

Noise

David Welch



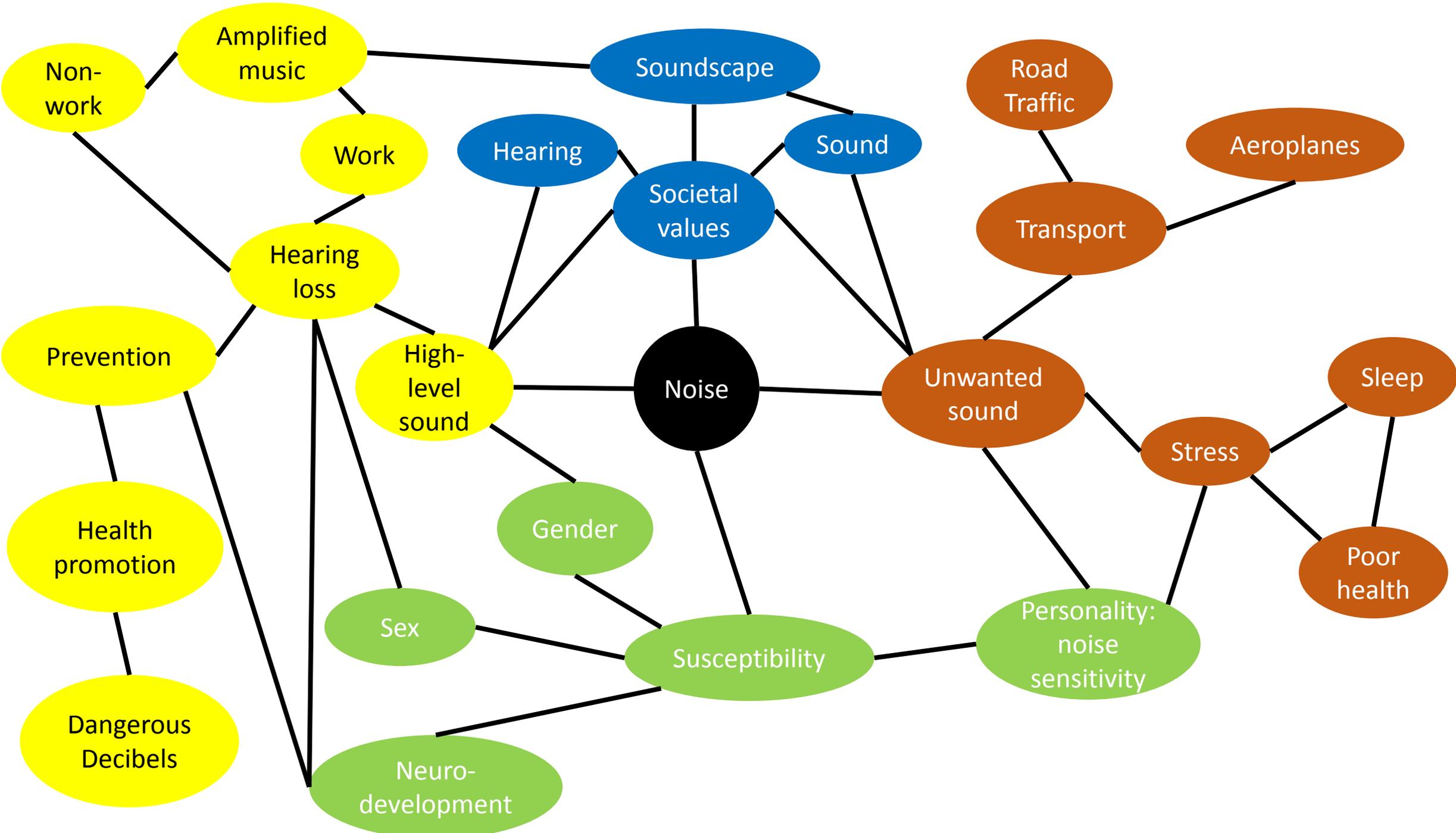
Plan

- Define Noise
- Overview
- Interesting bits of theory and our research findings

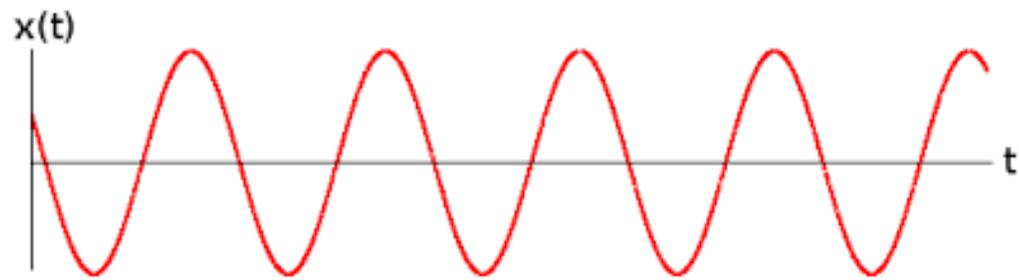
What is “Noise”?

Two usages:

- Any potentially damaging sound
 - Noise Induced Hearing Loss
- Any unwanted sound
 - Annoyance and other health effects



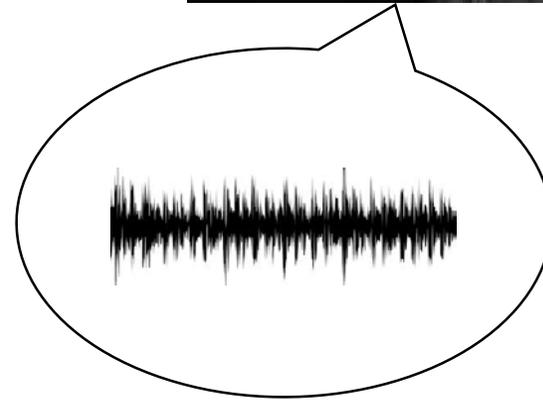
Sound



One sound can have more than one meaning

- Meaning is mostly what counts for people
- Meaning is ascribed in the brain
- We need to understand the auditory brain and how it interacts

Why do some sounds upset some people sometimes?



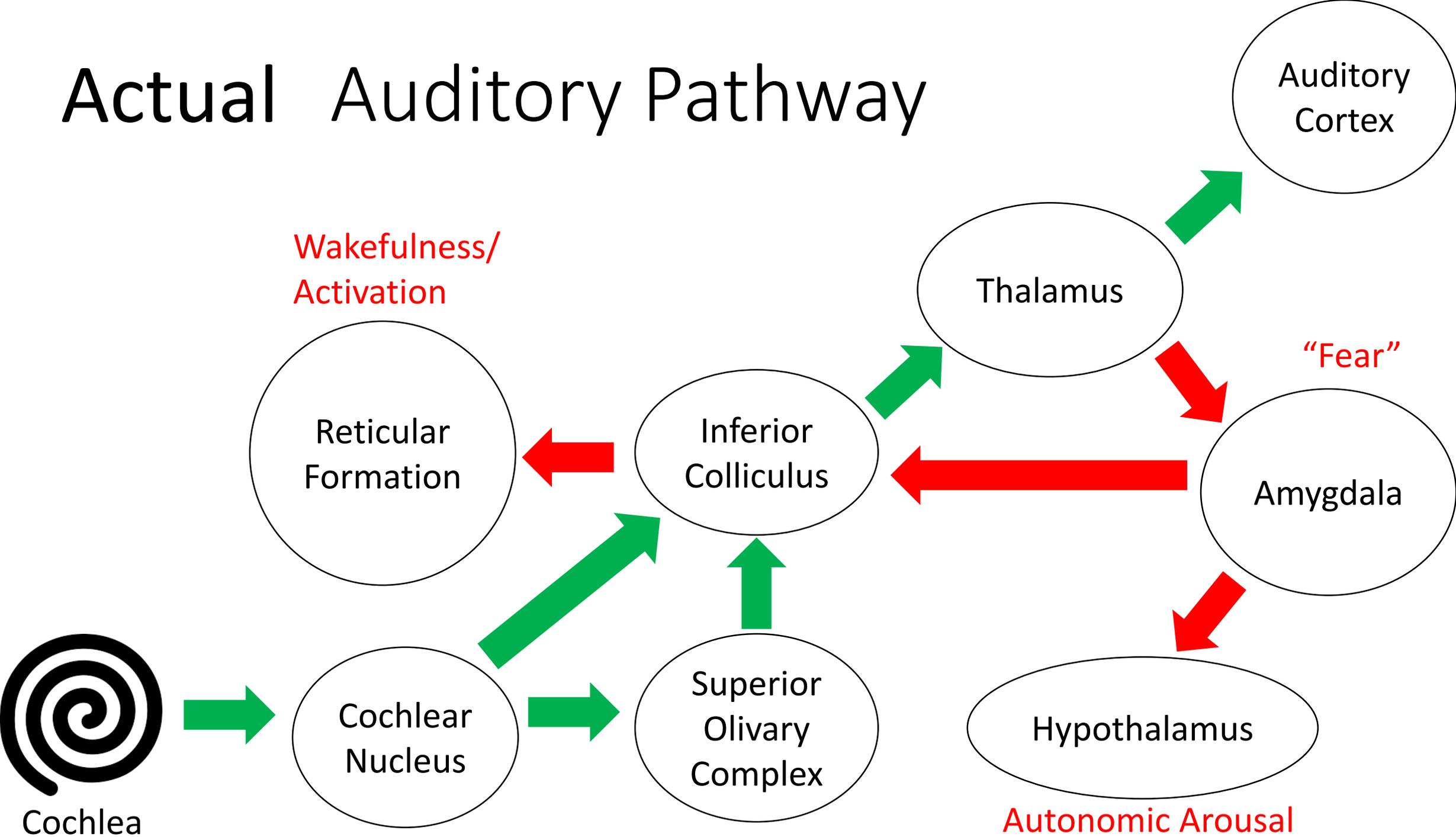
Evolutionary Significance of Sound

- Sound is physical energy carried on waves
- Detectable from any direction
- Detectable when we are asleep
- Warning and attention-grabbing stimulus

