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# MUS302 WEEK 4 (FROM WEEK 3)

SOUND, SOUNDSCAPE, TIMBRE AND MUSIC (SOUND-STRUCTURE IN MUSIC)

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# WHY CREATE WITH SOUND? (ENVIRONMENT AND EXPRESSION)

- ▶ R. Murray Schafer, a pioneer of 'soundscape composition': 'Two postwar developments, both related to technology, propelled [...] sound research. On the one hand, the world was becoming more urban and more noisy [...] On the other hand [...] new and more accessible technologies of recording and sound analysis made it easier to "freeze: sound, to listen to it repeatedly and analyze its components the way photography and the microscope had sharpened the observation of visual phenomena.'
- ▶ 'In the 1960s many of us felt that the whole sensorium of the Western was in upheaval. By 1970, having joined the communication department at Simon Fraser University, I had announced the World Soundscape Project [...] our purpose was to study the effects of the changing soundscape on human behaviour and with this information begin to develop the new discipline of soundscape design.'

(both quotes from Schafer's foreword to *Sonic Experience*, ed. Augoyard and Torgue, 1995, translated edition, 2005)

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# ENVIRONMENT AND MUSICAL EXPERIENCE

- ▶ Are musical cues derived from environmental audio cues? Have these cues changed in recent years? And if so, have the rules of music changed? (Think back to the Futurists and Luigi Russolo's manifesto.)
- ▶ If so, the processes of recording, manipulation and playback will allow us to respond to this challenge posed by the novelty of our contemporary soundworld. It will also allow us to respond to the challenge posed by the availability of musical materials from a range of different cultures (both contemporary and 'historical')
- ▶ Does the combination of these two factors give us a greater insight into musical possibility? How?

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# BEYOND 'TRADITIONAL' MUSICAL STRUCTURES: SONIC ART/SOUND ART

Trevor Wishart (1985/1991) notes that :**'Sound-art can no longer be confined to the organisation of notes'** (which is the primary 'traditional' definition of music.)

He continues...**'Even this original conception [of music] had already been broadened to include at least three areas:**

(1) the **instrumental** approach where pitched sound-objects of short duration and fixed timbre were organised into larger structures through the medium of conventional notation

(2) ***musique concrète***, using instead a vocabulary of sound-objects of various types categorised according to a phenomenological description of their properties and organised using studio techniques without (necessarily) any reference to the notated score

(3) [...] **synthesis techniques**, giving us the possibility of sustained yet transforming streams of sound [...]

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# SONIC ART (IN ITS VARIATIONS AND MUTATIONS)

- ▶ 'Traditional' instrumental composition or composition which retains its assumptions
- ▶ *Musique concrète/electroacoustic music/acousmatic music/soundscape music (also, industrial music)* - play with sense of sound source, in some cases plays with cultural associations, though sometimes attempts to overcome both of these 'extra-sonic' associations
- ▶ Sound poetry/text-sound art - focus on the dramatic, emotive content of sounds, impressions (expressions?) of proto-linguistic structures?
- ▶ Elektronische Musik/computer music - concern for timbre, but strong focus can remain on pitch structures and pitched materials
- ▶ Spatial composition/sound installation/composed sound environment (often used in all of the above, but may be foregrounded more)
- ▶ Plunderphonics - appropriation and re-contextualisation of more 'traditional' musical materials in compositional structures which owe more to concepts of timbre and cultural associations

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# SOUND STRUCTURES IN MUSIC

- ▶ If we're designing sounds or composing with new sounds, **we need to understand how we organise our perception of sound**
- ▶ In doing so, we need to engage with the concept of **timbre**, which is a term which is variously used in the contexts of '**sound texture**' and '**sonic signature**'
- ▶ **Timbre** is the key issue in this class: if we're composing with sound or designing sound, what is it that we're actually shaping/ changing? If we're gathering sounds from the wider world of sound materials around us, how can we describe them (apart from their sources)?

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# INTERLUDE: ASSIGNMENT 1 PROJECT WITH PROF. LEIGH LANDY

- ▶ Intro to Leigh Landy's academic work:
  - ▶ **Sound-based music**, 'that is, music in which **sounds, not notes, form the basic unit**. The separation of art music and popular music is clearly becoming less relevant as the distinction becomes less audible in a great number of sound-based works and the means of production converge, opening up this type of music to a much larger community than the one it has known in the past.' Landy, L. 2010, in Dean, R. ed. *Oxford Handbook of Computer Music*.
  - ▶ See also Landy, L. 2007. *Understanding the Art of Sound Organisation*. Cambridge, Mass.: MIT.
  - ▶ Landy (2007) is somewhat critical of other, pre-existing terms for this type of music (computer music, electroacoustic music, etc.); why do you think this may be?
- ▶ Discussion of this project and radio-based sampled materials
- ▶ Example of previous radio-based work by Landy
- ▶ Discussion of approach to local/regional/national radio materials (with soundbite samples) ...what is significant about our local 'mediascape'? (i.e. why would a leading figure in sonic arts want to make a piece here?)

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## DEFINING TIMBRE

- ▶ *Timbre is that attribute of auditory sensation in terms of which a listener can judge that two steady state complex tones having the same loudness and pitch are dissimilar. (ANSI)*
- ▶ Problematic/simplistic definition, but can we use it to get to a more representative idea of timbre?
- ▶ Does timbre comprise a number of factors? Can you think of any terms which describe a sound's texture?
- ▶ Are any of these terms related? Can we think of any as being points on a scale?

