

**Title:** Delivering higher density suburban development: The impact of building design, and residents' attitudes

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# **Delivering Higher Density Suburban Development: The Impact of Building Design, and Residents' Attitudes**

## **Abstract**

The urgent need for housing in London will be met almost exclusively through building on brownfield sites. While Inner and suburban Outer London are both home to a range of brownfield sites, the politics of delivering new housing varies between the two. First, Outer London is built at significantly lower density and therefore densification has a more noticeable impact. Second, many residents in Outer London value living at lower density and will see densification as undermining that which they value. Third, homeownership is more common in Outer London and as housing is the most significant asset for most homeowners any threat to its value is likely to be strongly resisted. Our research tests whether design can positively impact both the perception and acceptability of densification. For this, we run a randomized control trial presenting 939 Outer London residents with simulated images representing different design features. We find that the effects of building design are limited and relate almost exclusively to low and medium density options. Our research shows that vernacular design can make some increase in density acceptable but for significantly higher density the influence of design declines. As density increases the perception and acceptability of density is more influenced by people's views on, for example, the extent of London's housing crisis. This indicates that planners and politicians must reach beyond design and seek to better inform and persuade residents about housing need if the impasse on densification is to be overcome.

Keywords: Density, Housing crisis, Housing design, London, Suburbs.

## Introduction

Like many cities internationally, London has a highly stressed housing market with strong demand pressures for new housing (Gallent et al. 2018, Wetzstein 2018) coupled with a long-term deficit in delivering new housing. The result has been intense upward pressure on prices leading to a crisis of affordability (Antoniucci and Marella 2007, Gallent et al. 2017). New housing will overwhelmingly be delivered on previously used (brownfield) land, primarily on ex-industrial land. Substantial brownfield opportunities also exist in suburban Outer London where industrial sites were developed along with housing between the First and Second World Wars (Hebbert 1998: 147). The extent of these sites is significant, reflected in land use figures: in 2005, across Inner London, non-domestic land uses accounted for 11.7% of building land coverage while in Outer London the proportion was 26% (London Datastore 2020)<sup>1</sup>. This helps to explain why an extensive academic study of Outer London concluded that it comprised a flexible and adaptable physical form (Vaughan et al. 2009).

But while Outer London is home to extensive brownfield sites, planners and local politicians may encounter greater resistance to developing there. Homeownership remains more prevalent in London's suburbs, in 2018 only 40% of households in Inner London were owner occupiers or owned outright compared to 62% in Outer London. Homeownership is generally the most significant asset for households and therefore is associated with a strong defence of its value (van Gent 2010) making homeownership residents, "...highly vigilant of land-use changes..." (Whittemore and BenDor 2018:1360). Furthermore, residents have expressed a preference for suburban living, trading off centrality for a basket of 'benefits' linked to lower density, more and larger parks, less pressure on public goods including road-space and so on (Mace 2013). Densification threatens to undermine that which they value.

Differences in preference for city or suburban living, including related differences in tenure, have been linked to voting behaviour (Walks 2006), with political parties having

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<sup>1</sup> This compares the footprint of buildings not the square meterage of floor space; non-domestic buildings are generally lower rise in Outer than in Inner London, therefore taking up more land while providing relatively less m<sup>2</sup> of floor space.

long seen the suburbs as representing a distinct and decisive battleground (Clapson 2003). This held true in the 2008 London mayoral race, which Boris Johnson won by successfully depicting the incumbent, Ken Livingstone, as anti-suburbs (including for having foisted higher housing targets on the suburbs). In partial fulfilment of his promise to be a more suburban-friendly mayor, Johnson established an Outer London Commission. However, this did not provide a solution to the tension between the mayor's strategic function and his promise to give more control back to the suburbs (Holman and Thornley 2015). The challenge remains of delivering strategic priorities (not least a step-change in housing delivery), in the face of local resistance.

A step-change in housing delivery will be realised through higher – oftentimes much higher density in London as a suite of policies constrains land supply. This includes the decision to meet the city's housing need within its own borders, which has remained steadfast since the election of the first London Mayor in 2000. The city's own land supply is constrained by an almost exclusive focus on brownfield sites, required to maintain existing policies such as the greenbelt which applies to 22% of London's landmass. But development on brownfield sites can be limited in density and/or height by other policy constraints such as conservation areas and protected views, both of which particularly impact Inner London. Therefore, those brownfield sites that are available *and* relatively free of policy constraints will attract high prices on the open market, reflecting their scarcity. Outbidding the competition reflects a developer's view that, on these sites, they can achieve sufficient density to make a development viable (Bowie 2010, Dong and Hansz 2019). This is evidenced through development densities under the post 2000 London Plan regime, where the Plan's recommended density ranges have been routinely exceeded, sometimes manyfold (Gordon et al 2016).

