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Exploring 'good practice' densification projects: the impact of green space and density on local acceptance

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ABSTRACT

While the 'compact city' can provide environmental benefits, densification can result in negative trade-offs at the local scale – e.g. through increases in density and the removal of urban green space – and densification projects are often rejected by locals. This paper explores examples of densification in a compact European city, integrating different stakeholder perspectives from planners as well as neighbours of densification projects. Neighbours do not reject densification per se, but evaluate the individual projects and their contexts. Evaluation depended mostly on how the projects impacted urban green space, social mix and available parking spaces. Implications are discussed and 'good practice' criteria that could reduce the trade-offs of densification are suggested.

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Densification; compaction; compact city; NIMBY; urban density; urban green spaces

1. Introduction

The 'compact city' has become a central tenet of urban and regional planning policy. Compactness is pursued because it is said to have many environmental benefits compared to urban sprawl – among them lower energy use for transportation, economies of scale for public infrastructure such as connection to energy grids, public transport or cultural and social institutions, and the conservation of valuable land for agriculture, biodiversity and climate adaptation. There are also social benefits such as more accessible public and commercial services or more active modes of travel, and thus more active living. While some of the virtues of the compact city are debated (Berghauser Pont et al. 2021; Ihlebæk, Næss, and Stefansdottir 2021; Lin and Yang 2006), it is a major paradigm now, and many states and cities have made compactness a planning goal (e.g. EU Leipzig Charter 2007; EU Territorial Agenda 2030 2020; New Leipzig Charter 2020). To achieve, maintain, or increase compactness, *densification* – building inside the boundaries of the existing city – becomes an important strategy to accommodate urban population growth and housing demand.

There are also trade-offs on the local scale. The removal of urban green spaces and trees in the wake of densification reduces quality of life for residents (Næss, Saglie,

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and Richardson 2020), results in hotter microclimates (Erlwein and Pauleit 2021), and could lead to injustices between those who are able to travel to green spaces further out, and those 'trapped in dense urban areas with insufficient green space' (Westerink et al. 2013). However, the role of green spaces or trees has been little researched, especially at project level. Densification can also increase traffic and noise. Citizens often and increasingly reject densification for these reasons, often slowing down or preventing projects.

In previous literature, residents generally appear to be sceptical of new housing construction in their area, as they assume negative externalities from the project, such as loss of green (Haaland and van den Bosch 2015) and recreational spaces (Williams, Burton, and Jenks 1996), a strain on public services and infrastructures such as schools or parks, and traffic increases (Pendall 1999). Research from the US has shown that homeowners often oppose housing construction because it brings new neighbours from lower socioeconomic strata into their neighbourhoods and reduces the value of existing homes (Pendall 1999; Scally and Tighe 2015; Whittemore and BenDor 2019). There is ample research on neighbours' rejection of densification projects from countries with traditionally dispersed settlement such as Australia (Cook, Taylor, and Hurley 2013; Nematollahi, Tiwari, and Hedgecock 2016), New Zealand (Vallance, Perkins, and Moore 2005) or the UK (Breheny 1997), where people are culturally set against dense urban forms and housing. However, these findings may not be applicable to areas that are already denser, not as segregated, and where the number of homeowners is often much lower – such as in many European cities.[1]

Residents may agree that a certain service or infrastructure is necessary *in principle,* but still oppose it being located in their vicinity. This has been coined NIMBYism ('not in my backyard'), first in relation to, e.g. waste disposal or energy projects, but later applied to opposition against housing construction (Burningham 2000). There is also a faction of residents with more general anti-growth sentiments, which opposes densification anywhere. Wicki and Kaufmann (2022) found these sentiments to be more prevalent in rural areas, while urban residents were generally either accepting of densification or NIMBYs.

However, neighbours don't automatically reject local housing construction. The literature suggests that acceptance increases when neighbours receive some benefit from densification, such as when it increases the accessibility of urban amenities (Williams, Burton, and Jenks 1996) or beautifies the area (Kyttä et al. 2013). Wicki, Hofer, and Kaufmann (2022) found that acceptance is higher when a project contributes to affordable housing and involves the public. For Germany, it was suggested that neighbours accept densification more when projects satisfy comprehensible needs, such as accessible housing for seniors (BBSR 2019). In contrast, citizens seem to reject densification when private developers profit from it (Klement et al. 2023; Monkkonen and Manville 2019).

This overview shows that densification can threaten aspects of urban liveability, but is not necessarily perceived as negative and depends on the location, design and implementation. Instead of propagating compactness as a goal in itself, individual cases should be evaluated as to their social and environmental sustainability (Neuman 2005), through a site-specific assessment of a project's threats and opportunities (Fatone, Conticelli, and Tondelli 2012).

While there is a large body of research on neighbours' *rejection* of densification, criteria for acceptance are less researched. There is a knowledge gap regarding good

practices for densification, especially in regard to its effect on urban green spaces (Haaland and van den Bosch 2015; Khoshkar, Balfors, and Wärnbäck 2018). For Germany, 'no criteria exist about which aspects should be kept in mind when (re)densification is implemented to avoid threatening the residents' acceptability towards compact cities' (Artmann and Breuste 2015, 10). Although some German studies have presented examples of 'good practice' (BBSR 2014, 2018, 2019), these often rely on planners to evaluate densification projects and omit the perspectives of other stakeholders such as architects, housing professionals, or residents. Thus, Khoshkar, Balfors, and Wärnbäck (2018) call for more research that includes stakeholders outside the municipal planning authorities.

