COMPUTATIONAL DESIGN 2015

UNSW AUSTRALIA

Graduation Projects
Computational Design

Never Stand Still | Built Environment

This catalogue shows the combined graduation works by Bachelor of Computational Design and Architectural Computing. All projects explored the grand narrative of ‘mobility’ in 2015. The concept of Mobility was not only defined through transporting people from A to B, but also through social mobility, to overcome economic and cultural hurdles, or mobility of data and information between software and optimisation packages. Projects were often practice based and investigated alongside industry partners. Their support and knowledge proved invaluable for our students, and we would like to extend our sincere thanks to these people.

Thesis Index

Contents

PROFESSOR ALEC TZANNES AM

Congratulations to the students who have completed their degree at UNSW Built Environment and now join our alumni community.

This catalogue provides a glimpse into some of the many study themes and projects you have undertaken as part of your academic experience and serves as a record of your graduation class.

We have designed your program of study to reflect advanced contemporary professional practice emphasising the development of leadership skills and innovation, ensuring that as a graduating student you have the best opportunity to be at the forefront of your chosen field of endeavour.

Now that you have graduated, our relationship evolves from student to alumnus, continuing a lifelong engagement of support and involvement (register to join the alumni community at www.alumni.unsw.edu.au). As you travel the world through your career, you will meet many alumni who have become global leaders through their innovative thinking, acting as catalysts for change in all facets of the built environment professions as well as in other fields of work. As an alumnus we encourage you to keep in touch with UNSW Built Environment. We are always keen to support our graduates and publish their successes throughout our alumni network. Please email us your news and updates at BEalumni@unsw.edu.au.

We are also always grateful to our alumni who support our future students with scholarships, prizes, internships and mentoring programmes.

Should you wish to further your education, qualifications and knowledge, UNSW Built Environment Graduate School of Urbanism (AGSU) offers an extensive suite of post professional degrees. AGSU focuses on advanced qualifications in specialised interdisciplinary areas of professional practice and a suite of highly relevant research orientated programs of study. Our commitment to being the leading educators in the design and delivery of more liveable, sustainable cities has underpinned the creation of the AGSU.

As a professional, I also invite you to join our LinkedIn group (UNSW Built Environment) where you will be able to keep in touch and network with your peers, other professionals and UNSW Built Environment.

I wish you a successful and rewarding career.

Professor Alec Tzannes AM
Dean, UNSW Built Environment

M.HANK HAEUSLER
DISCIPLINE DIRECTOR

The Computational Design degree is very proud to have our first class of Graduates, leaving UNSW with a world first Bachelor degree in Computational Design. This catalogue showcases their work, as well as the work of the Bachelor of Architectural Computing students. I would like to congratulate all students on having accomplished your study and showcasing your hard work and dedication through your project, now featured in this handbook.

Without a doubt, the built environment has undergone dramatic changes in the last two decades. All these changes happened when design; architecture and urbanism have been linked with engineering and science through an advanced futuristic use of computing and computation. The predecessor degree, Architectural Computing, has neatly merged into the new program, building on the strong history established by our predecessors. Computational Design will continue to provide 21st century practice skills enabling essential spatial design concepts through the use of computers.. Thus, both courses have focused and will focus on applying state of the art thinking in design, architecture and urbanism, with theories from engineering and science fused with frontier computer skills and digital fabrication technologies.

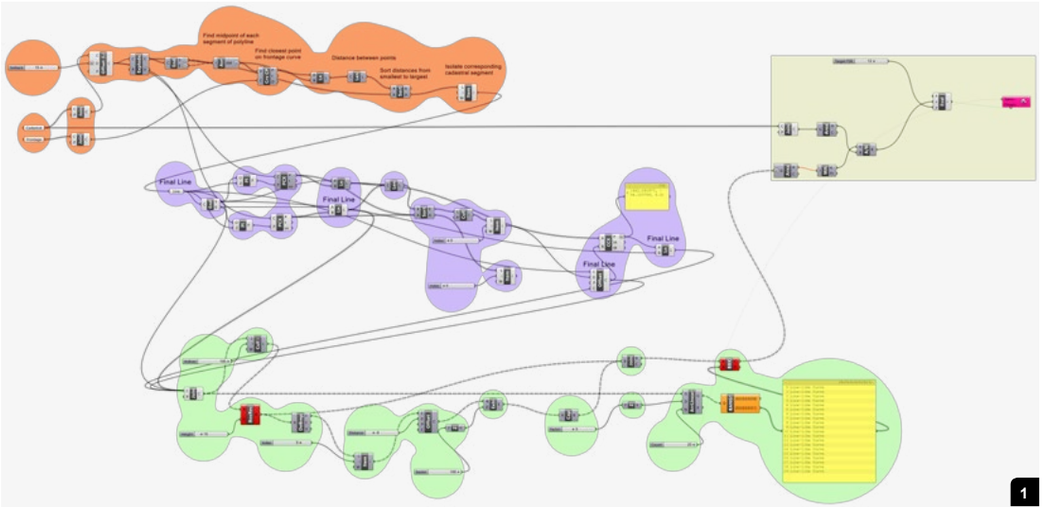
The Graduation Project is the culmination of how creative, technical and aesthetic solutions are gained through applying and accessing an extensive range of emerging digital tools for capturing, optimising, rationalising and fabricating digital design solutions. In 2015 we have chosen 'Mobility' to frame the Graduation Exhibition and give a context in how projects are related to each other.

Now empowered with a toolbox of digital skills, our students engaged under the 'Grand Narrative' Mobility in projects and ideas spanning from industrial design to architecture and from construction, to urban design – applying their skills on both imaginary and practice based projects. I would like to thank our industry partners, for the first time we embedded students from Architectural Computing and Computational Design into offices to investigate, research and document innovative concepts in computing and computation with them. Ten students, over a third of the gradation year, have worked for the last three months together with BatesSmart, BVN, Cox Richardson, Ineni, HASSELL, and PTW on projects in a real-life context, where students and their unique digital skills contribute to the work in these offices. Of these ten students six projects were submitted to an international conference and await the acceptance of the paper while writing these words.

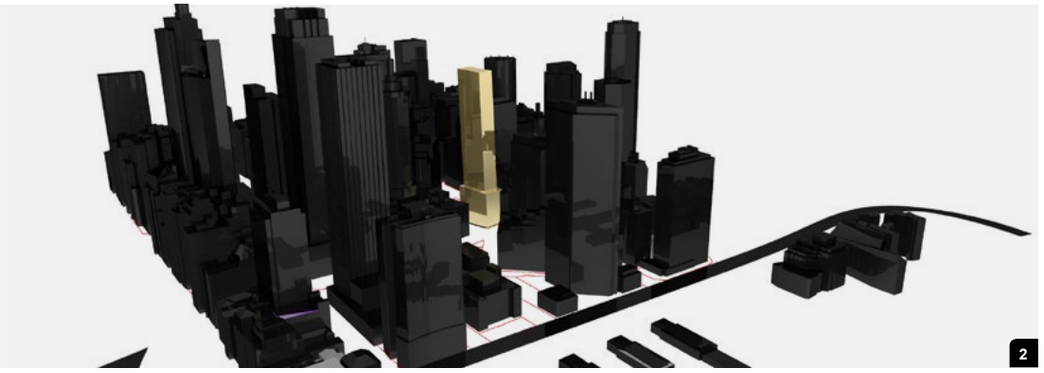
Unique in Australia, our degree offers all aspects off the application of digital technologies to face the challenges of the 21st century and take part in the progress of the built environment – so deftly and beautifully presented and demonstrated in 2015 on the example mobility.

M. Hank Haeusler

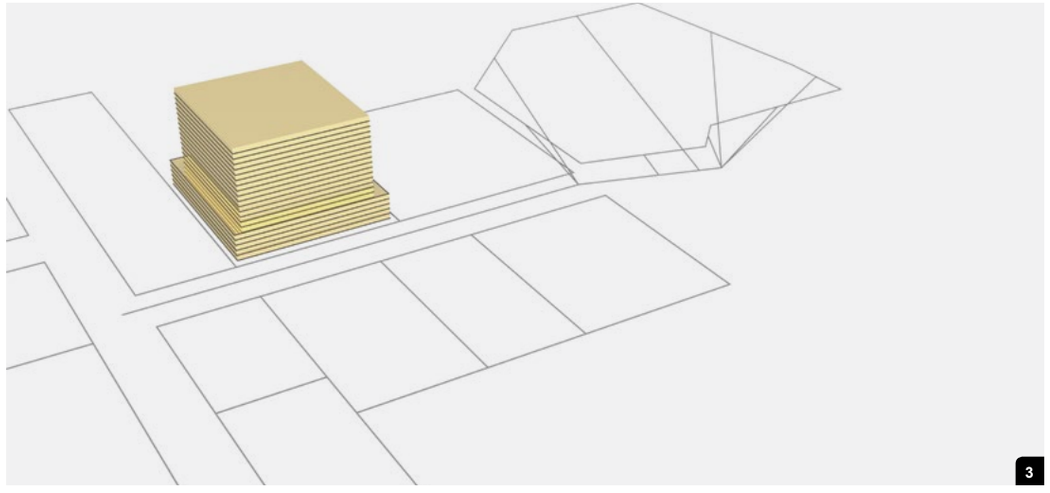
BACHELOR OF COMPUTATIONAL DESIGN AND ARCHITECTURAL COMPUTING FINAL YEAR THESES



1



2



3

Build Smart

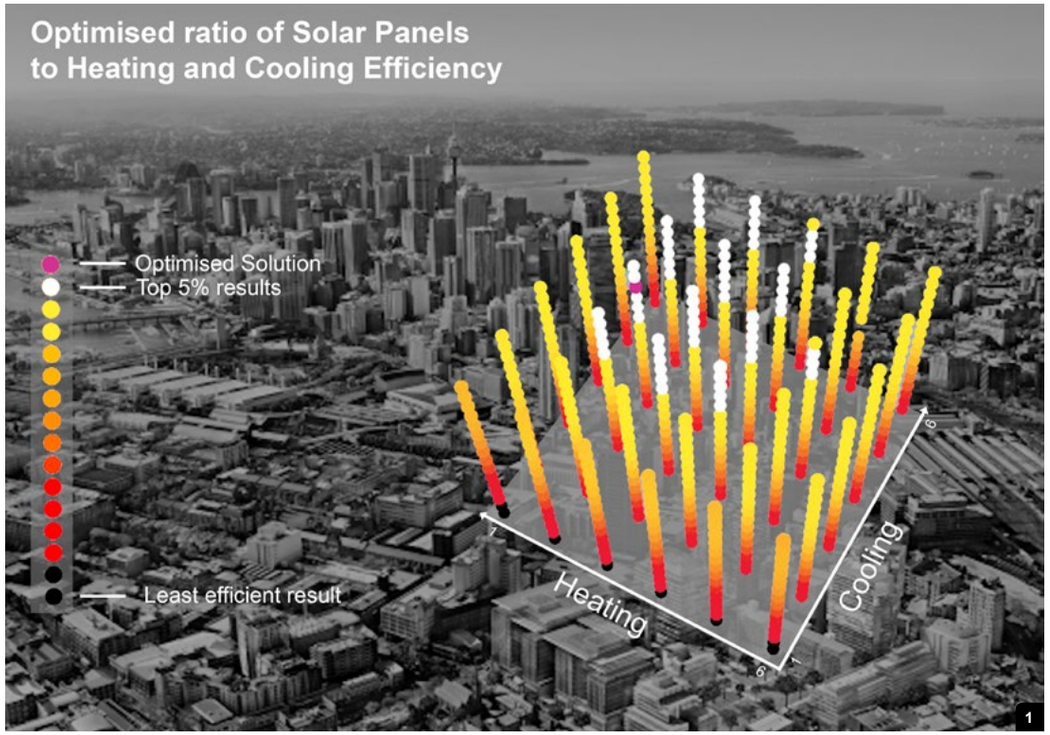
The City of Sydney Local Environmental Plan 2012 is a scaffold for the developable future of Australia's largest city. Sydney is set to get larger by approximately 23% over the next 15 years. Faced with this pressing need for housing, work and recreational amenities, developers are now subject to heavy scrutiny of their proposed projects.

