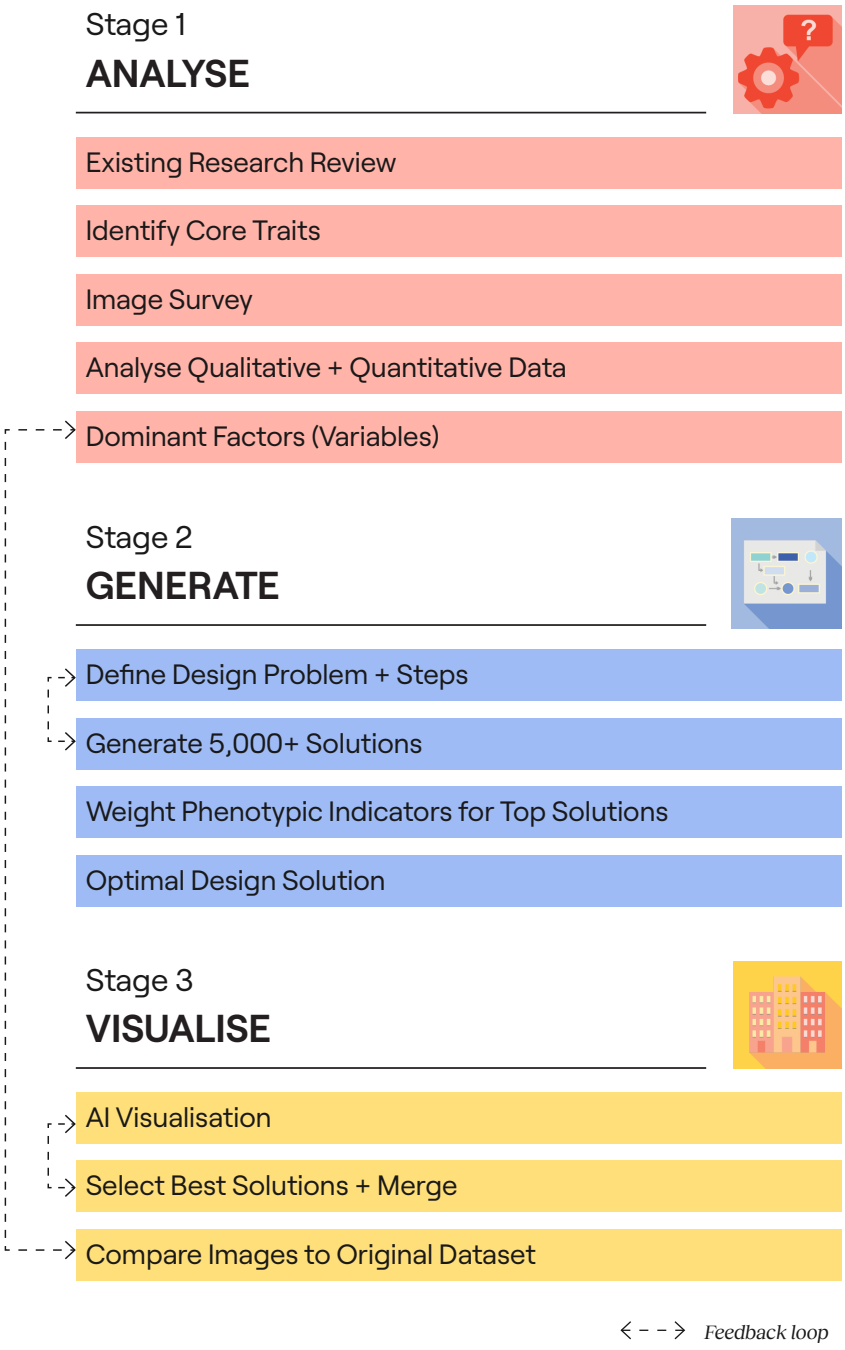
The process and methodology is the key resource of the research project. Rather than a single approach that can not be re-applied to other scenarios, Quantifying Quality has been developed to be scalable, adaptable, and flexible.

Developed across three key stages, the project is largely automated through the use of machine learning and AI. This ensures the outcome is cost effective, less time consuming, and greater confidence in the outputted data.

