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Relationships between Population Density and the Perceived Quality of Neighbourhood

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Population density and perceived neighbourhood quality
ABSTRACT

Two overseas survey-based scales measuring perceived quality of neighbourhood were adapted and replicated in a New Zealand context. An Italian study (Bonaiuto, Fornara & Bonnes, 2003) measuring Perceived Residential Environmental Quality (PREQ) and an American study (Carp & Carp, 1982) using the Perceived Environmental Quality Indices (PEQI) were applied to a sample of Auckland residents, separated into low, medium, and high population density areas. 369 respondents completed the surveys which measured attitudes towards subjects such as noise, neighbours, accessibility, green areas, welfare services, recreational services, safety, maintenance, environmental health, transport services, and characteristics of an ideal neighbourhood. Primary analyses examined differences in perception across the three density groups. The factor structures of both scales were replicated with the Auckland sample, and differences across densities were found for subscales of the PREQ. The results are discussed in relation to the cross-cultural similarities of perceived environmental quality, and the idea that environmental satisfaction is based on balancing aspects of the residential environment is proposed.

A recent comparison of the quality of living in 215 cities around the world ranked Auckland, New Zealand, 5th overall (Mercer, 2006a). However, like many others (for example Bell, 2000; Ministry of Social Development, 2003; Statistics New Zealand, 2006), this measure, is focused primarily on objective elements of the living environment. It does not take into account subjective perceptions of the environment. In fact, elements that may improve overall quality of life (QoL) for some residents, such as high levels of excitement and vibrancy, may reduce the quality of living score (Mercer, 2006b). Despite its high ranking, and the relative merits of living in such a city, to obtain a full picture of what life in Auckland is like it is necessary to examine Aucklanders' perceptions of their city. For instance, issues with Auckland's transport infrastructure are well publicised (see for example, Fitzsimmons, 2005; The University of Auckland, 2005), but how this actually affects residents' QoL is not so clear. Being aware of a problem does not mean being bothered by the problem (Thomas et al, 2004).

Quality of life has been studied cross-culturally, with both cross-cultural similarities (e.g. Jenaro et al, 2005; Xu et al, 2005) and differences (Jenaro et al, 2005; Murphy et al, 1998; Priebe et al, 1998; Warner et al, 1998) being detected. The World Health Organisation (WHO) has worked on a QoL measure that is consistent across cultures, the WHOQOL (The WHOQOL Group, 1997, 1998a, 1998b). Cross-cultural research using the WHOQOL has supported earlier findings (e.g. The WHOQOL Group, 1998b) that there are four major domains associated with QoL; physical, psychological, social relationships, and the environment (Power et al, 1999).

Residential satisfaction (RS) is associated with the environment domain, and is thought to contribute to overall QoL (Amérigo & Aragonés, 1997; Dunstan et al, 2005). Residential satisfaction has been characterised as the interaction between an individual and their (RE) (Amérigo, 2002), and has been defined as "the experience of pleasure or gratification derived from living in a specific place (Bonaiuto et al, 2006, p 24)". Lower levels of RS may be associated with poorer health (Cho et al, 2005). Under the conception outlined by Amérigo (2002) the RE consists of the home, the neighbourhood in general, and the neighbours. The RE can also be viewed as a specific element in the general environment that humans experience (Fried, 1982). More detailed descriptions of RS can be found in Francescato (2002) and Gärling and Friman (2002).

The focus of the current study is perceived neighbourhood quality, a factor contributing to RS (Bonaiuto et al, 2006). Two surveys, originally developed in an Italian (Bonaiuto et al, 2003, 2006) and an American (Carp & Carp, 1982) context, were tested on residents from Auckland, New

Population density and perceived neighbourhood quality Zealand, who lived in areas with different population densities (high, medium, and low). The factor structures were compared between the Auckland samples and the samples the surveys were developed on, and differences between the population densities for the Auckland sample were examined.

Population density has been studied in relation a number of factors, including crowding (Chan, 1999; Nagar & Paulus, 1997), mental health (Freeman, 1978), friendliness (Amato, 1980), and misanthropy (Wilson, 1985). However, the main focus for this study is how population density affects residents' perceptions of their neighbourhood. For instance, research has been conducted examining how population density affects QoL. Cramer et al (2004) measured seven QoL elements, and combined the seven together to give a global QoL measure. They found that as the population density increases global QoL decreases. Regarding the neighbourhood, higher population density was related to an increase in negative life events (although this element included both criminal and non-criminal events) and a reduced perception of neighbourhood quality.