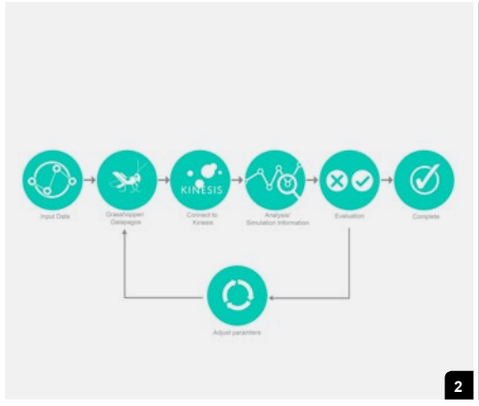
Held between a hybrid of capitalist economic-maximisation and socialist ecological/cultural sensitivity architects become the mediator between what can be built, and what should be built.

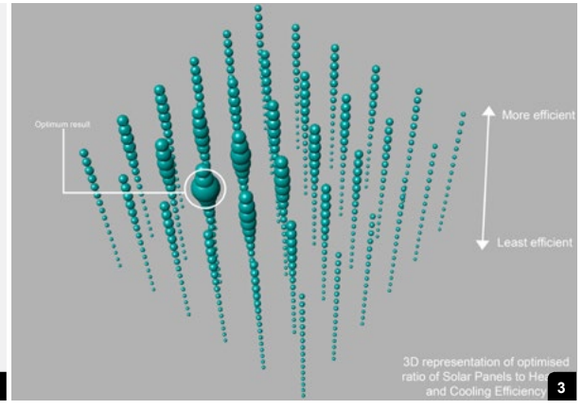
Currently, when undertaking large scale development, design and client needs are first addressed then subsequently assessed against legislation and controls to then be altered to fit. This is a regressive approach as the architect's time is mostly spent on formatting rather than design.

My project provides a reversed approach to this cycle. It computationally generates the maximum developable volume, dictated by the planning controls and based upon floor space ratio maximisation and set-back constraints. This provides a framework to which (in theory) any design would be acceptable. As this is a computational Decision Support Tool, it provides an efficient use of architectural skills allowing for more design time in the project life-cycle.

1. Parametric Grasshopper script that optimises a developable outcome.
2. City of Sydney cadastral model (black) with an overlay of a maximum developable site function (gold).
3. Working model, takes sight boundaries, applies the street set back, parametrically determines the primary and secondary facades and then applies the model and floor plates.







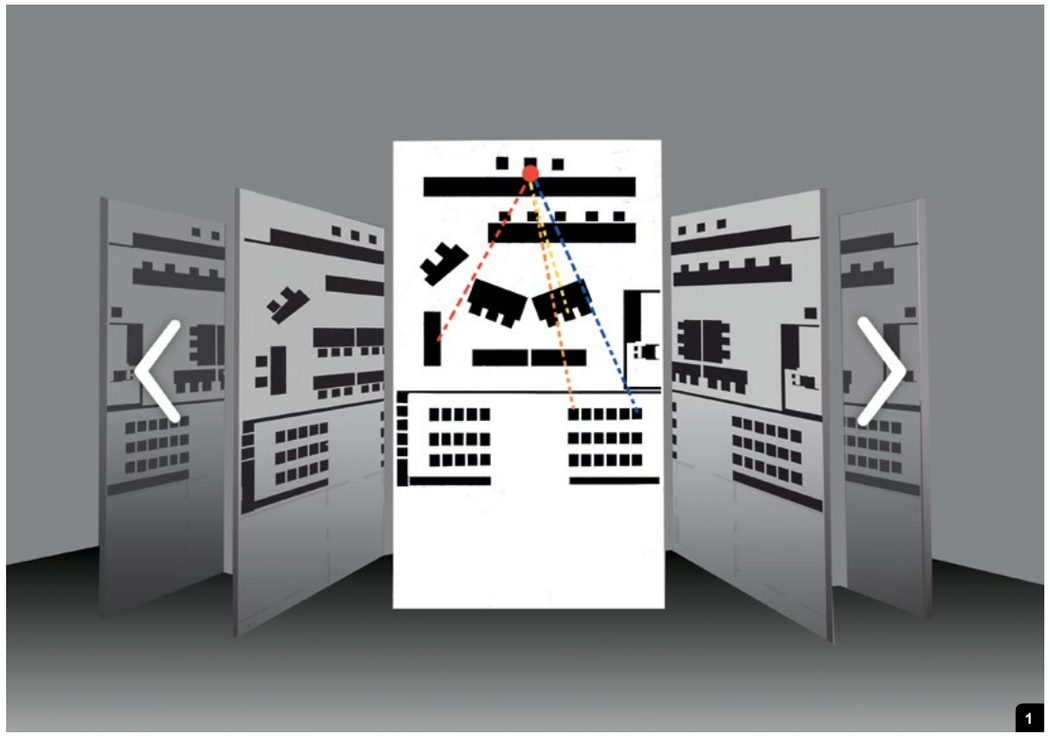
Optimisation of Urban Planning Design Metrics Using Genetic Algorithm

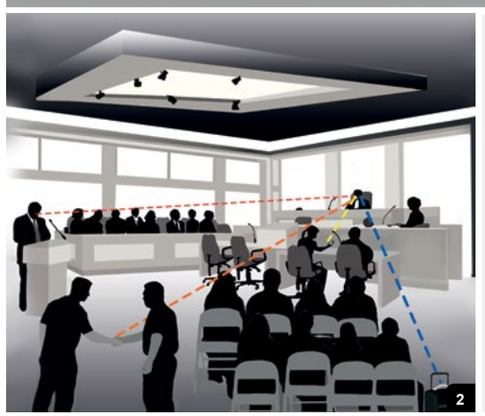
Optimising urban design for a more sustainable solution is an area that is gaining more attention as the need for more sustainable living options for the future is increasing, especially in relation to our social, economic and environmental resources. The objective of this research was to explore and improve the workflow of urban planning software, Kinesis, combined with genetic algorithm. The research aimed to find an optimal solution for urban planning decisions and projects whilst meeting Australian urban planning standards.

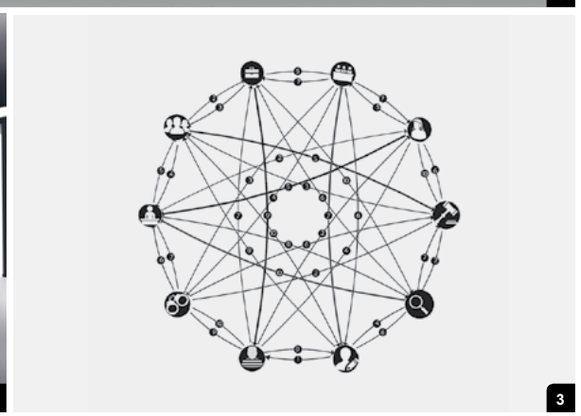
Currently, techniques used for planning and scheduling are lacking the element to provide a detailed, accurate solution when dealing with complex problems (data feeds) that are multi- objective (Eiben and Smith, 2003). Traditional urban planning tools mostly rely on a manual data feed in process making optimisation time and labour intensive. On the other hand, evolutionary algorithmic programs like Galapagos can enable multiple design options to be generated and analysed in a short time frame, therefore a more efficient workflow will be introduced.

Kinesis is a software that uses empirical data sets as a data and evidence based sustainability and strategic urban design tool (Kinesis, 2014). It allows the user to define a development using some simple inputs with the opportunity to build upon the initial data and through an iterative design development process, tune the development to meet the goals set by the developer and the planning authority. Therefore, it provides data sets that can be used as feed ins for Galapagos. Overall, the aim is to explore how the combination of genetic algorithms, Galapagos, and Kinesis can be used for the simultaneous optimisation, creation and analysis of urban planning design metrics.

1. Optimised ratio of Solar Panels to Heating and Cooling Efficiency.
2. Flowchart of the project's process/ workflow.
3. 3D representation of results – pinpointing the optimum solution.







Bidirectional Sightline Relationships Within Courtrooms

A mobile application for architects is being developed that examines sightline relationships and suggest arrangement for courtroom furnishing layouts.

