

Healthy urban living: integration of noise in other local policy domains

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Summary

Increasing numbers of people are living in, densely built, cities, and this trend will continue. Municipalities consequently are facing serious challenges such as accommodating spatial claims from housing, mobility and economy and in the meantime improve environmental quality and public health. Healthy urban living is gaining interest from academic as well as public administrations, integrating several of the aforementioned local policy issues. The city of Rotterdam, for example, currently implements policy on greening the city. Nature and green elements in the city, such as green roofs and green facades, catch rain water, isolate houses against energy loss and prevent water flooding and heat stress. In addition, research has shown the positive effects of green on stress reduction and masking of non-wanted noise sources. The Rotterdam ambition for 2014 is to increase the amount of blue (water) and green parts of the city, with a specific focus on the social-weaker southern parts of the city. In longer timeframe green has to be a standard topic in the policy instruments employed in noise, health, climate, water and air quality domains. Currently research is conducted by various municipal (health and environment) departments to develop tools and instruments in order to integrate noise in this healthy urban living policy domain. Ideas are, for example, to define a geographical norm for green and relatively quiet areas, to develop a cost-benefit analysis for relatively quiet areas, and to – hands on – redevelop three residential areas in Rotterdam Zuid with a focus on public participation (specifically by unemployed and social weaker groups), green features and health. In the latter, noise will be a minor topic. The main aim though is to get a better insight in the common language, approaches and tools used by social workers, public health and other municipal departments, and integrate noise and soundscape knowledge into their daily working practice.

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1. Introduction

Environmental policy since the 1980s, and specifically noise policy, has achieved significant results in reducing environmental health impacts. In the Netherlands, since the implementation of the national Noise Abatement Act in 1979, many houses with (too) high noise exposure have been insulated, new infrastructure and residential areas have been built within the noise limits set, and industries have been stimulated to install low noise equipment. In contrast to the air quality policy domain, however, no downward trends seem to be witnessed within the Dutch noise policy field – and this probably goes for the European level as well [1]. The percentages of noise annoyed and sleep disturbed humans, due to traffic, railway and industrial noise, have been stable since decades in the Netherlands. At European level the EEA recently reported similar figures [2], stating that “...more than 125 million people could actually be exposed to road traffic noise above 55 dB Lden, including more than 37 million exposed to noise levels above 65 dB Lden..”. Further on EEA concludes “...estimations show that nearly 90 million people are exposed to road traffic noise *inside urban areas*, in Europe, above 55 dB Lden...”(p.24).

Noise therefore is one of the main environmental issues that will be addressed in the review of the Environmental Noise Directive by the European Commission as well in the Dutch ministerial program on ‘modernisation of environmental policy’, which last year has been announced by the Secretary of State on Environment, focussing on public health and quality of life.

Long term exposure to noise negatively effects human well-being and health. Effects, such as annoyance and sleep disturbance, occur at relatively low noise exposure levels. The World Health Organisation (WHO) therefore suggests 40 dB during the night as preferred exposure limit; although in specific situations and for limited periods 55 dB Lnight might be accepted [3]. In order to limit noise annoyance and the subsequent health effects such as stress, high blood pressure, ischemic heart diseases and myocard effects, the WHO proposed a maximum limit of 50 dB Lden for road traffic noise and a maximum limit of 55 dB Lden for high noise annoyance [4].

An update of the WHO studies for Europe is to be expected end of 2015 or early 2016, which will hopefully gain attention and will influence noise policy development and implementation internationally.

Until recently environmental policy, and specifically noise policy, mainly focussed on setting preferred and maximum limits to be applied and assessed in spatial and infrastructural developments. The main aim is to prevent high noise exposure at dwellings due to these new developments; being a so-called limitative regulative policy approach. Today we witness, however, a new role for public health within the domain of the built-environment and the cities. New paradigms or problem frames occur, such as healthy urban living (e.g. water, quiet, light), green attractive cities, resilient cities (e.g. adaptive, adaptation), active and social cities (e.g. contact, participation). Regarding noise, concepts such as soundscape and (good) acoustic environments as part of environmental quality or quality of life gain interest. Relevant conditions are, amongst others, acoustic climate and relative quietness as positive (perceptual) values and compensation for high noise exposure, diversity (in time and place) in soundscapes and fit with area characteristics and functions of usage.

