

MUS302 WEEK 9

**AESTHETICS OF SOUND PROCESSING AND
SOUND STRUCTURE IN COMPOSITION**

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Recap: practical approaches to sound design and sound-based composition

- ✦ Back to *musique concrète*? Changing the source?
- ✦ Time/amplitude changes: fades/envelopes/edits/channel automation of volume (change of timbre if attack transients removed)
- ✦ Pitch-shifting: effects/implications on timbre
- ✦ Appearance of room acoustics (delay and reverberation)
- ✦ Loudness, panning and equalisation, room acoustics (perspective, localisation and 'distance'/'presence')
- ✦ Multiple speakers (spatial composition)
- ✦ It could be argued that, **with some of these changes, we are more concerned with creating a virtual environment** - changing the environment rather than changing the sources

Extended Technique: Vocalising (by Trevor Wishart)

- ✧ Ululation

Extended Technique: Vocalising (by Trevor Wishart)

- ✧ Pitched production - lunged/half-lunged

Extended Technique: Vocalising (by Trevor Wishart)

- ✦ Pitched production - normal/fluttered (tongue to lip)

Some (practical and aesthetic) thoughts

- So it's not just about processing (or even found sound) - you might be able to produce your own sound materials
- Arguably, Wishart's enhanced timbral vocabulary is informed by such performances - perhaps you could try this yourself
- Some such 'sound objects' may retain some of their associations with the original performance
- In some cases, there may be a sense of the *uncanny* about sounds engendered through unfamiliar actions of a familiar physical source (Wishart's examples are, in this way, quite dramatic and 'messily human', as well as texturally interesting)

Sources of Extended Sound Materials

- ✦ Many of these examples deal with experimenting at the edge of stable sound production for real physical systems
- ✦ In instrumental/acoustic composition, this class of effects is sometimes grouped under the heading 'extended technique'
- ✦ You can experiment with this if you play an instrument or sing (or even if you don't)
- ✦ You can also experiment with sounds on the edge of stability using Logic Pro's Sculpture synthesiser, which models the behaviour of certain acoustic instrument systems (complete with the possibility of experimenting with instability)

Extended Technique

- ✦ Wishart's examples are examples of acoustic 'extended technique': articulations of an instrument (or acoustic source) which 'go against the grain' of normal usage
- ✦ Some of these extended techniques are hard to execute, but you have an advantage as a digital composer/sound designer: you can record the successful attempts and discard the unsuccessful ones
- ✦ In some of your source recordings, you may find accidental vocal utterances/articulations which sound like extended technique when edited

Digital Sound Processes (Effects Plugins)

- ✦ We've already looked at some fairly powerful processes in this module and ideas in this module, including spectral processing (SPEAR and Michael Norris Soundmagic Spectral plugins)
- ✦ However, we also have a wealth of sound processes which are available via effects plugins within a digital audio workstation such as Logic
- ✦ Some of these may come with the application, others may be available as external processes

Different types of processing

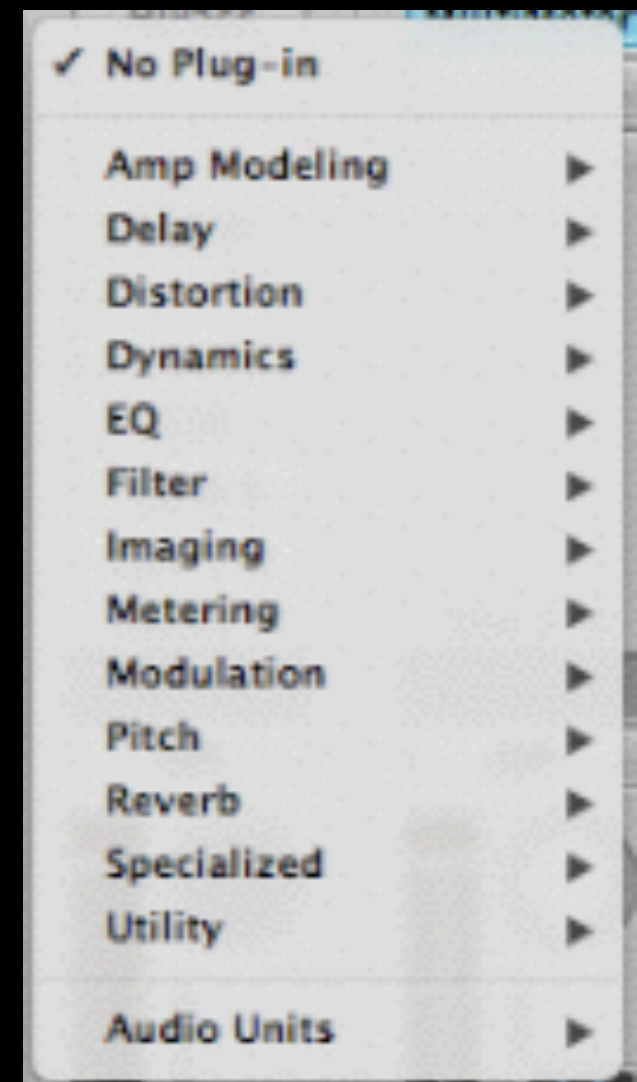
- ✦ (1) Some processes can be computed relatively easily and quickly - so quickly that they can happen in **real time** (nowadays, this is increasingly common)
- ✦ (2) Other processes are more computationally intensive - happen **offline**
- ✦ Some processes are computationally intensive but can just about happen in real time (as long as you don't use too many of them)...many more advanced sound processes are in this category (e.g. SPEAR's spectral processing)
- ✦ However, when combining complex processes, you sometimes need to be aware of processor/RAM limitations (and maybe process them offline or bounce the results to disk for later combination/mixing)

'Standard' sound processes/effects

- ✦ **How many can you name?**
- ✦ Many/most of these are processes which happen in the time domain - accomplished via combinations of delays, modulations, distortions
- ✦ Some common processes are non-realtime, at least for high-quality results - can you name any of these?
- ✦ Model for composition/processing - some processes applied as effects on channels (insert/send effects), others applied offline (in some cases this is termed destructive processing because the file is permanently changed, or, at the very least, a limited number of versions of the file are saved)

Common Effects families

- ✦ Distortion/amp modelling/lo-fi effects
- ✦ Delay effects
- ✦ Modulation effects (chorus, phaser, flanger)
- ✦ Reverb
- ✦ EQ
- ✦ Dynamics processing - compression



Some 'special' effects in Logic

- ✦ Study Space Designer if you are interested in creating virtual reverberant spaces, some of them artificial (but be careful not to make 'reverb soup')
- ✦ Delay designer offers some interesting combinations of delays and filters