Stage 1 focuses on the analysis of existing public spaces through the use of a web-based image survey. Stage 2 utilises data gathered from Stage 1 to generate thousands of potential solutions to a particular site using machine learning software. Stage 3 finalises the project by visualising the most optimal solution of Stage 2 using AI.

The project starts and finishes with the image. Whilst many of the steps can be adapted to various scenarios, the core aspect of using imagery to evaluate places can not be changed. Whilst it seems too simple that an image can define the quality of a place, it is important to recognise that imagery is one of the primary ways in which most people currently interact with pre-construction designs. It is used in community engagement, award panels, and on proponent websites to demonstrate and rank intent.

By using the image as the primary input and output of the process, we are creating a closed loop that reflects current practices, but is underpinned by far more data.



SUMMARY

- An image is a valuable resource in the evaluation of place design.
- The process can be both bespoke and repeatable, ensuring flexibility for any form of analysis.
- Innovative approaches to community collaboration can reduce complexity and time spent.
- Technology can play a much bigger part in all stages of the design process.

Design Solution Model

ANALYSE
STAGE 1

The research team visited 12 urban sites across Sydney representing varying typologies, taking photos of public space from the perspective of the pedestrian (not the car, as is the case with Google street view images). From this, 174 images were selected. These images were placed on a web-based survey that randomly selected an image and asked users to rank the image as 'Good', 'Neutral', or 'Bad' in response to Safety, Beauty, Comfort, Ambience, and Character. These are the 5 core traits of public spaces that were determined from the existing research review.

The responses to the survey were collated and the best and worst images were determined. Further analysis of the images was performed using machine learning resulting in the percentages and quantum of variable factors. By correlating the responses from the survey, to the image analysis, a series of dominant factors of urban space were discovered.

For each dominant factor, we can determine the approximate percentage of an image that should represent each for that image to be considered a more safe, comfortable, beautiful, or ambient place according to the survey respondents.

Whilst not the primary focus of the research, some correlations were evident between how various demographics responded to the images. For example, those that culturally identified as being from Lebanon and Kuwait (the third and fourth highest percentage of nationalities recorded) ranked images completely different to others. They typically preferred images of locations in Western Sydney that showed more road and low-density buildings. In contrast, locals showed a preference for denser inner-city environments with less cars and more pedestrianised space.