This ‘other’ perspective or policy paradigm requires a shift from the traditional sectoral noise policy approach based upon regulative instruments towards integrated, local(ised), participative and adaptive policy styles. The city is particularly fit for addressing these challenges, being the geographic, economic and institutional system for innovative policy approaches (see e.g. information on 100resilientcities.org). Within the city we find dynamism; new infrastructure (‘analogue as well as digital’) and urban renewal, of the 21st century, will incorporate public health and quality of life themes in addition to the traditional economic assessments. As such involving – local(ised) – knowledge from companies, knowledge institutes and citizens.

2. Paradigm shift towards quality of life: a brief summary of recent literature

Recently we find an increase of scientific interest in and research on the concepts of quality of life, health and well being in relation to environmental and noise stressors, soundscape and, for example, living quality of residential neighborhoods.

Although many cause-effect relations are still not fully understood, these studies provide interesting approaches in establishing a shift towards more holistic and resilient policy approaches at city level. In this section I will briefly introduce and discuss recent and ongoing research, in order to provide a framing for integration of noise policy in other policy domains (in section 3).

The appreciation and valuation of quality of life of residential areas depends on various factors, often grouped into personal attributes, characteristics of the dwellings and the characteristics of the neighborhood. Similar factors are known from research on annoyance and health and the dose-response mechanisms for environmental noise. Botteldooren et al. [5] provide the following brief summary regarding these indicators, stating “The most stable personal factor is ‘subjective noise sensitivity’, which is an important predictor of noise annoyance. Other significant indicators include person-related variables (age, years of employment, stress score, duration of stay at the accommodation during the day), house-related variables (windows of living room and/or bedroom oriented towards street) and neighborhood-related variables (noise levels as equivalent noise level Leq for the daytime and night-time periods, the maximal night-time noise level L_{max} , traffic flow during day and during the night)” (p.778). In their research on the relationship between traffic noise and perceived quality of life in the neighborhood they found, more or less to their surprise, that noise exposure during trips (from home to work, school or shopping) is a significant contributor to the appreciation of the quality of life; a stronger contributor than the noise exposure at the facade of the dwelling.

For example Devilee et al. [6] presume three different aspects as characteristics for the valuation and appreciation of the *acoustic quality of neighborhoods*. These are the following: social aspects (e.g. socio-economic status of the population, social cohesion), physical aspects (e.g. water, green, public space, type and density of built environment), and acoustical features (e.g. spatial and temporal variety in sounds, average noise levels, peaks and/or low frequency noise). From a literature review these authors found that social aspects influencing sound quality are age and length of residency. Physical factors influencing sound quality are the shape of the place, street furniture and visual features. This is

in line with results found in the LIFE+ financed QUADMAP project in Rotterdam; green, nature features, (well maintained) facilities and visual characteristics showed a strong correlation with the appreciation of the overall quality and the acoustic quality of two urban parks by its users [7]. Finally, the literature review by Devilee et al. resulted in a broad variety of indicators being applied regarding sound levels and sound characteristics. Examples, discussed in other studies [8, 9] as well, are measures for average A-weighted sound levels, background noise indicators (e.g. LA_{95} and – specifically – LA_{50}), and indicators expressing spectral variance or time structures, or subjective evaluations.

The Swedish Soundscape Support to Health research programme (for a comprehensive overview see [10]) addressed, amongst others, the effects, in terms of benefits, of quiet sides of dwellings and *nearby green areas*. In line with other scientists the authors stress the need to extend the current stress models (and subsequent policy approaches and legislation) to identify and include also environmental factors that may moderate the exposure-effect relationship by promoting health and well-being. Studies in the 1980s and 1990s learned that the availability of nearby trees and of, within walkable distance, green areas, parks or squares, are highly valued components of living quality and increase satisfaction and well-being in urban residents. With regard to green-area availability the study revealed that residents with ‘better’ access to green areas are significantly less noise annoyed due to road traffic both when being at home and when being outdoors close to the dwelling, than respondents with ‘poorer’ access to green areas. In addition, respondents with ‘better’ availability to green areas perceive noise significantly lower as a neighborhood problem. These residents seem to walk and exercise in their neighborhood far more; the positive effects of physical activity on public health being strengthened through this effect as well. Finally regarding psychosocial symptoms, respondents with ‘better’ availability to green areas scored significantly lower regarding tiredness, stress and irritations/anger.

