

Article

Quiet Areas and the Need for Quietness in Amsterdam

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Abstract: This paper describes the *Quiet Places Project* in Amsterdam. The purpose of the study was to find out: (1) which public quiet places there are according to Amsterdam residents; (2) what characterizes a quiet place; (3) to what extent do residents want peace and quiet; (4) how do residents realize these needs. The factors determining the need for quietness are presented in a model showing the influence of demographic and socio-economic issues, health status, sensitiveness to noise, daily activities and the noisiness in and around home. Most important of these factors is sensitivity to noise. Elderly and less healthy people are more often sensitive to noise. People who are annoyed by sound from traffic, airplanes and the like show a higher need for quietness. People with a lively household or neighbourhood report lower needs for quietness. Visiting a quiet place and going outside to walk or bike can have a compensating effect on the need for quietness. This suggests that creating quiet places and enhancing possibilities for quiet recreation in urban environments can have a positive effect on the quality of life in the city. Objective noise levels at the quiet places were taken from environmental noise maps. This shows that there may be a preference for low transportation noise levels, but levels up to 60 dB L_{day} are acceptable. Apparently this depends on a relative quietness or on non-acoustic characteristics of an area: the presence of vegetation and other pleasant stimuli.

Keywords: quietness; tranquillity; noise; health; soundscape; urban planning; area quality

1. The Need for Quietness in the Urban Environment

1.1. The Need for Quietness

Half of the World's population now lives in urban areas [1] and although the population of Western European countries is forecast to shrink, the population of cities is expected to rise [2]. Amsterdam is an example: it is viewed as a popular place to live and its population size has been growing annually. The liveliness of the city is an important factor in this popularity. Other qualities are, for example, the availability of shops, theatres, restaurants and other services. These qualities add to the liveliness in the city streets.

Quietness is not the first thing that comes to mind in the context of the urban environment. However, sound is an inseparable part of the living environment and the liveability of the city. Since the 1990s a lot of attention has been paid in Amsterdam to the liveability of the city, for example through design and management of public space, increasing safety on the streets and urban renewal programs. The results of these actions are monitored through different questionnaires on residents' satisfaction. This monitoring and research on the liveability of the city has paid attention to nuisances, but not to their counterpart: quietness and tranquility.

In the Netherlands and other countries the existing policies and research on quiet areas and the need for quietness focuses mainly on rural areas and natural areas (e.g., [3,4]). In urban settings there is more focus on noise and not on the reciprocal: quietness. The European Noise Directive [5] gives methods to calculate exposure to noise from transportation and industry in agglomerations, but not for the effect of quietness (see Section 1.2).

In this paper the focus is on the need for quietness and on quiet outdoor spaces in the urban environment. The few studies on the need for quietness have shown that quietness is indeed important. In a Dutch survey on the need for space, quietness and silence in recreational areas 80% of the respondents report that these aspects are (very) important. This did not depend on living in an urban or rural area, or on other background variables like age or gender [4]. In a survey of visitors to natural areas similar results were found [6]. Here the respondents were also asked about their sensitivity to noise. Though almost half of the respondents said they were (highly) sensitive to noise, this aspect did not seem to have any influence on the need for quietness. Both surveys were amongst people who visited natural or countryside areas or had a focus on quietness in natural areas. In this setting the need for quietness seems to be quite universal. But elsewhere green spaces and nature seem to be important aspects of quietness. The preference of soundscapes is clearly linked to a preference for natural elements [7].

1.2. Criteria for Urban Quiet Places

Schafer [8] distinguished soundscapes, the sonic aspect of the landscape or environment, according to quality. He attributed a high quality ('hi-fi') to the pre-industrial sonic world and a low quality to an industrial, mechanized world ('lo-fi'). In a hi-fi environment there are few loud sounds, certainly not permanent ones, so sounds from the surrounding area can be heard. Because of the low background level sounds have a wide range ('acoustic space'). For an observer in a hi-fi area the sonic horizon is distant (he can 'hear far'), for a lo-fi environment it is close. Due to the absence of constant loud

sources, there is little overlap between sounds and most of them can be heard separately. This high signal-to-noise ratio explains the use of the term ‘hi-fi soundscape’. An ever present sound in an area is the ‘ground note’ of that area: the surf close to the sea, the rustling of trees or the traffic in a city.

A pleasant sonic environment or soundscape is characterized by the presence of meaningful sounds that concur with the character of the area. The experience of the environment is supplemented by other sensory perceptions: we also see, smell and feel (wind, warmth) the environment. In a tranquil area the total impression is harmonic and no single perception is dominant [9]. Thus, soundscape quality can perhaps be defined in sonic (not: acoustical) terms, but a high quality area cannot depend on just its soundscape. In the present study the focus is on sonic quality in terms of quietness and noisiness, though also these study results show that indeed sonic quality is part of a total area quality.

According to the European Noise Directive (END: Directive 2002/49 of the European Parliament and of the Council relating to the assessment and management of environmental noise) a ‘quiet area in an agglomeration’ is an ‘area, delimited by the competent authority, for instance which is not exposed to a value of L_{den} or of another appropriate noise indicator greater than a certain value set by the Member State, from any noise source’ [5]. This definition leaves ample room for interpretation: the only actual requirement is that the area is delimited by the competent authority, the choice of a noise indicator is free, no limit is suggested. This is somewhat in contrast to the END definition of a ‘quiet area in open country’, which is an ‘area, delimited by the competent authority, that is undisturbed by noise from traffic, industry or recreational activities’ [5], which narrows the interpretation to the absence of (most) noise, regardless of the indicator.

The EU Working Groups on Assessment of Exposure to Noise and on Health and Socio- Economic Aspects have proposed noise limits for quiet areas in cities [10]. For moderately sensitive areas (cemeteries, gardens/communal areas, open air theatre) a limit for equivalent daytime sound level (L_{day}) of 40 to 45 dB is recommended, for areas for outdoor activities (play/game, picnic/lunch place, sports) a limit of 45 to 50 dB(A) is recommended. Limits for night time (L_{night}) and evening time ($L_{evening}$) requirements may either not be relevant or may be lower.

In a report for the British Department for Environment, Food and Rural Affairs (DEFRA) an overview is given of criteria for quiet areas [11]. Criteria recommended for quiet areas in agglomerations and based on research are 45 dB(A) $L_{eq,18h}$ and 50 dB L_{den} . The latter was given as a limit above which areas could not be considered quiet, but a ‘gold standard’ of 40 dB L_{den} was recommended. The report shows that criteria used in policy or legislation within European countries for quiet areas in agglomerations range from 45 to 55 dB(A) [11]. In Finland a limit for recreational areas in agglomerations is set at 55 dB(A) $L_{eq,1h}$. In Norway the limit is 50 dB L_{den} , and in Italy separate limits are used for the day/evening (50 dB(A) L_{eq}) and night period (40 dB(A) L_{eq}). In Denmark a limit of 45 dB(A) L_{eq} is proposed.

According to the Dutch Health Council [12] wanted, agreeable sounds must be distinguished from unwanted noise, when assessing the quietness of areas. For wanted sounds, *i.e.*, natural sounds and other sounds that are appropriate to an area, there is no limit in level or duration of these sounds. Of course, when high levels of wanted sounds do exist, such as in a sports or musical event, it need not be quiet, though the acoustic quality can still be high.