Where this happens in Outer London, the low density of the existing suburb makes sharp increases in density even more evident and, in turn, may potentially make communities view them as more threatening (Sivam et al. 2012). The threat of 'citification' jeopardises the lower density single-family home aesthetic, which is one of the attractors to the suburbs. In addition to challenging the suburban aesthetic, high density development is also tarnished by a longer story of quality relating to the poor design of new housing in

England. Different governments have established a variety of advisory bodies to seek to achieve better quality design. The Commission for Architecture and the Built Environment (CABE) has produced a large body of work including assessments of design quality one of which reported over a fifth of schemes being of poor quality (CABE 2004, 4)

CABE was abolished in 2011 as part of the Conservative-Coalition government's post 2008 austerity measures. But, in 2018 a later Conservative government announced the establishment of the Building Better, Building Beautiful Commission. Unlike CABE, this was set up as a time-limited body and was headed by a leading right-wing philosopher (Roger Scruton), rather than by members of the architect/design profession. It was therefore informed by a different philosophical perspective. However, of significance to our work, both highlight the importance of respecting the vernacular in contemporary development.

In this context, our research tests how design and attitudes can shape residents' views on density. Design is relevant as it is often portrayed as a primary way that planners can impact the perception and the production of the built environment (Carmona 2009, Churchman 1999 cited in Mousavinia et al. 2019, Imrie and Street 2009). Tying back to the design advice of CABE and the Commission, we asked whether the echoing of the vernacular suburban form through the design of higher density buildings and streetscapes would make new development *be perceived* to be less dense, altering people's emotional response and therefore, making density more acceptable (Rapoport 1975). However, design is only one element affecting human perception within a complex, intersection of rational resource concerns, economic interests and more subjective elements including belonging (Montserrat and Rose 2012, see also Whittemore and BenDor 2018 for a fuller discussion in a North American context). Therefore, we also look at the effects of residents' attitudes on several issues including the extent of the housing crisis to test how this impacts their perception of density and/or its acceptability.

## Method

We conducted an online randomized control trial (RCT) with 939 Outer London residents during March and April 2020. Participants were recruited via local associations networks, their newsletters and through social media. During late 2019 initial contact was made with

304 local association groups, covering residents', civic, housing, minority, and religious associations; 57 agreed to share their network. The online survey method proved to be prescient as by the time it went live a COVID-19 lockdown was imposed in England. Descriptive statistics of participants are shown in Table 1. As can be seen, the sample has a relatively higher share of UK born, female, older, white and owner occupiers compared to Outer London in general (GLA 2016; 2019; ONS 2020; MHCLG 2018). Therefore, as with any RCT, while the results of this study have strong internal validity, results should be interpreted carefully when extrapolating them to the larger population of outer London residents.

<INSERT TABLE 1 ABOUT HERE 'Characteristics of participants'>

The survey employed the online platform [www.urban-experiment.com](http://www.urban-experiment.com). The platform utilizes photo simulation to gather data on respondents' perceptions of a series of digitally altered pictures with varying degrees of intervention. We chose this method as visual simulations are a useful tool when measuring public attitudes on different development scenarios (Jorgensen et al. 2002; Kuo et al. 1998; Rodiek and Fried 2005). Several studies have found that participants respond to, and rate, photographs similarly to real places, making photo simulation a low-cost and preferable alternative to accurately measure residents' perceptions and attitudes (see Zube, et al. 1987; Kaplan and Kaplan 1989, Rossetti and Hurtubia 2020).

In the first section, in addition to demographic data, respondents were asked about their attitudes to housing development in London, their sense of belonging, and perceptions on local government efficiency. In the second section, participants were asked to rate a series of 24 randomly assigned pictures either according to the perceived density, ranging from very low to very high, or to rate how acceptable they found the presented development' density level was, from completely unacceptable to fully acceptable, on 10-point scales. Respondents were asked to imagine that the developments shown in the picture

series were to be built within a 10-minute walking distance of their homes, to capture sentiments towards local development.

We created 24 sets of control and treatment pictures. Each set consisted of one control picture of a current London housing development and two or three treatment images of the same development with varying degrees of design intervention (see Figure 1 for examples). The images were divided into two overarching typologies, together covering eight intervention categories. Setback, public greenery, private greenery, and parking belonged to landscaping, whereas fenestration, façade articulation, roofing, and façade material were part of the building design typology. These categories were selected as they cover major aspects of housing development and were assumed to be the most influential design attributes to neighbouring residents.

