

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, forces, processes ...
- Sound complements the visual perception, eg of space
- The eye analyzes distances and shapes hierarchically, while sound creates an overall impression that depends on other factors (wind, materials ...)

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: $W = c / f$

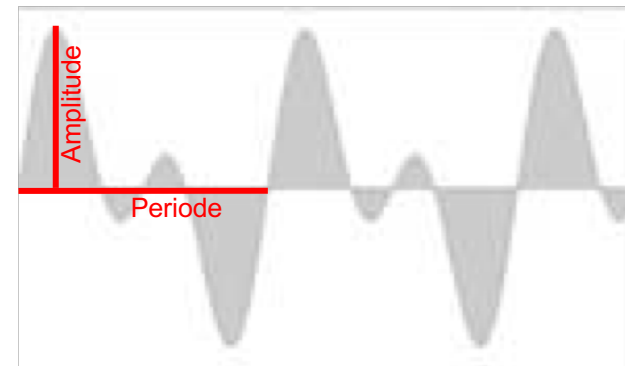


Illustration: Raffaseder, Audio Design, 2002

Description of acoustic events

- pitch -> frequency:

80hz, 160hz, 320hz, 640hz, 1280hz,
2540hz, 5080hz, 10160hz

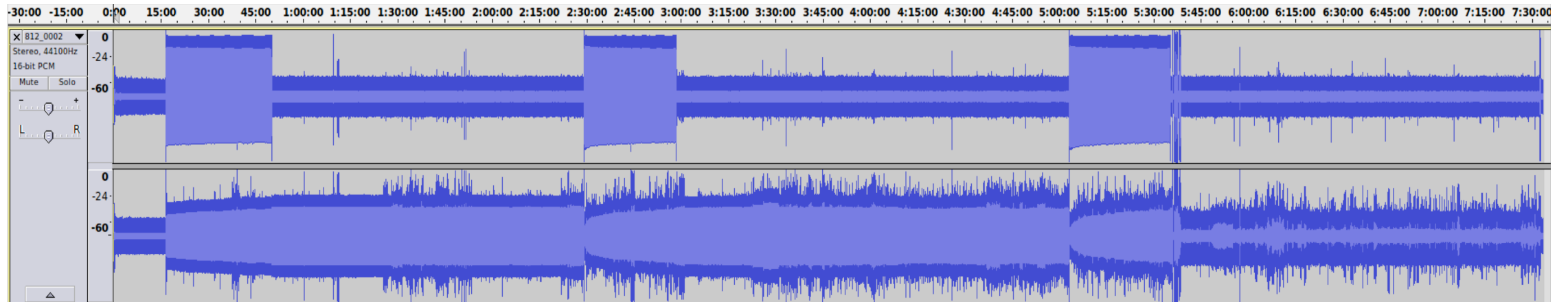


- volume -> amplitude

z.B: 0dB, -6dB, -12dB