Second (still following [12]), for non-continuous noises, such as a car passing through an otherwise quiet area, the percentage of time during which that noise is audible seems to have more influence on

the experience of quietness than the actual noise level. For continuous noise of a relatively constant level, such as a distant motorway, time does not play a role and the noise level determines the intrusiveness of the noise. Thus, various types of noise sources have to be taken into account and especially the distinction between continuous (and perhaps diffuse) sources and incidental passages or other sound events appears to be important.

Third, the type of area is important [12]. The expectations and need for quietness are different when in a remote natural area or a city park. Therefore the Health Council proposed a distinction based on the type of area:

- natural reserves, where natural sounds should dominate;
- green spaces in the countryside, with natural sounds and sounds from agricultural or forestry activities;
- green spaces in cities (such as parks and cemeteries) where unwanted sounds or noise should not dominate;
- quiet built-up areas in cities (such as court yards, squares or resting areas with little traffic) where again the unwanted sounds should not dominate.

Finally, very loud noises should be reduced because they can have a disproportional impact, especially when they are frightening or judged unnecessary. This may apply to low altitude military jets, speedboats, shooting noises, *etc.* outside cities, and mopeds, loud music, loud air conditioning or other appliances in the city.

Based on these considerations, a criterion for unwanted continuous sound of a relatively constant level is that it must not exceed a threshold level (the ‘level of quietness’), where the threshold level depends on the type of area. A criterion for unwanted discrete sound events with levels above the threshold is that the time it occurs must not exceed a percentage of the time spent in the area, and again this depends on the type of area. The Health Council did not propose quantitative criteria for the threshold or percentage of time. A Swedish working group used similar criteria for urban natural and cultural environments such as green spaces and thoroughfares, old urban environments and footpaths and cycle paths, and proposed a limit of 45–50 dB(A) (Leq), or 10–20 dB(A) below the level of surrounding streets [13].

2. The Quiet Places Project in Amsterdam

2.1. Description of Project

The aim of the Amsterdam Quiet Places project was to apply the advice of the Dutch Health Council [12] to the practical situation of the city and its management and to recommend points of attention for a policy for quiet areas relevant to the action plans required by the European Noise Directive [5]. This was on behalf of both the municipality of Amsterdam and the Netherlands Ministry of Housing, Spatial Planning and the Environment.

The project consisted of: (a) an overview of relevant literature; (b) a survey on the presence and importance of quiet places in the city, and a campaign to raise awareness for this topic; (c) a list of areas that Amsterdam residents consider to be quiet places; (d) an overview of relevant policy instruments (not reported here). The survey and campaign were held in the summer and early fall of

2008. Partners in the project were the Municipal Health Service and the departments for Environment and Building, Physical Planning, and Research and Statistics, all of the City of Amsterdam.

Here we will often use the term ‘quiet place’ because we wanted to include small urban areas within walking distance of respondents’ homes, suggesting in the questionnaire that it could be a street, square, park and/or water (see Appendix, question 8). In the questionnaire we avoid the use of the term quiet *area* because we did not want to prompt respondents to think of only bigger areas like parks. Of course quiet places are also quiet areas, and which term is used here depends on whether it refers to the survey response or the general notion.

2.2. Description of Survey

The aim of the survey was to understand which places in the city were considered as quiet places by Amsterdam residents and what part these places play in finding tranquillity and relaxation in the city. The survey was based on three main concepts: *peace and quiet* as a mental state, *quietness or tranquillity* as a situation without disturbing sounds and the presence of pleasant or neutral sounds, and a *place* where these can be experienced. In the questionnaire the following items were addressed:

- 1- *How do Amsterdam residents find relaxation and rest?*
 - ◆ What do people do to relax?
 - ◆ Where do people go to relax?
- 2- *To what degree do Amsterdam residents need peace and quiet?*
 - ◆ How sensitive are people to bustle and noise?
 - ◆ How busy are people in Amsterdam?
- 3- *What are the quiet places in the city, according to the Amsterdam residents?*
 - ◆ Is or has each neighbourhood a quiet place?
 - ◆ Are the urban green areas (parks, public gardens, courts) quiet places?
 - ◆ Are there paved places that are perceived as quiet?
 - ◆ What characterizes these areas, why are these areas perceived as quiet?

The questions specific to this survey are given in the Appendix (demographic and personal questions are omitted).

2.3. Description of Noise Map

Areas on noise maps with $L_{den} < 55$ dB are not very noisy with respect to transportation noise and may indicate relatively quiet areas. The ‘inverse’ of a noise map, with attention focused on noise levels below 55 dB is thus a low-noise map.

For reporting noise levels to the EU, road and rail traffic sound level L_{den} was calculated at a height of 4 m according to models required by the Dutch noise regulations [14]. For the purposes of this project, L_{day} was calculated at a height of 1.5 m as an indicator relevant for daytime outdoor recreation. In practice L_{day} from road traffic is close to L_{den} for many city streets and up to several dB lower than L_{den} for busy motorways. For air traffic the data and calculation model are not under the authority of the city of Amsterdam, but L_{den} and L_{night} are known. It can be shown that if $L_{night} \leq L_{day} - 10$ dB

and $L_{\text{evening}} \leq L_{\text{day}} - 3 \text{ dB}$ (which are plausible assumptions for aircraft noise this region), then $L_{\text{day}} = L_{\text{den}} + 1 \text{ dB}$ with an uncertainty of $\pm 2 \text{ dB}$.

Industrial noise levels in the Netherlands are determined for the ‘noisiest day’ or ‘13th day’, where once a month (12 days a year) noise levels need not comply with the usual limits. For an industrial area the 13th day noise levels of all industrial premises are added to obtain a total noise level. It is clear that for industries that do not produce a constant sound level the sum is often higher than the actual level and indeed the sum total may never occur in reality.

Based on these considerations daytime aircraft noise levels are sufficiently approximated by L_{den} , and industrial noise levels are probably overestimated by using L_{den} . In this project industrial noise levels of 45–50 or 50–55 dB L_{den} occurred in 14 quiet places mentioned by residents and in three cases only this level was higher than the level of road/rail traffic noise. Aircraft noise levels of 45–50 or 50–55 dB L_{den} occurred in 21 quiet places and in four cases this was higher than the level of road/rail traffic noise. Thus, in almost all quiet places (total number 139, see Section 4.1) road and rail traffic are the sources that determine the noise level. In only seven places the noise level due to industrial sources or air traffic is higher. We will therefore use only road and rail traffic to characterize the noise levels of quiet places that result from the survey.

3. Results of Survey

3.1. Methods

For a big city survey there is no single method to obtain a representative sample of all residents, as different social and cultural groups react differently to a request to take part. There are differences in literacy, language, accessibility by a specific means of communication (telephone, internet, newspaper, mail, direct personal contact) and willingness to take part. Therefore, to achieve a response as much as possible representative for the adult Amsterdam population, different supplementary survey methods were used. Members of the online panel [15] of the Department for Research and Statistics of the municipality of Amsterdam were interviewed (390 respondents), residents were taken randomly from the telephone directory (478 respondents) and finally a number of people were interviewed on the streets (177 respondents). Apart from these 1,045 respondents the remaining members of the online panel were asked to only name their favourite quiet place in the city, yielding an extra 1,280 responses (for only this question).

