

HOUSING THE FUTURE POPULATION.

Article for the Griffith Review.

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An Australian population of 36 million people by 2050 is increasingly being touted as a figure of fear. Pressure on food supply, lifestyle, natural resources, transport, housing and urbanisation will mean “we’ll all be rooned”ⁱ. But is it such a problem for the supply of housing and the quality of our cities?

The raw numbers suggest not. 36 million is a 65% increase on our current population in 40 years. If we travel back 40 years we find our population was 12.7 million, so in that time we have grown by 75% to our current 22.2M. Back in 1970 some of the housing numbers were quite different, in what we might call the 2x2x2x2x2 phenomenon: the blocks of land in the major capitals were twice the size, but the houses were only half as big, and single storey, in comparison to today’s two storey McMansions, which have twice the area of glass; there were half the number of cars and appliances, but the real figure that interests us in a population debate is the average number of occupants in each dwelling: in 1970 it was almost twice what it is now. Even allowing for changes in demographics, with a greater diversity of household makeup, and an increase in unoccupied holiday homes (which skews the figures), this is a dramatic difference.

Following this line of numbers, there is an easy solution to housing an ever increasing population, at least to a statistician: go back to 1970’s home occupancy rates: by adding one or two people to every household we could accommodate two thirds more residents. Problem solved. And lest this seems too preposterous, remember that we’ve been there, indeed some boomers think it was the ‘good old days’, and many immigrants coming to Australia would regard those occupancy rates as lower than the norm. But there are two lines of resistance to this simplistic solution: lifestyle and diversity.

What typifies the Australian domestic lifestyle? For many it is the ability to live outdoors, in private: think backyard BBQⁱⁱ. There is a symbiotic relationship between freestanding houses with front and back gardens (75% of the housing stock) and the very low dwelling density in the sprawling areas of Australian cities (10 dwellings/Ha or less). Unlike the denser cities of Europe, Scandinavia and the northeast of the USA where the occupants of apartments use public gardens for recreation, in Australia, as in the other countries

that heeded Ebenezer Howard's call for 'Garden Cities of Tomorrow'ⁱⁱⁱ, recreation was increasingly privatised to the 'backyard'^{iv}.

The interiors of contemporary Australian homes are the same as in many western countries - ever-larger open plan spaces, multiple bathrooms, bling kitchens and lightless media rooms - but the big difference is outside, where a transitional space, the outdoor room, is common. From the early 1800's this was something grafted on to the imported English and Irish plans which were strictly about the interior. For reasons of sun and rain protection, or for external circulation, a veranda was added; and the house and outbuildings were often linked and stretched to create an internal courtyard for added security. The word veranda comes from the Spanish 'baranda', meaning railing or handrail, and was corrupted by the English troops as they invaded the 'new world'.

One idiosyncratic way of seeing the difference between the houses of the 'old' and 'new worlds' is in the Irish writer Flan O'Brien's book The Third Policeman. The nameless hero is an expert on the writings of a fictitious scholar called De Selby. Amongst his many hilarious theories is the tale of a builder who made houses as 'wall-less roofs' and 'roofless walls' and he cautions against their use as "many a fool has died in attempting to live in one of the fantastic structures". But to Australian eyes we see these as perfectly reasonable, indeed they are our verandas and courtyards, and far from dieing in them, they are vital in keeping the occupants alive (well, at least comfortable).

By the early 1980's house designs were blurring the lines between inside and outside, and outdoor lifestyles became a defining mark of yuppies, or as Australian Crawl sang about them in the song Beautiful People, "the garden's full of furniture the house is full of plants"^v.

Recent home designs have gone further and now morph the veranda and courtyard into a one space called the 'sala' or 'al fresco'; and at display villages, such as Homeworld in western Sydney, every one is fitted out with a BBQ. These are the 'ne plus ultra' of Australian living, giving us the largest houses in the world^{vi}, but also creating a dire problem for sustainability, that will only be exacerbated by the vision of extending these houses over 'the sunlit plains extended'^{vii} as the population balloons.

The other trend that works against the simplistic arithmetic approach of adding more people to every dwelling is the increasing diversity in both the population and dwelling types. For a long time suburbia appeared to be a monoculture, not least because of its sheer size when seen on any plane flight into the big 5 cities. But there have always been some alternatives, particularly walk up flats built before and after the Second World War(WWII?). But they were small in number (less than 20% of all dwellings) and their compact size made them less visible, at least to politicians and planners if not the neighbours. In the last ten years however the growth in apartments has greatly increased (recently in Sydney more apartments than houses were being approved) becoming more noticeable and controversial. We are now building a far greater range of housing including duplexes, townhouses, low, medium and high-rise.

