

Addressing aircraft noise annoyance - Why non-acoustic factors matter

Aviation Noise & Emissions Symposium 2020

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Dirk Schreckenberg

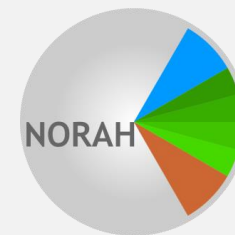
ZEUS GmbH,
Center for Applied, Psychology,
Environmental, and Social Research
D - Hagen, Germany

This contribution refers to ...

parts of the
European research project



and own national
research, i.e. the
German NORAH
study 2011-13



<https://norah-study.de>



... is an **European Horizon 2020** research project

- designed to contribute to **improved management of aircraft noise impacts** across airports in the EU.
- Project period: October 2017 – September 2021
- Research includes **critical reviews** and **pilot studies** on
 - **aircraft noise effects** (community responses, health outcomes),
 - airports' contribution to **residents' quality of life** (QoL)
 - **acoustic & non-acoustic contributors** of annoyance & QoL
 - the role of **community engagement & communication**

Exposure-
response
relationships

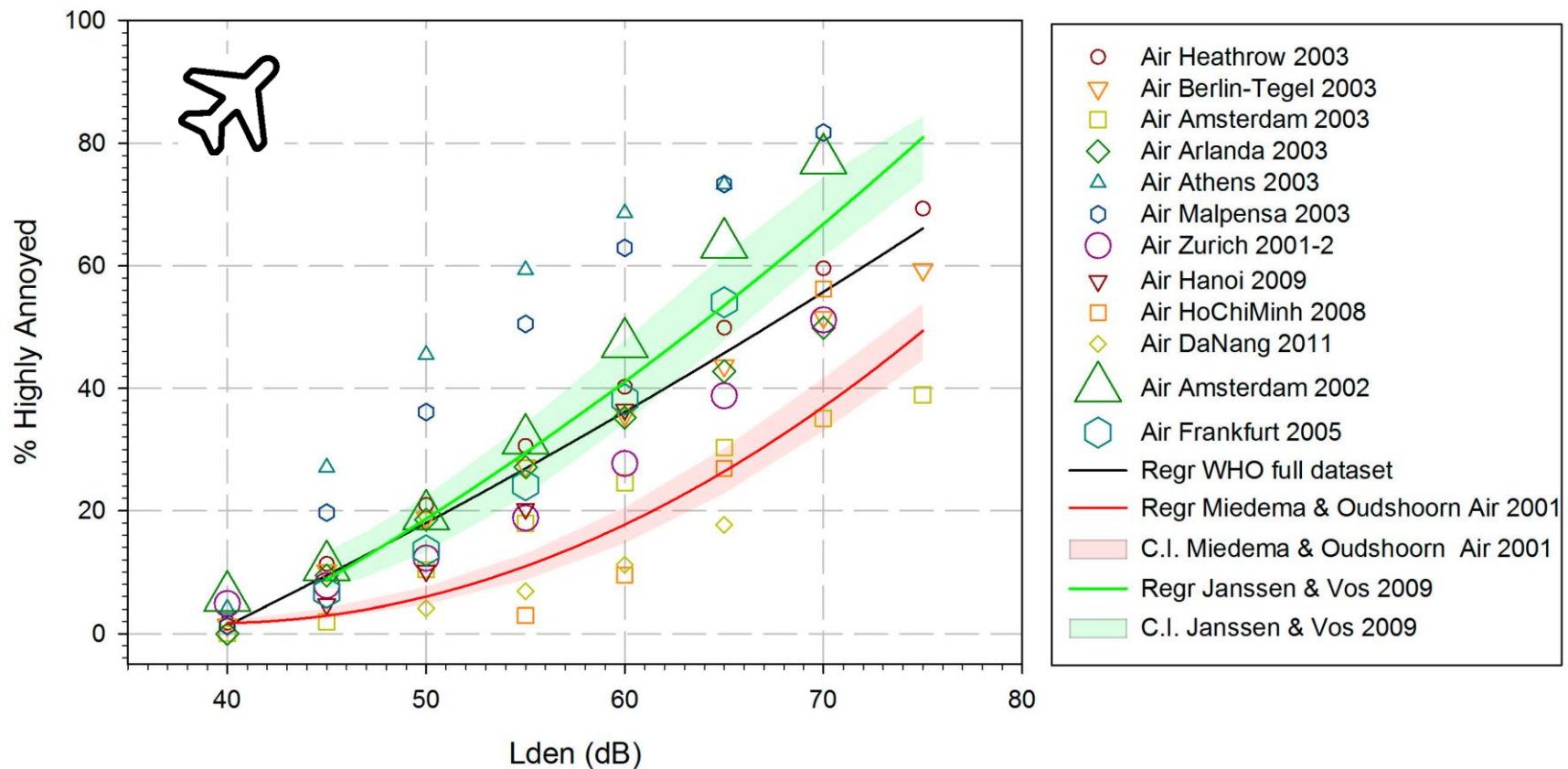
Definition of
annoyance

A social-
psychological
stress model of
annoyance

The role of non-
acoustic factors

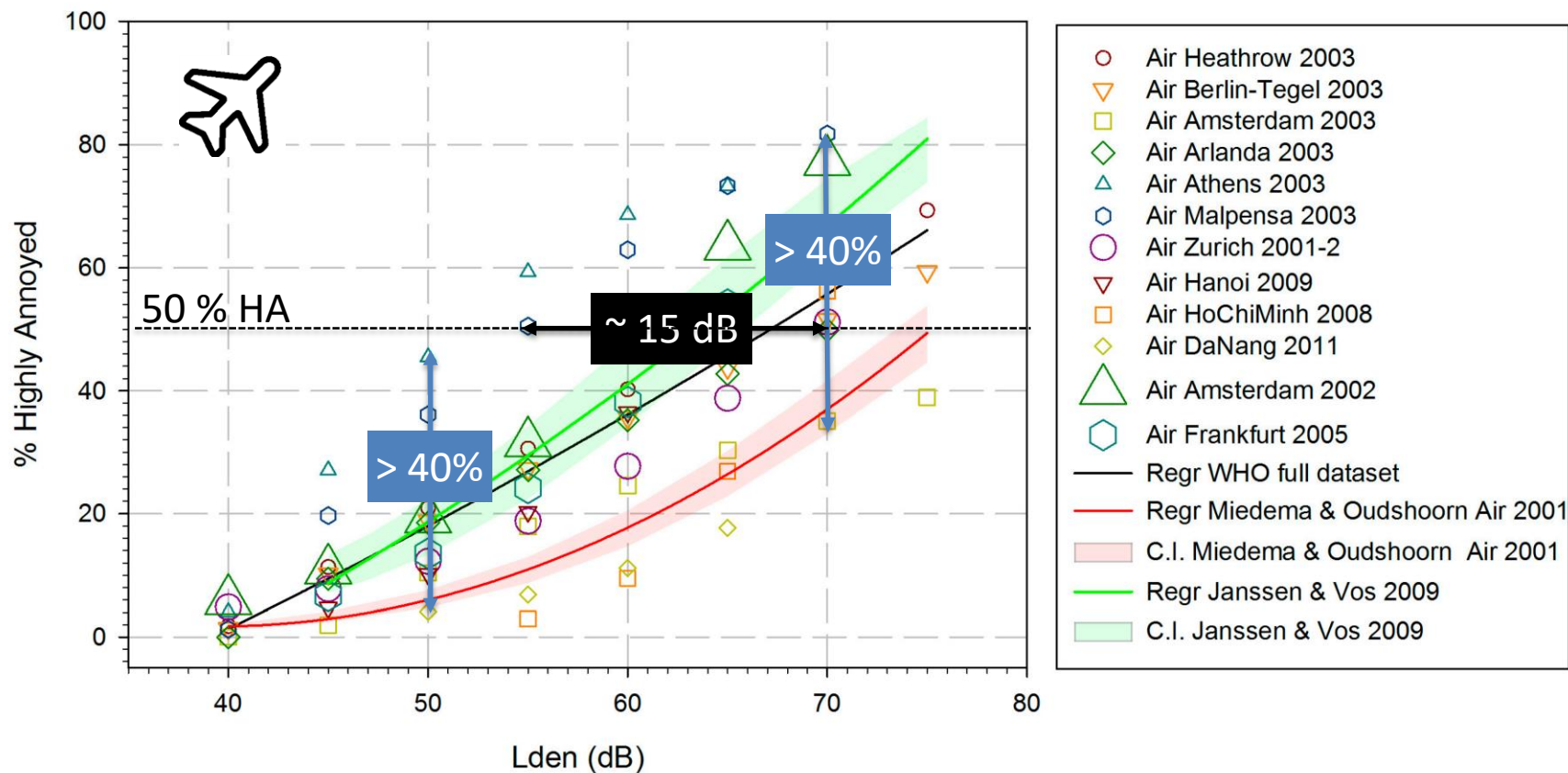
Chicken & egg

Exposure-response relationship for aircraft noise annoyance



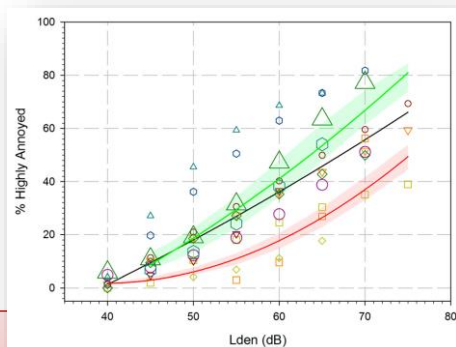
Source: Guski et al. (2017). WHO ENG: A Systematic Review on Environmental Noise and Annoyance

Spread in annoyance judgments



Source: Guski et al. (2017). WHO ENG: A Systematic Review on Environmental Noise and Annoyance

Contributors to noise annoyance



Acoustics:

Average sound level

L_{den} , L_{night} , $L_{Aeq,x}$ etc.

up to 33%

Further acoustic metrics:

maximum sound level, number, emergence/intermittency, (lack of) respite, rise time, frequency, psychoacoustics, ...