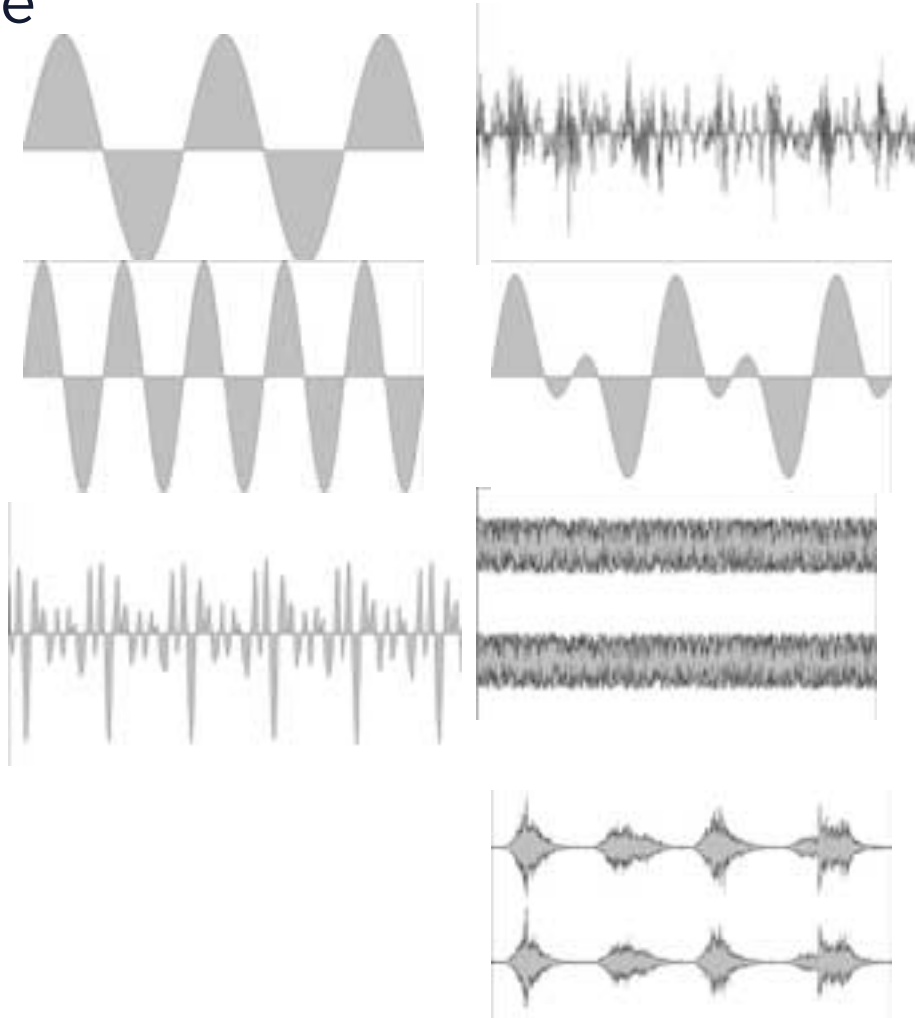


- Timbre -> frequency spectrum



Examples of amplitude, frequency, timbre

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

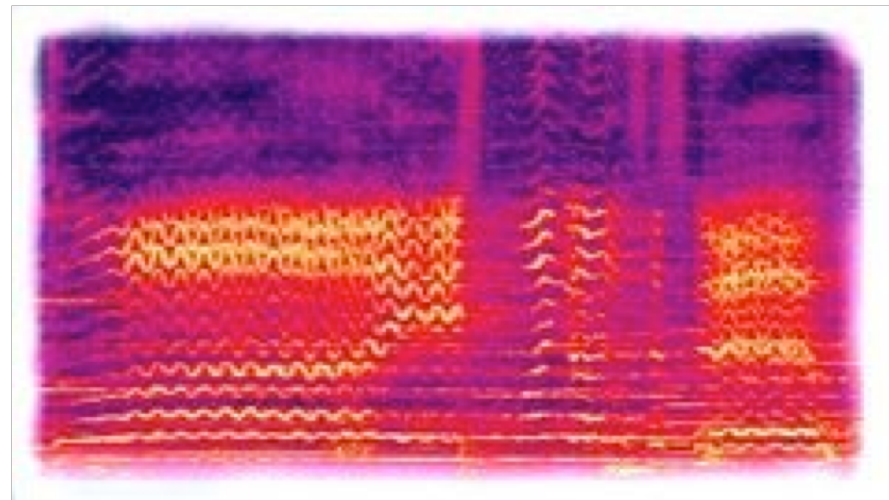


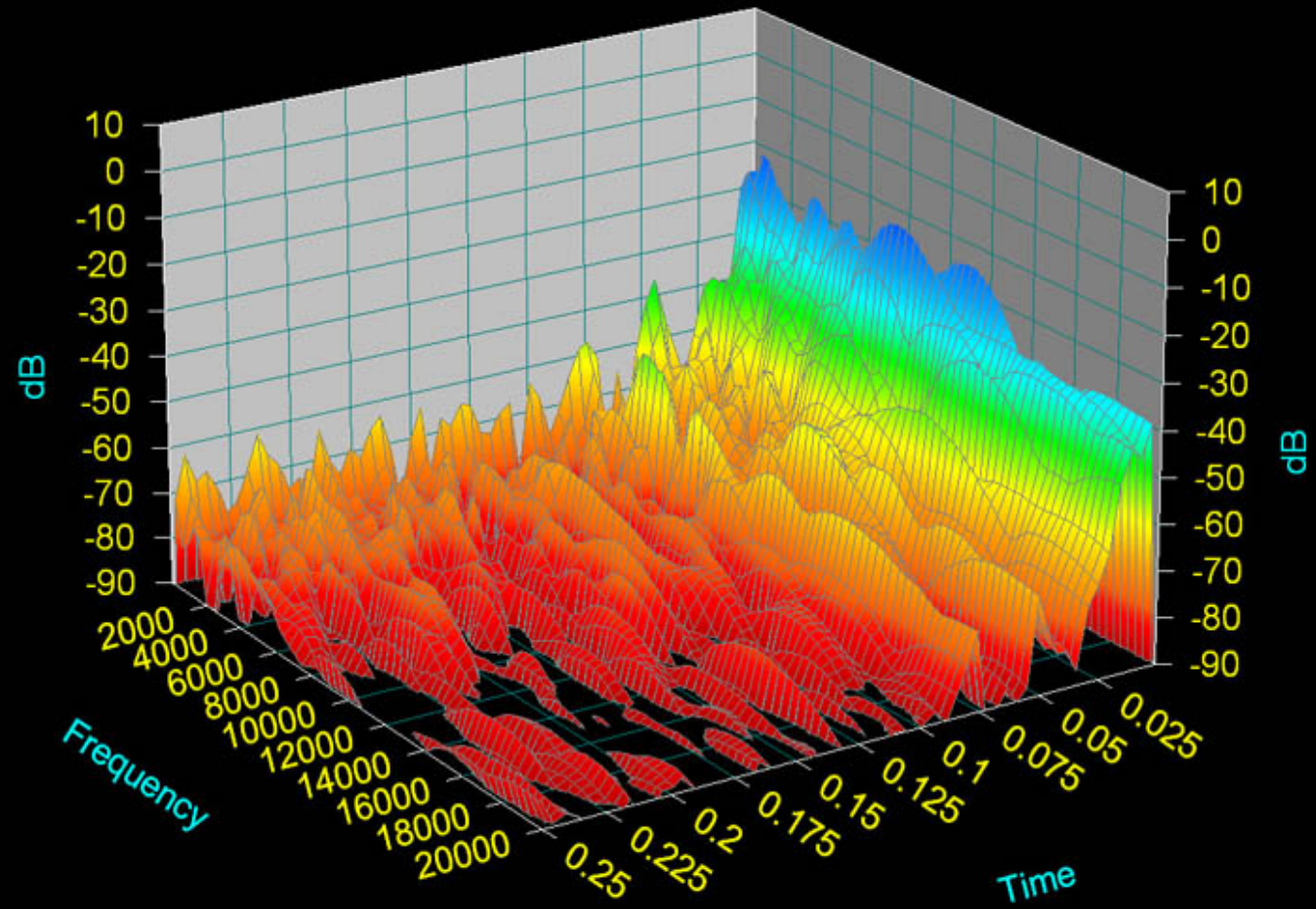
More about timbre

- 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](#)