The authors conclude stating that (p.123), “Applying the ART approach (attention restoration theory from Kaplan), green areas in close proximity to where people reside may provide an important place for urban residents to escape from stressful and challenging situations,

such as chronic noise exposure, together with a sense of “being away” (physically, psychologically) from everyday thoughts and experiences that tap attention. With respect to the “fascination” component of ART, contact with nature may assist in shifting noise-exposed resident’s attention from effortful (e.g. focus on traffic noise) to effortless (e.g. experiences of tranquillity, positive feelings). This can also be achieved in activities, such as promenades, exercise, and relaxation that an individual can be engaged with when visiting the nearby green area. Trafficked streets are not only noisy; they might also be visually complex.”

A significant effect for access to a *quiet side* was only observed for annoyance at home. Previous studies [e.g. 11, 12] underline these findings. The modifying effect of having access to a quiet side of one’s dwelling stems from the increased perceived control of the noise exposure by providing an opportunity to reduce the amount of time the individual is exposed to noise, including possibilities for non-noise disturbed sleep, relaxation, opening of windows et cetera.

A comprehensive literature study on the effect of so-called *quiet sides of dwellings* has been conducted by Van Kempen and Van Beek [13]. Annoyance and severe sleep disturbance due to road traffic noise decrease in situations where people have a quiet side of their dwelling, that is having a one or more facades that are not exposed to road traffic noise. The authors conclude that the effect of having a quiet side is similar to a reduction of the noise exposure at the most exposed facade of 2 to 8 decibel.

Since several years the research field on *soundscape* has enormously grown, in interest, research and publications. Gidlöf-Gunnarsson and Öhrström briefly discuss positive soundscape as well, referring to earlier studies by for example Kaplan, Grahn, Berglund or Guastavino, that opportunities to experience quietness or – rather – to experience freedom from unwanted sounds plays an important role in recreation experience. Natural sounds, such as birdsong, rustling trees and water, seem to be highly appreciated and perceived as pleasant sounds, in contrast to mechanical sounds such as traffic and machines.

Another interesting (sub)field of research concerns green areas suited for children to play. These areas seem to support social interaction and cohesion in addition to stress reduction [see e.g. 14, 15].

Finally, a recently started scientifically relevant research, funded by the EU framework programme FP7 called PHENOTYPE has to be mentioned in this section’s overview of literature. In this large study positive health effects of the natural outdoor environment in typical populations are researched, focussing on the underlying mechanisms for the relationship between green space and health and addressing stress reduction, restorative function, physical activity, social interaction, and exposure to environmental stressors (a research introduction is provided in [16]). Results will become available during the coming years; which will be of great importance for the shift towards policy on healthy urban living and the integration of noise policy into other (local) policy domains.

3. Integration of noise policy: resilient cities

From the literature in the previous section we learn that health impacts (negative or positive) due to noise exposure can be addressed in various ways. The traditional policy approach of stringent noise source regulations (at EU level) and noise immission limits for physical planning have proven to be effective, though the (policy) glass can be considered half empty or half full. Cities still face many challenges; noise or acoustic environments and the subsequent public health and quality of life themes should be high on the political and societal agendas. A way to gain this interest is by using a different policy frame or problem definition. Integrating noise into other policy domains such as climate adaptation, social and environmental inequity or (large scale) urban renewal will facilitate this necessary shift towards ‘sound policy making and implementation’.

Having gained some knowledge about and experience with sustainability topics, many large cities in Europe and worldwide adopted the concept and ideas of resiliency. Urban resilience to be understood as “the capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt and grow no matter what kind of chronic stresses or acute shocks they experience”. Long term exposure to noise due to road or railway traffic is an example of chronic stresses. City resilience has four key dimensions, that is (i) health and wellbeing, (ii) economy and society, (iii) infrastructure and environment, and (iv) leadership and strategy.

By identifying the most important risks stemming from these dimensions and their various factors, multiple entry points for actions and measures can be identified and implemented. From this resilience perspective conservation of assets, climate adaptation, environmental policy, public health and community participation could provide interesting 'entry points' for noise policy actions.