To analyse the results of the survey several steps were taken. To prepare the data for analysis only fully completed questionnaires were selected. Different questions referring to the same concept were recoded into scales. To test the reliability of scales Cronbach’s α was used. This test determines the internal consistency of the scale. Cronbach’s α can be less than or equal to 1. A high Cronbach’s α indicates a high internal consistency. Other variables were recoded into meaningful categories. Differences between categories were tested with t-tests (means) and z-tests (column proportions) on a significance level $p < 0.05$. Section 3.2 gives an overview of this data preparation and shows the results.

In Section 3.3, a model is presented of the need for quiet. The model is based on the different variables constructed and described in Section 3.2. This model is tested with a linear regression method.

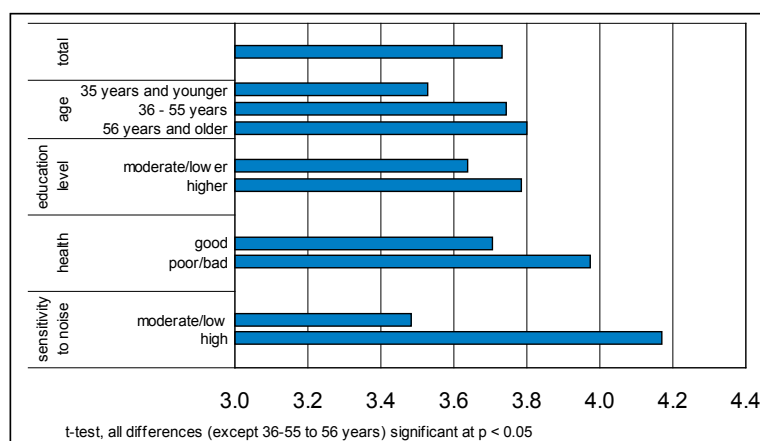
3.2. Need for Quietness

For the analysis only fully completed questionnaires were used. A total of 809 respondents were included. The mean age of the respondents was 51 years old (st.dev. 13.9; range 15–89). More than half of the respondents were female (58%). Two thirds of the respondents had a higher education level. The majority had paid work (80%). Compared with the whole population of Amsterdam older people, women, higher educated and working people are slightly overrepresented. A quarter of the respondents lived in a household with children. Eleven percent had problems with their health. Both are comparable with the total population.

Respondents were asked how important quietness is for them in and around the home, in the neighbourhood and in the city in general (Appendix, question 7). Most people (73%) like to have a quiet home, half of the residents prefer a quiet neighbourhood (49%) and 21% prefer a quiet city (all ≥ 4 on scale 1–5). To make a scale on the need for quietness the reliability is checked with Cronbach's α . Cronbach's α for these three variables is 0.635. People who prefer quietness at home tend to prefer quietness in the neighbourhood. The correlation with the preference for quietness in the city is lower (if item deleted Cronbach's α is 0.711). Therefore only the variables 'preference for quietness at home' and 'preference for quietness in the neighbourhood' were used to make a scale. The scale varies from 1 (no need for quietness) till 5 (high need for quietness) (mean 3.7; st.dev. 0.89). This scale is used to analyse the need for quietness in the urban environment.

People with bad health and older people have a higher need for quietness. But also people with higher education report higher needs for quietness. Other individual characteristics like gender, type of household (with or without children), occupation (working or non-working) and part of the city (central or suburb) did not have a significant effect on the need for quietness. The sensitivity to noise is the most important factor (see Figure 1): the need for quietness differs from 3.5 for the people who are not sensitive to noise at all to 4.2 for the people who are very sensitive to noise.

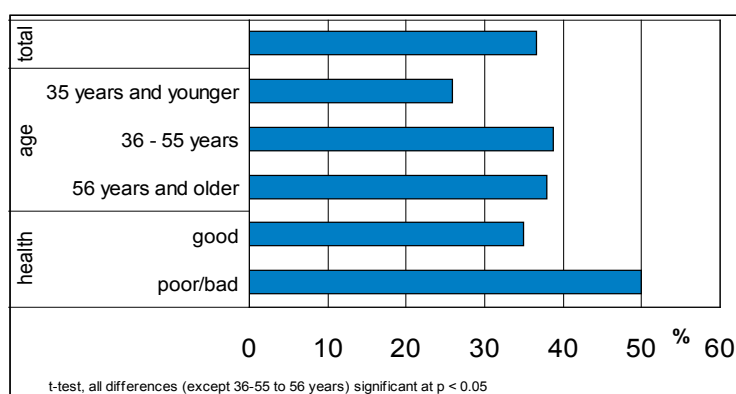
Figure 1. Need for quiet for different individual characteristics (scale 1, ..., 5).



More than one third of the respondents (37%) reported being sensitive to noise (≤ 2 on scale 1–5, Appendix question 6): see Figure 2. Compared to the outcome of a survey on visitors of natural areas [6] the sensitivity to noise in Amsterdam is lower. This could indicate that people who are sensitive to noise, more often visit natural areas. Eleven percent of the respondents reported a very

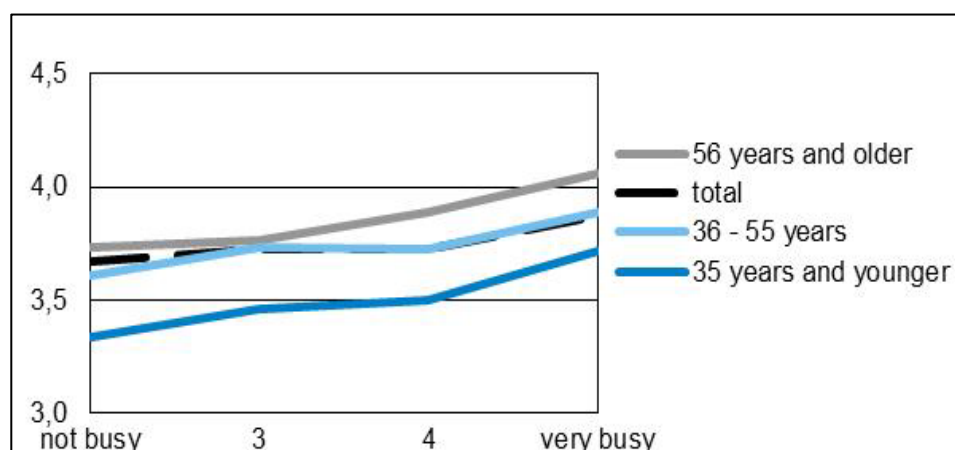
high sensitivity to noise (1 on scale 1–5). This is comparable with results in other surveys (results varying between 12%–15% [16]). Sensitivity to noise (≤ 2 on scale 1–5) is more common for middle-aged and older people than it is for younger people and it is more common for people with bad health (see Figure 2). Other individual characteristics did not have a (significant) influence on noise sensitivity.

Figure 2. Sensitivity to noise (in % of respondents) for different individual characteristics.



When people have a busy life, the need for quietness could increase. Especially in cities the rush of daily life could enhance stress. In the questionnaire people were asked to what degree they felt they didn't have enough time to relax (question 17). Almost half (46%) of the respondents said they often had the feeling that there wasn't enough time and a third (33%) reported that they often did not have enough time to relax, so a large group indeed had the feeling that their life was (too) busy. A third item in the question was about the counterpart: feeling bored. Only 3% often felt bored, and most people (81%) never felt bored. Cronbach's α on these three items was 0.514. Leaving the last item out (feeling bored) increased the reliability (Cronbach's $\alpha = 0.744$). Response to the first two questions were put in one scale ('busy life', 1 not busy–5 very busy).