This variety is also a response to the changes in demographics. The early 20thC ideal of a monoculture Australia living in uniform suburbia, has long gone, if indeed it ever existed. The early flats, small in number and largely unnoticed, are testament to a desired variety even within a relatively singular racial population. Add the post WWII immigration from southern Europe and more recently Asia and we have one of the most diverse populations in the world. So it is surprising that the culture of the freestanding single family home, on an eighth to a quarter acre, persists as 75% of the housing stock.

There is an increasingly rapid change in housing choice, mostly driven by consumer demand rather than planning policies, which are struggling to catch up. There is a recognition of the diversity, epitomised by changes in household make up: the traditional family of 2 adults and 2+ children is now less than 50% of all households, extended at one end by multigenerational families of 6 or more, share households of 4 to 5 (students and gen X) to an increasing number of couples (gays, couples sharing for financial rather than romantic reasons), and singles (OS students and gen Y).

In response, an array of different housing types is being designed and built to challenge the current "duoculture" of either single-family house or medium rise apartment. The need to have the largest homes in the world (ref: ABS data) is under challenge, and a survey of emerging typologies shows how the future population could easily be housed within the existing cities, with greater, rather than diminished, amenity.

The first type where change is afoot is in suburbia: the fringes of the cities continue to be developed, but the factors are changing: in response to smaller lot sizes demanded by costs and efficiency of services, if not sustainability, house designs on offer are changing. Many more smaller sized homes are in display villages (partly to meet the first home buyer price point); the problems over overshadowing of living areas by adjacent 2 storey houses is addressed by moving the living areas from the front (where they have been from 1900 to the Jennings houses of the 70's), to the rear, facing the rear garden (not yard), with the outdoor room on the corner so the plan can be oriented to north on a variety of sites; and some designs (though sadly not many) address the idea of a multi-generational home, with a separate 'flat' built within the house, often downstairs in a 2 storey house so the aged grandparents can have easy access, and stay home to mind the children whilst both parents are out to earn the mortgage.

Actually the idea of 2 houses in 1 has a long tradition in the form of the 'granny flat', which was often built illegally, but provided additional accommodation for the granny (who tipped her savings into the home) or to provide a supplementary income from a lodger, in both cases to offset the rising costs or to enable the changing family structure to remain in a desirable area. This form of single owner 'dual occupancy' is being increasingly codified in most cities; in Sydney a recent code brings back the dual occupancy that had been needlessly withdrawn by premier Carr in the mid nineties to curry favour with the upper middle class who feared their suburbs would be overdeveloped by stealth. Banning it doesn't stop the second dwellings being added, or built internally, it just drives the process underground (or under stumps in Brisbane) where it is unregulated and consequently often poorly built.

As well as new designs, recent subdivisions are also fostering different house types such courtyard houses on 'zero lot lines' (houses built to one boundary to reduced the waste space of the 'demilitarized zone' created by the 1 metre setbacks by traditional houses), or townhouses (having 2 two side zero lot lines). These can have lot sizes at 200-250 square metres, a quarter of the quarter acre (which is about 1000 sqm), with the consequent increase in density.

Is this potential doubling of the suburban density sustainable? Not really, as most current fringe suburbs are poorly served by public transport and the services are too scattered to be efficient. The problem is epitomized by the recently opened Zero Energy house in outer Melbourne, built by Henley homes and designed in conjunction with the CSIRO,

who are monitoring it's performance. Fairly conventional in its planning (with an added airlock for thermal comfort), but contemporary in its façade and internal finishes it can operate with zero demand on the local water or electricity supply, although it has to be connected to both (so you can have fluoridate drinking water and feed the solar PV panel electricity back into the grid). Key to overall sustainability is that it is almost 10 km from the nearest railway station at Epping, and it lacks the services of shops, schools and health clinics that are missing in all fringe developments.

Planners argue that these services will come, but there are often time lags, so some cities are demanding that the 'village centre' be built at the same time, although public transport inevitably arrives much later (or seemingly never in Sydney's case). Moreover planners also point out that those high cost services are often underutilized in existing suburbs that have undergone generational change, and that it would be more sensible, and sustainable, to increase the usefulness of existing services by increasing the local population, with added benefits if the new buildings are so well designed in electricity and water demand that they make little to no demand on the existing infrastructure.

