

Urban parks as nature-based solutions for improved well-being under the flight paths

A soundscape analysis
in the vicinity of Heathrow Airport

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http://www.londontown.com/LondonInformation/Travel/Heathrow_Airport/3ca1/imagesPage

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From environmental noise to soundscape research

In its recently published Environmental Noise Guidelines, the WHO calls for further studies directly linking noise interventions to health outcomes other than annoyance, such as mental health, quality of life, and well-being.

(Clark, 2018)

Nature-based solutions, including trees, parks and other tranquil areas, are increasingly being recognised as health-promoting and sustainable forms of noise mitigation in growing cities (EU Environmental Noise Directive).

(Jarosińska et al., 2018)

Noise as a health risk
Noise annoyance
Noise indicators
Goal: Absence of noise

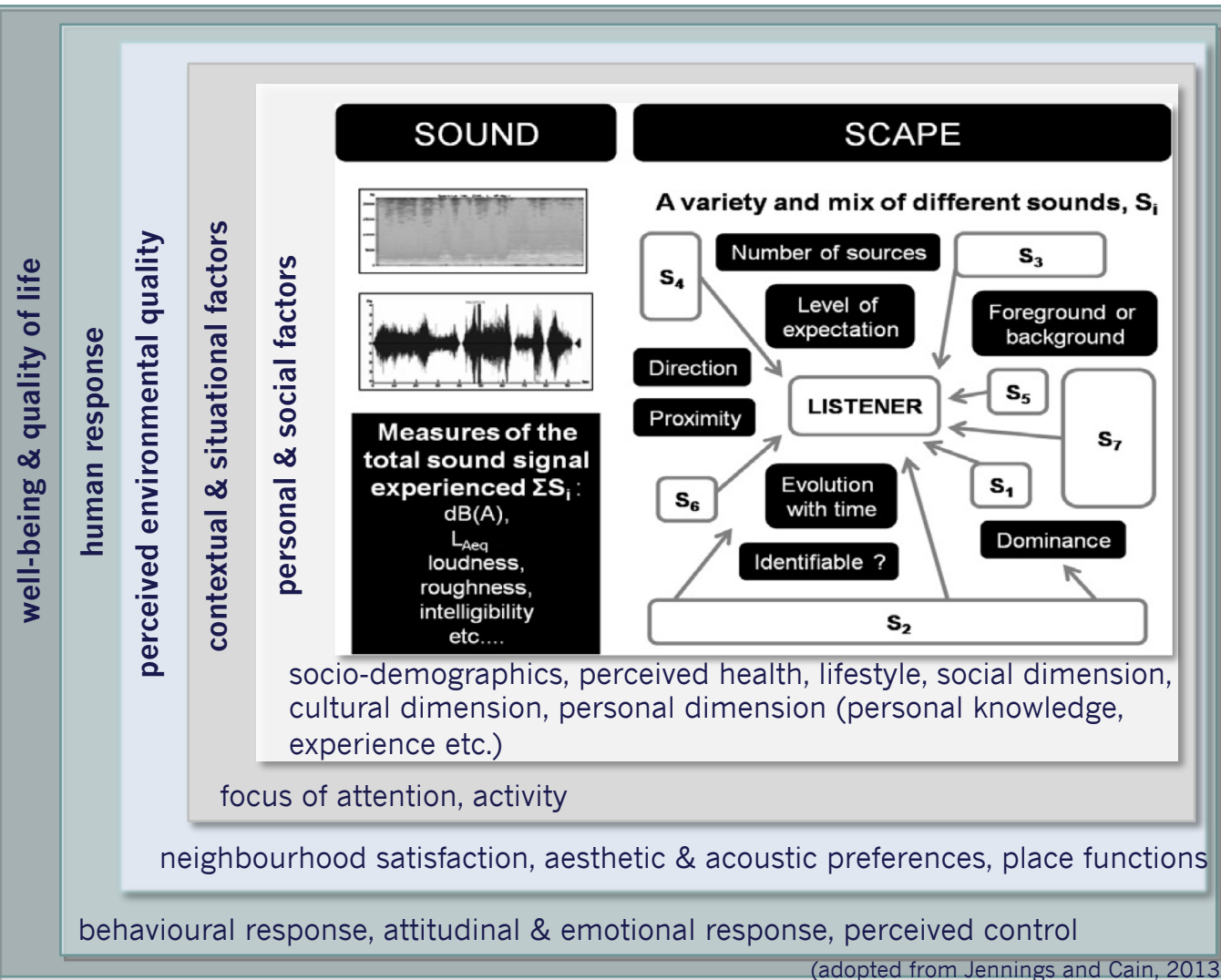
Traditional **environmental noise assessments** aim to reduce annoyance by decreasing noise exposure levels

Sound as a health resource
Well-being & quality of life
Contextual factors
Goal: Sounds of preference

Soundscape studies aim to support well-being and quality of life by promoting desirable soundscapes and neighbourhoods

(Schulte-Fortkamp and Fiebig, 2016)