Relying only on planners and architects to identify good practices might introduce biases. Planners generally view densification as a positive tool for sustainable city development (Holman et al. 2015), focus on broader urban issues such as decarbonizing cities, and sometimes overestimate the positive effects of density while underestimating the negative consequences (Berghauser Pont et al. 2021) without considering the specific place where a densification project is situated (Holman et al. 2015; Wallin et al. 2018). However, planners and architects interviewed by Holman et al. (2015) also reflected critically about whether or not densification projects had achieved their promised benefits.

We conclude that there is a research gap concerning the effect of densification in dense areas, such as many European cities, especially for good practice examples and studies that consider not only planners' evaluations, but the perspectives of different stakeholders. The goal of this study is therefore to examine how the compact city concept is executed in practice and perceived by different stakeholders by studying densification projects – and, if possible, to derive criteria for 'good practices'.

Munich, the capital of Germany's southern state of Bavaria, is a location well-suited to studying densification in already dense cities. Compared to other large German cities, Munich has a high population density of 50 inhabitants/ha (Bevölkerungsstatistik 2021), a large amount (46%) of impervious surface (Statistisches Amt 2017, 19), and relatively little green space. Public green spaces cover 39%, and urban trees 23%, of total city floor space (GeodatenService München 2020; Street Tree Layer 2012 of the EU Copernicus Project). For every inhabitant, there are 77 m^2 of open space (LHM PLAN 2015b, 18) – the smallest number of all large German cities, and this is expected to further sink to 67 m^2 by 2030 due to population growth (LHM PLAN 2015b). Population is expected to grow 16% by 2040 (Bevölkerungsprognose 2021). The city's housing market is strained, rental and purchase prices continually rise, and the issue of housing is hotly debated. There are constant calls for more construction, especially of affordable housing. As to planning strategy, Munich aims for a compact city, entailing mixed use, walkability and increasing urban densities (LaSie 2022; LaSie Konzeptgutachten, 5; LHM PLAN 2011). The 'low-hanging fruit' of densification – conversion of large sites such as former airports, railway, or military areas – have already been picked during the last decades. Therefore, the city's densification strategy now focuses on former commercial areas (e.g. abandoned workshops) and larger housing estates – with simultaneous expansion at the city's periphery (LaSie 2022). Aside from the cited strategic documents, there is no citywide planning framework for densification, and authorities approve projects on a case-by-case basis. There has been increasing protest against densification and a discourse about densification endangering urban green space and liveability, as well as

population and building densities becoming too high. It is in this contested environment that our investigation is situated. In the next section, we will introduce the materials and methods used. Results will be presented in section 3 and discussed in section 4.

2. Materials and methods

Prior studies using survey experiments (Wicki, Hofer, and Kaufmann 2022) are informative and have methodological strengths, but only test hypothetical, not built, projects. Single-case studies can offer a rich account of how local conditions influence the acceptance of real densification projects (e.g. in Wallin et al. 2018), but a case study design is considered stronger when it can contrast multiple cases (Yin 2003, 46). We therefore conducted a multiple-case study where the projects varied in conditions that, based on prior literature, are relevant for acceptance. We focused on 'good practice' examples because this was identified as a research gap. Also, we assumed that stakeholders might discuss positives and negatives in a more nuanced way than they might do reviewing 'worst practice' examples.

2.1. Expert interviews and case selection

We first drew up a database of densification projects that had won important architecture awards (Deutscher Bauherrenpreis; LHM PLAN 2015a, 2018; STMB 2020) and/or had attracted press coverage. For these, we interviewed planning experts, architects, and/or building owners involved in the planning/construction process. Additionally, we interviewed local politicians and activists, as they are key stakeholders and often have keen knowledge of the local situation. To supplement the research through architecture awards and press coverage, we employed a snowball method: Interviewees were asked for further recommendations on interesting densification projects and other relevant stakeholders who should be interviewed. Sampling stopped when already-interviewed experts were repeatedly recommended and there was a saturation of information, i.e. only limited new perspectives appeared in the interviews. We interviewed a total of 18 experts.[2] Interviews were transcribed and evaluated using qualitative content analysis.

From the interviews, we obtained the discussion of 16 best practice projects. For a closer evaluation we selected five of these that represented a variety of project characteristics (modes of densification, owner type, price category of housing created, population density of the area and impact on green spaces). All selected projects are located in existing residential neighbourhoods and next to other buildings. For an overview of the selected projects, see Table 1.[3]

2.2. Neighbour survey

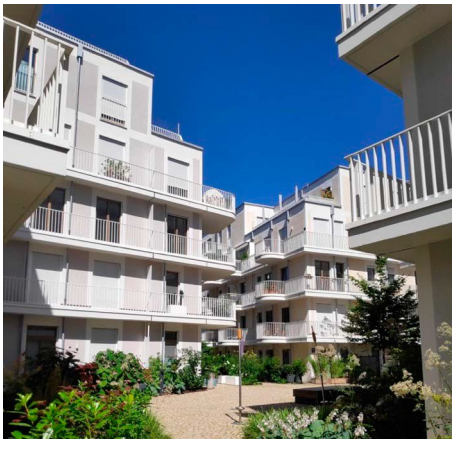
The projects were considered good examples of densification by the committees of architecture prizes and our interviewed experts from planning and architecture. As research has shown that their opinions often differ, we aimed to complement the experts' assessments with the perceptions of residents. The idea was to explore the perspective of those who were most directly – and possibly worst – affected by the projects. This was also an opportunity to test the NIMBY hypothesis: were neighbours generally in favour of

Table 1. Overview of projects.

