

The Lovenasium – A 4D housing case study.

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Abstract:

The “Lovenasium” is a housing case study looking at new ways to address some of the shifting living scenarios of the contemporary family over time.

The project tests the potential of 4-Dimensionally master planning a residential site to address these different living scenarios within the confines of ‘ResCode’ (the residential building code of for the state of Victoria). From the beginning of the life of the house occupied by a young couple moving into the housing market, through to young family, to a live/work scenario, all the way to empty nesting and retirement.

This modest (\$193k construction budget) project challenges the accepted norm in suburban housing - the single house as a large mass in the middle of a site with 3-6 bedrooms plus a master bedroom - by breaking the house into 3 separate “units”, each with one “master” bedroom and a large flexible living/ 2nd bedroom space. Each unit has its own separate entry sequence and the second level is accessed by an external stair.

The design both pushes the limits of the ResCode guidelines by breaking the house into three, and pushes itself against the volumetric guidelines, embracing the maximum permissible envelope as a part of the form making process. A parametric study model was used which utilised 3d, 4d (3d plus time), as well as alternate options/realities. The design ‘tuned’ to optimise daylight access, views, minimal span floor areas and architectural formal aspirations by adjusting the parameters with real time feedback. The 3d model information was linked back to plans which were used to check suitability of different living scenarios.

4D Parametric massing within ResCode Constraints

The Lovenasium began with a quick yield exercise to see what would fit onto the block within the ResCode building envelope constraints. Whilst testing different massing variations, percentage of site coverage, and checking projected shadows against the regulations, it was noted that shadows rarely fell towards the north of the building envelope. This was contrary to the ResCode setback profile for the north boundary (Figure 1), which is a similar profile to the setback on all other boundaries. This implies that the ResCode setback is less to do with solar access and more to do with pushing a design aesthetic, with a single mass building, front and centre of the site, tapering in as it goes upwards.

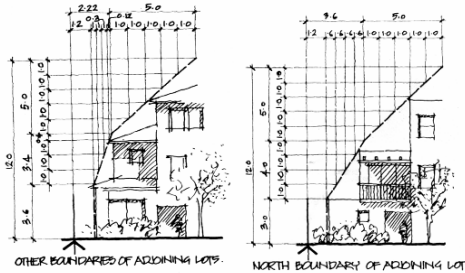


Figure 1
ResCode: Building envelope setbacks from boundaries.



Figure 2
“Comfortable fitting forms”, a typical Dutch barn (left) and Hitler’s Berghof (right).

The setback was tested for numerous forms. The forms that sat most comfortably were examples of provincial European building types. These forms are typically seen as aesthetically inappropriate by architects and they generally seek town-planning dispensations to penetrate the volume. This leads to more time consuming and expensive design options. However, as Hugh Ferriss demonstrated, there is potential beauty in legislated envelopes¹; it can be far more interesting when a design engages directly with the envelope, but without restricting the massings to those of comfortable fit.

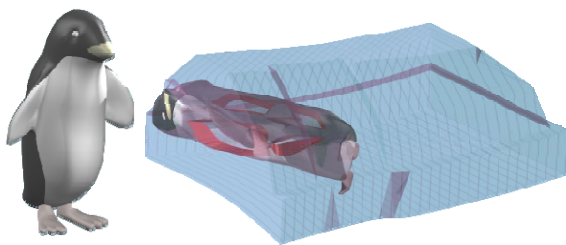
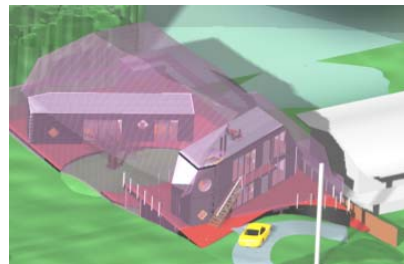


Figure 3
ResCode: uncomfortable, ill-fitting forms.



A parametric digital model was created which used a live Boolean intersection of an aesthetically desirable “Archi-Box”, (currently fashionable minimal rectangular box form) and the ResCode maximum envelope. The ‘live Boolean’ meant that the Archi-Box could be scaled, rotated and moved like one might do in a physical model, but have the Boolean collision shown real time (Figure 4).