Figure 3. Need for quiet per age group in relation to level of having a busy life.

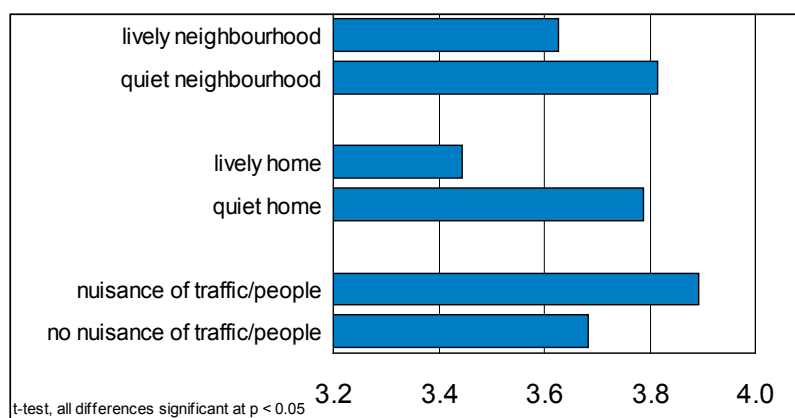


In general there is no difference between the degree of being busy and the need for quietness when all ages are included. People with busy lives tend to have the same need for quietness as people with more restful lives, but when we look at different age groups the following pattern appears: the need for

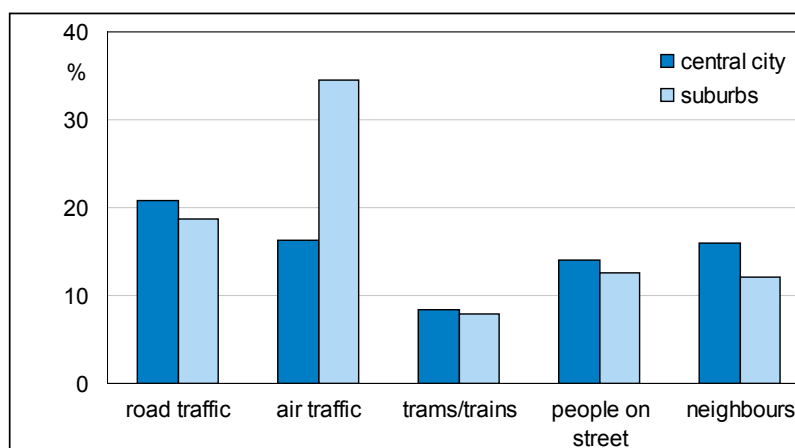
quietness does increase with the degree of being busy, but the level differs per age group (see Figure 3). Younger people with busy lives do have a higher need for quietness than young people with more restful lives and the same is true for middle-aged and older people. Because younger people in general have a busy life and older people in general have a more quiet life the effect disappears when we look at the total group.

Respondents were asked about the level of noise in their home and neighbourhood in different ways (questions 2 through 5). They were asked if it was more likely to be quiet or lively/noisy in their home, their garden or balcony and their neighbourhood. More than a quarter (28%) had a lively/noisy neighbourhood, one in five (21%) a lively/noisy balcony/garden and 11% had a lively/noisy household at home. To make a scale of these three variables the reliability was verified (Cronbach's $\alpha = 0.514$). Leaving the variable 'liveliness at home' out increases the reliability of the scale (Cronbach's $\alpha = 0.574$). The variables 'liveliness in the neighbourhood' and 'liveliness in the garden/balcony' were put in one scale (1 not lively–5 very lively). 'Liveliness at home' was taken separately (1 not lively–5 very lively). People with a lively neighbourhood (including garden/balcony) have a lower need for quietness than people with a quiet neighbourhood (see Figure 4). The effect for people with a lively home is stronger: they report the lowest needs for quietness (need for quietness = 3.4).

Figure 4. Need for quiet in lively or quiet neighbourhood and home, and nuisance from traffic noise or people.



In the questions about liveliness/noisiness there was no reference to nuisance or disturbance, so 'noisy' alluded to the presence of more or less chaotic sound. A further question was specifically about being annoyed, disturbed or irritated by types of sound when being at home. This question thus probed unwanted sound. When at home about one in five respondents is disturbed or annoyed by noise from road (20%) or air traffic (22%) (≥ 4 on scale 1–5). As some of the suburban areas are below flight paths to/from Amsterdam's Schiphol Airport, there is more annoyance caused by aircraft noise in the suburbs than there is in the central part of the city (see Figure 5). Nuisance of neighbours (15%) and people on the streets (14%) were less common. Only 8% often had nuisance of buses and trams and the like. For these noise sources a somewhat larger proportion of respondents in the central part of the city seems to be disturbed compared to respondents in the suburbs. These five variables were used to make one scale (nuisance, Cronbach's $\alpha = 0.528$). The need for quietness increases when people have nuisance of traffic, people or airplanes.

Figure 5. Percentage of respondents annoyed or disturbed at home by different noise sources.

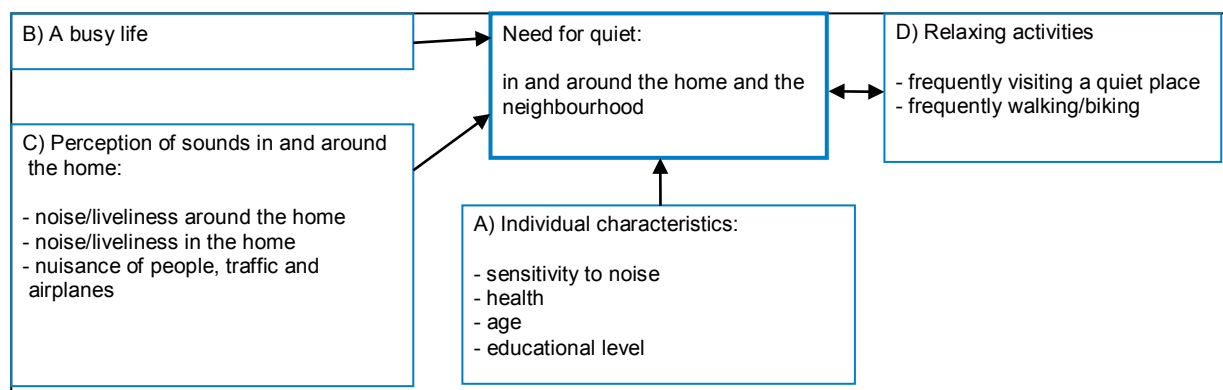
In response to the first question in the questionnaire: “Please describe in short what you do to recover from the city’s hustle and bustle” (open question, no choices given), being at home and relaxing is the sort of answer most often given (by 24% of respondents). Second to this is going to a park, wood or beach (15%) and also cycling, sitting in the garden/on balcony, gardening, go out of town, and walking are popular (each 11%–13%). Added together 50% of the respondents spontaneously say they go outside to relax.

In response to more specific questions a large group of respondents say they go outside to relax, therefore visiting quiet places or going outside to walk or bike apparently meets a need for quietness in the city. Fifty percent of the respondents visit a quiet place in the city on a regular basis (at least once a week; question 14). An even larger group (62%) regularly goes outside to walk or bike (question 18). People who often participate in relaxing activities have a higher need for quietness than people who do not visit quiet places or go outside to walk or bike on a regular basis. The need for quietness can be the reason why people undertake relaxing activities.