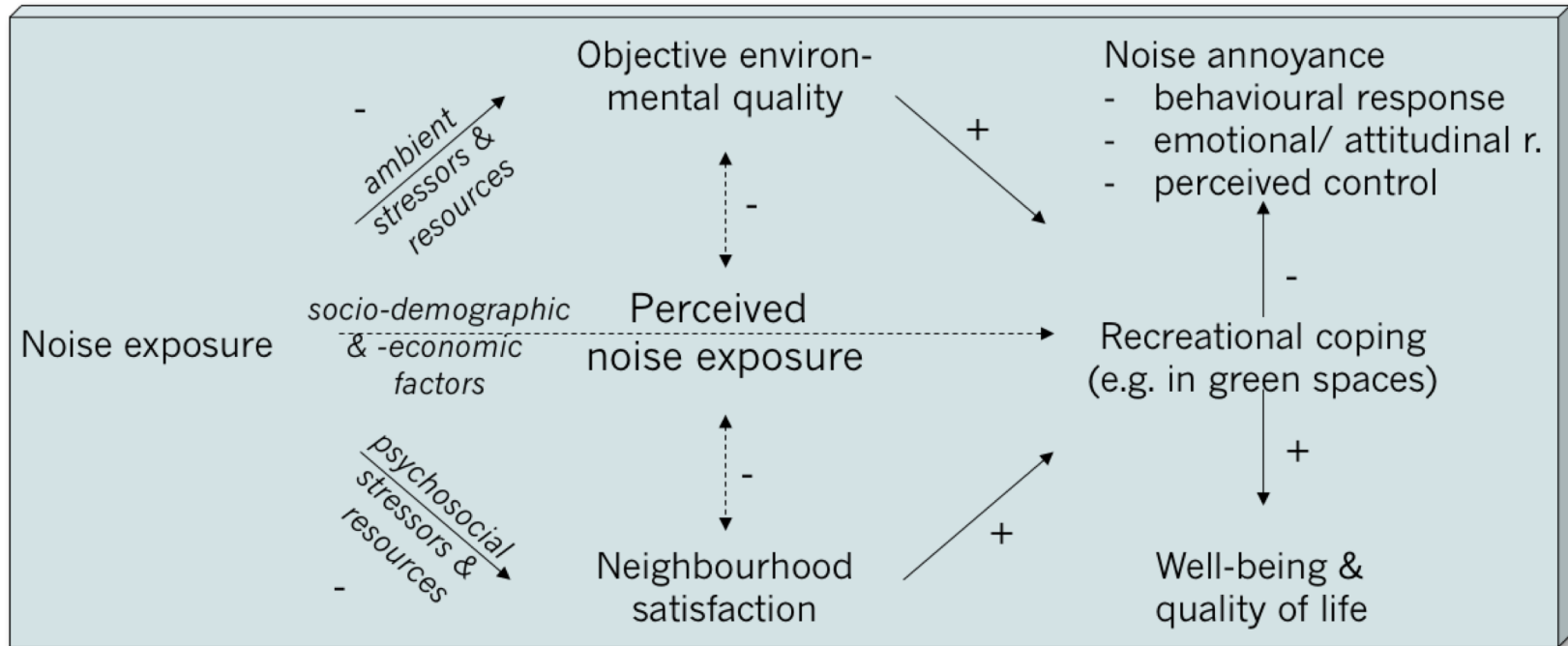
Theoretical approach – Soundscape



Sound quality describes the perception of the adequacy, suitability or desirability of a sound being judged against an individual's desires, expectations and needs in a specific situational context

(Schulte-Fortkamp and Fiebig, 2016)

Aims & Rationale



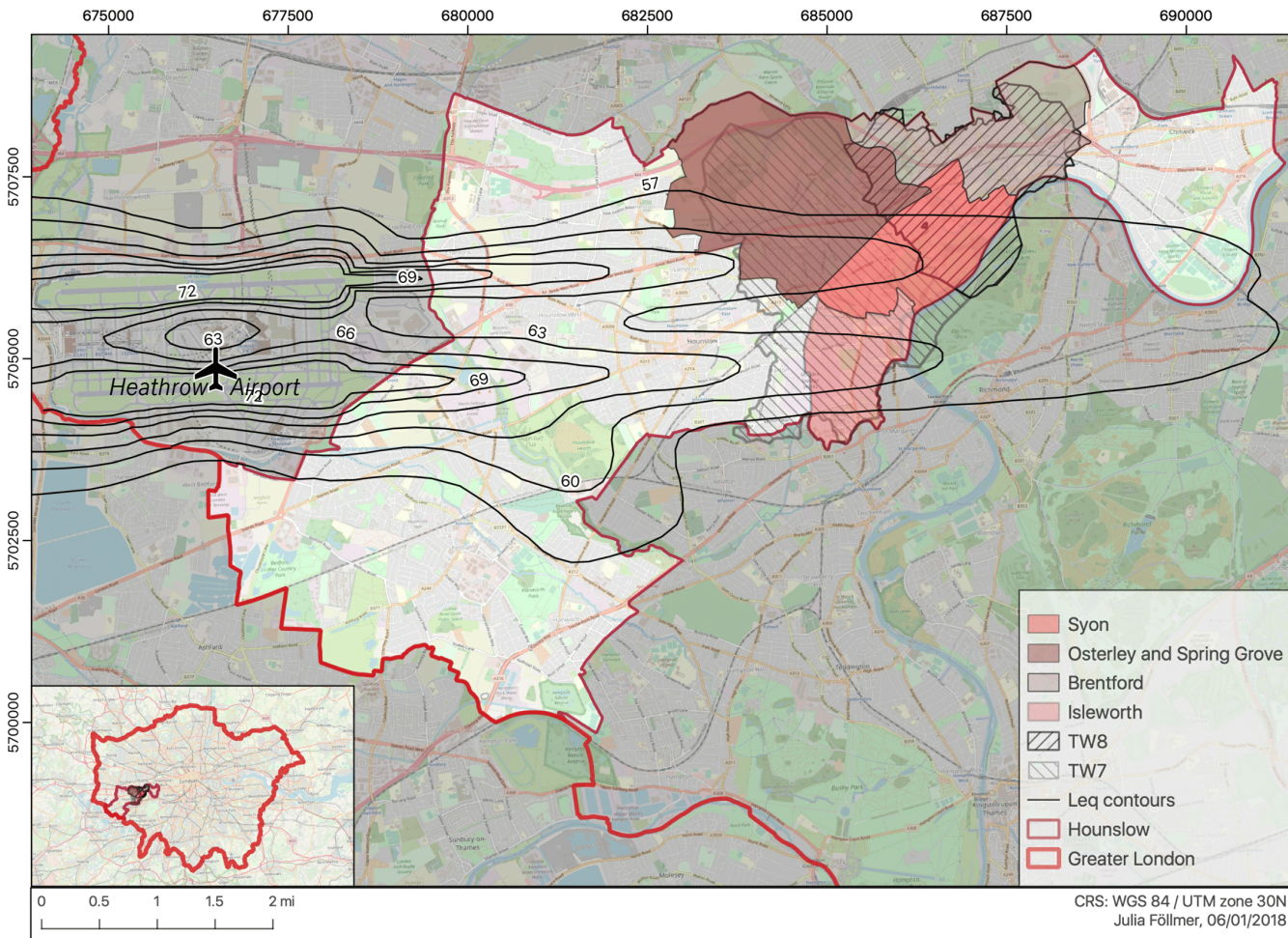
(J. Föllmer, based on Riedel et al., 2015)

