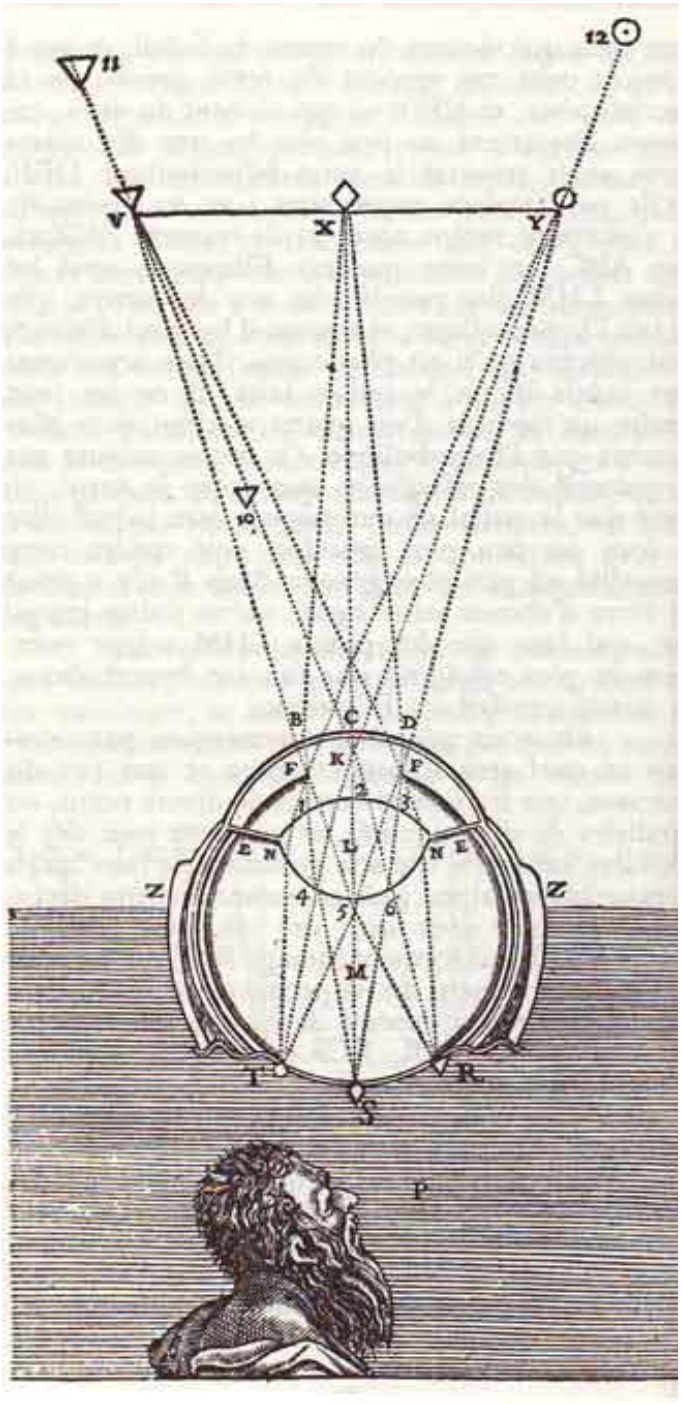
Time, music and mathematics

Wilfrid Hodges

Dartmoor, November 2009

http://wilfridhodges.co.uk/greenwichtime.pdf

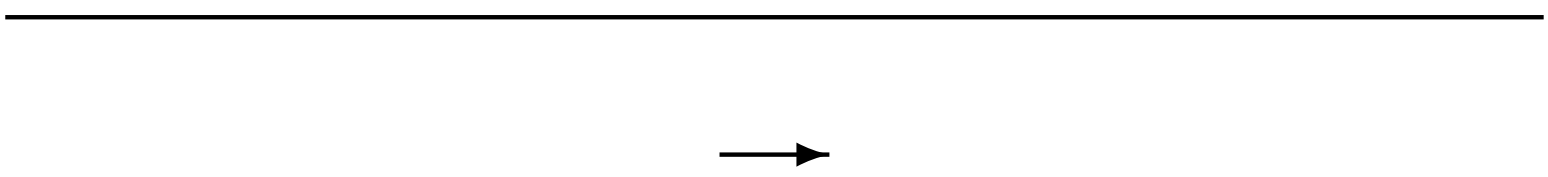


‘Time’

‘Ear’ (!)

Mathematician

Time looks like this:



Grasshopper warbler

(1) Events in time
(2) Rhythms and repeated events
(3) Hierarchies of rhythms
(4) Clash of rhythms
(5) Mixing time and space (pitch)