Perception of Sound as “Annoying”

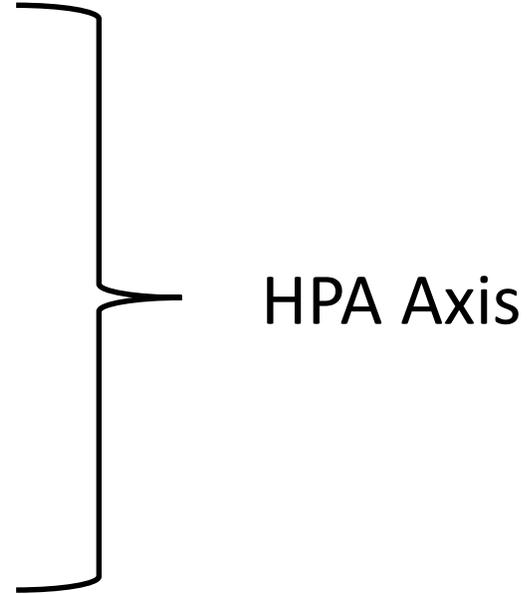
- Source
 - Proximity/“Looming”
 - Variability/Intermittency
- } Of the external sound
- Personality
 - State of mind
- } Of the listener
- Memories/associations/meaning
- Of the sound for the listener

Actual Auditory Pathway



Psychoneuroendocrinology

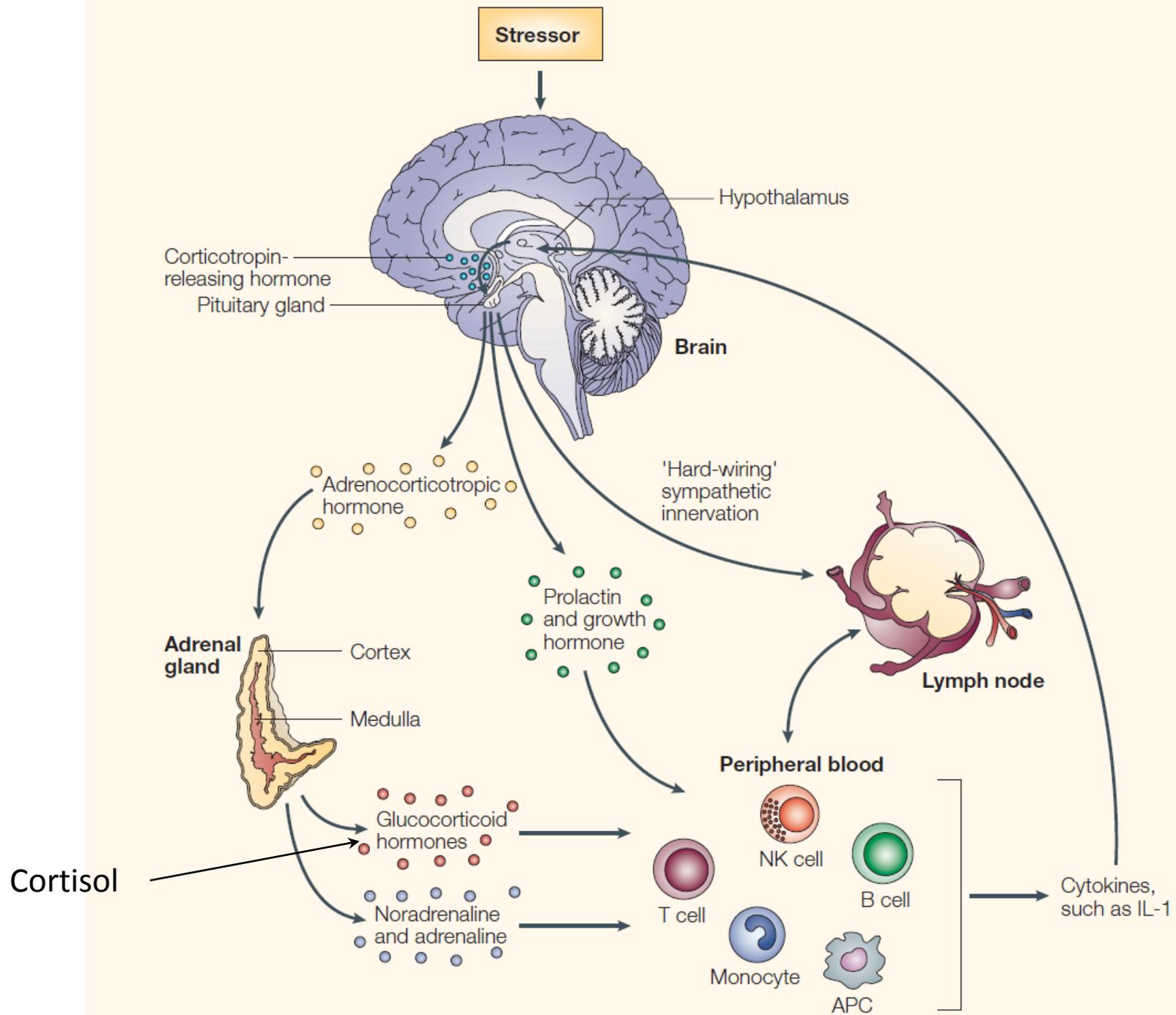
- Hypothalamus
- Pituitary Gland
- Adrenal System
- Autonomic Nervous System



Psychoneuroendocrinology

- Psychosomatics
- Influence of the mind on the body
- Voodoo

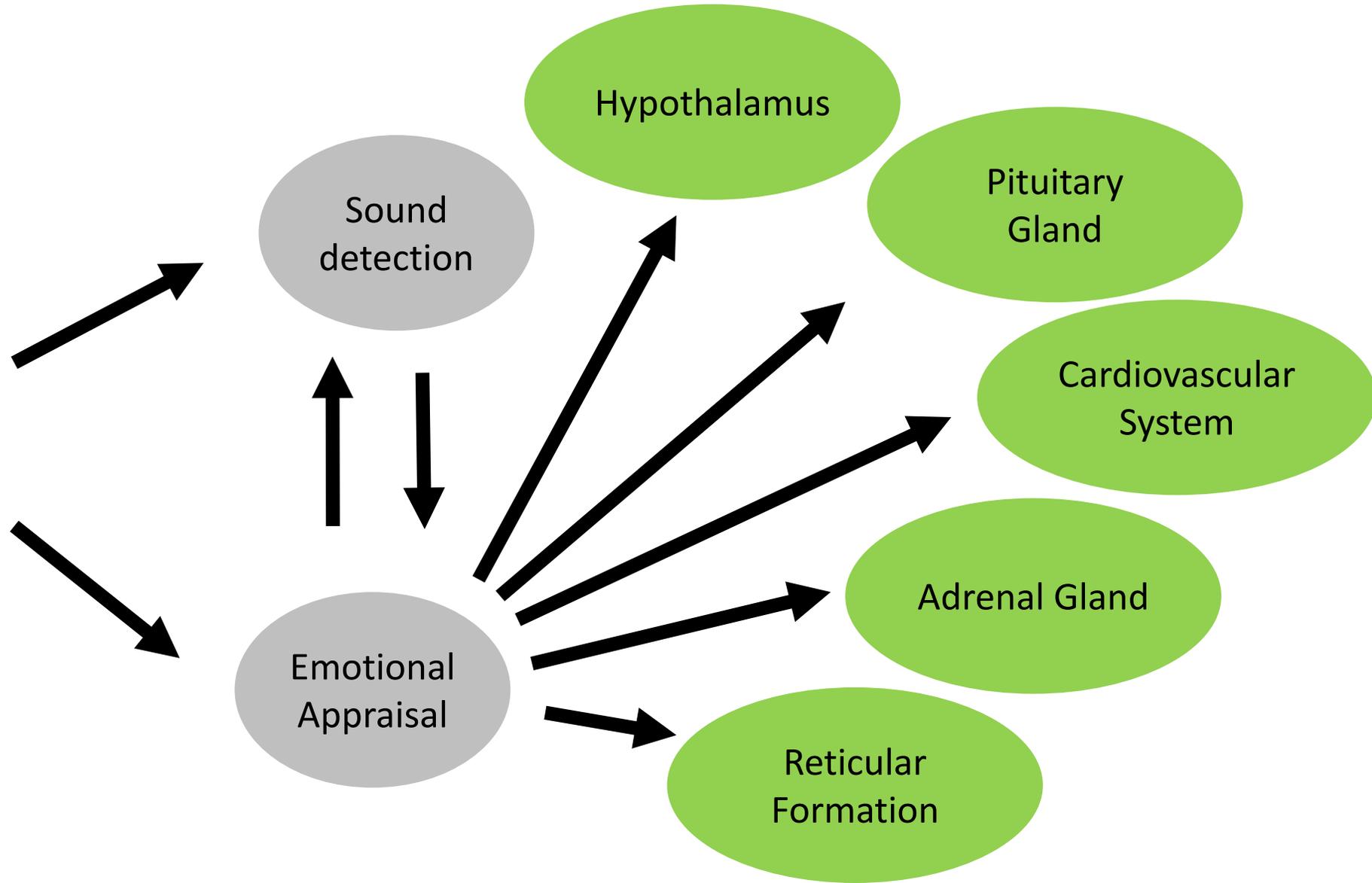
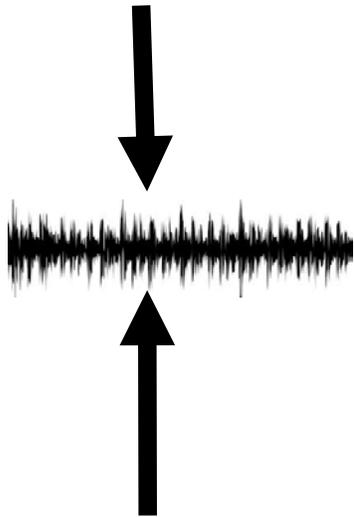