Gollierstraße

Courtyard restructuring in the course of necessary renovations. The underground garage was modernized, and the low building on top, which had housed workshops and apartments, was demolished and replaced by a new timber construction. The surrounding buildings were modernized.

– 6 newly built flats and 2 artist studios (public housing) for low-income renters
– 13 resident underground parking spaces were maintained



Theresienstraße

A former industrial repair site in a courtyard was demolished and filled with five large buildings.

– 117 new flats (condominiums)
– 160 new resident underground parking spaces

Postillonstraße

A timber-construction superstructure on top of a public car parking space.

– 100 new flats (public housing), mainly small (23 sqm) for low-income renters
– 107 public above-ground parking spaces were maintained

Braystraße

Two curved buildings were set inside a courtyard, an additional floor was added to surrounding buildings in the process.

– 66 new flats (rental)[a]
– 101 new resident underground parking spaces

Piusplatz
Four buildings were set in courtyards between existing row buildings.
– 64 new flats (public housing) for low-income renters, mostly larger flats for families
– 84 new resident underground parking spaces

[a]This number refers only to the new buildings inside the courtyard, since we could not assess how many apartments were created by the additions to surrounding buildings.

densification, but rejected the project on their own doorstep? We expected to receive many of the complaints already studied in the literature – but if the neighbours' feedback varied between projects or was even positive, we might be able to deduce factors that had influenced acceptance.

In July 2021, we delivered 100 questionnaires to the buildings surrounding each project.[2] In one case the response rate was very low (Piusplatz) and we distributed 150 additional questionnaires (Table 2). By delivering the questionnaires personally, we could ensure all addressed buildings really were in close proximity of the densification project.

2.3. Data and analysis

The questionnaires included a mix of mostly Likert-scale questions and additional free text sections for respondents' commentaries.[4] Free texts were analyzed using qualitative content analysis. Scales were analyzed using descriptive statistics and the statistical software Stata for correlation analyzes. In the text, we report only correlation coefficients (Spearman's rho) significant at least at the 5% level that appear relevant and plausible in light of the other data sources.

Furthermore, we obtained data on density, impervious surfaces and tree population before and after construction from a prior study (Grießer 2020) and additional analysis of satellite images.

3. Results

3.1. No NIMBYism, but sensitivity to local context

While interviewed experts see potential for densification in the city, residents were more conservative in their estimation (experts: mean of 2,7 and residents: mean of 2,1 on a scale from 1 = densification potential fully exploited to 4 = potential not yet exploited at all). Still, residents were relatively positive towards housing construction in general. Most agreed with the statement that 'more housing has to be built' (68%), while 42% agreed that 'too much is being built'. The assessment of densification

Table 2. Overview response rates: 136 completed questionnaires were sent back from the total of 650 delivered, which amounts to an overall response rate of 20.9%.

	Dantebad	Therese	Gollierstr.	Braystr.	Piusplatz	Average
Completed questionnaires	33	37	14	23	29	n.a.
Response rate	33.0%	37.0%	14.0%	23.0%	11.6%	23.7%

Completed questionnaires.

potential for the city has a strong positive correlation with the acceptance of new construction (correlation coefficient $cor = 0.64$) – those who think there is still a large densification potential also tend to accept new construction more. The NIMBY argument would predict that even when residents approve of housing construction on the city level, they would oppose the densification project 'in their backyard' because of its negative externalities for themselves. Several experts shared this sentiment: 'I think you have to accept that this egoism […] is human nature – as soon as it affects someone personally, they react differently […] and abandon the whole-city perspective' (B4: 100). However, this view was not confirmed in our survey. The general acceptance of new housing construction and the estimate of densification potential for the whole city are both positively correlated with the acceptance of the densification project in their own neighbourhood (at $cor = 0.33$ and 0.44, respectively). Residents seem to 'follow through' on their acceptance of densification from the municipal to the local level, or vice versa.

There was a small group with general anti-growth opinions. While experts from planning and architecture did not debate the need for housing construction, some activists and local politicians suggested 'demand-side management' strategies to reduce the need for construction. For example, the municipality should stop its programmes to attract businesses, or the state should fund development in economically weaker regions instead of the capital (B3: 105, 157, B9: 110, B13: 81, B15: 47). A few residents echoed this 'degrowth' argument: 'The municipality should consider whether it really needs all the Googles, Apples and Amazons or whether it can do without these harmful giants. Then we'd have fewer housing problems.' 26% of residents agreed that 'building activity in the city should be stopped'.

As could be expected, residents' first reactions upon hearing about the densification project are generally negative: 58% were 'unhappy' or 'very unhappy' about the news. Still, 21% reacted positively ('happy' or 'very happy'). We gave residents the opportunity to comment on their first reactions. The most frequent reasons for a negative first reaction were concerns about loss of green space (19 mentions) and trees (11), higher density (22) and that there would be fewer parking spaces or more traffic (11). These unprompted comments reinforce that green space, as well as changes in density and traffic, were the most pressing issues in the acceptance of the densification projects. The comments about positive first reactions reflected a general acceptance of new housing construction (10), an expected improvement of the site (8), and for Postillonstraße, the building of a superstructure above car parking spaces, which was considered a promising concept (5). The latter two, in particular, show that residents consider the local context and the specific characteristics of the proposed project and are not, by default, against densification.

