

Noise annoyance in the Inner City of Copenhagen

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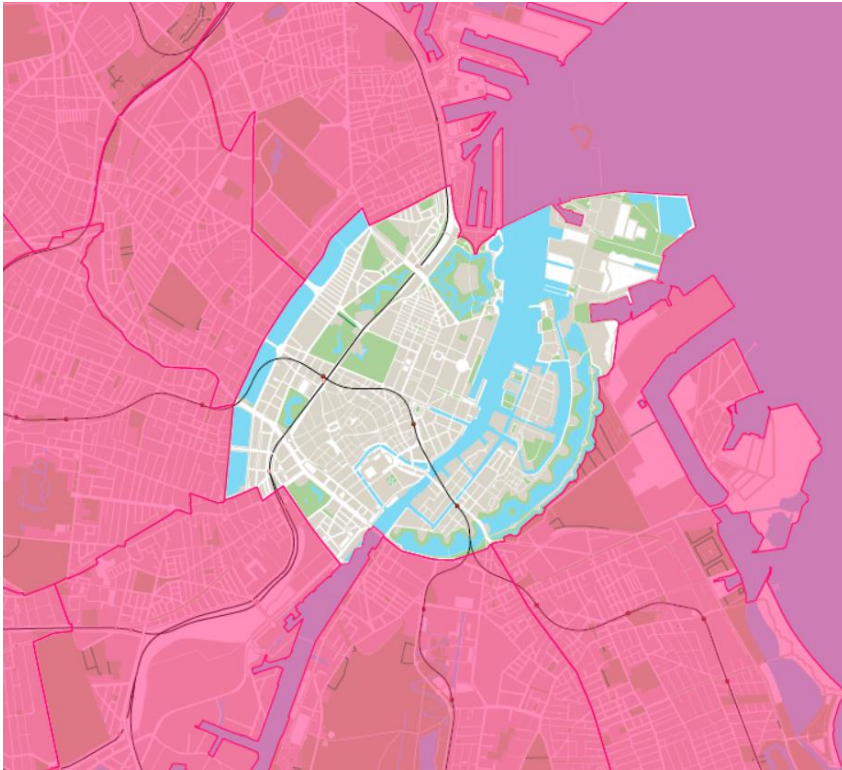
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$$f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^i}{i!} f^{(i)}(x)$$

$$\int_a^b \epsilon \Theta + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$$

∞ χ^2 Σ $!$



The Thesis

- Are people living in Indre By annoyed, disturbed or irritated by noise when they are at home?
- What are the most annoying sources and what type of source are they?
- At what time are people annoyed by these sources?

Objectives

- The main goal is to study noise annoyance in Indre By and which noise sources are disturbing, annoying and bothering people.
- Specifically, investigate the annoyance level of people and which sources people consider the most annoying.

Questionnaire

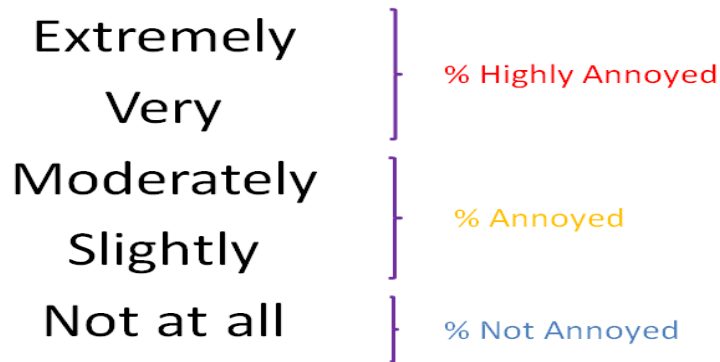
- Question 1:

“Thinking about the last 12 months or so, when you are here inside your home, how much does noise bother, disturb or annoy you? Tick one answer.”

- Question 2:

“If you now think about the last 12 months here, which are the most annoying noise sources you can hear inside your home and how much do they bother, disturb or annoy you? Also, indicate with a cross if it is during the day (7:00 to 19:00), evening (19:00 to 23:00), or at night (22:00 to 7:00).”