Why Stress Causes Health Problems

Physiological Response to Stress	Positive Effects	Negative long-term effects
Upregulation of the immune system	<ul style="list-style-type: none">• Increased resistance to disease/injury• Better healing	<ul style="list-style-type: none">• Immune dysfunction• Increased vulnerability to allergies.
Cardiovascular arousal	<ul style="list-style-type: none">• Stronger/Faster	<ul style="list-style-type: none">• Cardiovascular disease• Poor sleep
Cortisol release	<ul style="list-style-type: none">• Carbohydrate conservation	<ul style="list-style-type: none">• Overeating• Visceral fat storage• Diabetes

Summary: sound and stress



Research: Environmental Noise

Our soc

- Wind turbines
- Road traffic
- Aeroplanes
- Trains
- Amplified music
- Construction



Natural Experiment

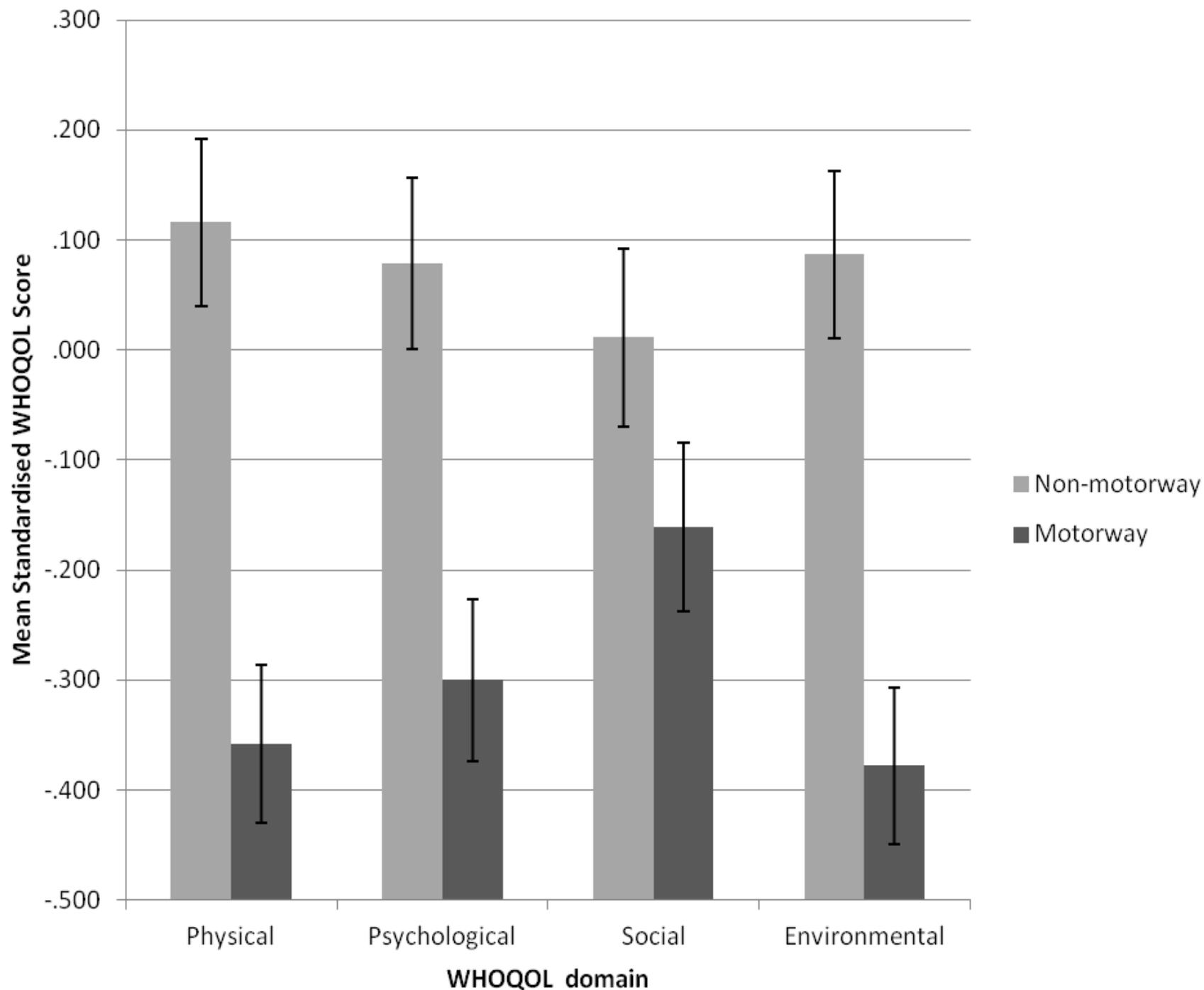
Two SES-matched areas

- One within 50 metres of a motorway
- One > 800 metres from any main road, airport, or railway
- “Camouflaged” questionnaire about neighbourhood amenity
- Measured Health-Related Quality of Life in >500 people using WHOQoL
- Also asked how sensitive they were to noise

Auckland housing can be very close to motorways:

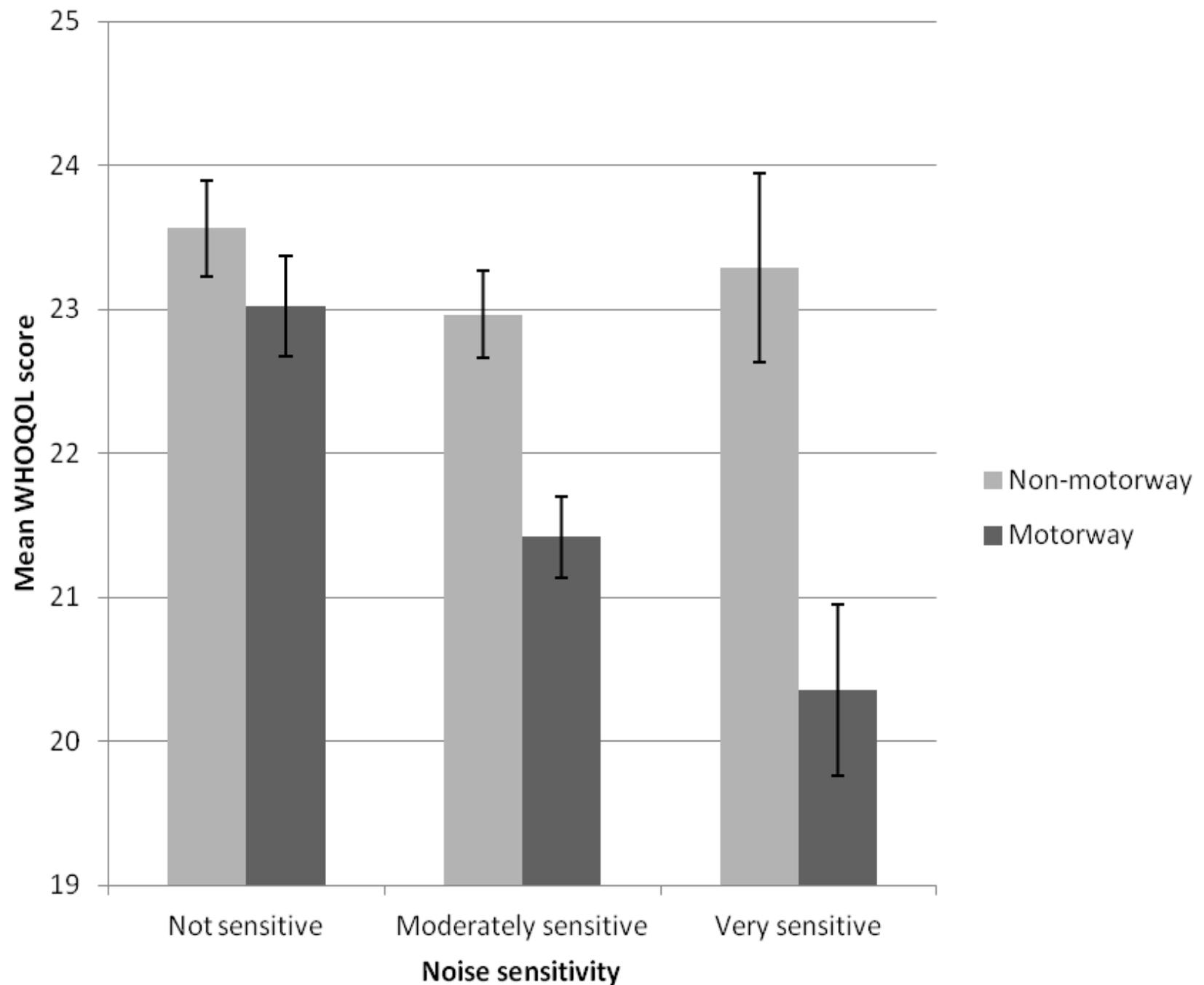


People living near motorways had lower health-related quality of life in all four domains . . .