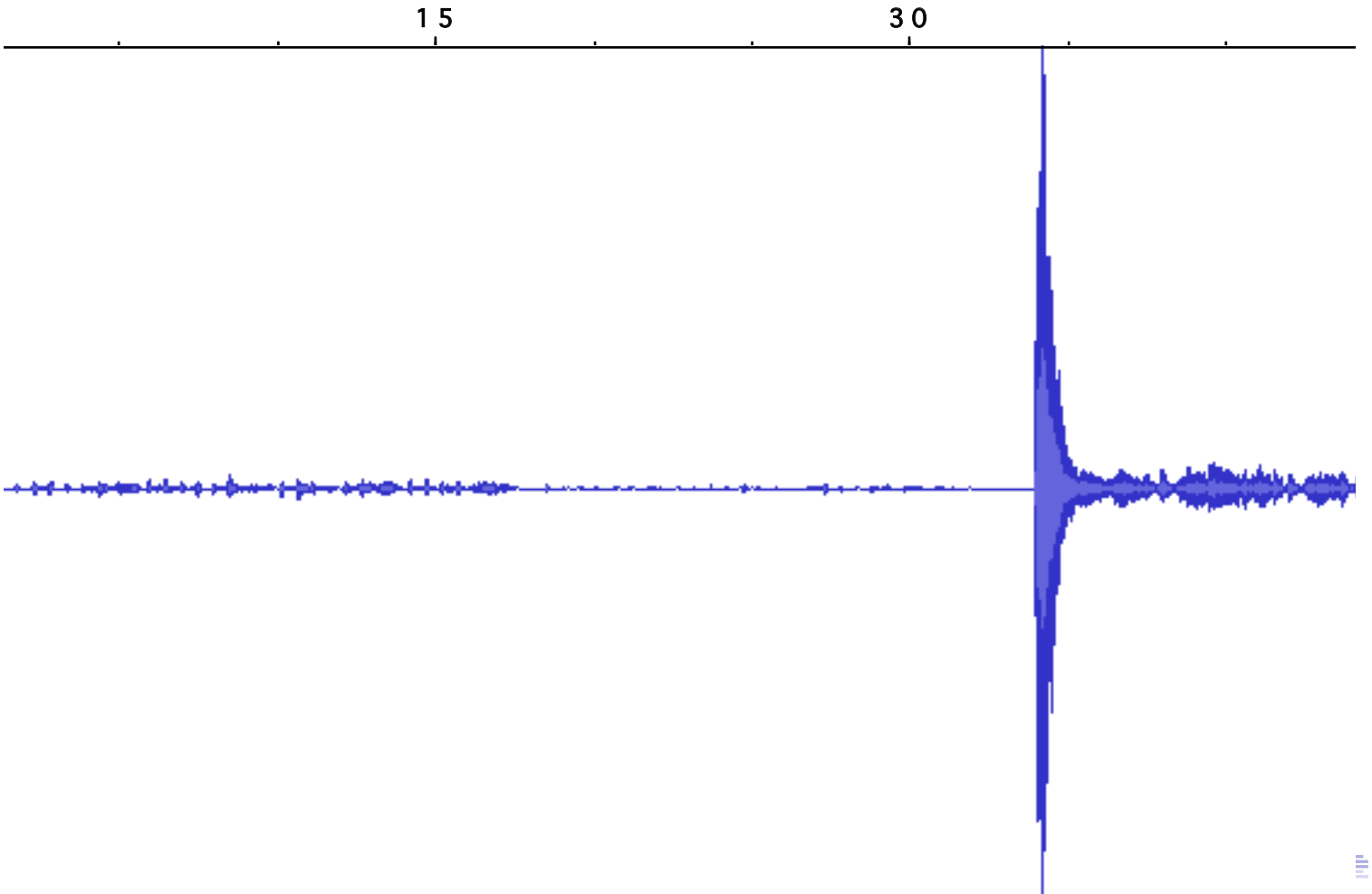
1. Events in time

Time only becomes interesting when an event occurs in it.

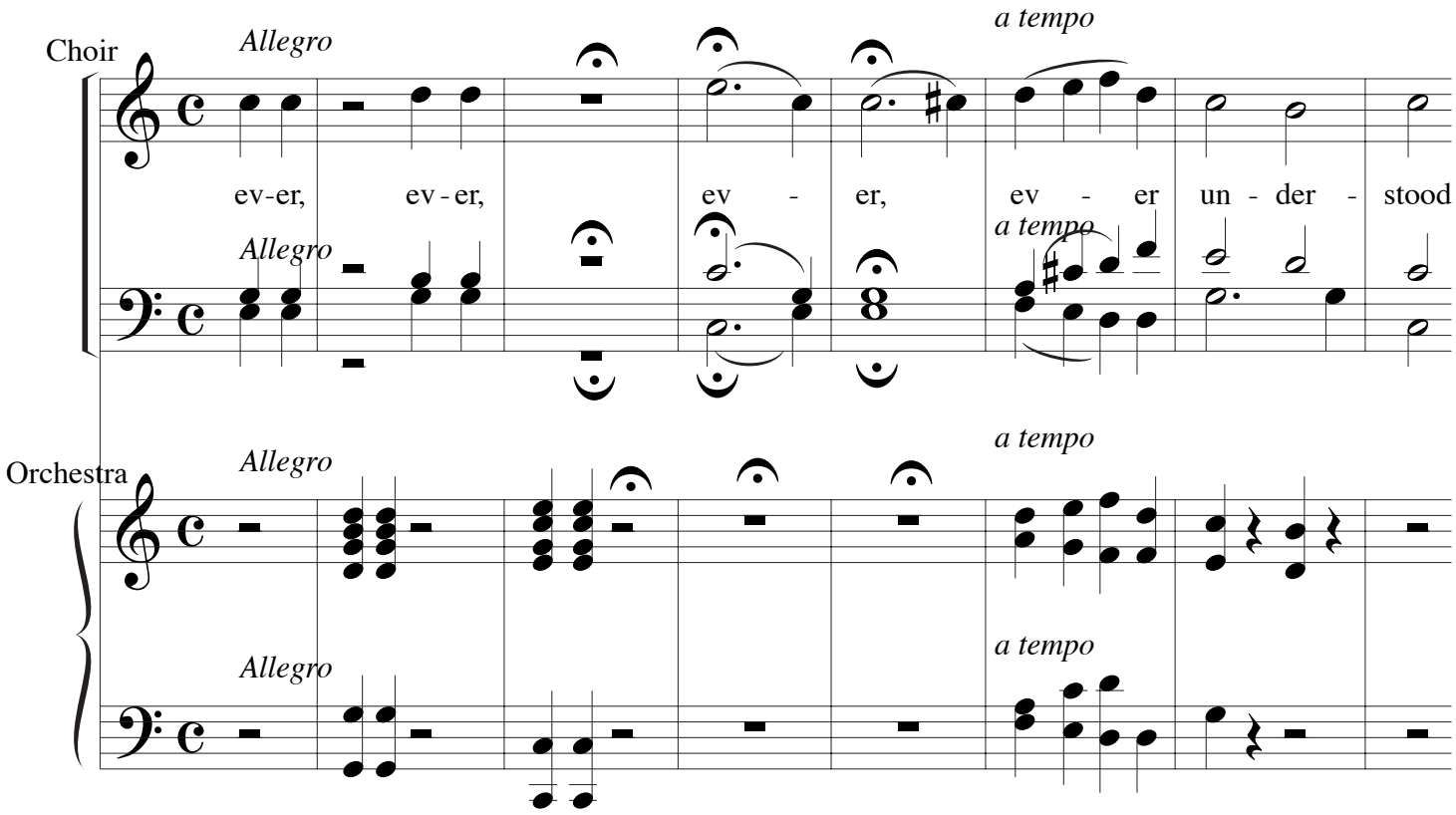
Three kinds of event:

