Nothing Gained by only Counting Dwellings per Hectare:
A hundred years of confusing urban densities

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Abstract:
Urban density measures are broadly used in urban planning as tools for calculating development yields, defining indicative targets, or development controls. A century ago Raymond Unwin argued in the influential pamphlet "Nothing Gained by Overcrowding" that limiting the number of dwellings per land area would be the simplest and best way to avoid overcrowding of both buildings and people, a measure which became widespread. The same measure was used by Jane Jacobs when describing the minimum density required for a vital neighbourhood. This density measure is however highly problematic as it does not account for the size of dwellings, mix of uses or size of households, factors that vary significantly in time and space. This implies that the number of dwellings per hectare alone is not useful for historic comparisons, urban versus suburban comparisons, or comparisons between different social contexts. Likewise, pedestrian flow surveys conducted in three urban areas from Melbourne show that dwelling density is not a reliable indicator of streetlife intensity. Furthermore, it is shown that its vagueness makes it particularly vulnerable to be linked to any type of qualitative conception of density, thus contributing to the ongoing confusion and misuse in the density debate. It is concluded that dwelling density on its own is not an adequate measure to describe urban environments, and instead multi-variable density models need to be used in both research and urban planning. Such a model is illustrated for a range of urban morphologies.

Introduction

Urban density is a key concept in urban theory and planning practice, at the core of often conflicting theories concerning the relationship between urban form, human wellbeing and environmental sustainability. Measures of density relate the number of certain entities such as people, ground floor area, gross floor area, built volume or dwellings, to a reference area, which can be a lot, neighbourhood, city, region or else. The combination of these results in a large number of possible measures, which without detailed specification can and do lead to confusion and misunderstandings. Further confusion is caused by the multitude of terminologies in use for the same measure or the same term used for different measures. For instance Floor Area Ratio (FAR) can be referred to as plot ratio in the UK, Floor Space Index (FSI) in India, Gross Plot Ratio (GPR) in Singapore and Floor Space Ratio (FSR) in New South Wales. On the other hand Residential Density may refer to the number of dwellings per hectare but also to the number of residents relative to the area of residential land. Gross Density can refer to the reference area being a lot together with half the width of adjacent streets, or it can encompass a neighbourhood, city or metropolitan region. While it has been recognised long ago that urban density is "plagued by numerous myths" (Lynch 1981) and there have been numerous attempts to disentangle density measures (Churchman 1999; Cheng 2010; Boyko and Cooper 2011), much confusion remains.

Probably the most common measure in the Anglosphere is the number of dwellings per hectare, while other measures such as people density, site coverage and floor area ratio are also in use. These measures are used in planning as tools for calculating development yields, defining indicative targets, or development controls. In Australia the measure of dwellings per hectare was notably used by the Commonwealth Housing Commission in 1944 to recommend desirable net densities of 20dw/ha for single dwelling neighbourhoods, 27 dw/ha for attached dwellings and 100 dw/ha for multi-storey units (Dodson and Gleeson 2007). Currently dwellings density is the most widely used urban density measure in Australia (Griffiths 2009). It is the key density zoning parameter in Western Australia and is widely used in regional and metropolitan strategies such as the South Australia Planning Strategy 2010 (Government of South Australia 2011), the Sydney Metropolitan Plan 2036 (Government of New South Wales 2010), Melbourne 2030 and its successor the Draft Plan Melbourne (State of Victoria 2002; 2013). In these documents typically minimum density targets aim to improve access to public transport and community services, while maximum density controls aim to protect private space amenity.

This paper examines the problems associated with using dwellings per hectare as a single density measure and proposes an alternative multivariate approach.

A weak planning tool

In the book *Town Planning in Practice* (1909) and the influential pamphlet "Nothing Gained by Overcrowding!" (1912) the English town planner Raymond Unwin argued that limiting the number of dwellings per acre would be the simplest and best way to avoid overcrowding of both buildings and people. He contended that this would be a better measure than limiting the ratio of cubic metres of building to land area, as it would have the additional advantage of limiting the density of people as well. The proposed target of a maximum gross density of 17 dw/ha (7 dw/acre) was to be achieved by imposing a maximum net density ranging between 20-35 dw/ha, depending on the cost and size of the dwelling. With the average household at the time of 5 persons, his target implied a gross population density of around 90 people per hectare. Similar density controls are in place today, for instance in parts of Perth net dwelling density is limited to 20 per hectare. However, with the considerably diminished average household size the resulting gross population density is below 35 p/ha. Concomitantly, with the increasing size of dwellings, internal density has been continually diminishing as well (Figure 1). This highlights the problem that urban densities measured as dw/ha do not reliably reflect population numbers, and that comparisons in time loose validity as houses get larger and families smaller.
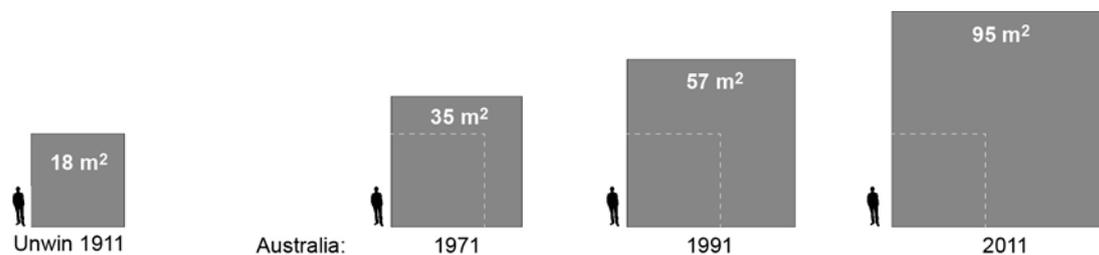