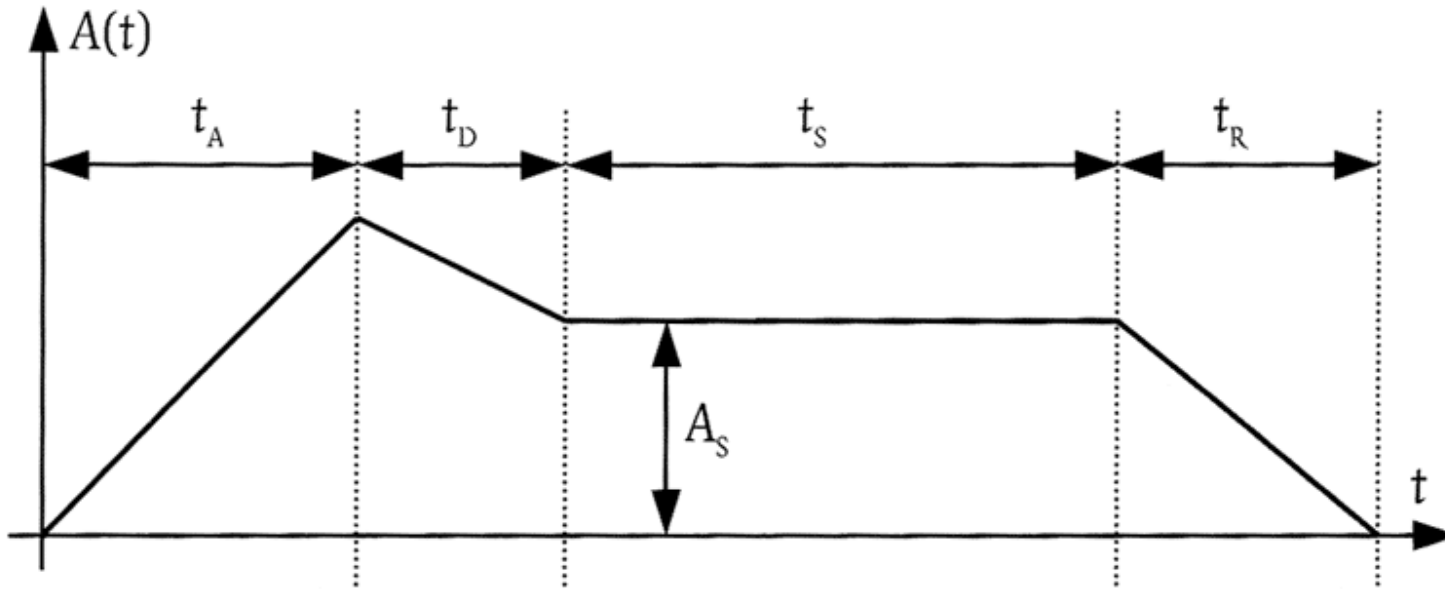
More about timbre

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)

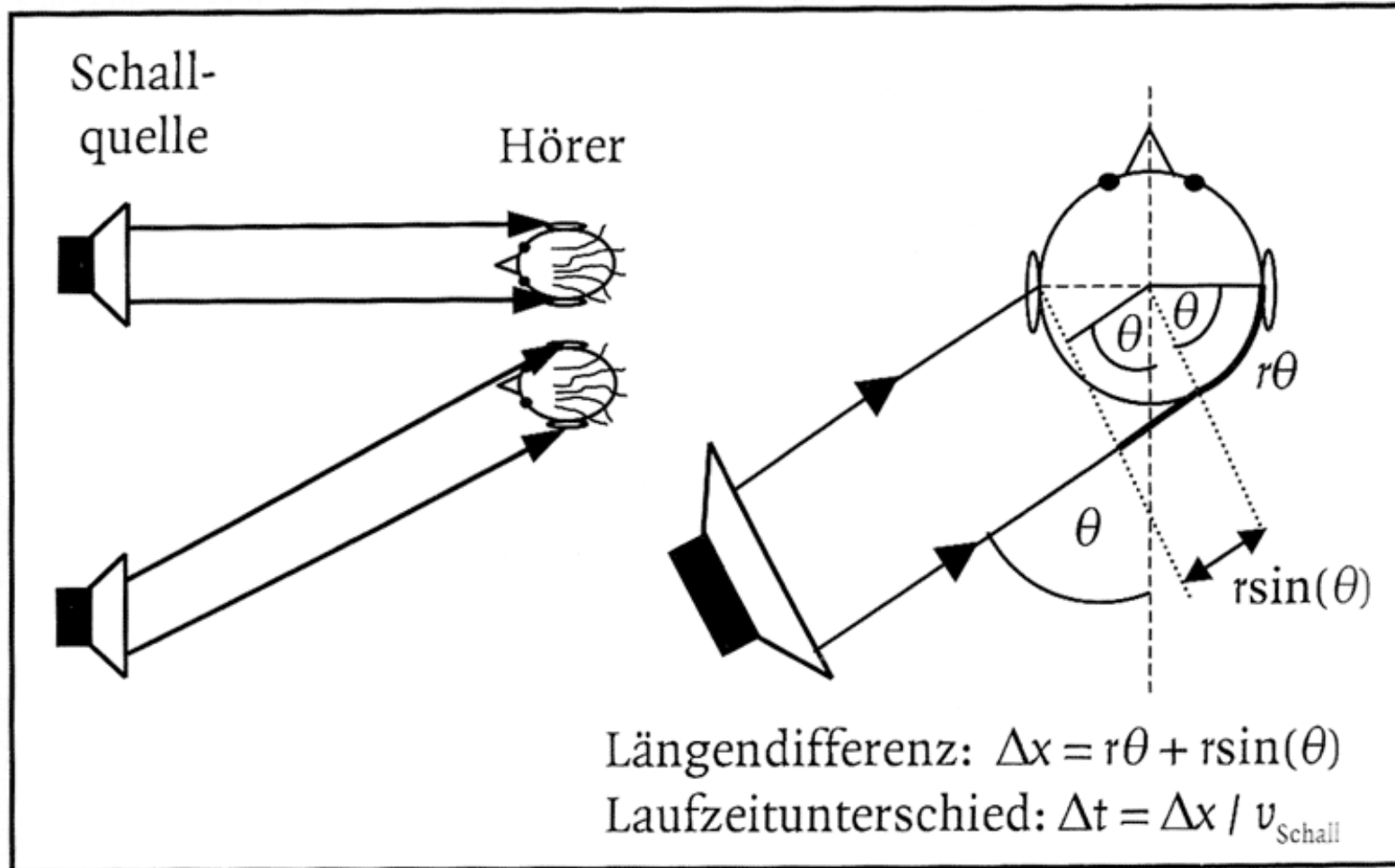
– [1](#), [2](#), [3](#), [4](#)