3.2. Impact of the densification projects on urban green

Of the five projects, the densifications inside completely paved courtyards (Theresienstraße, Gollierstraße) were numerically the most beneficial. Both reduced the impervious surface by about 30 percentage points – replacing it with lawn or pervious surfaces such as cobblestone – and significantly increased tree counts on sites that had been entirely, or almost entirely, without greenery. The two projects inside green courtyards (Braystraße, Piusplatz) increased soil sealing, and a large number of trees were felled during construction. At Piusplatz, the felled trees were more than replaced, while at Braystraße, there was significant replanting, but not up to the level before construction. Lastly, the Postillonstraße house was built on an entirely paved site and thus had no effect on either greenery or soil sealing. Two trees had to be felled during construction, of which one was replanted. However, residents' feedback in several instances differs from this quantitative assessment. As we will see, important local details in design and execution have a strong impact (Table 3).

The two completely paved courtyards (Theresienstraße, Gollierstraße) have one key difference when it comes to their green space: Theresienstraße is not accessible to the public, whereas Gollierstraße is. The Theresienstraße development consists only of high-priced condominiums. Its green courtyards are walled off from the street and can only be accessed by key or application to the concierge. While some surveyed neighbours still approved because the project had greened the site and they now have a more attractive view, many resented the inaccessibility of the space and its urban greenery: 'great courtyard, but only for residents', '"Luxury ghetto", not a publicly accessible space'. Consequently, although the project has decreased soil sealing and increased the tree count substantially, the effect of the densification on the urban green infrastructure was actually rated as *negative* by 56% of respondents. Gollierstraße, on the contrary, created a playground and sitting area accessible to residents around the project. Eight trees were newly planted. Since a dividing wall was removed during the restructuring, residents also gained the ability to cross through the courtyard to the next street. Many neighbours evaluated the change in green space positively (43% of respondents), although some commented that the densification did not create more green space, or could have created even more.

For the two projects inside green courtyards (Braystraße, Piusplatz), the main difference appears to be the quality of the former green spaces. The Piusplatz project felled 30 trees, but an astonishing number of residents evaluated the change as positive (38%). While 7 respondents commented that green space had decreased, 5 commented that it had increased (in quantity and/or quality) and 4 stated they had perceived no change, or that the replacement was adequate. Some respondents commented on the positive changes to the existing green spaces, e.g. modernization or new playgrounds for children, where before the spaces had been empty except for laundry rods. An architect involved in the project described the green spaces prior to construction as aged, not well maintained, and little used (B14: 8). The Piusplatz project had drawn on federal urban renewal funds for participation formats. In these, residents met with housing company representatives, architects and landscape architects to discuss how the green spaces could be improved, for example, by adding playgrounds for children (B17: 23, B14: 8).

The green courtyard at Braystraße, on the other hand, had been perceived by residents as a 'green lung' or 'private park' inside the block which the neighbours had jointly used

for a variety of functions (playground, relaxing, sunbathing, barbecue) and described as a home to different animals. This variety of functions was lost after the densification, leaving only a playground and benches without backrests, perceived as unfriendly to seniors. The new design of the remaining green spaces was considered a poor replacement: 'architects' scrub [Architektengestrüpp] replaced a green space with native plants'. The acceptance of this project was very low (overall negative evaluation: 70% of respondents; negative evaluation of project's impact on local green infrastructure: 91%). This negative evaluation is in stark contrast with that of experts from planning and architecture. The project had won several architectural prizes for the clever design of the buildings, constructed in organic shapes in order to save trees. A Munich jury gave the project an award for good housing construction (categories 'space efficient' and 'well inserted'), especially highlighting the 'protection of the tree population [in one part of the courtyard] used for the differentiated design of public, continuous open spaces and quiet courtyard areas' (LHM PLAN 2018, 22). The architecture firm's website claimed that 'The valuable tree population is almost entirely preserved', when in fact 36 decades-old trees had been felled and soil sealing almost doubled. One interviewed expert from architecture/planning who had worked on the project considered it a success story with great acceptance after initial scepticism (B4: 132, 140) – a notable difference when compared to residents' perceptions and the conditions on the ground.

Lastly, the Postillonstraße project did not change either soil sealing or green space. On its roof, a terrace for residents was created with some green elements such as raised beds, but this private space was hardly mentioned by the surveyed neighbours. Their

Table 3. Green indicators and perception.

	Postillonstr.	**Theresienstr.**	**Gollierstr.**	**Braystr.**	**Piusplatz**
Trees felled and planted on-site during densification					
Trees felled	2	1	0	36	30
Trees planted	1	13	8	27	32
Soil sealing (change in impervious surface due to densification)					
Soil sealing	No change (100% sealed)	99.9% to 72%	100% to 69.9%	33.6% to 58.1%	25.4% to 33.8%
Residents' evaluation of the project's impact on local green infrastructure					
Negative	28%	56%	29%	91%	46%
Neutral	66%	25%	29%	5%	15%
Positive	6%	19%	43%	5%	38%
Residents' overall evaluation of the densification project					
Negative	46%	62%	0%	80%	48%
Neutral	25%	21%	55%	20%	20%
Positive	29%	17%	45%	0%	32%

The colour highlights evaluate the change in green/soil sealing: improved (green), worse (red), little or no change (orange). For residents' perception, only selected figures – that appear especially informative or surprising – were highlighted.

evaluation of the project's impact on local green infrastructure is therefore mostly neutral – with one respondent's comment ('there aren't more green spaces because of it') pointing to a sense of 'lost potential', which might explain the 28% of negative evaluations.