3.3. Model for the Need for Quietness

All potentially relevant variables were put in one model (Figure 6). In this model three types of variables (A–C) act on the outcome variable (need for quietness). In Section 3.2 we already saw that the need for quietness is related to different individual characteristics, that it depends on the perception of sounds around the home and the neighbourhood and it differs for people with busy or quiet lives. With a linear regression the effects can be made clear in relation to one another. After that a fourth type of variable is added: relaxing activities (D). This is not a variable that explains need for quietness, but it may be a reaction to the need for quietness: such activities could have a reducing effect on the need for quietness. Of course, for none of the relations in these models causality can be established. A busy life or a quiet home could increase the need for peace and quiet, but people less in need of peace and quiet could also allow for a more busy life or a livelier home.

Table 1 shows the results of the linear regression analysis. The blocks of variables are put in the model one by one. First we look at the effect of individual characteristics (Model A), after that the variable ‘busy life’ is added (Model B), and then we look at the influence of the perception of noise in and around the house (Model C). Model D gives insight in the influence of relaxing activities.

Figure 6. Models for the need for quietness.**Table 1.** The need for quietness in and around the home and in the neighbourhood (N = 809), multiple linear regression ¹.

	Model A		Model A+B		Model A+B+C		Model A+B+C+D	
	B	sig.	B	sig.	B	sig.	B	sig.
(Constant)	3.122	0.000	2.928	0.000	3.131	0.000	3.032	0.000
age (15–89 years old)	0.005	0.032	0.006	0.014	0.004	0.107	0.003	0.178
education level: higher education	0.172	0.006	0.162	0.011	0.150	0.016	0.135	0.031
health situation: poor/bad	<i>0.172</i>	0.068	<i>0.164</i>	0.083	0.143	0.122	<i>0.176</i>	0.059
sensitivity to noise: (very) sensitive	0.665	0.000	0.656	0.000	0.596	0.000	0.592	0.000
busy life			0.048	0.187	<i>0.065</i>	0.069	0.073	0.041
noisy/lively neighbourhood					−0.125	0.000	−0.117	0.000
noisy/lively home					−0.115	0.000	−0.115	0.000
nuisance of traffic, people, airplanes					0.200	0.000	0.191	0.000
walking or biking on a regular basis							<i>0.106</i>	0.081
visiting a quiet place on a regular basis							<i>0.099</i>	0.093
R ²	0.151		0.153		0.195		0.202	

¹ bold: significant at $p < 0.05$; italic: $p < 0.10$. B: unstandardized coefficients.

From the first model (Model A) we can conclude that the need for quietness is strongly influenced by sensitivity to noise and education level. Age and health have an influence but this is less strong. Other background variables like gender, household type, employment status and part of the city (not shown), do not have a significant influence on preference for quietness in the neighbourhood and are therefore left out of the model.

In the next model (A+B) the variable ‘busy life’ is added. In itself it has no influence but the influence of age is now stronger. Here the moderating effect of age appears: people with a busy life have a higher need for quietness than people who are not that busy, but on the whole this need for quietness is greater for older people than it is for young people.

In model A+B+C the perception of liveliness and noise in and around the house is included. A positive perception (liveliness at home and in the neighbourhood) has a negative effect on the need for quietness, a negative perception (noise nuisance) has a positive effect on the need for quietness. These perceptions rule out the influence of age and health, but the effect of education level and sensitivity to noise is still there.

In the final model (D added) the influence of relaxing activities (walking, biking or visiting quiet places) is added. Both variables have a small, though not significant positive correlation with the need for quietness: a high need for quietness thus may be related to participating in relaxing activities more often. What is interesting is the increased influence of health and busy life. This means that people with poor health or a busy life who do not participate in relaxing activities report higher needs for quietness than those who do visit a quiet place or go outside to walk or bike once in a while. Having a busy life or poor health could be an obstacle to participate in these activities, but with the present data it is not possible to test this hypothesis.

4. Quiet Places in the City

4.1. Awareness and Activities

80% of the respondents could mention a quiet place, either in their neighbourhood (question 8) or elsewhere (question 12). Fewer city centre inhabitants (63%) and fewer people of primary education level (66%) could mention a quiet place. The most often mentioned and perhaps most iconic quiet place in the city is in the heart of the city centre: the Begijnhof (Beguine's Court). This courtyard with the chapel of the 'Beguines' is just around the corner of the busiest shopping street of the city. City centre dwellers think of this less often as a quiet place, perhaps because of the number of visiting tourists they always see there. Second favourite is the Vondelpark, most of it lying between old houses on quiet streets, but with one end next to a main street and the Leidseplein area, one of the top entertainment centres.

Figure 7. Quiet places mentioned most often by respondents that live in or outside the inner city.

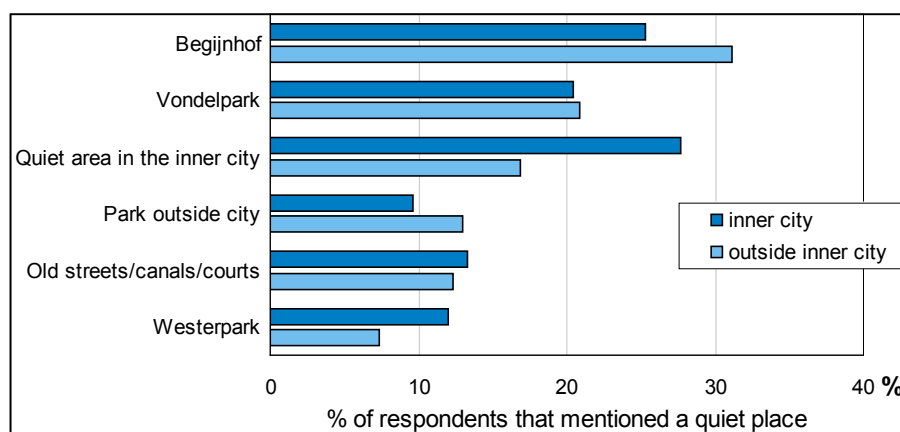


Figure 7 shows the percentage of respondents that mentioned a specific area or a specific type of area. Here respondents are classified into those that live in the central part of the city (the mostly pre-war part within the city's ring road) and those that live in the post-war suburban areas.

Respondents mentioned a quiet place 2,096 times, distinguishing 139 specific areas within the city limits (and six outside, not included here). Some were mentioned very often, such as the Begijnhof (423 times), Vondelpark (232) and Westerpark (126 times), but most (95 out of 145) were mentioned

by no more than five respondents. Most of the quiet places mentioned are green places: small and larger parks and recreational areas and along ponds, canals and rivers.

When asked what they preferred to do in a quiet place, choosing from seven items, most items were mentioned by the majority of respondents. Only reading and picnicking/talking/being together scored below 50%. In Figure 8 the response is plotted for three categories of noise sensitivity of respondents: (very) sensitive, neutral, and (very) insensitive. It shows that noise sensitive people find quiet places more important for relaxing activities than less sensitive people do. This is not or less the case for feeling free/no obligations and picnicking/talking/ being together.

Figure 8. Importance of a quiet area with respect to desired activities.