Welch, D., Shepherd, D., Dirks, K. N., McBride, D., & Marsh, S. (2013). Road traffic noise and health-related quality of life: A cross-sectional study. *Noise & Health, 15(65), 224-230*

... and this depended on noise sensitivity



Welch, D., Shepherd, D., Dirks, K. N., McBride, D., & Marsh, S. (2013). Road traffic noise and health-related quality of life: A cross-sectional study. *Noise & Health, 15*(65), 224-230

Replicated the study

Wellington Airport

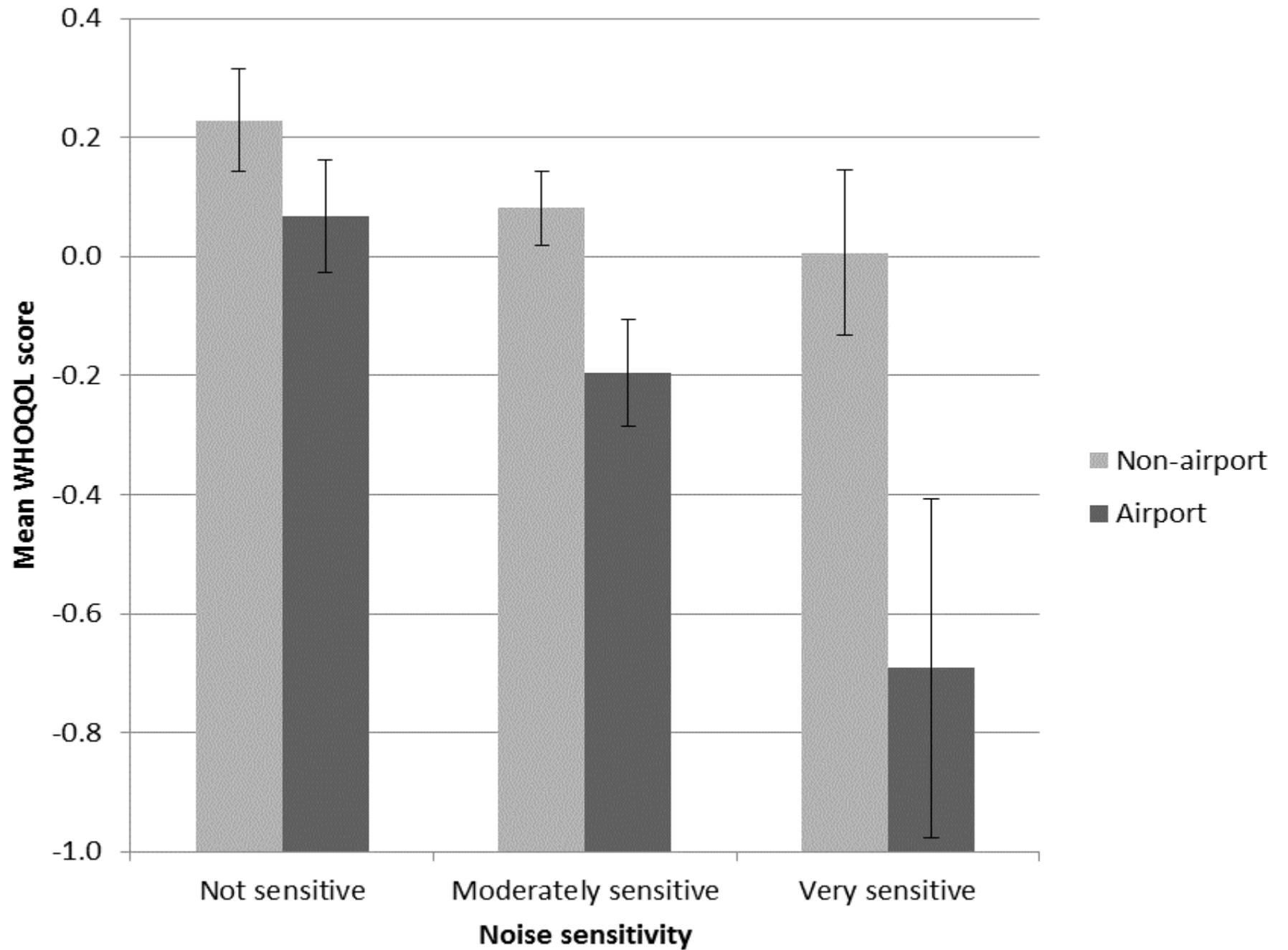
vs

SES-matched area

Same approach to
data collection

Replicated twice:
2012 and 2015

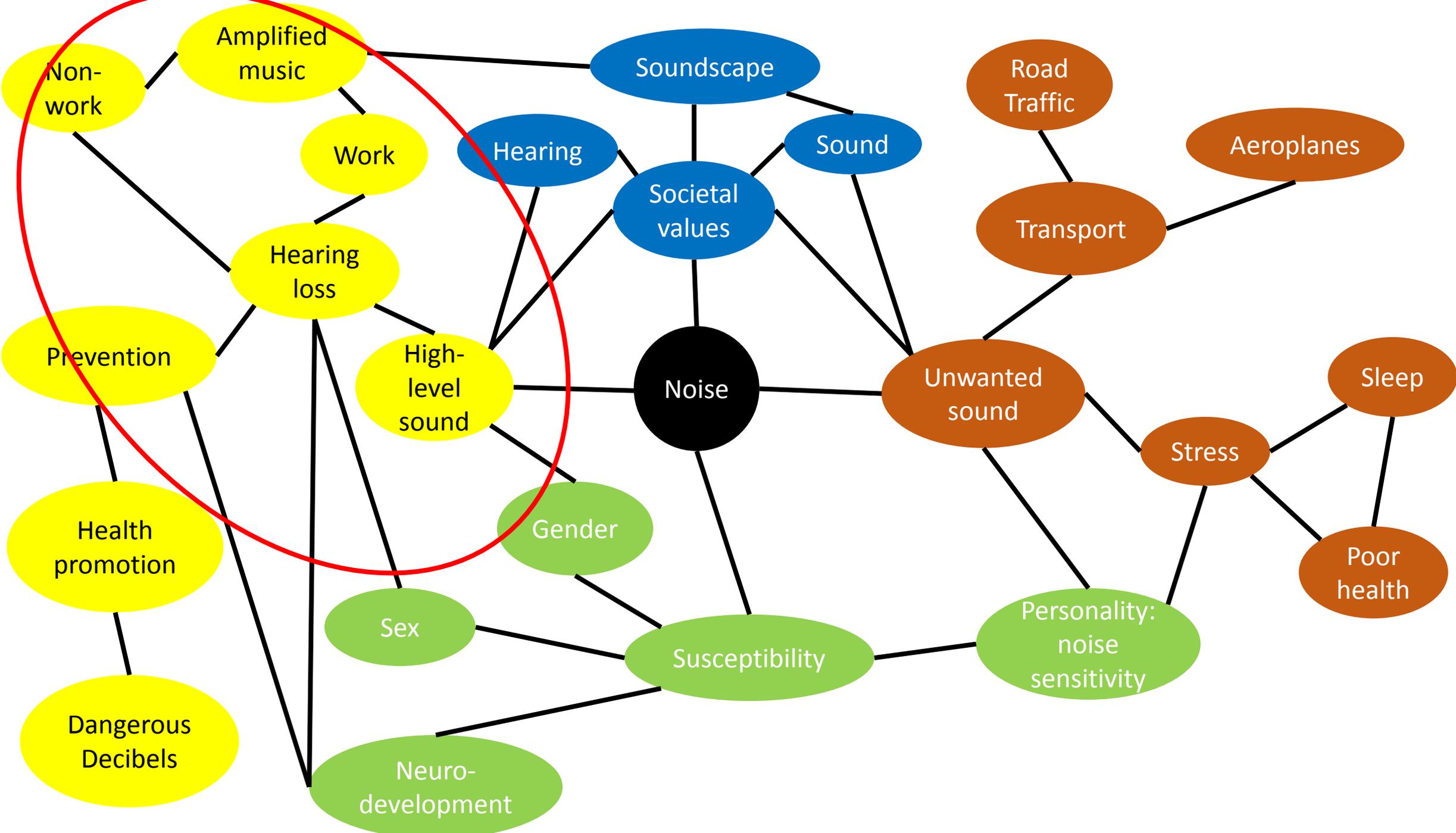




Welch, D., Dirks, K., Shepherd, D., & McBride, D. (2016). *Health-related quality of life is impacted by proximity to an airport in noise sensitive people*. Proceedings of Internoise, Hamburg.

Noise troubles people

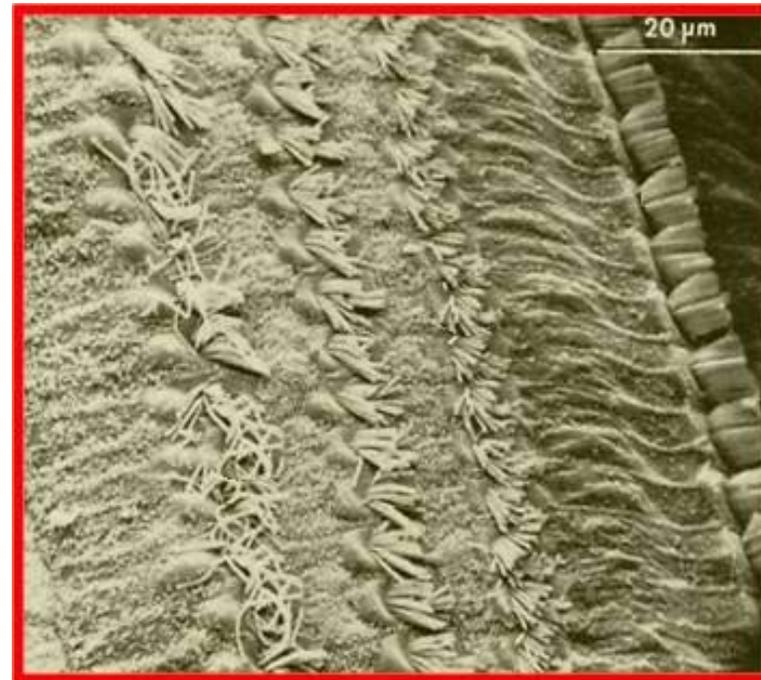
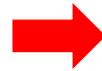
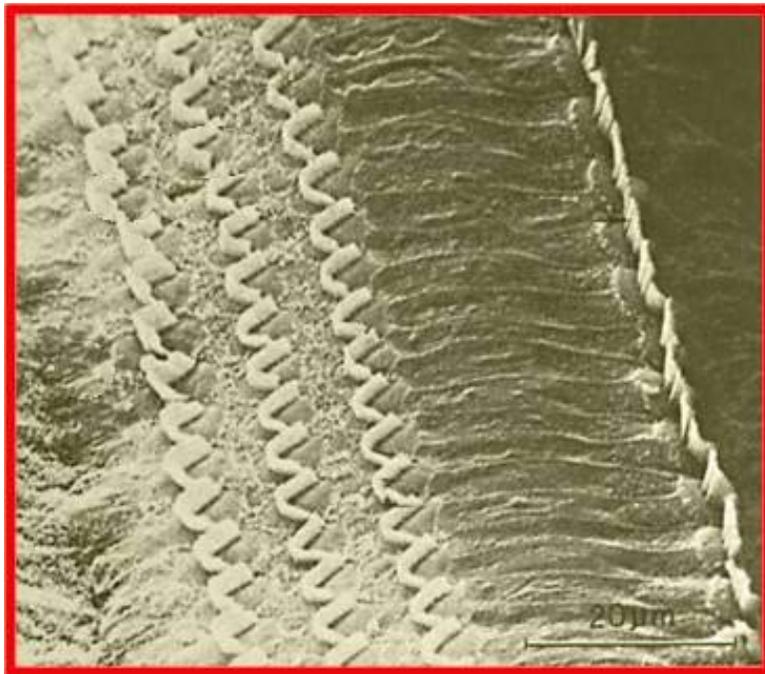
- By definition
- It causes stress
- This results in psychoneuroendocrinological effects