These infill developments are sometimes named 'six-packs' as they seek to replace a single house on a 1000 sqm plus site with 3, 4 or, optimally from a developer's point of view, 6 townhouses or apartments. But this compactness cannot be achieved by simply squashing existing houses closer together. They would overshadow each other, the cars will dominate the streetscape, the houses won't be able to breathe and cross-ventilate and the private garden will be lost. Is there a way to combine the more efficient higher density housing with best aspects of the freestanding home (individuality, privacy, variety and, most critically, access to a private garden)? This is the Holy Grail for sustainable housing, and the solution may well be a scheme that is upside-down, inside-out and back-to-front (UD-IO-BF).

To counter the effects of overshadowing in medium density it can be beneficial to turn the house upside-down. As densities increase, the blocks of land get smaller, the houses get closer, become 2 or 3 storeys and are so tight that the sun doesn't reach the lower floor. With the house turned upside-down, bedrooms and home offices are on the lower floors and the living areas are on the upper levels and roof. It sounds Mediterranean and therein lies a salient lesson: the Greek or Arabic home, with a flat habitable roof, may be a better climatic paradigm to draw from for Australian cities.

This begs the question of the latest ESD trend: the “green roof”. Not to be confused with a common or garden roof, these are designed to have both green planting and green technology. Being accessible, they can be used as living areas, to grow food, sequester carbon, as well as for solar thermal and electricity generation. But the idea of BBQs on the roof, outdoor plasmas and sleep-outs looking at the stars (through clearer air) is a challenging concept for many councils, who see only the downsides – loss of privacy, overlooking and neighbour amenity problems – rather than the environmental benefits that a better performing house might offer.

Regardless, this approach may well stumble for more practical reasons: access from a basement car park to a kitchen and living areas several floors above may demand a dumb waiter or lift (undoing the energy gains) and perhaps we are not yet ready to think of turning our living patterns upside down.

The second challenge is to turn the house inside out: recent research suggests that thermal mass has been underplayed in the design of houses for temperate Australia. Our predilection for brick as a veneer over a timber frame is the exact opposite of what is needed: the internal house is lightweight and has no storage of coolth or warmth, while the mass of external brickwork adds only a little by way of insulation. We should have put the mass (concrete blocks, precast, bricks etc) on the inside, with a layer of more effective insulation around it, and then a more weatherproof veneer on the outside.

Often in higher density town housing this increased mass happens by default, with solid party walls and concrete upper level floors offering better mass and acoustic isolation. By contrast the boundary walls of freestanding homes, facing across a two metre “demilitarised zone” of water heaters and fences, offers little by way of acoustic privacy or good land use, but it is cheap. To build a single party wall, which takes up less space, costs more as it has to reach a higher standard of fire safety and acoustics, and so, curiously, a smaller townhouse, on less land, becomes less affordable.

The thermal comfort of apartments is actually improved with the necessity of building concrete. With the need for apartment floors to be insulated against noise transfer, the exposed mass is often found in the walls and ceilings, and this has the great benefit of promoting coolth. We are well used to the notion of passive warmth being facilitated

by sun shining on the floor. The converse is true in summer: thermal mass in walls and particularly ceilings absorbs the day's heat, which can then be "night purged" using colder night-time air, rendering the house cool for the next day. Given that electric-powered cooling produces more greenhouse gas than gas heating, a more general uptake of this kind of passive cooling approach would have a substantial impact on emissions.

A symbiotic relationship between the first two ideas now emerges – the upside-down house needs concrete for the upper living floors, and to support the green roof, and so this immediately offers the potential to build it inside-out, with mass to support these weightier upper floors.

Finally, why turn it back to front? Well, it's the effect of the car, that's influence over house design has grown disproportionately in the last 50 years, to the point where the garage is now the largest and most prominent room in most project homes. So much so, many councils have legislated a set back from the house alignment for the garage and limited its dimensions to no more than, say, 50% of the frontage. As the garages get ever bigger to accommodate SUVs, wagons and 4WDs, and the houses get closer on smaller sites, the large steel door, occupying more and more of the streetscape, is a last gasp image of the 20th century's love affair with cars.

So for the 21st century the car is best banished to the rear, to a service lane that is a "back to the future" return to the 19th century. This will certainly be aided by the imminent demise of the big car; soon we will see the uptake of a whole host of smaller personal mobility options: smart cars, mini electric cars, electric bikes, cycles and so on. The traditional garage will be overkill. The rear service street will be narrow, but will accommodate smaller cars, mini recycling trucks (because there is less garbage, with less packaging and consumption, and more composting on site for the green roof) and a safer area for children's play. And over the top of the garage could be a 'Fonzi' flat, a second residence for the 3rd generation, a nanny, a guest, student or bon vivant to bring you 'happy days'.