Categorising effects

- ✦ We've already carried out some divisions of effects relating to classes of digital sound processes - dividing them **according to their method** (reverb, delay, distortion)
- ✦ We can also divide them into categories **relating more broadly to their results**

Additive effects

- **Distortion** - adds frequency components to materials (voluntarily, in the case of composition)
- **Frequency shifting** - not strictly additive, but moves the upper frequency components relative to a fixed fundamental - makes harmonic sounds more inharmonic (hence, metallic-sounding) by applying a shift of a fixed frequency amount to each successive harmonic, can dramatically alter timbre and change the emphasis of a spectrum from predominantly low frequency components to a significant proportion of higher frequency components...see <http://www.soundonsound.com/sos/jan02/articles/synthsecrets0102.asp> (a related effect which is additive is ring modulation <http://www.theguardian.com/music/2009/nov/09/ring-modulators> and, if you're into Max/MSP, <http://cycling74.com/docs/max5/tutorials/msp-tut/mspchapter08.html>) Listen to Mantra by Stockhausen
- **Resonant filtering** - filter with high resonance (feedback) setting will produce pronounced 'ringing' - single partials/frequency components will be heard separately around the cutoff frequency of the filter

Sound structures and structural effects

- ✦ **Drone** - refers to a constant layer of stable pitch with no noticeable variation in intensity ... the drone effect can also be observed in urban and industrial soundscapes (Augoyard and Torgue, 2005)...see also the 'Maximal Objects' chapter of Demers (reading from previous weeks) for more details
- ✦ **Fade** - disappearance (or appearance) of a sound through a progressive decrease (or increase) in intensity...adapted from Augoyard and Torgue (2005)
- ✦ **Echo** - a phenomenon observed in nature, is the simple or multiple repetition of a sound emission linked to a reflection in the space of diffusion. The term comes from Echo, a mythological nymph condemned to never speak first, but only repeat the last syllable of others. (Augoyard and Torgue, 2005) - to my mind, echo is a structural effect - elements which occur separately in time are superimposed

Structures or structural effects

- **Reverb/reverberation** - A propagation effect in which a sound continues after the cessation of the emission. Reflection of the sound on surfaces in the surrounding space are added to the direct signal. The longer these reflections conserve their energy, the greater the reverberation time. In everyday language, reverberation is often referred to as the 'cathedral' effect. (Augoyard and Torgue, 2005)
- **Granulation** - the division of a source sound sample into short bursts/slices called grains, each with their own amplitude envelope to prevent discontinuities (resulting in clicks). In the process of asynchronous granular processing, the temporal order of some of these grains is randomised, such that temporal detail is 'blurred' or, in extreme cases, undergoes a significant degree of rearrangement. As part of this processing, some grains may be played at different rates, resulting in higher frequency components to the sound. (The chopping up of files into short slices is also known as **brassage**.)

Subtractive Effects

- ✦ Filters (without resonance)
- ✦ Equalisation
- ✦ **Subtractive** is perhaps somewhat misleading - is **shaping** more appropriate?

Contour effects

- ✧ Envelopes
- ✧ Automation
- ✧ Shorter fades
- ✧ Compression
- ✧ ...all change the character of a sound dramatically -
can make the tame sounds more dramatic and visa
versa!

Not forgetting 'size' effects

- ✦ Speed recordings up or slow them down to present an impression of different sizes of source objects (due in many cases to the change in resonant peaks in the filter response - **formants**)
- ✦ Some pitch-shifting plugins or processes will allow you to try this out whilst keeping the pitch constant (e.g. Logic's Vocal Transformer plugin)

Not forgetting where you stand (personal aesthetic preferences)

- ✦ Are you more interested in the physical/representational aspect of sound? => less dramatic processing, more collage/juxtaposition/pairing
- ✦ Are you more interested in more abstract musical structures? => more dramatic processing, more focus on harmonic timbres, nearly harmonic timbres or timbres with some clearly discernible partials (frequency components) 'ringing out'

Recap: Spectral Audio Effects

- ✦ Michael Norris Soundmagic Spectral plugins (free AudioUnit plugins)
- ✦ <http://www.michaelnorris.info/software.html>
- ✦ As the name suggests, these plugins use spectral processing (like SPEAR), but rather than tracking the progress of individual partials (frequency components), these processes move groups of partials
- ✦ The manual contains very illuminating discussion of spectral processing
- ✦ Some plugins quite complex - experiment!
- ✦ Most are computationally expensive (you're lucky they're in real time at all) so some elements may need to be bounced if you are using them on multiple channels

Soundmagic spectral plugins

- summary of time domain fx

- ✦ Not all are spectral/frequency domain (as the name might suggest) - some nice takes on 'standard' or non-standard time domain effects
- ✦ Chorus - does a version of what it says on the tin, though can, with extreme settings, act as a more general modulating delay line
- ✦ Comb filter bank - bank of tuned resonant filters
- ✦ Idee Fixer - granulator/brassage - careful to trigger sample start and bounce results for repeated use

Soundmagic spectral plugins

- summary of freq domain fx

- Spectral averaging/blurring - smears frequency content variations over time
- Spectral bin shift - reduce or increase distance between frequency components - can make harmonic sound more inharmonic ('metallic'/'bell-like')/can also change apparent 'weight'/dimensions of other sound sources (change apparent formant structure)
- Spectral Dronemaker - advanced combination of spectral averaging and other processes
- Spectral emergence - applies new amplitude envelopes to different partials
- Spectral freezing - another drone-based effect - freezes state of particular 'filters'/'bins' until certain conditions are reached
- Spectral granulation - splits up sound into chunks/grains on the basis of both frequency and time
- **Note FFT/Fourier Transform size - bigger = better freq accuracy; smaller = better time accuracy** (reasonable setting is often 2048/4096)

