Sound Design Basics

The World of Sound, Part 1

Introduction

materialisation, emotion & attention - https://vimeo.com/228891758 (0:00 – 7:26)

See With Your Ears: Spielberg And Sound Design https://www.youtube.com/watch?v=kavxsXhzD48

Talking About Sound

Sound is...

- Vanishing, transient
- Urgent (ears can not be closed)
- Multidimensional
- Social, connecting
- Emotional, influencing manipulative (direct effect on the limbic system)
- Intuitive Informative: material, force, process ...
- Sound complements the visual perception, eg of space
- The eye analyses distances and shapes hierarchically, while sound creates an overall impression that depends on other factors (wind, materials ...)

Klang ist…

- Verschwindend, vergänglich
- Eindringlich (Ohren können nicht geschlossen werden)
- Multidimensional
- Sozial, verbindend
- Emotional, beeinflussend manipulativ (direkte Wirkung auf das limbische System)
- Intuitiv Informativ: Material, Kräfte, Prozesse…
- Klang ergänzt die visuelle Wahrnehmung, zb von Raum
  - Das Auge analysiert Distanzen und Formen hierarchisch,während Klang ein Gesamteindruck erzeugt, welcher abhängig von weiteren Faktoren ist (Wind, Materialien…)

Three approaches to sound analysis

- Acoustics
  Machine measurable, "objective" characteristics of sound. Adjacent: psychoacoustics: signal processing and sound perception in the brain?

- Sound object
  The smallest completed tonal unity stands alone, detached from the sound source and the sound body.
  Difference to "sounding object"

- Soundscape
  Describes the ensemble of the sound environment as a unit

Talking about sound 1: Acoustics

Basic physical properties

- To create sound, vibration is needed
- To generate vibration, a physical force on an elastic object is needed
- A resonator transmits and "shapes" the vibrations into the air
- The type of material and the mass affect the vibration behavior
- Basic elements of the sound: Amplitude, period, frequency (f)
- Propagation speed "c" in the air? = About 343m / s
- Wavelength: W = c / f

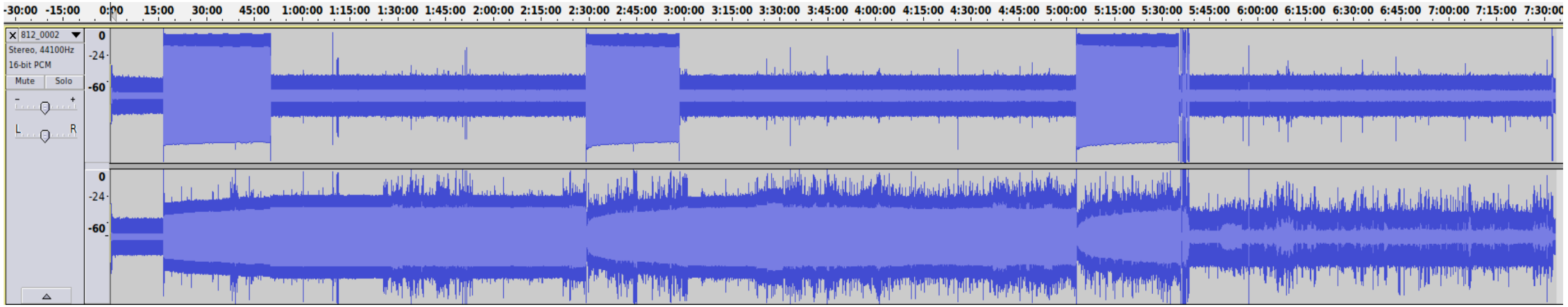
Illustration: Raffaseder, Audio Design,2002

Description of acoustic events

- pitch -> frequency:
  80hz, 160hz, 320hz, 640hz, 1280hz,
  2540hr, 5080hz, 10160hz

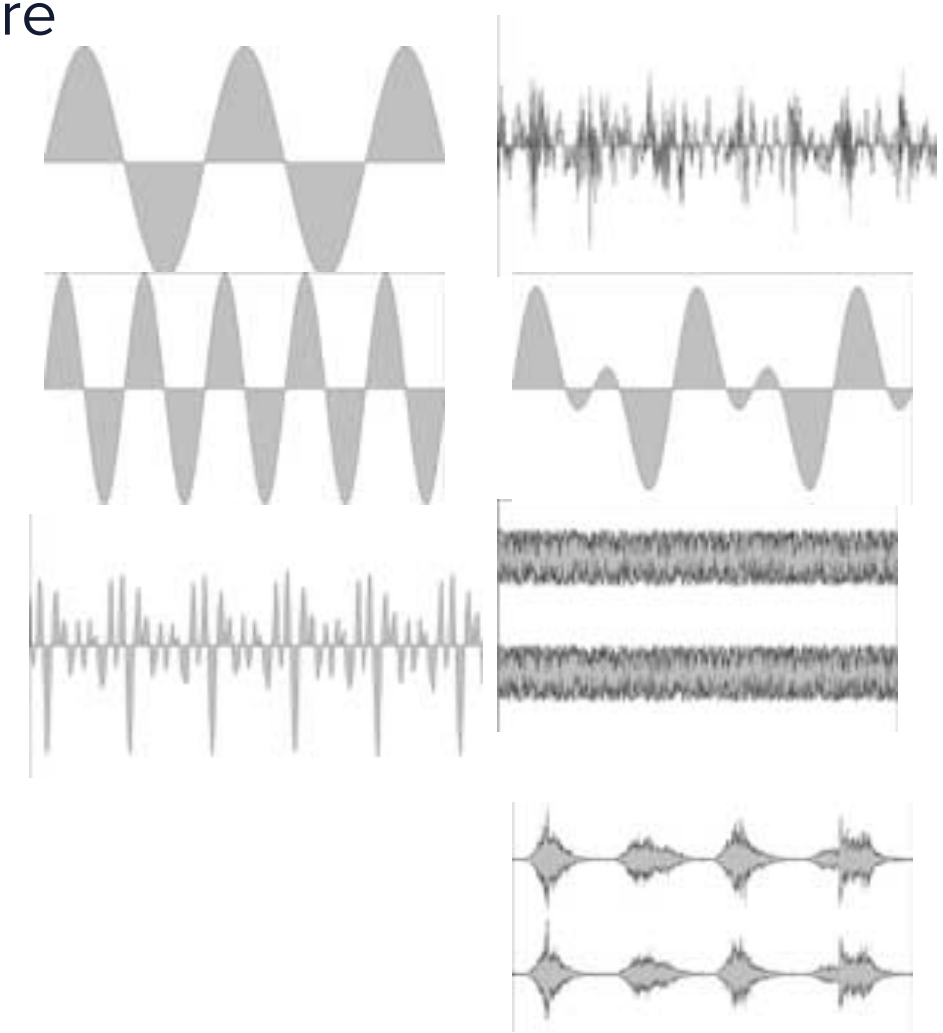
- volume -> amplitude
  z.B: 0dB, -6dB, -12dB