Carp and Carp (1982) developed the Perceived Environmental Quality Index (PEQI) survey to examine how residents perceived the environmental quality of their neighbourhoods. The PEQI consisted of 11 scales examining the respondents' satisfaction with aspects of the living environment, such as aesthetics, air quality, neighbour characteristics, noise characteristics, and also included an additional 2 scales asking about their ideal neighbourhood. Their sample was drawn from residents living in the Bay Area of San Francisco and was administered via a personal interview. Their goal was to see whether objective information about the environment, including housing type and distance to the nearest freeway, could predict PEQI scores beyond the effect of subjective ratings of neighbourhood characteristics. After partialling out the effects of the subjective ratings the objective information still significantly predicted respondent scores on the PEQI.

The Perceived Residential Environmental Quality (PREQ; Bonnes et al, 1997; cited in Bonaiuto et al, 1999) is similar and was designed to evaluate resident perceptions of their nearby environment was survey. One of the aims of this survey was to predict neighbourhood attachment, measured by the Neighbourhood Attachment Scale (NAS; Bonnes et al, 1997, cited in Bonaiuto et al, 1999). The survey was administered via personal interviews for this study, as well as for the subsequent studies. The scales for the original version of the survey suffered from a number of problems: poor inter-item reliabilities for many of the scales; insufficient items for some scales; an uneven number of positively- and negatively-worded items for some scales; and items that were overly long or had double meanings (Bonaiuto et al, 2003, 2006). These issues were corrected in the later studies, with only two of the scales having Chronbach's alphas below .8.

Bonaiuto and colleagues developed the survey on a sample drawn from Rome (Bonaiuto et al, 1999; Bonaiuto et al, 2003), while participants for the most recent study were sampled from 11 Italian cities from the north, centre, or south of the country (Bonaiuto et al, 2006). An additional aim of the most recent study was to examine whether the survey could discriminate between the sampled cities. They concluded that the PREQ could discriminate between larger and smaller cities, and between cities in each geographic location (north to south). They note, however, that as only two northern cities were used the overall findings from the survey may only be generalisable to central and southern Italian cities. While not an explicit goal, Bonaiuto et al (2006) seemed to be interested in neighbourhood quality and population density, indicated by their examination of larger and smaller cities. However, any density effects are confounded by differences between the cities. The PREQ may be able to discriminate between cities of different sizes, but it had not been tested on different population densities within the same city.

One term that requires clarification is *neighbourhood*. Given that the term can mean different things to different people (Amérigo, 2002; Carp & Carp, 1982) care must be taken with its definition. For instance, Carp and Carp (1982) cite a variety of studies in which the size of the area defined as a neighbourhood varied from a small group of houses (four to six) to 800 to 1000 acre (324 to 405 hectare) areas. One method, used by Carp and Carp (1982) and Bonaiuto et al (1999), is to allow the respondents to answer the survey questions using their personal conception of their neighbourhood, rather than trying to define it for them. This subjective approach allows the respondents to answer the questions without making them consider a definition of neighbourhood that may be narrower or wider than their own conception.

The present study had three main aims. First, to test the PREQ and PEQI in a New Zealand context. This included an examination of the factor structure and the reliabilities of the scales using an Auckland, New Zealand sample. Second, to examine cross-cultural differences, or similarities, in the perceived environmental quality by comparing scale means from Bonaiuto et al (2006) with means from the Auckland sample. Third, to see if population density (low, medium, high) was related to perceived environmental quality.

Participants

Participants were selected from low, medium, and high population density areas of Auckland, New Zealand. Population density was calculated using Statistics New Zealand census data from 2001. The low population density group (1257-1326 people per square km), the medium population density group (3089 to 3109 people per square km) and the high population density group (4294 to 4351 people per square km) were calculated from the 15th percentile, the median, and the 85th percentile respectively. This method removes the absolutely lowest and highest population density areas to limit the chance of areas being chosen which are primarily non-residential, for example rural areas or halls of residence.

Out of a total mail out of 1998 surveys, 369 participants responded, with a further 144 surveys returned due to incorrect addresses, giving a response rate of 26%. The low response rate is in part due to the outdated nature of any cadastral database. The versions of the PREQ and PEQI used here were also longer than the original versions, and were mailed to participants rather than being completed via personal interview, which may have further reduced the response rate. Sample demographics, split by survey type and population density, are given in Table 1.