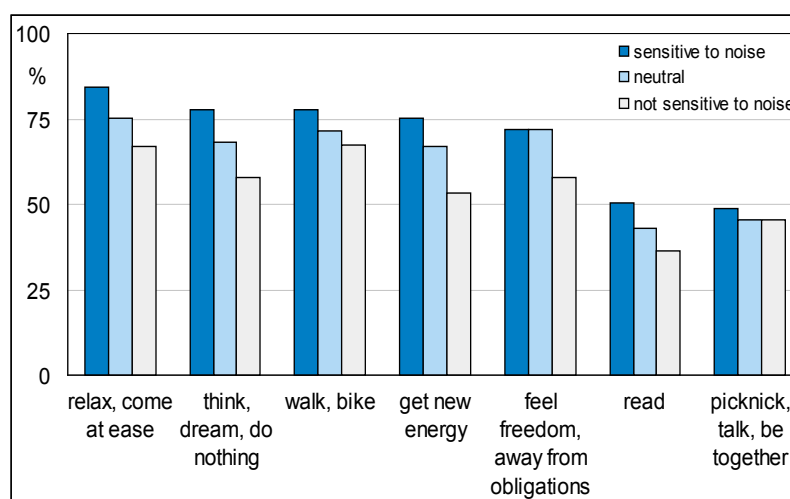
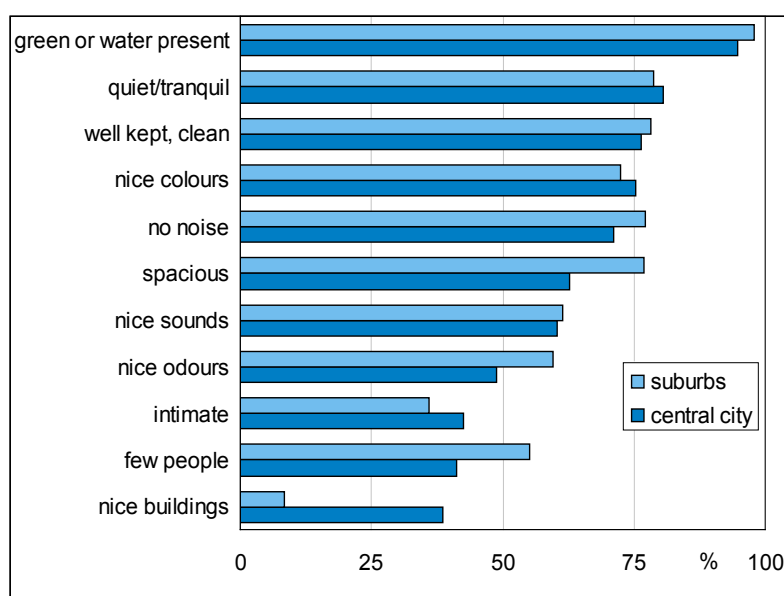


Figure 9. Percentage of respondents who think the given characteristic applies to a quiet area.

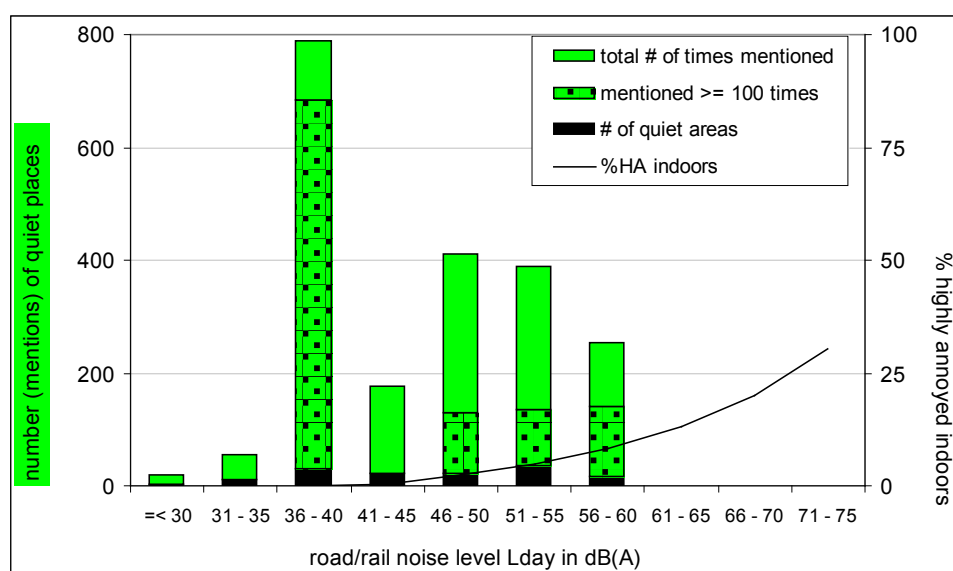


4.2. Area Characteristics

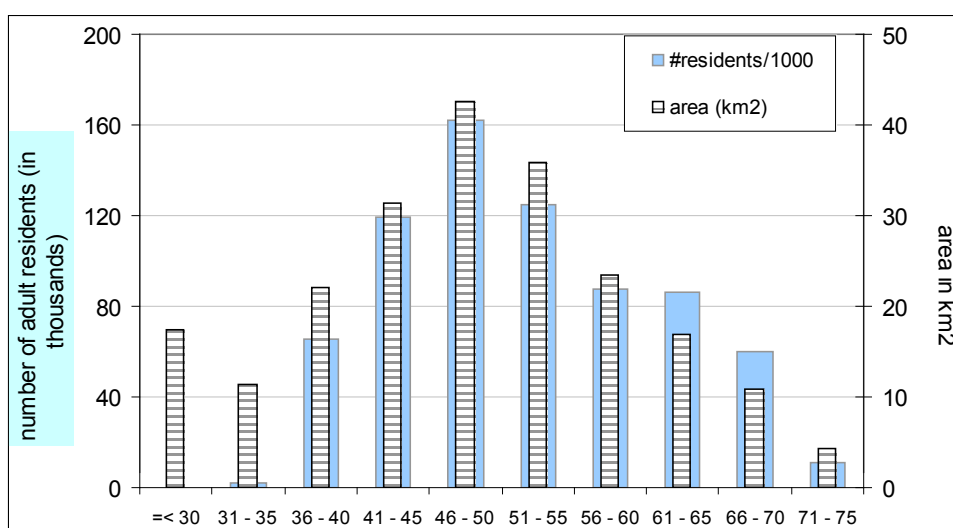
Respondents were asked what characterized the nearby quiet place (at walking distance from home) they most liked to visit. They could rate the importance of eleven different descriptions. In Figure 9 the

percentages of respondents are shown who thought that the description did apply entirely or in part. This shows that residents from the suburbs more often thought a quiet place is spacious, with nice odours and few people. Residents of the central city, a World Heritage site, far more often thought nice buildings were an important characteristic. The other characteristics were more equally shared by both types of residents

Figure 10. (A) Number of quiet areas mentioned (black) and number of times areas were mentioned (green), including areas mentioned over 100 times (dappled); (B) Area within noise contours (striped) and numbers of residents (light grey); all within each 5 dB noise class.