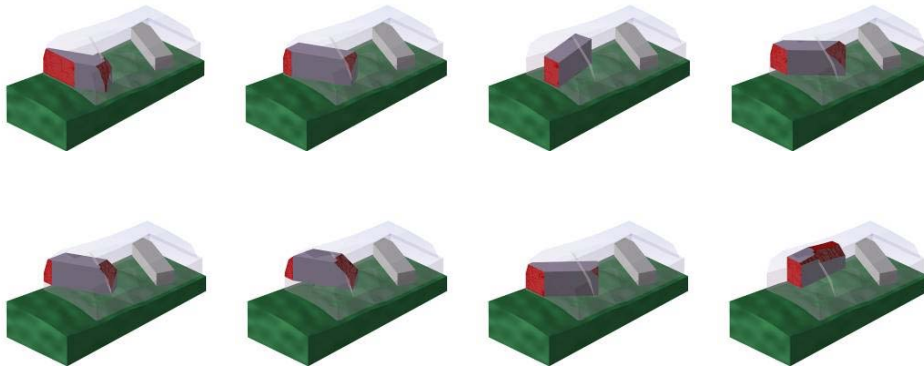


Figure 4
Adjustment of design parameters gives real time visual feedback for pragmatic design assessment.

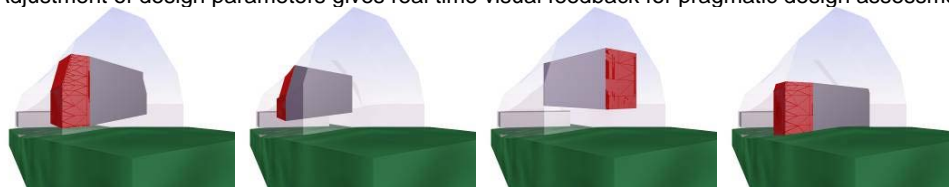


Figure 5
Instantaneous perspective feedback of live boolean for aesthetic design assessment.

The digital model allowed the parameters to be adjusted to achieve a balance of affordability, amenity, aesthetics and flexibility, finding a position of compromise when the variables had conflicting results. For example, orienting the house mass east-west is better for daylight access, but key views required a north-south orientation. The rotation variable was adjusted and resulting forms tested until a compromised orientation was found which achieved the maximum solar penetration whilst still retaining the key views. This could have been calculated using complex optimisation algorithms like the research being undertaken by Kristina Shea with Arups², but because architectural form was also being tested concurrently in perspective views (Figure 5 & Figure 6), the designer's judgment was required to make the final informed but ultimately subjective decision. This process enables the kind of rigorous testing and optimisation commonly associated with a digital model, but also a kind of tactile malleability as though modelling with clay.



Figure 6
"The money shot"³ - tested with digital model and photograph. (Photo S.Harrison)

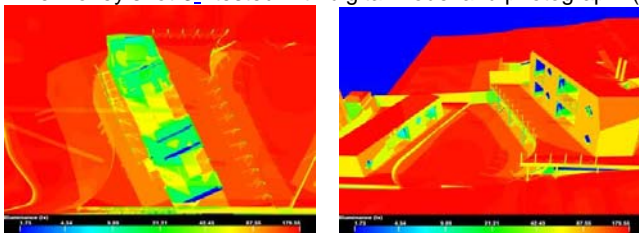


Figure 7
Daylight analysis of digital model.

The house's use over time.

Though the project is classified as a single dwelling, the client requested a long term (40+ years) Master plan. This was because the client did not want a large empty house, nor be forced to renovate and/or extend further down the track. Due to the unpredictable nature of contemporary living, it was uncertain exactly how the house would be used in the long term and by whom. Therefore the digital model also needed to be concurrently tested against the following potential living scenarios over the lifespan of the family:

- ✓ Young couple moving into the property market, affordability being the key issue.
- ✓ Renting out part of the house to help subsidise mortgage repayments.
- ✓ Young family: live / work scenario. Should function like a typical small suburban house, but with a separate office for at-home parent.
- ✓ Function with an extended family, with some relief from in-laws.
- ✓ Accommodate teenagers - Include the 'converted garage' to provide teenagers a level of independence and privacy.
- ✓ Accommodate for possible parental separation / divorce.
- ✓ Empty nest / retirement village. Units can be rented out for "Super Subsidy" or shares bought by other elderly friends for semi-independent 'mini retirement village'.