How does (physical/ perceived) environmental quality influence ...

- ... cognitive & emotional responses to noise?
- ... behavioural responses to cope with noise?

To what extent does interaction with urban vegetation modify the way people perceive noise?

Study area

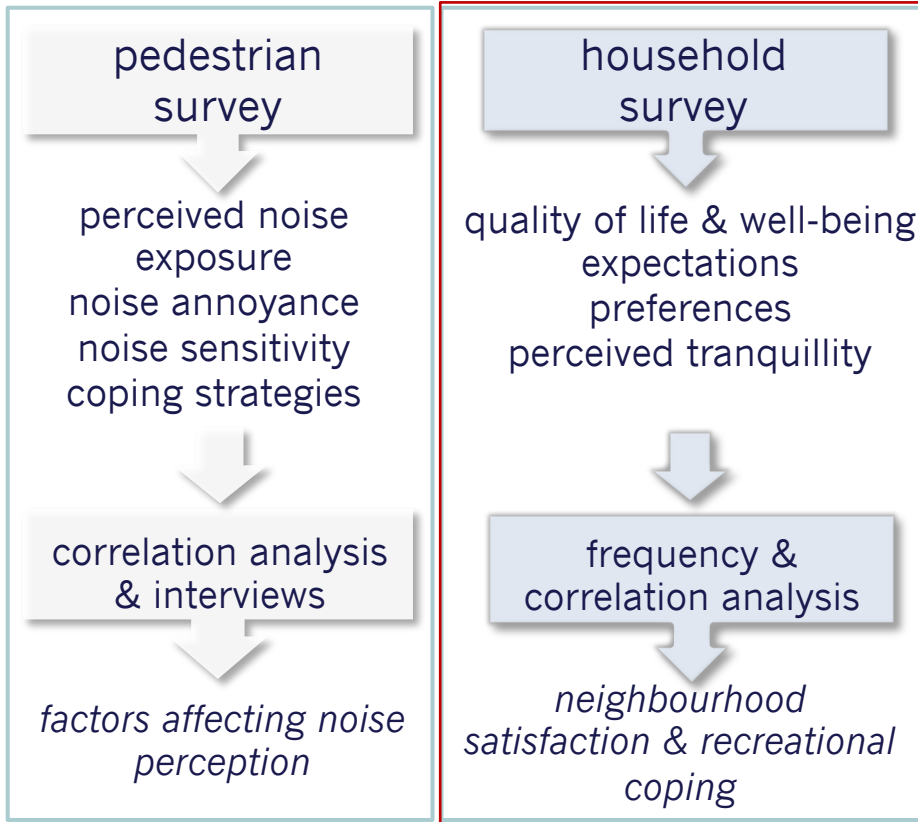


The opening of a third runway would result in approximately 92,700 more people being affected by **noise levels of at least 54 dB $L_{Aeq, 16hr}$** , leading to a total number of **653,900 people** (DfT, 2017a).

Hounslow is the most overflowed London borough. In Isleworth and Brentford, 94,000 residents have to bear a **plane every 60 to 90 seconds** (House of Commons Hansard, 2016).