(a) At a point.
(b) Over an interval, i.e. between two points.
(c) With a clear start (the ‘attack’) but no clear end.

(a) A point event (Haydn, 'Surprise Symphony')

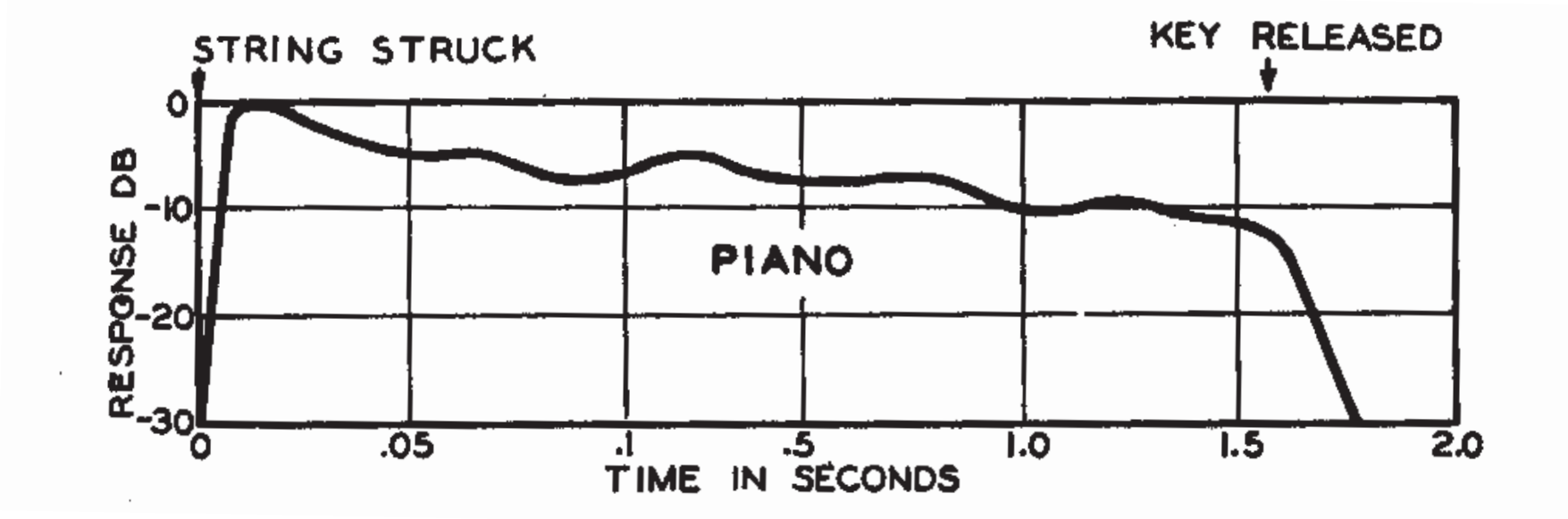


(b) An interval event (Haydn, 'The Creation')