UNIQUE USERS
236

MALE:FEMALE RATIO
49:46

IMAGE VIEWS
5,632

IMAGE SUBMISSIONS
4,791

NATIONALITIES
42

AUSTRALIAN
42.4%

IN NSW
56.4%

AGED 25-34
33.9%

35-49	31.4%
18-24	17.8%
50-59	8.1%
60-69	5.1%

TOP 5 NATIONALITIES

LEBANESE
AUSTRALIAN
KUWAITI
INDIAN
CHINESE

BEST

Best Rated Image - Martin Place

WORST

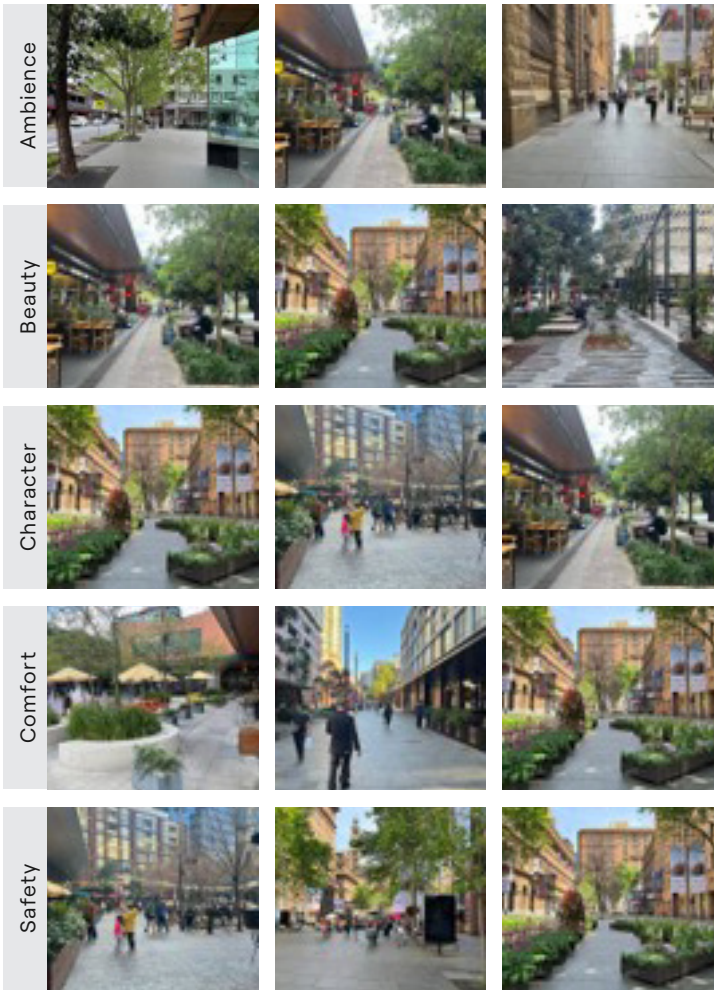
Worst Rated Image - Oran Park

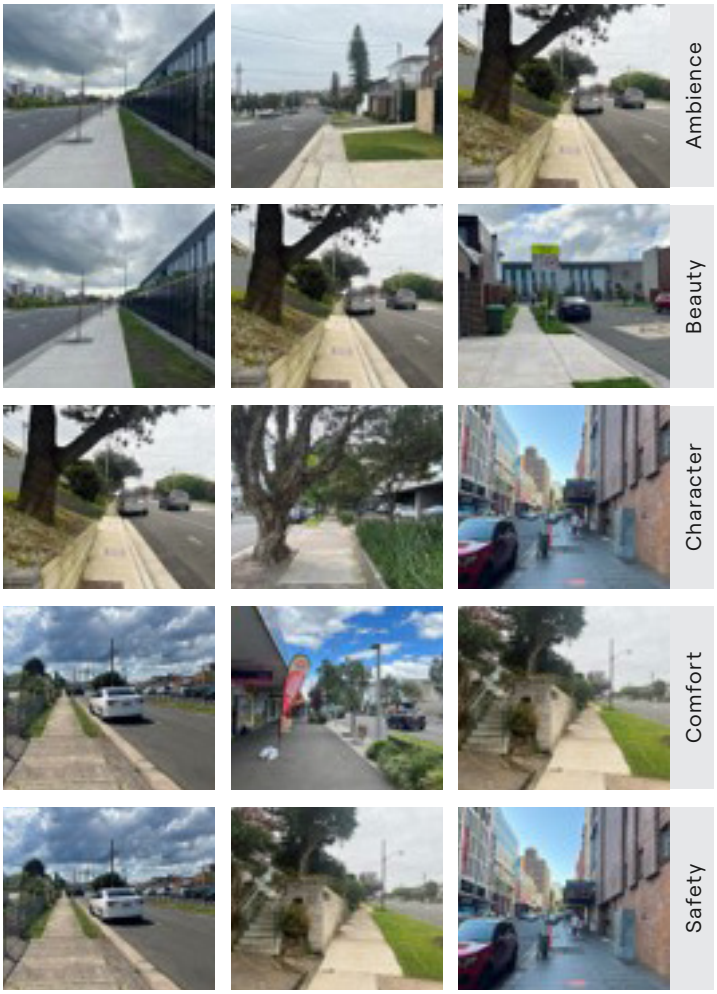
SUMMARY

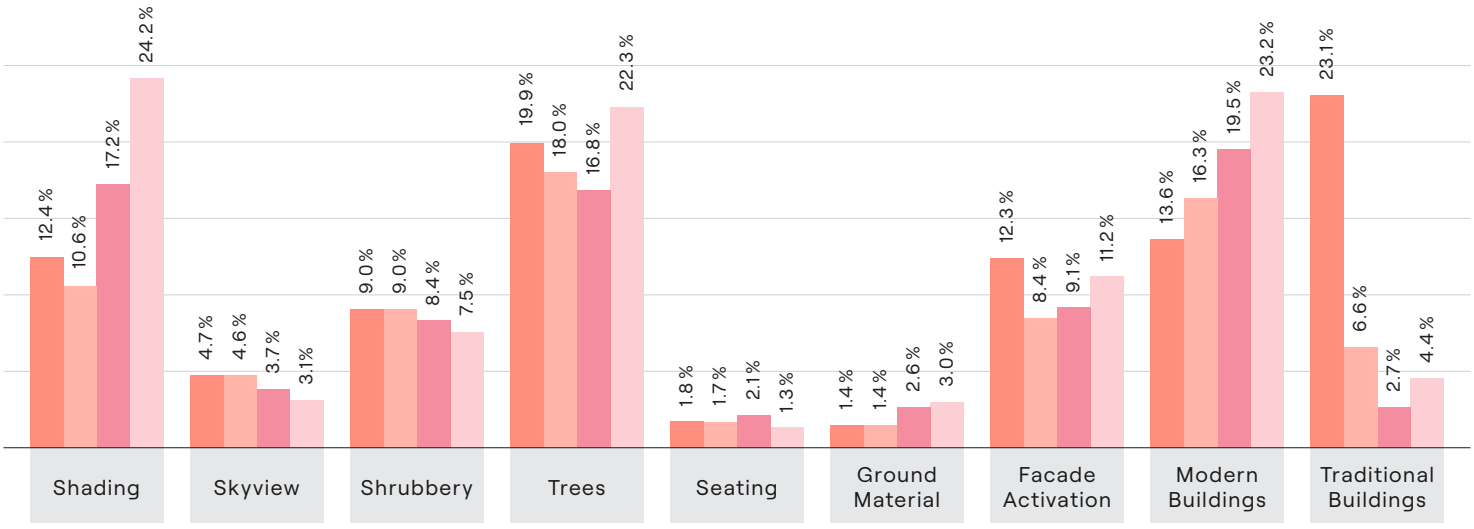
- Variable demographics responded differently to the image survey.
- Best images are more likely to be pedestrianised with more planting whilst worst are street interfaces and more exposed.
- The image does not convey all aspects of that place however, this method is no different to typical methods of engagement.

BEST IMAGES

WORST IMAGES







Dominant Factors of Urban Space

Note: Character had no significant correlation in the survey responses. This could be due to the definition of 'Character' that may be hard to interpret. Therefore, character was removed from the study findings.
Note 2: Totals do not add up to 100% for each trait. The balance is made up of various other items of small percentages that collectively add up to 100%. These are items such as people, signage and other furniture etc.

Ambience
Beauty
Comfort
Safety

SUMMARY

— There are clear visual differences between the best and worst images.
— Contrary to typical planning controls, skyview, and therefore solar access, is not as important in the public opinion of space.
— There are multiple factors that should be considered as equal or greater benefit in creating high-quality spaces.

GENERATE
STAGE 2

CASE STUDY LOCATION