Figure 1. Unwin's 1911 vision addressing "overcrowding" assumed a dwelling area per person of ca.18m^2. In Australia dwelling area per person increased rapidly as result of diminishing household size and concomitantly growing dwelling size (Source: author, based on ABS figures).

But it is not just time comparisons of dwelling density which are misleading. Comparing suburban densities with urban densities can be equally misleading given the large differences between dwelling size and household size between inner city and suburban fringe. In Melbourne's CBD the average dwelling size is around 60m^2 (City of Melbourne 2010) while on the fringe new single dwellings are 250m^2 (James 2009). In the same time average household size is 1.8 in the CBD and 3.5 in suburbs on the fringe (Australian Bureau of Statistics 2011). Thus while 200dw/ha in the CBD is a tenfold dwelling density compared to 20dw/ha at the fringe, building density is only threefold, while residential density is fivefold.

Comparisons of dwellings per hectare get even more confusing however when it involves different social contexts. Comparing parts of an informal settlement in India with "high-density" residential areas such as parts of Manhattan in terms of dwellings per hectare can indicate a similar density of ca.600 dw/ha (gross at neighbourhood level), but while actual built density is three times higher in Manhattan, population density is three times higher in the informal settlement, as a result of the vastly different dwelling and household sizes (Dovey and Pafka 2013). A good illustration of the problems related to international comparisons of dw/ha measures is provided by the examples presented in the *DBook* catalogue of densities (Fernández Per et al. 2007).
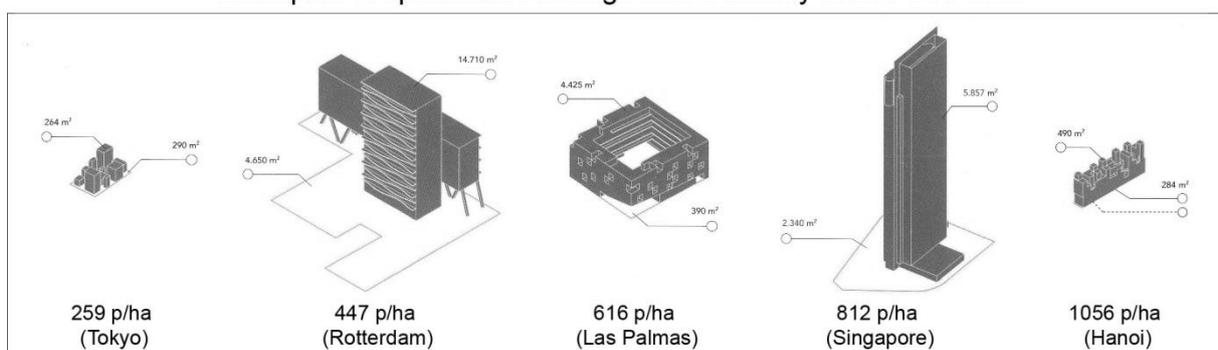
Figure 2. Range of building types at 210-230 dw/ha, illustrating vast population and building density variations depending on dwelling and household size. Source: Fernández Per et al. (2007).

For the examples in the same range of 210-230 dw/ha net, the population density is 259 people/ha in a Tokyo example, 447 p/ha in a Rotterdam case, 616 p/ha in Las Palmas, 812 p/ha in Singapore, and 1056 p/ha in Hanoi. Remarkably the Hanoi example with the highest people density has the second lowest building density when measured as FAR (Figure 2).

Considering the above, it is not surprising that attempts to correlate net dwelling densities and built form lead to incoherent results. For instance row houses have been considered to be 40-60 dw/ha (Lynch 1984), 32-142 dw/ha (Alexander 1993) or 50-100 dw/ha (Cheng 2010), and was recognised that other housing typologies are not less likely to occur within the same ranges.

Thus while for abstract homogenous urban environments with similar and stable family sizes and similar dwelling sizes the measure of dwelling per hectare could have been a useful simplification, in a heterogeneous and changing world it is generally inadequate.