Soundmagic spectral plugins

- summary of freq domain fx

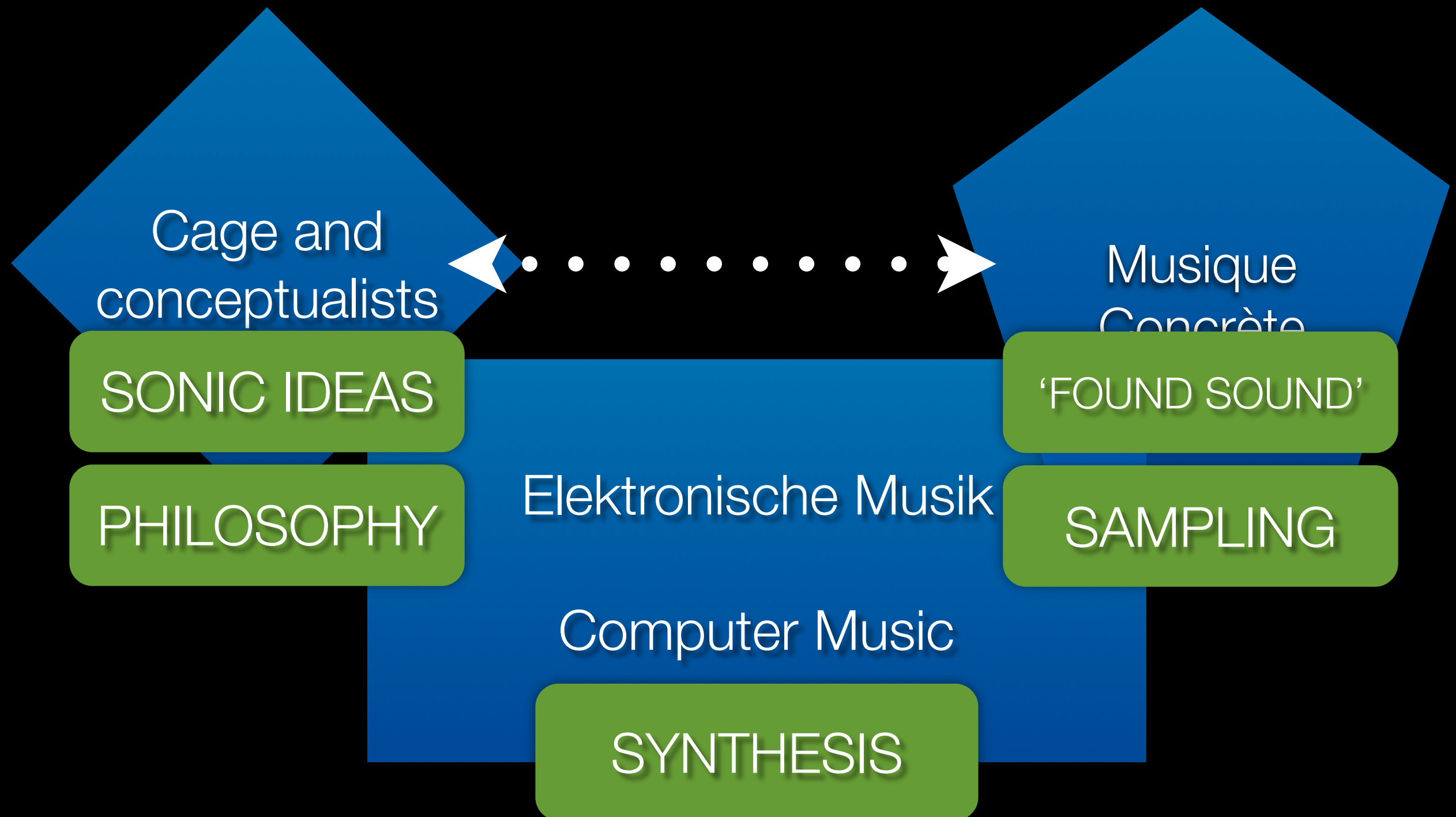
- Spectral tracing - trace 'outline' of sound, keep loudest partials
- Spectral gate and hold - accumulator effect similar to freezing, but with envelopes
- Spectral stretch - make harmonic sounds more inharmonic/'metallic' with varying ranges of spectral emphasis (apparent dimensions of sound due to density/diffusion of spectrum)
- Spectral shimmer - add a high-frequency, jittery 'sparkle' to your sound
- Spectral pulsing - switches 'bins' (i.e. filters) on and off across spectrum in a pulsating fashion (somewhat like an LFO applied to a multiband filter)

Electroacoustic Composition and Structure

- ✦ So far, we've concentrated on the 'building blocks' of electroacoustic music: the technologies and terminology which have enabled us to (hopefully) grasp a wider range of details in sound structures
- ✦ But **composition isn't just about momentary structures...**it's about structures which develop over time
- ✦ So, now that we know more about 'how sound works', we need to think about what this means in terms of this wider frame

music technology as meme c.1950

changing the building-blocks of music?



Becoming Composers

- ✦ **‘Composer’ is a weighty—sometimes loaded—term**, but it simply means ‘someone who organises musical (or sound) structures in advance of a performance’ or, in a more contemporary sense, someone who uses technological tools to order sound without (necessarily) performing
- ✦ **Electronic music/digital technology has democratised composition**: as a result of these technological developments, practitioners are able to test a wide range of sound materials without having to laboriously score the structures first and employ a group of musicians, only to find that the sonic results are not as expected
- ✦ **Nonetheless, some people shy away from the term, preferring to gravitate towards the related (but arguably still distinct) ‘producer’, ‘sound designer’, ‘sound artist’ or, simply ‘musician’**
- ✦ **RECAP: what do you think of these issues? Are you concerned about your label? Do you think about the implications of labels you apply to others? Do you feel differently about any of this, having followed this module thus far?**

CREATIVITY and 'RULES'

- **'Rules': maybe an unhelpful term for some of the restrictions we sometimes encounter in creative practice** when trying to produce predictable (even in terms of 'predictable unpredictability') and coherent (even in terms of 'precisely specified incoherence') results
- **As we've seen, the environment may provide some of these 'rules' or, more neutrally, 'structural principles'** through its 'environmental regularities'
- So, we've learned some of the 'rules' of how timbre (and sound processing) works and we've learned about some of the self-imposed restrictions which early composers used to focus them in their exploration of particular domains of sound and music (e.g. exclusive use of 'found sound' or electronically-generated materials)

CREATIVITY and 'RULES' II

- 10 Rules for Students, Teachers, and Life by John Cage and Sister Corita Kent (1967/8)

Key 'rules':

- **Consider everything an experiment.**
- **Nothing is a mistake. There's no win and no fail, there's only make.**
- **Don't try to create and analyze at the same time. They're different processes.**
- **"We're breaking all the rules. Even our own rules. And how do we do that? By leaving plenty of room for X quantities." (John Cage)**

Do you agree with these 'rules'? Can you suggest reasons why they might (or might not) be applicable to your own creative work?

