Chapter 12. Meeting 12, History: Iannis Xenakis

12.1. Announcements

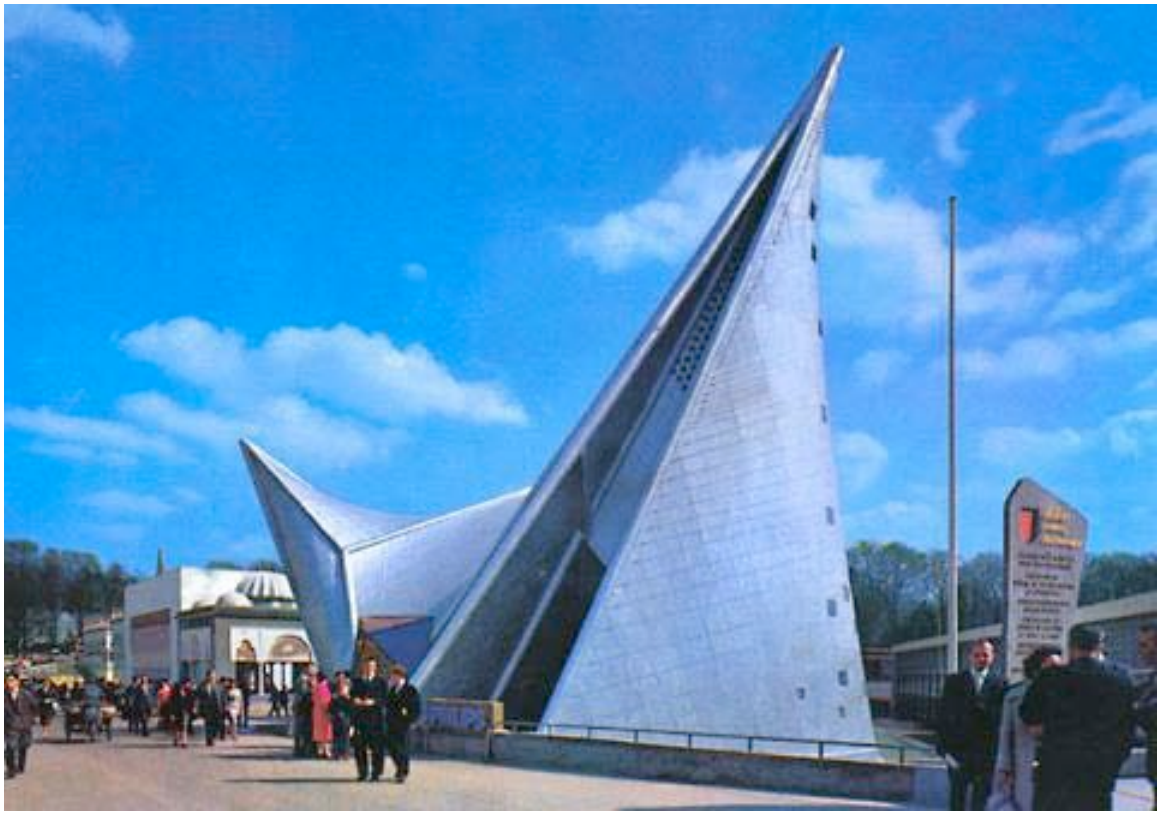
- Musical Design Report 3 due 6 April
- Start thinking about sonic system projects