Townhouses and apartments will face a public street, possibly lined with small businesses in the ground floor home offices, or new "shop-houses", the greater density enabling the revival of the pedestrian and cycle friendly street. Smaller vehicles mean

more and better car parking between the trees that form a shade canopy for the entire street.

The battle to design a freestanding sustainable or zero energy home has been won, but it is a pyrrhic victory: they are now seen as worthy objects, whose dependence on a massive infrastructure and hidden transport costs hinders rather than aids the development of a sustainable city. The push is on to increase residential density, but we are in danger of throwing out the baby with the grey water in a rush to medium and high-rise apartments. A century of freestanding homes has bred a love affair with the possibilities of an indoor and outdoor private life, a lifestyle that will not be easily shoehorned into towers.

Three typologies from the past may indicate a way forward. Terrace houses, with their party walls and rear lanes, could be updated with green roofs. Courtyard homes offer privacy with compactness. But the reviled three storey walk up may be the best surprise package – it comes with high thermal mass, which can be wrapped in cladding and insulation to reduce the red brick overkill, balconies can be extended and fitted with planting for privacy, and a new green roof can be built over the brick walls.

Unless the site is relatively large the desired 6-fold increase may not be possible in the UD-IO-BF townhouse form, and a small apartment block may be appropriate. We have many existing examples: 3 storey, red or orange brick, walk up flats, surely the most reviled hose form in Australia, but what if it was capable of being the most sustainable? They have all the ready ingredients: small footprint, modest sized apartments, high thermal mass being full brick often with concrete floors, minimum carparking under or adjacent. With a bit of tweaking they could be better than zero! Adding external rigid insulation that is then rendered in more muted colours, adding shade devices and increasing the balconies with more private balustrades and screening, will increase both the amenity and the thermal efficiency, and importantly repairing and rebuilding the garden will offer the potential for productive food gardens as well as better landscape screening. We could go further and remove the tiled roof and replace it with a flat 'green roof' similar to the UD-IO-BF townhouses.

The economic imperative for the market to make these changes are not with us just yet, but the qualities of the design described are incorporated into hundreds of infill projects

being built throughout many existing suburbs, particularly in Sydney, Melbourne and Brisbane. There is a common perception, particularly fostered by groups such as 'Save Our Suburbs', that these have been foisted onto an unwilling, and resistant, public. SOS, drawn from the wealthier suburbs, views these apartments as some sort of socialist conspiracy, but they are a perfect example of the capitalist market economy. With the exception of some recent government sponsored affordable housing, apartments are built by developers, who are notoriously driven by profit. The traditional formula for success is to split the sale price into thirds: the land/the construction/the profit. On that basis the project won't 'stack up' unless there is demand, and at a relatively high increase in value.

Sadly for SOS the key to their success, and the continued demand for their construction, lies with 'the enemy within': it is local residents, downsizing from their large houses once the children have left home that are buying into a different way of living, within the suburb they have grown so attached to over 20 or 30 years.

Many of these low rise apartments are based on 'passive thermal design', utilising solar gain to provide warmth in the internal thermal mass in winter and cross ventilation and night purging (high rate exhaust fans late at night in summer) to provide 'coolth' in the same mass, reducing the need for both artificial heating and cooling. It has been a feature of well-designed freestanding houses in temperate Australia since the publication of 'Homes in the Sun' by Walter Bunning in 1945. What is more unique in Australia is the attempt to transfer these ideas into medium, and even high-rise buildings.

Given our relatively benign climate and a relatively relaxed view about thermal comfort, even where passive design is not rigorously pursued, demand for artificial heating and cooling is relatively low. By contrast, dwellings in Europe and the USA have larger heating, ventilation and air conditioning (HVAC) systems, in buildings that are far more tightly sealed, with less interaction with the surrounding climate. There are several reasons for this, some obvious such as the harsher, colder climates, and some less so such as the higher levels of comfort expectation and particularly the higher densities of dwellings that demand greater privacy and hence less windows, openings and external spaces. A by-product of these sealed, low air change interiors is the second difference to Australia: air quality has prompted far greater emphasis on low VOC/off-gassing materials. The

expo that accompanied Greenbuild was vast in size and remarkable for the breadth of invention and diversity of materials touted as green.