Table 1 around here

Materials

Two surveys were produced, one adapted from a translation of the PREQ (Bonaiuto et al, 2003, 2006), and the other adapted from the PEQI (Carp & Carp, 1982). Items from the PREQ and PEQI were reworded to fit within a New Zealand context and to ensure grammatical sense. In the adaptation of the PREQ the semantic anchors of the Likert scales were changed from “totally agree” to “totally disagree” to “strongly agree” to “strongly disagree”. Chwalow (1995) has argued that a translation of a scale should produce an equivalent scale, rather than a literal translation, so these changes are appropriate.

For the PEQI two new sets of items were produced based on existing scales (Carp & Carp, 1982). One examined the accessibility of the ideal neighbourhood and was based on the *accessibility* scale. The other examined the characteristics of the present neighbourhood and was based on the *ideal neighbourhood* scale. In addition to these changes, disruption to sleeping was added to the scale

Population density and perceived neighbourhood quality *noise from neighbours and own home*, giving a total of 102 items. Additional items were added to the end of the survey as described below.

A number of items were added to both surveys to measure the percentage of time spent in the neighbourhood, the quality of life, the quality of life compared to the average Aucklander, neighbourhood satisfaction, likelihood of moving, desire to move, length of residency, preference for section size or travel time to city centre, free time spent doing improvements to house and garden, and how many days in and average week participants travelled outside the neighbourhood to work, to socialise, to shop, for outdoor recreation, and for indoor recreation.

Items included to measure density were: the distance between the participant's front door and neighbours front door, the type of residence, section size compared to "kiwi quarter acre", and the type of neighbours. Demographic items measure occupation type, weekly fuel and grocery bills, residential situation (e.g. renting, home owner), ethnicity, annual household income, age, and gender. Also measured were the number of children, dogs, cats, registered motor vehicles, bedrooms, and total people generally present at each residence.

Two questions asked for estimates of how many people live in the respondents' residential area, and for estimates of how many people live in the average Auckland residential area. Three different wordings were used to describe the residential area for this question; neighbourhood, suburb, and local community.

Two items measured how difficult the survey was and how long the survey took to fill out, and one item checked to make sure that the item was delivered to the participant's residence. An open response item was also included to encourage comments on anything not covered in the survey but that the respondents thought were important to the quality of their neighbourhood environment.

Procedure

For each residential area selected the legal addresses from the cadastral database were generated, with 1998 addresses being generated in total. Half of the addresses were mailed the PREQ and half the PEQI. The surveys were sent out using a 3 (population density) * 3 (wording for residential area) design, meaning that 111 surveys of each type (PREQ and PEQI) were sent to each combination of density and wording type.

Participants were sent a personally signed cover letter, a self-addressed return envelope, and offered entry into a prize draw to encourage response. Cover letters also requested that a person “over the age of 18 who makes financial decisions concerning the household” participate. The area number for the participant’s address was written on the top left of each survey and it was explained in the cover letter that this was to identify the general area that participants lived in.

RESULTS

The two surveys were analysed by principle components analysis using varimax rotation with Kaiser normalization. This analysis produced the same factors with the Auckland sample as were found in the Italian and American studies. The scales have high internal reliability, indicating that the PREQ and PEQI scales can be effectively transferred to a New Zealand context. Supporting this is that the magnitudes of the alphas are very similar between the samples. Table 2 presents the factor structures and reliabilities for the PREQ from both Bonaiuto et al (2006) and the current study, and the scale means from the current study. Table 3 presents the same information, but for the Carp and Carp (1982) and the current PEQI data.

Table 2 around here

Table 3 around here

Neighbourhood Density

From the PREQ, high density neighbourhoods had better perceived building aesthetics compared with medium density neighbourhoods, and better external conditions and transport services compared with low density neighbourhoods (see Table 4 below). Medium density neighbourhoods were perceived to have better building volume, internal practicability, school services and commercial services than low density neighbourhoods, and better security and tolerance and upkeep and care compared with high density neighbourhoods. Low density neighbourhoods did not rank significantly better on any of the scales. Overall, medium density neighbourhoods are perceived as more satisfactory, but this was not a significant difference. Only one scale from the PEQI showed differences across densities, maintenance by neighbours, $F(2, 193) = 3.14, p < .05$, with low density residents reporting being most satisfied and high density residents being least satisfied.