A history of confusion

Confusion related to the number of dwellings per hectare is persistent throughout history, and not only limited to dwelling size, household size, mix of uses and built form, but is often further combined with common misunderstandings about net and gross densities. The scale at which density is measured greatly influences the numeric outcome, as with increasing area more non-residential land is included. Centred on the same suburban location, the site density of 25dw/ha might become 12dw/ha at neighbourhood level and 7dw/ha at metropolitan level (Forsyth 2003).

Examples of such confusion are abundant and include some of the most noted urban writers. An outstanding case is Lewis Mumford's attempt to promote Ebenezer Howard's Garden City model in the foreword to *Garden Cities of To-Morrow* (1946 pp.31-32). Here he repudiates the idea that Howard was advocating low densities, estimating that the indicated minimum lot size would result in a gross residential density of 225-240 people per hectare, much higher than Unwin's 90-120 people per hectare.
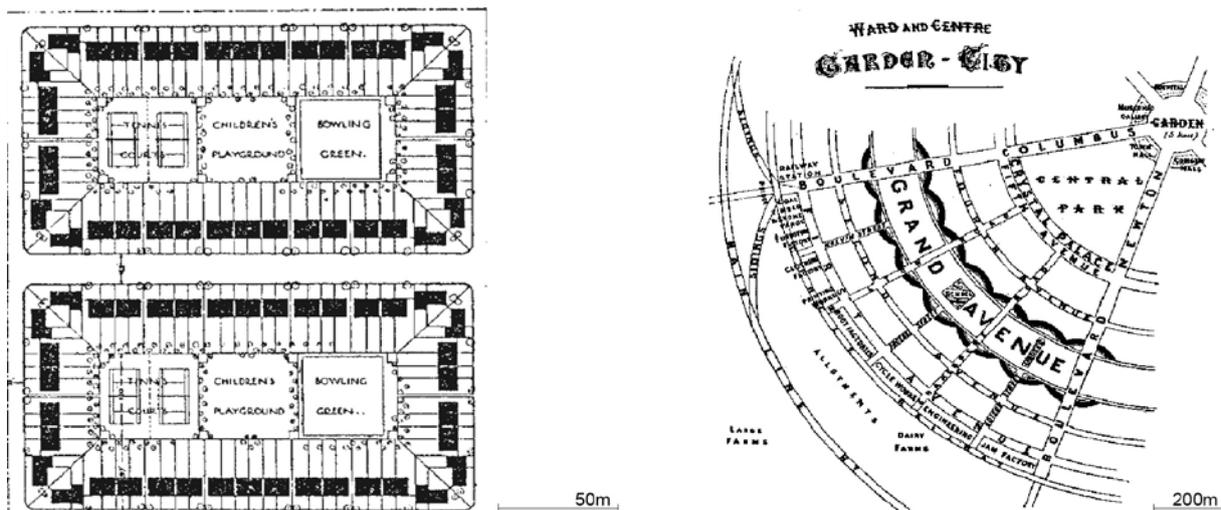

Figure 3. Unwin's Scheme II and Howard's Garden City.

However, Mumford's figures are incorrect, because the inconsistent assumptions made regarding household size and the ratio between net and gross densities. Unwin explicitly referred to households of 5, not 3-4 people, while Howard's earlier work assumed households of 5.5, not 5 people. Furthermore, Unwin's 30 dw/ha was a net measure and in fact he advocated a gross density of 17 dw/ha (Unwin 1912), implying a gross population density of 90 people/ha. In Howard's scheme, the minimum lot size is equivalent of a net 55 dw/hectare, but when calculating the gross density, Mumford used an implausible net to gross ratio of 84%. This figure may have come from Unwin's proposal to reduce road surfaces to only 16% of the total development area, by creating very large blocks of ca.200x100 metres and narrow streets of 13 metres. But he also provided communal gardens and recreation spaces in the interior of the block, hence used a net to gross ratio of 58% in his calculations. On the other hand Howard's Garden City plan is entirely different, providing wide streets, 36m wide boulevards, a 128m wide circular avenue and a 60ha large central park, while the total number of streets was also much higher due to blocks about half the size of those in Unwin's scheme (Figure 3). While Howard's conceptual diagram and description don't correlate perfectly, it is