- Timbre -> frequency spectrum



Examples of amplitude, frequency, timbre

- Sound vs. noise
- Basic frequency and harmonics
- White noise

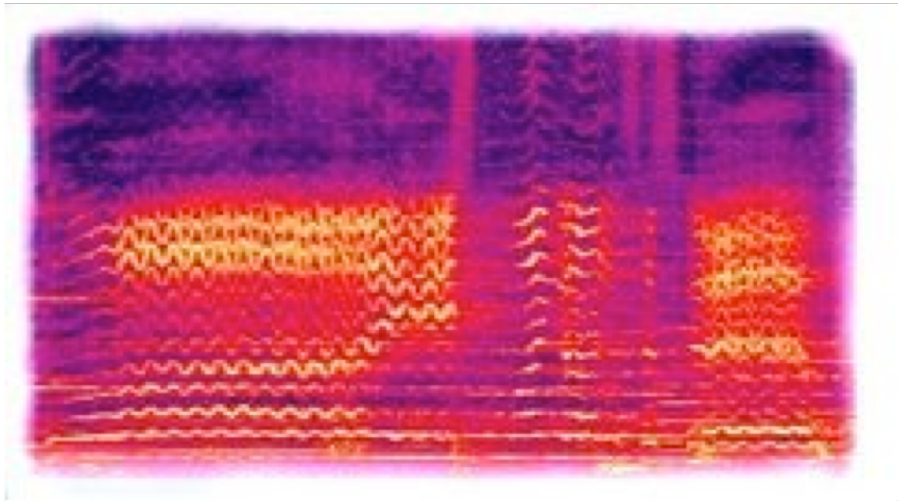


More about timbre

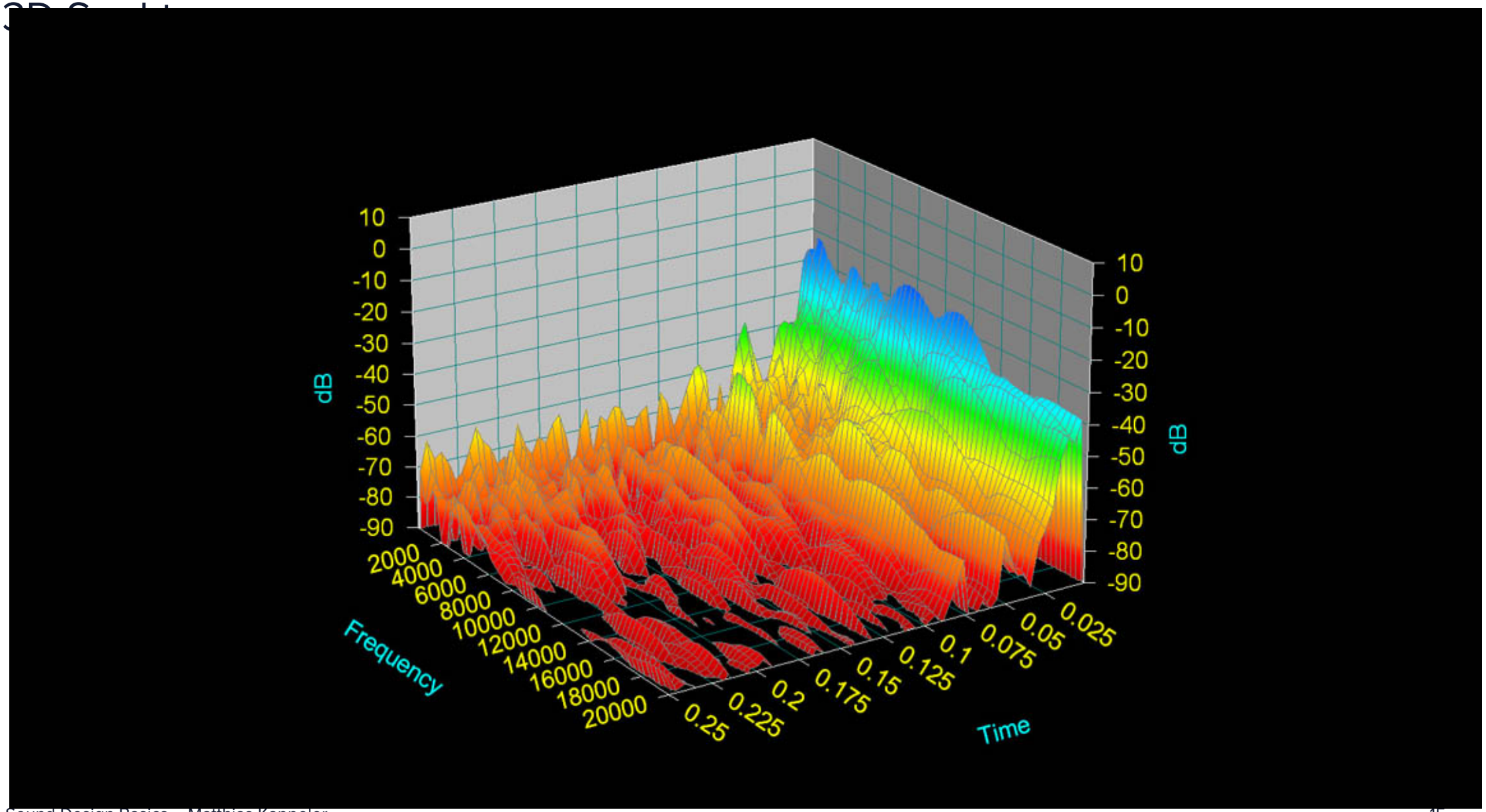
- Makes two sounds of the same pitch and volume distinguishable
- Is determined by the frequency spectrum
- Can change over time
- Changes time-dependent! (eg backwards played piano or "white noise" with "wavy" volume curve)

white noise...