We assumed that the proportion of a site covered by any given use other than buildings, open land, streets and so on would remain constant. Therefore, increasing density would require increasing the heights of buildings rather than greater coverage of the site by the building. Each intervention category covered three densities reflected by height levels: low density (around three-storeys), medium density (around six-storeys), and high density (around nine-storeys). We assume that three-storeys produces a floor area ratio (FAR) of 1:1, where one third of the site is built on at three-storeys and two-thirds of the site is given to highways, gardens etc. Therefore, with the same one third to two thirds split, six-storeys gives a FAR of 2:1, doubling the density and 9-storeys gives a FAR of 3:1 tripling the density. These configurations produce heights that reflect the prevailing new housing development range in Outer London and would therefore be familiar to our respondents. It is important to note that our low-density option nevertheless represents approximately a doubling of the density at which housing in Outer London was originally developed.

As our preference was to show participants images as viewed from street level, we could not show a whole site. Rather, participants were presented with our design interventions applied to a series of buildings of different heights. While building height alone does not correlate with density, it can offer a useful proxy for density for respondents (Rapoport 1975). Treatments for each image set (for an example see Figure 1) were applied in such a way that except for the treatment, all other important features were held constant

(such as weather, light or passers-by). While many of the intervention categories show treatments on a scale of intensity (none, low, medium), such as levels of fenestration and setback, others simply featured design alternatives, like façade material (e.g. brick, steel, clay or wood).

Images were allocated to each respondent according to a double randomization process to ensure that all covariates are balanced between participants and treatments (Navarrete-Hernandez and Laffan 2019). First, the image order was randomized to control for potential fatigue and spillover effects for the respondents rating several images. Second, as customary in an RCT setting, the online platform randomly assigned the participant one image from every picture set. Together, this resulted in a unique combination of viewing order and control-treatment images for respondents. To test that randomization was successful we carried out balance tests before the analysis. From a total 1,590 tests conducted, 49 were significant at the 5% level. This indicates that the randomization was successful in equaling out groups characteristics across each treatment and control images (the results and readouts of the balance tests are available upon request).

**INSERT FIGURE 1 ABOUT HERE 'Example of Photographic Simulations of Building Design Interventions'**

## Data

Through the online survey, we gathered four sources of data to enable our analysis. A detailed description of this data, along with the measurements used, can be found in Table A1 in the Appendix. The first source contains participants' demographics (age, ethnicity, gender, residential location, country of birth, tenure, and length of time lived in the neighbourhood). Second, we collected information on respondents' attitudes on whether they agree that London is experiencing a housing crisis, their subjective sense of belonging in their local neighbourhood, how much they feel they can affect decisions made by their local council, and where in London they think new development should occur. The third



source contains data on the experimental conditions of the survey and covers image order, treatment status, time taken to complete the survey, and date, day of the week and time of the response. Last, the fourth data source consists of participants' stated perceptions of acceptability and perceived density of each development shown in each presented photo simulation.

## Regression Analysis

We estimated two different regression models. The first is a mixed-effect model with fixed effects at the image level and random intercept on the individual level (Eq1). We use random effects at the individual level to account for the fact that each participant rated 24 images, thus image scores are not independent from each other. Additionally, we add image fixed effects to controls for any image-specific attributes. The second model is a linear regression model with neither the image level fixed effect nor individual-level random intercepts (Eq2). The regression models take the following forms:

$$\text{Perception}_{ij} = \beta_1 \text{Treatment}_i + \beta_2 \text{Image}_i + U_j + E_{ij} \quad (\text{Eq1})$$

$$\text{Perception}_{ij} = \beta_1 + \beta_2 \text{Treatment}_i + E_{ij} \quad (\text{Eq2})$$

The dependent variable  $\text{Perception}_{ij}$  gives the perception rating for the  $i$ th image by the  $j$ th individual on a scale of 1 to 10. Treatment, the independent variable of interest, is a categorical variable and the magnitude of its average effect on people's perceptions of density and acceptability in the  $i$ th image is indicated by the coefficient  $\beta_1$  in Eq1 and  $\beta_2$  in Eq2. For Eq1,  $\beta_2$  shows the image fixed effect for picture  $i$ ,  $U_j$  the random intercept associated with individual  $j$ , and  $E_{ij}$  is the error term. In Eq2,  $\beta_1$  represents the intercept. Significance levels of 10%, 5%, and 1% are reported across all regressions.

To understand better how density and treatments related to acceptability and perceived density on a general level, we ran Eq1 and Eq2 on three different density levels (Low, middle, and high). Additionally, each model was applied separately for both questions asked in the survey. In the first instance, we focused on the effect of increased density. This was achieved by using Eq1 and only utilizing the control images for each density level. While this gave us an indication of how actual density relates to perceived

density and acceptability, the nature and composition of developments vary significantly across density levels meaning we were only able to draw suggestive connections. The second way Eq1 was applied was by pooling all treatments and studying their effect compared to the control for each density level. This was to uncover the overall possibility treatments have to alter density perception and acceptability. As these models were applied to each density level individually, a clearer direction of the causality emerged. Finally, Eq2 was applied to each image group to study the effect a specific treatment has at a particular density level.