(A)



(B)

4.3. Noise Levels

For all quiet places resulting from the survey the sound level due to transportation and industrial noise has been determined from the noise maps. A single number was determined by using either L_{day}

of road/rail traffic, or the highest level of the three sources (road/rail, aircraft, industry), determined for the centre of the quiet place or, if not publicly accessible, a spot close to the centre. In Figure 10A all favourite quiet places mentioned by respondents are plotted in 5 dB classes of daytime road/rail traffic noise levels.

For most places the road/rail traffic determined the noise level (see Section 2.3), so there is little difference between these levels and the highest value of all transportation and industrial noise L_{den} levels. The (six) areas that were mentioned a hundred times or more are indicated separately. The low black parts in Figure 10A total the number of quiet places irrespective of the number of times mentioned. In most quiet places noise levels are above 40 dB L_{day} and apparently any noise level below 60 dB can occur in (the centre of) a quiet place. Noise levels up to 60 dB apparently do not exclude an experience of quietness. This could be because it is *relatively* quiet: for 70% of the respondents it is important that a quiet place is quieter than the surrounding area. Another explanation may be that the area has qualities (pleasant nature, nice colours and odours, clean) that are valued highly, giving the area a sufficient overall quality. There seems to be a preference for noise levels between 35 and 40 dB, although this depends predominantly on the two areas (the Beguine's Court and Vondelpark) that were mentioned most often.

As a reference with respect to the noise annoyance that is usually reported, Figure 10A includes the percentage of residents that are highly annoyed when being indoors when the façade is exposed to noise levels according to each noise class. The percentages are according to the dose-relationships given by Miedema *et al.* [17].

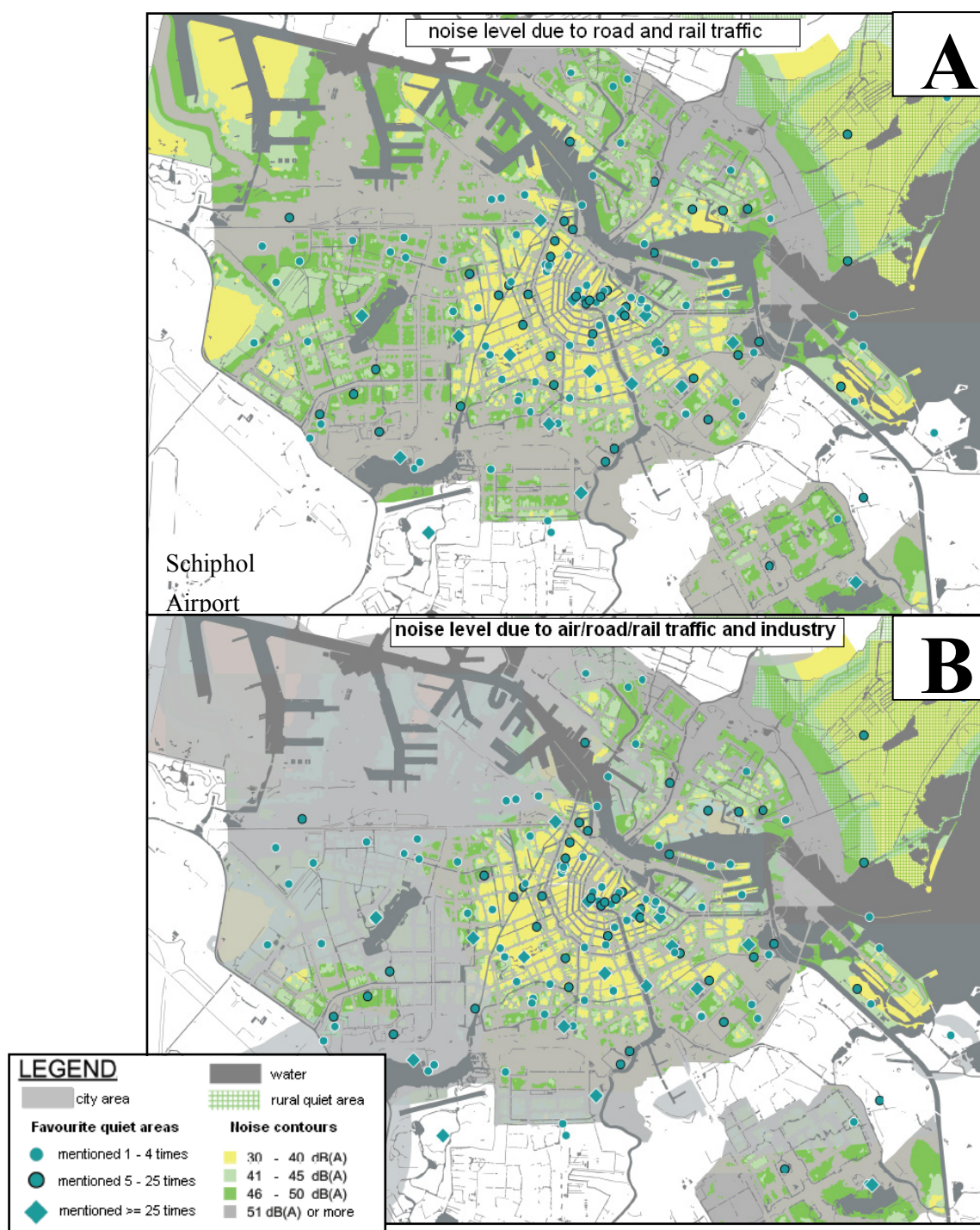
The distribution of quiet places over noise classes could be due to differences in the areas of the noise classes or the number of people living in the area. e.g., the high number in the 35–40 dB class could also be the result of a vast area of land surface, including recreational areas, in this class relative to the other classes. The relation with the area in each noise class is shown in Figure 10B and it shows that there is no excess area at noise levels below 40 dB. In Figure 10B also the number of residents in Amsterdam is plotted per 5 dB class of façade noise level. This shows that relative to the area of a noise class, less people live in the noise classes below 36 dB and more people live in noise classes between 61 and 70 dB.

It is possible that respondents who report a higher need for quietness mention other, more quiet, areas than other people do. This hypothesis could not be confirmed by the results of this survey. People who are more sensitive to noise did not mention areas with lower sound levels. Other personal variables, like age or household composition, do not give significant differences. Also the characteristics of quiet places (Figure 9) are not different for areas with higher or lower sound levels. These survey results thus do not support a link between the perception of sound and real sound levels.

4.4. A Low-Noise Map

In the upper panel of Figure 11 a low-noise map is shown of L_{day} (at 1.5 m above ground) of road and rail traffic, including trams and metro, in three intervals: <40 dB (yellow), 40–45 dB and 45–50 dB (light and dark green). In the lower panel L_{den} due to air traffic (Amsterdam Airport Schiphol is in the lower left corner) and due to noise from industrial premises (mostly near the harbour and the IJ river in the upper part) are added, reducing the area with low noise levels.

Figure 11. Quiet areas on low-noise map; (A) daytime sound level (L_{day}) of road- and rail traffic within the Amsterdam city limits in 5 dB intervals from 30 to 50 dB(A); (B) highest value of L_{day} road- and rail traffic, L_{den} of air traffic and L_{den} of industry.



The yellow and green area in the north east (map upper right) is Waterland, a provincial quiet area mainly for agricultural and recreational use. The map shows that large low noise areas are on the outskirts of the city and many small areas are in the older, central city. In between is a contiguous grey area adjacent to the city ring road; here are some small lower noise areas where high (apartment and office) buildings cast a sound shadow creating a quieter area. Many of the smaller yellow areas are the (either public or private) courts and gardens and small streets in and between the closed city blocks.