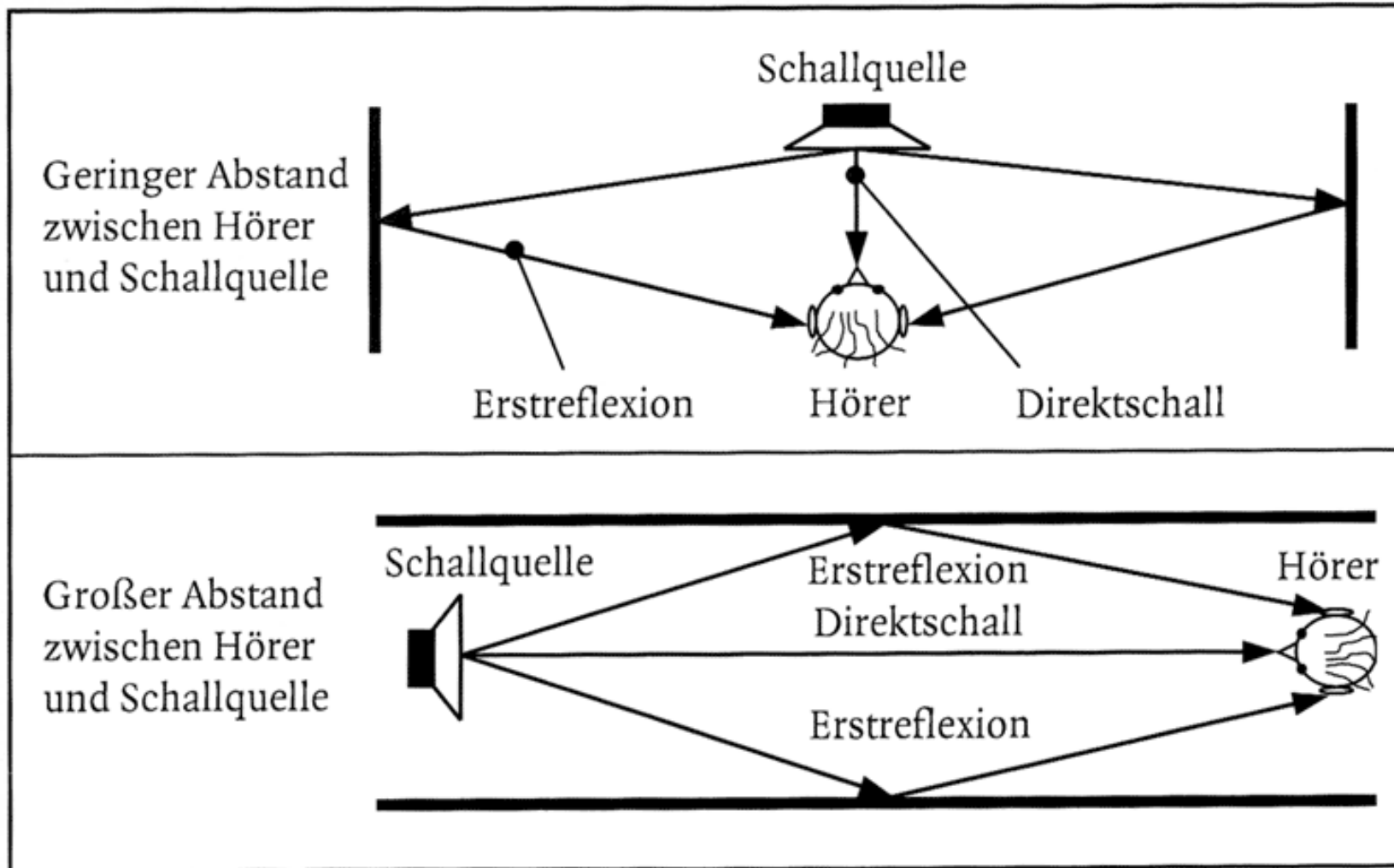
Spatial aspects of sound

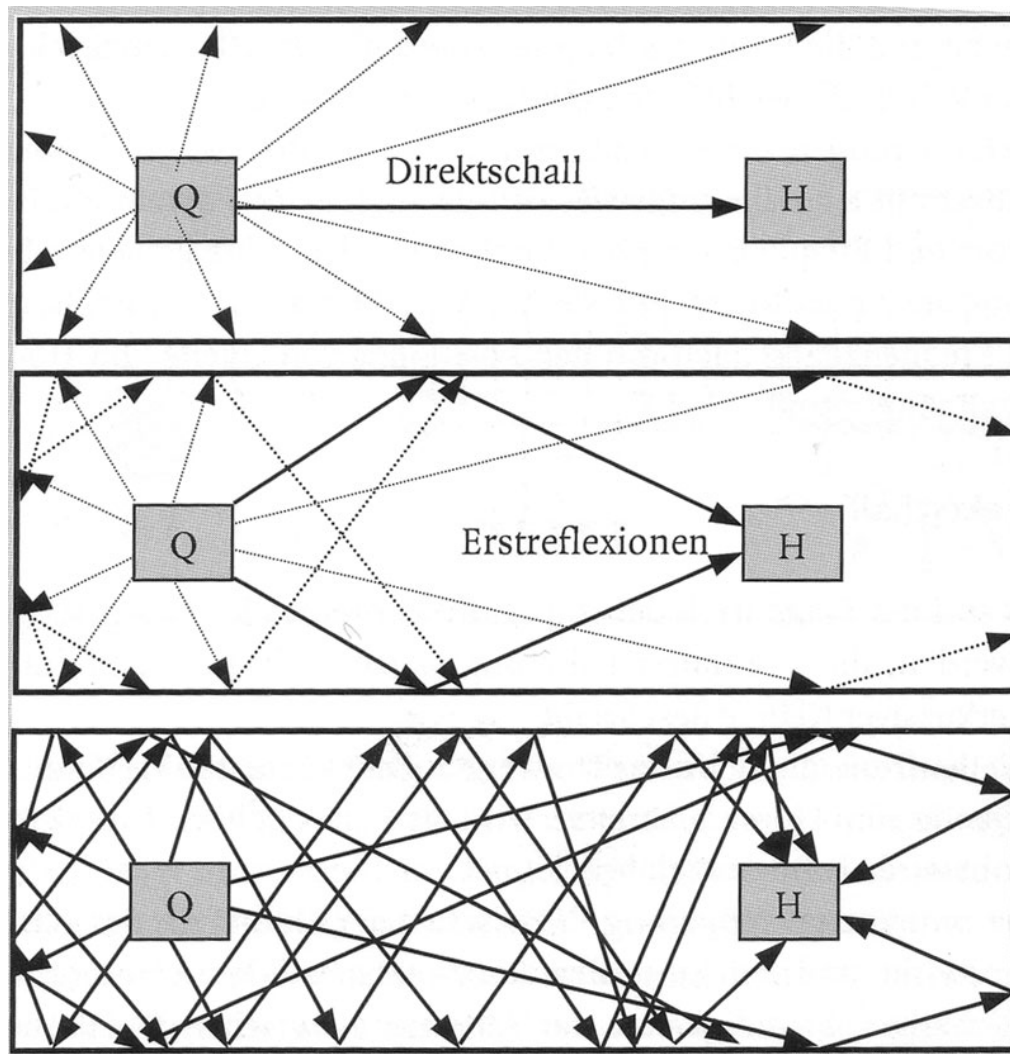
- The sound wave "transforms" space in time
 - Propagation & Reflection
- depending on material and surface structure becomes sound
 - reflected / absorbed
 - bent, scattered or bundled
- The influences are reflected in propagation delays
 - hall, or echo
 - ... and filtering / attenuation of the spectrum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