waves



3D Spectrum


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
dB
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Frequency
0.25
0.225
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
Time
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
dB

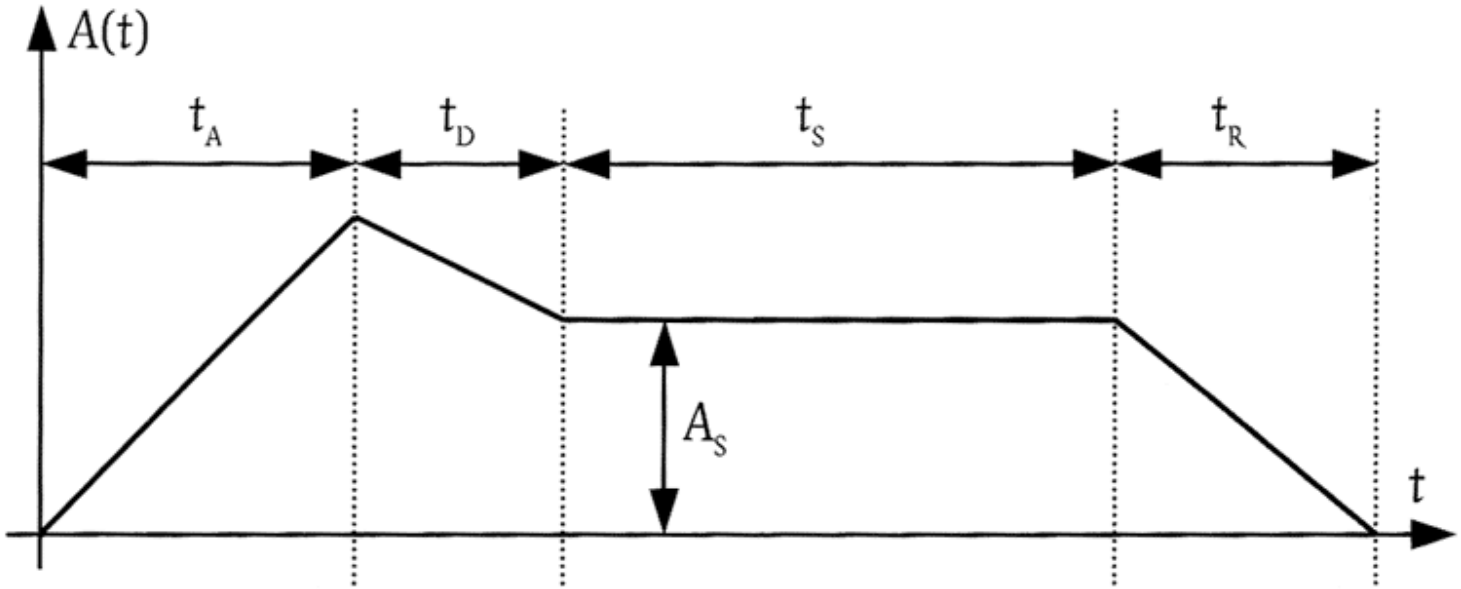
More about timbre

Is defined by:

- Change in amplitude (tremolo, vibrato -> “pulsating”, "hissing", "hammering"... -> time-dependent
- “Volume” and density, refers to the amount, density and amplitude of certain frequencies in the sound
- “Sharp & bright” (share of high frequencies) / “dark” (share of low frequencies)
- Roughness 
- Timbre conveys important semantic and emotional aspects
- Words evoke characteristics of timbre, illustrating qualities in terms of material, emotion and processes

More about timbre

- A D S R curve: attack, decay, sustain, release



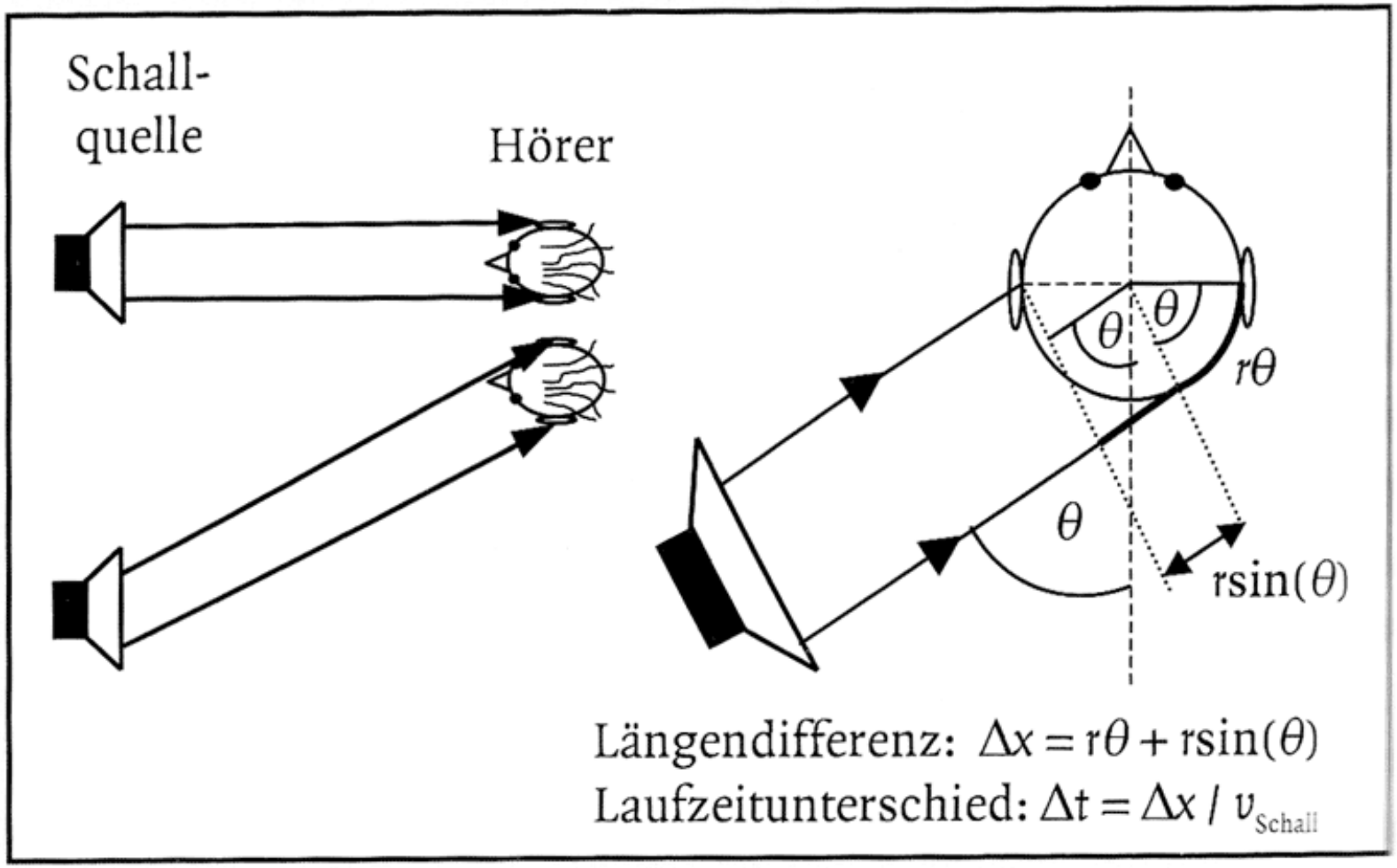
- Examples (Instruments)