The area around Town Hall was chosen for the case study location as a future 'Town Hall Square' is proposed by the City of Sydney at the corner of George Street and Park Street. This research project proposes that there are better opportunities available to increase open space in this area whilst being more responsive to community input.

SOLUTIONS

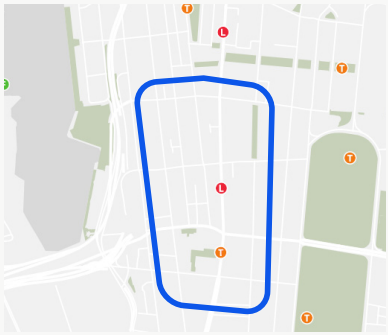
5,000

RUNTIME

9h 58m

PER SOLUTION

8.3s



Case Study Location - Town Hall, Sydney

The second stage of the research demonstrates the opportunities for embedding the data collected in Stage 1 as part of a generative design process. Advanced algorithmic tools are utilised, primarily through the use of evolutionary computation, in which a design model mimics a biological evolutionary process to optimise design options. Such tools allow for a numeric and evidence-based approach to the design problem, equipping the designer with a high degree of agency to produce design solutions that respond to the data identified by the survey respondents, thus allowing for greater objectivity in the design process.

An urban superblock within central Sydney was selected as a case study for this evidence-based evolutionary process. The design problem in this demonstration is comprised from two key components, design variables and design goals. The algorithm performs countless adjustments to the design variables, such as location of open spaces, pathways between open spaces, location of vegetation, choice of ground material, with the objective of generating a design solution that is optimised to the design goals, which in this case are the 4 key traits of Beauty, Ambience, Safety, and Comfort.