- Type of answer: Verbal Scale



- *Subjective measurements:* people's perception of noise.
- Questionnaire or survey based on ISO/TS 15666. Five linear scale

- Noise sources:

- *Transportation:*

- Road
- Rail
- Air

- *Domestic & Social-leisure:*

- Domestic
- Social-leisure

- *Construction & Industrial:*

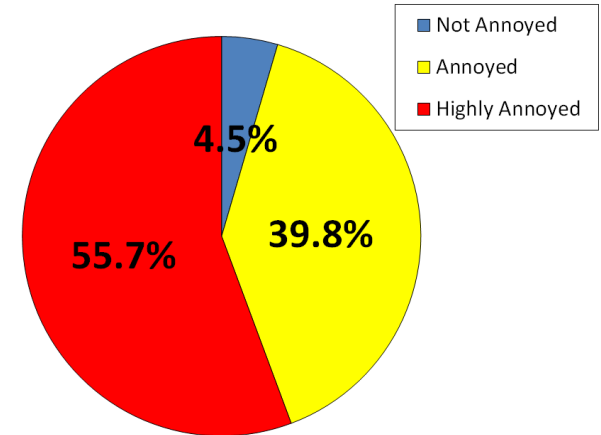
- Construction-Building services
- Industrial

- Environmental noise is also called community noise, which is the noise emitted from all sources except noise at the industrial workplace (WHO, 1999).

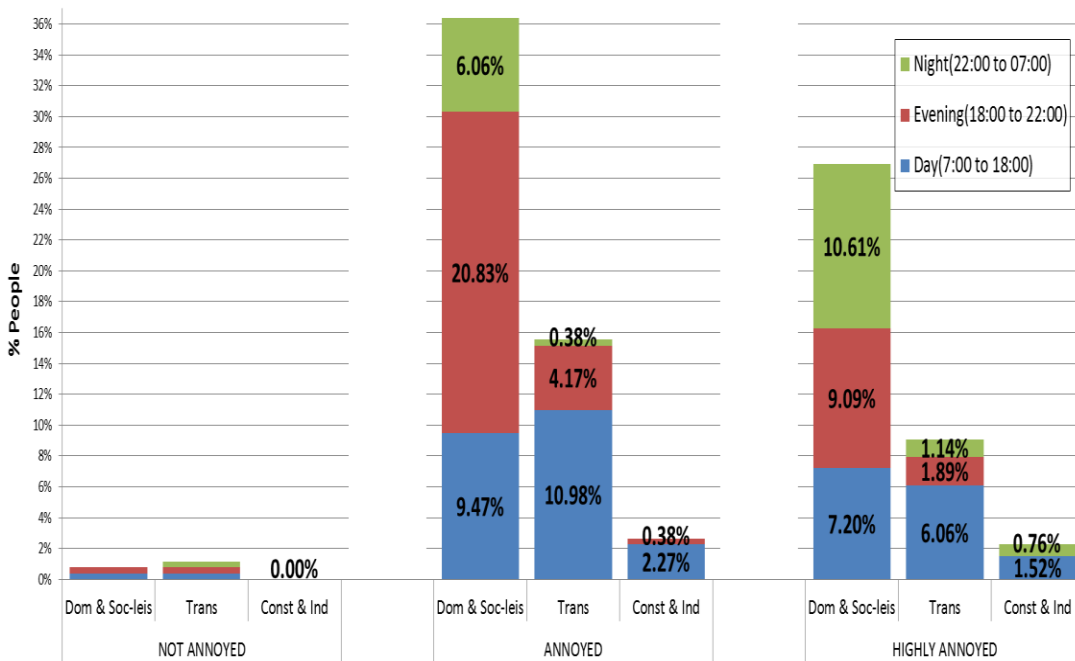
Results

Question 1:

- More than half of people are *Highly Annoyed* (%HA).
- Just 4.5% people are *Not Annoyed* (%NA).

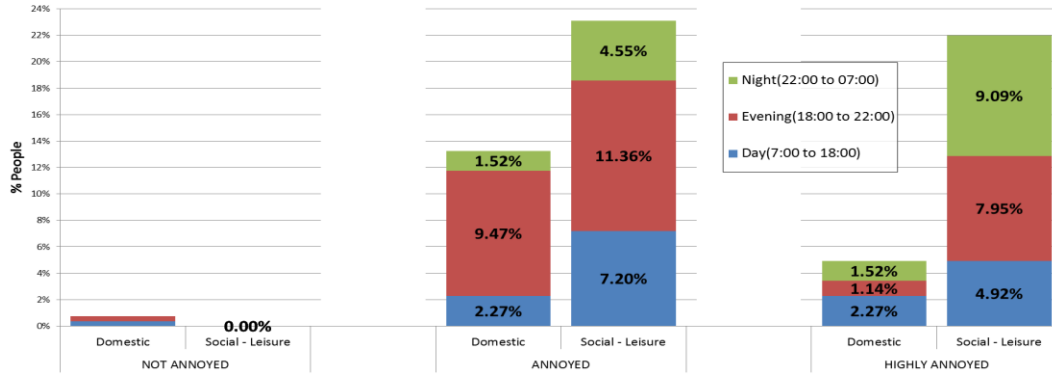


Question 2:



- The most annoying noise sources are: Domestic & Social-leisure and Transportation.
- Dom & Soc-lei highly annoys people during the whole day. Trans mostly highly annoys during the day time (7am to 6pm).
- Almost 11% is highly annoyed at Night time (10pm to 7am) => nightlife.