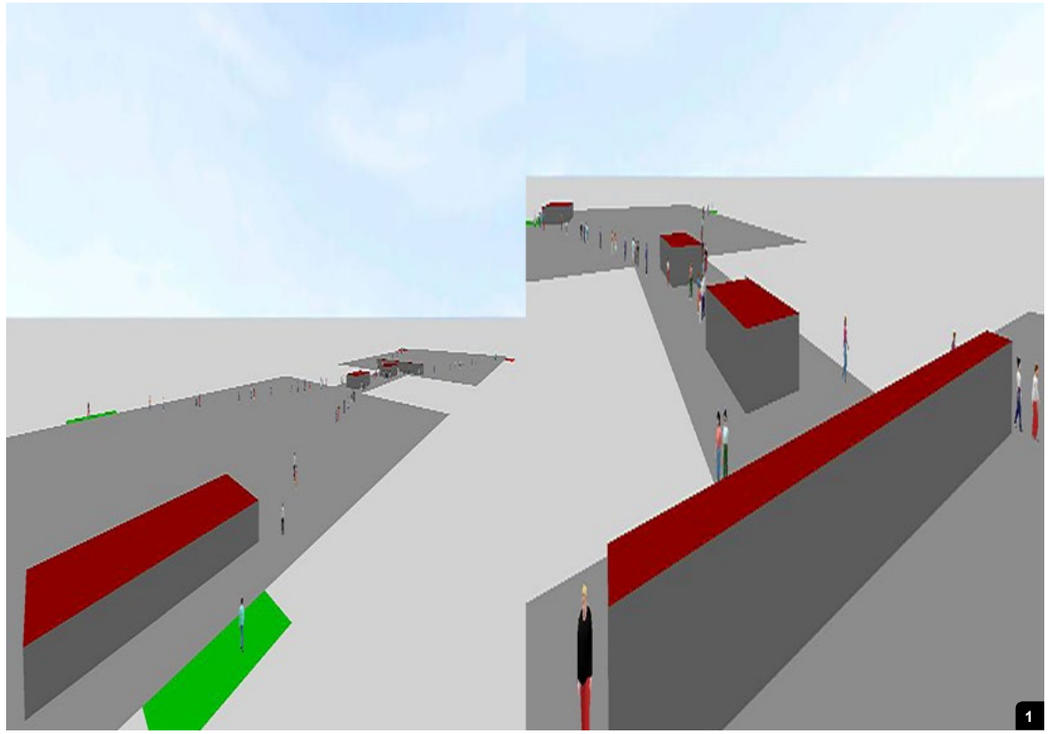
Courtrooms have rich, bidirectional sightline relationships between the various actors. The geometry of the room determines the nature of those sights lines and it is common for a courtroom to be designed to accommodate for day to day alterations.

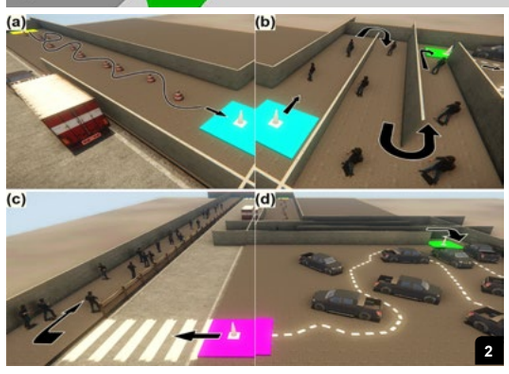
Research has shown that sightline quality can bias the outcome of court room trials, often times when furnishings are placed/moved carelessly. Technology, especially the introduction of teleconferencing is changing the requirements for sightlines. As Australia has a sparsely distributed population; teleconferencing is used for participants who live long distances from courtrooms. It is also used to accommodate for vulnerable witnesses etc.

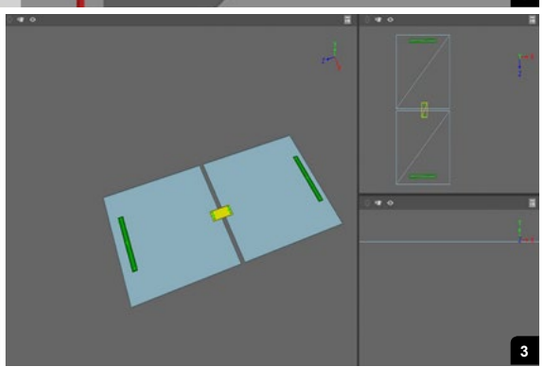
Physical and remote actors cause a series of new challenges for designers. These exasperate the already difficult design problems involving bidirectional al sightlines. Currently, courtroom designers use intensive manual practices to analyses sightline relationships when developing courtroom layouts, furnishing and joinery. The task is further complexities by the introduction of teleconferencing.

When completed, the application will (1) Test sightlines within a floor plan, (2) Receive adjacency parameters for intended sightline relationships (3) convert those parameters via a hierarchical clustering system for a floor plan, and (4)network weighted push and pull forces that will determine seating orientation.

1. Architects Application for courtroom seating arrangements.
2. Perspective view developing application in real-time.
3. Asymmetric-graph linking sightlines with courtroom actors.







Pedestrian Modeling

Transport NSW are in the process of constructing a new light rail system across the city of Sydney, due to be completed in the next 5–6 years. The benefits that Transport NSW are accepting to have is that space for 300 commuters on each light rail, reduces congestion and buses freed up. The light rail service In the CBD will run every 2–3 minutes in peak times. Two new light rail stops have been proposed for the UNSW campus – one on Anzac Parade across the main walk way and the second at upper campus at the junction of High Street and Wansey Road. The movement and mobility of pedestrians across the campus will inevitably change once the light rail system is completed, and it will be very important to take into account the effect that the new structures will have on pedestrian movement patterns. There are many different simulation programs available to designers which help to predict pedestrian movement patterns. This project will investigate the effect that the new light rail stops at UNSW will have on pedestrian movement patterns using four such programs (Cry-engine SDK, Pedestrian dynamics, Mass Motion and PTV Viswalk) in order to assess which is most effective.

1. A simulation with objects created in VISWALK.
2. A route a pedestrian must take in CRYENGINE.
3. A simulation in MASS MOTION for pedestrians.

3D Printing in Bridge Construction

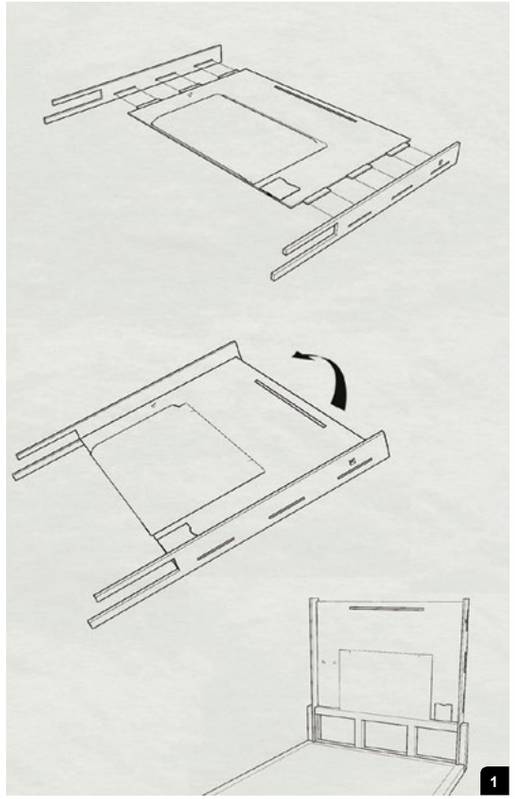
3D printing makes it as cheap to create single items as it is to produce thousands and thus undermines economies of scale. This study demonstrates that 3D printing technology is viable for bridge construction and that there are a multiple 3D printing fabrication strategies that would allow new bridge construction solutions.

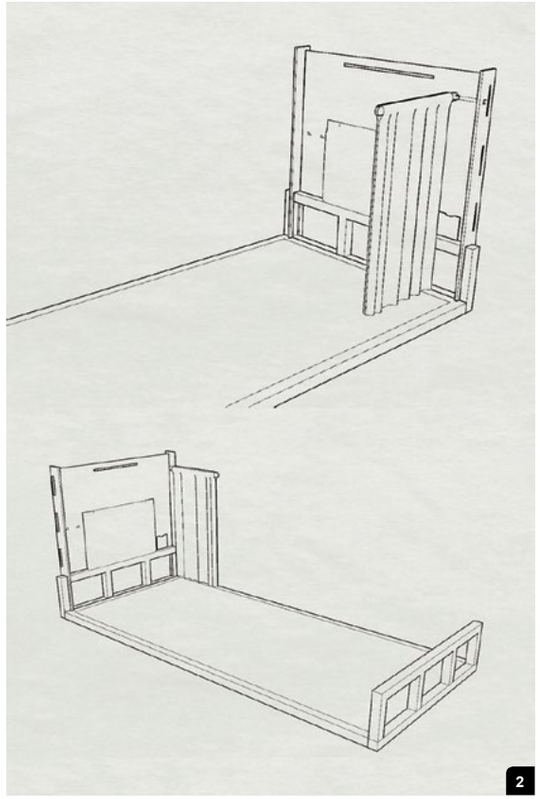
It is significant as 3D printing finally enters the world of large-scale, functional objects and sustainable materials while allowing unprecedented freedom of form. As most construction project costs can be split into four categories: finance, materials, labour and maintenance. 3D printing could potentially erase significant amounts of money in bringing construction projects to market, through shorter project times and fewer wasted resources.

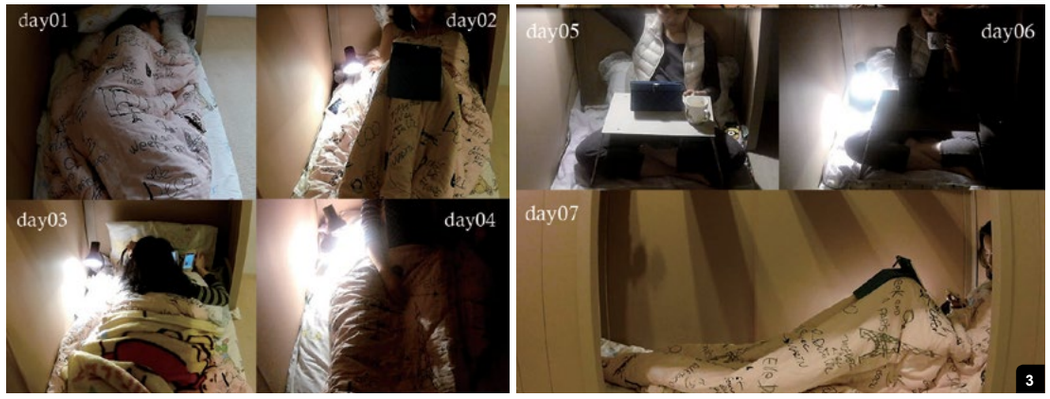
First steps in this direction are done by Dutch-based construction service company Heijmans collaborates on the 3D printing of a steel bridge that will be located in the centre of Amsterdam and designed by Joris Laarman. When analysing this bridge it is limited to a small scales and basic structure.

The extent of this study raises questions into possibilities of utilising 3D printing technology for bridge construction. In this project there are more possible ways presented to build bridges in different scales and shapes.