Statistical analysis of the questionnaires shows that the perception of a project's impact on local green space correlates quite strongly with the overall evaluation of the project (cor = 0.45). If a project enhances the green infrastructure of a neighbourhood, residents are more likely to approve of it.

3.2.1. Densification potential for different urban areas

Experts agreed that densification could actually improve living situations on urban sites of low building or residential density but high levels of impervious surface and little green space, e.g. former workshops, industry sites, or garages with asphalt courtyards (B5: 84–95). They have a high potential for conversion, unsealing and greening. Our cases confirm this, to some extent: Densification could green such grey areas, as was the case in Gollierstraße. However, as became apparent in Theresienstraße, while paved courtyards are a preferred spot for densification and greening, the 'how' matters. The green spaces were more successful when they were accessible to residents and designed according to the users' wishes (e.g. Piusplatz), rather than architects' visions (e.g. Braystraße).

Another case is the post-war housing estates with ample green spaces between row buildings or inside blocks, built according to the Athens Charter principles to provide 'light, air and sun', with floor area ratios between 0.8 and 1.2 (B16: 19). There, experts saw high potential to improve the often desolate and underused green spaces along with densification. The higher quality of improved green spaces could then balance out the increased residential densities (B1: 142–143). The Piusplatz case seems to point in this direction. Here, residents were asked about their uses of the spaces and how the area could be improved. Seeking residents' feedback is, however, the exception and not the norm: Public participation is costly, and at Piusplatz it was financed by urban development funds. According to one expert, municipal housing companies occasionally shoulder the costs because with participation, tenants will be more satisfied – but the expert assumed that private companies would most probably save on these costs (B14: 33–34).

Lastly, while urban green space mattered for acceptance in all projects, it can be critical for certain areas and population groups. Experts described green courtyards as especially valuable in central neighbourhoods that are denser and lack green infrastructure, and where courtyards provide important functions as 'green, quiet retreats' (B9: 68, B10: 122–126). In central as well as more suburban neighbourhoods, the green inside apartment blocks is important to residents with less mobility – e.g. those who are elderly, poor, or lack the knowledge – who cannot easily drive or cycle to public parks, but depend on nearby green spaces with benches (B3: 45).

3.3. Residential density and car density

After urban green space, changes in density and traffic increase were the most important concerns for the surveyed neighbours of densification projects.

When high density is perceived as negative, people feel crowded. We asked respondents to rate their perceived crowding in the district on a crowding scale (see Kalisch

and Klaphake 2007). In the district with the highest population, 68% of respondents feel (very) crowded (Table 4). However, for all other projects the crowding perception does not noticeably follow population density. The distribution of residents' answers (Figure 1) shows how broadly the perception differs. Crowding appears to be influenced by many more factors than 'objective' population density.

Whatever its cause, higher perceived crowding correlates with lower acceptance for densification in general and a lower assessment of urban densification potential (cor = −0.30 and −0.41). Apart from this tendency, residents again considered the local context when evaluating the projects.

3.3.1. Residential density: quantity and social mix

The complaints about residential density seem to roughly follow the actual population increases: The more apartments that were built, the more neighbours tended to complain about increased residential density. Apprehension was greatest for Theresienstraße and Postillonstraße, while residents at Gollierstraße and, to some extent, Piusplatz also perceived that the increase in residential density brought positive effects.

Comments for Gollierstraße saw the new residents in a positive light, as younger residents and families that brought 'positive revitalisation' to the sociodemographic structure of the area. Piusplatz residents commented equally as often on the positive aspects as on the negative aspects of increased residential density – positives included new neighbours, as well as an increase in services, culture and commercial infrastructure.

In the Postillonstraße and Theresienstraße projects, the social mix was a crucial topic. Since all Theresienstraße apartments are high-priced condominiums, several neighbours criticized the lack of affordability and social mix, with consequences for the social fabric of the district. The new owners are seen as 'isolated, not integrated into the neighbourhood', and the project was perceived to gentrify the area and drive up prices. At the other extreme, the project at Postillonstraße was constructed specifically to house newly arrived refugees in small and affordable apartments. With over 100 apartments planned on a narrow space, many survey respondents expected conflicts with the culturally different residents. One expert involved in the planning process vividly described the protests against the densification project, with several extremely racist objections made against the expected new residents (B11: 11–13). Following these initial protests, the apartment structure of the building was changed:

> The neighbours looked very closely at the project and saw that it would be a lot of one-room flats. Based on the refugees that had arrived [in 2015], they were worried that it would be an all-men refugee home. The housing company reacted well to this by making sure that there was a mix of people in the apartments. So now 50% of the flats were for refugees and 50% were subsidised housing. Attention was paid to ensuring a very good male-female ratio. And that was also the moment when the family flats came back into the project. In order to have a better social mix, 14 flats for families were added. We had already tried this out and suggested it in the initial phase of the project, but the municipal housing company was more oriented towards a mathematically measurable demand, so to speak. They had a shortage of flats for trainees, students, and refugees – a high demand for one-room flats. And the structure of our building lent itself to that. Family flats could be built just as economically elsewhere. But for our project, this mix makes a lot of sense, it was definitely the right thing to do for the social mix. That was a very good process. (B2: 54–67)

Table 4. Density indicators and perception.