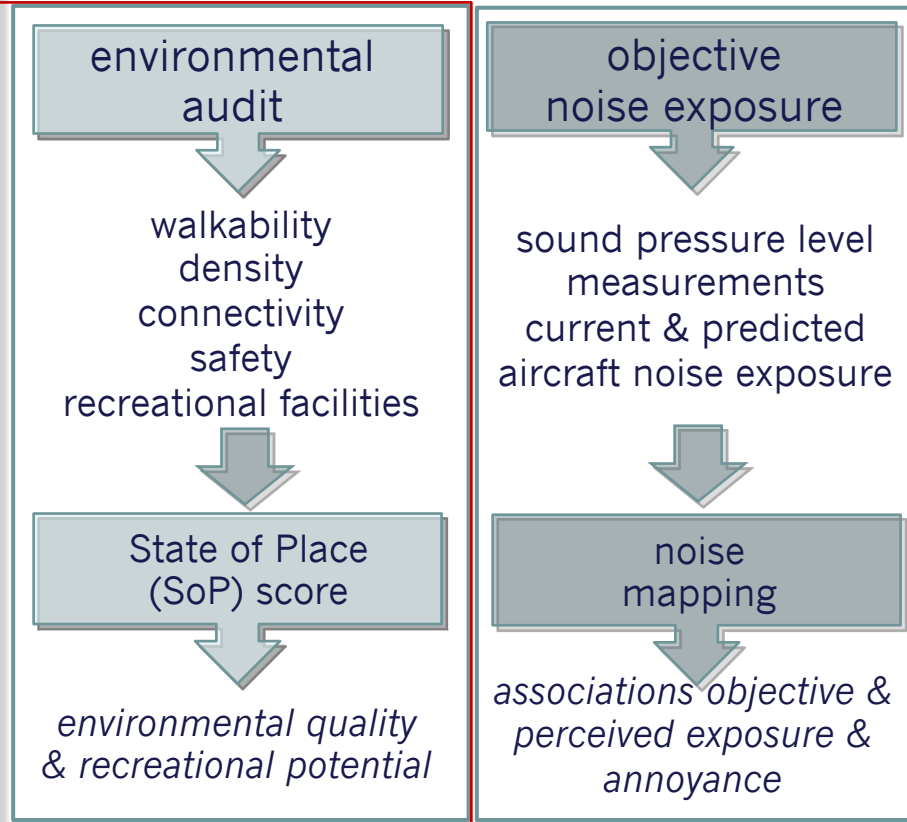
Methodological approach

I psychosocial stressors & resources



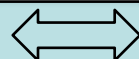
perceived environmental quality

II ambient stressors & resources

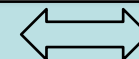


objective environmental quality

psychscape



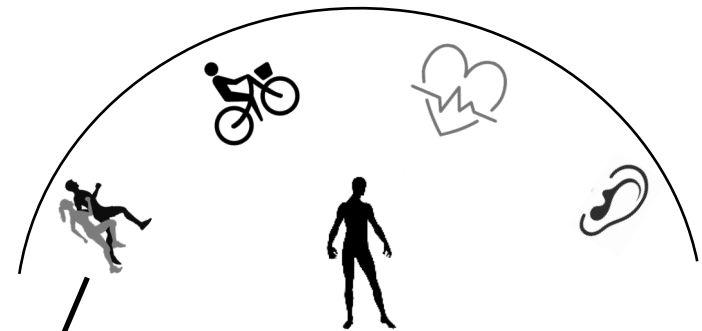
enviroscape



soundscape

Results: Micro-meso level

Being annoyed from aircraft noise and perceiving one's noise exposure in everyday life as high appeared to negatively impact well-being
(*hypothesis h_1*).



Meso level

situational context

- perceived noise exposure & tranquillity
- lifestyle & activity (disturbances)
- stress level
- environmental preferences
- perceived access to & usage of recreational facilities

Micro level

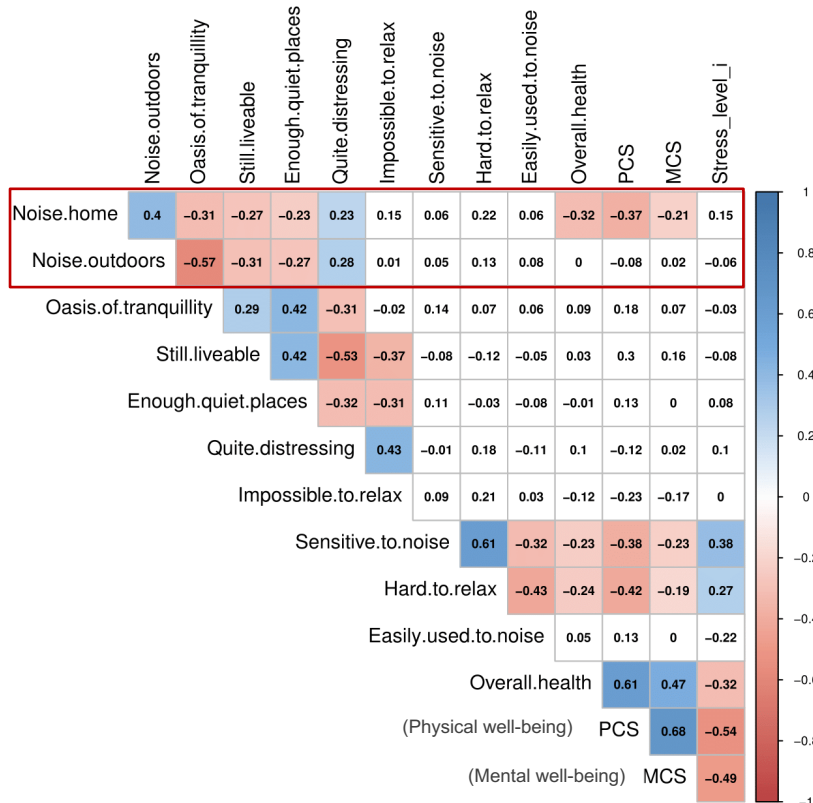
personal context

- perceived well-being & quality of life
- personal knowledge & experience
- noise sensitivity