clear that the net to gross ratio of his scheme couldn't be 86% but close to 40%. Thus the implied gross population density within residential areas in Howard's scheme was 110 p/ha, close to Unwin's 90p/ha. When including the industrial areas at the fringe and public buildings in the centre, the Garden City had only 30,000 people per 1,000 acres or 75 p/ha (Howard 1965). In the end in practice neither Howard's ideal nor Unwin's targets were achieved, as when the Garden City of Letchworth eventually reached a population of 33,000 inhabitants, it extended over three times the envisioned area, at a density of less than 30 p/ha overall and even its densest district only reaching 52p/ha (UK Office for National Statistics 2011), way below Mumford's presumptions of 225-240 p/ha.
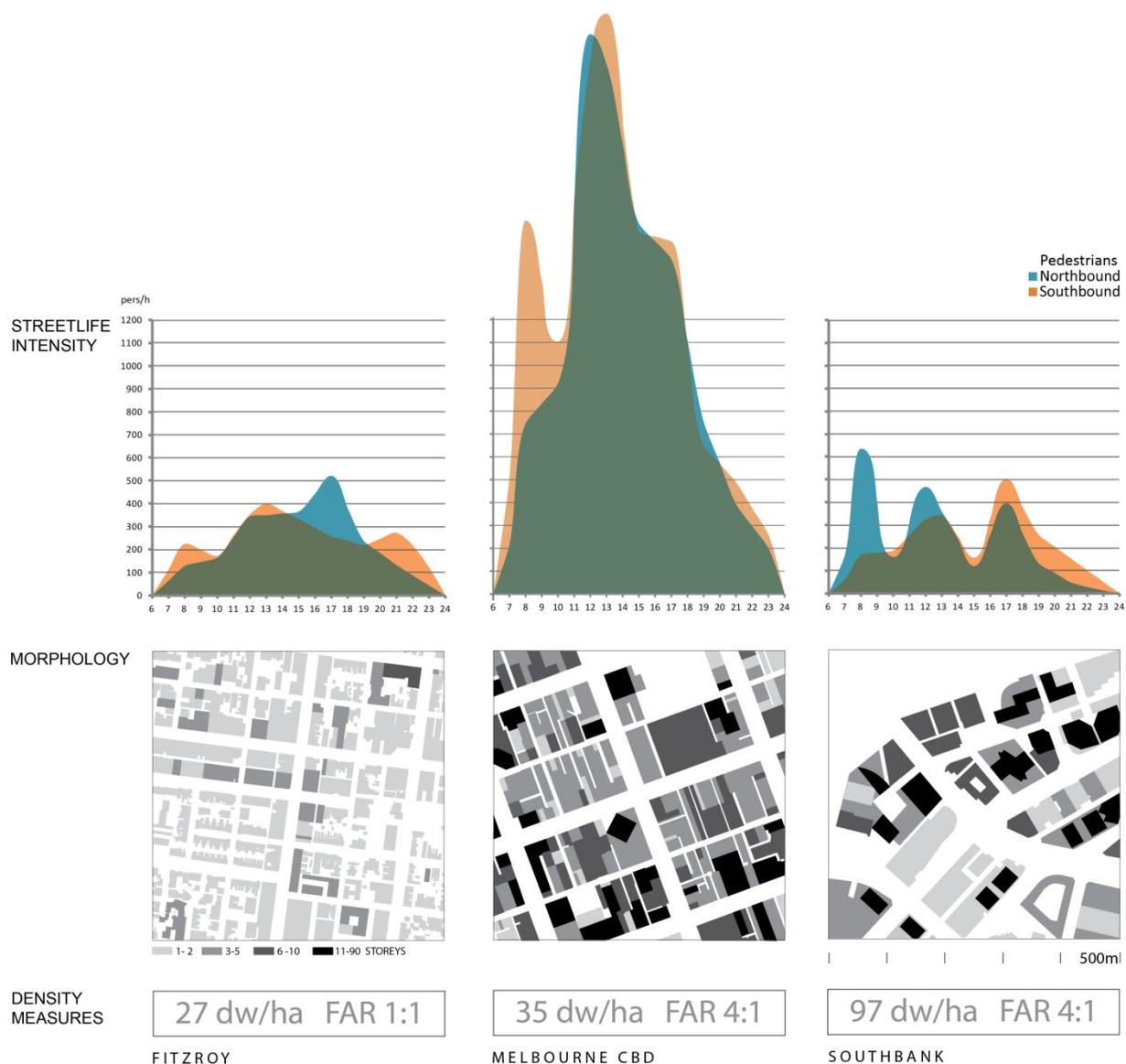
Density and intensity

The measure of dwelling density was also used by Jane Jacobs, who saw the concentration of people as one of four preconditions of urban vitality, and used the hybrid-measure of dwellings per hectare to link measured density to streetlife intensity (Jacobs 1961). However, when writing about density, her concern was the number of people walking and residents with eyes on the street. Thus the minimum net 250 dw/hectare (100 dw/acre) suggested as a condition for vitality, is a poor descriptor of what she was aiming for: a minimum density of residents, workers and attractions for visitors, per gross land area. While the use of this measure stemmed from a lack of choice, as it was the only available data provided by planning departments at the time, it represents a rare lapse in Jacobs' otherwise critical questioning of planning practices.