	Postillonstr.	Theresienstr.	Gollierstr.	Braystr.	Piusplatz
Population density (hab./km²)[a]	6,472	29,790	13,406	18,224	8,743
Apartments created (absolute)	100	117	8	66	64
Density perception of residents (agreement with the statement)					
District is (very) crowded	28%	68%	14%	39%	21%
District is (rather) not crowded	38%	11%	14%	13%	14%

[a]Numbers are for the sub-districts in which the projects are located (smallest available unit of municipal statistics), and for the year 2021; Munich average: 5027 hab./km²(Indikatorenatlas München 2021).
The colour highlights show how the population density of each project compares to the others: lower (green), higher (red), mid-range density (orange).

This expert describes the social mix as being beneficial for acceptance, as well as for the project itself. In our survey, there were few negative comments about the new residents. Many commented positively that affordable housing was created for those who truly need it (10) and a few even mentioned explicitly that the project had improved social mix and local diversity (4).

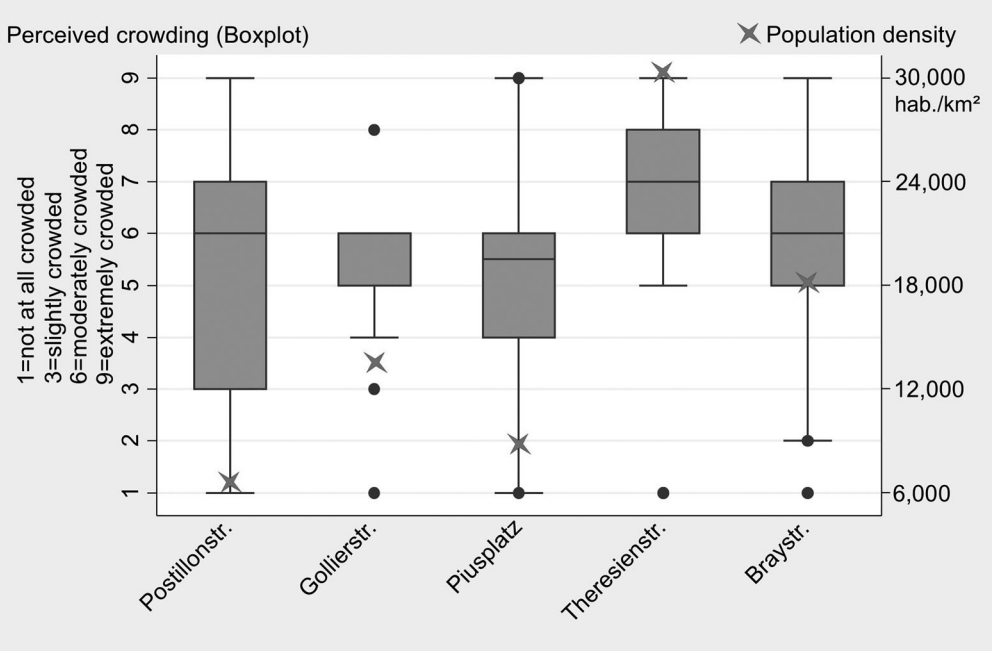


Figure 1. Distribution and median for residents' crowding evaluation of each district, and objective population density for reference. Numbers are for the sub-districts in which the projects are located (smallest available unit of municipal statistics), and for the year 2021; Munich average: 5027 hab./km² (Indikatorenatlas München 2021).

From these cases, it appears that smaller projects tend to be more acceptable and allow neighbours to see not only negative effects, but also some benefits of increased density. In projects with higher numbers of apartments and residents, the social mix as well as the affordability appeared to influence acceptance: When projects are 'monofunctional' (e.g. only for rich people, one-person households, or refugees), neighbours are more apprehensive than with mixed apartment structures. In Munich, a city with very high rents, affordable housing appears to be more accepted by neighbours than expensive housing.

3.3.2 Car density: parking spaces above and below ground

Next to urban green space and higher density in general, increased *traffic* density was one of the top concerns for survey respondents. We call this 'car density' because it concerns not only the increase in car traffic on the streets, but also the question of where the additional cars are parked. Larger densification projects usually mean more cars – in the federal state of Bavaria, this is enshrined in the law: For each residential unit, one dedicated private car parking space has to be provided.

At Postillonstraße, traffic density was the most important concern for respondents. There was already a certain pressure on the public parking spaces, since residents as well as visitors to the nearby public swimming pool use them. Since there was no plan for an underground garage, residents expected that with the construction of 100 apartments, 100 public parking spaces would be turned into private ones – per the Bavarian mandate of one dedicated parking space for each apartment. However, the mandate was successfully negotiated with the approving authority down to 0.2 parking spaces per residential unit since the future residents – refugee and other low-income households – in all probability would not own cars. In effect, none of the new residents had a car, so there was no loss of parking spaces (B2: 99–102).[5] In our survey, many commented positively that the expected 'traffic chaos' did not materialize, and all parking spaces were conserved due to the building's architecture. One expert reported that the initial protests against the project clearly decreased after it had become apparent the public parking spaces would be preserved (B2: 55, 71).