1. Large-scale 3D printing, D-Shape.
2. Ancient Roman Bridge, Pont-Saint-Martin.
3. Robots printing steel bridge, MX3D.







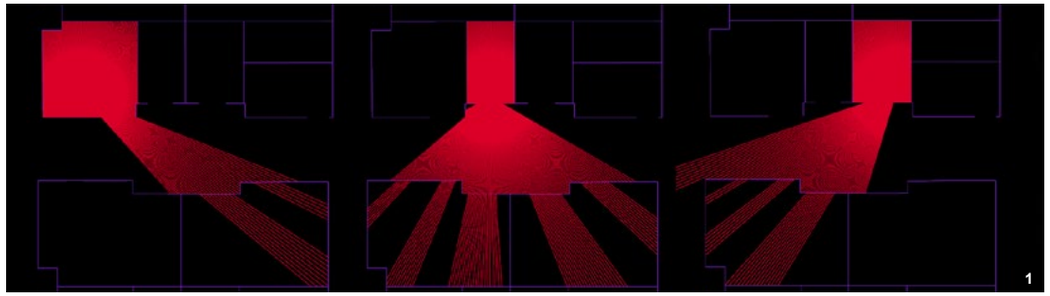
Improvement of Living Environment for Migrant Construction Workers

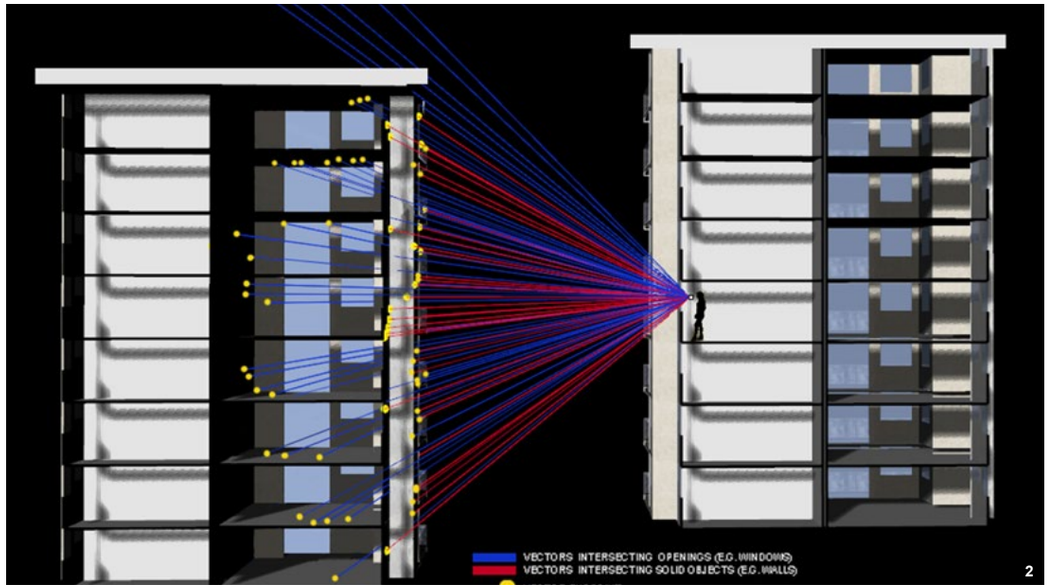
The rapid development of the architecture industry in China has promoted the construction industry and consequently led to increasing demand for construction workers. In Shanghai, current migrant construction workers are mostly living in temporary shelter supplied by construction companies on site. Due to large population and poor wages, living conditions of migrant workers are terrible and has become a problem yet to be resolved in the sector.

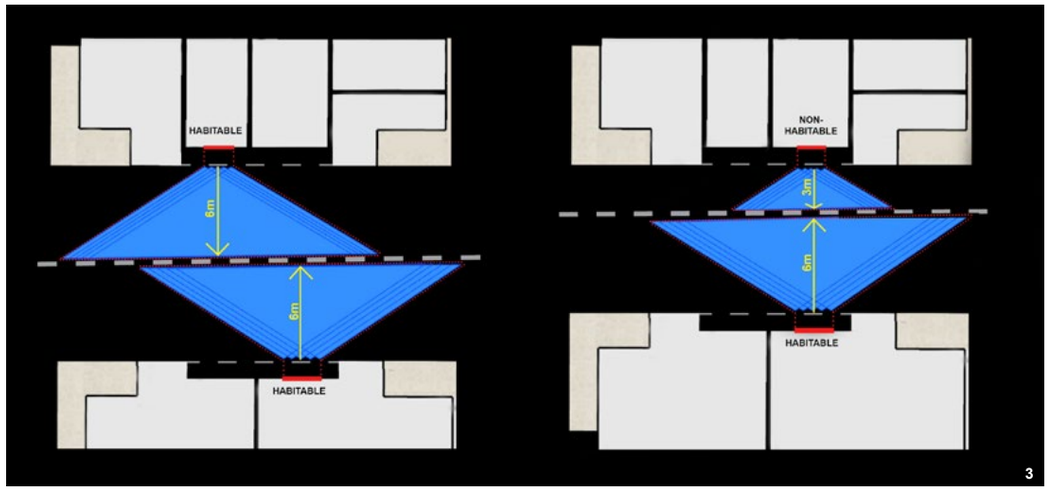
By analysing the drawbacks and basic living needs of the workers, five issues have been defined. These include lack of privacy, personal reading light, table, storage for working equipments and personal belongings. Therefore, this project aims to analyse living needs of Shanghai migrant construction workers and to explore potential options which may practically address the issues, in order to improve quality of the workers' daily lives.

To address these issues, a 14 days living experiment was conducted in a 1:1 prototype of existing living environment and videos were recorded in order to develop the further design. Taking real life situations into consideration, multifunctional 'hacks' were designed to address the five issues and prototypes were developed to test the feasibility. Hacks can be installed in existing bunk beds and are detachable, which assist in meeting the needs of temporary living for migrant construction workers.

1. Hack A, assembly instructions step 1, 2 and,
2. Hack A, assembly instructions step 4 and 5.
3. Living experiment day 1 to 7.







Assessing Accuracy of Legislative Guidelines on Visual Privacy Through a Decision Support Tool

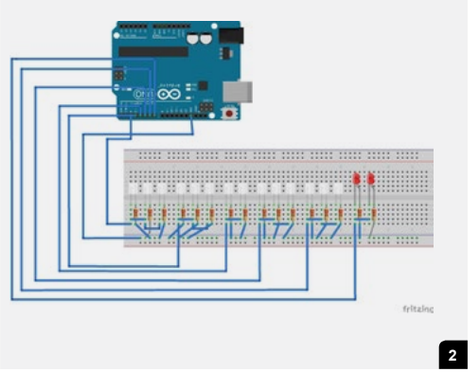
Sydney is growing rapidly and consequently becoming denser. Development regulations such as the NSW State Environmental Planning Policy – Design Quality of Residential Apartment Development (SEPP65) endeavor to respond to the demands of the growing state and be a method for delivering a more efficient and sustainable city.

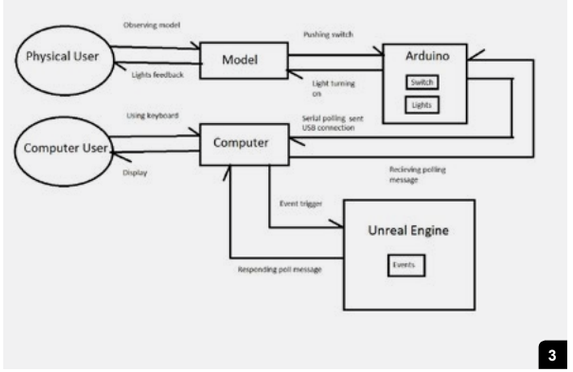
Currently assessing compliance with SEPP65 for overshadowing and solar access is a simple and efficient process due to existing commercial tools. Visual privacy is also an important aspect of building design, but commercial software to analyse such compliance is not readily available to the industry. As a result visual privacy is generally assessed using limited visual representations, 'rules of thumb' and 'analogue' techniques. The consequence of this is that visual privacy can be unintentionally neglected or overlooked. This opens up the potential for the creation of a commercial software to assess visual privacy.

Utilising the knowledge gained from a literature review and qualitative research, a Design Support Tool (DST) was developed using the software Grasshopper and Rhino3D. This tool can provide architects with a better method for assessing the impacts of visual privacy violations. Ultimately the DST could foster the development of more computational tools that assess a range of SEPP65 Design Criteria.

It is hoped that this project will encourage further research on creating high quality residential environments through using such decision support tools.

1. 2D ray tracing of visual sightlines as per SEPP65 criteria. (Plan View).
2. 3D representation of visual sightlines using the decision support tool. (Sectional elevation).
3. D SEPP65 diagrams used currently to assess visual privacy. (Plan view).





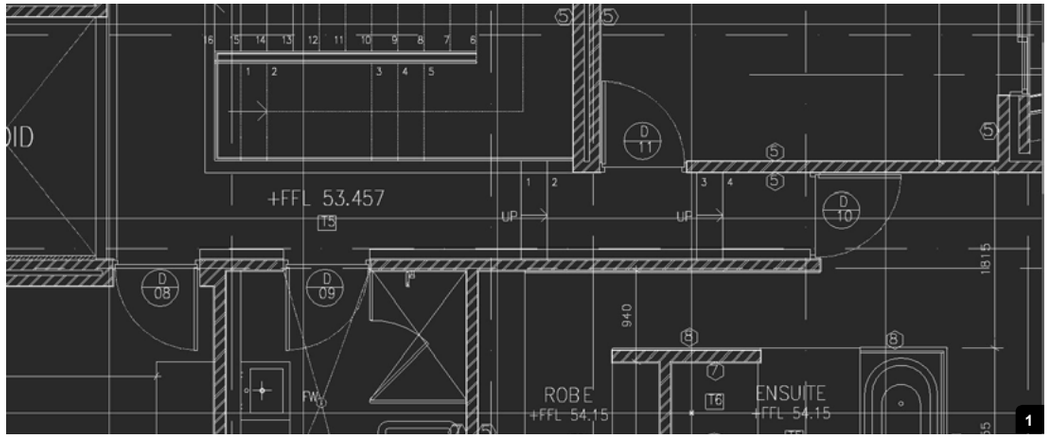
Dual Interactive Tool Development

Interactivity is becoming a staple in homes and home design with smart homes becoming more integrated and becoming more sophisticated in households. With this the development of tools or other uses to express new versions of interaction in a home.

By developing new ways of interacting in smart homes it can start displaying other potentials that smart homes can develop. This development is done through dual interaction, a physical model with controls and a virtual environment which combine together to create feedback on each other's actions and events that users control. Using Bill's house as the central example of this toolset, created around the controlling of nodes within the home.

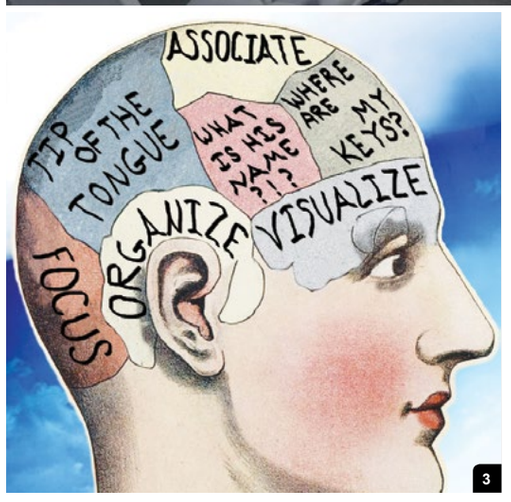
The physical is made to show the interaction that the home itself would have but a smaller scale, controlling light fixtures within the scale model. The virtual environment done within the Unreal Engine allows users to fully interact with the home without having to physically be present. This means that virtually the users can control their household instead of physically adjusting it. By providing it within a replicated environment users will understand more easily the use of switches and placement of objects familiar to them.