These 'problem definitions' or 'entry points' were found in the brief literature overview in section 2 as well. For example, conservation of assets is in line with the EU Environmental Noise Directive's requirements to preserve areas where the acoustic quality is good. (Relatively) Quiet urban areas, such as inner courts, squares and parks, provide green areas where citizens can rest, relax, walk, exercise or socialize. Interesting combinations can be made with climate adaptation, heat stress and air quality policy domains.

A promising measurement is the use of green facades, which seems to improve the acoustic climate inside the dwelling as well as reduces energy costs (for heating). In addition, edible green at the facades is specifically interesting at the disadvantaged social classes and deprived neighbourhoods. Although recent experiences learn that maintenance of these green and/or edible facades requires intensive support by the local administration or other institutes.

These features of green and nearby relative quietness should be addressed in spatial planning as well; at an early stage of design of (re)new(ed) residential areas the following 'stepwise approach' can be recommended; dwellings should have:

- at least a bedroom and the living room at the quiet side of the house.
- an outside space (balcony, roof terrace, inner court or (shared) garden) at the quiet side of the building block.
- access to nearby green area within 5 minutes walking.
- access to a larger natural area within 15 minutes travelling by bike or public transportation.

As such both the characteristics of the dwellings and of the neighbourhood are improved, and physical activities (health improving) are supported.

4. Inspiration from the resilient and sustainable city of Rotterdam

Since several years Rotterdam has been working successfully on establishing a city with high quality of life combined with a strong economy. As part of its sustainability programme significant results have been achieved such as the establishment of a huge network of charging points for electric vehicle, many main streets have been paved with low noise asphalt, and regarding climate adaptation Rotterdam can be considered frontrunner internationally.

In 2014 the mayor and elders adopted a new four year programme, specifically targeted at the Rotterdam citizens. Rotterdam is famous for its workers' mentality that has been incorporated in the city's programme #Kendoe (similar to the English 'can do') as a synonym for an approach of rolling up your sleeves, diligent working and less talking. The main focus of the city for the coming years will be on greening the city, improving air quality and, for example, energy neutral houses. Topics that are of direct interest of and that will have a clear and visible (and audible) impact on the Rotterdam citizens.

Rotterdam's ambition is to realize a healthy, livable and flourishing city. As such air quality will be improved, biodiversity will be increased, the city will have to have more green and nature, and water retention and water safety will be enhanced. Quiet urban areas from the perspective of noise policy makers are green natural areas from the perspective of urban planners. Or stress reducing and physical activity stimulating areas from the perspective of the experts from the public health department.

Green natural areas stimulate people to get outside and become physically active or socially interactive. And these areas create healthier living environments, facilitate water retention, reduce heat stress and increase attractiveness and value of real estate. The ambition therefore is to provide green areas and natural urban soundscapes within walking distance for all Rotterdam citizens in due time. A parallel will be made with the so-called Rotterdam norm for playgrounds for children, taking into account for example geographical spread, inhabitant density and seize of the green area.

An interesting approach has been initiated in 2014, called the Green Focus Areas (in Dutch: Groene Focuswijken). In seven old and deprived residential areas green, natural features will be implemented in close cooperation with the citizens, citizens' organizations and several municipal departments. A multi disciplinary and participative approach will have to result in high quality small green areas and public spaces, trees along the roads, or green facades. Small scale city farming initiatives or even the so-called city guerilla claiming wastelands, provide working opportunities and edible green for the unemployed or socially excluded citizens. The teahouse and mint plant garden facilitate social interaction between autochtones and immigrants, and working opportunities for Moroccan and Turkish women in that specific neighborhood. And many more inspiring examples can and will be found within the city boundaries. Crucial though is the willingness of the city council and the civil servants to initiate, invest and involve.....

5. Conclusions

Improving public health and quality of life requires different approaches in addition to the traditional policy instrumentation of noise source regulations and immission limits for physical planning. A paradigm shift towards 'sound policy' and integration into other – sustainable and resilient – policy approaches is needed. Recent research on the positive effects of areas with good acoustic (and other) qualities and initiatives within front runner, resilient cities provide ample opportunities to provide insights into the mechanisms, the challenges, risks and benefits of these approaches, and call for continuous research and knowledge sharing and dissemination between public and private stakeholders.

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