In the final stage of the analysis, Eq2 was used to test how attitudes on housing development impact density acceptability and perception. Treatments were substituted with each variable in these data sources. Each specification was applied for each density level and question. We provide a pairwise comparison test to identify significantly different or attitudes categories. For this, we performed an analysis of variance testing for equality of means reporting p-values with Bonferroni corrections, as a conservative approach to mitigate against type I errors.

#### Robustness checks

To test the robustness of our results, we re-ran previous regressions and control for the following variables: age group, ethnicity group, gender, location, whether the individual was born in the UK, tenure, length of time lived in the neighbourhood, development preferences, attitude towards London's housing crisis, local influence in council politics, sense of local belonging along with the image order of appearance, the date, and day of the week and the time the survey was taken. This gives the following model for Eq1:

$$\text{Perception}_{ij} = \beta_1 \text{Treatment}_i + \beta_2 \text{Image}_i + \beta_3 X_{ij} + U_j + E_{ij} \quad (\text{Eq3})$$

And the following model for Eq2:

$$\text{Perception}_{ij} = \beta_1 + \beta_2 \text{Treatment}_i + \beta_3 X_{ij} + E_{ij} \quad (\text{Eq4})$$

In both,  $X_{ij}$  represents all the variables previously mentioned and  $\beta_3$  their corresponding coefficients. The results of these regressions are presented in the section below.

## Results

### Relationship between perceptions of density and acceptability

In this section, we conduct a preliminary analysis to test if the different densities presented (reflected in differing building heights) impact on Outer London residents' perceptions of density and in turn, the acceptability of a new housing development. Figure 2.A shows that as we increase building heights perceptions of density changes significantly, providing evidence of its use as good proxy for building density (further detail in Table A2.A in the Appendix). Figure 2.B shows a strong correlation between perception and acceptability for the three given densities. As can be seen, the acceptability of density decreases as the perception of density increases (see also Table A2.B in the Appendix). Moreover, rating for images containing low, middle, and high density tend to cluster together with images of low density developments being perceived as lower density and more acceptable and high density developments being perceived as higher density and less acceptable.

<INSERT FIGURE 2 ABOUT HERE 'Relationship between building height, perceptions of density and acceptability'>

### Changing perceptions of density and acceptability by building design

Following the notion that vernacular design might make density more palatable to residents, we showed our respondents various photos of our three densities with altered design features (our treatments) to gauge how design (especially suburban features) impacted on perceived density and its acceptability. As explained above, we focused on design treatments that are integral to the building (e.g. fenestration and roof lines) as well as on design treatments relating to the public and private realm (e.g. green space and car parking arrangements). In

this section, we present findings that show that while design can influence the perception and acceptability of density, the effect is only marginal. Moreover, the impacts of treatments relate almost exclusively to low and medium density options. Virtually no treatments were statistically significant for transforming the negative perceptions of higher density options.

#### *Low density housing developments*

We first consider the impact of different design features on perceptions of, and the acceptability of density for low density developments (Figure 3.A). Design treatments had the most impact on our low density options in terms of both perception and acceptability (see Table A3.A in the Appendix). Buildings finished in brick (acceptability=0.757) or wood (acceptability=0.757), rather than with steel facades, made low density developments more acceptable. The preference for brick facades reflects the existing UK housing stock which contrasts to much of Europe<sup>2</sup>. High levels of fenestration (acceptability=0.788; perception=-0.444) and large public green space (acceptability=0.763; perception=-0.530) also increased acceptability and decreased perceptions of density. Finally, a pitched roof (acceptability=0.714) and no parking space (acceptability=0.763) increased the acceptability of low density development; but did not modify residents' perceptions of the density.

< INSERT FIGURE 3 ABOUT HERE 'Impacts of design features on acceptability and perceptions of density' >

These results suggest that for low density housing developments in London suburbs, vernacular or traditional architecture, is more acceptable. This is reflected in the higher acceptability of brick facades, reflective of the typology of many London suburbs and wood finishes, which echo wooden decoration used in the past to produce a so-called 'mock Tudor' effect. Large green spaces also recreate a more rural feel to developments, recalling earlier design ambitions for suburban public realm, typified by the Radburn principles of the

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<sup>2</sup> It has been argued that a preference for brick originates in the desire of house buyers (initially landlords and then owner-occupiers) to be able to view easily the quality of the construction with rendering allowing a builder to hide poor quality work (Jackson 1973).

‘village green’. Overall, these results seem to support the greater acceptability and lower density perception of vernacular suburban design that support the attempt to achieve an illusion of the rural in the city (rus-in-urbe).