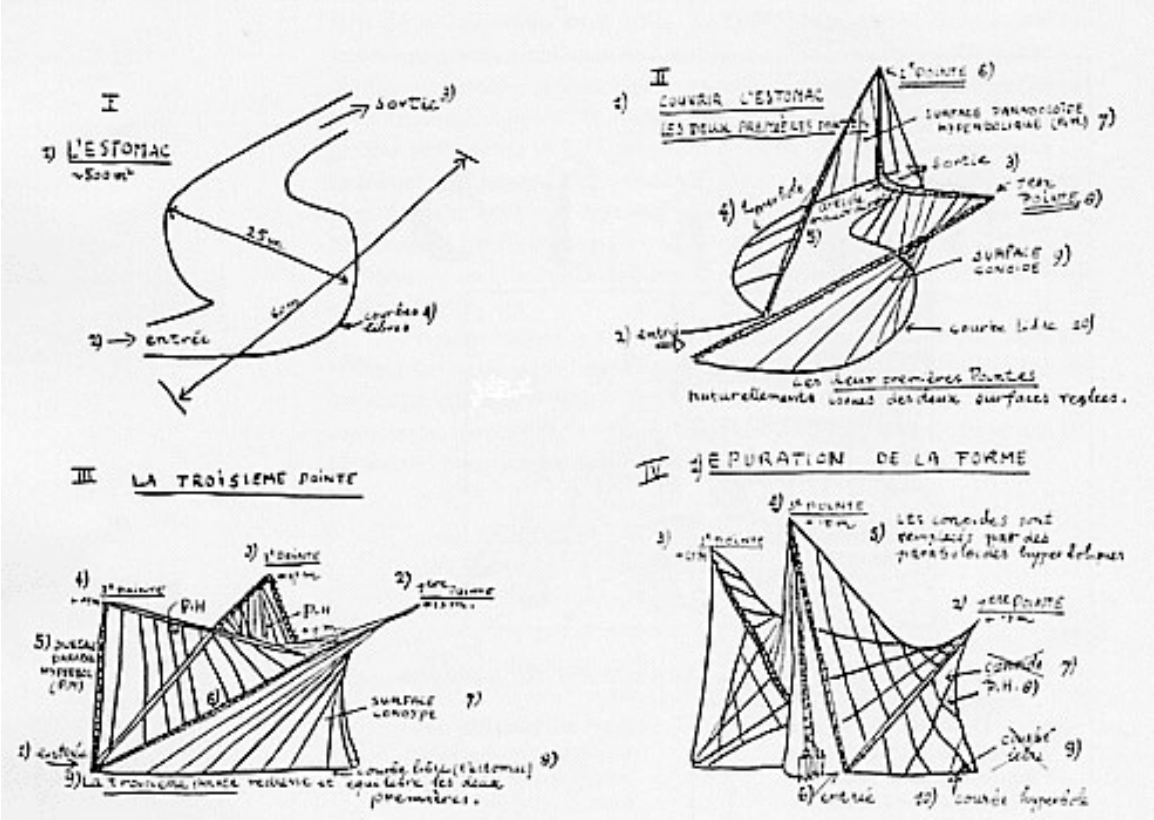
12.2. Quiz

- 10 Minutes

12.3. Xenakis: Background

- An architect, mathematician, music theorist, and composer
- 1958: Designed Philips Pavilion for Brussels Worlds Fair as assistant of Le Corbusier (1887-1965)





- Early tape music: Diamorphoses (1957), Concret PH (1958), Orient Occident (1960)
- Innovative early instrumental music based on geometries and procedures