10 Rules for Students, Teachers, and Life (full list)

- ✦ RULE ONE: Find a place you trust, and then try trusting it for awhile.
- ✦ RULE TWO: General duties of a student — pull everything out of your teacher; pull everything out of your fellow students.
- ✦ RULE THREE: General duties of a teacher — pull everything out of your students.
- ✦ RULE FOUR: Consider everything an experiment.
- ✦ RULE FIVE: Be self-disciplined — this means finding someone wise or smart and choosing to follow them. To be disciplined is to follow in a good way. To be self-disciplined is to follow in a better way.
- ✦ RULE SIX: Nothing is a mistake. There's no win and no fail, there's only make.

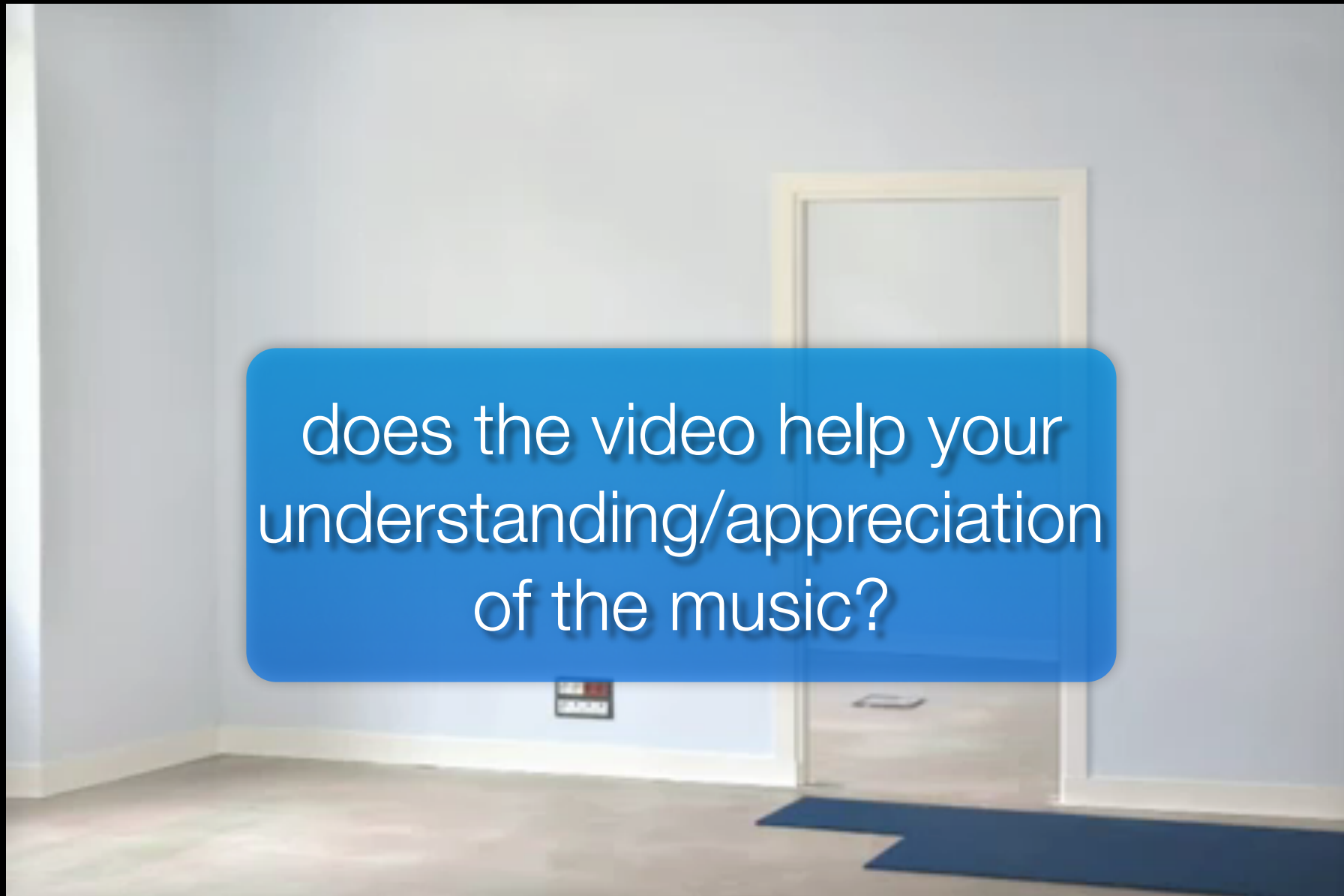
10 Rules for Students, Teachers, and Life (full list)

- RULE SEVEN: The only rule is work. If you work it will lead to something. It's the people who do all of the work all of the time who eventually catch on to things.
- RULE EIGHT: Don't try to create and analyze at the same time. They're different processes.
- RULE NINE: Be happy whenever you can manage it. Enjoy yourself. It's lighter than you think.
- RULE TEN: "We're breaking all the rules. Even our own rules. And how do we do that? By leaving plenty of room for X quantities." (John Cage)
- HINTS: Always be around. Come or go to everything. Always go to classes. Read anything you can get your hands on. Look at movies carefully, often. Save everything — it might come in handy later.

About **Music** (abstract vs concrete?)

- ✦ **Some rules may be based more on ‘natural’/universal constraints (i.e. how we hear/perceive/process sound), some based on specific cultural (contextual) overlay; some may be a combination**
- ✦ Morton Feldman (1983): ‘Cage was the first composer in the history of music who raised the question by implication that **maybe music could be an art form rather than a music form**—rather, something about music, always and always **something about music and only about music in a historical sense.**’
- ✦ **Music’s differences and similarities to other art forms** (and technology’s role in this) ... historically, (abstract) form/structure rather than overt ‘meaning’/referential connection was the dominant mode