#### *Medium density housing developments*

Second, we consider the impact of each intervention category on the perception and acceptability of medium density developments (Figure 3.B). Concerning building design, compared with a steel facade, again brick finishes significantly enhance the acceptability of a development (acceptability=0.830), while render or wood have a weakly significant positive effect. Design of the private and public realm also enhance acceptability. High levels of private greenery made medium density building be perceived as lower density and more acceptable (acceptability=0.649; perception=-0.458), while large public spaces have a positive but weakly significant effect in increasing acceptability (see Table A3.B in the Appendix).

This again indicates a greater preference for traditional design echoing the original ‘rus-in-urbe’ intent of London’s 20<sup>th</sup> century suburbs. The acceptability of developments containing large private green spaces might speak to the early purpose of the suburbs which was to achieve the mixing of rural and urban where the front lawn has been identified as an essential aspect of delivering the impression the home built in parkland (Fishman 1987).<sup>3</sup>

#### *Higher density housing developments*

We next consider our high density developments with respect to design treatments (see Figure 3.C and (see Table A3.C in the Appendix). Moderate facade articulation reduces perceptions of density (perception=-0.534) while large facade articulation, large public spaces, and large building setback have a weakly significant negative effect on perceptions of density. The one intervention significantly increasing acceptability for the higher density option was a pitched rather than a flat roof (perception=1.127). This may have a double significance, as positively, the pitched roof echoes the suburban vernacular of the single-

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<sup>3</sup> Although in suburban London many a suburban front lawn has been lost to hardstanding to park cars, arguably it remains as a marker of the public face of suburbia.

family suburban house<sup>4</sup>. Negatively, a flat roof echoes the public housing blocks of the 1950 which, for multiple reasons including a lack of maintenance, came to be viewed as problematic. Notwithstanding the positive perception of pitched roofs, our findings show that, for high density buildings, their design, or indeed that of the public realm around them is unlikely to improve residents' views on these types of developments, which runs counter to the dominant discourse (Campoli & MacLean 2007; Sivam et al. 2012).

To summarise, our findings indicate that by itself, design can do relatively little to change the acceptability of the density of developments in the suburbs. This is particularly true in the case of higher densities. However, in addition to design, an individual's views might also shape perceptions and acceptability of density; we turn to these in the following section.

The effect of an individual's attitudes on perceptions of, and the acceptability of density

In this section, we carry out an exploratory analysis on the relationship of an individual's attitudes with their perceptions of density and acceptability of new housing developments at given densities. For this, we ran Eq2 at each building's density observing variations in a selected attitude. Below, we comment on those that are statistically significant at 5% significance level after Bonferroni corrections.

We analyse how four attitudes shape people's perceptions of density and its acceptability. Figure 4.A presents the results of density perceptions and acceptability of new developments based on people's attitudes in response to the statement, 'London has a housing crisis'. As Table A4.A show the level of agreement with the statement significantly decreases perceptions of density and increases its acceptability for all levels of buildings. It is worth noting here that the effect size of the "London's Housing Crisis" attitude is so pronounced that it has a larger impact in lowering perceptions of density and increasing acceptability than any of the design treatments that we tested.

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<sup>4</sup> It is noteworthy that the internal modernist style of housing, rendered and flat roofed, is not common in the UK.

<INSERT FIGURE 4 ABOUT HERE 'The Impact of resident's attitudes on perceptions of acceptability and density'>

Figure 4.B presents the results where respondents expressed a preference for the location of new development; Outer London, Inner London or both. This question was included to test the existence of potential NIMBY (not in my back yard) attitudes, that new housing development should happen elsewhere. Compared with those residents that think that development should happen in Outer London, residents who thought new housing should be built in Inner London significantly perceived all buildings densities as less acceptable, while changes of density perception were not significant (see Table A4.B in the Appendix). This means that while both groups perceive density similarly, the NIMBY group is less willing to accept new housing developments at any density. The effect size of this NIMBY's attitude is in many cases larger than any change in perception made by any of the design features presented above.

Figure 4.C presents the results according to how much influence participants felt they had over developments in their area. With this, we wanted to see what impact, if any, a sense of local agency would have. We found that those with some sense of agency perceived developments as more acceptable and less dense than those who felt disempowered (responding; no, or very little influence over local planning) (see Table A4.C in the Appendix). We cannot conclude much about those who reported that they believed they had a great deal of planning influence, as only a few people selected this option resulting in large standard deviation and less reliable point estimates. This suggests that empowering communities/achieving a greater sense of agency could potentially create a sense of control over shaping developments to obtain desirable outcomes resulting in higher levels of development acceptability and lowering perceptions of density.