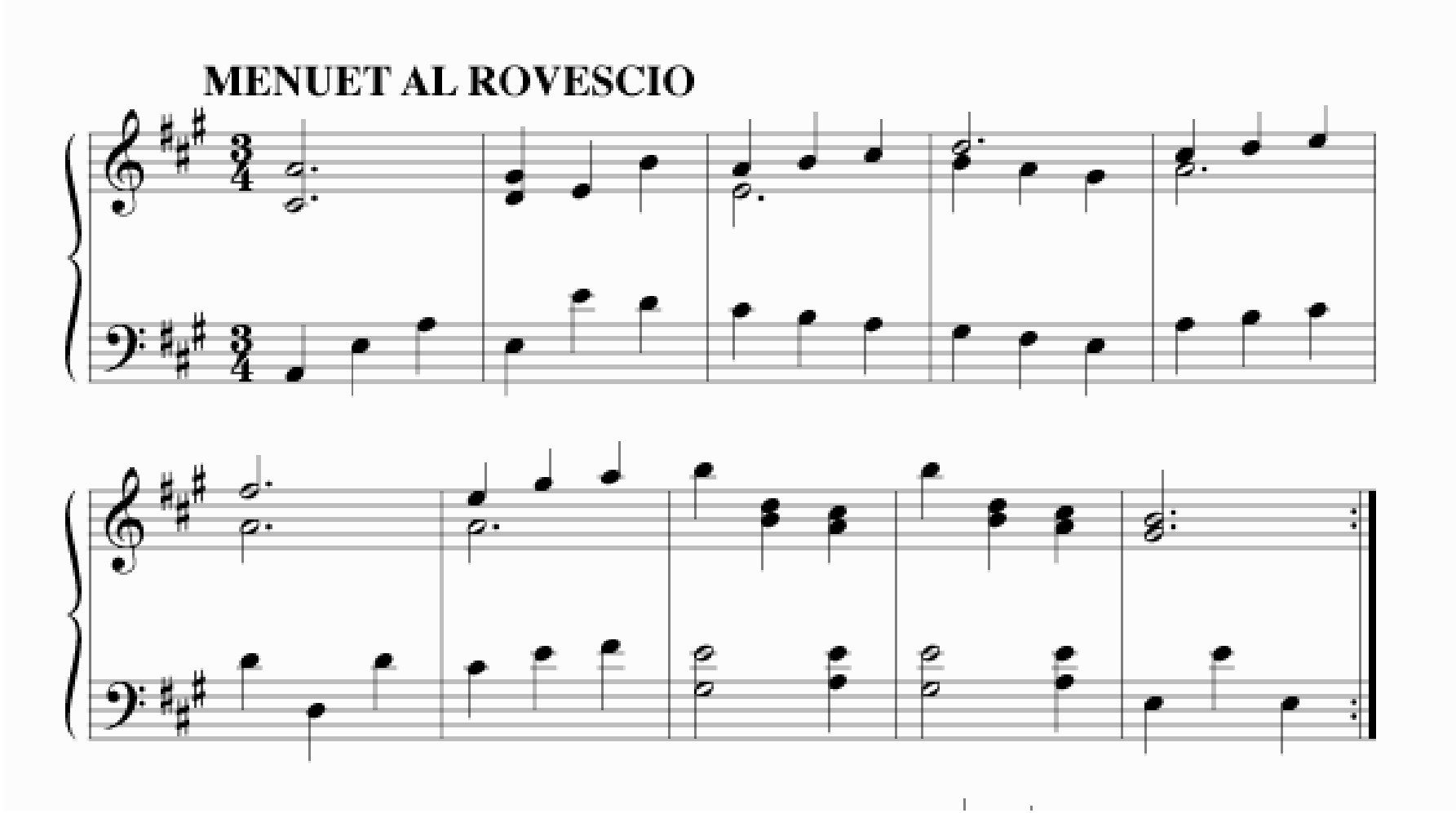


(c) An event with clear start but no clear end

A piano note

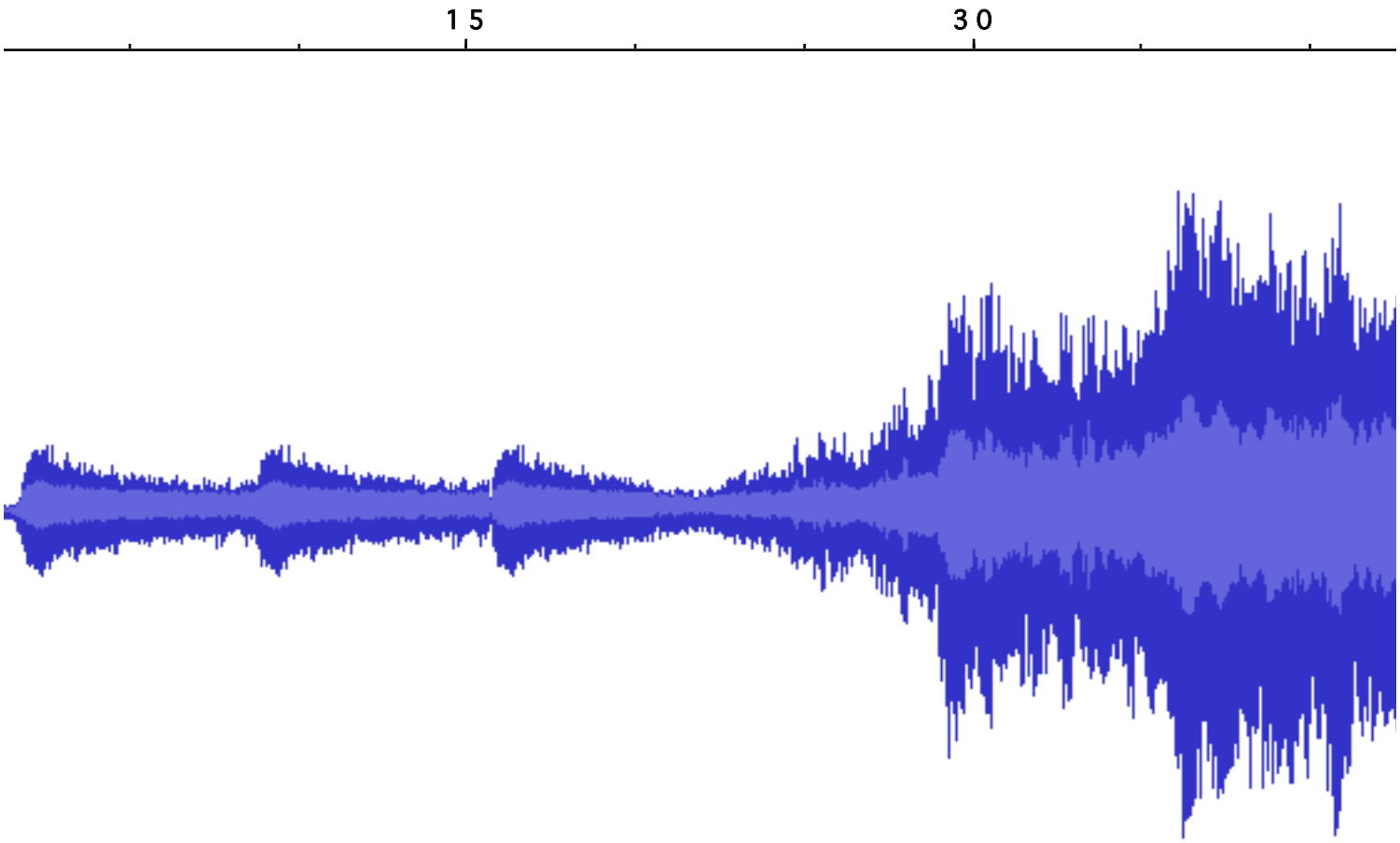


Haydn, ‘Minuet al Rovescio’