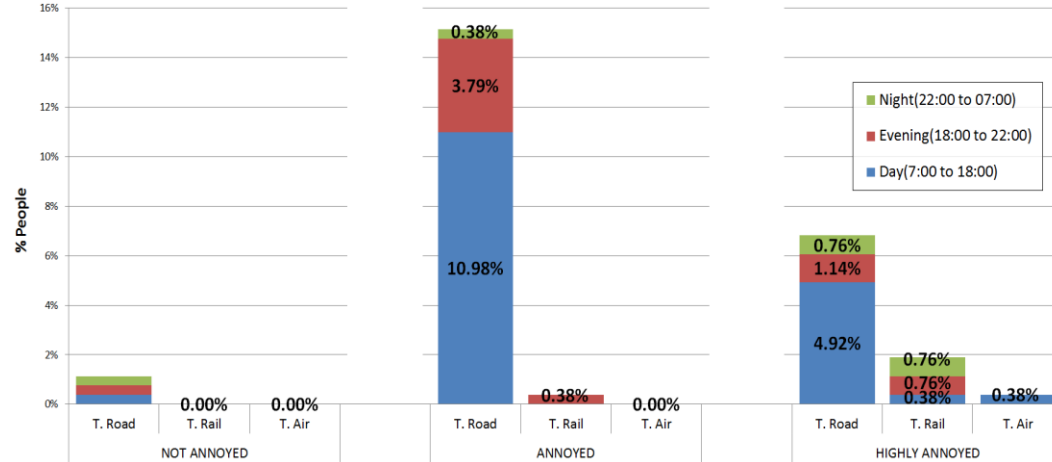
Domestic & Social-leisure



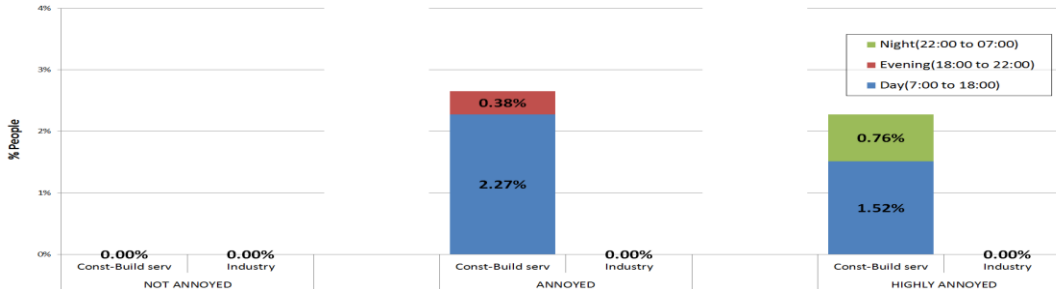
- 9%HA by Social-leisure sources. 14% including the *Annoyed* people (A%).
- Nightlife is a big part of social and leisure activities. Also annoying in the evening.
- 9%A by *Domestic sources*.

Transportation

- Note the vertical scale in relation with the graph above.
- Road Transportation noise source (5%HA and 11%A) is mostly more present during 7am to 6pm
- Rail and Air T. are not perceptually noticed by people.



Construction & Industrial



- Note the vertical scale in relation with the graphs above.
- Industry is not perceived at all by people.
- Construction-Building services 2%HA, not significant contribution to annoyance.

Discussion and Conclusions

- Mostly the questionnaire was carry out during summer.
- During summer more activities, more festivals, concerts, more time for leisure activities, and people tend to open their windows and doors at home => annoyance increase due to cultural and life style differences(W. Yang and J. Kang, 2005) .
- Create a net of measuring noise stations spread within the city to develop Noise maps. Consequently, improvement of urban design, and noise reduction to take care of people's health.
- Improve and increase control by authorities to reduce noise. Ask for noise permits to open and keep a bar, concert, outdoor festival, pubs, sport event, musical festival
- Avoid guidelines and create more imperative normative about noise, considering Domestic and Social-leisure sources to establish noise limit levels.
- Nightlife in Copenhagen seems to contribute with the increasing of noise annoyance in people. Social campaigns about awareness noise and its negative effects on health and people's productive life.