Spatial perception: localization





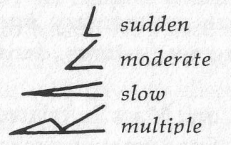
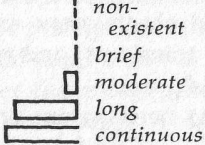
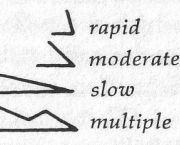
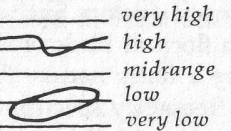
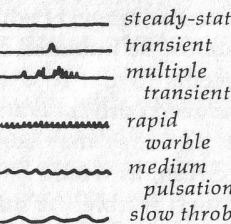
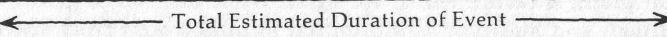


Examples [A](#) [B](#) [C](#) [D](#)

Talking About Sound 2a: Objet Sonore

Visual representation of sounds

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

Physical Description	Attack	Body	Decay
Duration	 <i>sudden</i> <i>moderate</i> <i>slow</i> <i>multiple</i>	 <i>non-existent</i> <i>brief</i> <i>moderate</i> <i>long</i> <i>continuous</i>	 <i>rapid</i> <i>moderate</i> <i>slow</i> <i>multiple</i>
Frequency/ Mass	 <i>very high</i> <i>high</i> <i>midrange</i> <i>low</i> <i>very low</i>		→
Fluctuations/ Grain	 <i>steady-state</i> <i>transient</i> <i>multiple transients</i> <i>rapid warble</i> <i>medium pulsation</i> <i>slow throb</i>		→
Dynamics	<i>ff</i> <i>very loud</i> <i>f</i> <i>loud</i> <i>mf</i> <i>moderately loud</i> <i>mp</i> <i>moderately soft</i> <i>p</i> <i>soft</i> <i>pp</i> <i>very soft</i> <i>f > p</i> <i>loud to soft</i> <i>p < f</i> <i>soft to loud</i>		→
 Total Estimated Duration of Event			

Description of a sound event.

FOG HORN				CHURCH BELL		
Attack	Body	Decay		Attack	Body	Decay
			Duration			
			Frequency/Mass			
			Fluctuations/Grain			
			Dynamics			

BARK OF A DOG

SONG OF A BIRD

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

TELEPHONE				MOTORCYCLE		
Attack	Body	Decay		Attack	Body	Decay
			Duration			
_____			Frequency/Mass			
			Fluctuations/ Grain			
<i>f</i>	<i>f</i>	<i>p</i>	Dynamics	<i>p</i>	<i>ff</i>	<i>p</i>
← 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

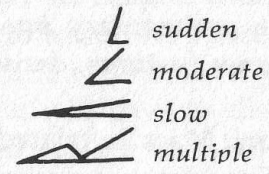
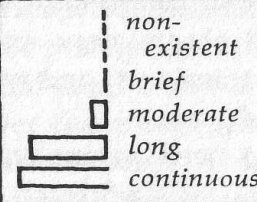
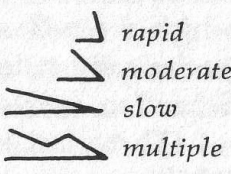
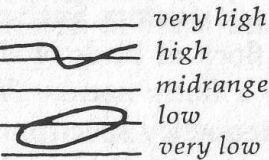
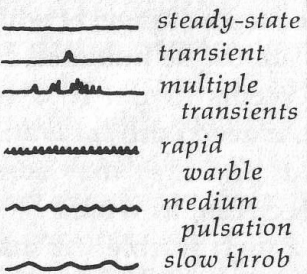
Sound between narration and abstraction

- 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

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- 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

Physical Description	Attack	Body	Decay
Duration	 sudden moderate slow multiple	 non-existent brief moderate long continuous	 rapid moderate slow multiple
Frequency/ Mass	 very high high midrange low very low	→	
Fluctuations/ Grain	 steady-state transient multiple transients rapid warble medium pulsation slow throb	→	
Dynamics	ff very loud f loud mf moderately loud mp moderately soft p soft pp very soft f > p loud to soft p < f soft to loud	→	
← Total Estimated Duration of Event →			

Description of a sound event.

Exercise 2: My First Soundlibrary

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Preparation: In 5 groups (20m)

- Listen to brought 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)