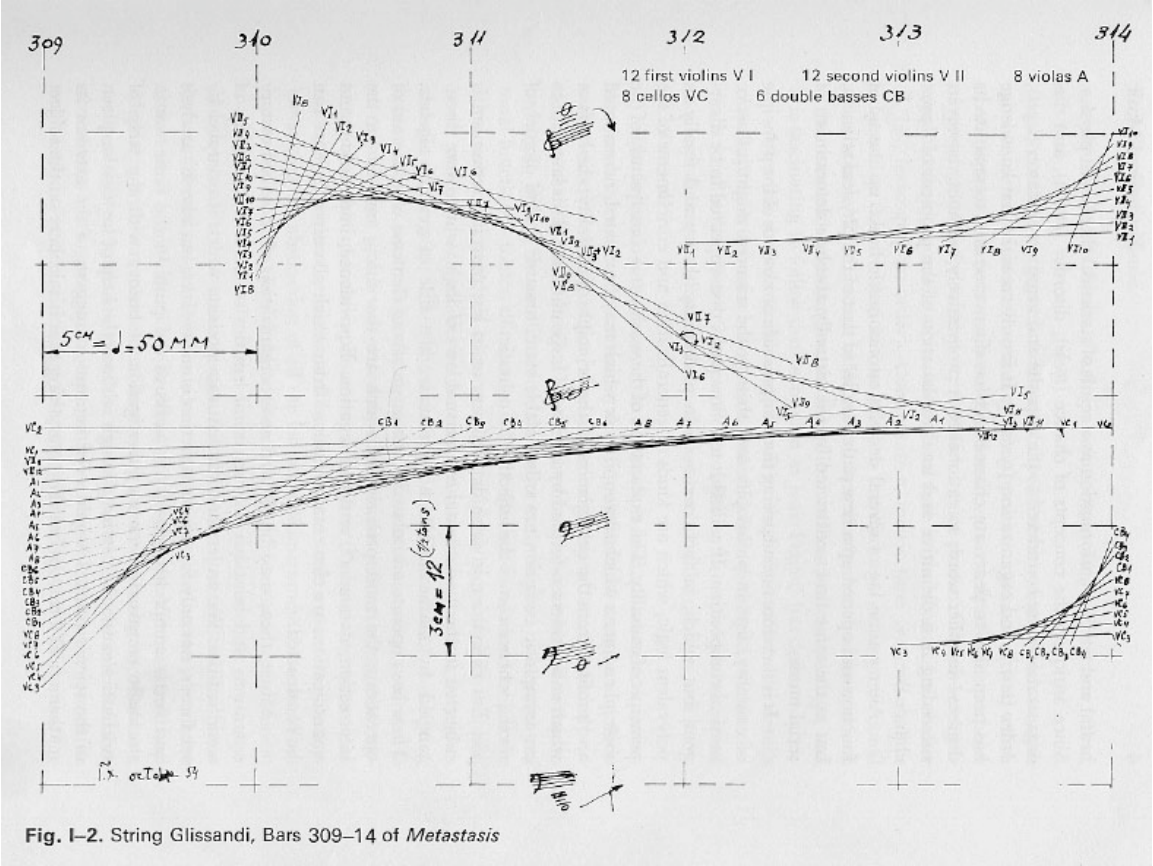


Fig. I–2. String Glissandi, Bars 309–14 of *Metastasis*

- Proposed models of granular synthesis after research of Gabor
- Proposed and developed a wide range of music technologies for creative applications

12.4. Xenakis: History

- Fought in Greek resistance to Nazi occupation during World War II
- Moved to France, began work with Le Corbusier, heard music of Schaeffer
- Studied composition with Olivier Messiaen
- 1955: "The Crisis of Serial Music" (Xenakis 1955)
- 1963: first edition of text *Formalized Music*
- 1967-1972: professor at Indiana University, Bloomington
- 1972: creates the Centre d'Etudes de Mathematiques et Automatiques Musicale (CEMAMu) near Paris
- 1972-1989: professor at Sorbonne University in Paris

12.5. Xenakis: Pithoprakta and Achorripsis

- *Pithoprakta* (1955-56) and *Achorripsis* (1956-57): composed with systems based on probability and statistics
- Employed techniques of "stochastic music": specify statistical trends, densities, and ranges rather then all note parameters
- A procedural approach to composition
- A response to the "Crisis of Serialism" (Xenakis 1955)
- "But other paths also led to the same stochastic crossroads -- first of all, natural events such as the collision of hail or rain with hard surfaces, or the song of cicadas in a summer field. These sonic events are made out of thousands of isolated sounds; this multitude of sounds, seen as a totality, is a new sonic event. This mass event is articulated and forms a plastic mold of time, which itself follows aleatory and stochastic laws." (Xenakis 1992, p. 9)

12.6. Listening: Xenakis

- Achorripsis, (1956-1957) [4:50 to 6:41]

12.7. Reading: Xenaxis, Xenakis on Xenakis

- Xenakis, I. 1987. "Xenakis on Xenakis." *Perspectives of New Music* 25(1-2): 16-63.
- What was Xenakis's early background in music and sound?
- Throughout his writings Xenakis talks about the pressures and problems of the Conservatory, Instruments, and Solfege: what is he referring to?
- Xenakis has particular relationship with the visual, graphical, and drawn approaches to thinking about music. Explain this relationship.
- In what ways does Xenakis imagine that technology will change the role of music in people's lives?

12.8. The Stochastic Music Program

- 1961: Xenakis gains access to an IBM 7090 at IBM France

Courtesy of IBM Corporate Archives. Used with permission.