1. Bill's House, images provided by Tony Owen.
2. Arduino breadboard layout.
3. Image System Architecture diagram.



1

2



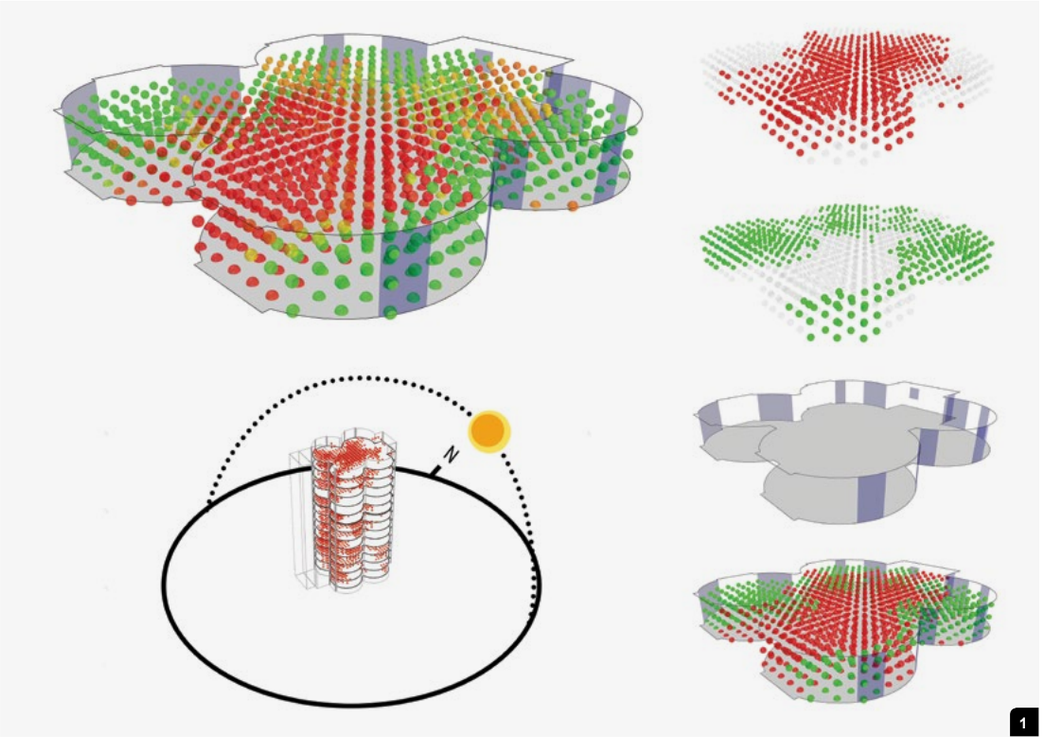
3

A Study on the Effectiveness of Spatial Memory in a Residential Context

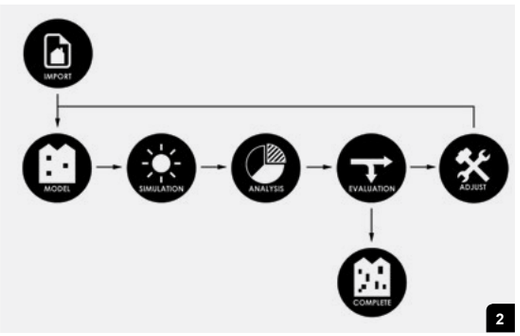
Spatial memory and recognition plays a fundamental role in everyday life, it allows for the ability to understand and remember the location of objects, features and landmarks in a space. Thus leading to more significant tasks such as reading a map to find out how to travel to a destination, or merging into a different lane whilst driving. In the property and architectural industry, potential clients may not have the best expertise in interpreting and understanding space from purely looking at a two dimensional drawing. They perhaps require three dimensional materials such as virtual models and visualisations to fully grasp what the building looks like to then spark interest. Even through small details, capturing attention is what leads to a proposal or an existing building in being memorable, opening the possibility to gain business.

The aim of the study is to examine the effectiveness of spatial memory on participants when exposed to three different representations of the Bill's House, by Tony Owen Partners. Each participant was exposed to the same virtual model rendered in Unreal Engine 4 (UE4), however were shown a different room of the house. First, screen captures were to be examined, followed by exposure to UE4 giving them the ability to browse and navigate, and then finally being immersed into a virtual reality simulation. The study questions, which spaces and features are more memorable with respect to the representation? In which of the mediums do object, material, and spatial recognition become the most memorable for potential clients? How can the findings change the way in which businesses approach their advertising and proposals?

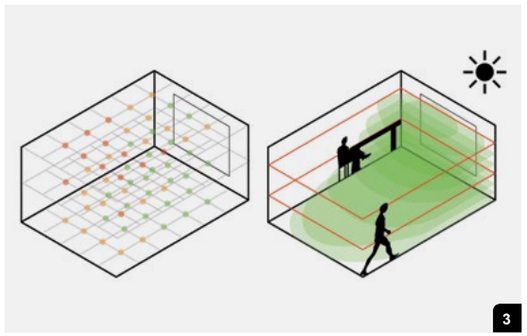
1. Ground floor plan of the Bill's House
2. Unreal Engine 4 screen capture of the living and dining area of the Bill's House
3. 'Map' of the brain illustrated. Image source:
   http://www.semel.ucla.edu/sites/all/files/users/user-412/brainmapprintv4.jpg



1



2



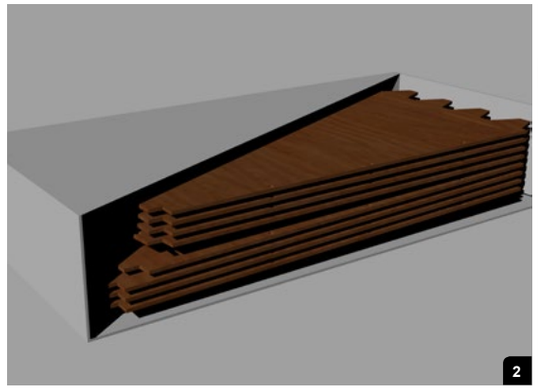
3

Developing an Active Tool for Daylight Simulation in Early Design Stages to Address Green Star

Simulations are primarily used to assist in optimising a buildings performance in later stages of design development. Daylighting analyses are primarily used as passive tools and not active tools to impact the overall design. Australian regulations rely on 2D simulations to prove that the design meet the requirements, as they disregard the volume. 3D daylight simulations can explore the internal space of a building to help inform and educate the design consequences, linking façade design to interior daylight. Hence the project experiments with 3D daylight simulation as an early active tool, to educating and assisting designers to achieve the benchmark requirements in the sustainable design rating, Green Star.

The script works in three stages; a basic digital model is imported and prepared into the daylight simulation, data values are filtered with the Green Star benchmarks and outputs detailed results within the model, the user then makes model changes and re-runs the simulation until satisfied. Additionally the project explores the accessibility of energy analysis and simulation tools through the use of Grasshopper plug-ins to evaluate an existing project designed by HASSELL. The research will outline the outcomes of voxel based daylight simulations and evaluate the effect of volume based simulations.

1. Daylight simulation results, Summer Hill Flour Mill 3C, 8th floor.
2. Project script flow chart of daylight simulation in Grasshopper.
3. Representation of 3D daylight simulation data outputs.

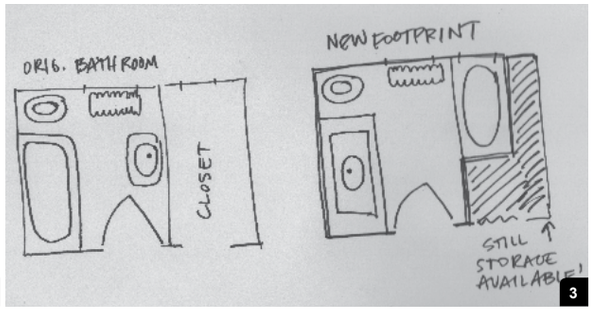


One of the most immediate effects of natural disasters is population displacement resulting in many people having to abandon their homes and seek shelter in other regions. Aside from the natural danger that is left behind by natural disasters, health complications can be prevalent among survivors of natural disasters causing bacteria or malaria. Thus, without the help of emergency relief from international aid organisations, death tolls can rise.

This project defies these issues where victims are proposed with material that guides the restructuring of their community through providing temporary shelter for the displaced in need of warm and enclosed homes. In addition, undertaking extensive material research of local disaster struck locations and providing adequate information to educate the importance of each step of construction and material used. Using plywood through extensive prototyping it enables a better understanding on how the joinery and overall structure will be affected. Having a fast deployable flat pack post disaster shelter that is easy to assemble and configure without much construction knowledge with a set of simple instructions to follow.

By providing these systems in place, victims are provided with adequate shelter, thus assuring their safety and health.

1. Displaced Disaster Victims by Ivor Prickett.
2. 3D Render of a Flat Pack.
3. 3D Render of Fully Assembled Shelter.



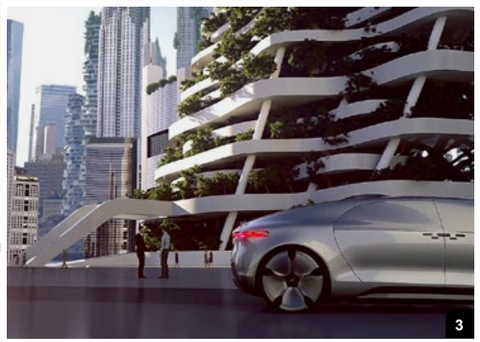
Virtual Reality vs Accessible Bathrooms

An accessible bathroom is about meeting the needs of people who require higher level access and aimed at a specific persons' mobility. It is about freedom, about being able to move with ease and confidence by accessing all parts of the bathroom space independently without outside assistance. Many bathrooms in Australia today are designed without taking into consideration the changing needs, from our young population that eventually grow older. This project looks at challenging the above material through the use of elderly/disabled people and the Oculus Rift head mounted Virtual Reality gear. Virtual Reality, an interactive computer generated environment that stimulates the real world, immerses the user with the environment enabling them to perform a series of actions thus testing their satisfaction.

