

# The Effect of Sound on Humans

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# Outline

- **What is “Sound”**
- **What is “Soundscape”**
- **What is “Psychoacoustic”**
- **Examples**
- **Discussion and Conclusions**

# What is "Sound"

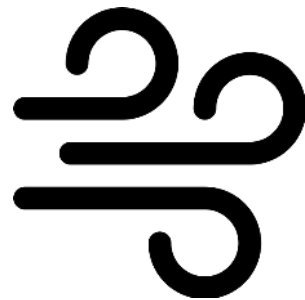
- In physics, sound is a vibration that propagates as an acoustic wave, through a transmission medium such as a gas, liquid or solid.
- In human physiology and psychology, sound is the reception of such waves and their perception by the brain.



Example: Our hearing system

# What do we hear in daily lives?

- **Biophony** - Sounds created by biological organisms, mostly insects, amphibians, birds and mammals. Signals carry information and are thus complex.
- **Geophony** - Sounds from the movement of wind and water. Driven mostly by climate. Running streams, rain and wind.
- **Anthrophony** - Sounds by human-made objects such as machines, friction from road noise, bells, and sirens [7].



# What is “Soundscape”

*SOUND + SCAPE??*

The term “Soundscape” [1] is a combination of the words sound and scape (a suffix meaning “view of”).

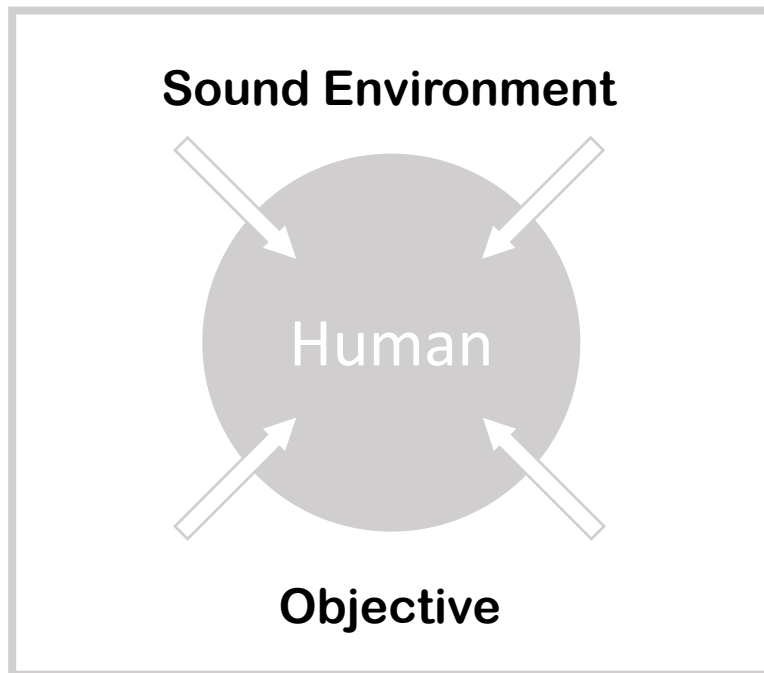
It was first proposed by Raymond Murray Schafer who is the Canadian composer. This orientation aims not only to consider sound as a physical entity, but also to uncover what kind of sounds people hear in society, what kind of meaning they receive, and how they value them.