The key innovation of this process is driven by the fact that the research was successful in quantifying the four qualitative traits listed above, in doing so allowing for the integration of these qualitative traits within an algorithmic process that demands numeric representation of variables and goals. As the algorithm adjusts the variables, it tests each generated design solution against the four defined goals, retaining high performing solutions and discarding poor performing ones. Through this, the algorithm can generate an extensive amount of design solutions in a short amount of time, each solution unique in its own way, both in geometry and performance.

This methodology of generative design is highly malleable, allowing the user to adjust design steps, weighting, and indicators to their desire, ensuring that the process can be adapted on an as-needs basis for any potential scenario.

SUMMARY

- The use of generative design tools can generate thousands of potential solutions in a short time-frame.
- Tools such as Wallacei can also determine the most optimal solution(s) that meet the input criteria.
- The outcome is a design scenario that is entirely driven by public opinion.

END STAGE 1

Select site

Identify heritage + high rise (unlikely to change)

Identify buildings that can change

Identify

Identify lanes and alleyways adjacent to change buildings

Select buildings to remove - convert to open space

Add volume of removed buildings to retained buildings

Analyse

Analyse solar of ground floor

Identify streets to become pedestrian priority

Analyse surrounding streets for space syntax, solar and skyview

Apply

Place vegetation based on solar access

Apply ground material and randomise

Apply new building facades as traditional or modern

Apply

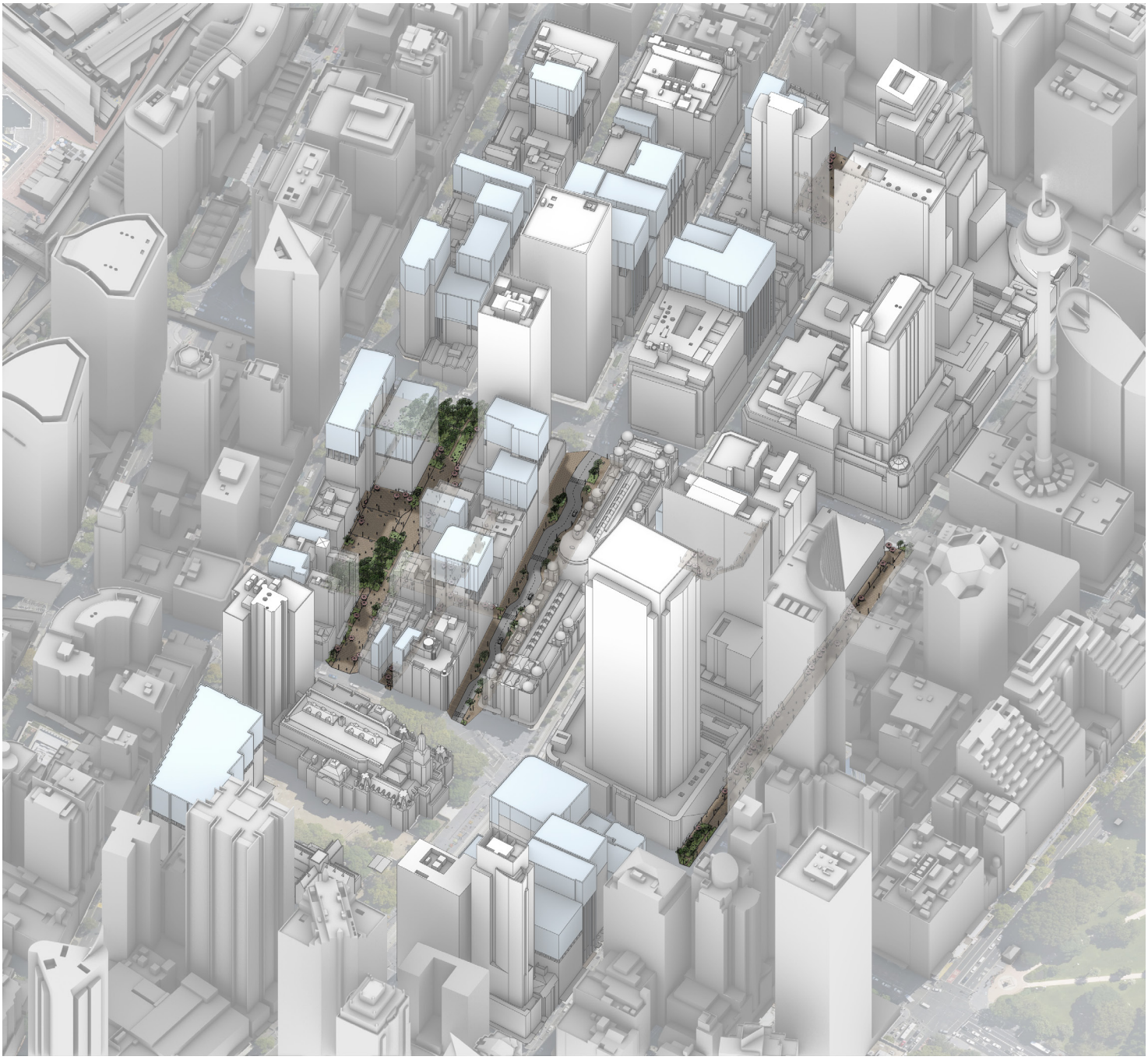
START STAGE 3

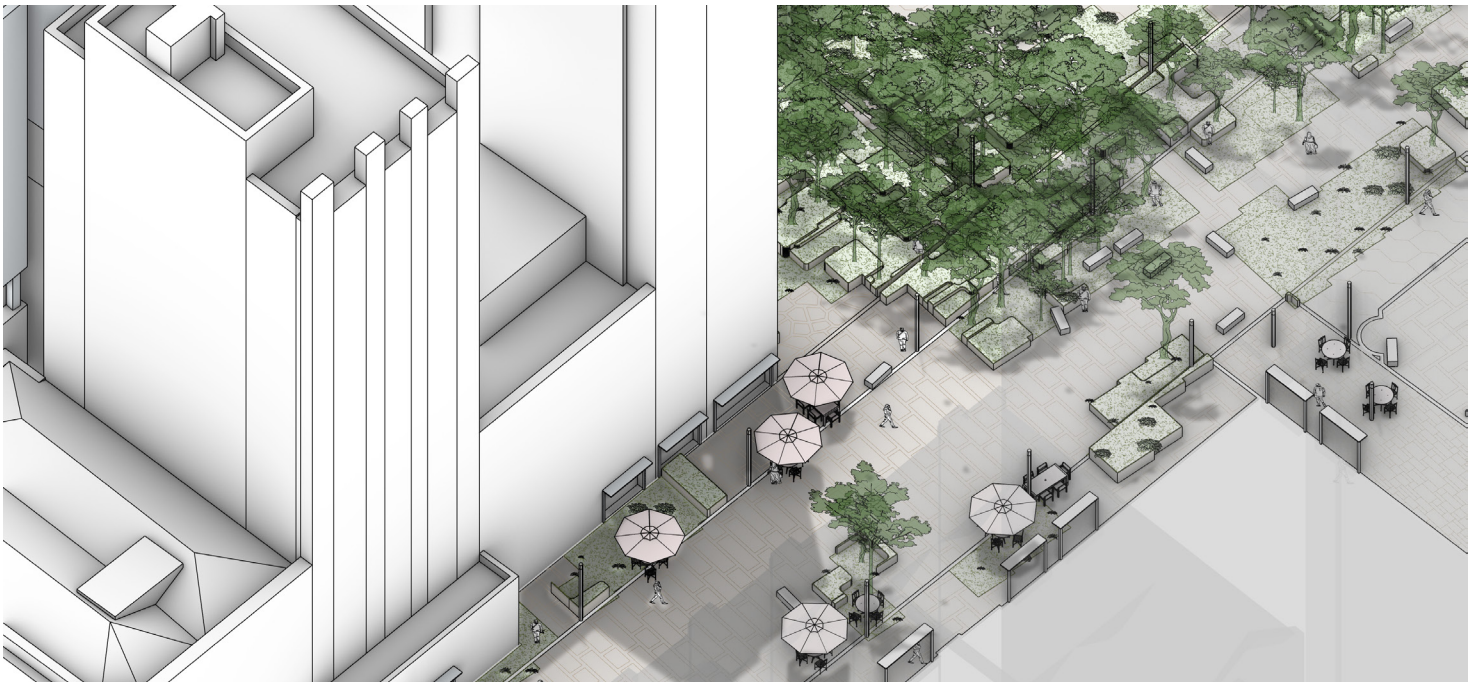
Calculate phenotypic indicators for analysis