In order to achieve this, the following procedure has been undertaken:

- Meet the participants at their residence
- Measure up, and photograph their existing bathroom to be modelled in a game environment
- Get their views on their 'ideal accessible bathroom'
- Test the realism of their existing bathroom in Virtual Reality to benchmark the system
- Test their satisfaction of their ideal accessible bathroom in VR

1. Virtual Reality Bathroom.
2. Oculus Rift HMD.
3. Before & After sketch plan.



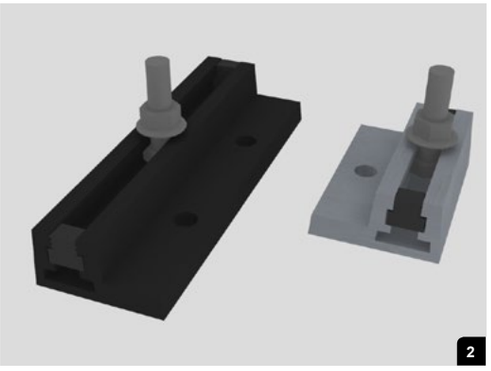
Sydney CBD Redevelopment Concept in the Context of Autonomous Vehicles

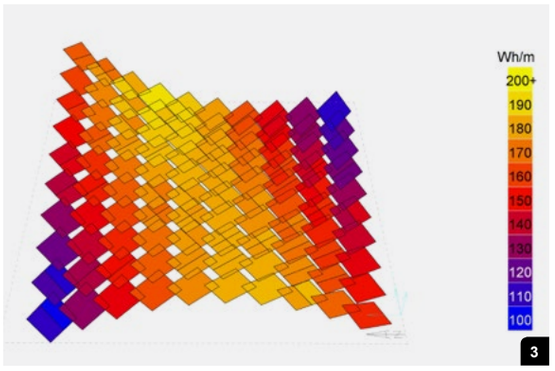
With the inevitable mass-influx of autonomous cars, predicted to occur by 2030, our cities will see the biggest increase in available space for design and development this century. What must be attended is how our cities will make use of this freedom of development, in particular Sydney, and what strategies and plans can be put into action to redevelop this city, activate new public space, and create urban places to add social, cultural, economic and ecological value.

The overarching theme of this study is the redevelopment of the Sydney Central Business District. To do this we will be looking at the effect of the autonomous car on the number of vehicles still needed to maintain our transport needs and accommodate for predicted trip numbers in 2030. In concert with this we must find solutions for getting these vehicles off of the street when not in use: automated parking. We will look at solutions for minimising through traffic for the CBD, namely with increased underground 'highways', in the same vain as the Cross City Tunnel. With this also comes minimised visual impairment of the city skyline. Next we determine what routes are necessary to the operation of the CBD, and which ones can be redeveloped for use by the pedestrian, increasing green space within the steel jungle, store frontage, and small scale dining and culture within the many interwoven lanes and alleys. All this will then come together with the redesigned and newly connected three main squares, being Circular Quay, Town Hall and Railway Square.

1. Four Elements - Green space, General and Restricted Access Roads, Main Service Routes, and Highway Bypasses.
2. Town Hall redesigned as a city square. Image courtesy of Gehl Architects.
3. Inspiration Image: The Mercedes F-015 Luxury in Motion in a future cityscape. Image courtesy of Mercedes Benz.

ANDREW MCDONALD





According to the Bureau of Infrastructure, Transport and Regional Economics (BITRE), emissions from the Australian road transport sector in 2010 are estimated to be close to 44 per cent above the level for 1990, reaching around 78.7 million tonnes of direct CO_2 By 2020, the projected base case emissions for road transport are expected to increase to 65 per cent above 1990 levels at about 90.3 million tonnes of CO_2.

Meanwhile the sales of electric cars in Australia are trivial, and one of the lowest in all developed countries. During development on their electric cars, Mercedes Benz discovered that the CO_2 emissions released by their electric car were actually more then that of a regular petrol car. This is because Australia gets the majority of its electricity from coal burning power stations.

This project involves creating an efficient and effective photo-voltaic (PV) system in order to charge electric cars for the current context. As the system is fully parametric, both new and existing surfaces including residential and commercial can be analysed and optimised in order to achieve the most electricity in a single day. Tracking components can angle panels perpendicular to the sun increasing solar insolance. With more energy received, users have the ability to charge their cars at night, possibly without the need to visit a commercial station.

Australia is under pressure to move away from its currently coal powered stations. The introduction of commercially available solar PV charging stations not only assists majorly in the strive towards sustainability, but will also have a great impact on quality of live and convenience.

This system has the ability to combine both form and function, However unlike Alvin Huang it has been designed to go beyond concepts and be implemented today.

1. Alvin Huang.
2. Component Render.
3. Dynamic Curved System.

The Rise & Fall of Architectural Utopias on Water:

Arguing for dependency on energy pricing & world events

Throughout history we have seen Utopian architecture emerge sometimes in consolidated patterns. This paper aims to find a connection between the energy resources and events that influence energy prices and availability to the utopias of the corresponding time. As new architectural designs for waters-based utopias are produced it seems logical to find a pattern or relationship with the energy sources available to provide these new designs with some data based research to improve the feasibility of the future prospects of water based utopias. The research conducted in this paper will be based of a number of designs relating to architectural utopias on water and based on the findings proceed to prove a relationship to energy availability or discern that there is not enough proof to base the idea on.

Drawing on existing theory and knowledge of architectural utopias on water in literature, the energy data available from governmental bodies along with the technology and research of new renewable energy, this paper will aim to explain, correlate and present evidence of relationships between a select few of the most prominent architectural proposals for utopias on water with the energy events and availability of their respective time.

Credit: Solar Drop by Vincent Callebaut
http://projets-architecte-urbanisme.fr/architectes/vincent-callebaut/

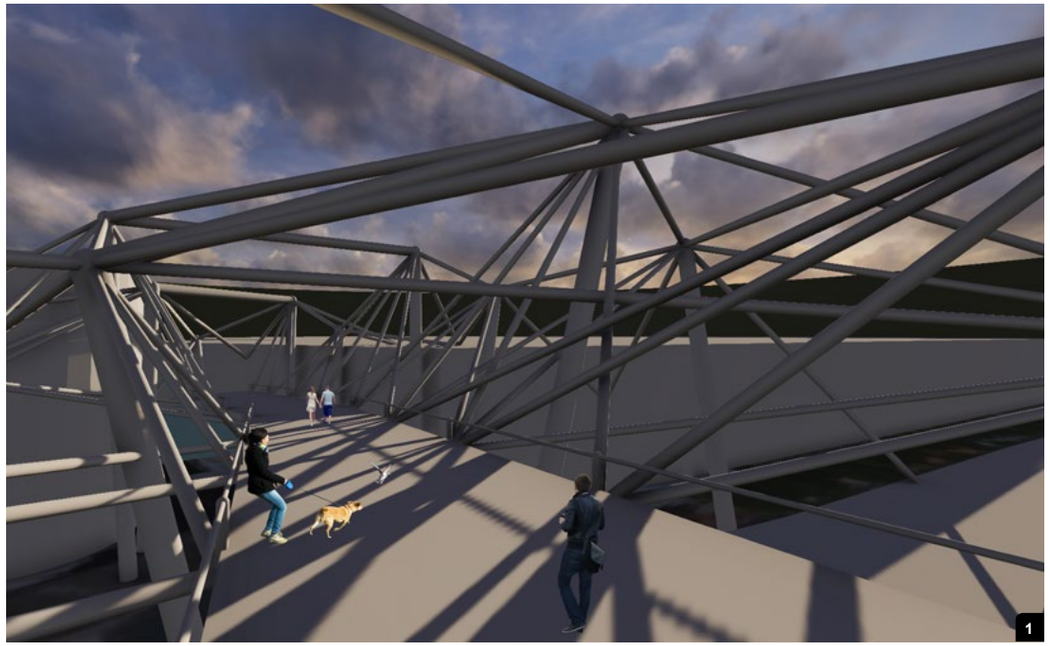
Virtual Conservation of Built Heritage Using Free Photogrammetry Software

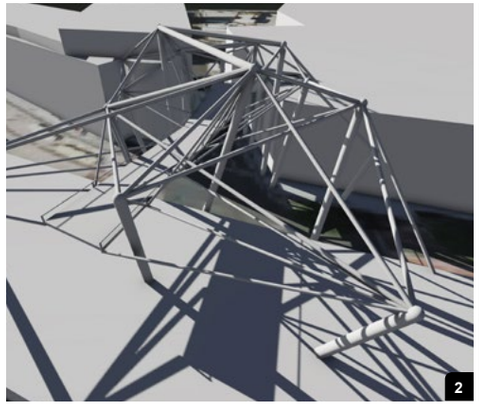
As disasters both natural and man-made can occur at any time, virtual Architectural conservation can be regarded seriously as an alternative to protect our built heritage. Recently developed free photogrammetry techniques and software can replace expensive photogrammetry techniques and the conventional techniques to create a free and affordable solution to virtually conserve our small scale built heritage.

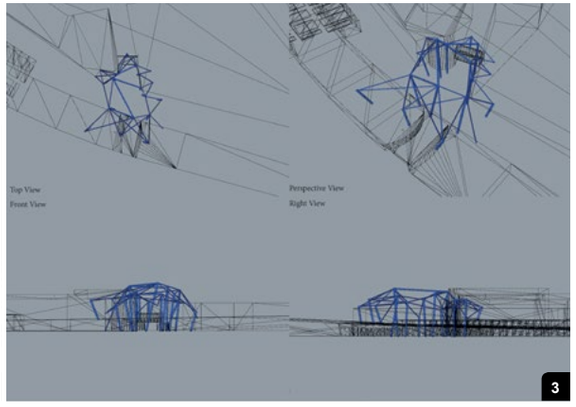
There are numerous examples of free photogrammetry software that can offer a free solution for virtual conservation of the smaller built heritage. Organisations such as the Heritage Council of NSW often focus on built heritage of great value leaving an opportunity for virtual conservation of the smaller and less prestigious built heritage thus encouraging local councils and its locals to attempt virtual conservation.

This aims and motivations are to investigate the list of free photogrammetry software available and compare each of the software against a detailed checklist to filter out the best software to use for virtual conservation of smaller built heritage. This investigation will also cover the optimisation of the created geometry to enable the importation of this geometry into other software such as Google Sketchup or Unreal Engine for visualisation or archiving purposes. The research and results obtained from this investigation will help in simplifying the choice in picking the ideal free photogrammetry software to use when conserving small scale built heritage.