The maps show that in fact in the city centre transportation noise levels can be low and many of the quiet places mentioned in the survey and campaign are in the central part of the city, even though there are also busy main streets in this area. The low noise map in Figure 11 is published on the Amsterdam digital maps website [18].

5. Discussion and Conclusions

The results give a first impression of the characteristics of the need for quietness in the urban environment. The need for quietness is strongly related to noise sensitivity and the perception of sound. When sound is perceived as a negative factor (noise from transportation and people) there is a higher need for quietness, but as a positive factor (perceived liveliness at home/in neighbourhood) it reduces that need. However, the results do not allow us to establish the causality of these relations. There is also a relation between the need for quietness and the level of education: more highly educated people report a significantly higher need for quietness.

It would be interesting to investigate the need for quietness with both perceptions of sound and with measured sound levels. Here a first step is taken in comparing the perception of quietness with calculated sound levels. This shows that areas can be considered quiet at sound levels due to road and rail traffic up to 60 dB L_{day} , a level that is known to cause indoor noise annoyance in a part of the population. Perhaps a relatively high noise level is still less than the level in the immediate surroundings, or the noise could be compensated by other qualities of the (quiet) urban space. Noise levels of 36–40 dB seem to be preferred, though this is mainly due to two very popular areas.

Which quiet places people prefer, what characteristics they have or what sound levels are present does not depend on personal characteristics such as noise sensitivity, age or household composition. Therefore quietness seems to be a rather universal concept, at least for Amsterdam citizens: very different people can prefer the same quiet place.

The results show that relaxing activities are related to a lower need for quietness. An explanation could be that visiting, *i.e.*, walking or cycling to, quiet places is to find quietness that is insufficiently available at home or in the neighbourhood. It could also mean that more active people have a lower need for quietness.

Most people indicate they have the opportunity to go to a quiet place and go outside to walk or bike. Older people, people with poor health and people with busy lives, who report a higher need for quietness (though not significant with respect to health), can benefit if these places are nearby and accessible. In the light of the aging of the population and the 24 hours economy, quietness may thus become a factor of increasing importance that needs to be understood better.

It is clear that the acoustic quality of the city not only depends on the absence of noise but also on the presence of quietness and liveliness. As Jane Jacobs argued, a city flourishes because of diversity: in people, use of public space, architecture, *etc.* [19]. This also applies to the soundscape: there must also be diversity in the sonic/acoustic environment. A city can be very noisy, but that is less a problem if its inhabitants have access to quiet places: a quiet home and a quiet place outdoors. This project shows that this acoustic diversity is more prevalent in the old centre of Amsterdam than in the modern, suburban parts. Quietness and also liveliness (in terms of sound) are positive qualities.

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Conflict of Interest

The authors declare no conflict of interest.

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Appendix

Questionnaire Questions

Demographic and personal questions not shown below. Answering items in brackets and separated by “|”.

Introductory Text at Beginning of Questionnaire:

The city is synonymous with buzz and vitality. However, living in the city also means being able now and then to get away from it all. We would like you to tell us what peace and quiet in the city mean to you. We would also like to know what action you take yourself to find rest and relaxation.

1. Please describe briefly below what you do yourself to recover from the pressures of city life? YOU DO NOT NEED TO INCLUDE EVERYTHING, JUST WRITE THE FIRST THING THAT COMES TO MIND. IF NOTHING COMES TO MIND, OR IF YOU DON'T DO ANYTHING, LEAVE THE SPACE BLANK.
2. Is your neighbourhood inclined to be quiet or lively/noisy? (1 very quiet|...| 5 very lively/noisy).
3. Is it inclined to be quiet or lively/noisy in your home? (1 very quiet|...| 5 very lively/noisy).
4. Is it inclined to be quiet or lively/noisy in your garden or on your balcony? (1 very quiet|...| 5 very lively/noisy| 6 no garden/balcony).
5. To what degree are you annoyed, disturbed or irritated by the types of noise below when you are at home? Consider the last 12 months (road traffic| aircraft| trams and/or trains| people in the street| neighbours; each item: 1 not annoyed at all| 2| 3| 4| 5 very annoyed| 6 not heard).
6. To what degree are you generally sensitive to noise? (1 very sensitive| 2| 3| 4| 5 very insensitive| 6 don't know).

7. How important is quietness to you... (in/around home| in the neighbourhood| in the city; each item: 1 not at all important| 2| 3| 4| 5 very important).
8. Is there a quiet place within walking distance of your home, or perhaps several? If so, can you describe where that place is or where those places are? Mention the name of the street, square, park and/or water. (yes -if so, give name| no there are none| don't know).
9. Which place, of those you have mentioned, within walking distance of your home do you prefer to go to for peace and quiet? (give name).
10. How often have you visited that place in the last 12 months? ((almost) daily| at least once a week| at least once a month| at least once in the last 12 months| have not visited it in the last 12 months).
11. How would you characterise this place? (absence of bustle/noise| few people/deserted| quiet compared with the surrounding neighbourhood| pleasant sounds| pleasant smells| lovely colours| greenery or water| beautiful buildings| open space/being able to see into the distance| closed in/intimate| well maintained /clean; each item: does not apply at all| barely applies| neutral| applies a little| applies entirely).
12. Amsterdam has a variety of parks, water bodies and (enclosed) gardens, as well as squares, side streets and courtyards where the buzz of the city seems to disappear. Can you name one or more places in the city where you experience peace and quiet? Mention e.g., the name of the street| square| park and/or water body (give names).
13. Which of the places in the city, among those you have mentioned, do you prefer to visit for peace and quiet? (give name).
14. How often have you visited this place in the last 12 months? ((almost) daily| at least once a week| at least once a month| at least once in the last 12 months| have not visited it in the last 12 months).
15. What do you think is important in a quiet place? That you can... (walk/cycle| picnic/talk/be together| read| think/dream/do nothing| get away from it all /take a breather| feel free /get away from obligations| charge the batteries/refresh your energy; each item: 1 not at all important| 2| 3| 4| 5 very important).
16. Do you feel that you have a lot or too little free time? By free time, we mean the time that you are free to spend entirely as you choose (I have a lot of free time| I have quite a lot of free time| not really too little but not really a lot of free time| I don't have much free time| I seldom have free time| don't know)
17. How regularly... (do you feel you don't have enough time| do you feel you have too little time to relax| do you feel bored; each item: very often/almost all the time| regularly| now and then| seldom/never).
18. How often do you undertake the following activities in your free time? (walking or cycling in (the surroundings of) Amsterdam| going to a festival, picnic or barbecue in the park| going to a pub, terrace or cinema| visiting a museum, theatre or concert| going to the zoo, botanical garden or children's farm| shopping, going to the market; each item: regularly| now and then| seldom| never).
19. To what extent do you agree with the following statements? (because of my health I can't go to a park, green area or quiet place| I can visit a park, green area or quiet place if I want to| I have

no time to go to a park, green area or quiet place| it costs me too much money to go to a park, green area or quiet place| from where I live, it is difficult to get to parks, green areas or quiet places| I don't feel safe in the parks, green areas and quiet places in the area where I live; each item: agree entirely| agree| neither agree nor disagree| disagree| disagree entirely)

20. How is your health in general? (excellent| very good| good| reasonable| poor).

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