Our findings indicate that an individual's attitude plays a crucial role in shaping perceptions of density and acceptability of new housing developments. A low level of awareness of London's housing crisis, a NIMBY sentiment, and perceptions of low capacity

to influence new developments remain as major obstacles for the development of new housing at any building density. Compared with building design strategies, attitudinal factors have, in general, a larger effect, indicating the importance of working with and on local attitudes when trying to deliver higher density developments.

## Discussion

Our research establishes a strong correlation between increasing density and decreasing acceptability of new developments indicating that there is a problem that planners and politicians need to address. In this context, we sought to test whether suburban ‘vernacular’ treatments could lessen perceptions, and/or increase the acceptability of densification. We also sought to test how personal characteristics and attitudes impact the perception and/or acceptability of differing densities.

Our starting point was that design was only one of many elements that would impact existing residents’ acceptance of or resistance to higher density development. Even with this in mind, our findings show that overall, design is likely to have only a limited impact with just a few treatments being significant. Starting positively, the low density option produced the most treatments that made a significant difference. This suggests that the incorporation of vernacular design offers possibilities to improve the acceptance of density and therefore design should be more attentive to local features. Framing our low density option as suburban by incorporating familiar traditional design elements will make them seem less dense and make them more acceptable to their neighbouring community. It is important to note that our low-density proposition is still considerably higher than typical existing suburban densities and so, if made more acceptable by design, it could contribute to significantly increasing housing density in the suburbs.

But once we move beyond our lower density option, design has a diminishing effect. At medium density, there are still some ‘vernacular’ suburban treatments that can make development more acceptable and, although not a ‘silver bullet’ to overcoming opposition, they should not be dismissed. Rather they should be employed with more understanding that their impact will be limited and that there is a need to address more than just design to make density more acceptable. As the real density level increased, so did people’s perception of density while acceptability decreased. Design did little to reduce the impression of density.



This was firmly the case for higher density development where, aside from the clear positive impact of a pitched roof, no other treatments were significant. There is very little that design can do to make higher density development either appear to be less dense or to be more acceptable.

Thus, design can make a difference in promoting density that is higher than the existing suburban fabric. This supports the importance of respecting the local vernacular advocated by CABI and the 'Building Better' Commission. But the benefits of reflecting the vernacular declines rapidly for our medium and higher density options. Put bluntly, these cannot be designed to look vernacular in the suburban context. We might then conclude that to make suburban densification acceptable to existing residents we should not exceed out lower density options. But to do so while achieving a step-change in housing delivery would require policy makers to abandon the suite of policies that constrain land supply. The present approach has been challenged (Stringer et al 2016), but it seems likely to ensure. The economics of land supply will drive exponential increases in density. On very large suburban sites such as at Meridian Water in North London there may be scope for the sensitive management of densities as an entire new urban quarter is created. But on smaller sites there are limited options to mitigate the impacts and new development will be in stark contrast to the existing urban form. As this is the most likely case for London in the immediate future the choice is to do what is possible through design and then to 'face down' opposition or to seek to alter existing residents' views.

The limited potential for design to make a difference is less problematic if we see it alongside other elements that might reduce resistance. When we consider the responses to density against the 'attitudes' of residents, we start to see the importance of influencing people across several fronts (with design being just one). More significant are attitudes, which are open to challenge and change (Forester 1988, Healey 2005), and thus can become an active policy arena for urban planning. The challenge of persuading existing residents of the need for higher density development is significant (in the case of the US see Whitemore and BenDor 2018). However, as our results show, there is evidence that the effort is worthwhile as changes to opinions can significantly influence the perception of density and/or its acceptability independent of the design route. A good example of this disconnect

is where respondents agreed that London had a housing crisis. Those holding this view recorded a significant reduction in their perception of density as well as strongly positive impact on their view of the acceptability of density. We need further work to understand the full range of attitudes that can have a positive impact on increasing the acceptability of much needed housing supply, as well as the effectiveness of communication strategies to make communities more receptive to London's challenges.

There is ample evidence of significant change in London's suburbs which could play into more positive attitudes towards densification. Perhaps most significantly homeownership is steadily declining, falling from 68% of households in 1991 to 62% in 2018 (reflecting a general shift in England from home ownership to renting since the latter part of the 20<sup>th</sup> century). The shift to renting includes younger professionals historically associated with gentrified parts of inner London who (at least until COVID), have been priced out to the suburbs (Paccoud & Mace 2017). Another well-established social change has been a significant increase in the ethnic diversity of Outer London (Johnston et al 2015), although it is less clear how this might change attitudes to density. All these changes are unevenly distributed spatially (see Paccoud & Mace 2017 in the case of tenure shifts) and therefore some suburban areas may become more open to new higher density development while other are likely to remain opposed.