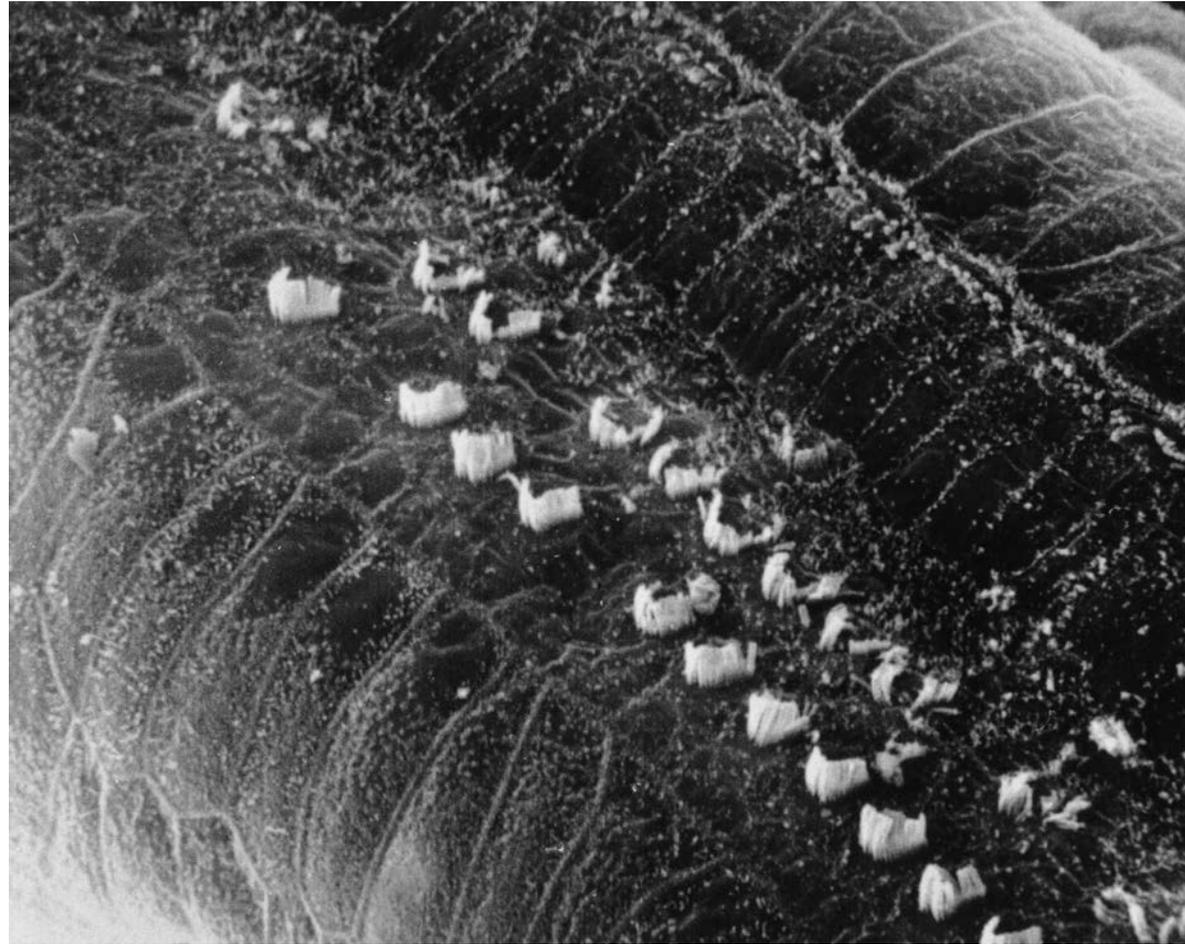
Loud sound causes hearing loss

- Combination of temporary (adaptation) and permanent
- Mammalian ears cannot heal once damaged
- Does not matter whether the person enjoys the sound or not