At Theresienstraße, a similar number of apartments were built – but this project created a total of 160 underground parking spaces for 117 apartments, well surpassing the mandatory amount. Households who can afford to buy an apartment in Munich will plausibly own one or more cars (B16: 173). Garages were dug two stories below ground, which proved extremely noisy to surrounding residents.

The impact of parking spaces is clear throughout the analyzed projects. The acceptance of the Postillonstraße project increased significantly when it became apparent that there would be no competition for public parking spaces from the new residents. While underground parking spaces seem to solve the conflict for public space, they have several other consequences. First, there is the construction effort apparent in the Theresienstraße case. Second, they compete for underground space with urban trees. For all projects analyzed, except Postillonstraße, most of the newly planted trees are situated on underground garages (Table 5). Since this inhibits rooting, the trees cannot be expected to grow much. Thus, densification not only removes urban green space during construction, but when accompanied by underground parking, it also limits the potential of replanting.

There is a third, maybe less obvious consequence of parking spaces which one real estate developer described:

> We don't bother with small flats. If I have a hundred micro-apartments then I need a hundred parking spaces. In the city centre, a building site is perhaps a thousand square metres in size. One parking space requires 25 square metres, if it's efficient. That means I need 2,500 square metres just for parking spaces, that's two and a half basement floors, when it's a substructure under the entire property, which I'm not allowed to do. So I need three basement floors and then another basement floor for cellars. So I need four to five basement floors, you can forget that, it's not possible. [If we didn't have these limitations,] there would be a massive change. There would be significantly more flats. They would be smaller, but there would be significantly more. And I'm not just speaking for myself, I'm speaking for many market participants. (B5: 130–135)

From this perspective, the obligation by Bavarian state law to ensure one car parking space per apartment is seen as a barrier to housing construction – effectively keeping housing companies from building the small apartments that are in high demand.

4. Discussion

The study showed that densification projects vary significantly in their effects on local conditions and their acceptance. While many experts described residents' reactions to densification projects with the NIMBY narrative, we found that most residents were not generally against densification and those who support housing construction in general also tend to support it 'in their backyard'.

A small portion of residents were generally against new construction, some proposing degrowth arguments, e.g. reduce the city's economic growth to enhance liveability. Wicki and Kaufmann (2022) similarly found that a section of Swiss residents oppose densification *anywhere*, but these sentiments were more prevalent in rural areas, while urbanites were generally either accepting of densification or 'NIMBYs'. Experts did not generally question the necessity of more housing construction, and tended to perceive more densification potential in the city than residents.

Densification projects that removed well-used green spaces and trees were less acceptable to residents. Replantings are often a poor replacement, especially when situated over underground garages. The protection of existing trees should therefore be of the highest priority – to ensure the acceptance of residents, as well as for the urban microclimate. When projects created or improved (accessible) green spaces, they were generally better accepted. This empirically confirms the suggestions of prior literature (BBSR 2019; Kyttä et al. 2013). Admittedly, the cases where densification can enhance green space are probably fewer than where it diminishes green space. Yet these spaces exist and should be duly prioritized in urban planning – especially in central areas, where green space is in high demand. The green spaces created in the wake of densification should be accessible to the public. The 'privatization of public open space' through densification has been observed in other cities (Treija, Bratuškins, and Koroļova 2018), and our case shows this has a strong negative influence on acceptance.

Densification could enhance little used green spaces of poor quality, e.g. in post-war housing estates. However, some have criticized this approach as it reduces the access to urban green space for often already disadvantaged population groups living in these

Table 5. Comparison of old and newly planted tree.

Piusplatz: old tree with unhindered rooting

Piusplatz: newly planted tree on underground garage

estates (Treija, Bratuškins, and Koroļova 2018; Zalar and Pries 2022). Zalar and Pries (2022) state that planners assess green space 'qualities' in the abstract (e.g. based on maps), without examining the actual functions of the green spaces for the people in the neighbourhoods. In one case (Braystraße), we found a similar disconnect between planners' and neighbours' perception of green spaces and the impact of densification. In contrast, when green spaces were improved together with residents, the acceptance also improved. Our cases show that the functions of similar green spaces can differ immensely and should be studied *in situ*. Assessing their actual use would make sense not only to fact-check the perceptions of planners, but also those of neighbours – since residents might over-report the value of spaces endangered by densification where planners might under-report them. Functions and uses could be assessed through observation or interviews with local experts such as social workers or tenant management.

In prior literature, locals appeared to reject densification when the profit would go towards private developers (Klement et al. 2023; Monkkonen and Manville 2019). Neighbours in our survey not only resented high-priced and inaccessible development, but they also appeared to accept development more when it created affordable housing for those in need. This supports the thesis that neighbours accept development more when projects satisfy comprehensible demands, e.g. accessible housing for seniors (BBSR 2019). Whether private or affordable, the social mix of densification projects clearly mattered for acceptance. However, private developers seek profit and housing companies are pressured to fulfil quotas of 'measurable demand' (e.g. much-needed one-person apartments), which makes it harder to achieve a social mix. This increasing political pressure on social housing companies was also found in BBSR (2020), and it could lead to problematic monofunctional developments with poor local acceptance.