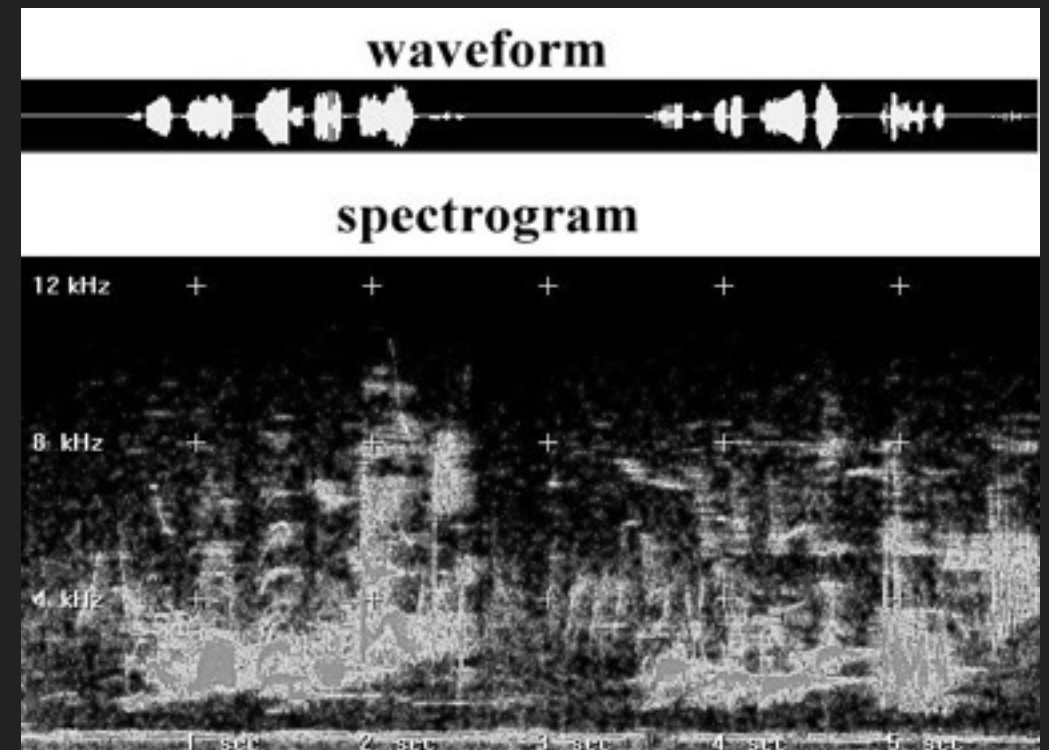
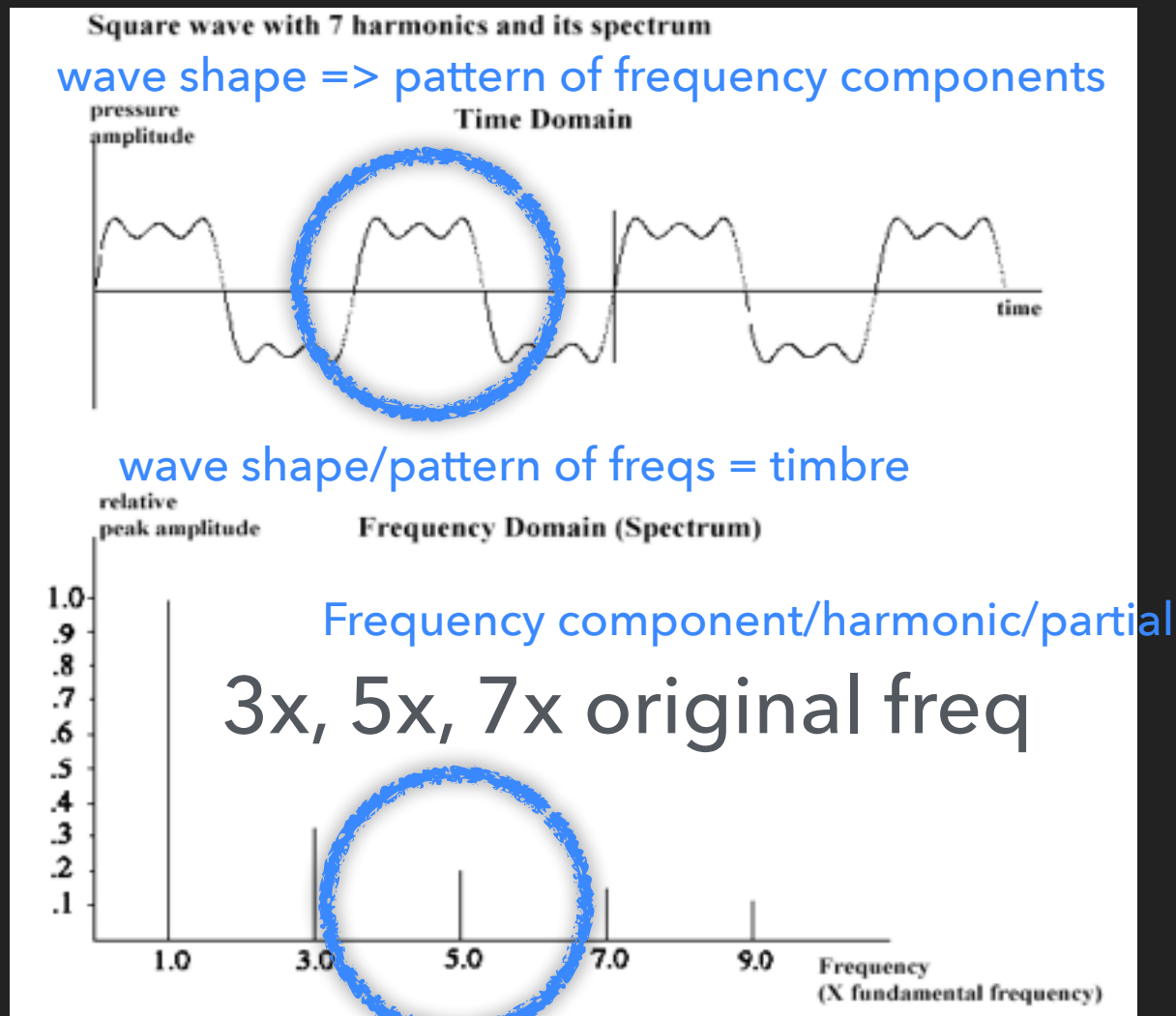


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# FROM SOUND SOURCE AND SIGNAL TO TIMBRE

- ▶ **Frequency spectrum** - pattern of frequency components, harmonic or inharmonic partials or bands of noise (distributed inharmonic spectra)
- ▶ **Amplitude envelope** (volume contour)
- ▶ **Attack transient** (brief noise at the start of the sound, not to be confused with 'attack time' of an envelope')
- ▶ **Instrument body resonances**

# FREQUENCY SPECTRUM



(NB: for it to be called a 'harmonic', it has to be a whole number multiple of the lowest frequency...most musical tones

will exhibit these properties

...musical scales are based on these proportions)

Play example: La Monte Young 'Second Dream of the High-Tension Stepdown Line Transformer'