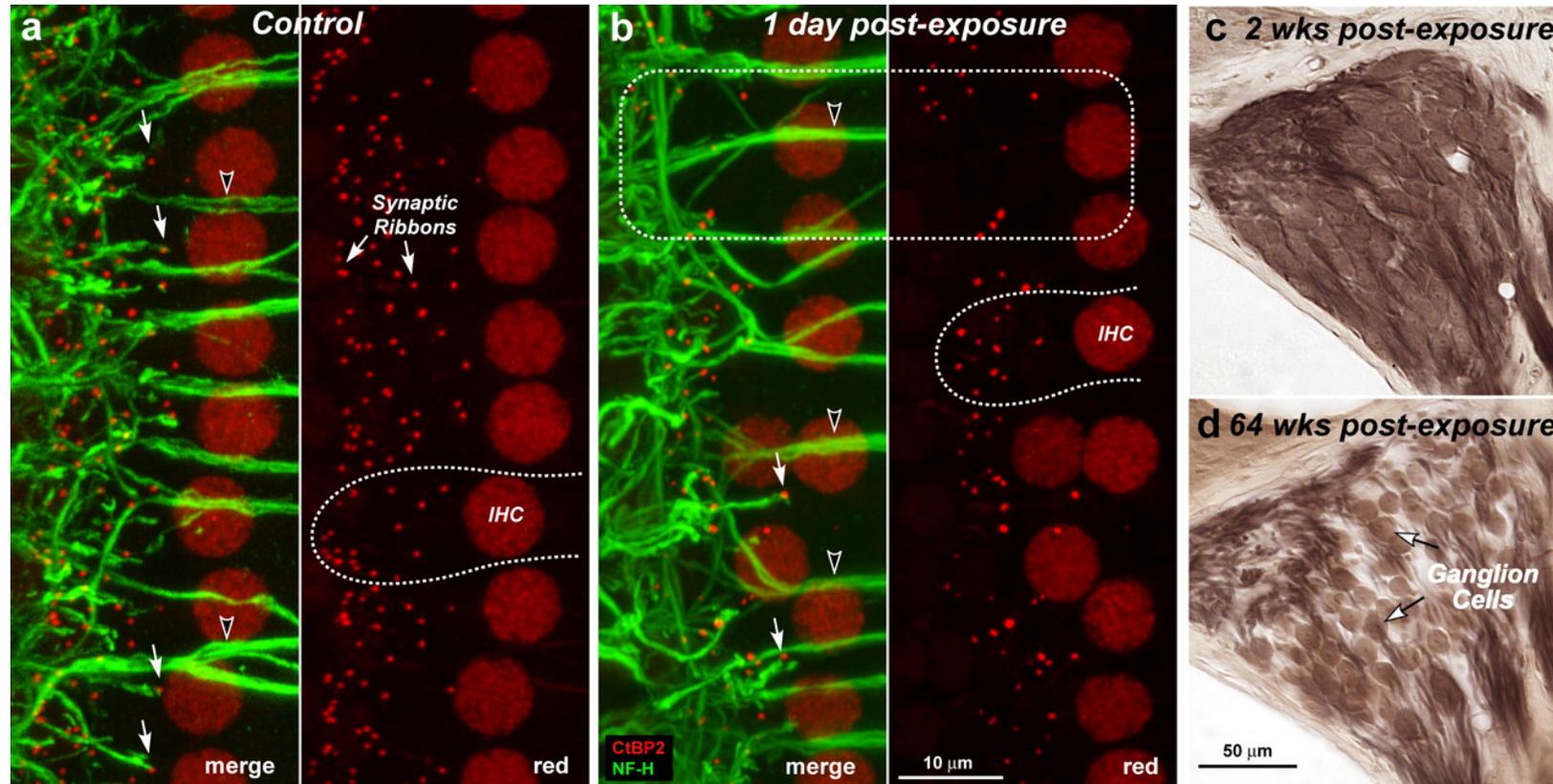
Mechanical damage to the organ of Corti



Sensory cells die and the organ of Corti seals where they were



Excitotoxic damage to the auditory nerve



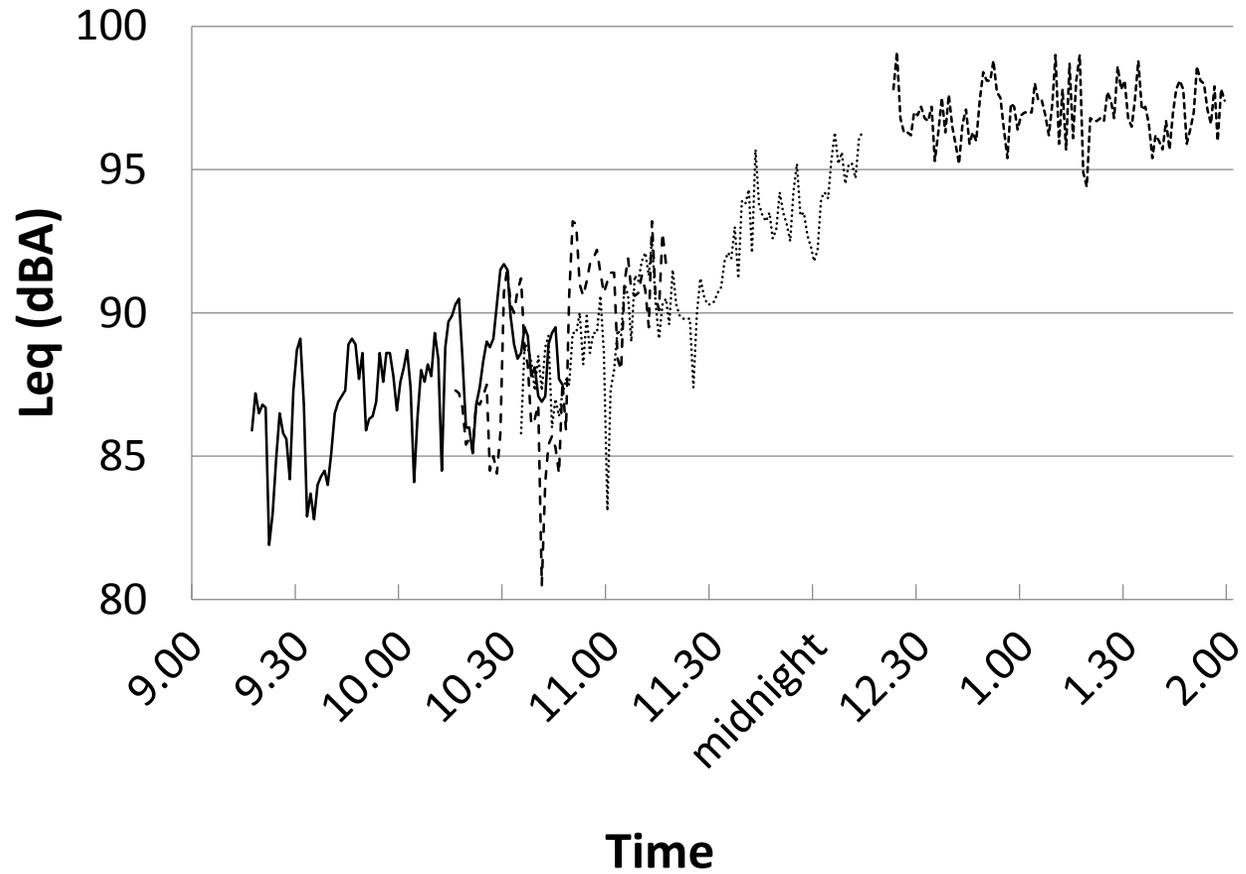
“Listening to music at high levels
will irreparably damage your ears”

“But it’s fun”

Research and Model

- Interviews:
 - Regular club-goers
 - Musicians/DJs
 - Club managers
- Sound Measurement
- Model
 - Processes
 - Based on data and theory

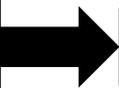
Sound levels measured in clubs across an evening