Table 4 around here

Consistent Questions

Data for the questions that were consistent across both surveys were combined together and analysed using one-way ANOVAs. There were no differences between densities for most of the variables. For instance, no significant differences between densities were found for estimated number of people in the neighbourhood, the estimated average number of people in an Auckland neighbourhood, the estimated distance to the closest neighbour, or the average weekly fuel bills. There were also no differences in possible indicators of satisfaction, including general satisfaction with the neighbourhood, the respondents' desires or intentions to move to a new neighbourhood, their length of residence, how much free time they spent in the neighbourhood, and their subjective QoL or subjective QoL compared to other Aucklanders. However, respondents in high density neighbourhoods ranked their sections as being smaller than did those respondents from lower density neighbourhoods, $F(2, 355) = 3.40, p < .05$. More occupants were generally found for residences in high density neighbourhoods, $F(2, 360) = 4.21, p < .05$, but there were no differences for how many bedrooms, cars, children, or dogs and cats were present at the average residence. Respondents from high density neighbourhoods spent more days travelling each week to socialise than respondents from the other two densities, $F(2, 344) = 3.34, p < .05$, while medium density respondents travelled less often, and low density respondents most often, to shop, $F(2, 344) = 6.44, p < .01$. There were no differences for how often respondents travelled for work, and for indoor or outdoor recreation.

There were ethnicity differences between densities when comparing New Zealand Europeans to other ethnicities (due to limited numbers of non-New Zealand Europeans the numbers were pooled), $\chi^2(2, N = 350) = 12.99, p < .01$. This was exhibited by more New Zealand Europeans living in low density neighbourhoods, and fewer in high density neighbourhoods, than would be expected. These differences were controlled for in the appropriate analyses and did not change the findings. No differences were found for gender, age, household income, or for whether respondents' homes were rented or owned.

When asked what best described their neighbouring areas, people in low density areas were more likely than the others to report living near reserves, parks, or bush, $\chi^2(2, N = 364) = 18.49, p < .001$. Respondents in high density neighbourhoods were less likely to report living in separate houses, $\chi^2(2, N = 364) = 9.34, p < .01$, and more likely to report living in attached flats or houses, $\chi^2(2, N = 364) = 12.30, p < .01$. Respondents from medium density areas were less likely to live near industrial business, $\chi^2(2, N = 364) = 8.4, p < .05$, although as one of the assumptions for the χ^2 analysis was violated this result may not be reliable. There were no density-related differences for

Population density and perceived neighbourhood quality the reported presence of neighbouring farmland, office buildings, lifestyle blocks, or multi-story apartment buildings.

PREQ Scale Comparisons with the Italian study

Compared with the mean of the overall Italian cities, Aucklanders rate the quality of their residential environment more highly than Italians on the PREQ scales (see Table 5). In particular, green areas (e.g. “there is at least one reserve/park where people can meet in this neighbourhood”), social care-services (e.g. “the provision of local health services is inadequate for this neighbourhood”), and sports services (e.g. “in this neighbourhood there are areas where you can do outdoor sports”) were all rated higher in terms of perceived quality in Auckland compared with Italian cities.

The only scales that did not significantly differ between the samples were: external connections (e.g. “this neighbourhood has good transport connections to important parts of the city”), security and tolerance (e.g. “the streets are safe enough in this neighbourhood”), sociability and cordiality (e.g. “people in this neighbourhood are polite”), and commercial services (e.g. “there are all kinds of shops in this neighbourhood”)

Table 5 around here

Security and tolerance received the lowest relative ranking (Auckland mean – Italian mean) and was rated as significantly lower in Auckland when compared with 6 of the 11 Italian cities ($p < .05$). The only scale score not to be rated positively in terms of its perceived quality was Socio-cultural activities (e.g. “entertainment activities for residents are lacking in this neighbourhood), which rated significantly higher than the overall Italian score, but still averaged just below 3 on the scale score.

The variation in scale score responses was lower for Auckland compared with the overall Italian cities, which is unusual considering the smaller sample size in Auckland. This finding was also consistent within the individual Italian cities. When all of the scale items are averaged for each city, Auckland ranks third in terms of overall perceived residential quality (see Table 6).