In our study we limited the number of questions capturing attitudes to limit the time required to respond, to maximize completed surveys (we required a large number of responses to provide statistical robustness). As the method necessarily required each participant to respond to many images of alternative designs, we restricted questions on attitudes. This provides for strong validity and allows us to make causal claims over the effectiveness of design strategies and to study attitudes across different buildings proposals. Further research could expand on 'attitude questions'. And could test the reliability of the findings – to what extent can we generalise across Outer London or indeed to other suburbs? Outer London is a highly varied social and built environment and we would expect this to be reflected to some extent in local responses to densification.

Our design options are not exhaustive and further research on different treatments would be valuable as would testing the impact of a broader range of attitudes than we have

here. Our sample of building images is composed by stand-alone multi-storey buildings, and therefore our findings are restricted to this widely used type of development. In contrast, the impact of building design might be different for larger and more comprehensive neighbourhood re-development plans.

## Conclusion

When seeking to lessen resistance to new development in London's suburbs, design can play a positive role, but it is a limited one and needs sensitive application. On their own, design treatments have some impact on the perception and the acceptability of new development in suburban areas. Employing vernacular treatments in the lowest of our increased densities was effective. However, these treatments need to be applied with sensitivity by designers. The use of pitched roofs produced positive outcomes in all cases, but private and public greening had a positive or negative influence depending on the tested level of density. This suggests that for design tropes to have a positive influence on acceptability and/or perception we need great sensitivity to how design impact varies across densities.

With few exceptions, as densities increase further, we cannot 'trick the eye' of existing residents to make densities appear less than they are. However, design is not the only tool available to politicians and planners. Our research shows that residents' attitudes are significant and therefore, directing attention to informing and shaping these attitudes may prove a way forward in making density more acceptable. For higher density housing developments, we saw that an individual's attitudes had a powerful influence in shaping perceptions and acceptance of density. New development can be at higher density and acceptable where existing residents see it as part of a wider picture, where they are convinced of its need. Alongside design, attitudes related to the need for density are open to change and are a potentially powerful policy arena to further the delivery of new housing on brownfield sites in the suburbs.

## References

- Antoniucci, V. and Marella, G. (2017). Is social polarization related to urban density? Evidence from the Italian housing market. *Landscape and Urban Planning*, 177, 340-349.
- Bowie, D. (2010). *Politics, Planning and Homes in a World City*. London: Taylor & Francis Books.
- CABE (Commission for Architecture and the Built Environment) (2004). Housing audit, assessing the design quality of new homes. Online [https://www.mae.co.uk/assets/pdfs/151123\\_Mae\\_Architects\\_Housing\\_Audit\\_Architecture\\_Design.pdf](https://www.mae.co.uk/assets/pdfs/151123_Mae_Architects_Housing_Audit_Architecture_Design.pdf)
- Campoli, J. & MacLean, A.S. (2007). *Visualizing Density*. Cambridge: Lincoln Institute of Land Policy.
- Carmona, M. (2009). Design coding and the creative, market and regulatory tyrannies of practice, *Urban Studies*, 46, 2643-2667.
- Churchman, A (1999). Disentangling the concept of density, *Journal of Planning Literature*, 13, 389-411.
- Dong, H. and Hansz, A. (2019). Zoning, density, and rising housing prices: A case study in Portland Oregon. *Urban Studies*, 56, 3486–3503.
- Clapson, M. (2003). *Suburban Century: Social Change and Urban Growth in England and the USA*. Oxford (UK): Berg Publishers.
- Fishman, R. (1987). *Bourgeois Utopias: The Rise and Fall of Suburbia*. NY: Basic Books.
- Forester, J. (1988). *Planning in the Face of Power*. University of California Press.

- Gallent, N., Durrant, D. and May, N. (2017). Housing supply, investment demand and money creation: a comment on the drivers of London's housing crisis, *Urban Studies*, 54, 2204-2216.
- Gallent, N. M., Durrant, D., & Stirling, P. (2018). Between the unimaginable and the unthinkable: pathways to and from England's housing crisis, *Town Planning Review*, 89,125-144.
- GLA (2016), ethnic groups by borough [data file], Online  
<https://data.london.gov.uk/dataset/ethnic-groups-borough>
- GLA (2019). London borough profiles and atlas [data file], Online  
<https://data.london.gov.uk/dataset/london-borough-profiles>
- Gordon, I., Mace, A., & Whitehead, C. (2016). *Defining, measuring and implementing density standards in London*. London Plan Density Research Project 1. London: GLA.  
Online  
[www.london.gov.uk/sites/default/files/project\\_1\\_defining\\_measuring\\_and\\_implementing\\_density\\_standards\\_in\\_london.pdf](http://www.london.gov.uk/sites/default/files/project_1_defining_measuring_and_implementing_density_standards_in_london.pdf)
- Healey, P. (2005). *Collaborative Planning: Shaping Places in Fragmented Societies*. London: Palgrave Macmillan.
- Hebbert, M., (1998). *London: More by Fortune than Design*, Chichester: Wiley.
- Holman, N., & Thornley, A. (2015). Backlash in the London suburbs: the local-strategic tension in multilevel governance. *Environment and Planning C: Government and Policy*, 33(3), 496–511.
- Imrie, R. & Street, E. (2009). Regulating design: the practices of architecture, governance and control, *Urban Studies*, 46, 2507-2518.