1. Temple of Baalshamin in Syria.
2. Closeup test and exterior test.







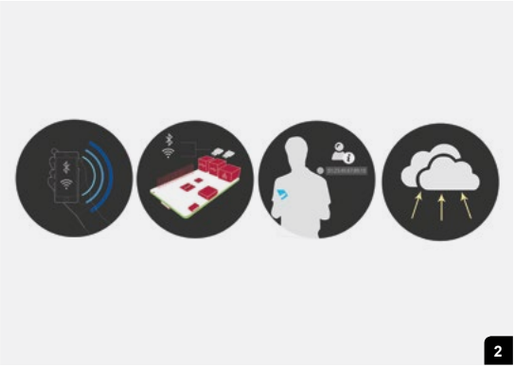
Enhancing Quality of Living via Optimising Circulation

Congestion is a significant problem that affects certain areas in the highly populated CBD region; especially within the proximities of public transport at Parramatta Station.

Congestion causes inconveniences and obstructs the efficient flow of busy commuters that utilises public transport and areas around it. The aim of this project is to enhance the quality of living and the performance of urban services by providing a safer, efficient and convenient means of travelling from point to point within areas that are usually heavily congested – in this case, from Parramatta train station to the Westfield Shopping Mall.

The solution to address this problem is to implement new suitable pathways in the affected site to ease and efficiently direct the flow of busy commuters coming into and out of the area. This is achieved by analysing the existing site to identify where the construction of new pedestrian facilities are needed, e.g. constructing a footbridge and/or additional entry and exit points for the Station to ease the flow of commuters, and simultaneously optimising the flow of circulation by reducing the waiting time and queuing. Ultimately, the footbridge must accommodate all the various types of pedestrian and the quality of living will be achieved.

1. Perspective view over the footbridge.
2. Main Structure of the Footbridge and Elevation View.
3. Perspective view during sunset over Pedestrian Footbridge.



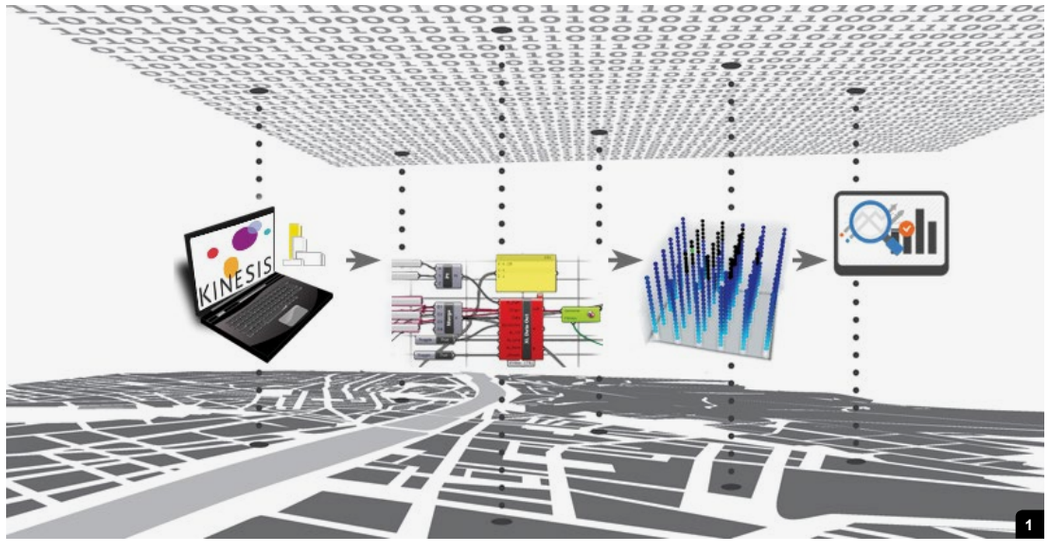
Indoor Tracking within the Workplace

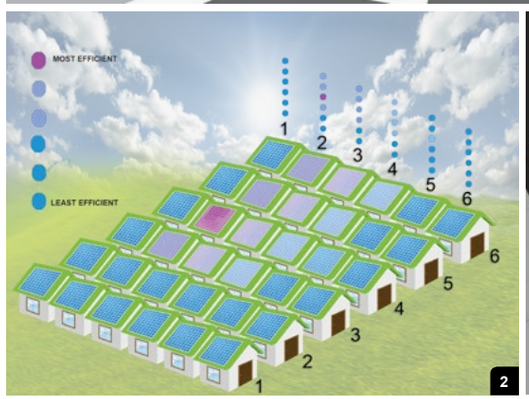
Knowing how people move within workplaces will allow designers to improve them. Today, the GPS provides information about the location of a person outdoors, however the results can be deemed redundant inside buildings due to the absence of a line of sight to satellites. Therefore, tracking people indoors remains an open research problem. There are a number of commercial applications and devices that can track people indoors, however, they are expensive, require a lot of setup of equipment and do not give full control over the data received.

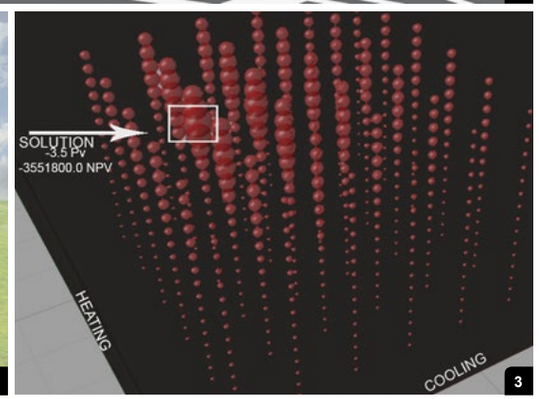
To minimise deployment and extensive infrastructure costs, this project presents the development of a low-cost open-source platform, which allows the administration and provision of a metric database. To demonstrate this data, Bluetooth and Wi-Fi traffic of extant devices are captured in the kitchen area of a large Australian workplace. This data will then be visualised and evaluated against a video analysis to establish their veracity.

The contributions of this project are elements of a solution to the problem of providing a framework to evaluate built workplaces as part of post occupancy evaluation through a metric means of analysis. The results will allow designers to improve the spatial configuration, interaction patterns and productivity of a workplace.

1. Visualisation of video footage vs. data capture.
2. Representation of experiment process.
3. Floorplan representing presence in the kitchen.







Evaluation of Urban Planning Design Using Genetic Algorithms

Optimising urban design for a more sustainable solution is an area that is gaining more attention as the need increases for more sustainable living options for the future, especially in relation to our social, economic and environmental resources.

Traditional urban planning tools mostly rely on a manual data feed in process making optimisation time and labor intensive. On the other hand evolutionary algorithmic programs like, Galapagos can automate this process by employing data feeds from Rhino. Yet Rhino offers only spatial data sets but not empirical data sets such as unemployment, gender to name but two. Still empirical data sets such as the mentioned two are important for optimising urban planning.

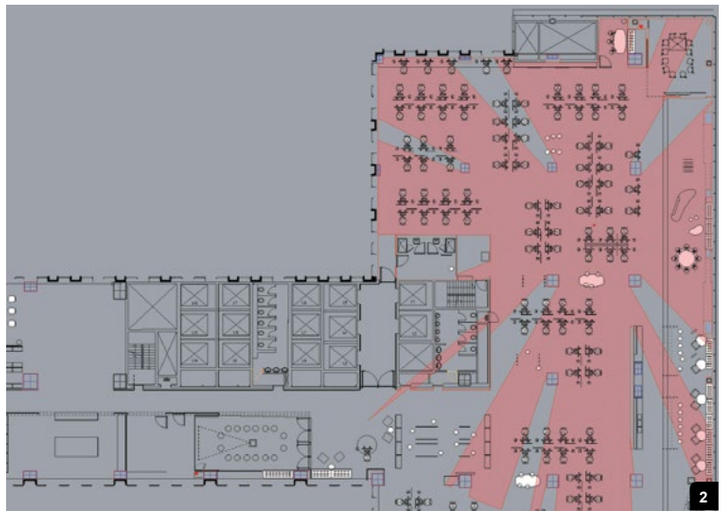
The paper contributes by researching and developing a workflow that will connect a program like Kinesis and Galapagos, as more accurate solutions can be achieved. This will be a more efficient method that can be adapted to different projects. Still, a spatial interface for kinesis to work on has not yet been achieved and will provide a pathway into the computational field in which complex data can be collected and comprehended. By identifying advantages and disadvantages of evolutionary algorithms, future research can be undertaken on improvements, different methods as well as the limitations of the interface.

This will be done through the case study of finding the most efficient heating and cooling systems for a specific location.

1. Workflow diagram of the process of connecting Kinese with Galapogas and analysing the results.
2. Graphical representation of analysis results showing the least efficient and most efficient heating and cooling system.
3. Solution found using Galapogas showing the most efficient result within the defined resolution grid.

MAURISHKA SAHANI

1



2

Ascertaining Becon Positioning for Adequate Coverage

Indoor location tracking using beacon technology has been greeted with enthusiasm since it's recent release. Existing examples have been limited to cellular spaces (rooms) that can be covered by a small set of beacons. This project shows a method of determining the number of beacons that are needed to provide location tracking in a large open-plan volume, with a specific example of an Australian workplace.

Current occupancy measurements are quite inaccurate when dealing with non-cellular space, knowing sufficient beacons is required and discrepancies between sensor data and what actually happens. Hence a lack of understanding to determine when and where people occupy a commercial building and information being static.

The project explores the use of proximity beacons from Beaconstac in the work place environment consisting of a provided app, software, beacons and Bluetooth low energy enabled mobile phones as the measuring device to display its received signal strength indicator when they in are in a specified range from the beacons. Specifically, the received signal strength is plotted on a floorplan to generate data to understand sensor data accuracy against distance from the beacon.

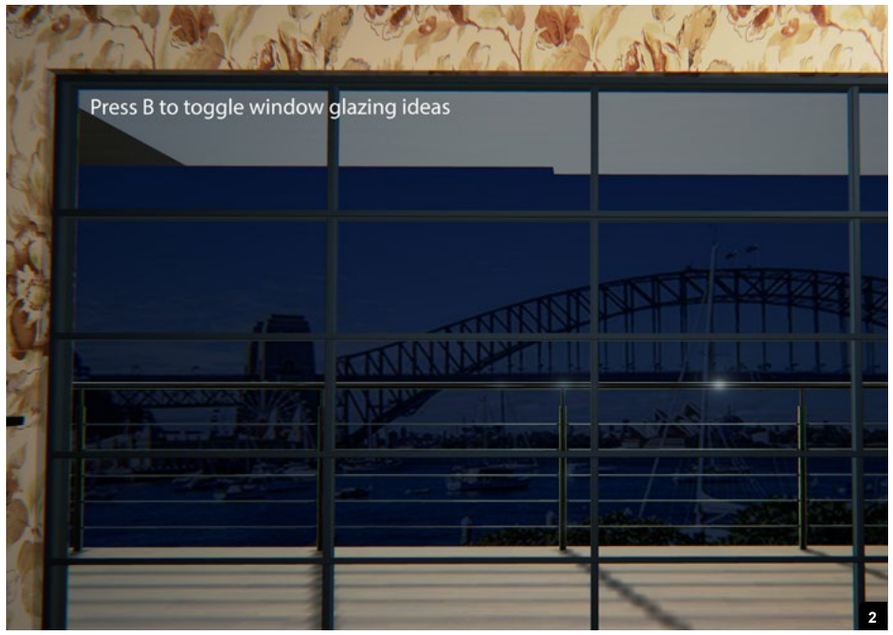
1. Beaconstac Kit: Includes 3 x Bluetooth Beacons and QR code linked to Beaconstac app.
2. Isovist of beacon: Field of vision study of a beacon at specified range in BVN Architectural Office located at Pitt St, Sydney, Australia.