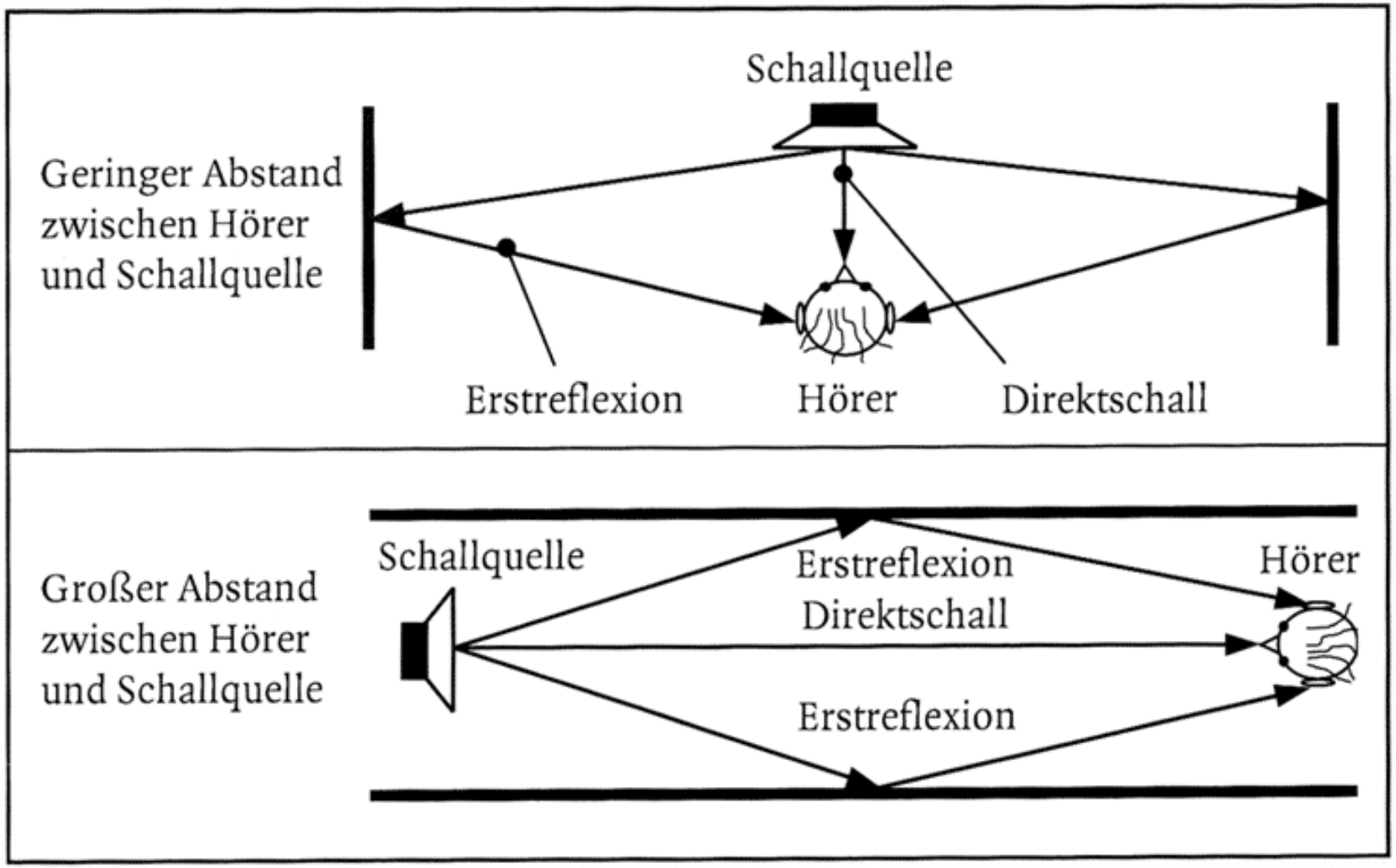
- 1, 2, 3, 4

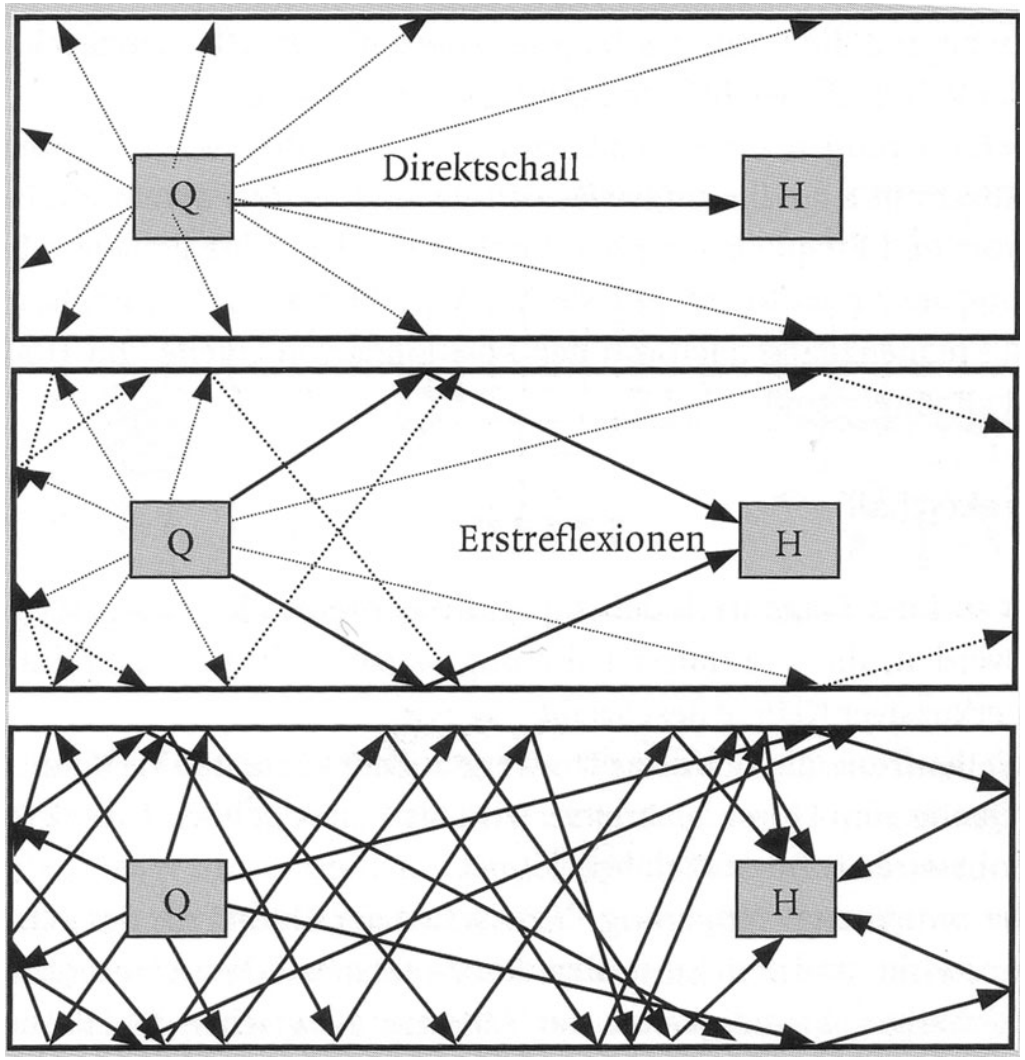
Spatial aspects of sound

- The sound wave "transforms" space in time
  - Propagation & Reflection
- depending on material and surface structure becomes sound
  - reflected / absorbed
  - bent, scattered or bundled
- The influences are reflected in propagation delays
  - hall, or echo
  - ... and filtering / attenuation of the spectrum
- Measurement reverb & resonance over short pulse or abrupt signal
- Room modes: increase or decrease of certain frequencies due to phase overlays

Spatial perception: localization




Geringer Abstand
zwischen Hörer
und Schallquelle
Schallquelle
Erstreflexion
Hörer
Direktschall
Großer Abstand
zwischen Hörer
und Schallquelle
Schallquelle
Erstreflexion
Direktschall
Hörer
Erstreflexion