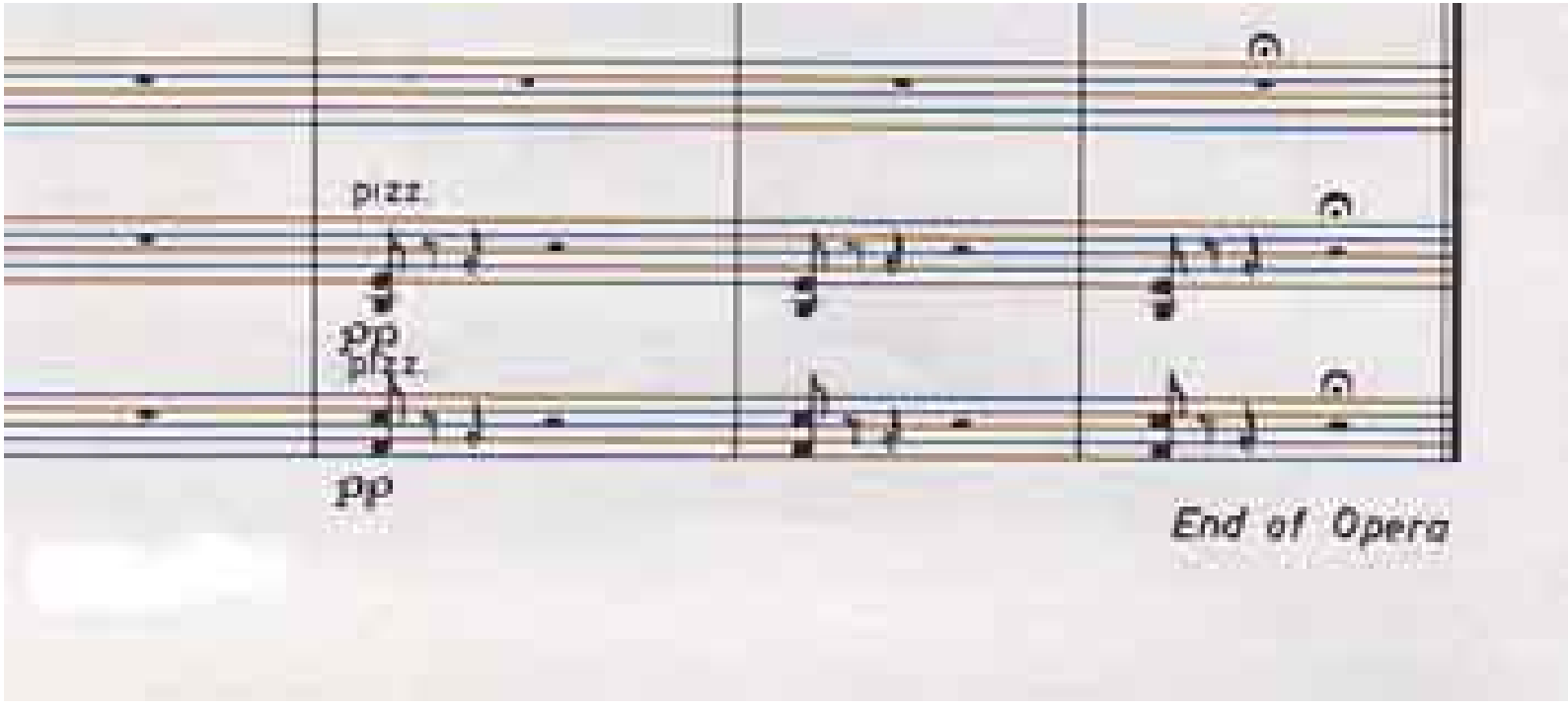


2. Rhythms and repeated events

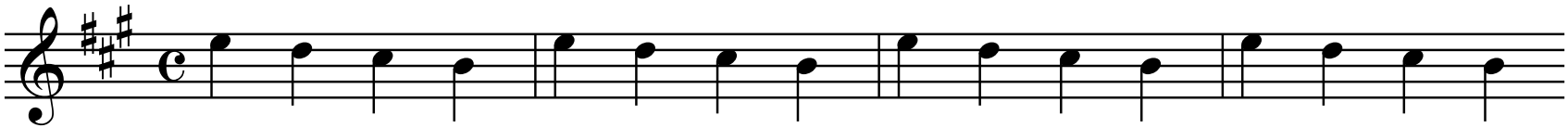
Pärt, ‘Cantus in Memoriam Benjamin Britten’