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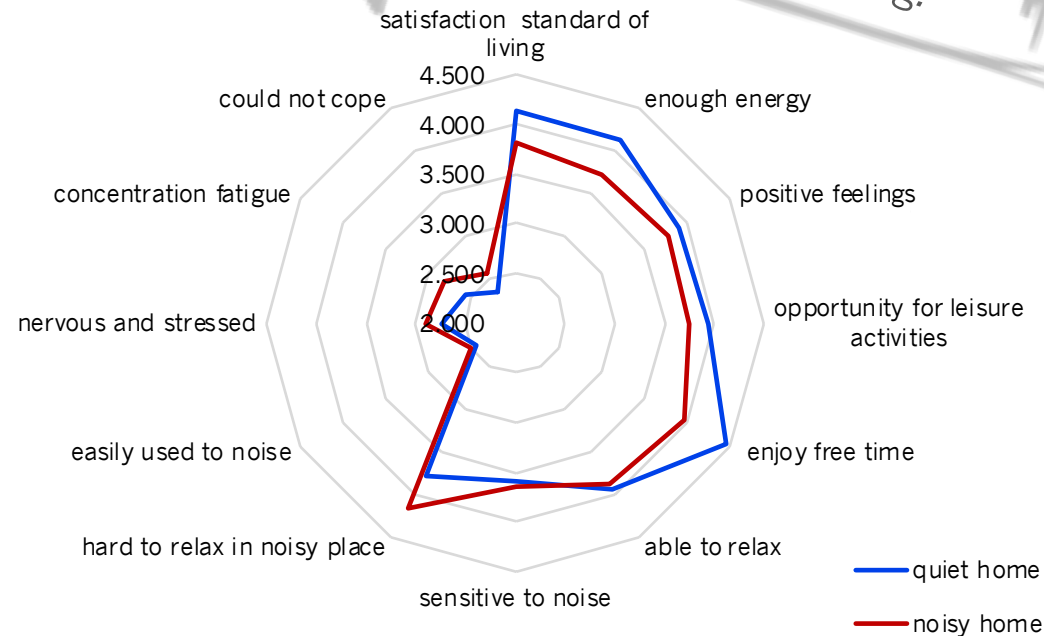
Results:

Micro-meso level



Spearman rang correlation coefficient for perceived noise levels, perceived tranquillity, and self-rated health outcomes.

Both high indoor and outdoor sound levels diminished quality of life in the neighbourhood. Yet, only rating indoor sound levels at home as low was significantly associated with consistently higher ratings of overall health, physical well-being, and mental well-being.



Self-rated well-being and stress level during the past four weeks [mean on a 5-point scale].

Neighbourhood satisfaction was found to act as a psychosocial noise buffer, by reducing perceived noise exposure and enhancing neighbourhood tranquillity (h_2).

perceived
environmental quality

Psycho-social buffer

- recreational coping
- place attachment/ cohesion
- neighbourhood satisfaction

Meso level

situational context

- perceived noise exposure & tranquillity
- lifestyle & activity (disturbances)
- stress level
- environmental preferences
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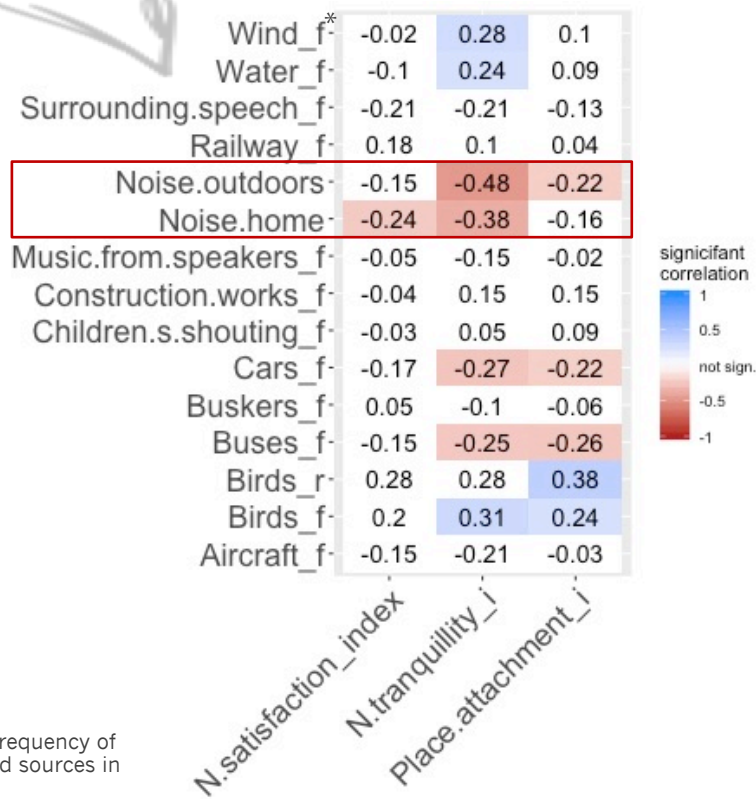
Micro level

personal context

- perceived well-being & quality of life
- personal knowledge & experience
- noise sensitivity