?

Personal and social factors

Noise annoyance

up to 33%

Situative factors

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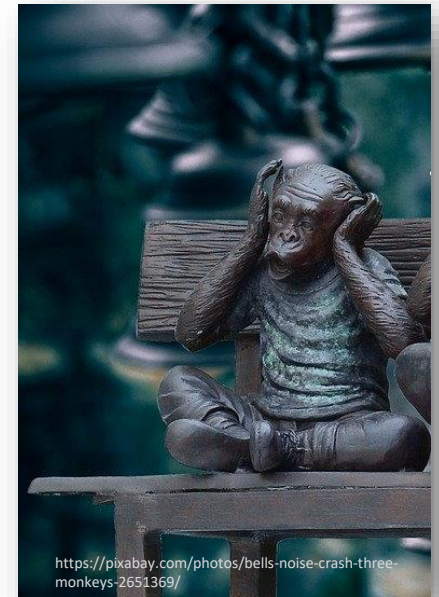
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Chicken & egg

What is annoyance?

Annoyance ...

- as a result of **disturbances**
(e.g. Taylor, 1984)
- as an **emotion**
(Lindvall & Radford, 1973)
- as an **attitude** towards the source
(Jonsson & Sörensen, 1970)
- as **knowledge** about noise effects
(Bosshardt, 1988)
- as a result of a **rational decision**
(Fidell, 1987)



Summary: Bartels, 2014; Guski et al., 1999

What is annoyance?

Annoyance includes:

- an **often repeated disturbance** [...] combined with behavioral responses in order to minimize disturbances;
- an **emotional / attitudinal response**
(anger about the exposure, fear, and negative evaluation of the noise source)
- **perceived capacity to cope** with noise (perceived control):
 - ✚ The distressful insight that one cannot do much against this unwanted situation

Journal of Sound and Vibration (1999) **223**(4), 513–527

Article No. jsvi.1998.2173, available online at <http://www.idealibrary.com> on IDEAL®



THE CONCEPT OF NOISE ANNOYANCE: HOW INTERNATIONAL EXPERTS SEE IT

R. GUSKI AND U. FELSCHER-SUHR

Faculty of Psychology, Ruhr-Universität, D-44780, Bochum, Germany

AND

R. SCHUEMER

FernUniversität Hagen, Germany

What is annoyance?

Annoyance includes:

- an **often repeated disturbance** [...] combined with behavioral responses in order to minimize disturbances;
- an **emotional/psychological stress response** (anger about the exposure, fear, and negative evaluation of the noise exposure);
- **perceived capacity to cope with noise** (perceived control):
 - ➡ The distressful insight that one cannot do much against this unwanted situation