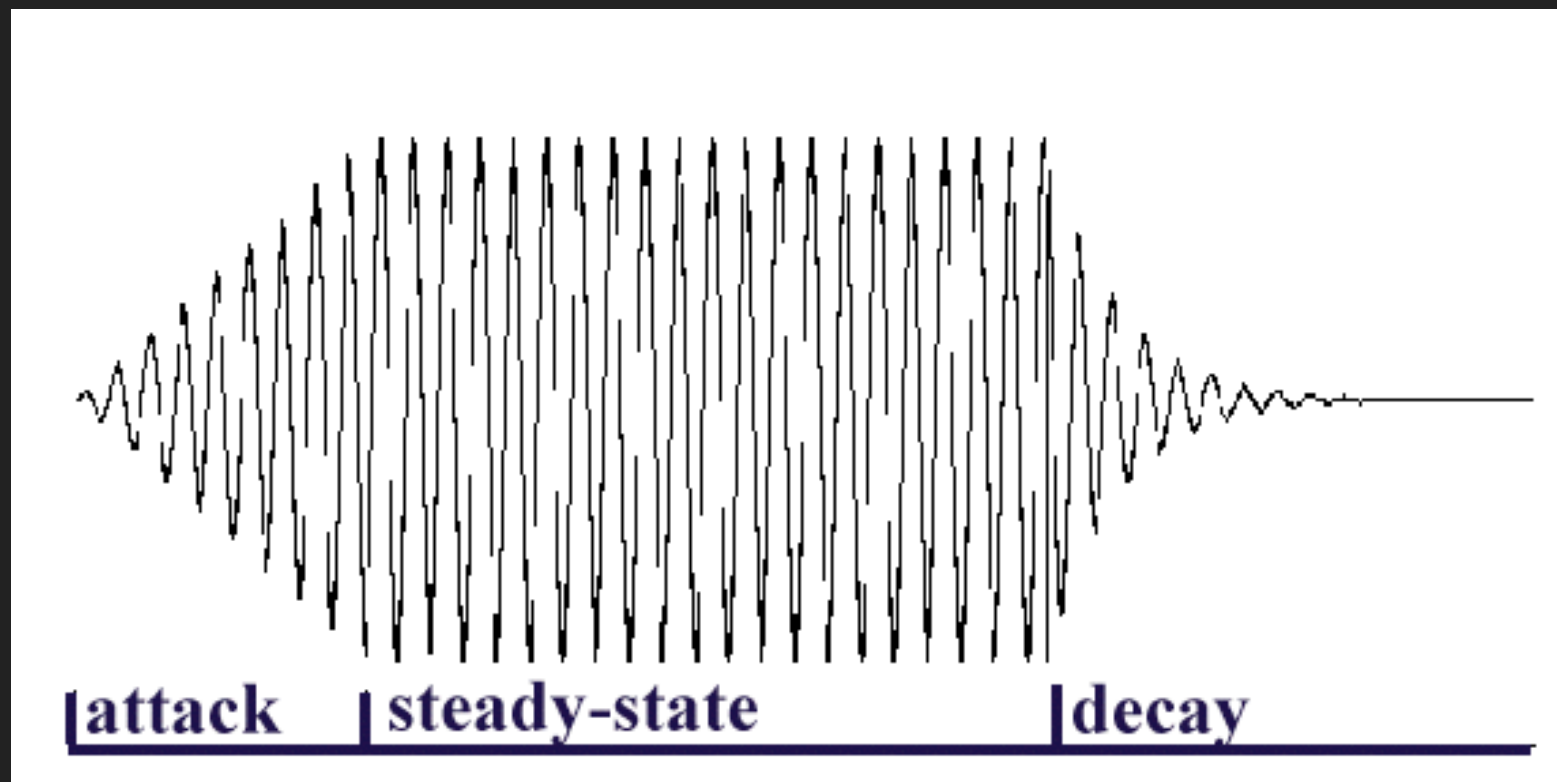
<https://www.youtube.com/watch?v=UzWoldQAGCw>

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# FREQUENCY SPECTRUM AND PERCEPTUAL PATTERN

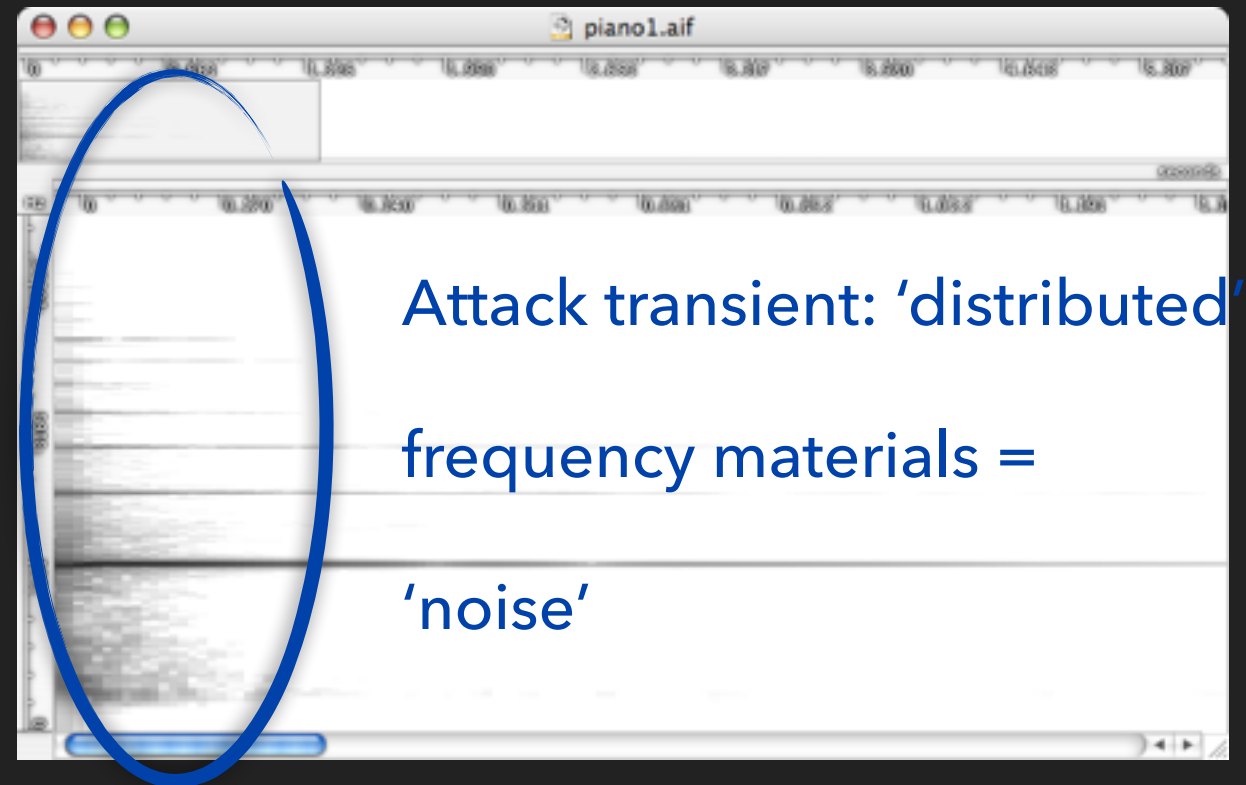
- ▶ Whole number relations (2, 3, 4, 5, etc.) of frequency components provide the coherent/'grouped'/'single clear pitch' result found in most musical instruments...**harmonic relations** (though when musical notes approach the harmonic components of other musical notes, higher harmonics may be heard separately)
- ▶ Relations between frequency components which are *not* based on whole numbers result in the hearing of a number of different pitches from a single sound source (this is the case in bells or struck metal objects in general)...**inharmonic relations**
- ▶ Using bells as textural and pitched materials: Jonathan Harvey *Mortuous Plango, Vivos Voco* (1980)...title from an inscription on a bell from Winchester Cathedral: 'Horas Avolantes Numero, Mortuos Plango: Vivos ad Preces Voco (I count the fleeing hours, I lament the dead: the living I call to prayer)'
- ▶ Particularly characteristic section of strongly inharmonic materials at c. 6'50