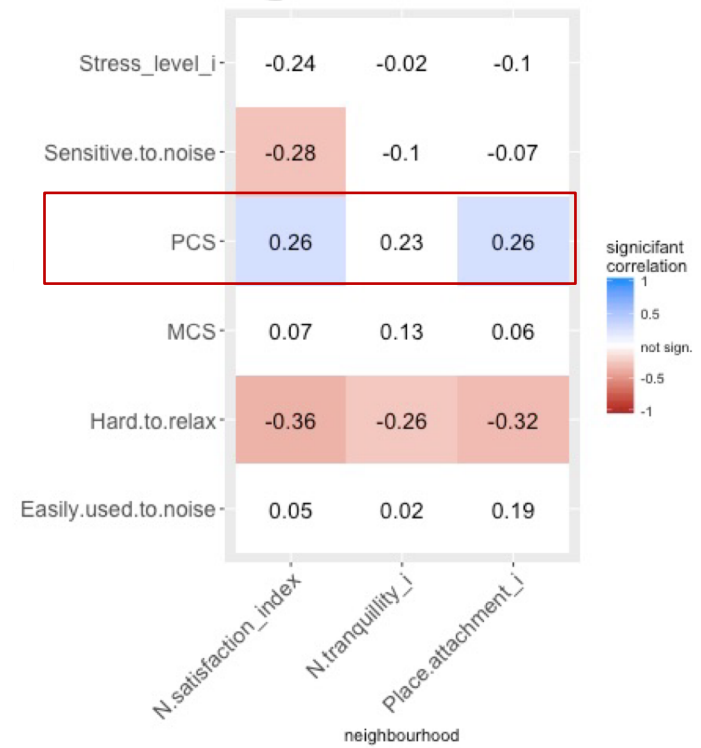
Results: Psycho-social buffer

While perceived outdoor sound levels seemed to be an underlying driver of place attachment, indoor sound levels affected neighbourhood satisfaction more significantly.



* Perceived frequency of various sound sources in everyday life

Neighbourhood satisfaction and place attachment, in turn, positively influenced physical well-being, such as a feeling of having enough energy.



Macro level

Built environment

- urban design
- walkability
- recreational facilities (access/ quality)



Natural environment

- noise level
- green & blue spaces

High environmental quality leads to neighbourhood satisfaction (h_3).

perceived environmental quality

Psycho-social buffer

- recreational coping
- place attachment/ cohesion
- neighbourhood satisfaction



Meso level

situational context

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Micro level

personal context

- perceived well-being & quality of life
- personal knowledge & experience
- noise sensitivity

Results: Macro level

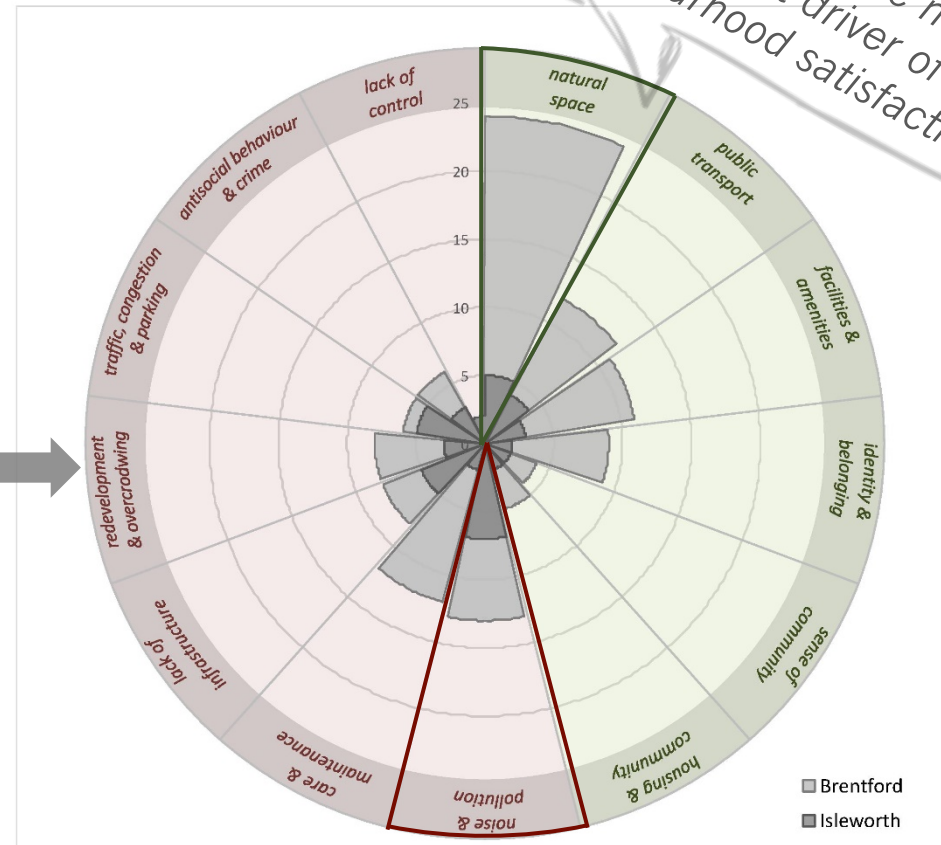
Objective environmental quality (SoP): rather functional than recreational or aesthetically appealing areas, with urban form, density & connectivity rated most positively

vs.

Perceived environmental quality: lively area despite of noise pollution due to sense of belonging & natural areas



Neighbourhood satisfaction: function of physical-material elements and subjective social, symbolic, experienced associations



Aspects residents like (green) and dislike (red) about their neighbourhood. Qualitative statements in the household survey were coded and the frequencies of the coded categories were counted.

Results: Macro level

Recreational coping in green spaces could reduce perceived noise exposure and promote tranquillity in communities affected by aircraft noise (h4).



Perceived **quality of green spaces** seemed to be more important for **experienced tranquillity** in the neighbourhood than satisfaction with access and quantity.



Especially people being highly exposed to negative sounds considered living close to green spaces as important for health promotion.

Discussion

Tranquillity in green spaces even though affected by aircraft noise?