This distinction between density and streetlife intensity central in Jacobs' writing is similar to the distinction between extensive and intensive properties that is fundamental to Deleuzian ontology. Unlike extensive quantities (ex. area) that are additive, intensive quantities (ex. temperature, speed) are indivisible and produce change only when there is a difference in their degree of intensity. The equivalent distinction in mathematics is between metric and non-metric spaces (DeLanda 2005). In the urban realm, intensity can be seen as emerging from the interactions and differences between people, as mediated by built form (Dovey and Symons 2013). Thus static measures of density such as dwelling density, floor area ratio, or the number of people per hectare counted on census night, are extensive attributes of space relatively easy to measure, whereas streetlife vitality is an intensive attribute defined by the multiplicity of encounters between people, which so far eluded methods of measurement and representation.

To investigate the relationship between density and intensity, three case study sites have been selected in Melbourne. The density measures are based on surveys of 25ha (500x500m) reference areas, which correspond to an average walking distance. The daily rhythms of pedestrian flows at the centre of each area have been recorded between 6am to 12am. The time sample was 15 minutes per hour for each flow, recorded every two hours. Flows in each direction have been recorded separately and represented in a chart graph (Figure 4) as an overlay of northbound rhythms (blue) and southbound rhythms (orange). Two-directional flows corresponding to face-to-face encounters thus appear as a mix of the two (green). While the total number of people is an extensive attribute, the basic level of visual interaction between pedestrians represented by colours is an intensive attribute of streetlife. This simple representation does only capture one key aspect of streetlife intensity, and does not account for differences in speed and nuanced variations in movement path orientation. Such differences have been captured with time lapse video recording, but haven't shown major differences between these study areas. The resulting diagrams allow a basic comparison of the density, urban morphology and intensity of the three case study areas.

In the CBD the residential density is only 35dw/ha, but there is a high job density as well as a high number of day visitors. The residential density in Southbank is three times higher than in Fitzroy, but the magnitude of pedestrian flows is lower and the level of encounter is even more limited. This relatively high level of pedestrian flows in Fitzroy and their balanced mix is similar to other creative clusters in London and New York, and is related to a morphology characterised by small grain size (Pafka 2013). The measure of dwellings per hectare provides no indication of either building density (FAR), internal density, or density of people on the street, and neither does it correlate with the observed streetlife intensity.

These examples demonstrate that dw/ha is not an adequate measure for comparisons between urban and suburban areas, comparisons in time or comparisons between different social contexts, nor does it provide a reliable indication of building type or urban intensity, and it has a high potential to mislead.

Figure 4. Three case studies in Melbourne compared, showing the absence of a simple correlation between the measures of dwellings per hectare, FAR and intensity of pedestrian flows (Source: author's survey 2012).

Politics of density

After demonstrating that dwelling density is not a good tool for analysing urban environments, new questions arise: why would planners and planning departments choose such a vague measure when more precise measures are available? Is the more widespread use of this measure in the Anglosphere related to the higher degree of suburbanisation? Why after so many attempts to bring clarity in the urban density debate, little progress is made?

A very simple argument in favour of dw/ha provided by Unwin was that it is easier to calculate. This argument has been reiterated more recently in the "Urban Density Definitions" report of the Australian Department of Health, Housing, Local Government and Community Services (1993) which stated that dw/ha "relates more directly to opportunities for collecting, aggregating or updating data", and therefore is a better measure than population density. While this practical advantage possibly explains in part its ongoing popularity, is not fully explanatory. A further clue is provided by Unwin's initial argument that limiting the number of dwellings to land area is a good instrument for population density control. While this aim is rarely stated as such, and did not stand the test of time, it reveals that what the measure can do is to bring people density and building density into one combined hybrid concept. The resulting ambiguity combined with the impression of being "a more finite and less fluid unit of measurement" (ibid.) makes it particularly vulnerable for being appropriated for various purposes.

The appropriation of density conceptions for political purposes has a long history and continues today (Ross 2011). A detailed exploration of the political dimensions of density conceptions is provided by Nikolai Roskamm (2012), whose work provides a starting point for understanding the appeal of the dwelling density concept. Roskamm argues that the concept of "density" applied to the urban realm is an abstraction, the word being an empty signifier. Throughout history the term has been constructed and appropriated by different fields of science and practice in various ways. Such a process does not lead to clarification, but to the coexistence of different and often conflicting conceptions. Measured density conceptions are fictionalisations, reductions and abstractions of reality. These are often linked to qualitative conceptions of density, by which the quantitative concept acquires a metaphorical meaning, while the qualitative conception acquires scientific aura, as he puts it becoming a "potentially computable metaphor".