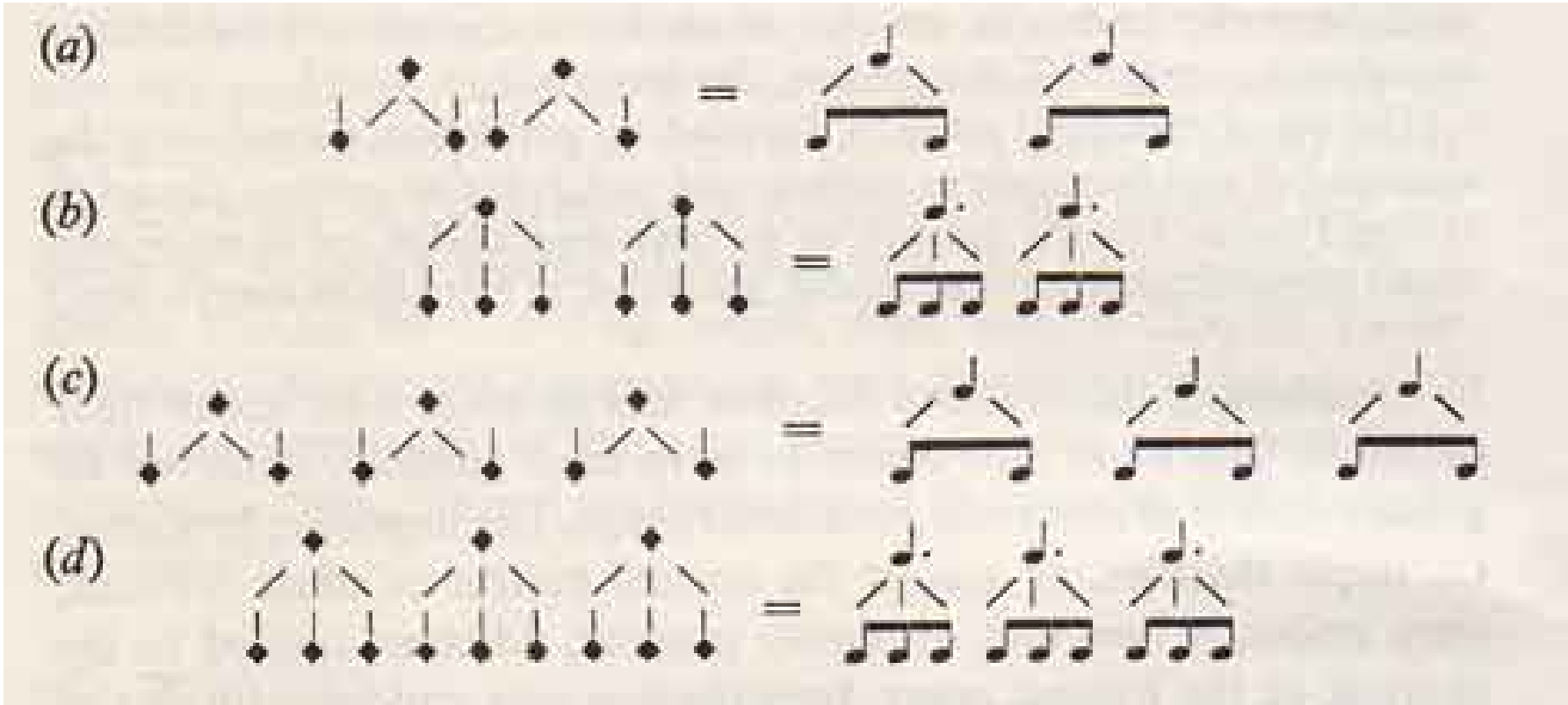
Dot-dot-dot in Britten ‘Peter Grimes’



Glinka, Finn's song in 'Ruslan and Lyudmila'