Environmental Structures and Music

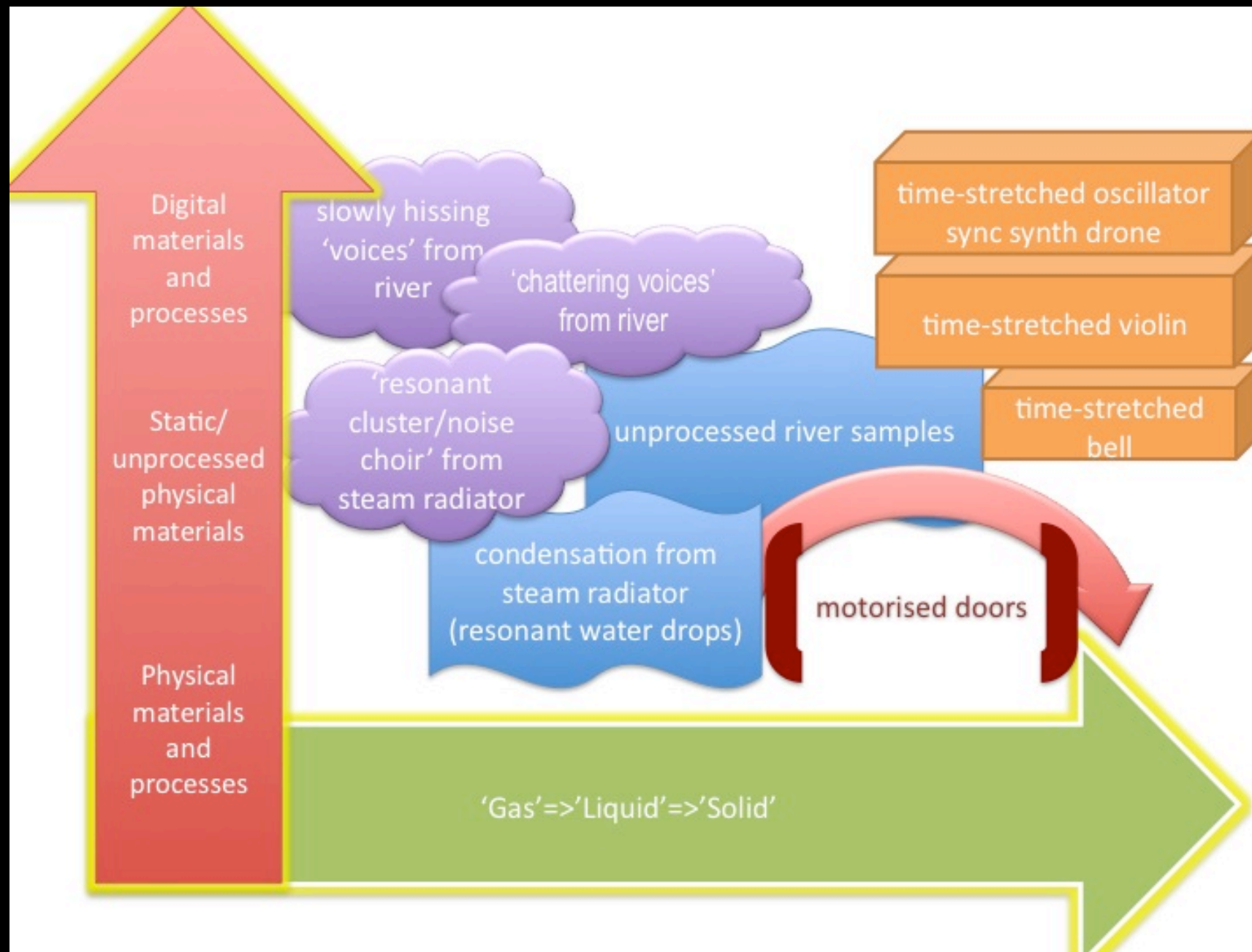


Denis Smalley (1997) *Empty Vessels* for
electroacoustic sounds

Video: Julien Spiewak

<https://www.youtube.com/watch?v=yrBeL7IzbP0>

Environmental Models, Charts and Music Structure (BB, *Conduit*, 2009)



Conduit:
Organising
source
materials

Composing: organising your Materials

- ✦ LISTENING METHOD: Lay them out on a timeline (e.g. in Logic) play them one after another, play them at the same time, play them with gaps, find connections (pre-planning), start to compose (composition)
- ✦ GRAPHIC PLANNING METHOD: graph your materials...listen for important timbral details, find a way to draw/graph these, graph connections (pre-planning)
- ✦ GRAPHIC SCORING: extend these plans/charts into descriptors of your musical connectors (composition)

Graphing Sound Events

- ✦ Composer Denis Smalley has written about the consideration of perceptually-relevant timbral events in electroacoustic music: he terms the relevant sound structures **spectromorphology**
- ✦ Spectromorphology comes from **spectra** and shape: it is the change in the spectra (and sound level) over time
- ✦ It may be added to to incorporate **spatial gestures**
- ✦ A chart of such structures might give us a **listening score** for an electroacoustic piece

GRAPHING SOUND EVENTS

- Composer Manuella Blackburn has graphed/visualised some of Smalley's spectromorphological gestures using a combination of shapes (for the morphologies of the spectra) and icons for material associations
- Such graphics may help you plan/reflect on the structure of your compositions



Figure 23. Layered *streams*.

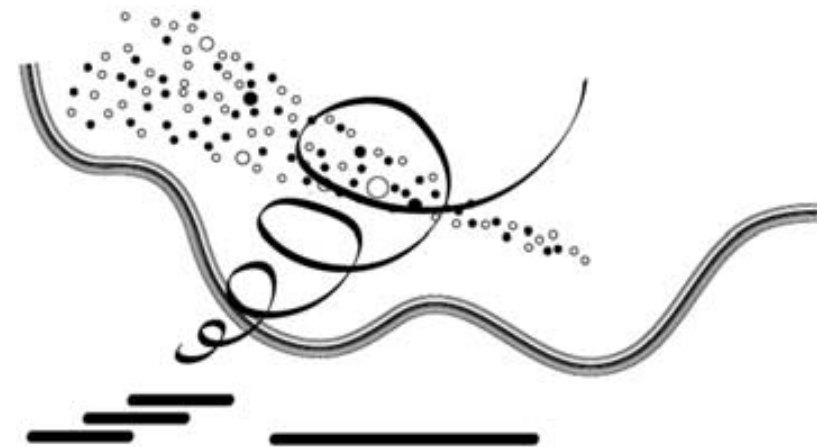


Figure 17. *Turbulence*.



Figure 18. *Turbulent* wind and leaves.