*Tranquillity is about more than just the sound environment, it is rather the **interplay of visual and acoustic factors.***



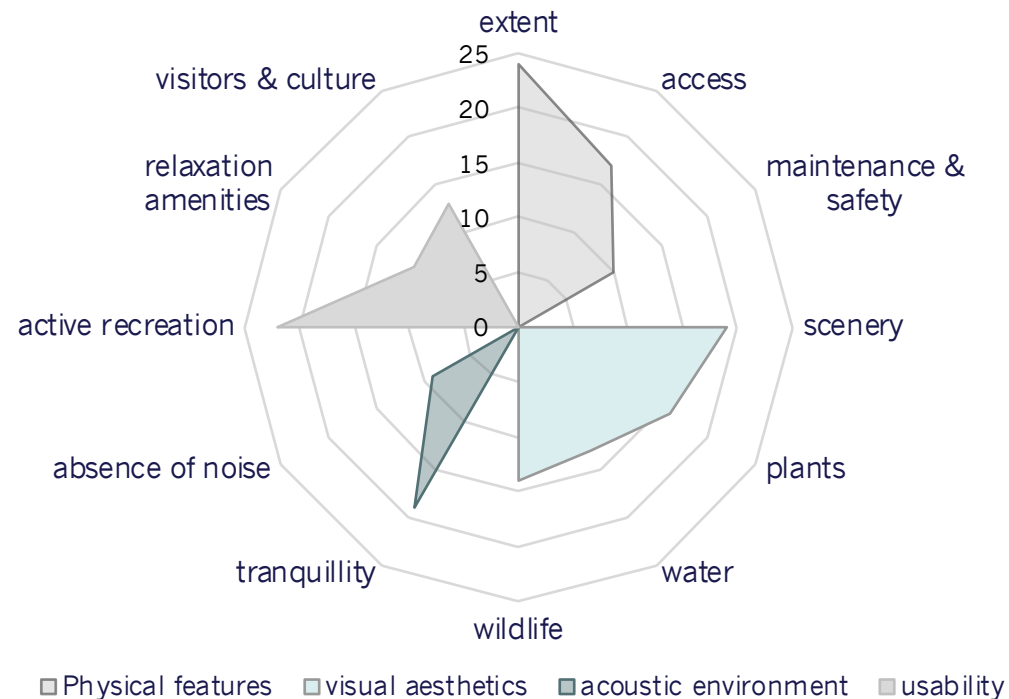
Qualitative statements on green space preferences grouped according to Axelsson et al.'s (2010) principal components model of soundscape perception

Discussion

Types of green spaces preferred for recreational coping?

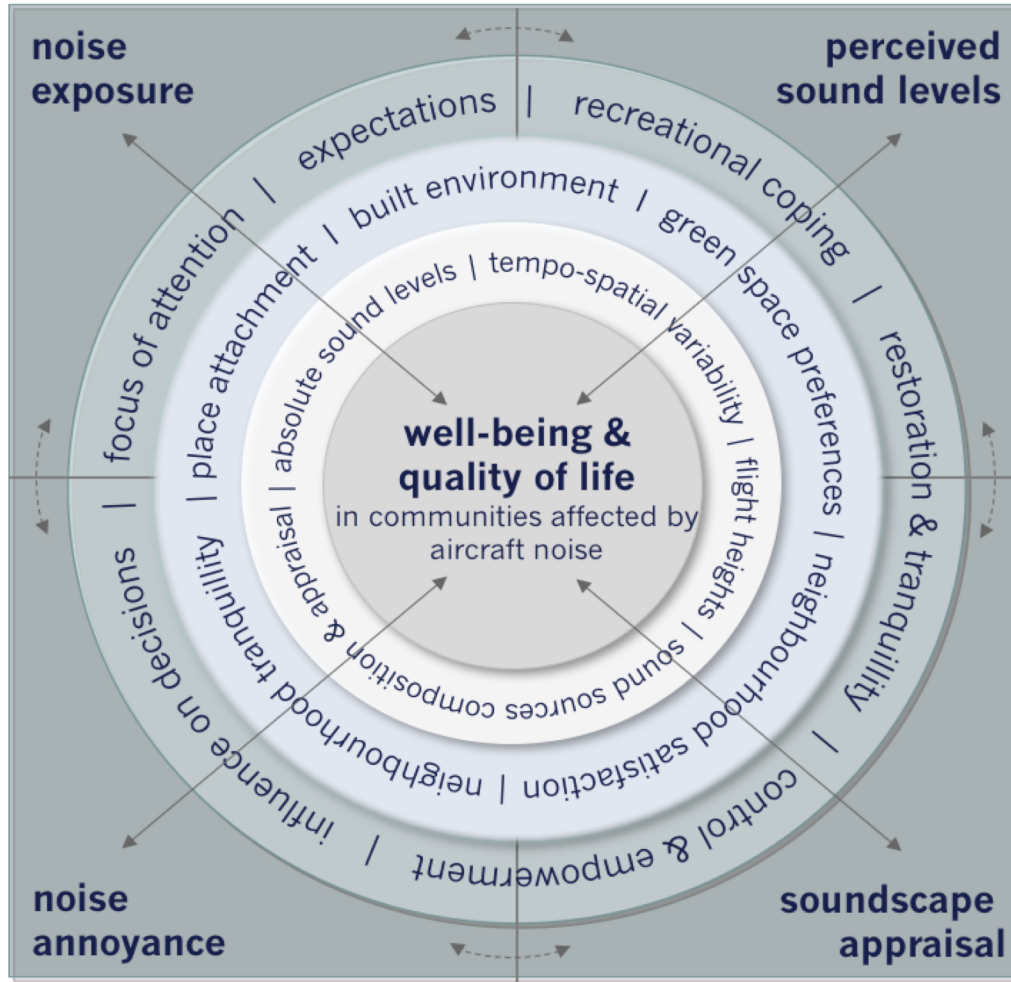


- both publicly accessible green spaces and private gardens are important places for recreational coping
- either with a designed, cultural character or a more unplanned, natural character
- structural diversity through extent, scenery, water elements, seasonal changes, and wildlife evoke fascination & a feeling of being away, even under the flightpaths
- large green spaces facilitate attention restoration and stress recovery through a feeling of being immersed by nature



Green space preferences among all participants of the household surveys. Qualitative statements were coded & their frequencies counted.