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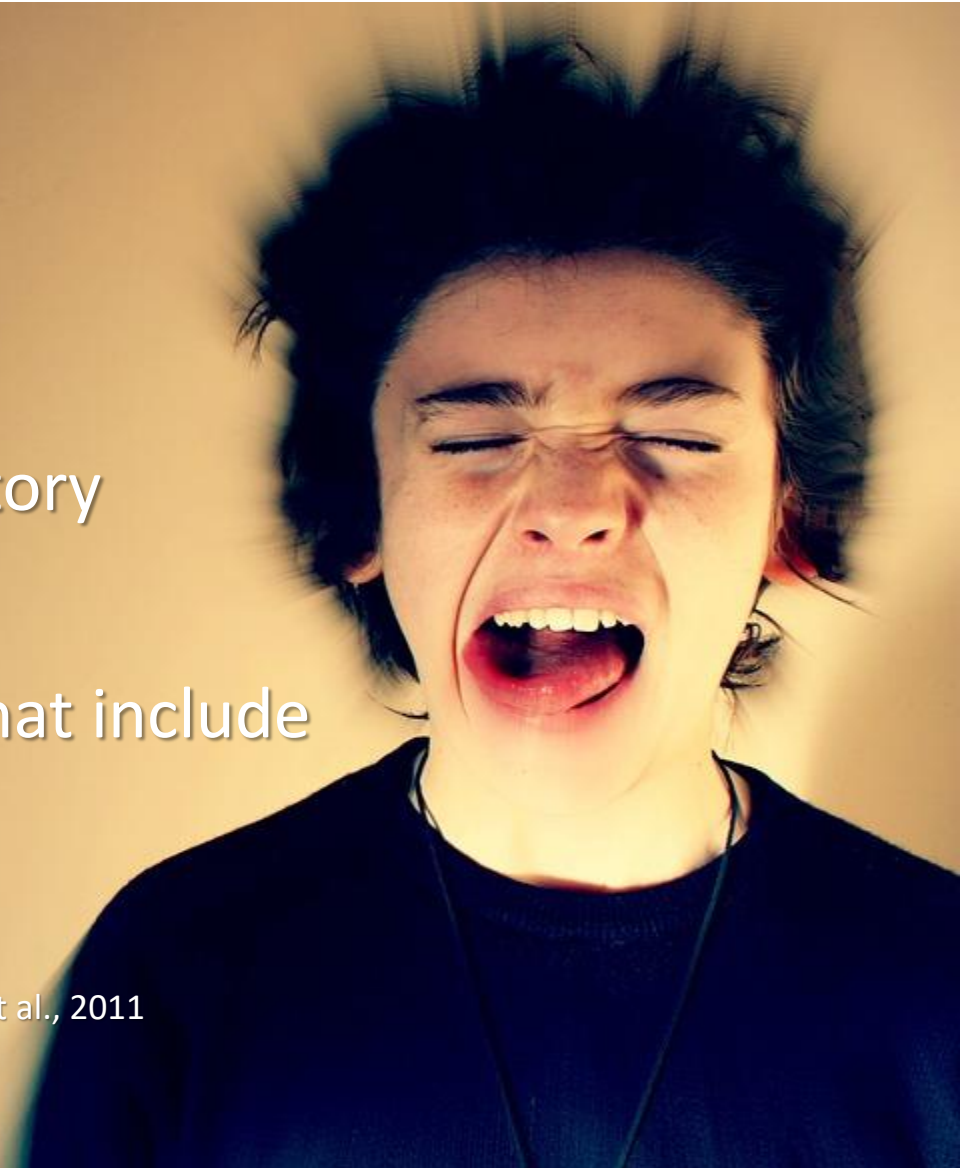
Psychological stress response

Stress

conditions where an

- environmental demand
- exceeds the natural regulatory capacity of an organism,
- in particular in situations that include
 - unpredictability and