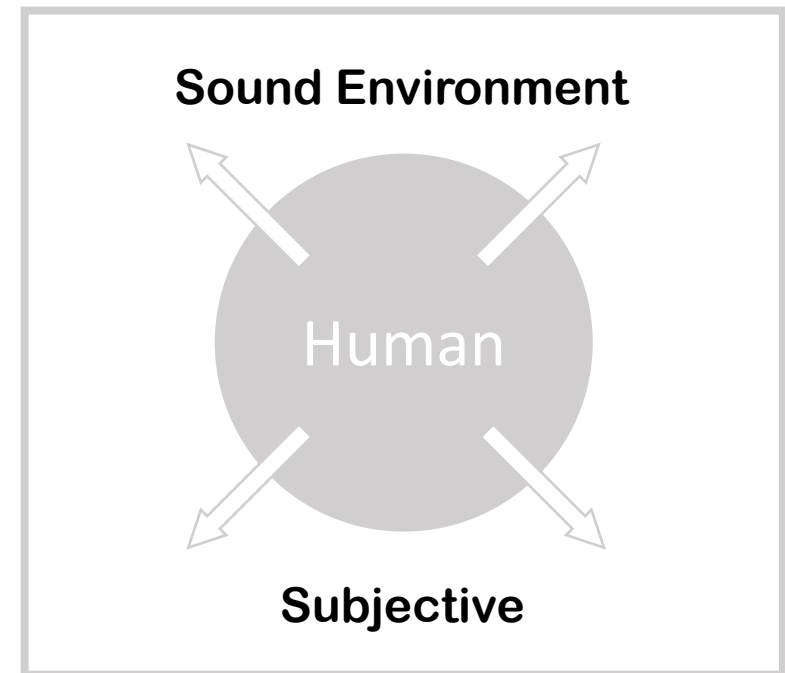
[Figure D] R. Murray Schafer in 2007

# Soundscape

**Physically perceived  
sound environment**



**Subjectively perceived  
sound environment**



# What is “Psychoacoustic”

- **Psychoacoustics is the branch of psychophysics involving the scientific study of sound perception and audiology—how humans perceive various sounds. More specifically, it is the branch of science studying the psychological responses associated with sound (including noise, speech, and music).**
- **Psychoacoustics is an interdisciplinary field of many areas, including psychology, acoustics, electronic engineering, physics, biology, physiology, and computer science. [4]**

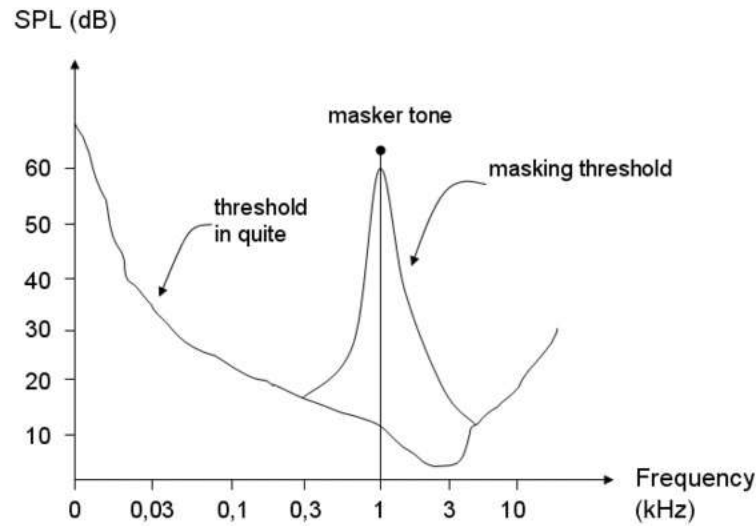
# Examples

- **The Psychoacoustic Model “MP3”**
- **Earthquake Early Warning**
- **Fake Engine Noise of Electric Vehicles**
- **Onomatopoeia**



# MP3 (1/3)

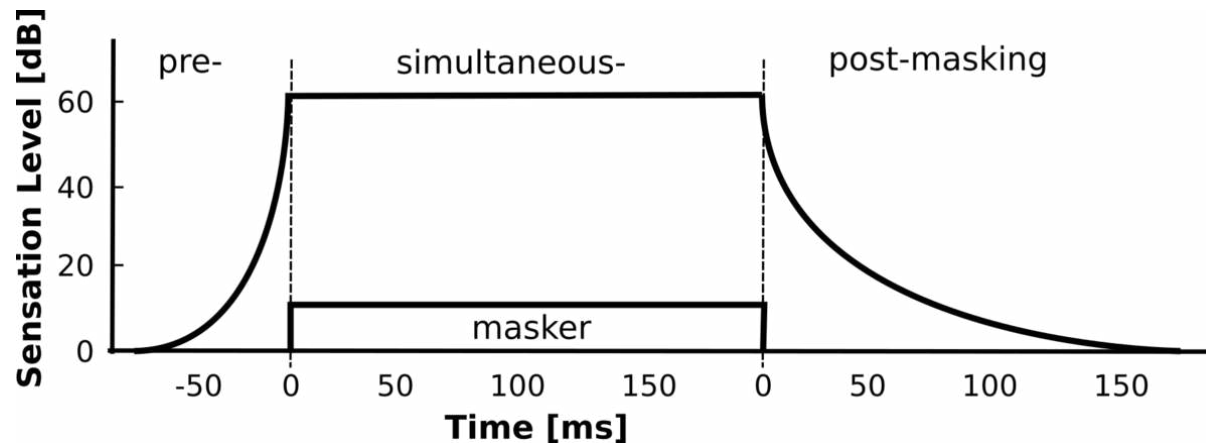
- Auditory masking is the elimination of similar frequencies, based on the principle that when two sounds of similar frequency are played together and one is significantly quieter, people will hear only the louder sound.