Table 6 around here

Residential Area Population Estimates

As described earlier, three different wordings were used in the questions asking for estimations of how many people lived in the respondents' residential area or the average Auckland, residential area; neighbourhood, suburb, and local community. There were differences in estimations across the wording types, $F(2, 169) = 20.39, p < .001$, and between estimations for the respondents' own residential area versus the average Auckland residential area, $F(1, 169) = 60.68, p < .001$ (see Figure 1). Fewer people were estimated to live in the residential area when the term neighbourhood was used, with the term suburb producing the highest estimations. People also estimated that more people lived in the average residential area than in their own. There was also an interaction between the wording and the area being estimated, $F(2, 169) = 7.75, p < .001$. From Figure 1 it appears that when the term neighbourhood was used respondents' population estimates for their own residential areas and for the average residential areas were closer than when either of the other terms was used. There was also less variance for the use of the term neighbourhood than for either of the other terms, with the standard deviations for suburb and local community being approximately twice the size of the deviations for neighbourhood.

Figure 1 around here

DISCUSSION

The factor structures of the PREQ and PEQI were maintained within the Auckland sample. This indicates that there are, at least, cross-cultural similarities in how people think about their residential environment despite presumably large differences in their lifestyles, building design, transportation systems and so on. The Chronbach's alphas were also very consistent between the samples, with the overall differences being fairly minor. For the PREQ, while Bonaiuto et al (2006) expressed concerns regarding the generalisability of the survey due to their sampling (only two cities from northern Italy being used) these results suggest the scale has cross-cultural validity. For the PEQI this finding indicates that the structure was maintained over a 20-year separation in data collection times. Of note is that the factor structures for both surveys were maintained even though the surveys for the current study were administered via mail rather than personal interview, and even though the PREQ was translated from Italian. Similar findings for scale structures have also been found in cross-cultural QoL studies (see for example Xu et al, 2005).

Significant differences were found between densities for 9 of the 19 PREQ scales, with the medium density neighbourhood being ranked most favourably for 7 of these 9 scales. High density

Population density and perceived neighbourhood quality neighbourhoods were ranked significantly better for 2 of the 9 scales, *external accessibility* and *transport services*, with medium density ranked second for these scales. For the non-significant scales, medium density neighbourhoods had the highest satisfaction scores. Across all the scales, for the second and third rankings there was a fairly even split between high and low density neighbourhoods. For the PEQI significant differences between densities were found for only one scale, *maintenance by neighbours*, with high density neighbourhoods being ranked worst and low density ranked best.

One reason for the difference in discrimination between the scales may relate to the types of questions asked. The questions asked by Carp and Carp (1982) were more general in nature than those asked by Bonaiuto et al (2003, 2006). To elaborate, PEQI items tend to involve overarching elements of the neighbourhood, such as whether the neighbourhood is beautiful, how well the neighbours keep the streets clean, and how the respondents feel living in their neighbourhood. In contrast, the PREQ questions are more tangible, asking about specific elements of the RE. When pooled together the PREQ scales did not discriminate between densities, and this may relate to why the PEQI scales did not discriminate: The PEQI scales may have only tapped into the higher levels of perceived environmental quality, and not the specific areas where differences exist.

Overall, population density had no significant effect on most of the variables that were consistent across both surveys. Notably, there were no differences in residential satisfaction, QoL, or the intention or desire to move from the neighbourhood. This suggests that people are fairly happy living where they are. People in high density areas did travel more often to socialize however, while people in low density areas travelled to shop more often, with medium density residents travelling least often to shop.

The measures of density were also generally non-significant; only section size was related to density (increasing density relating to a decrease in reported section size). While it would be expected that people living in different densities would have higher population estimates for their area, and would also live closer together, the design of the experiment may have limited these effects. As the 15th and 85th percentiles were chosen for low and high density respectively, extremely close housing (such as apartment blocks) and extremely distant housing (such as farms) were most likely underrepresented in the data. Population density may also be affected by the number of people living at each residence, as our results suggest, which may limit the effect of density on the distance between a respondent's front doors and their closest neighbour's front door.

As noted earlier, Cramer et al (2004) found that as population density increases were related to an increase in negative life events and a decrease in perceived neighbourhood quality. The results from this study do not support this conclusion. Overall, there was a general trend towards the medium density neighbourhood being preferred (for the PREQ) or for no significant preference (for the PEQI). Compared to the PEQI and the PREQ, the questions asked by Cramer et al (2004) were narrower in focus (i.e. they only asked five questions, three of which were focused on interactions with neighbours). It is possible that Cramer et al (2004) primarily tapped into those aspects of the residential environment that are unaffected or negatively associated with QoL when the population density increases.