Conclusion: Urban parks as nature-based solutions for improved well-being under the flight paths

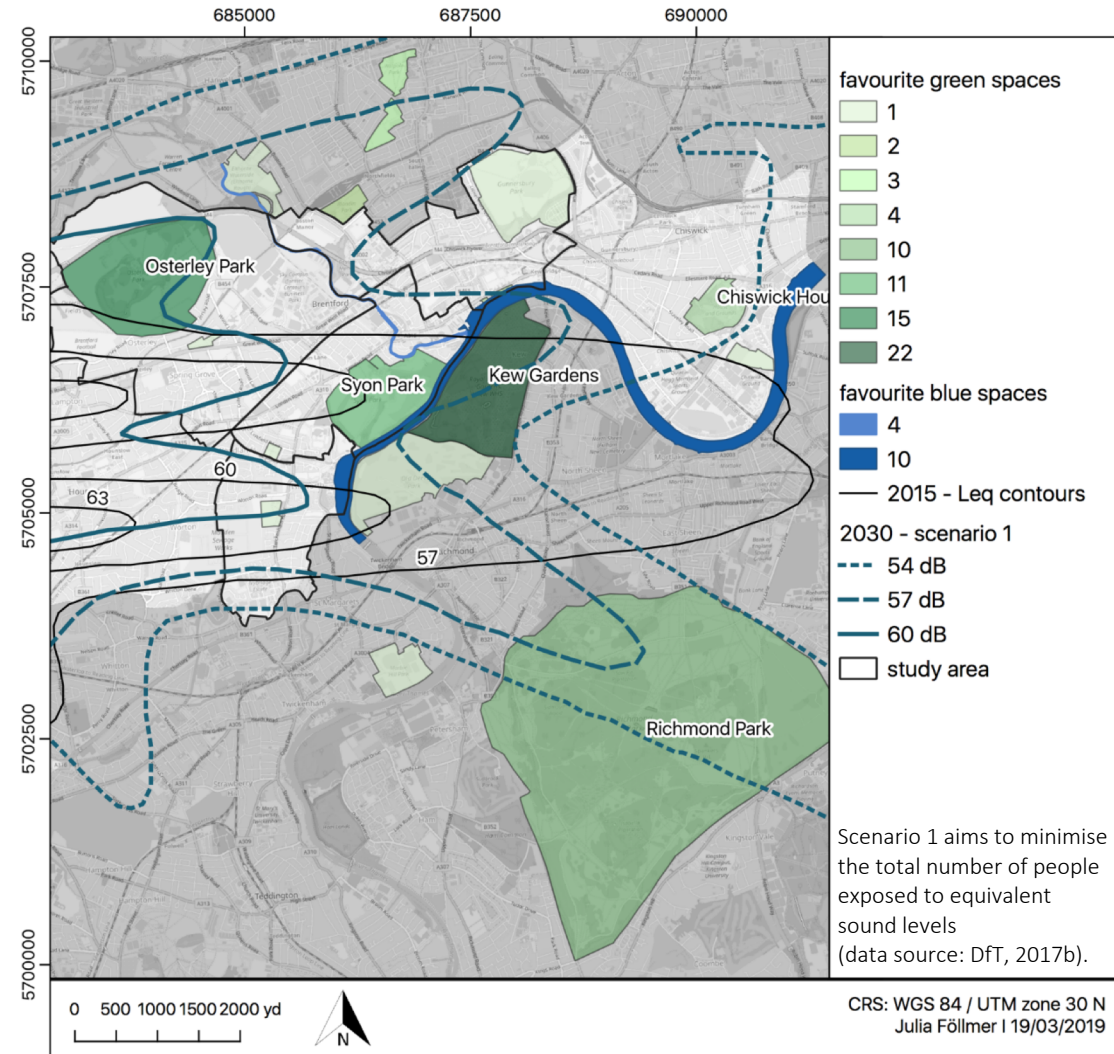


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Neighbourhood satisfaction and place attachment were associated with perceived sound levels both at home and outdoors.

High-quality green spaces have the ability to reduce stress & refresh concentration capacity by enabling noise-exposed residents to shift from effortful (e.g. focusing on aircraft noise) to effortless (e.g. experiences of tranquillity) attention, thus potentially enhance well-being.

Outlook: How might changes in aircraft noise exposure influence recreational experiences in urban parks?



Mapping the identified favourite green & blue spaces alongside (1) current aircraft noise exposure and (2) proposed future flight routes is a valuable basis to estimate the possible effects of a third runway on recreational coping


help close knowledge gap:

‘[w]ithout **further information on levels of use of recreational amenities** assessed it is not possible to specify the areas or populations affected.’

(Department for Transport, 2018. Health Impact Analysis : 30).

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Thank you for your attention!

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