GRAPHING SOUND EVENTS

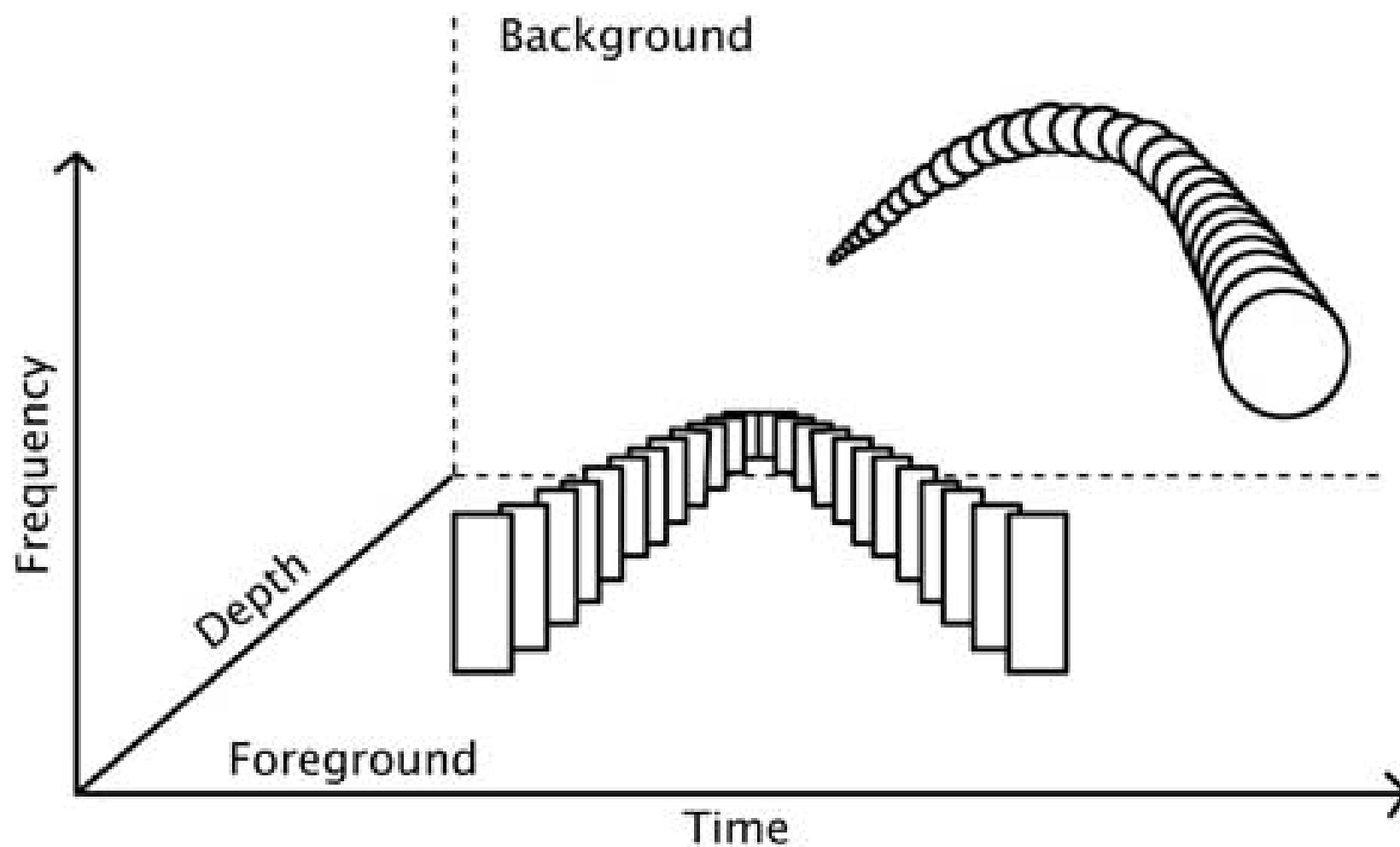


Figure 27. Depth perspective.