It has been argued that community satisfaction can be measured by summing the components that contribute to community satisfaction (Sirgy & Cornwell, 2001). The current findings from the PREQ do not support this. For instance, while medium density neighbourhoods were preferred overall for the PREQ study the second most preferred was split between low and high density neighbourhoods. If the components were summed to produce overall satisfaction then medium density neighbourhoods should have been significantly most preferred overall, which was not the case. This seems to indicate that satisfaction may be based on trade-offs. Supporting this is that overall QoL and RS are not significantly affected by neighbourhood density, nor are there any differences in intent or desire to move to a new neighbourhood. Given that it can be difficult to maximise satisfaction with all of the residential aspects measured by the PREQ scales (e.g. a relaxing life may not be compatible with a stimulating life), it is likely that people favour some aspects of the residential environment at the expense of others they deem less important.

The significant differences found for the PREQ may indicate the respondents' main residential concerns. For instance, as transport services (measuring public transport perceptions) and external conditions (measuring how well connected the neighbourhood is to the central city) were ranked highly for the high density neighbourhood, it is likely that people desiring good public transport and connectedness would live in higher density areas. People who want improved school services may prefer to live in medium density areas and so on. This would support the balance theory, as having improved school services would mean having a lower perceived quality transportation services. Given that QoL scores did not differ between densities it would seem that people are generally happy making the trade-off.

The differences in population estimates depending on the wording used (i.e. neighbourhood, suburb, local community) for the specific questions highlights the need to be careful with the language and definitions used for the residential area. For instance, as suburbs were perceived to contain more

Population density and perceived neighbourhood quality people than neighbourhoods, it is likely that the respondents' conception of the area encompassed by a suburb would also be larger. Supporting this is that Bardo (1984) found that there were size differences in how participants' marked out their neighbourhood and their area of belonging on a map. Also, giving specific definitions for the terms may cause problems. There was a large amount of variability in the population estimates, both for the respondents own residential area and the average Auckland residential area. This would suggest that people will have different conceptions of what makes up their residential area (Amérigo, 2002; Carp & Carp, 1982). Using the term neighbourhood, as it had the least variation in population estimates, without giving a specific definition, still seems to be the most appropriate way to proceed.

One potential issue with these surveys is that, overall, they do not take perceived importance into account. (Some of the items in the PEQI ask how bothered the respondent is by noise, pollution, etc.) Simply perceiving something, such as air pollution, does not necessarily mean that RS is reduced. For instance, in relation to certain strategies for measuring neighbourhood satisfaction, Handal et al (1981) notes that "[an] assumption of this strategy is that what is perceived by residents is synonymous with what is important (p. 119)". If air pollution does not affect someone's perceived RS then taking their perception of air pollution to mean their RS is affected is problematic. Sirgy and Cornwell (2001) addressed this by weighting the perceptions with self-report measures of importance, which may be the solution. What does need to be addressed is whether there are predictive differences between the weighted and unweighted perceptions, as some research indicates that there may not be (Russell et al, 2006). Sirgy and Cornwall (2001) did not test their model using unweighted scores, so at this stage more research needs to be conducted in this area.

Conclusions

For both surveys the factor structures and assessments of reliabilities were maintained when tested on a culturally different sample to the samples the surveys were originally developed on. Also notable is that this study used a different data collection method to the original studies, and was a translation from Italian for the PREQ. This suggests that there may be a general underlying structure to how people view their living environment. Population density differences were found for almost half of the PREQ scales, but there were no differences for overall satisfaction for the PREQ and only one scale exhibited population density differences for the PEQI. This suggests that people trade-off elements of their environment against each other for their overall neighbourhood satisfaction. This is supported by the lack of a significant difference in QoL scores and general neighbourhood satisfaction scores between neighbourhood densities.

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Table 1. Demographics for the sample divided by survey and by neighbourhood density

Table 2. The reliabilities for the Perceived Residential Environmental Quality (PREQ) scales for Bonaiuto et al (2006) and the current study, and the scale means for the current study.

Table 3. The reliabilities for the Perceived Environmental Quality Index (PEQI) scales for Carp and Carp (1982) and the current study, and the scale means for the current study.

Table 4. Means, standard deviations, and significant differences for the Perceived Residential Environment Quality (PREQ) scales across residential densities in Auckland, New Zealand.

Table 5. Means, standard deviations, and significant differences for the Perceived Residential Environmental Quality (PREQ) scales in an Auckland, New Zealand and an overall Italian context, ranked by mean difference.

Table 6. The 11 Italian cities and Auckland ranked by the overall mean score of all PREQ scale items.