- Jackson, A.A., (1973). *Semi-Detached London*, London: Allen and Unwin.
- Johnston, R., Poulsen, M., & Forrest, J. (2015). Increasing diversity within increasing diversity: the changing ethnic composition of London's neighbourhoods, 2001–2011, *Population, Space and Place*, 21, 38–53.
- Jorgensen, A., Hitchmough, J., & Calvert, T. (2002). Woodland spaces and edges: their impact on perception of safety and preference, *Landscape and Urban Planning*, 60,135-150.
- Kaplan, R. & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*, New York: Cambridge University Press.
- Kuo, F. E., Bacaicoa, M., & Sullivan, W. C. (1998). Transforming inner-city landscapes: trees, sense of safety, and preference, *Environment and Behavior*, 30, 28–59.
- London datastore (2020). 'Land use by borough and ward (2005)'. Online: <https://data.london.gov.uk/dataset/land-use-ward>
- Mace, A. (2013). *City Suburbs: Placing Suburbia in a Post-Suburban World*, London: Routledge.
- MHCLG (2018). 'English Housing Survey, 2018: Housing Stock Data'. Online: <https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8670>
- Mousavinia, S.; Pourdeihimi, S. and Madani R. (2019). Housing layout, perceived density and social interactions in gated communities: mediational role of territoriality, *Sustainable Cities and Society*, 51-101699.
- Navarrete-Hernandez, P. & Laffan, K. (2019). A greener urban environment: designing green infrastructure interventions to promote citizens' subjective wellbeing, *Landscape and Urban Planning*, 191, 103618.

- ONS (Office for National Statistics) (2020). Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland [data file], Online <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalescotlandandnorthernireland>
- Paccoud, A., & Mace, A. (2017). Tenure change in London's suburbs: spreading gentrification or suburban upscaling? *Urban Studies*, 55, 1313-1328.
- Rapoport, A. (1975). Toward a redefinition of density, *Environment and Behavior*, 7, 133-158.
- Rodiek, S. D., & Fried, J. T. (2005). Access to the outdoors: using photographic comparison to assess preferences of assisted living residents, *Landscape and Urban Planning*, 73, 184–199.
- Rossetti T., & Hurtubia, R. (2020). An assessment of the ecological validity of immersive videos in stated preference surveys, *Journal of Choice Modelling*, 34, 1-12.
- Sivam, A., Karuppanan, S., & Davis, M., (2012). Stakeholders' perception of residential density: a case study of Adelaide, Australia. *Journal of Housing and the Built Environment*, 27, 473-494.
- Stringer, B., Lloyd, T., Jefferys, P. (2016). *When Brownfield isn't Enough*, *Strategic Options for London's Growth*. Quod in partnership with Shelter. Online [https://assets.ctfassets.net/6sxvmndnnpn0s/6bXEnCMoB3VS6lOK5XMSYh/b835e86f2f12dc8d8f41d86b6e823242/2016\\_02\\_29\\_When\\_Brownfield\\_isnt\\_enough.pdf](https://assets.ctfassets.net/6sxvmndnnpn0s/6bXEnCMoB3VS6lOK5XMSYh/b835e86f2f12dc8d8f41d86b6e823242/2016_02_29_When_Brownfield_isnt_enough.pdf)

- van Gent, W. P. C. (2010). Housing policy as a lever for change? The politics of welfare, assets and tenure. *Housing Studies*, 25(5), 735–753.
- Vaughan, L., Griffiths, S., Haklay, M. & Jones, C. (2009). Do the suburbs exist? Discovering complexity and specificity in suburban built form. *Transactions of the Institute of British Geographers*, 34, 475–488.
- Walks, R. A. (2005). City-suburban electoral polarization in Great Britain, 1950-2001. *Transactions of the Institute of British Geographers*, 30, 500–517.
- Wetzstein, S. (2018). The global urban housing affordability crisis, *Urban Studies*, 54, 3159-3177.
- Whittemore, A. H., & BenDor, T. K. (2019). Exploring the acceptability of densification: how positive framing and source credibility can change attitudes, *Urban Affairs Review*, 55, 1339–1369.
- Zube, E. H., Simcox, D. E., & Law, C. S. (1987). Perceptual landscape simulations: history and prospect”, *Landscape Journal*, 6, 62-80.