Optimisation of Architectural Visualisation Workflow Utilising Gaming Engines

Architectural Visualisation has been slowly phased out within the architectural industry which is now paving towards the direction of BIM Modeling. While architectural visualisations are still a requirement for marketing and used as a visual representation to clients they are commonly outsourced to graphic design studios who specialise in architectural visualisations. Visualisation plays a vital role in communicating architecture to those outside the field. Bringing concepts and ideas into conceivable forms, they tend to be (particularly in home builders) generic in quality, aiming for a safe photorealistic look than can be quickly mass produced. With the emergence of Unreal Engine 4 (UE4) in March 2014 a power tool for the creation of games for the next generation of consoles it is applicable to be used as an application for architectural visualisation. While the engine does have its graphical limitations compared to such powerful renders as Vray the engine can still produce photo realism in its final results.

The aim of this paper is to conduct a study of the Utilisation of gaming engines to optimise architectural visualisation workflow. Could the utilisation of gaming engines produce a similar if not better result in terms of photorealism? Will gaming engines solve the mobility issues of 3D rendering programs? Are gaming engines an unnecessary tool by reinventing the wheel of the current workflow of architectural visualisation? The research will evaluate if the investment of adopting this workflow will be beneficial for a company to begin using as a tool to communicate a design to clients with features from existing gaming engines to represent architecture.

1. Final visualisation utilising Unreal Engine 4 real-time capabilities.
2. Comparison visualisation utilising ArchiCAD Renderer.
3. Unreal Engine 4 visualisation process.



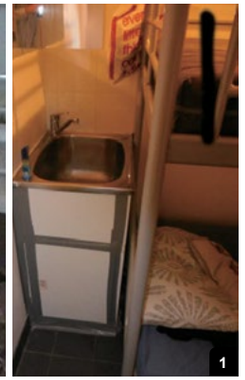
Immersion

I aim to explore the practicality of material selections through the use of virtual environments and user-based experiments – Exploring different techniques of communicating materials to clients and to gain a better understanding of the impact that virtual environments have on both the designer and client.

I endeavor to create a more realistic and engaging approach to materiality selection for design work in a virtual environment. I want to investigate the use of virtual environments on the topic of materiality, to see if giving clients realistic visuals of materials in the setting that they will be applied will be beneficial. I believe that changing this communication process will eliminate barriers between the client and designer and the client will have a greater understanding of the design and a better relationship with the designer.

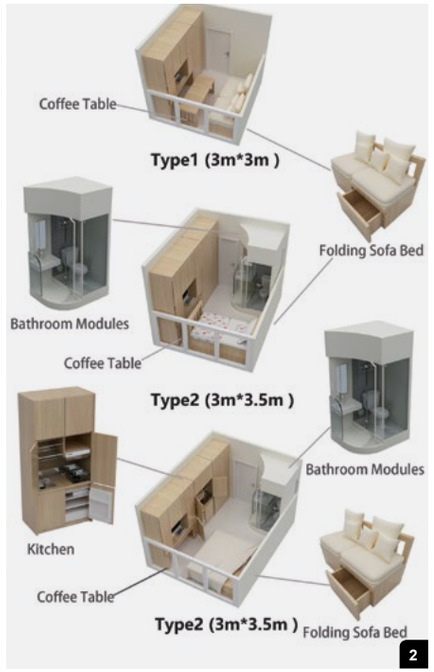
This will then lead to a more effective approach to how information is conveyed to clients in a design firm that isn't stagnant. I would like to conduct my own experiments with having different people from different professions sit through the process of being shown materials in a virtual environment, and then being shown physical samples accompanied by two-dimensional images to compare the effectiveness of each process and to analyze their experience.

1. Here is displayed different instructions for the user to navigate - allowing materials to be altered and considered in real-time.
2. Possible window glazing options that a client could toggle between and make a decision on preference.



1

3



2

Laneway Micro-apartment in Surry Hills

Shortage of new apartment in Sydney CBD become more and more seriously which cause rental price increase extremely high. A lot of student or office worker cannot afford, so they choose to rent illegal accommodations in Sydney CBD. In June 2015, Sydney Morning Herald report City of Sydney cracks down on black market syndicates. They found a nondescript three-bedroom house in Ultimo with 58 beds crammed into 19 dirty, makeshift rooms which are very dangerous.

My project is creating lane-way micro-apartment around Sydney CBD. The test site chooses Bloomfield Lane in Surry Hills which is cross 3 blind alleys. This location would less impact on car or resident access. For micro-apartment, I design multifunction and foldable furniture to reduce space usage which includes sofa bed, hidden coffee table, hidden kitchen and bathroom modules. For studying maximum unit fit in single floor, I design 3 type micro-apartments. First type micro-apartment just has basic furniture which includes sofa bed, coffee table, TV bench and storage. . Second type micro-apartment only has extra bathroom modules. Final type micro-apartment has extra kitchen and bathroom modules. First type micro-apartment floor plan only fit 19 units which also include public bathroom, laundry and kitchen. Second type micro-apartment can fit 22 units which only include public kitchen. Third type micro-apartment can fit 16 units.

1. Illegal accommodation in Sydney CBD.
2. Type Micro-apartment With Folding Furniture.
3. Site Measurement.

Riddle City Game

Each city has a lot of public telephone booths, but people have gradually forgotten the public telephone booths and they are no longer be used, The increasing popularity of mobile phone, people are beginning to use mobile phones make life more convenient. So I decided to apply different purposes for telephone booths and bring back to sight.

My project is going to use the telephone booths to able a city game. Absolutely, the existing telephone booths will be the key component of this game, After I have done a lot of researching, I find two different precedents; the first one is the artist project called Invader which is stem from Paris, and the second is an famous adventure game called escape hunt. My project is getting the advantages from them, and create a new city game. This game is suitable for players of any ages and no time limitation. The benefit of this project is to reused the existing telephone booths for game purpose and has potential to bring people to social level together, also connecting people and improve relationships, it helps people more understanding about the city that we are living and engage the city.

1. Telephone booths location map.
2. Photo of telephone booth.
3. Riddle on the actual public telephone.

GRADUATING CLASS OF 2015

MOBILISING CoDe
is proudly sponsored by:

BATESSMART™

BVN

COX

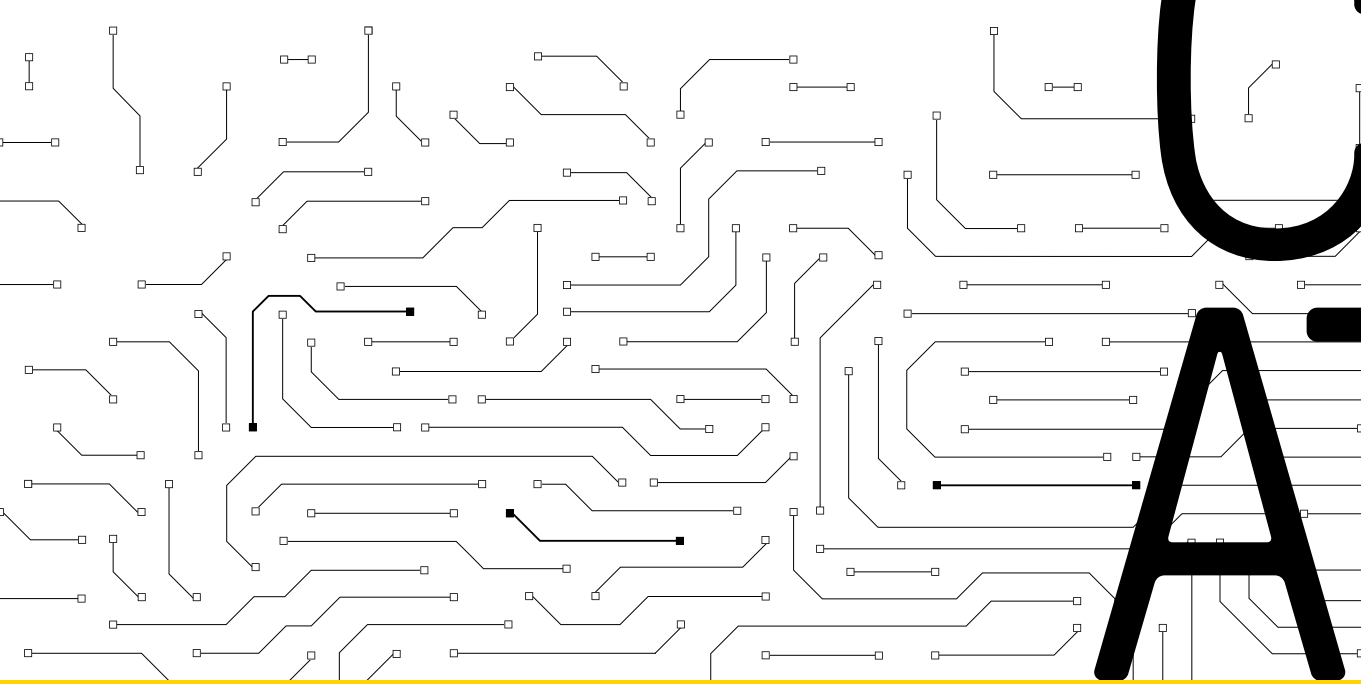
ineni Realtime

HASSELL

PTW

DESIGN BY: Equilibrium Design
equilibriumdesign.com.au

AUSTRALIAN MADE · FOREST MANAGEMENT · RENEWABLE ENERGY · ECF ELEMENTAL CHLORINE FREE · EMS ENVIRONMENTAL MANAGEMENT SYSTEMS · ISO CERTIFICATION



UNSW BUILT ENVIRONMENT

UNSW Australia

Phone: +61 (2) 9385 4799

Email: fbe@unsw.edu.au

Online: be.unsw.edu.au

CRICOS Provider Code: 00098G

KEEP IN TOUCH

Facebook: UNSW Built Environment

Twitter: @UNSWBuiltEnv

Linkedin: UNSW Built Environment

Instagram: @unswbe

Flickr: UNSW Built Environment

Google+: UNSW Built Environment

YouTube: UNSW Built Environment