Add street furniture

Apply street front activation according to high pedestrian areas

VISIBILITY	ACCESSIBILITY	ENVIRONMENTAL	SOLAR	URBAN
SKY VIEW PLAZA VISIBILITY STREET VISIBILITY	SPACE SYNTAX PROXIMITY	OPEN SPACE TREE COVER SHRUB COVER	SOLAR GAIN SHADING	ACTIVITY SEATING FACADE MATERIALS VOLUME





Optimal Design Scenario

The best solution identified the pedestrianisation of Clarence St between Druitt Street and Market Street. Along this axis, several buildings have been removed to increase open space with variable characteristics between heavily vegetated and plaza areas. Through-site links between other frontages are provided to increase permeability and visibility from multiple edges. The metrics to the right demonstrate the design solutions score and how close it relates to the input core trait values.

Ambience	224.98	92%
Beauty	212.54	100%
Comfort	156.84	95%
Safety	60.99	92%

SUMMARY

— Wallacei was able to optimise the design solution within 90-100% of the target metrics.
— The best solution identified the removal of several buildings in exchange for open space.
— The strategy envisions that surrounding sites would gain additional height and density at 3x the amount removed.
— A clear link can be made to the best images from Stage 1 that identified plazas and laneways as the highest quality spaces.

VISUALISE
STAGE 3

To finalise the project, the top solution of Stage 2 is visualised using AI. Whilst this could be done manually using traditional methods, the project sought to use AI processes where possible to understand the value that the latest computational innovations have in the design process.

Off-the-shelf generative AI can be cumbersome and unreliable to achieve the most desirable solution. Therefore, a new method of creating images using AI in conjunction with manual editing was employed.

The first input is a line drawing [1] of a specific scene extracted from the Stage 2 model. This is the exact output of the generative model in Stage 2 with no manual modeling, demonstrating the level of detail that this process is capable of achieving.

Using the image as a base, dozens of AI images [2] are generated with particular attention given to prompt engineering to achieve the best results. Three images are selected [3], and the best elements of each are merged together to create the final output. As part of this process, the project utilised two different artists to produce images from the same original image [4 - over page]. This demonstrates how diverse AI can be and how reliable it is on good inputs, model and prompts.

The final images are then analysed for colour profiles and metrics to ensure they can be correlated back to the original data sets. Whilst not intentional, the most interesting outcome of this is how close the colour profiles match the best images from Stage 1.

1

Model Output

2

Generative AI Images

3

Top 3 Images

SUMMARY

- The use of AI further emphasizes the value that technology can play in the design process.
- By combining the designer with AI, more control can be had over the final output.
- Using two artists at the control of the AI generation, demonstrates clearly different styles and responses.
- Prompt engineering is a key component in the variance of output.
- The designer's skills are not obsolete in the face of AI, rather they are complimentary. AI is not to be feared.