 - uncontrollability.

Koolhaas et al., 2011



Exposure-
response
relationships

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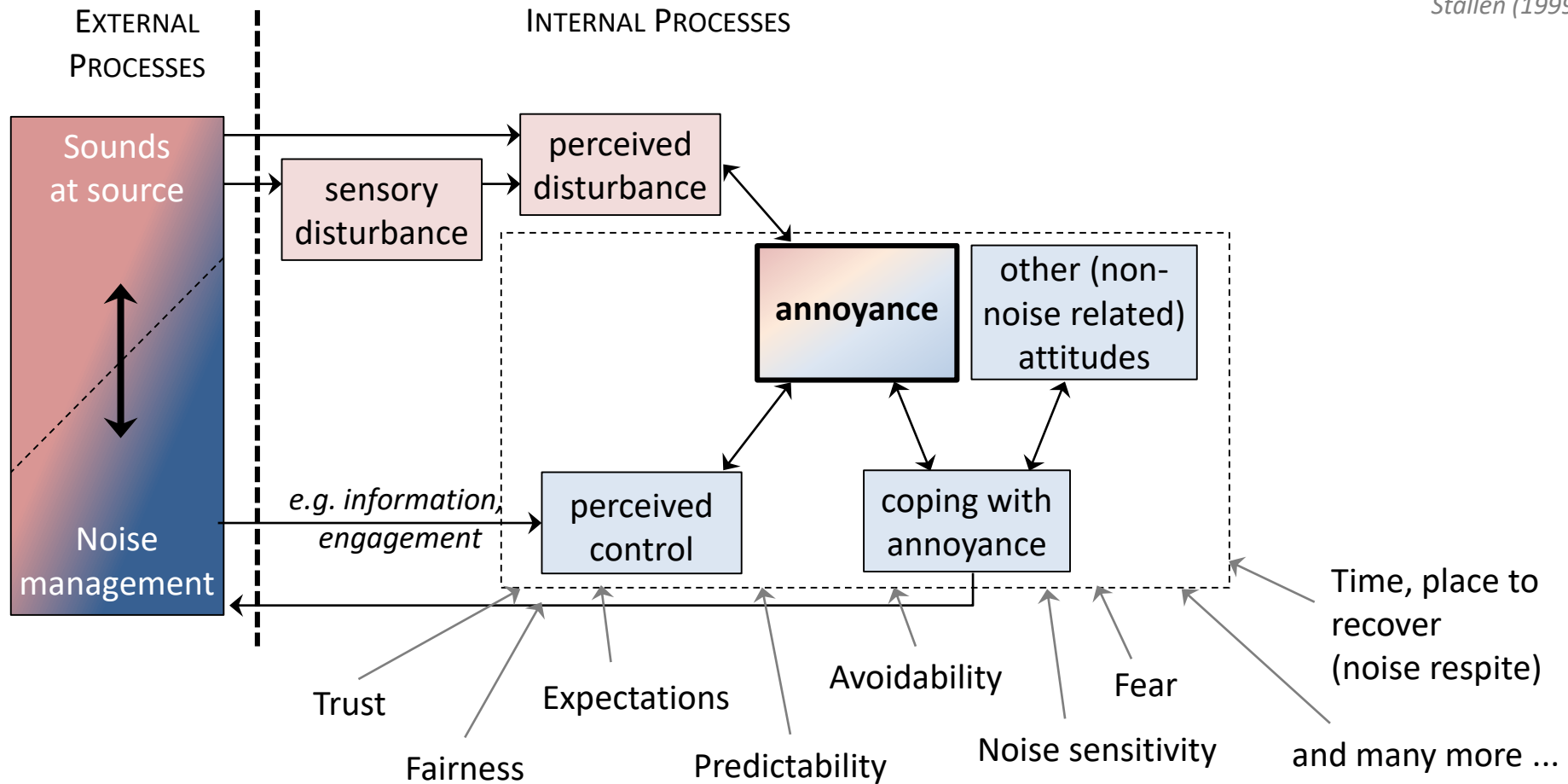
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Stress-related model of aircraft noise annoyance