# AMPLITUDE ENVELOPE



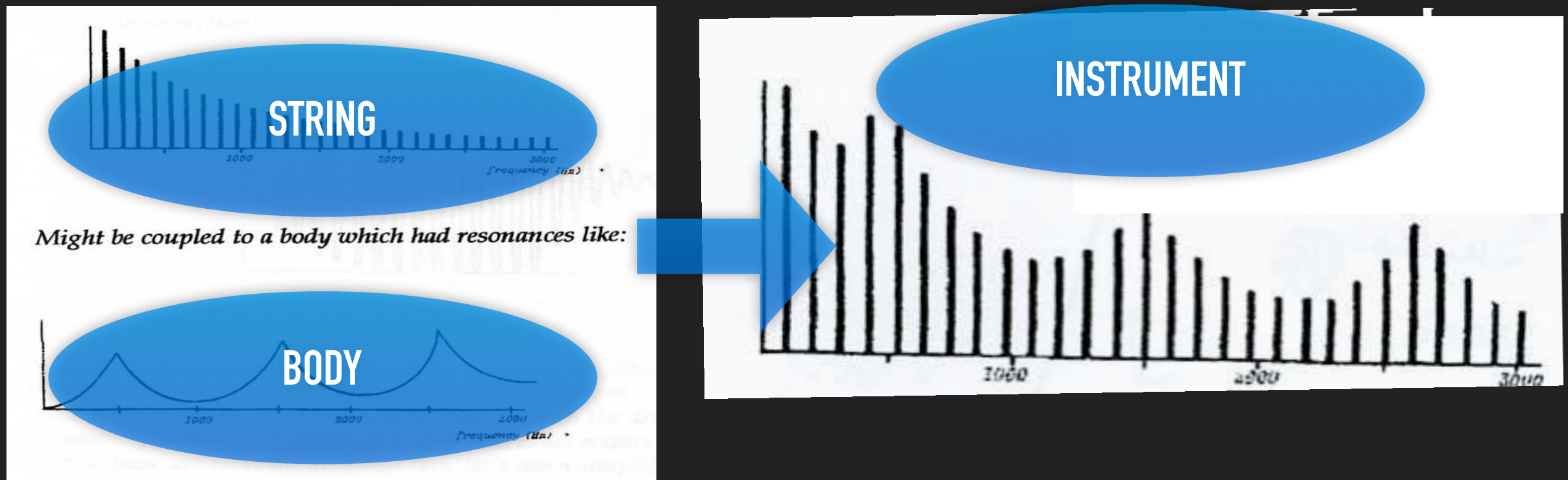
A sound or tone will vary its amplitude (loudness) over time. This could be termed its **amplitude envelope**, much like the envelope that controls the attacks and decays of synthesizer sounds. Individual frequency components may have different amplitude envelopes, though with most 'musical' tones, there will be a reasonable degree of synchrony - they will start and stop at roughly the same time.

# ATTACK TRANSIENTS



The manner in which the sound source is struck, plucked, bowed or otherwise excited will have a great effect on the perceived timbre. This is because timbre is part of our view of a sound source's signature - these things are considered by us to be important to the signature. This 'part' of the sound, which occurs during the attack phase (early part of the sound) is called the attack transient.

# INSTRUMENT BODY RESONANCES



Applicable to some sounds: the characteristics of the instrument or object's resonating body (formant characteristics). A resonating body will amplify the sound but changes its frequency spectrum due to certain partials being boosted (at peaks in the body's resonant response).

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# MUSIQUE CONCRETE'S VIEWS ON TIMBRE

**Mass and Dynamics:** organization of the sound in a spectral dimension - overall spectral balance - 'bright' or 'dark' - etc.

**Profile of Mass:** evolution of the groups of spectral components in the overall sound mass

**Tone quality/timbre** - more specific qualities to do with the 'colour of the sound' - formant characteristics

**Melodic profile:** temporal evolution of the more obvious harmonic partials

**Pace:** analysis of amplitude dynamics of a sound (overall amplitude envelope)

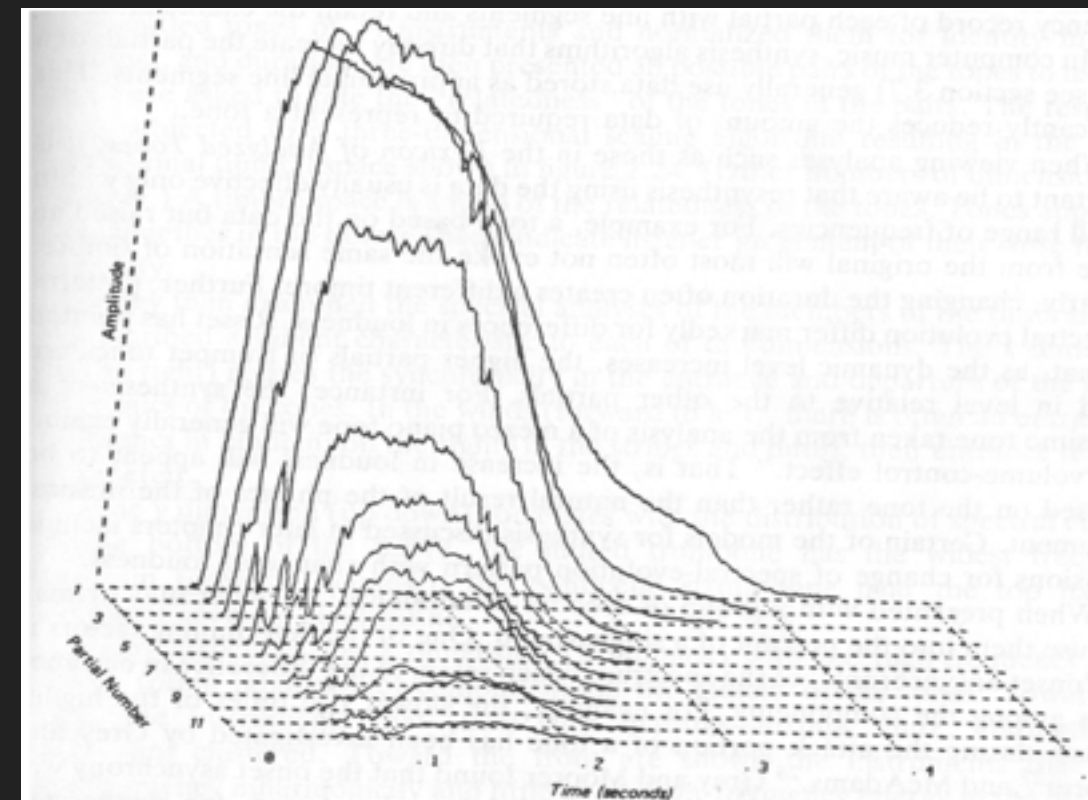
**Grain:** analysis of irregularities/noise/transients within the sound

After the account in Thom Holmes, *Electronic and Experimental Music*, p.97.