4

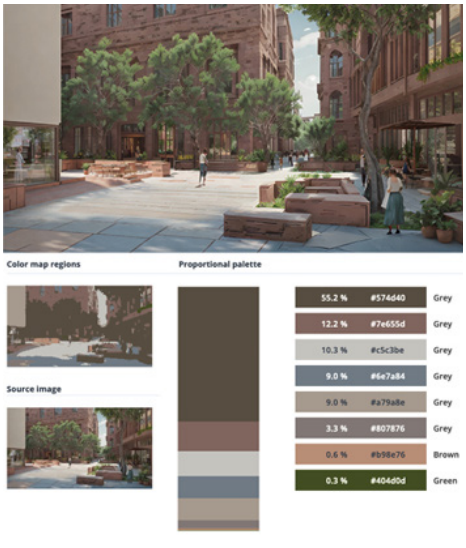
Artist: Blake Raymond

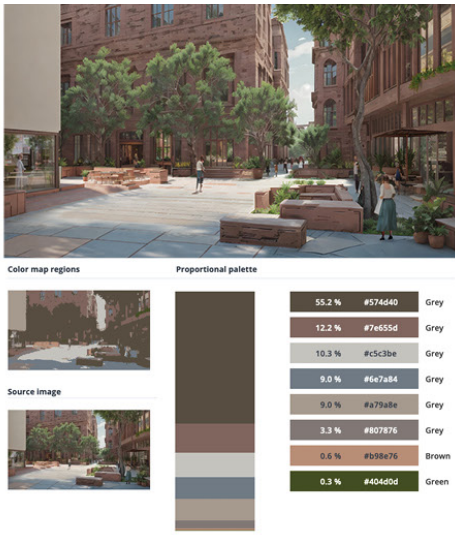
4

Artist: Marlin Hannam

REAL IMAGE / VIDEO

AI GENERATED IMAGES





KEY FINDINGS

The quality of space is a key factor in both conscious and subconscious public opinion. Quantifying Quality is the first step in capturing these opinions and using them to inform design and planning processes.

The quality of urban space significantly influences the sustainability and well-being of cities, but quantifying this attribute has proved difficult in urban planning. Quantifying Quality describes how integrating qualitative and quantitative datasets through analytical and generative methods can enhance the comprehension and evaluation of public space quality.

Through a three-stage process, Quantifying Quality uses various methods, including algorithmic models and community surveys, to assess the quality of public spaces with varying typologies according to key qualitative properties and their urban determinants. Through this, qualitative metrics are embedded as design parameters in the design process, in which additional algorithmic methods are used, primarily evolutionary computation, to generate a numerically evidence-based model for public space design. The results reveal insights into the relationships between various public space attributes and their perceived quality, offering a comprehensive understanding of the determinants of the quality of public spaces.

Quantifying Quality is not an exhaustive research project, but it is the first step in understanding how the quality of spaces can be better informed and driven by the community that the spaces are built for. We hope that the research can be developed further and to inform systemic change in the way places are considered, designed, and analysed.

THE VALUE OF AN IMAGE IN DESIGN

Images are used everyday to communicate design with the community. Quantifying Quality proposes no different, however demonstrates that the image has much greater value than just a visual description of place. It holds an incredible wealth of data that if correlated with community opinion, can be used to quantify the quality of a place in a way that has never been done before. With this data, we can reshape the way we design.

VARIABLE DEMOGRAPHICS ARE IMPORTANT

Whilst not the subject of this research, Stage 1 began to correlate how different demographics responded to the images. For instance, those from Kuwait identified sites in Western Sydney as great places, however the same images were ranked as poor quality by Sydney locals. Gender, ethnicity, location, and age all showed variable correlations demonstrating that how people respond can be attributable to their background and experiences. This is important to consider in how we design and shape public spaces to be equitable for all the community.

COMMUNITY CAN PLAY A BIGGER PART

The evaluation of public space can be heavily driven by the community from the start, rather than a post-justification exercise as it usually is. Involving the community before we start designing can allow us to identify the aspects of the built environment that are most important to them, before using these to benchmark design proposals. By bringing the community on the journey we can achieve consensus much sooner, and give them and other stakeholders confidence that the real-world outcome will be truly representative of the communities desires.

DESIGN CONTROLS CAN BE MORE INCLUSIVE

Current approaches to planning controls that aim to quantify the quality of public space are usually limited to solar access, sky view, and tree canopy coverage. Quantifying Quality demonstrates that these metrics are not necessarily representative of high quality places and shows that there are multiple more quantifiable characteristics that could be integrated in controls.

MULTI-SCALAR SOLUTION

As Quantifying Quality is a process, rather than a specific outcome, it can be adapted and applied to variable situations. From the design of a plaza that is safer for gender diverse people, to reshaping transport corridors for better access to amenity, the process is scalable and flexible. Thus ensuring that it can be utilised by any proponent, at any point in the design process, as a bespoke tool for any scenario.

GET IN TOUCH

If you would like to know more or are interested in utilising Quantifying Quality on your next project, please get in touch with Jordan, Jonathan or Frankie.
We'd love to tell you more about it!

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Pictured (left to right): Jonathan Knapp, Jordan Mathers, Mohammed Makki, Frankie Layson, Linda Matthews

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