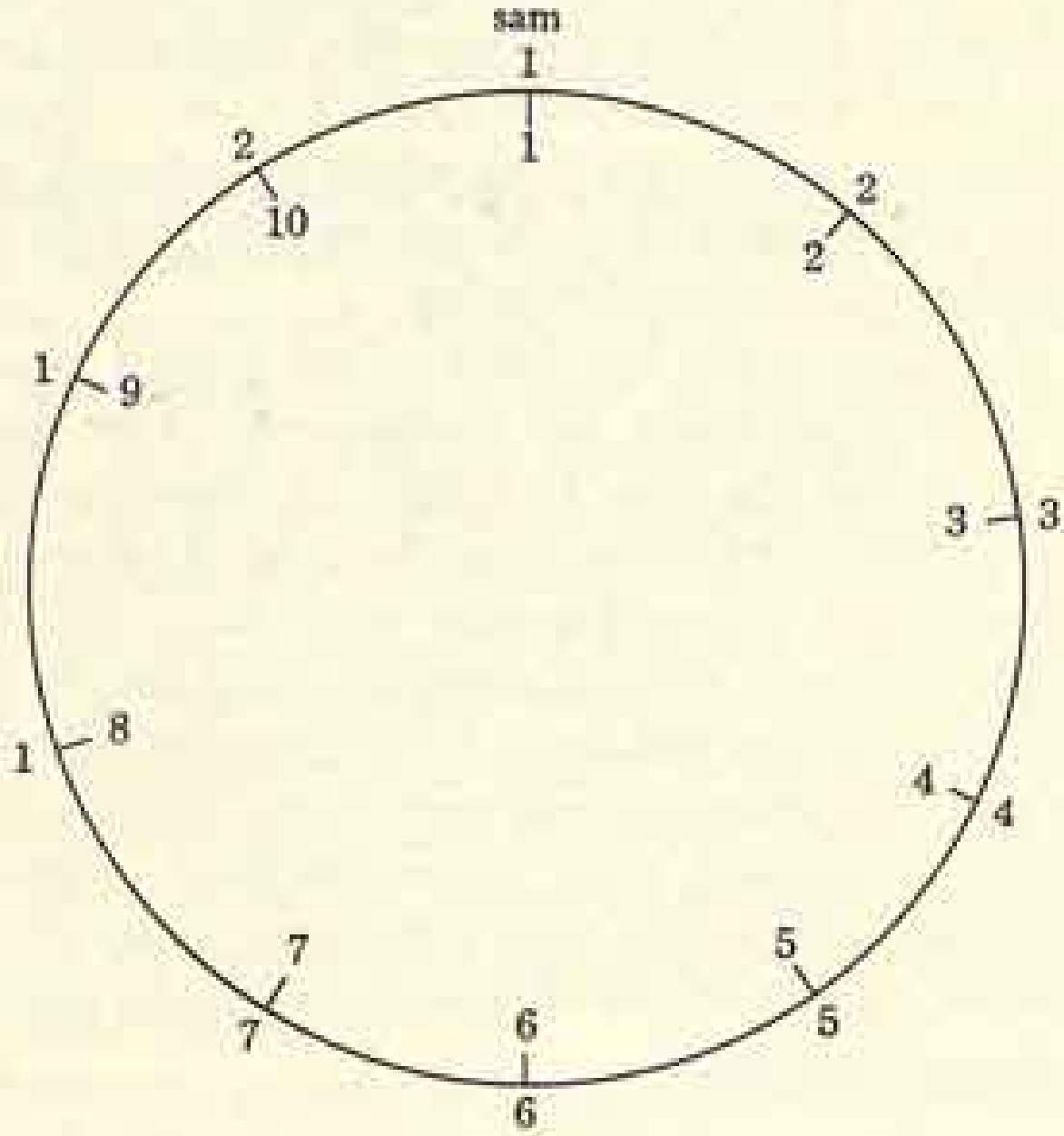
3. Hierarchies of rhythms



“Whichever art makes the greater use of perfection [i.e. dividing time into 3s] appears to be the more perfect.
But this is true of the ancient art. . . .
The new art has what it calls imperfect time [which divides time into 2s or 4s].”
Jacob of Liège, c. 1330.

Ravel, ‘String quartet’

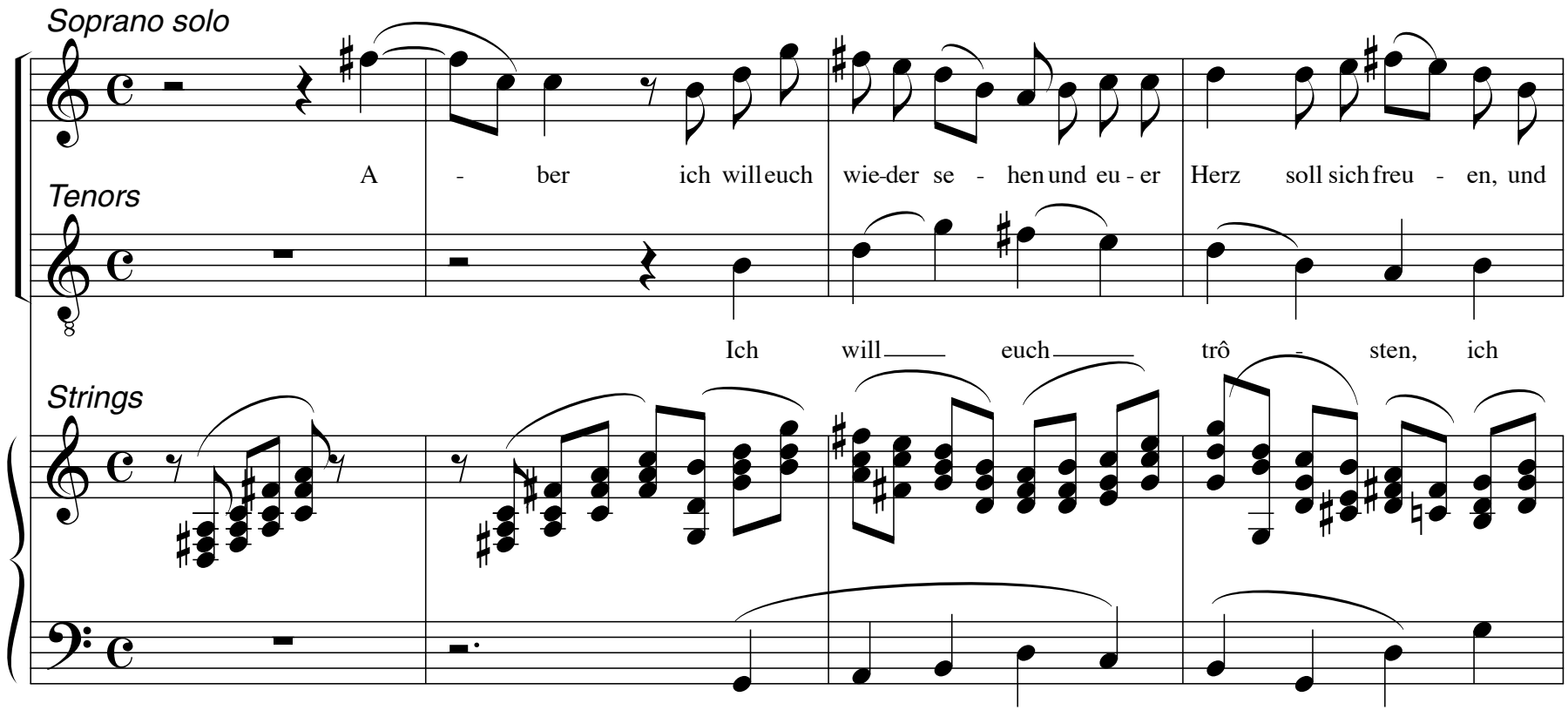
(Cf. Genesis, ‘Apocalypse in 9/8’.)



b. The Karnatak *jhampa tala*.