# CAN WE SIMPLIFY/CODIFY THIS GROUP OF TIMBRE-FACTORS?

- ▶ Stanford timbre studies
- ▶ Grey, Moorer and Gordon studied various aspects of timbre perception for instrumental sources in the 1970s
- ▶ In particular, they were interested in the psychological organisation of the various physical factors into a timbre-space whereby similarity/difference of sources could be judged
- ▶ They found two factors which we have not discussed extensively were of great significance in the perceptual organisation of musical timbres





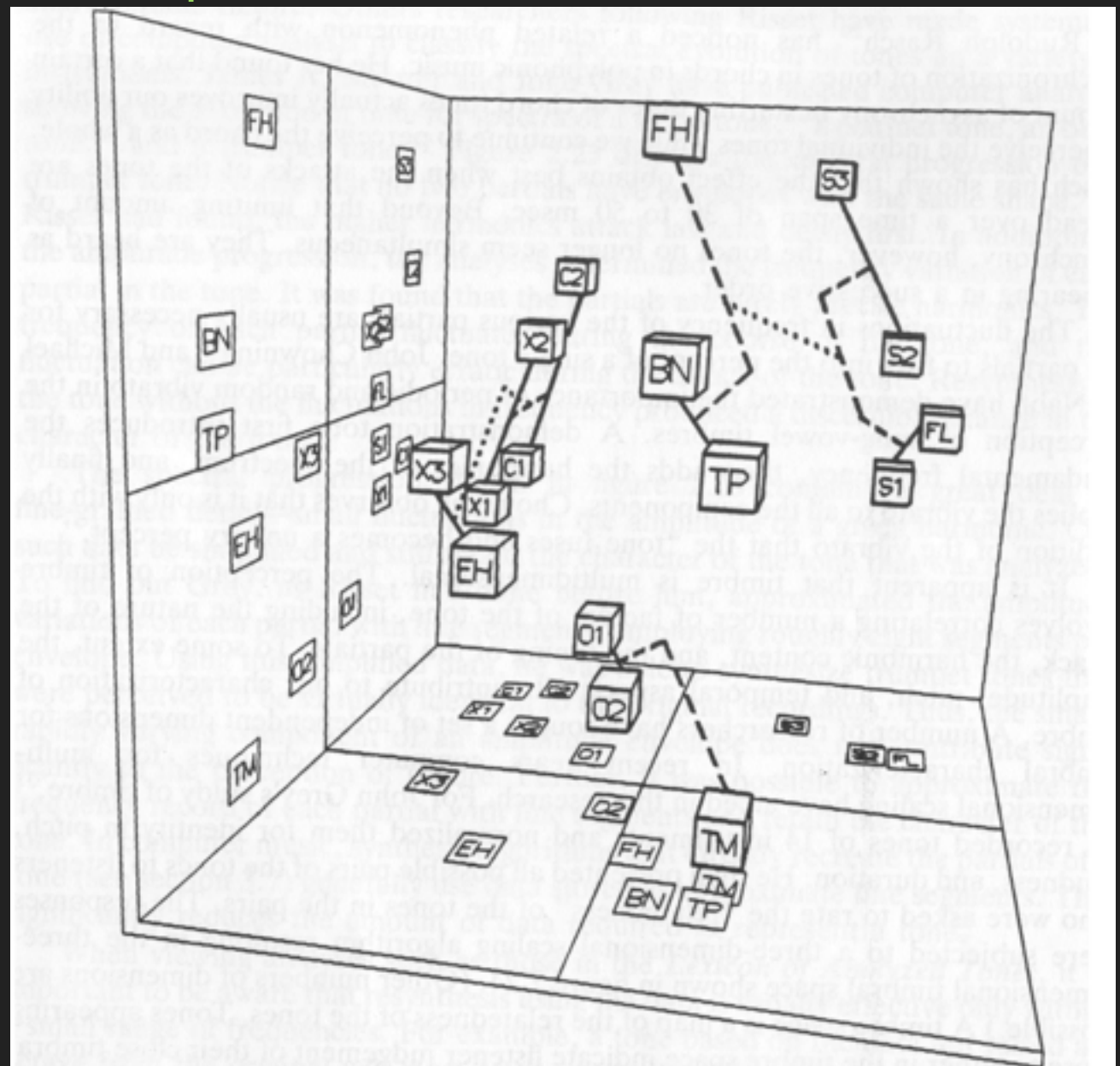
# TIMBRE-SPACE

The 'Timbre-Space'  
produced by Gordon and  
Grey to illustrate and  
summarise their results.

Reproduced from John W.  
Gordon and John M. Grey  
'Perception of Spectral  
Modifications on Orchestral  
Instrument Tones', pp. 24-31  
*Computer Music Journal*,  
Vol. 2, No. 1, Jul., 1978

x= onset synchrony/  
asynchrony of  
materials (i.e.  
envelope)

y=distribution of  
spectral energy  
(*'bright'/'dark'*)