A striking example of such a process is the concept of "Volksdichte" (national density) which appeared in the 19th century in Germany. Geographers established the term to describe and analyse the relationship within a country between the number of people and the available resources. It has been argued that as population density at the scale of the nation increases, societies develop more efficient forms of land use. In the 1920s this concept has been altered to imply the superiority of nations having higher density. This line of thought has been traced from the geographers Friedrich Ratzel and Karl Haushofer to the latter's student Rudolf Hess a friend and later deputy of Hitler (Roskamm 2011). The relationship of nation to space became central in *Mein Kampf*, where it was argued that there is an upper limit to land use efficiency (a similar concept to that of carrying capacity), and that the only option for a nation which reached the maximum sustainable level of Volksdichte to further develop, is to expand its living space, its "Lebensraum" (Roskamm 2011).

The quantitative measure of dwelling density has been similarly linked to various qualitative conceptions of density. Expressions of such processes are the various standards of maximum or minimum dwellings per hectare, or the designation of numeric thresholds for "low", "medium" or "high" densities. In Australia thresholds are set by planning departments at around 20dw/ha (net) for low density, respectively 60 dw/ha for high density. Such arbitrary thresholds are socio-political constructs, well illustrated by variations between countries, for instance in the Netherlands "high density" starts at 100dw/ha and in Israel it starts at 290dw/ha (Churchman 1999).

The choice of the measure is of particular significance, because as noted above, dwelling density obscures the diverse possible relationships between built and population densities and maximises the measured difference between urban and suburban areas. Its vagueness makes it particularly vulnerable to be linked to any type of qualitative conception of density.

Multi-variable density models
It has been shown by Dovey and Pafka (2013) that any single measure of urban density is limited, and does not reflect the complexity and multidimensionality of urban environments. It also has been argued that ultimately what matters is the much more difficult to measure intensive property of urban space, variously referred to as urban vitality (Jacobs 1961), visual density (Sennett 1970), the density of interactions (Häussermann 2007), the density of experiences (Wolfrum 2007), the buzz (Storper and Venables 2004) or urban intensity (Shelton et al. 2009). Nevertheless, planning professionals and decision makers do require precise and objective tools to describe, analyse and control urban development. However, particularly the impression of being a simple, universal, exact and objective measure encompassing both aspects of people and buildings is what makes dw/ha vulnerable to misuse. Instead of relying on a single measure with a very high potential to mislead, it seems more worthwhile to consider multiple measures at the same time, such as population density, job density, site coverage and floor area ratio. Together multiple measures are at least getting closer to describing the complexity of urban environments. In the last decade several multi-dimensional models have been proposed, including: the three dimensional "Spacematrix", a model combining FAR and MIX (Mixed use index) and a chart with six density variables.

In *Spacematrix* Pont and Haupt (2010) argue that rather than relying on a single part-measure of density, multiple measures should be combined to better describe urban environments through the prism of building density. Spacematrix is defined as a three dimensional diagram which represents three different measures: FAR (which they refer to as Floor Space Index), coverage (referred to as Ground Space Index) and Network Density (N). Together these measures characterize the typomorphology of an urban environment, in which differences in street patterns and building typology are recorded. However, considering that axonometric representation is not useful, the authors decided to go back to 2D projections of this model named "Spacemate". The FSI & GSI Spacemate, on which gradients of building height and OSR (Open Space Ratio, a measure of "spaciousness" defined as the

amount of open space divided by gross floor area) are also represented, is a tool which relates building density to urban form. This highlights the tension between the need to capture the whole complexity of the phenomena and the practical need for simplicity of representation.

While the Spacematrix model only addresses built form, another model that incorporates the functional mix of urban neighbourhoods has been proposed by Hoek (2008). The model comprises a chart that represents FAR on the vertical axis and an index of land use mix (MXI) on the horizontal axis. It has been shown that in this model, urban neighbourhoods with similar character (19th century urban expansions, modernist districts, CBDs, etc) cluster in the same area of the chart. As this model has been developed based on examples found in the Netherlands, it remains to be tested in different cultural contexts.

A more complex multi-dimensional model, which encompasses both building and population density measures was proposed by Patel (2011). His model illustrated with a sophisticated diagram shows, how at the scale of a neighbourhood gross population density (GD) and net population density (ND) are mediated by the plot factor (PF), the ratio of private to public land. Further the model illustrates how the link between net population density and net floor space index (FSI) is mediated by the ratio of built area per capita (BUA). A sixth measure is the public ground area per capita (PGA) which is linked to PF, FSI and BUA, via the formula PGA=BUA/FSIxPF. The model demonstrates that while one or two of these measures are fixed, the others can change. A variety of examples from India and the United States demonstrate how no single density measure can reliably characterise particular urban morphologies. In this model with six variables at least three have to be known to determine the other three. While the model is complex, it still doesn't include key morphological and sociological aspects, most notably functional mix and pedestrian flow rhythms.