EXAMPLE GRAPHIC SCORE

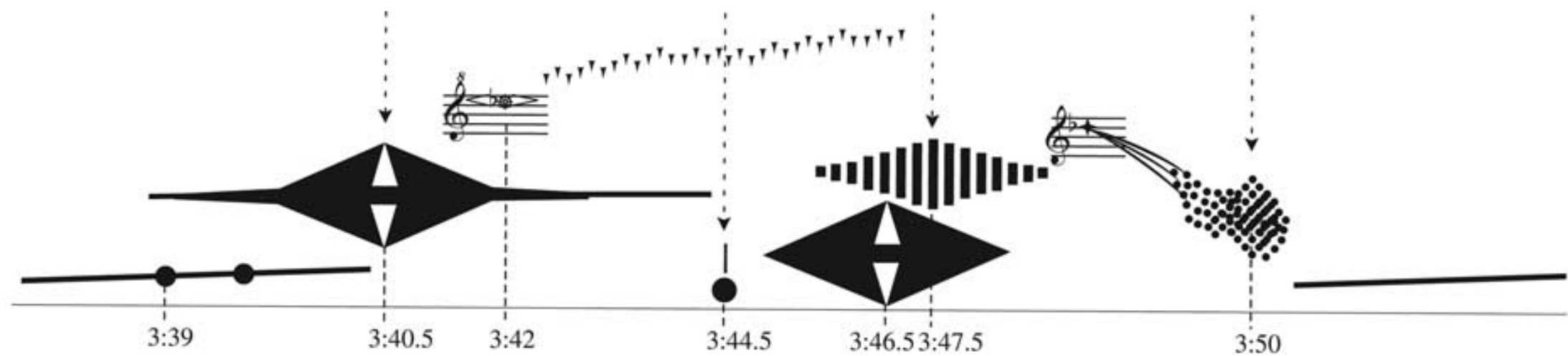


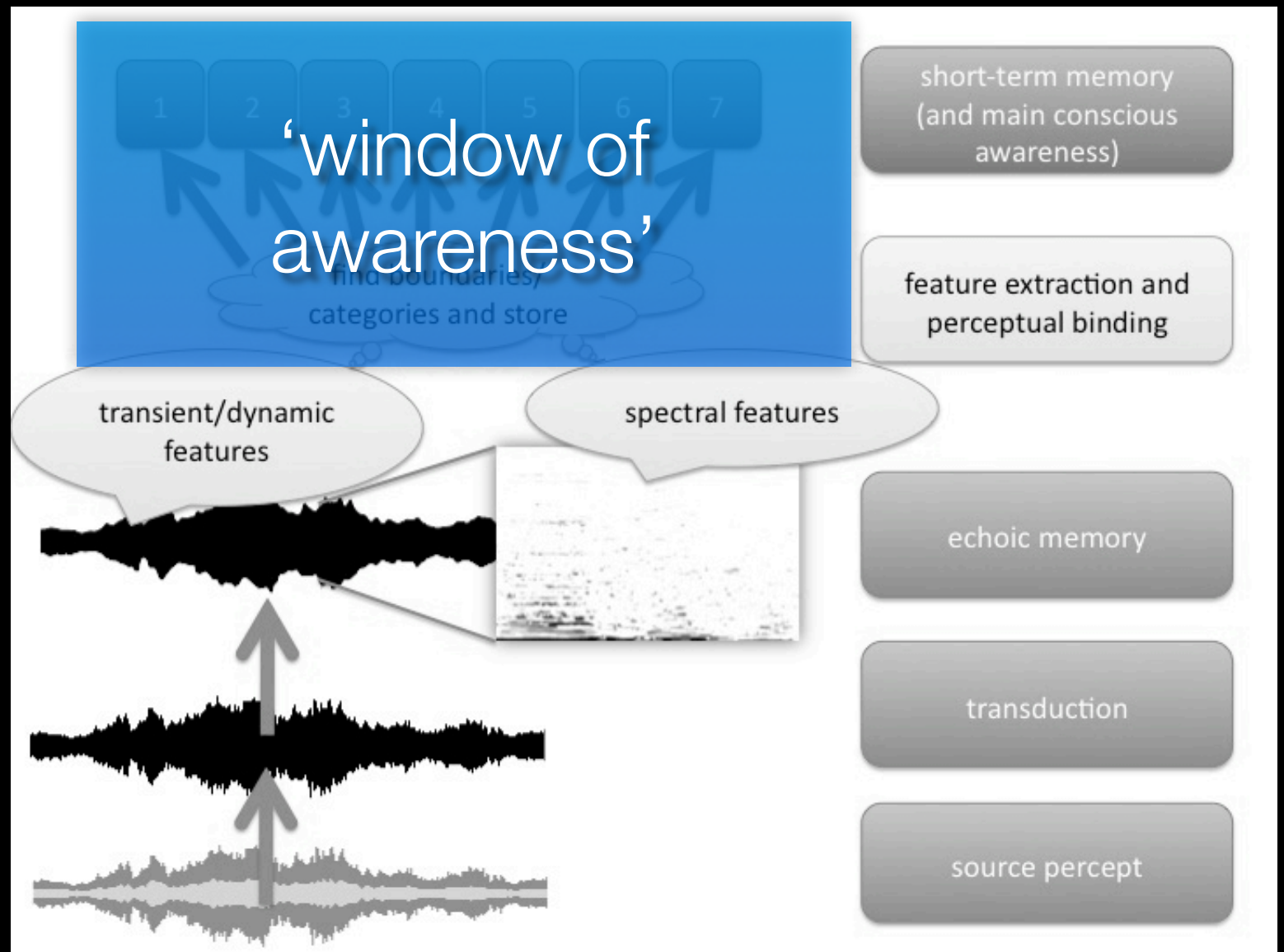
Figure 16. Rajmil Fischman, *No Me Quedo...* score extract, page 28 (with permission of the composer). Also illustrated in Sauer 2009.

Music as a Time-based Medium and the Role of Memory

- ✦ Music could be defined as the creative structuring of sound events over time so that they seem to have causal relationships
- ✦ Based on this definition, music's structure isn't just 'in the moment' (though some more experimental practices resist this) but lies across the time-span of the piece
- ✦ But our capacities in this regard are limited...

Music and Memory Capacity

- Short-term memory: generally 7(+/-2) discrete elements (Miller, 1956), 4-8 seconds duration
- Long-term memory: much greater capacity (entire human memory store, technology aside), but logical ordering less clear
- A successful piece must make use of both



from source to short-term memory: after Snyder (2001)

Memory and Musical Form

- Snyder (2001) uses current theories of human memory to inform a theory of music
- Based on the divisions outlined in the last slide, he assigns different aspects of musical structure to different memory processes
- (1) Detecting individual events/grouping harmonics into pitched notes - EARLY PROCESSING
- (2) Grouping notes together in melodies, grouping similar sounds which occur close together in – SHORT-TERM MEMORY
- (3) Larger-scale form: sections/‘movements’/entire pieces – LONG-TERM MEMORY

Working with More than Just Short-Term Memory

- For a piece to sustain interest over longer time-spans, it helps if it takes these divisions into account
- i.e. it is relatively easy to structure things clearly for short-term memory (4-8 seconds)...it is relatively more difficult to sustain interest over longer spans
- One approach is simply to avoid this issue altogether: much electroacoustic music plays with momentary texture and 'gestures' within short-term memory, but may not be explicitly organised to consider longer spans (long-term memory) — Snyder (2001) terms this 'memory sabotage'
- In contrast, much classical symphonic music is carefully structured so that connections run from the most localised level to the longer time spans of sections of pieces/movements

Working with More than Just Short-Term Memory

- However, even if electroacoustic music doesn't contain the extensive network of 'motivic connections' which more traditional symphonic music often does, it can still make use of our more basic, environmental-level, awareness of form
- Composers will take some elements from the timbral structure of an individual sound and may elaborate (group) these individual events into an extended series of gestures
- The broad similarity of these gestures may provide a similar unifying context for our vantage point through our short-term memory 'window'
- Groups of these gestures may also be structured on the basis of relatively simple (but effective) dynamic trajectories from soft-loud, near-far, bright-dark etc. as arranged over time (sense of relative order of events)
- The overall pace/density of these changes may dictate some overall structural impressions on the part of the listener (e.g. a slowly-developing piece or a frenetically active piece)

Linearity and Apparent Causality

- ✦ Perception is often all about **finding out how to group or separate elements** in a complex perceptual ‘field’
- ✦ Our perceptual predisposition is to search for elements which ‘go together’ in continuous ‘streams’ of events (**continuity**) or events which appear to belong to other causes (and so are assigned to separate ‘streams’) — Albert Bregman (1990, 1993) studied this aspect of perception —**grouping/segregation**
- ✦ As Snyder notes, some sound events may signify **closure** (e.g. the drawing of an engine to a stop, with a sense of kinetic energy being reduced, or a bouncing ball similarly coming to a stop)
- ✦ In electroacoustic music, by making a new activity occur in another part of the virtual soundscape just after a coherent gesture, we might craft an impression of **apparent causality** or **linearity**...as Snyder (2001, p. 63) notes, the events in such a sequence/stream may ‘**seem connected to and to grow out of each other**’

Linearity and Apparent Causality: suggested effects

- ✦ **Repetition for closure/emphasis**
- ✦ Follow 'real-world' models for trajectories: 'spinning up', slowing down, bouncing etc. ...hence, mirroring the motion of 'real-world' objects (metaphor of motion)
- ✦ **Avoid linearity to emphasise dramatic divergence from expectation**
- ✦ Contours of event streams/sequences: smooth contours to highlight continuity/ 'jagged' contours/abrupt movements to reinforce sense of discontinuity
- ✦ **Which events/streams/'chains' go together? Which appear to interrupt/split apart?**

Structural Issues: Listener's Perspective

- ✦ Interruption/chaotic behaviour versus constancy
- ✦ Focus on moment ('moment form') versus focus on larger-scale progression
- ✦ Focus on moment through drone/absolute constancy versus focus on moment through intermittent/transient gestures (or particularly striking sound textures)
- ✦ Sometimes the perspective may be blurred (with digital processing technology, it is easy to carefully craft progressions which morph between the two extremes)