z=presence of attack  
transients

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**SO, HOW CAN WE USE THESE INSIGHTS TO EDIT/SHAPE OUR SOUNDS?**

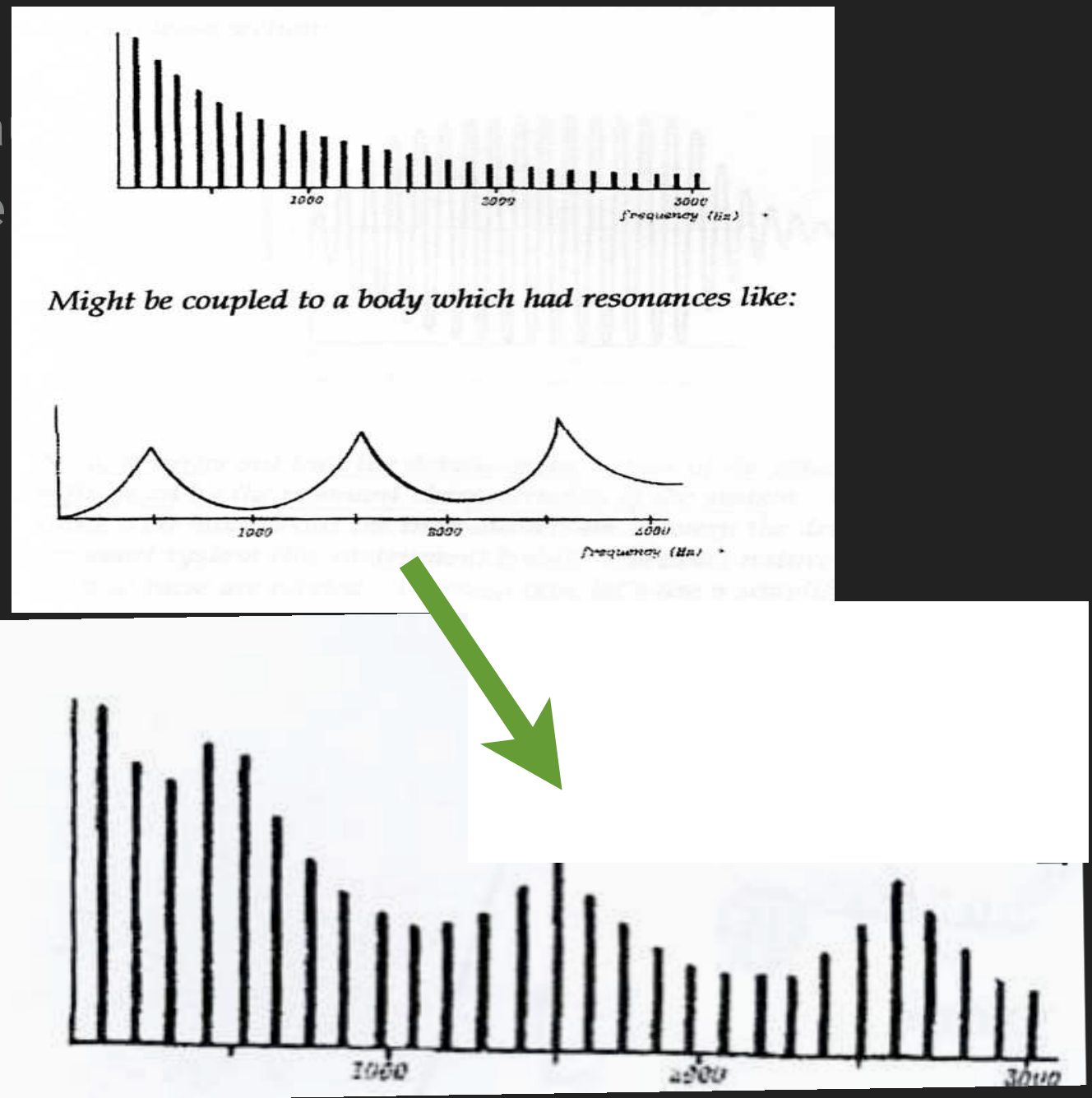
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# BASIC SOUND PROCESSES IN ELECTROACOUSTIC COMPOSITION (1)A

- ▶ Back to *musique concrete*: Changing the source
- ▶ Time/amplitude changes: fades/envelopes/edits
- ▶ Pitch-shifting: effects/implications on timbre (see next slide)
- ▶ Is composition a process of focusing attention? If so, how do these changes focus attention on different aspects of sound material?

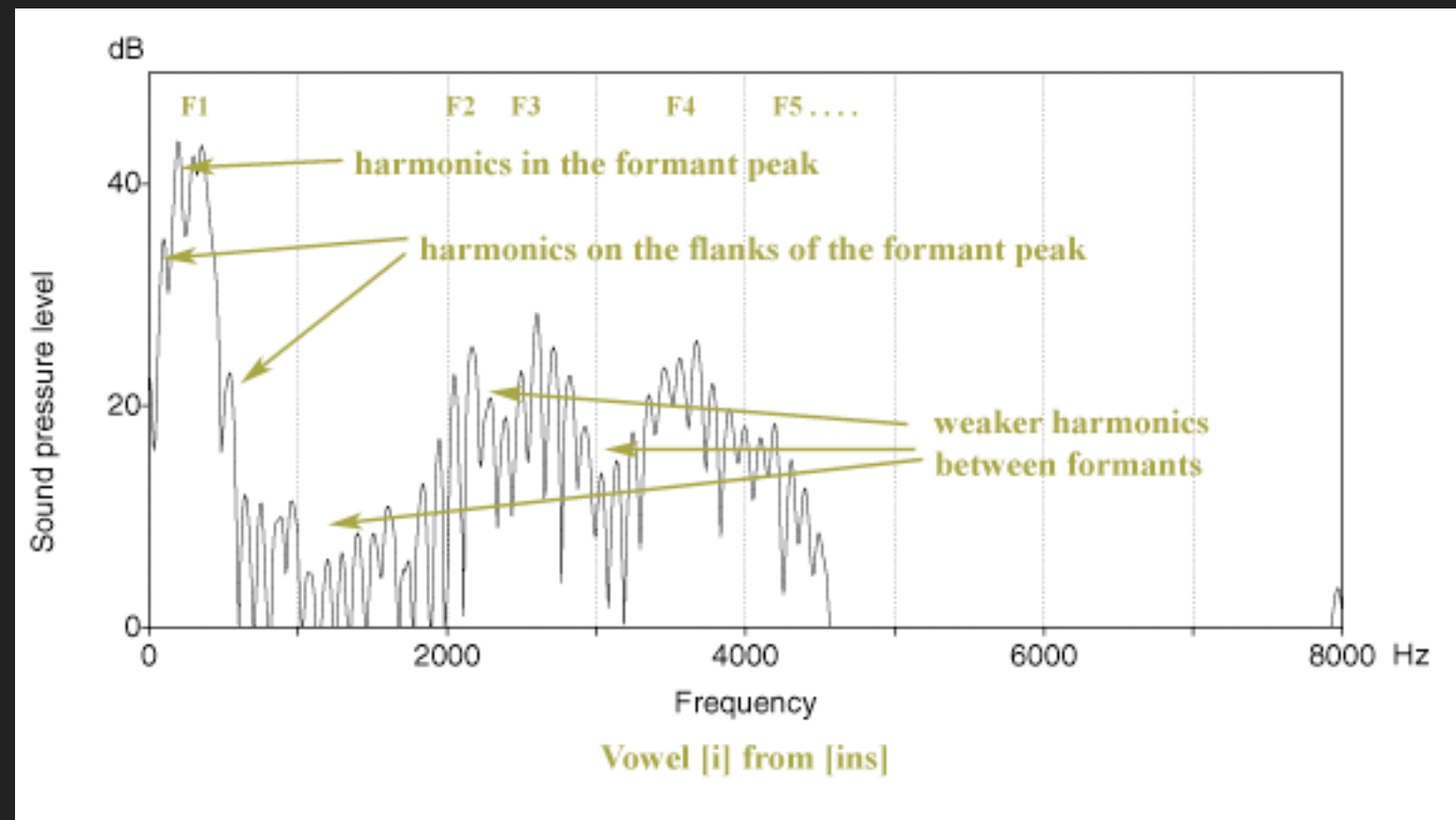
# DIGITAL PITCH-SHIFTING AND TIMBRE

- ▶ Pitch-shifting affects timbre because instruments or objects have different harmonic spectra (patterns of harmonic partials) if played at different frequencies
- ▶ A major effect is related to the formant characteristics (i.e. filter characteristics) of the object's resonating body