A more simple and open way to approach the issue of multi-dimensionality of concentration proposed here, is by comparing various density measures as illustrated in Figure 5. For each of the three examples presented earlier, the diagram shows three building density measures followed by three population densities. Density values are expressed as a proportion of the highest value for each example. This shows that there is no consistency between urban morphology and density measures.
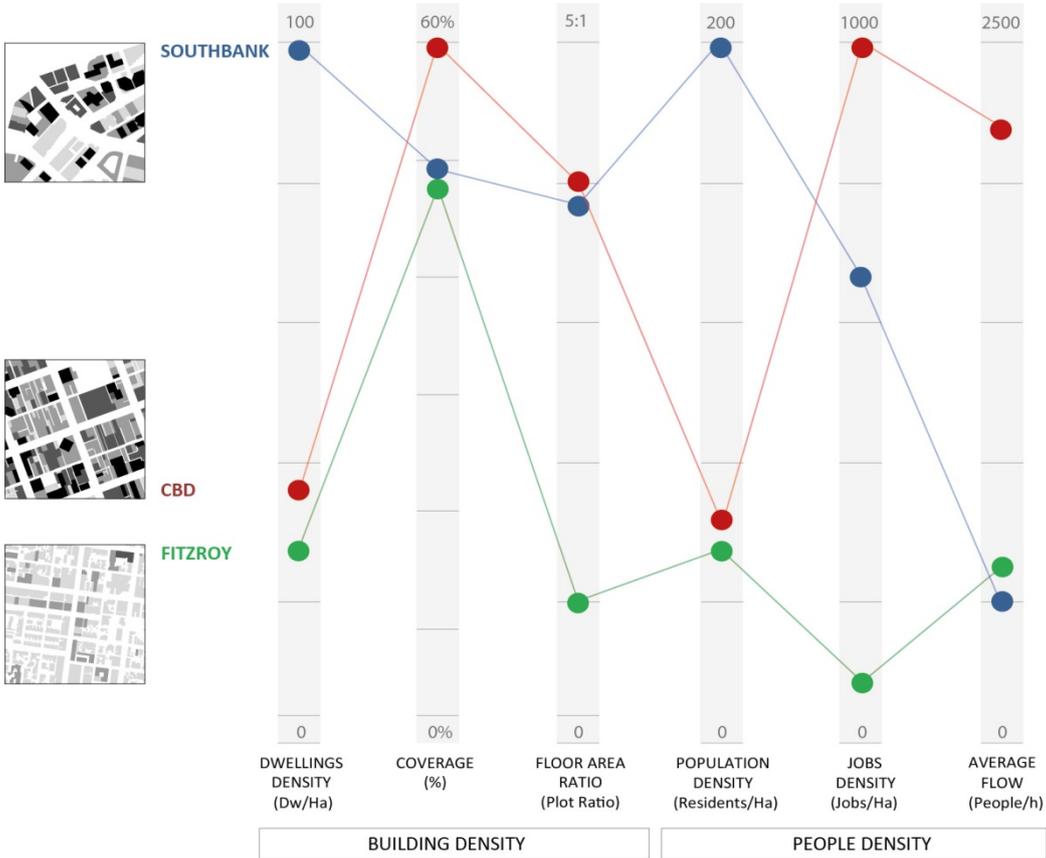
Figure.5 Density measures profiles for three 25ha case study areas is Melbourne. Sources: author's survey 2012, (Australian Bureau of Statistics 2011), (City of Melbourne 2010).

While Fitzroy (green) generally scores lowest in all building density and two static population density measures, it has a higher pedestrian flow than Southbank (blue), despite the latter having a much higher FAR. The CBD (red) has a similar population and dwelling density as Fitzroy, yet a much larger job density and pedestrian flows. The big fluctuations of profile for different urban conditions illustrate that no single measure of density can be used to simply predict urban outcomes. The exceptional consistency between dwelling and population density is the result of the consistency of household sizes in Melbourne's inner city apartments.

These incipient attempts to capture complex urban phenomena through pairs or systems of precise measures, have still a long way to go to handle aspects such as walkability, streetlife and multi-scale relationships. As a first step however, there needs to be a shift from single density measures towards more complex models that integrate multiple aspects of urban concentration.

Conclusions
It has been shown that the measure of dwellings per hectare should be treated with caution, as comparisons between urban and suburban areas, comparisons in time or comparisons between different social contexts can be easily misleading.

Further it has been shown that dwelling density is particularly vulnerable for being misused, as it obscures the diverse possible relationships between built and population densities and maximises the measured difference between urban and suburban areas. Its vagueness makes it particularly vulnerable to be linked to any type of qualitative conception of density, while maintaining the impression that it is an objective and sound measure.

As no single measure of urban density is sufficient to capture the various aspects for concentration, multi-variable models need to be used. Several such models have been proposed in the past few years that need to be further tested and developed.

Acknowledgements

References
Alexander, E. R. (1993). "Density Measures: A Review and Analysis." Journal of Architecture and Planning Research 10(2): 181-199.

Australian Bureau of Statistics (2011). Census.

Australian Department of Health, Housing, Local Government and Community Services Steering Committee (1993). Urban Density Definitions.

