Environmental noise is differently associated with negative and positive urban experience: an exploratory first-person mobile study in Santiago de Chile

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Background

- Specific city features related to the etiology of stress include neighborhood quality, the amount of greenspace, industrial activity, and traffic volume[1]
- A relevant and measurable stressor emerging from cities is environmental noise or sonic pollution[2]

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[1](Gong et al., 2016)
[2](Pedersen, 2015)

Research question

- How first-person experience of the urban environment in presence of environmental noise is modulated by different socioeconomic/demographic factors

Noise has an impact on health

- Induces hearing loss[3]
- Sleep disturbances, increased nor-adrenaline and cortisol levels, perceived stress augmentation, and higher cardiovascular risk, among others[4]
- Others …

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[3](Kryter, 1994; Nandi & Dhatrak, 2008)

[4](Barbaresco, Reis, Lopes, Boaventura, Castro, Vilanova, Da Cunha Júnior, Pires, Pôrto Filho, & Pereira, 2019; Münzel et al., 2018; S. A. Stansfeld & M. P. Matheson, 2003; Tonne et al., 2016)

Effects of noise might be modulated by socioeconomic and topographic factors

- Evidence suggests that **socio-demographic factors mediate as risk and protections variables**[5]
- From different stressors measured in 14 low socioeconomic-level neighborhoods among different communities in New York City, environmental noise was only considered a stressor in 4 neighborhoods and restricted only to specific city places.[6] In contrast, traffic noise had no relation to socioeconomic differences in London[7]
- Socioeconomic modulation is not clear

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[5](El-Gilany, Amr, & Hammad, 2008; Klein & Forehand, 2000; Lederbogen et al., 2011; Lindencrona, Ekblad, & Hauff, 2008; Reynolds, O'Koon, Papademetriou, Szczygiel, & Grant, 2001)

[6](Shmool et al., 2014; Shmool et al., 2015)

[7](Tonne et al., 2018)

Socioeconomic effects might be accentuated in Chile

- Chile leads the ranking of most unequal countries in the world
- Santiago has one of the highest environmental noise levels
- Socioeconomic factors impact on stress and mental healt remains unknown

Natural walking behavior task

- Preguntas?

Data processing

- Environmental noise data was extracted from video recordings, and normalized to obtain a comparable metric between participants
- 'Positive' and 'negative' moods were assigned to a 4 second time window centered at the begginning of each reported event
- A mean noise level was computed per window

Data analysis

- Two logistic models were fitted to the data
- Model 1: noise was used as predictor of mood
- Model 2: interaction of noise and socioeconomic status was used as a predictor of mood

Logistic regression

- Predicts a binary outcome variable
- Is a classifier
- Basically a linear regression, but with log odd ratios
- $Oddsratio = \frac{Goodmood|Highnoise}{Goodmood|Lownoise}$
- $logit(Y) = natural - log(odds) = ln(\frac{Pr}{1-Pr}) = \alpha + \beta X$
- $Pr = Probability(Y = outcome \quad of \quad interest | X = x, specific \quad value \quad of \quad X) = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)}$

Fitting the model

- Fitted logistic regression
- Wald's test for coefficient significance
- Likelihood ratio for model comparison against null
- Kappa & accuracy for model performance
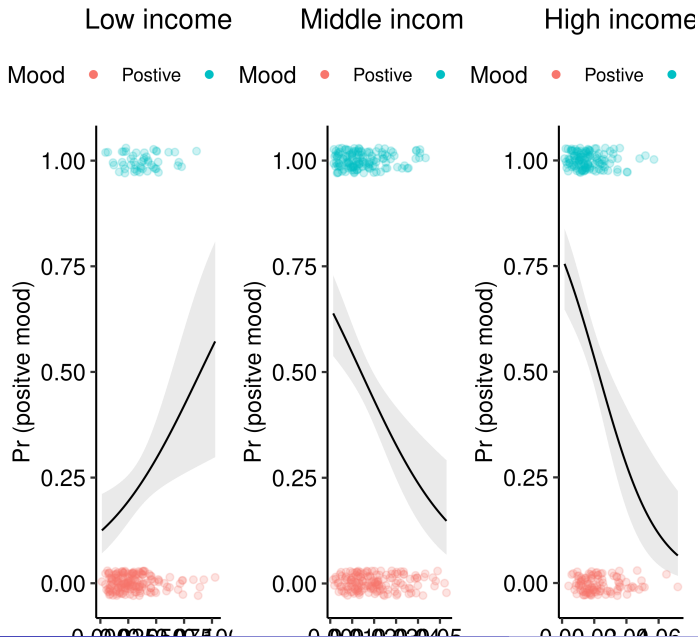- K-fold cross validation

Results

- Both models are significant
- Noise seems to be a "good" predictor of mood (Kappa = 0.21)
- Model 2, as classifier, improves upon model 1, (Kappa = 0.26)
- Socioeconomic Mid and Low have significant interactions with noise, when predicting for mood

Results
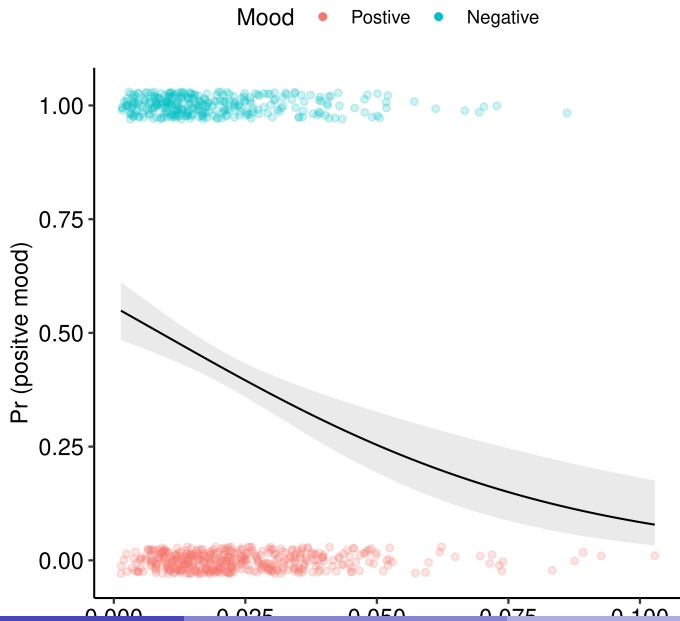
Results

Discusion

- Is it noise related to safety?
- Accesibility to urban benefits?
- More green-space in low income areas?
- There seems to be a clear general effect of noise
- Interaction effect of noise, however, is less clear