Stallen (1999)



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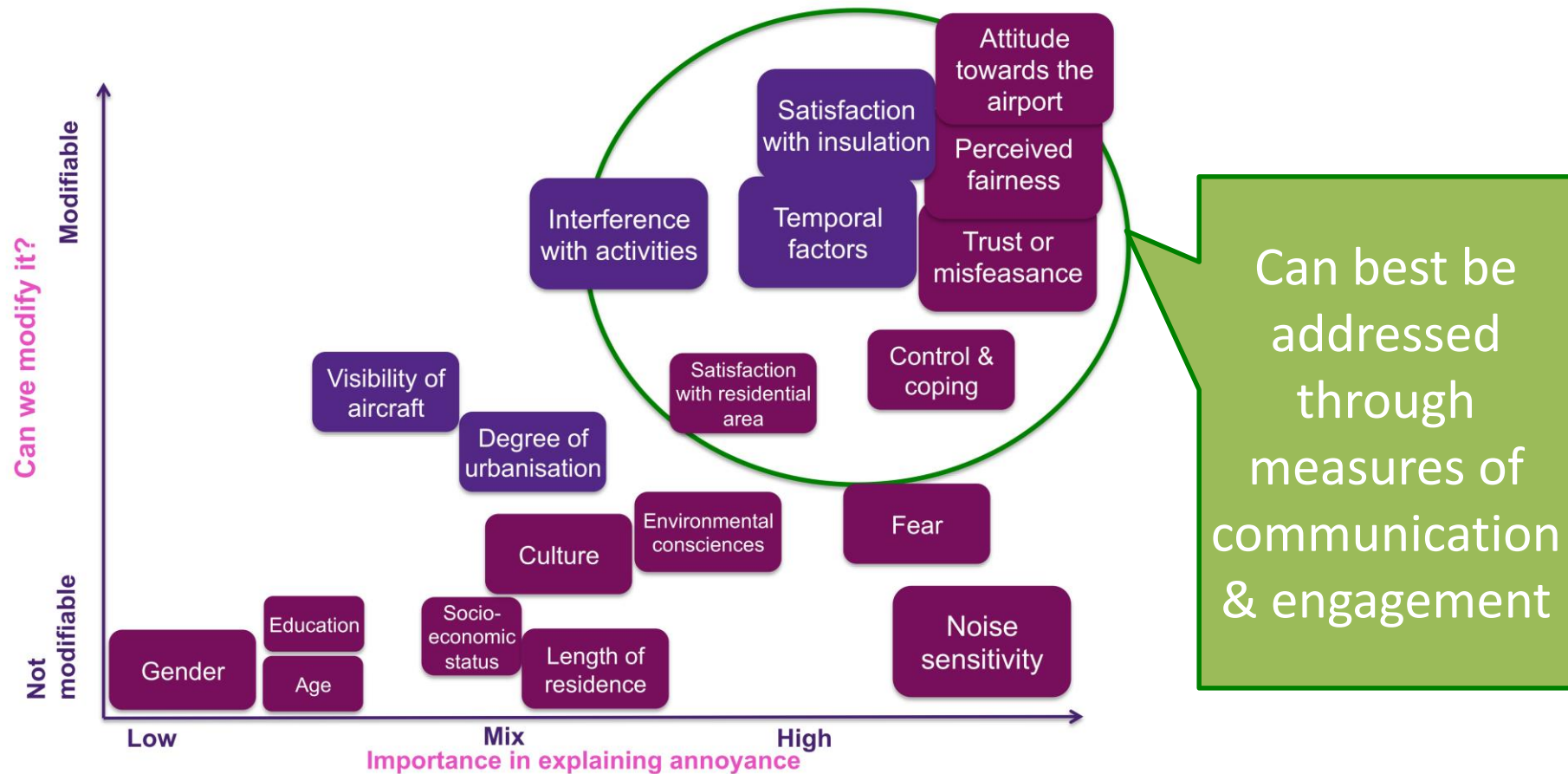
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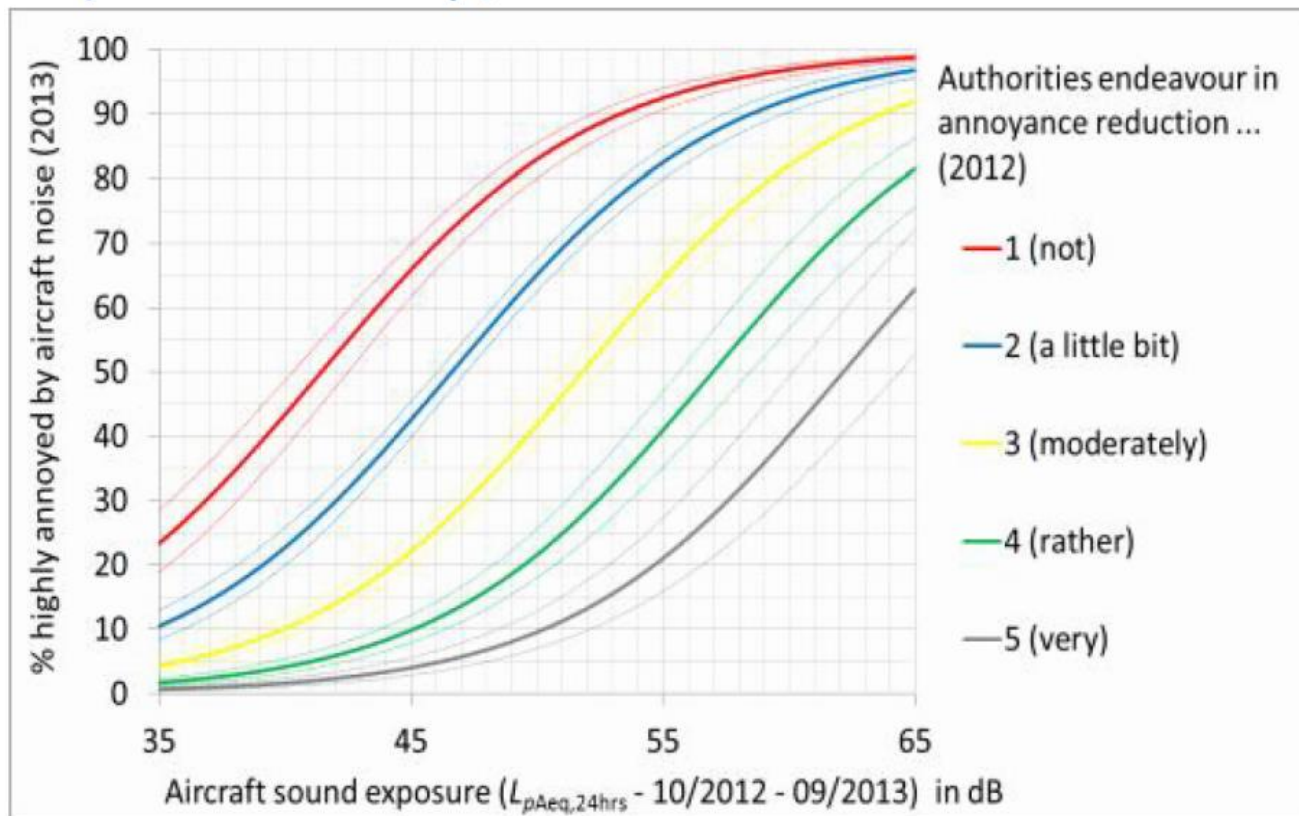
Categorisation of non-acoustical factors: Modifiability, importance for annoyance



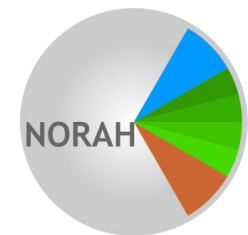
Sanchez et al. (2015)

Trust in authorities 2012 – annoyance 2013

a) %HA-curves by 'trust in authorities'