Boyko, C. T. and R. Cooper (2011). "Clarifying and re-conceptualising density." Progress in Planning(76): 1-61.

Cheng, V. (2010). Understanding Density and High Density. in Designing high-density Cities for Social and Environmental Sustainability. E. Ng (ed.). London, Earthscan: 3-18.

Churchman, A. (1999). "Disentangling the Concept of Density." Journal of Planning Literature 13(4): 389-411.

City of Melbourne (2010). Census of Land Use and Employement (CLUE): Small Area Report.

DeLanda, M. (2005). Space: Extensive and Intensive, Actual and Virtual. in Deleuze and Space. I. Buchanan and G. Lambert (ed.). Edinburgh, Edinburgh University Press: 80-88.

Dodson, J. and B. Gleeson (2007). The use of density in Australian planning. State of Australian Cities Conference. Adelaide.

Dovey, K. and E. Pafka (2013). "The urban density assemblage: Modelling multiple measures." Urban Design International.

Dovey, K. and F. Symons (2013). "Density withouth intensity and what to do about it: reassembling public/private interfaces in Melbourne's Southbank hinterland." Australian Planner.

Fernández Per, A., J. Mozas and J. Arpa (2007). DBook: Density, Data, Diagrams, Dwellings, a+t ediciones.

Forsyth, A. (2003). Measuring Density: Working Definitions for Residential Density and Building Intensity. Design Center for American Urban Landscape, University of Minnesota. Design Brief 8.

Government of New South Wales (2010). Metropolitan Plan for Sydney 2036. Department of Planning. Sydney.

Government of South Australia (2011). Understanding Residential Densities: A Pictorial Handbook of Adelaide Examples. Department of Planning. Adelaide.

Griffiths, D. (2009). Density targets: Measuring everything except that which makes life worthwhile? 10th International Cities Town Centres & Communities Society Conference. Deakin University Geelong.

Häussermann, H. (2007). Phänomenologie und Struktur städtischer Dichte. in Städtische Dichte V. M. Lampugnani, Nzz Libro: 19-30.

Hoek, J. W. v. d. (2008). The MXI (Mixed-use Index) as Tool for Urban Planning and Analysis. Corporations and Cities: Envisioning Corporate Real Estate in the Urban Future. Delft University of Technology.

Howard, E. (1965). Garden Cities of To-Morrow. London, Faber and Faber.

Jacobs, J. (1961). The death and life of great American cities. New York, Random House.

James, C. (2009). Australian homes are biggest in the world ComSec Economics.

Lynch, K. (1981). A theory of good city form. Cambridge, Mass., MIT Press.

Lynch, K. (1984). Site Planning, MIT Press.

Mumford, L. (1946). The Garden City Idea and Modern Planning. Preface to the 1946 edition of Garden Cities of Tomorrow. F. J. Osborm, Faber and Faber.

Pafka, E. (2013). Places as Intersecting Flows: Mapping Urban Morphologies, Functional Constellations and Pedestrian Rhythms. 4th Global Conference: Space and Place. Mansfield College, Oxford.

Patel, S. B. (2011). "Analyzing urban layouts - can high density be achieved with good living conditions?" Environment and Urbanization 23: 583-595.

Pont, M. B. and P. Haupt (2010). Spacematrix: Space, Density and Urban Form. Rotterdam, NAi.

Roskamm, N. (2011). Dichte: Eine transdisziplinäre Dekonstruktion. Diskurse zu Stadt und Raum, Transcript.

Roskamm, N. (2012). "The Concept of Density." GAM(08 Dense Cities: Architecture for Living Closer Together): 130-141.

Ross, A. (2011). "Nothig Gained by Overcrowding": The History and Politics of Urban Population Control. in The New Blackwell Companion to the City. G. Bridge and S. Watson (ed.). Chicester, Wiley-Blackwell.

Sennett, R. (1970). The uses of disorder: personal identity & city life. New York, Knopf.

Shelton, B., J. Karakiewicz and T. Kvan (2009). The making of Hong Kong: from vertical to volumetric, Routledge.

State of Victoria (2002). Melbourne 2030. Department of Infrastructure.

State of Victoria (2013). Plan Melbourne (Draft). Department of Transport Planning & Local Infrastructure.

Storper, M. and A. J. Venables (2004). "Buzz: face-to-face contact and the urban economy." Journal of Economic Geography 4(4): 351-370.

UK Office for National Statistics (2011). Census.

Unwin, R. (1909). Town Planning in Practice. An Introduction to the Art of Designing Cities and Suburbs. London.

Unwin, R. (1912). Nothing Gained by Overcrowding! How the Garden City type of development may benefit both owner and occupier. Westminster, P.S. King &Son.

Wolfrum, S. (2007). "Urbane Dichte: Plädoyer für Erlebnisdichte in Städten." Garten+Landschaft(1).