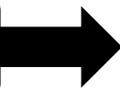
Loud sound



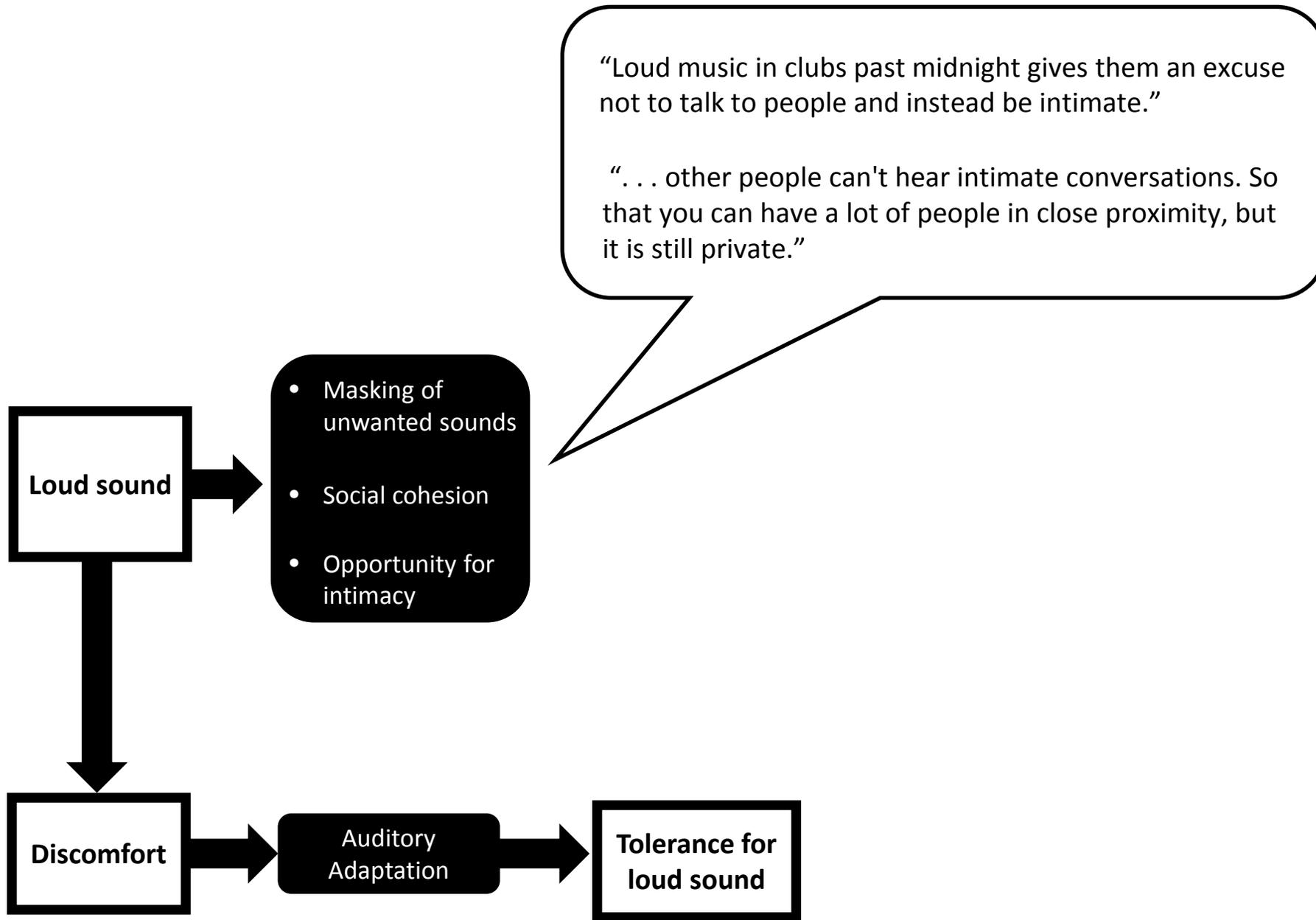
Discomfort



Auditory Adaptation

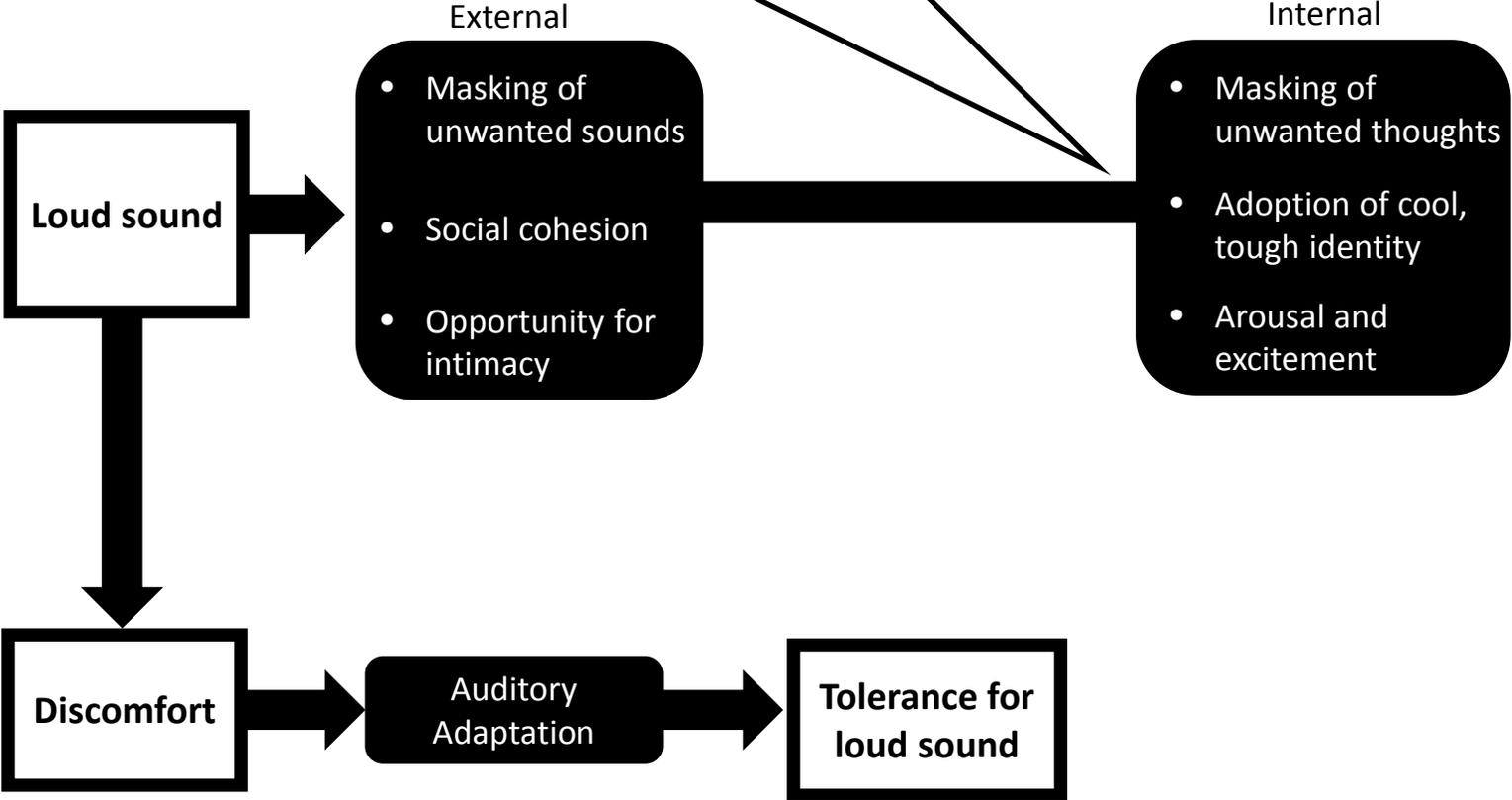


Tolerance for loud sound



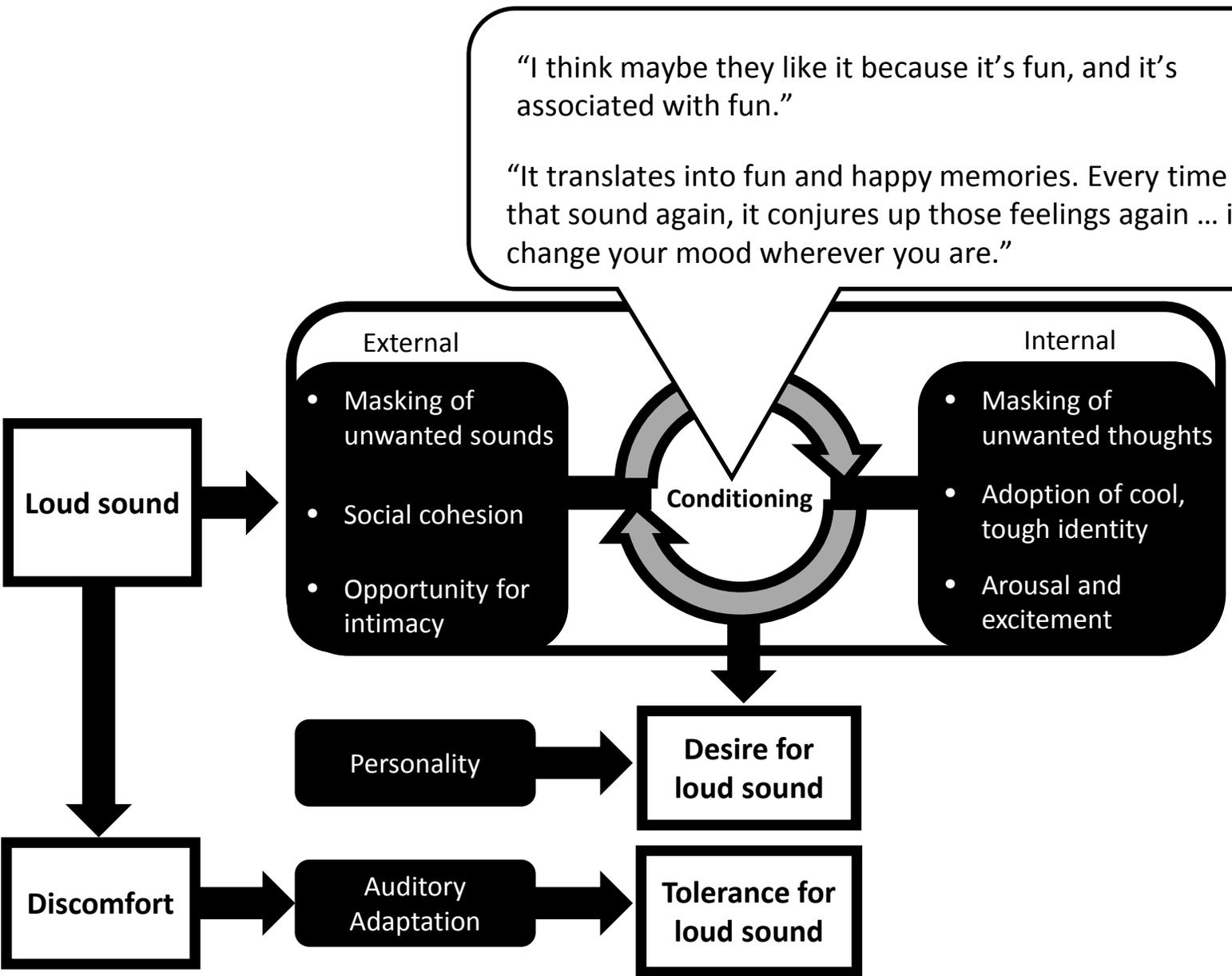
“They make me feel happy and energized and I want to turn it up even louder.”

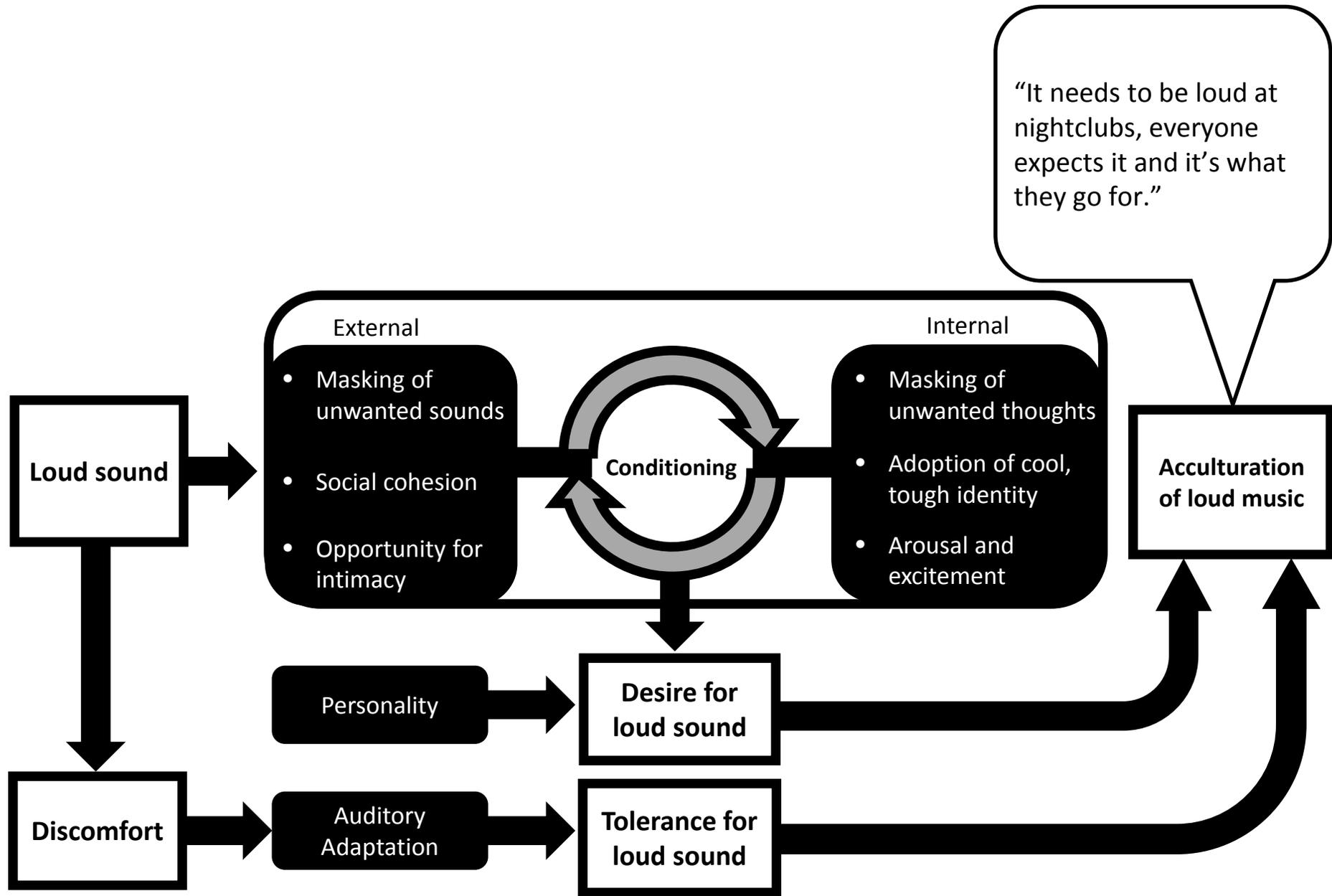
"The loud beat makes you want to move your body and be more active."