Figure 1. The interaction between residential area wording (neighbourhood, suburb, and local community) and residential area (own or average Auckland) for population estimates.

Table 1.

	Survey		Neighbourhood Density			Overall
	PREQ	PEQI	Low	Medium	High	
Gender						
Male	70	63	39	55	39	133
Female	84	96	40	75	65	180
Ethnicity						
NZ European	131	137	80	110	78	268
Other	30	52	11	32	39	82
Mean Age	50.5	50	52	50.5	48.5	50
Residential Area Wording						
Neighbourhood	58	66	32	49	43	124
Suburb	52	69	23	50	48	121
Local Community	60	64	42	49	33	124
Mean Completion Time (min)	23	18	21	20	21	21
Difficulty						
Very Easy	55	88	43	58	42	143
About Right	106	104	51	84	75	210
Very Hard	4	1	1	1	3	5

Table 2.

		Alpha It	Alpha NZ	Mean NZ ³
Scale 1	Architectural and town-planning space			
	F1 Building aesthetics	.92	.881	3.6548*
	F2 Building Density	.92	.871	3.5348
	F3 Building volume	.89	.891	3.8674 ⁴
Scale 2	Organisation of accessibility and roads			
	F1 Internal practicability	.80	.797	3.4184
	F2 External Connections	.78	.745	3.6697 ⁴
Scale 3	Green areas	.89	.854	3.7870
Scale 4	People and social relations			
	F1 Discretion and civility	.81	.668 (.763)¹	3.6278 ⁴
	F2 Security and tolerance	.82	.811	3.3294 ⁴
	F3 Sociability and cordiality	.80	.846	3.3822
Scale 5	Welfare services			
	F1 School services	.81	.859	3.8864 ⁴
	F2 Social care-services	.73	.617	3.3367
Scale 6	Recreation services			
	F1 Sport services	.87	.803	3.6405 ⁴
	F2 Socio-cultural activities	.81	.551 (.694)²	2.9593
Scale 7	Commercial services	.86	.899	3.2458
Scale 8	Transport services	.82	.860	3.2901
Scale 9	Pace of life			
	F1 Relaxing vs. distressing	.88	.843	3.7994
	F2 Stimulating vs. boring	.84	.796	3.2426
Scale 10	Environmental health	.92	.862	3.5581 ⁴
Scale 11	Upkeep and care	.85	.808	3.4601
Scale 12	Neighbourhood and attachment	.91	.828	3.5055

¹ removed item 53 (survey 62) "No one minds what you do in this neighbourhood"

² removed item 93 (survey 139) "There are few cultural events held in this neighbourhood"

³ All items five-point scales, high positive

⁴ not normally distributed

Table 3.

		Alpha US	Alpha NZ	Mean NZ ⁸
Scale 1	Aesthetics ¹	.91	.916	3.3715
Scale 2	Noises bother outdoor activities ²	.93	.919	1.3868 ⁹
Scale 3	Characteristics of Neighbours ¹	.83	.918	2.9049
Scale 4	Ideal Neighbourhood ³	.79	.762	1.5414 ⁹
Scale 5	Noise from neighbours' and own home ³	.79	.738	1.8751 ⁹
Scale 6	Noise from industry, construction, traffic³	.81	.696 (.737)⁵	1.8952 ⁹
Scale 7	Safety ⁴	.85	.921	3.3265 ⁹
Scale 8	Accessibility (for ideal) ³	.64	.625	2.5049
Scale 9	Maintenance by neighbours ²	.85	.802	1.5697 ⁹
Scale 10	Air quality ²	.77	.888	1.5051 ⁹
Scale 11	Noises bother indoor activities ²	.89	.857 (.866) ⁶	1.3046 ⁹
Scale 12	Privacy²	.65	.493 (.515)⁷	2.0347 ⁹
Scale 13	Maintenance by city ³	.67	.716	1.7208 ⁹
Scale 14	Own area compared to others ¹	.72	.766	2.6380
Scale 15	Living in this neighbourhood makes me feel ¹	.90	.942	2.7678 ⁹
Scale 16	Ideal Neighbourhood (current) ³		.801	1.6055 ⁹
Scale 17	Accessibility (for current) ³		.690	2.4999

¹ Seven-point scales

² Three-point scales

³ Four-point scales

⁴ Five-point scales

⁵ With item 32 "level of noise experienced from construction" removed

⁶ Added new item "Noise bothers sleeping in home"

⁷ With item 69 (survey 70) "Friends or relatives dropping by unexpectedly" removed.