[Figure B] Auditory Masking

# MP3 (2/3)

- Temporal masking is a similar principle across time: if there are two sounds very close together in time (less than about five milliseconds apart, depending on the material) and one is significantly louder than the other, listeners can only hear the louder sound.

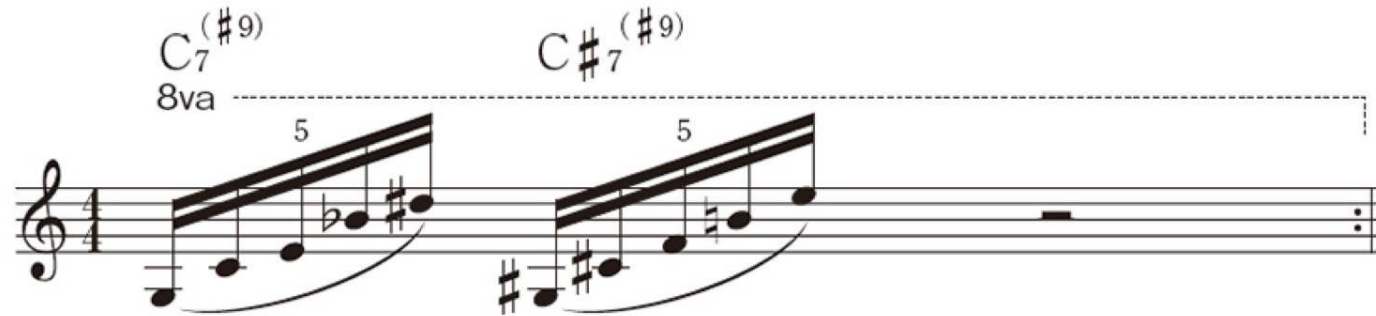


[Figure C] Temporal Masking

# MP3 (3/3)

- The third principle is spatialization. While it is very easy to locate the direction of sounds in the middle of the audible range when they are played back in stereo, it is close to impossible for people to locate very low or very high sounds. To save more dataspace, the mp3 encoder saves sounds at either end of the frequency spectrum only once for both channels, rather than twice and plays them back as mono files.
- The frequencies of sound that humans can perceive (the audible range) are from about 20 Hz to 20 kHz.

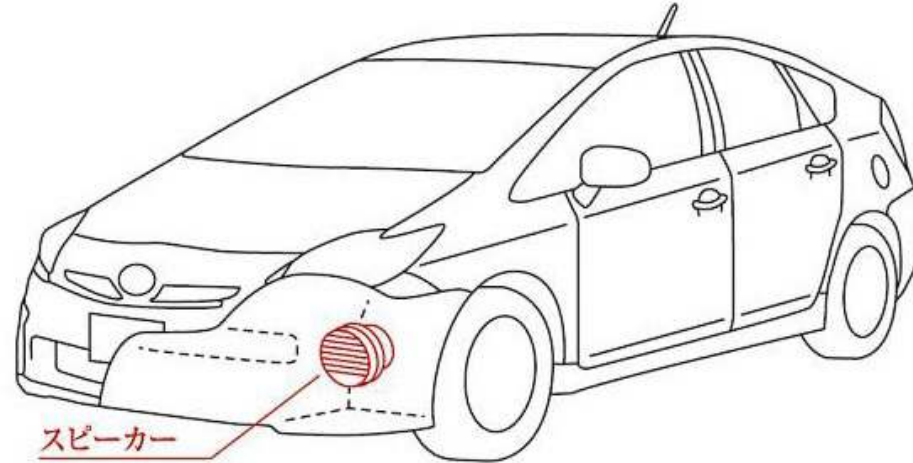
# Earthquake Early Warning



The scale of Earthquake Early Warning by  
Ifukube, T. (Japan) [3]