# BODIES AND FORMANTS

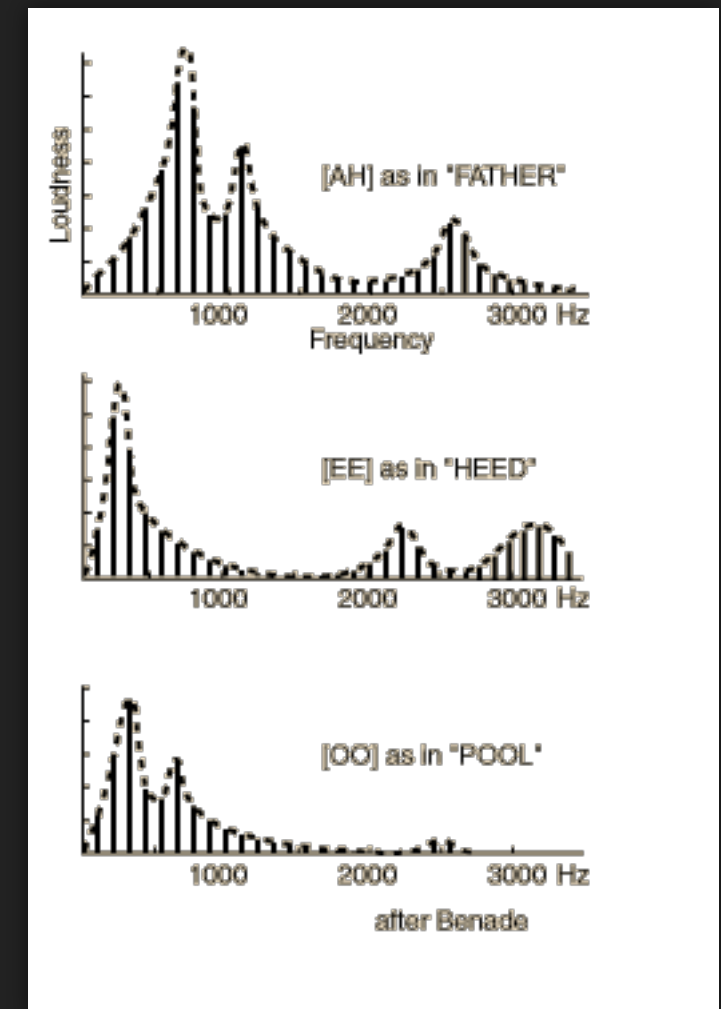
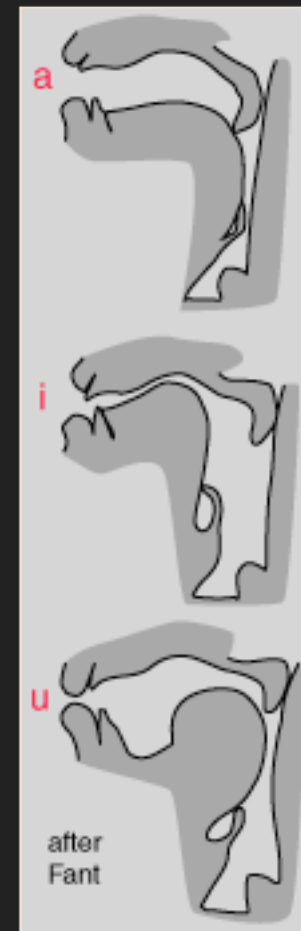
- ▶ Formants are peak amplitude responses for particular input frequencies
- ▶ They are discernible as pronounced peaks in a sound spectrum which maintain their position, even if the source vibration changes its frequency
- ▶ In other words, the centre frequencies of formants are independent of pitch for fixed bodies



*Can you think of any implications for the treatment of digital samples?*

# FORMANTS AND VOWELS

- ▶ We communicate using timbre change for our vocal cavities
- ▶ A significant aspect of our linguistic vocalisations is the use of changing formant characteristics of our vocal cavities, producing different positions and patterns of formant peaks known as vowels
- ▶ Can you relate this to any synthesis/sound processing method?



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# CHANGE OF TIMBRE WITH TRANSPOSITION

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## EFFECT ON VOCAL TIMBRE OF PITCH (AND RESULTANT FORMANT STRUCTURE) CHANGE

- ▶ Example from Trevor Wishart *On Sonic Art*



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## EFFECT ON VOCAL TIMBRE OF PITCH (AND RESULTANT FORMANT STRUCTURE) CHANGE

- ▶ Played back more slowly

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## EFFECT ON VOCAL TIMBRE OF PITCH (AND RESULTANT FORMANT STRUCTURE) CHANGE

- ▶ Played back even more slowly

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## MUSICAL USE OF THIS EFFECT

- ▶ Roger Doyle, *Under The Green Time* (1995)
- ▶ <http://vimeo.com/17851404>
- ▶ Collaboration with uilleann piper Brian Ó hUiginn
- ▶ Piece based on uilleann pipes and electric typewriter samples
- ▶ Electric typewriter samples become rhythmic (and 'industrial'-style) drone accompanying edited uilleann pipe performances
- ▶ As typewriter samples are transposed down, their apparent dimensions are increased (pattern of formant-style peaks is changed along with pitch)

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## BASIC SOUND PROCESSES (2): SOUND 'ENVIRONMENT'

- ▶ Appearance of room acoustics (delay and reverberation)
- ▶ Loudness, panning and equalisation, room acoustics (perspective, localisation and 'distance')
- ▶ Multiple speakers rather than 'standard' stereo (spatial composition - we may touch on this later in the module)
- ▶ It could be argued that, with these changes, we are more concerned with creating a virtual environment - **changing the environment** rather than changing the sources