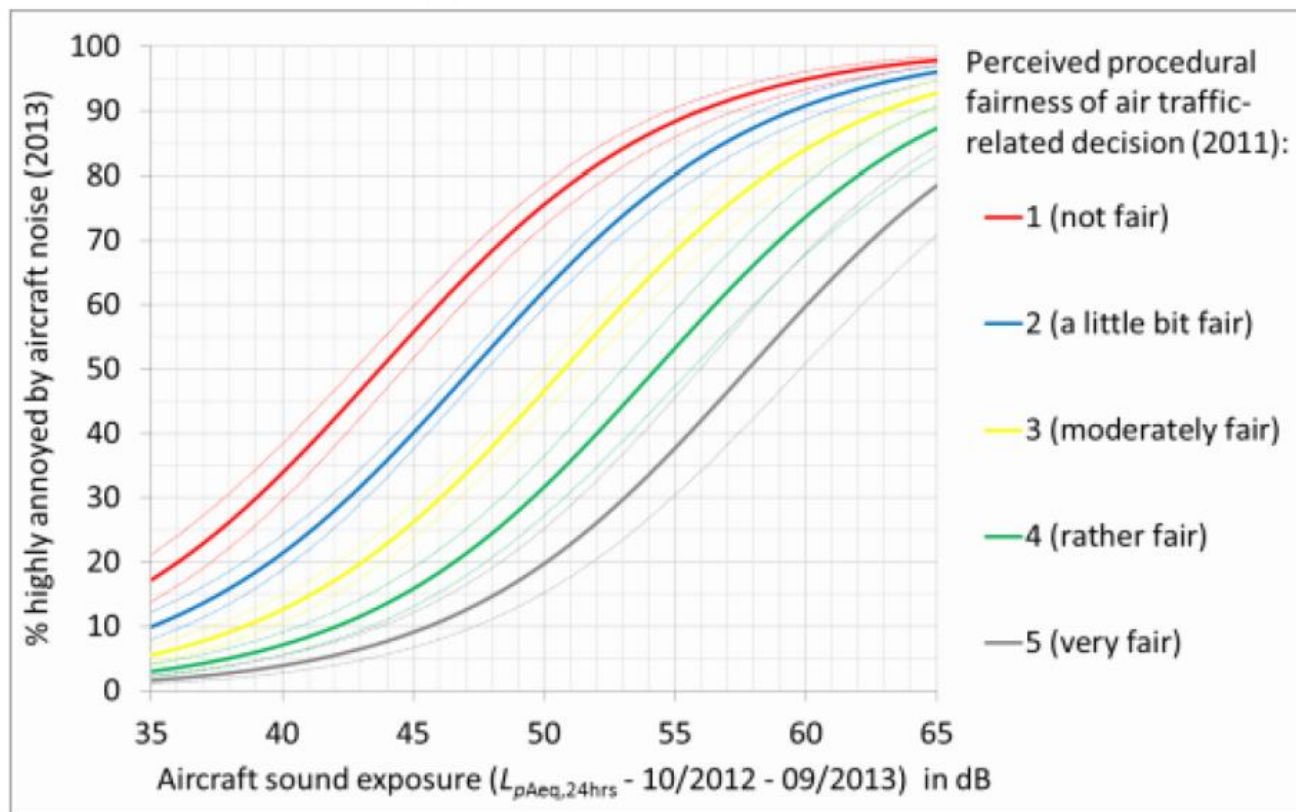


n = 3 426

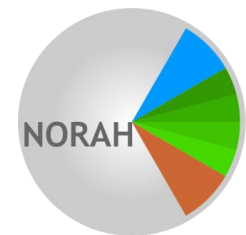


Perceived fairness 2011 – annoyance 2013

b) %HA-curves by perceived fairness



n = 3 426

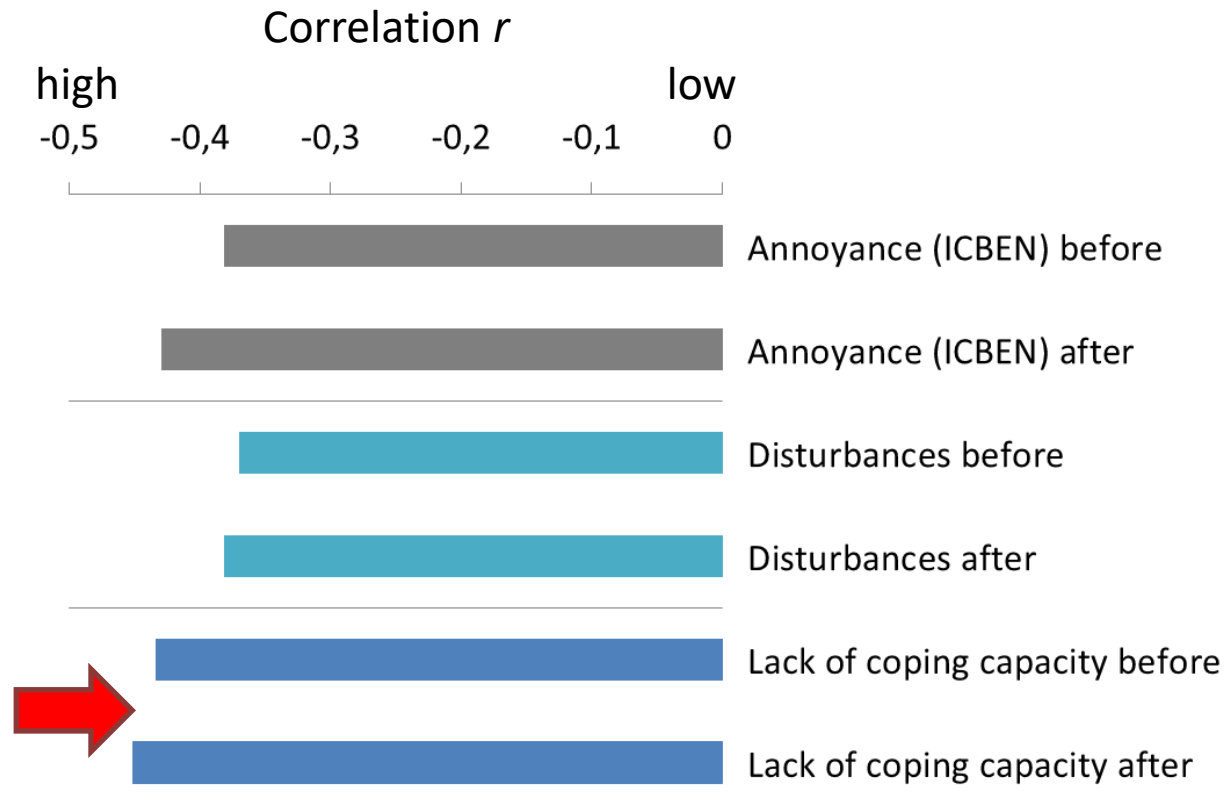




Frankfurt Airport before/after opening of 4th runway

Correlations of **trust in authorities** with components of annoyance

- **trust in authority** correlates with all components of annoyance
- It **correlates higher** with the factor '**Lack of coping capacity**' than with 'Activity disturbances'



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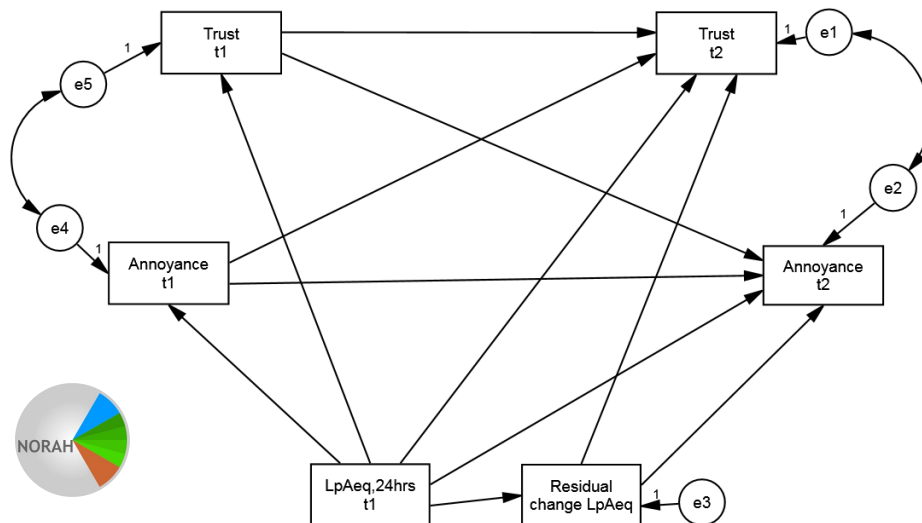
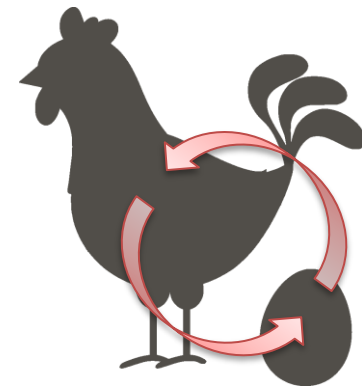
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Chicken & egg



SEM: Trust => Annoyance

Annoyance => Trust



Trust and annoyance seem to be **reciprocally related** to each other

However:

The **strength of paths changes**.

effect size of path
trust => annoyance

>
higher

in **conditions of change**
(before/after runway opening)

than

in conditions of steady state
(after runway opening)

Take home message:

- **Aircraft noise annoyance** follows noise levels
- It can be regarded as a **psychological stress response to noise**
- Annoyance is also associated in particular with those **non-acoustic factors** that are related to **perceived control**
- **Relationships** between non-acoustic factors and annoyance are **complex and dynamic**.
- Worthwhile to address non-acoustic factors through tools of **engagement and communication** particularly in situations of **changes in air traffic**
- Need of **evaluating impact** of airport noise management on **noise effects** and **quality of life**





Thank you for your attention

Contact: Dirk Schreckenberg
schreckenberg@zeusgmbh.de
Phone: +49 2331 47 87 194