⁸ High indicates negative evaluation

⁹ not normally distributed

Table 4.

Scale	Low density		Medium density		High density		Sig
	Mean ¹	SD	Mean ¹	SD	Mean ¹	SD	
Building aesthetics	3.63	0.57	3.82	0.60	3.52	0.67	*
Building density	3.54	0.71	3.69	0.59	3.39	0.75	
Building volume	3.72	0.64	4.01	0.58	3.84	0.53	*
Internal practicability	3.24	0.68	3.58	0.56	3.41	0.59	*
External conditions	3.44	0.59	3.64	0.71	3.88	0.56	**
Green areas	3.72	0.72	3.89	0.51	3.74	0.63	
Discretion and civility	3.62	0.43	3.71	0.56	3.56	0.57	
Security and tolerance	3.26	0.62	3.50	0.59	3.23	0.61	*
Sociability and cordiality	3.39	0.50	3.46	0.59	3.30	0.59	
School services	3.55	0.77	4.09	0.45	3.96	0.69	***
Social care services	3.20	0.62	3.39	0.53	3.39	0.51	
Sport services	3.59	0.65	3.74	0.62	3.58	0.61	
Socio-cultural activities	2.86	0.56	3.09	0.57	2.92	0.65	
Commercial services	3.03	0.87	3.42	0.75	3.26	0.79	*
Transport services	3.12	0.77	3.21	0.76	3.51	0.62	*
Relaxing life	3.81	0.48	3.92	0.57	3.68	0.63	
Stimulating life	3.23	0.58	3.25	0.51	3.24	0.61	
Environmental health	3.45	0.66	3.70	0.64	3.51	0.69	
Upkeep and care	3.43	0.56	3.60	0.51	3.35	0.56	*
Neighbourhood and attachment	3.54	0.59	3.54	0.64	3.45	0.72	
Total	3.42	0.63	3.61	0.59	3.49	0.63	

¹All items five point scales, high positive

*** = p < .001 ** = p < .01 * = p < .05

Table 5.

PREQ Scale	Auckland NZ			Overall Italian cities			Mean Difference	Sig
	N	Mean ¹	SD	N	Mean ¹	SD		
Green areas	170	4.18	0.93	1488	2.94	1.47	1.24	***
Social care-services	170	3.51	0.83	1488	2.31	1.08	1.20	***
Sport services	170	3.96	0.94	1488	2.79	1.37	1.17	***
Stimulating vs. boring	170	3.36	0.85	1488	2.43	1.02	0.93	***
Socio-cultural activities	170	2.94	0.90	1488	2.02	1.21	0.92	***
Building Density	170	3.80	1.04	1488	2.93	1.18	0.87	***
Building aesthetics	170	3.98	0.94	1488	3.27	1.10	0.71	***
School services	170	4.33	1.01	1488	3.69	1.23	0.64	***
Environmental health	170	3.84	1.01	1488	3.2	1.42	0.64	***
Building volume	170	4.30	0.88	1488	3.72	1.19	0.58	***
Discretion and civility	170	3.94	0.79	1488	3.37	1.19	0.57	***
Relaxing vs. distressing	170	4.20	0.86	1488	3.65	1.13	0.55	***
Upkeep and care	170	3.69	0.83	1488	3.3	1.42	0.39	***
Internal practicability	170	3.63	0.93	1488	3.24	1.15	0.39	***
Neighbourhood and attachment	170	3.76	0.99	1488	3.4	1.20	0.36	***
Transport services	169	3.44	1.10	1488	3.1	1.30	0.34	***
Commercial services	170	3.37	1.21	1488	3.26	1.38	0.11	
Sociability and cordiality	170	3.57	0.85	1488	3.49	0.89	0.08	
External Connections	170	4.00	0.97	1488	3.95	1.06	0.05	
Security and tolerance	170	3.49	0.92	1488	3.61	1.15	-0.12	

¹All items five point scales, high positive

*** = p < .001 ** = p < .01 * = p < .05

Table 6.

City	Overall Mean ¹ (PREQ)
Cesena	3.66
Grosseto	3.55
Auckland NZ	3.51
Bologna	3.47
Salerno	3.33
Latina	3.19
TOTAL	3.18
Florence	3.12
Matera	3.10
Pescara	3.10
L'Aquila	3.05
Palermo	2.83
Agrigento	2.76

¹All items five point scales, high positive

Figure 1.