Residents who felt crowded in their neighbourhood showed lower acceptance of densification in general. However, the crowding assessments did not clearly follow the population density values, and there were large variations in perception between respondents. This suggests that (numerical) residential density is moderated by individual, sociocultural and contextual factors, and, as the crowding literature has established (Rapoport 1975), people can perceive a dense neighbourhood quite differently. Thus, individual perception of crowding and a project's properties might be more important than the numerical density.

While underground garages were well accepted by survey respondents, they appear problematic for other reasons. Since they prevent root growth, they also hinder effective climate adaptation (Erlwein and Pauleit 2021). The state mandate of one parking space per residential unit could also inhibit the construction of smaller apartments. This might partly explain why housing companies cannot fulfil the increasing demand for small, affordable apartments (as observed in Weber 2020). A reduction of this mandate could have a positive effect on the supply of smaller flats. However, the current demand for parking spaces also has to be taken into account. Until the mobility transition that is necessary from a climate standpoint has been achieved, flexible buildings without underground garages could fulfil this demand. Superstructures like Postillonstraße can maintain above-ground parking spaces, which can easily be unsealed and greened when car ownership declines. Above-ground multistorey car parks could house cars and later be converted into housing for people (Konstanz PLAN, 49–53; Senatsverwaltung Berlin 2018). Ensuring the social mix in densification projects would also mitigate the effects of densification on local traffic, as affluent households are more likely to own cars while garages in social housing often remain empty. Additionally, housing companies could make a portion of their apartments car-free by including this as a condition in the rental contract, as is already practiced by one Munich housing cooperative that we interviewed.

5. Conclusion

5.1. Main takeaways

In this study, the 'NIMBY' hypothesis was not confirmed. Whether a densification project is accepted or rejected by residents depended much more on different socio-environmental factors summarized in Table 6.

In several instances there was a noticeable difference between interviewed experts from planning and architecture and surveyed residents. Experts see more densification potential in the city and do not debate the need for housing construction, whereas residents see less potential and there is also a portion of 'degrowth' voices. Architectural experts can assess an area's green spaces quite differently than the local population. In these cases, citizen participation could lead to better understanding of local needs and increase acceptance.

5.2. Limitations and further research recommendations

The results from a case study cannot claim to be representative for densification projects in general. Rather, the goal is to add insight to theories, which can then be tested on other

empirical examples (Yin 2003, 38). An important limitation of this study is that the selection of only 'good practices' might have narrowed the range of discussion topics, and therefore missed some relevant criteria. For further research, it would be interesting to test the criteria we have found with a 'two-tail' design (Yin 2003, 52) that also includes cases from the other extreme, i.e. 'worst' practices. Further studies could also include more environmental parameters, e.g. noise levels, and ask residents about further lifestyle changes, such as different mobility patterns if densification improved public transport. People who felt crowded in their neighbourhood were less accepting of densification, but we could not establish a link to objective population density. This relationship could be an interesting area for further studies.

Another limitation of our study is that it asked for opinions only after the projects were built. A panel design would be more helpful in assessing how the projects themselves might have influenced neighbours' general perception, and vice versa. For example, when neighbours perceive a nearby densification project to be a success, this could influence how they see the city's densification potential. A panel design could also shed light on how perceptions change over time – while many survey respondents reported to have reacted quite strongly to the initial plans, the comments also showed that evaluations change, and new buildings or new neighbours 'turned out alright' in the end.

5.3. Policy and planning recommendations

Not only for microclimatic and biodiversity reasons, but also to increase acceptance, the protection of existing trees should be of the highest priority in densification projects. Locations where densification can enhance green space should be prioritized in urban planning. Before construction, the use of and demand for green spaces should be checked with the population and local experts, as planners and architects are removed from local context and can only assess green space 'qualities' in the abstract. Although costly, this participation could greatly increase acceptance.

Due to market or political forces, developers prioritize projects geared towards certain household or income groups. Policies should ensure social mix to increase acceptance and mitigate the effects of densification projects on local traffic.

For Bavaria, reducing the state mandate of one parking space per residential unit could have a positive effect on the supply of in-demand smaller flats. Reducing car numbers would free up space for trees and greenery, but residents reject projects when they decrease available parking spaces in the area. Until the necessary mobility transition has been achieved, innovative solutions such as superstructures or above-ground multistorey car parks, as well as car-free households per rental contract, are necessary.

Table 6. Factors contributing to neighbours' acceptance of densification projects.

+ support for housing construction in general	– rejection of housing construction in general
+ improvement of existing green spaces	– removal of trees and well-used green spaces
+ creation of new (accessible) green spaces	– creation of inaccessible, private green spaces
+ no change to parking spaces available in the area	– decrease of available parking spaces
+ improvement of neighbourhood social mix	– lack of social mix in new buildings
+ affordable housing with a good social mix	– high-priced and inaccessible housing

Notes

1. In Munich, where our study is situated, 75% of households are renters (LHM PLAN 2020, 26).
2. Informed consent was obtained from all participants, with detailed information on study aims and participants' rights, according to the ethics and data protection requirements of faculty and university.
3. Bird's eye view photos comparing the sites before and after the constructions can be accessed in the appendix.
4. See appendix for translated questionnaire.
5. Experts confirmed that, city-wide, many low-income households do not own cars and the obligatory parking spaces in municipal housing projects therefore often remain empty (B1: 125, B2: 99–102).

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