These different living arrangements do not suggest the amalgamation of many rooms into a single mass as is the current trend in housing. Rather, they suggest the separation or detachment of elements.



Figure 8
Plan showing 2 levels of units with large communal deck and detached studio.

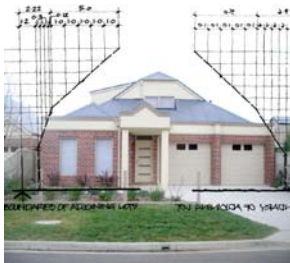


Figure 9
A typical house in Caroline Springs, illustrating the amalgamation of many rooms into a single mass within the ResCode setback..

Affordability

In line with the first programmatic consideration, “young couple moving into housing market”, a major emphasis on cost was inevitable. The design uses repetition of a ‘unit type’ though not separately titled with small floor areas (less than 50m²), with minimal spans and minimal circulation space. Though there was a desire for some ‘formal gymnastics’, the plan was kept as a simple rectangular shape (domestic builders seem to price off the plan only), with a small amount of complexity in section tested in the digital model for maximum visual effect.

Design aesthetics: experimentation and the 4th dimension

The client was very supportive design experimentation but was also aware of experimental architecture by the likes of Boyd, McIntyre etc in the 50s and 60s, where some of the experimentation with materials and construction techniques resulted in costly maintenance and eventual replacement of building elements. Therefore experimentation was restricted to that which would be easy to fix if the experiment was unsuccessful over time.



Figure 10

Windows: Burns Residence (1963)⁴, Melnikov House (photo C.White), Sandman panel van, combined for a Corrigan meets Burns meets Melnikov meets surfer's van aesthetic.

The experimentation, not limited by ‘good taste’, draws inspiration from the surrounding area's asbestos-clad boxes with clichéd porthole windows, and memories of sweaty encounters in the backs of sandman panel vans by using skylight bubbles in rotated awning windows. (Figure 10) If the inexpensive bubble fails over time, the glazing profile allows it to be snapped out, and replaced with regular glass. A reinterpretation of the foil sun protector commonly used for car windscreens is used for extremely cheap drapes using “Aero Foil – Retro Shield™”, an insulation material with a 1.5 R rating and the ability to be taken down quickly if the clients decide that over time they no longer love the Barbarella space aesthetic⁵.

Conclusion:

The current trend to produce large single dwellings is thought to be related to the ease of comparison for the real-estate purchaser (value = more area for each dollar), but it may also be because people feel a big house with more bedrooms give greater flexibility. In the past, houses were initially built relatively small, and added to over time with extensions and “granny flats” if family size changed, but increases in construction and planning costs means this no longer feasible.

This case study has shown that when a house is planned with many possible scenarios over time in mind, the emphasis shifts away from “area=value” to design quality and flexibility. The house was completed 14 months ago and has so far

been successful in the first stages of its 4D Masterplan. The Lovenasium has already proven to comfortably fit an extended family, with both young children and elderly in-laws with a desirable balance of connection and separation. By master planning in 4 dimensions, the project has produced a housing type that is affordable, addresses issues of amenity and aesthetics, can slot into a typical suburban lot, and caters for fluctuating family sizes over time.

References

- ¹ [Hugh Ferriss](#), [Metropolis of Tomorrow](#), Canada. Princeton Architectural Press, 1986, Pg 73-79.
- ² **Dr. Kristina Shea**, Structural Systems Optimization for the Building Industry <http://www-edc.eng.cam.ac.uk/research/computationaldesign/cd3/buildingindustry/buildingindustry.pdf> , 2005.
- ³ **Marcus White**, The Money Shot, Issue (Mongrel & Subaud), 2004
- ⁴ **Doug Evans** – Modern in Melbourne, Melbourne, RMIT, <http://users.tce.rmit.edu.au/doug.evans/ModMelb/mm2/modmelbprac2/pb/html/kanga/kanga.html> 2006.
- ⁵ **Jean Forest and Roger Vadim**, Barbarella Queen of the Galaxy, Paramount Pictures, 1968.