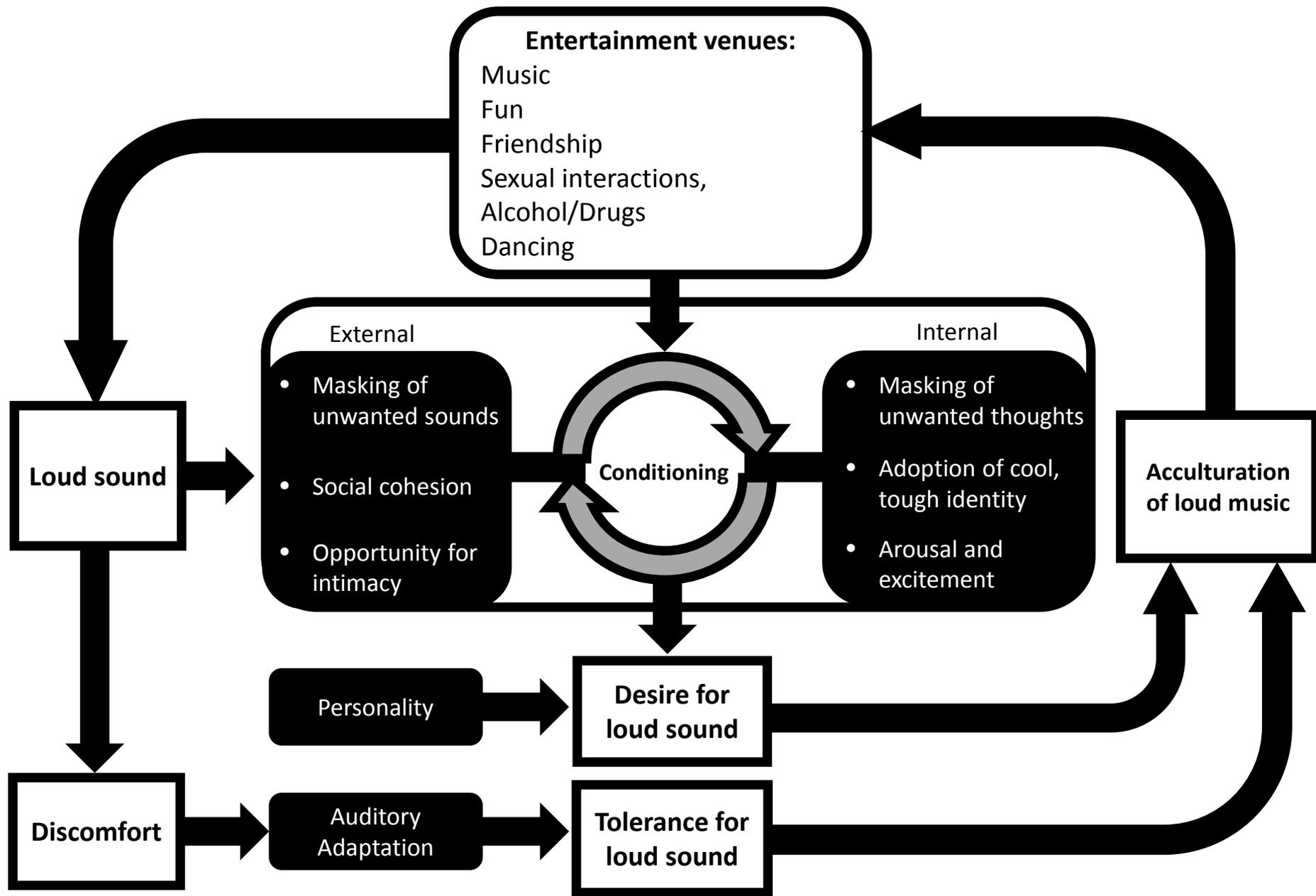


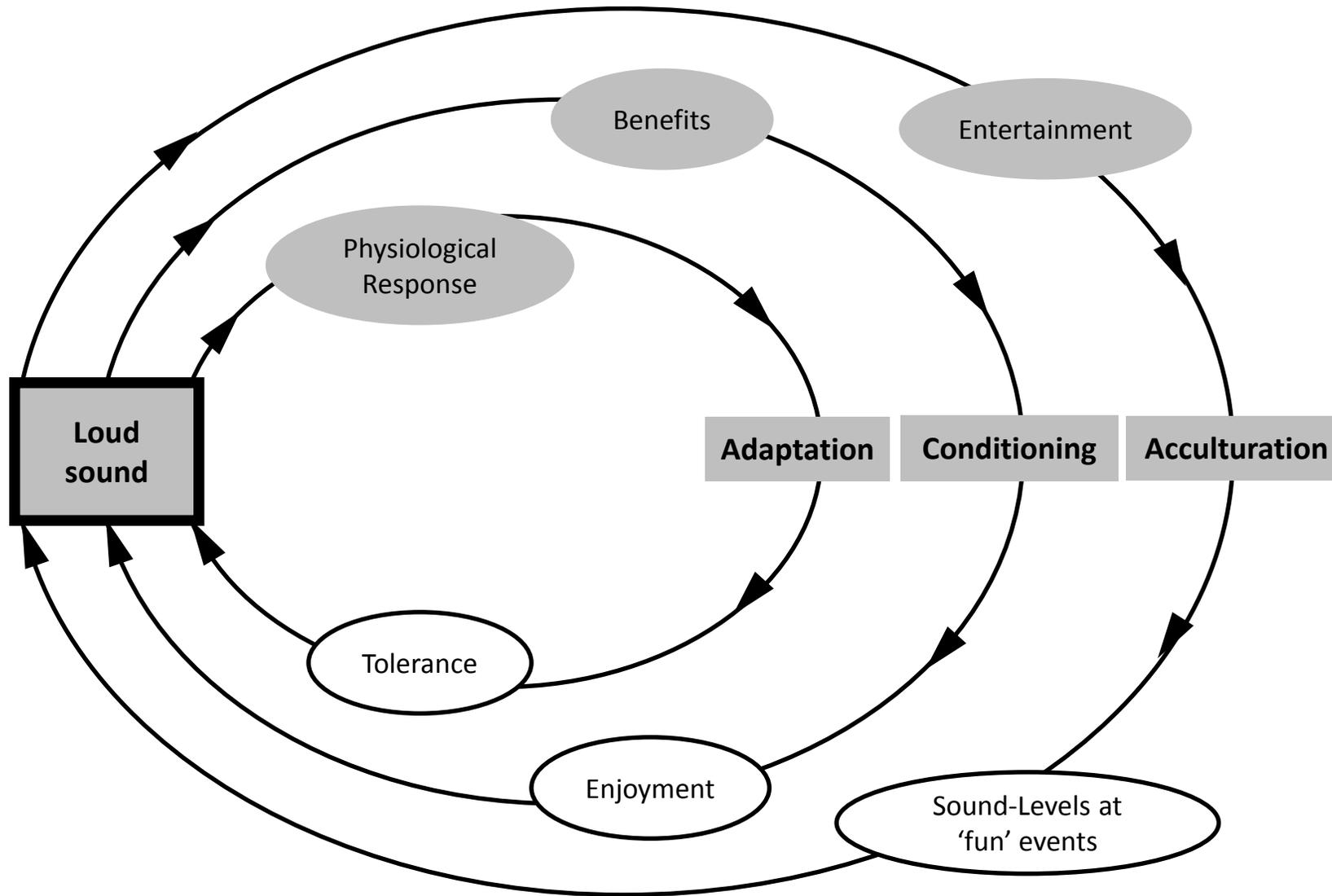
“I think maybe they like it because it’s fun, and it’s associated with fun.”

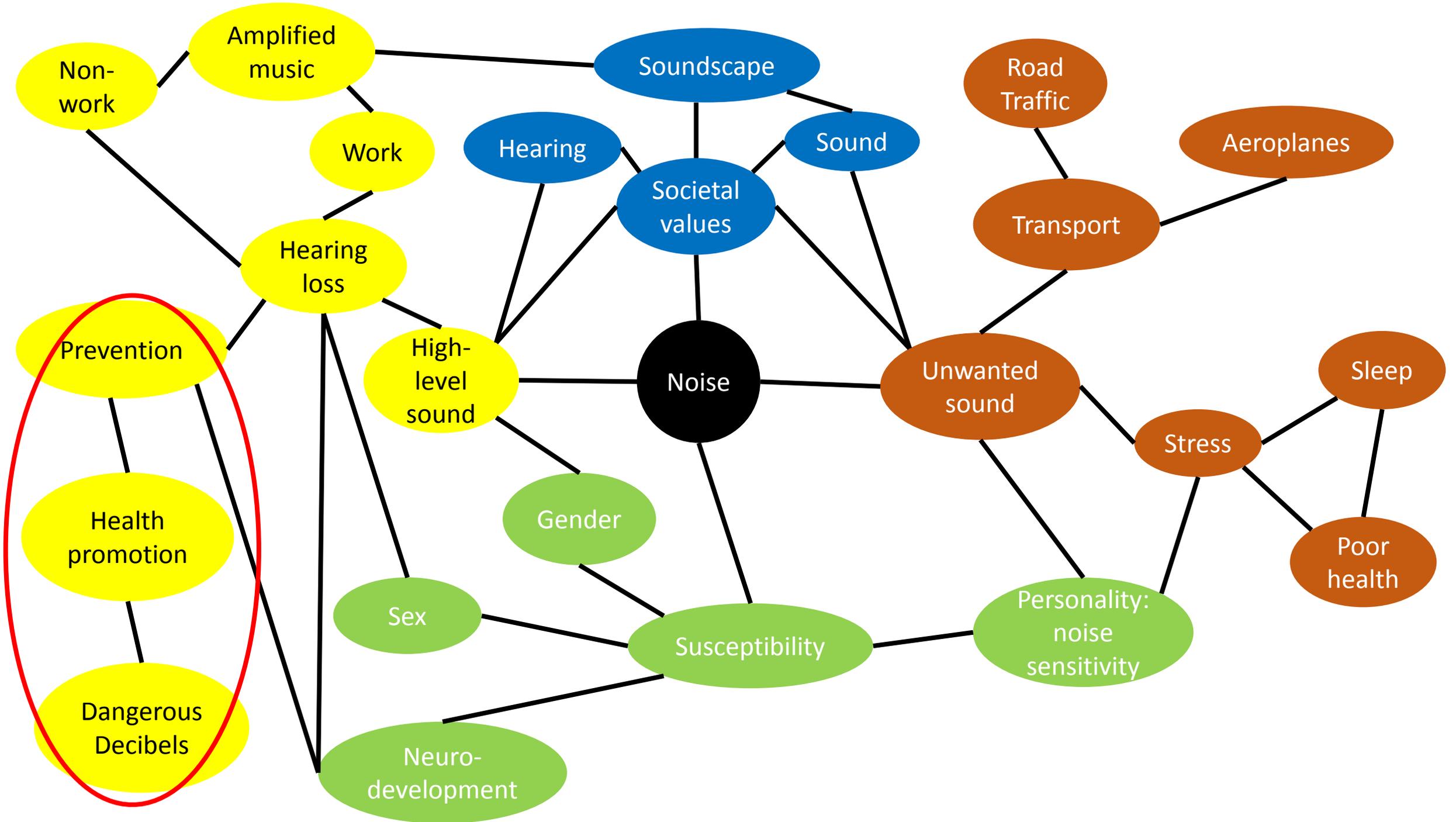
“It translates into fun and happy memories. Every time you hear that sound again, it conjures up those feelings again ... it can change your mood wherever you are.”











Thank-you for listening!

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