Snyder's views of Form and Memory

- ✦ **Sound elements and categorisation** (clear/scalable versus more indistinct categories...e.g. pitch versus timbre...or even a sound's associative properties)
- ✦ **Constancy and closure**
- ✦ **Information/redundancy** (being aware of memory-based limitations which frame our perceptual 'window' on the piece and providing 'more than enough' information)
- ✦ **Temporal order and long-term memory** (unclear, more associative form...think of dreams...or networks...rather than clear stories) [electroacoustic music can sometimes feel a little dream-like for this reason]
- ✦ **Memory strategies:** (1) maximise organisation through hierarchical structures or associative networks of materials (attempting to overcome long-term memory limitations) or (2) music which attempts to frame its reception via an overwhelming focus on the present ('memory sabotage')

Metaphor and Musical Form

- ✦ Associative memory: reminded of some things when we think of others
- ✦ Metaphor: element stands for (replaces or 'maps to') a distinct alternative element 'E.g. the moon was a dish' rather than 'the moon was like a dish'
- ✦ Metaphor and environment: do certain environmental interaction/reaction possibilities provide us with certain key thought structures (e.g. up/down–gravity, centre–periphery, into/out of–container) etc.... with direct use of environmental materials, it is possible that this predisposition is heightened

METAPHORICAL STRUCTURES: EMBODIED THINKING AND IMAGE SCHEMAS

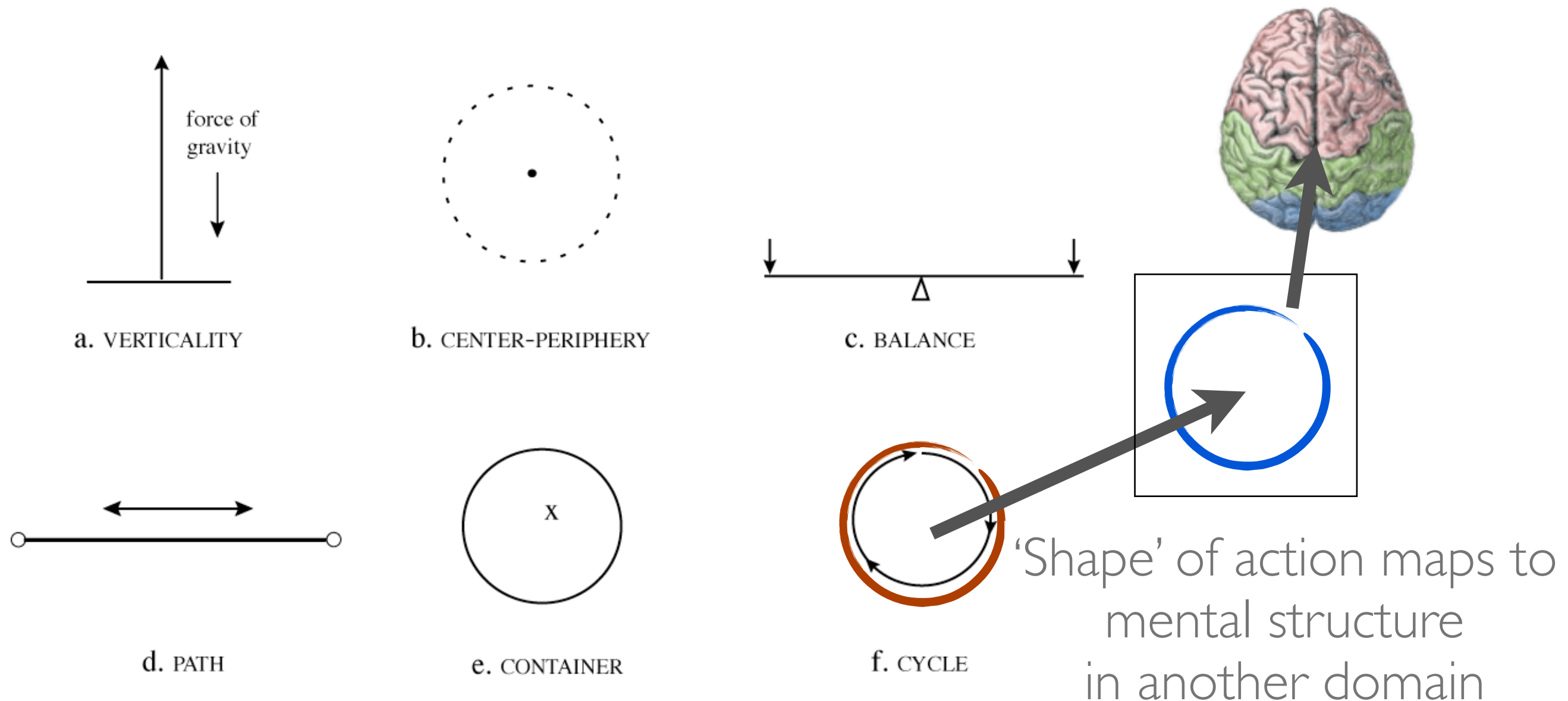


Fig. 9 Embodied image schemas

Image Schemas after Lakoff and Johnson

i.e. 'virtual action'

Conclusion

- ✦ **Musical/Sonic form** = **connecting sound events** so that our perceptual and memory systems can apprehend larger-scale structures
- ✦ **Three main levels of form: event** (and its texture), **localised chains of events** (short-term memory 'window') and **longer-term groupings** (hierarchies and **networks of events**)
- ✦ **Metaphorical mappings from our environment** (and our engagement with it) are powerful tools which support this type of activity

References (part I)

- Augoyard, J. and Torgue, H. 2005. *Sonic Experience*. Montreal: McGill–Queen’s University Press: a catalogue of sound effects and their reception.
- Norris, M. 2011. *Soundmagic Spectral*. [Software: audio plugins]: make sure you read the manual!
- Wishart, T. 1996. *On Sonic Art*. London: Routledge. [a PDF of some/all of this currently seems to be readily available online if you Google it]: a weighty text on sound-based composition

For some commentary/analysis on the composition examples/composers, see:

- <http://chambermusictoday.blogspot.co.uk/2009/04/outer-surfaces-of-seemingly-simple.html>
- <http://laughtersounds.wordpress.com/2013/06/21/stockhausen-analyzes-mantra/>
- <http://journalofmusic.com/focus/composition-vandalism>

References (part II)

- Smalley, D. 1997. Spectromorphology: Explaining Sound Shapes. *Organised Sound* 2(2). (to be supplied or in library e-journals)
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