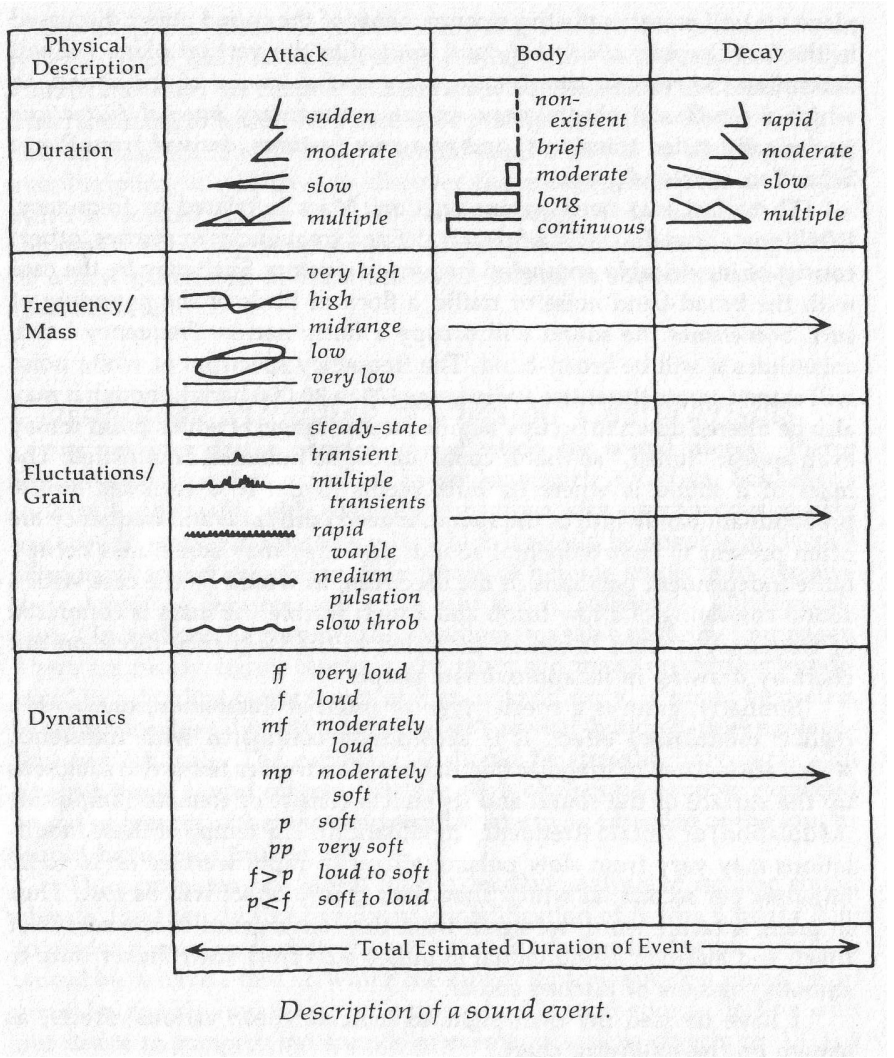


Examples A B C D

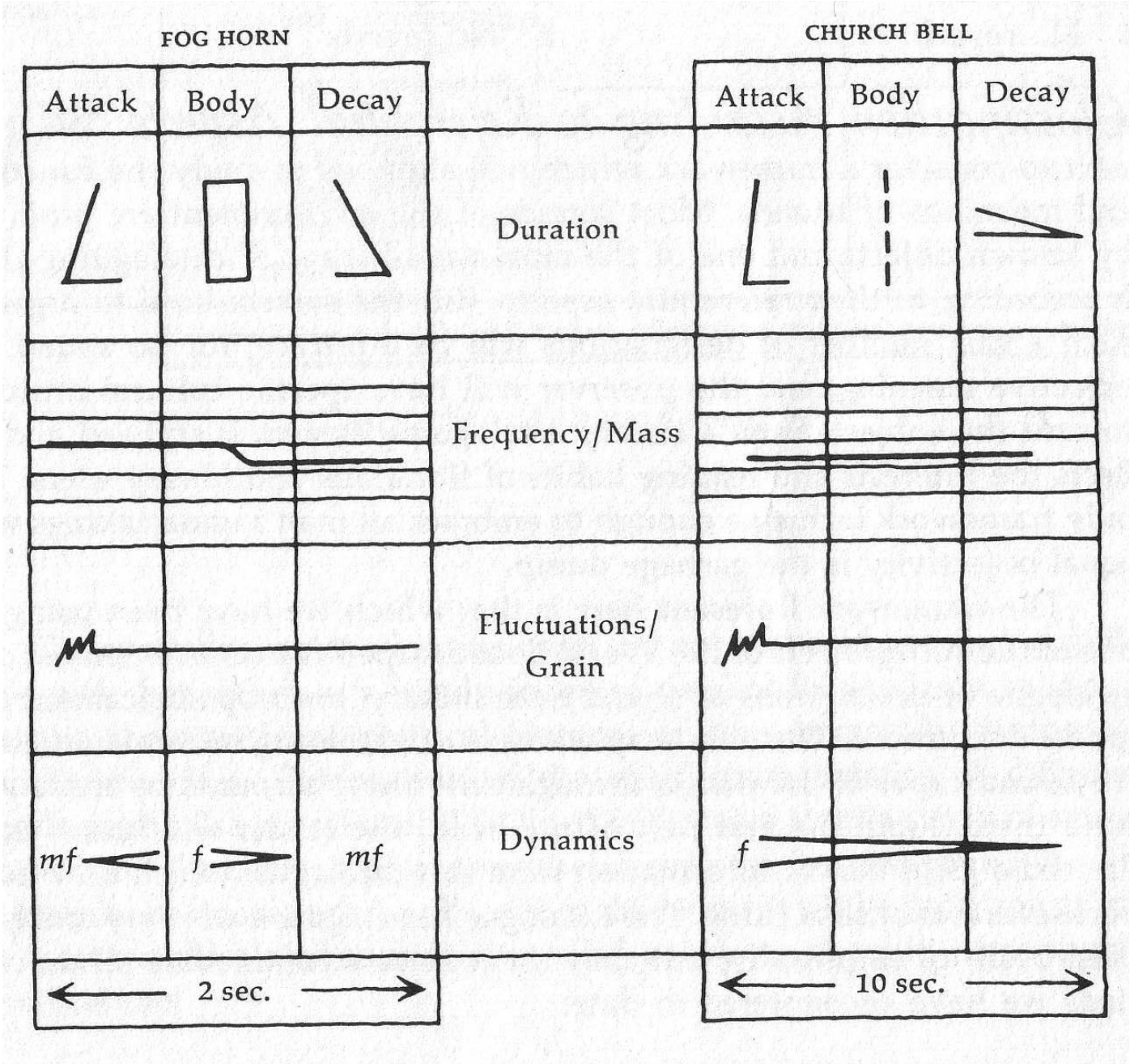
Talking About Sound 2a: Objet Sonore

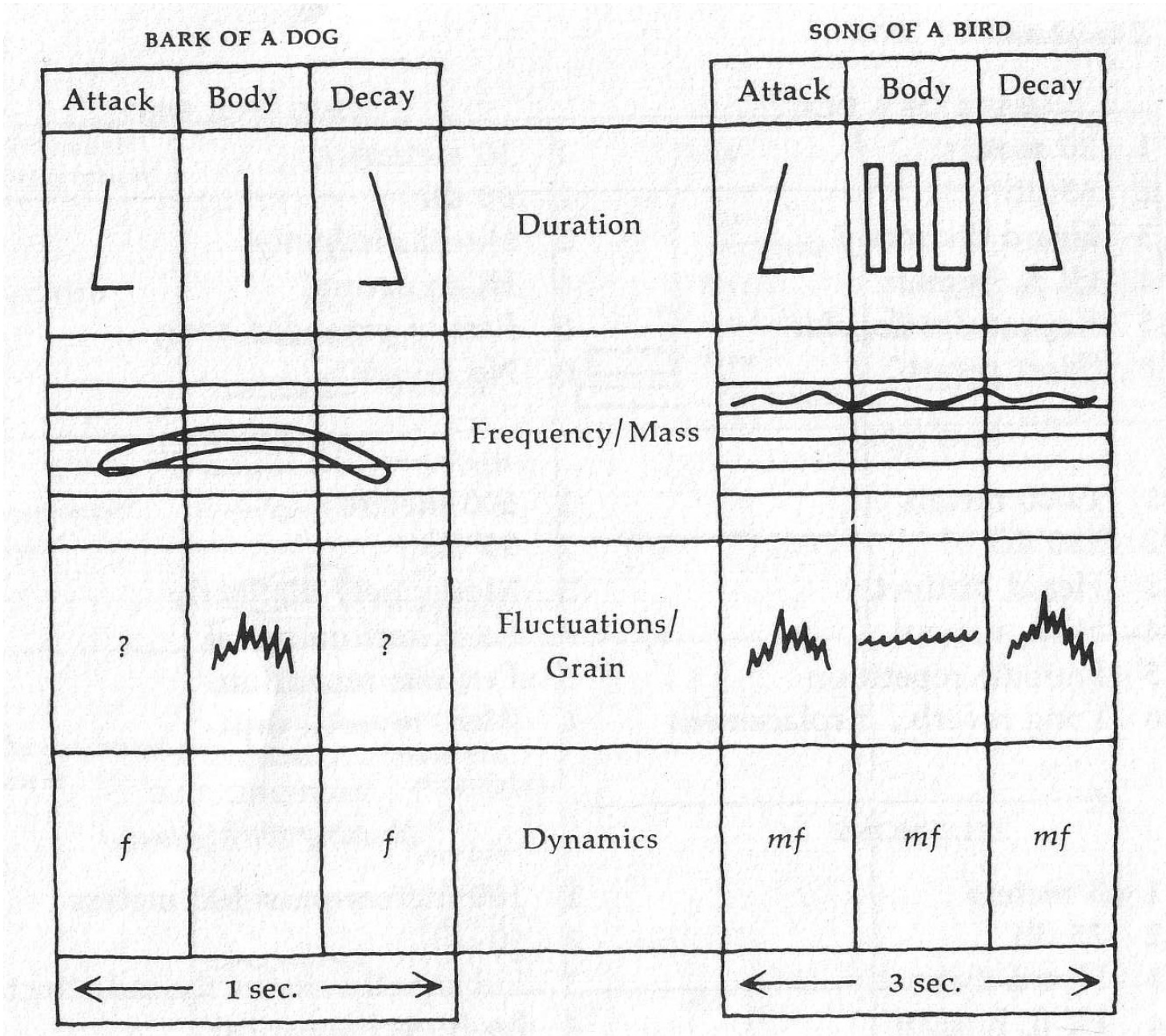
Visual representation of sounds

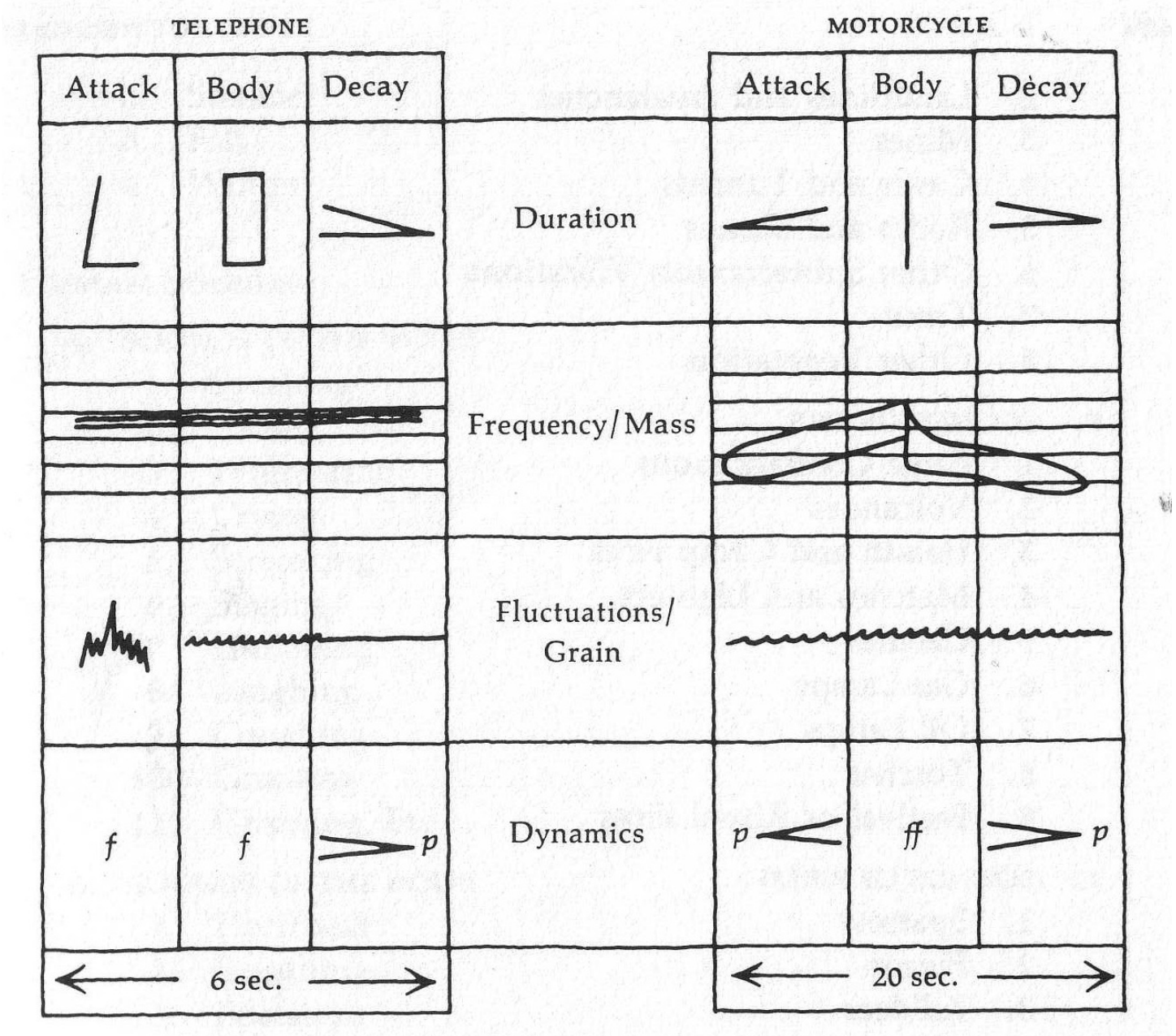
- Murray Schafer's method (simplification of Schaeffer):



Description of a sound event.


FOG HORN
CHURCH BELL
Attack
Body
Decay
Attack
Body
Decay
Duration
Frequency/Mass
Fluctuations/
Grain
Dynamics
mf
f
mf
f
2 sec.
10 sec.


BARK OF A DOG
SONG OF A BIRD
Attack
Body
Decay
Attack
Body
Decay
Duration
Frequency/Mass
?
?
Fluctuations/
Grain
f
f
Dynamics
mf
mf
mf
1 sec.
3 sec.


TELEPHONE
MOTORCYCLE
Attack
Body
Decay
Attack
Body
Decay
Duration
Frequency/Mass
Fluctuations/
Grain
Dynamics
f
f
p
p
ff
p
6 sec.
20 sec.