- Originally, composers supposed that it makes someone feel urgent but does not give them anxiety [3]
- The number of people who associate a tragedy with this alarm melody was increased after Tohoku Earthquake (2011)
- This is one of the effect of sound on humans

# Fake Engine Noise of Electric Vehicles



Vehicle approach notification device  
added to "Prius" [Figure A]

- For substantiality of driving (Reality)
- For the safety of pedestrians (Universal Sound Design)

# Onomatopoeia [6]

- Naming things and actions by imitating sounds, and making words for them, or words made by such a method
- Created by copying the sounds of animals and humans

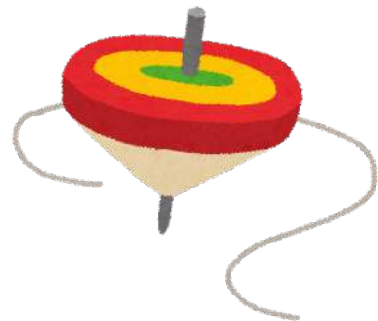


**がお-**  
**(hoak)**



**ワンワン**  
**(woof)**

- Created by imitating various sounds in the natural world



**くるくる**



**クタクタ**

# Discussion and Conclusions

- **Sound is an essential part of human and human history**  
There is no real feeling without sound  
A lot of history has been made in a short time  
Japanese Onomatopoeia etc.
- **Sound has a psychological effect on humans**  
Promote human's sense of fear = In the worst case, sound causes symptoms of PTSD
- **Sound complements virtual environment more realistic**  
It is also possible to create an ideal state like a painting

# Reference

1. Schafer, R. M. (1994). *The soundscape: Our sonic environment and the tuning of the world.*
2. Iwamiya, S. (2020). 音と音楽の科学.
3. JAS. (2012). *JAS Journal Vol.53 No.2 (March)* 「音の日」記念講演より「緊急地震速報チャイムの誕生秘話」
4. Ballou, G (2008). *Handbook for Sound Engineers*(Fourth ed.). Burlington: Focal Press. p. 43.
5. Sterne, J. (2006). The mp3 as cultural artifact. *New media & society*, 8(5), 825-842.
6. Tamori, I. (1998). 日本語オノマトペ：多様な音と様態の表現. *THE JOURNAL OF THE ACOUSTICAL SOCIETY OF JAPAN*. Vol. 54.



7. Pijanowski, B. C., Villanueva-Rivera, L. J., Dumyahn, S. L., Farina, A., Krause, B. L., Napoletano, B. M., ... & Pieretti, N. (2011). Soundscape ecology: the science of sound in the landscape. *BioScience*, *61*(3), 203-216.

# For Your Information

- 日本サウンドスケープ協会

<http://www.soundscape-j.org/soundscape.html>

- 音と音楽の科学 **[BOOK]**

<https://gihyo.jp/book/2020/978-4-297-11191-5>

# Figures from

[A]

<https://car.watch.impress.co.jp/docs/news/1023908.html>

[B]

[https://en.wikipedia.org/wiki/Masking\\_threshold](https://en.wikipedia.org/wiki/Masking_threshold)

[C]

[https://commons.wikimedia.org/wiki/File:Temporalmasking\\_adapted.png](https://commons.wikimedia.org/wiki/File:Temporalmasking_adapted.png)

[D]

[https://en.wikipedia.org/wiki/R.\\_Murray\\_Schafer#/media/File:R.\\_Murray\\_Schafer.jpg](https://en.wikipedia.org/wiki/R._Murray_Schafer#/media/File:R._Murray_Schafer.jpg)

**Thank you for your  
listening!**