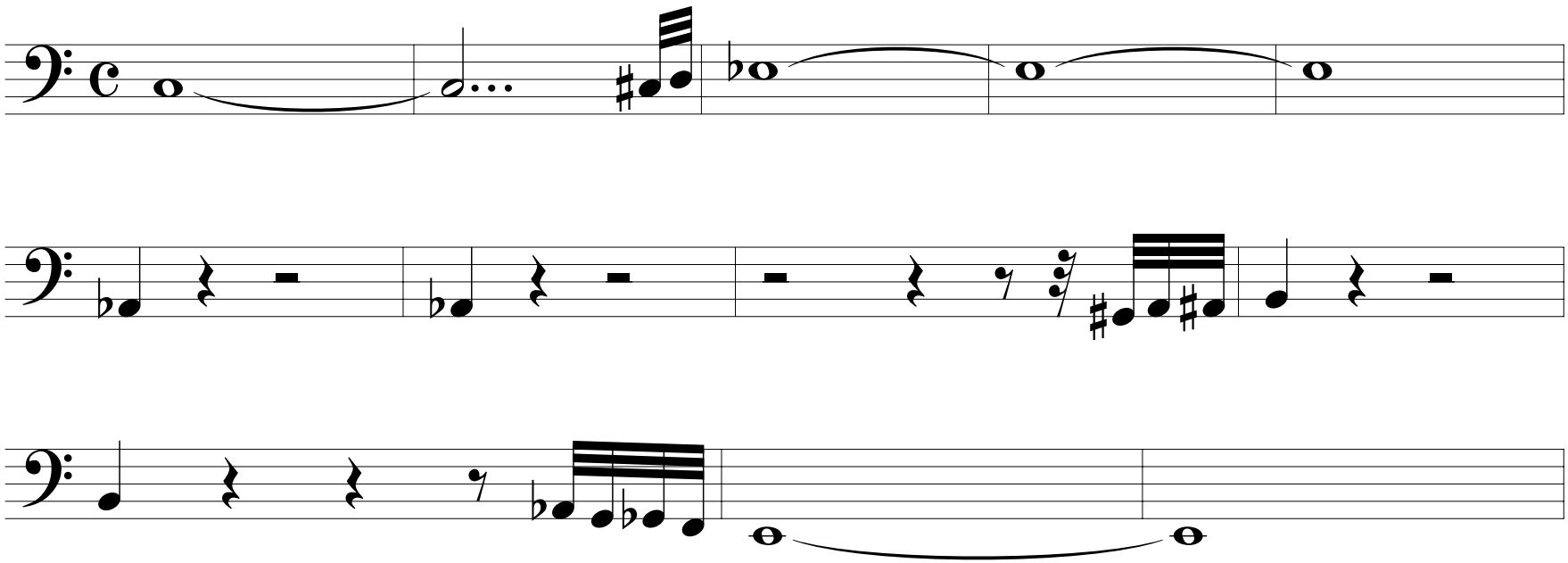
4. Clash of rhythms

Time ratio 1:2 (Brahms, 'Ein Deutsches Requiem')



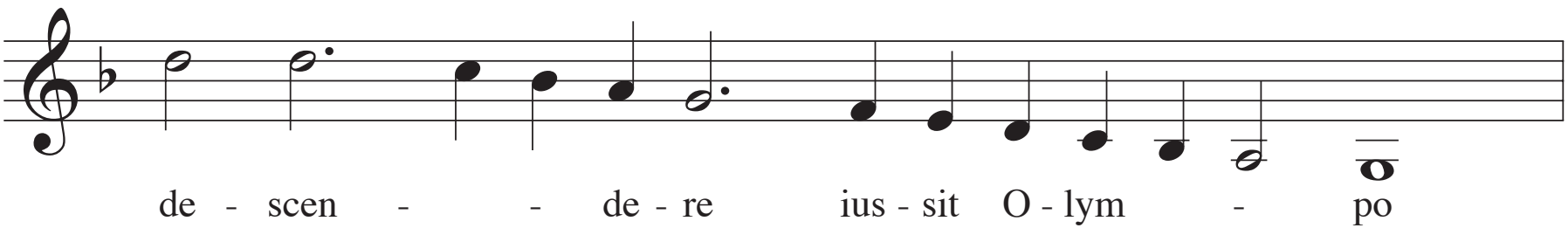
Time ratios 20:19:18:17:

Nancarrow, ‘Study 36 for player piano’



5. Mixing time and space (pitch)

Josquin Desprez (c. 1500), ‘Huc me sydereo’, represents a meteor shower



To read

J. Fauvel, R. Flood and R. Wilson (eds.), *Music and Mathematics: From Pythagoras to Fractals*, Oxford University Press 2003.

L. Harkleroad, *The Math behind the Music*, Cambridge University Press 2006.

Diagrams from G. Reaney in *The New Oxford History of Music* vol. III 1960;
W. Malm, *Music Cultures of the Pacific, The Near East, and Asia*, Prentice-Hall 1977;
and H. Olson, *Music, Physics and Engineering*, Dover 1977.

Music cited

- Johannes Brahms, Ein Deutsches Requiem, EMI Classics 1993.
- Josquin Desprez, Huc me sydereo, Archiv 2000.
- Mikhail Glinka, Ruslan and Lyudmila, Bolshoi 1978-9.
- Joseph Haydn, The Creation, Oiseau-Lyre 1990.
- Joseph Haydn, Piano sonata Hob.xvi.26, Auvidis Valois 1993.
- Joseph Haydn, Surprise Symphony, Brilliant Classics 2001.
- Inde du Nord, Girija Devi en concert, Harmonia Mundi 1995.
- Conlon Nancarrow, Studies for Player Piano 36, Wergo 1990.
- Arvo Pärt, Cantus in Memoriam Benjamin Britten, EMI Classics for Pleasure 2002.
- Maurice Ravel, String Quartet, Lindsay String Quartet, ASV 1995.