Talking About Sound 2b: Information & Narration

Informational content of acoustic events

Sound source	space	Stimulation
location		type
form	form	power
size	size	rhythm
material	material	speed
movement		texture of the exciter

The electroacoustic recording makes it possible to separate a signal from its source and create new levels of meaning.

Higher levels of meaning

- "Archetypes" (wind, rain, crying baby ...)
- Symbolic (religious, cultural ...)
- "Sacred" sounds, sound and power 
- Signals (bells, horns ...)
- Symbols (culturally "charged", eg animals, keys ...)
- KeySounds (strategically used in a narrative context)
- Stereotypes (generated by repetitive, contextualized use) 
- «Theme» (eg in Starwars) 

Klangdokument (siehe Server > Materialien)

Musique Concrète

- Pierre Schaeffer, 1948
- Pierre Henri, 1963

Electronic music

- Karlheinz Stockhausen, Kontakte, 1960

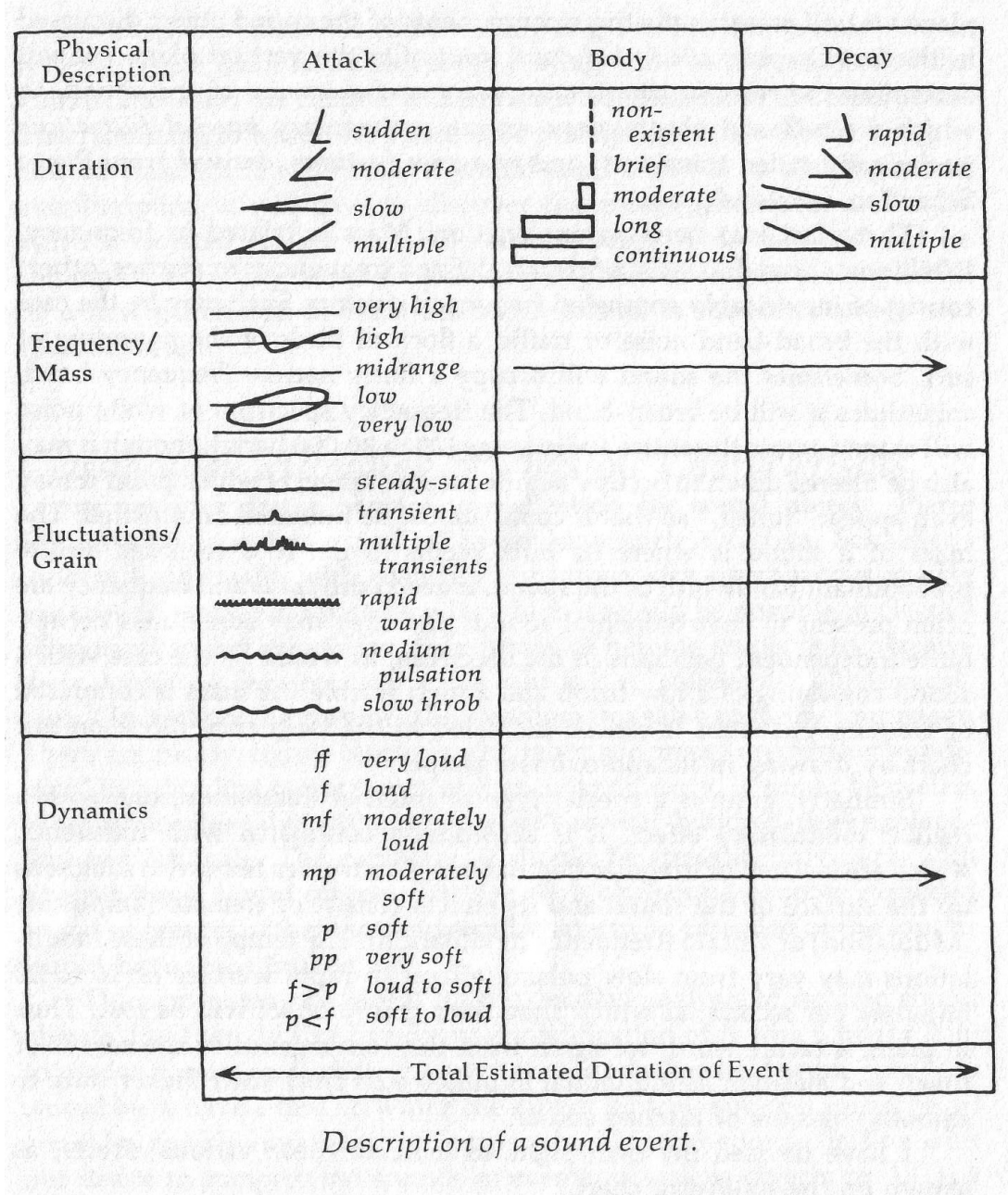
Sound between narration and abstraction

- Walter Ruttmann: Weekend
- Luc Ferrari: PRESQUE RIEN n.1 - le lever du jour au bord de la mer
- Trevor Wishart: Red Bird

Exercise 1: Sound Zoo

Exercise 1: Sound Zoo

- Teams of 2
- Find 2 items
- Examine the objects for their sounds
- Which sounds are "interesting"?
- Select an object and explore the different sounds that can be created with it
- Select a sound (at least 1s) and visualize it using M. Schafers method together with the help of the sound vocabulary
- 10m, then discuss



Description of a sound event.

Exercise 2: My First Soundlibrary

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Preparation: In 5 groups (20m)

- Listen to found objects "through the lens" (microphone)
  - Playing with the tonal possibilities
- Create recordings (systematic)

All together:

- Process recordings in Audition
  - Study spectrograms
- Create a sound library
  - Denoise
  - Clean cut to zero crossing
  - normalized
  - Mono / stereo, as needed
  - Useful file names: Designation with the help of sound vocabulary
- Store files on server

Exercise 3: Sonic Transplantation

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Pick a sound from exercise 1 resp. 2, Recreate this sound by using a different sound as the material

Step 1

- Select the target sound and material sound
- Focus on the temporal evolution of the volume and recreate it (editing, volume editing)
- Use pitch and time correction to further adjust the sound

Step 2

- Use the parametric EQ and PitchShift to further adjust the frequency spectrum
- Also experiment with reverb and delay

Step 3

- Use automation envelopes for detailed editing
- Export / render the sound and place it (along with ”material sound" and ”target sound") on the filer (exercises folder)