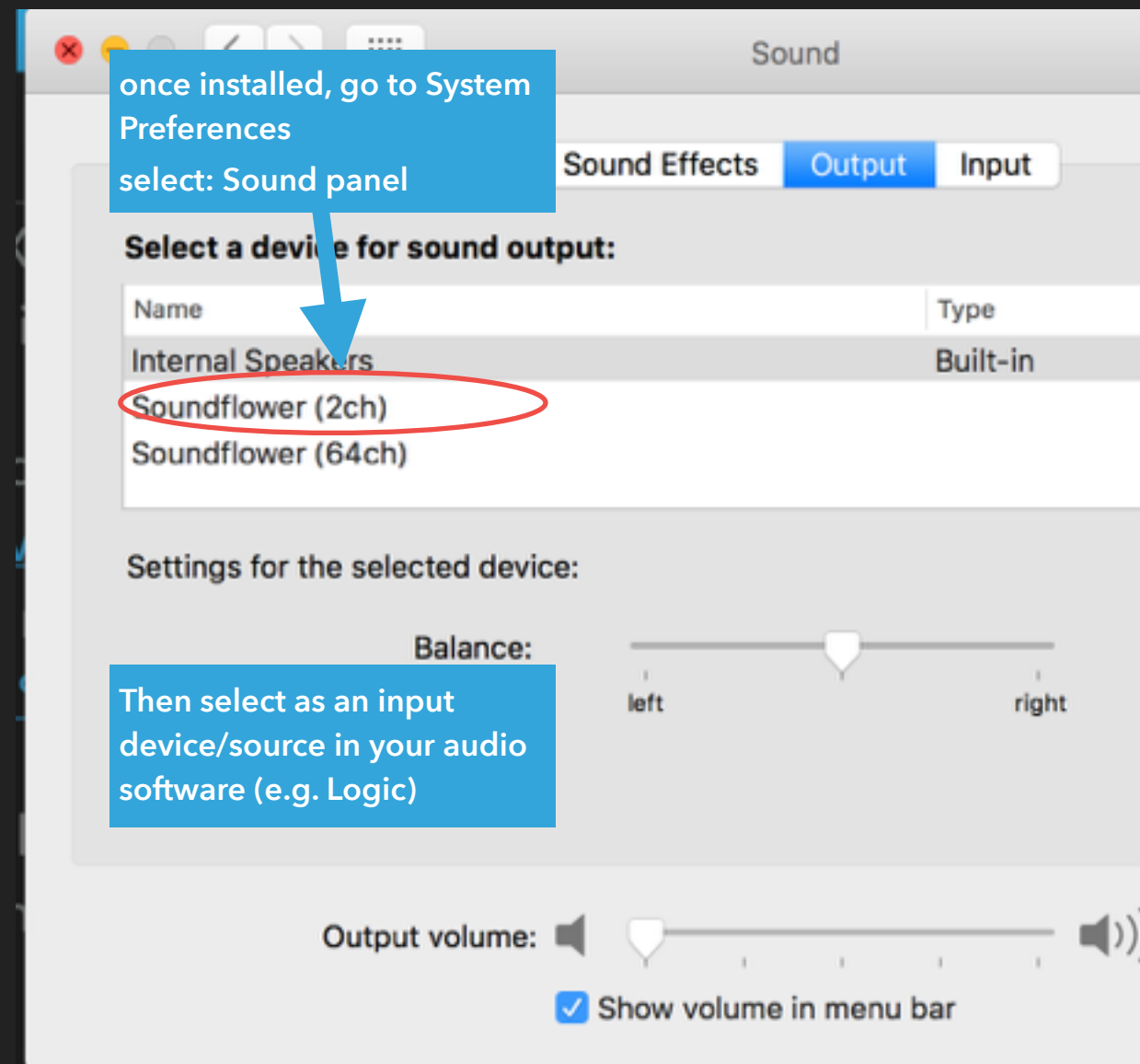
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# SOUND GESTURES AND COMPOSITION

- ▶ Are we also **animating** the environment?
- ▶ Combinations of sounds (synchronised timings)
- ▶ Developments/alterations of these combinations (grouping and splitting)
- ▶ Movements of these sonic objects/complexes and dynamic changing of their sonic 'signature'/timbre
- ▶ **Structured change of sonic attributes = composition?**

# PRACTICAL NOTE: GRABBING SOUND SAMPLES FROM MEDIA

- ▶ OS X: use Soundflower <https://github.com/mattingalls/Soundflower> - allows inter-application audio routing using a virtual stereo or multichannel driver
- ▶ Windows and Linux: use JACK <http://www.jackaudio.org/> (OS X version too <http://www.jackosx.com/>) which is an even more powerful audio routing API; see beginners' note here <http://libremusicproduction.com/articles/demystifying-jack-%E2%80%93-beginners-guide-getting-started-jack>
- ▶ We'll demonstrate an **OS X setup for grabbing web audio (internet radio) using Soundflower** (JACK is similar, just more routing options)



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# NEW SOUND MATERIALS IN MUSIC: DISCUSSION OF READINGS

- ▶ Cage, J, 1937. The Future of Music: Credo, in Cox, Christoph and Daniel Warner (eds) *Audio Culture: Readings in Modern Music*, London: Continuum, 2004. Also online at [http://www.elemental.org/element/said&did/future\\_of\\_music.html](http://www.elemental.org/element/said&did/future_of_music.html)
- ▶ Russolo, L. 1913. The Art of Noises: Futurist Manifesto. in Cox and Warner (eds) *Audio Culture: Readings in Modern Music*. Also at: <http://www.unknown.nu/futurism/noises.html>
- ▶ Varèse, E. 1966. The Liberation of Sound. in Cox and Warner (eds) *Audio Culture: Readings in Modern Music* [this is a compilation of various articles by Varèse, presented as a chapter in *Audio Culture*]. Also at: [http://www.zakros.com/mica/soundart/s04/varese\\_text.html](http://www.zakros.com/mica/soundart/s04/varese_text.html)
- ▶ Cascone, K. 2000. The Aesthetics of Failure. *Computer Music Journal*. [http://www.ccapitalia.net/reso/articulos/cascone/aesthetics\\_failure.htm](http://www.ccapitalia.net/reso/articulos/cascone/aesthetics_failure.htm)



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## THINKING IN SOUND?

- ▶ Cage as modernist? (He seems to be leaning that way in this early text)
- ▶ Luigi Russolo clearly situates himself as an arch-modernist
- ▶ A similar idea and sensibility pervades Varèse's words, though it is arguably the most speculative
- ▶ Cascone's ideas are clearly different...things are at a very different stage; the search for sonic 'newness' takes different forms!

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# LISTENING

- ▶ You only have a short listening list this week...two tracks on Spotify and the other links embedded in these slides
- ▶ <https://open.spotify.com/user/impulseresponse/playlist/3R12CEZ1WawfCqSbhelXRq>
- ▶ The most important thing is to start listening with these conceptual 'tools' for analysing sound, and to maybe start to record some sounds 'out there' in the world

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## ALSO: ASSIGNMENT PLANNING NOTES

- ▶ Get recording/sound-searching
- ▶ We will concentrate on grabbing media (specifically, radio samples) for our first assignment, due to our upcoming project with Prof. Leigh Landy.
- ▶ I am breaking the first assignment deadline into two: a first submission for some initial feedback on choices, and a second, final submission on the following Tues 7th by 12 noon.
- ▶ We will cover use of portable recorders in a future class. (Manuals, resources are available on my blog on Random Twist)
- ▶ I will send you an updated set of notes on the assignment shortly; we will use RandomTwist or Google Spaces to coordinate this project
- ▶ NB: you can transfer samples to me using USB or a Google Drive or WeTransfer link.