Both these issues are now affecting Australia: greater densities in urban consolidation and the higher levels of thermal comfort being demanded are leading to more sealed HVAC schemes and less passive design. Do we go down the road of buildings such as Solaire in New York, a LEED certified housing tower by César Pelli, that is sealed with PV's embedded in the façade to offset the energy demand, or do we press on with naturally ventilated apartments, with single depth plans and deep blade walls for privacy, such as those by Frank Stanisic and Ian Moore. The latter's Altair was highly awarded internationally and suggests that, while there is local pressure to follow the European/US example, many temperate areas in South America and Africa want to follow Australia's lead.

With all these different typologies finding out which residential density is most sustainable occupies the minds of many architects at present. At one end is suburbia, at the other are high-rise towers, dense certainly, but often poorly performed in energy and water as they require foyers lights to be on 24/7, mechanical carpark ventilation and are usually fully air-conditioned to avoid wind and acoustic issues with passive design. And there is little roof for water collection and use. Where on the bell curve is the best mix of housing density, transport distance and urban form? It may well be that about 40 to 50 dwellings/Hectare is the answer, about 5 times suburbia but 5 times less than high-rise.

With the change in form comes a change in the design of streets. Ideas of a more cosmopolitan city that were championed in the 1960's come back into focus, such as Edward Cullen's Townscape and Bernard Rudofsky's Streets for People (the latter most tellingly subtitled "A Primer for Americans"). Often the new housing forms go hand in hand with public transport systems: the so-called TOD, or transport oriented design.

In Sydney this is linked to the evolution of the "cities within cities" approach championed by Sue Holliday, and developed by Chris Johnson in the regional plan to strengthen Parramatta, Penrith, Chatswood, Liverpool et al as urban growth centres, cites in their own right with medium and high rise apartments within walking/cycling distance of the centre.

A different form is proposed in Melbourne where Rob Adams has suggested that far greater density can be achieved along the high streets of that radially formed city. He mounts a persuasive argument that streets, as well as the buildings, are the key to future urban design and suggests that only 6% of the city fabric will need to be changed to 3 - 5 storey townhouses and apartments over shops and offices along tram and train lines, leaving the vast array of suburbs untouched. Density can be increased to maximise the efficient use of services, without the need for wholesale changes to the house form that Australians are so fond of.

In Perth Peter Newman has developed the radial TOD even further with a freeway and integrated train line from the city centre to Mandurah offering the chance for hubs at every train station, although only the commuter carparks are there at present. This greenfield-planned approach is far easier to implement than a reworking of the existing fabric such as Adams proposes. An example of this resistance to the imposition of linear TOD can be seen on the north shore of Sydney where Ku-Ring-Gai council is at odds with the state government's mandating urban consolidation along the existing highway and railway line (that already has several major centres at Hornsby, Gordon and Chatswood).

[Brisbane SEQ linear development Peter Skinner – need to add here.](#)

Looking into the future the question we might ask is what happens when we reach 2050 when many demographers think the population will plateau at about 9 to 9.5 billion. What happens if we have built sufficient diversity of housing for that population. A key issue will be what happens to the vast homebuilding industry when it has no more work to do, other than renovation and maintenance. For the building industry, which is currently Australia's the largest single industry employer, that is a future more scary than housing 65% more people in 40 years.

References:

ⁱ Said Hanrahan, John O'Brien, 1921

ⁱⁱ The suburban BBQ is not uniquely Australian but its domestication is a very southern hemisphere idea: the 'braai' in southern Africa, the 'churrasco' in Brazil and the 'asado' in Argentina, Chile and Uruguay. However, unlike these countries, and the US southwest, where they are conducted in an open 'back yard', increasingly in Australia they are in a dedicated 'outdoor room'.

ⁱⁱⁱ E. Howard, *Garden Cities of Tomorrow*, 1902, reissued MIT Press 1967.

^{iv} 'backyard' is an ugly, but quintessentially Australian, term. Given the rural beginnings of sheep and cattle, 'yards' are common, but in the rest of the world they are gardens. Perhaps Burke's *Back Garden* didn't have the same ring to it.

^v Australian Crawl, *Beautiful People*, written by James Reyne and Mark Hudson, released on the album *Boys Light Up*, 1980.

^{vi} ABS figures, Nov 2009. Average Australian houses size 215 square metres. By comparison, the US is 202 (shrunk from 212), Denmark 137 (largest in Europe), Britain 76 (smallest).

^{vii} Banjo Patterson, *Clancy of the Overflow*, *The Bulletin*, 1889.

Other ideas not used:

Co-ops: artists (Alpha), students (Stucco)

maisonettes, shop top housing and low-rise apartments.