- Programs the Stochastic Music Program (SMP) based on techniques used for *Achorripsis*
- System produces "score tables" that are transcribed into Western notation

JW= 1 A= 7.71 NA= 67 Q(I)=0.09/0.15/0.16/0.16/0.15/0.02/0.08/0.13/0.06/

N	TA	CLAS	INST	H	VIGL1	VIGL2	VIGL3	DUREE	DYNAM
1	0.	8	10	33.0	0.	0.	0.	0.	22
2	0.07	6	41	25.9	0.	0.	0.	13.94	54
3	0.09	9	1	60.7	0.	0.	0.	3.98	15
4	0.14	3	4	20.6	0.	0.	0.	0.89	1
5	0.24	3	2	50.1	0.	0.	0.	1.20	36
6	0.28	7	28	48.7	0.	0.	0.	0.	54
7	0.33	7	25	47.2	0.	0.	0.	0.	9
8	0.40	8	40	33.0	0.	0.	0.	0.	11
9	0.54	5	34	26.4	-8.0	-10.0	-6.0	4.72	53
10	0.68	8	38	24.1	0.	0.	0.	0.	54
11	0.72	2	5	42.0	0.	0.	0.	1.39	22
12	0.83	4	3	43.4	0.	0.	0.	1.60	15
13	0.85	2	4	58.3	0.	0.	0.	1.59	56
14	0.98	4	3	34.0	0.	0.	0.	1.76	55
15	1.23	4	2	42.0	0.	0.	0.	0.74	44
16	1.26	2	6	43.4	0.	0.	0.	2.12	15
17	1.28	3	2	61.9	0.	0.	0.	1.70	2
18	1.30	2	3	55.7	0.	0.	0.	0.29	38
19	1.34	2	3	58.1	0.	0.	0.	2.97	13
20	1.35	8	5	64.4	0.	0.	0.	0.	31
21	1.37	3	2	41.4	0.	0.	0.	0.	22
22	1.52	4	2	49.8	0.	0.	0.	0.02	53
23	1.59	5	32	46.7	-13.0	14.0	-11.0	4.10	25
24	1.63	7	28	44.7	0.	0.	0.	0.	7
25	1.68	6	38	41.5	0.	0.	0.	13.68	41
26	1.73	4	4	40.9	0.	0.	0.	0.66	13
27	1.73	2	6	18.4	0.	0.	0.	0.64	32
28	1.83	8	33	28.6	0.	0.	0.	0.	46
29	1.86	3	1	61.1	0.	0.	0.	0.79	14
30	1.95	2	3	40.1	0.	0.	0.	2.34	48
31	2.07	3	2	41.2	0.	0.	0.	1.21	9
32	2.19	1	4	0.	0.	0.	0.	8.63	56
33	2.33	5	16	47.8	-36.0	-24.0	-31.0	4.20	19
34	2.56	9	1	63.9	0.	0.	0.	1.84	54
35	2.61	5	22	67.6	-37.0	-50.0	31.0	12.97	41
36	2.67	8	46	23.4	0.	0.	0.	0.	33
37	2.75	4	1	67.9	0.	0.	0.	1.52	51
38	2.78	9	2	70.3	0.	0.	0.	6.06	6
39	2.92	4	4	25.1	0.	0.	0.	0.48	52
40	2.93	4	2	73.1	0.	0.	0.	1.02	25
41	2.98	7	42	25.9	0.	0.	0.	0.	43
42	3.08	4	2	54.7	0.	0.	0.	0.95	38
43	3.15	5	45	24.3	32.0	-20.0	26.0	5.78	60
44	3.17	5	43	38.4	21.0	-20.0	17.0	9.33	33
45	3.22	4	2	67.2	0.	0.	0.	0.34	60
46	3.22	8	41.	33.6	0.	0.	0.	0.	5
47	3.25	7	2	59.9	0.	0.	0.	0.	43
48	3.34	9	1	57.0	0.	0.	0.	2.50	47
49	3.52	1	7	0.	0.	0.	0.	17.06	10
50	3.67	8	13	54.3	0.	0.	0.	0.	41

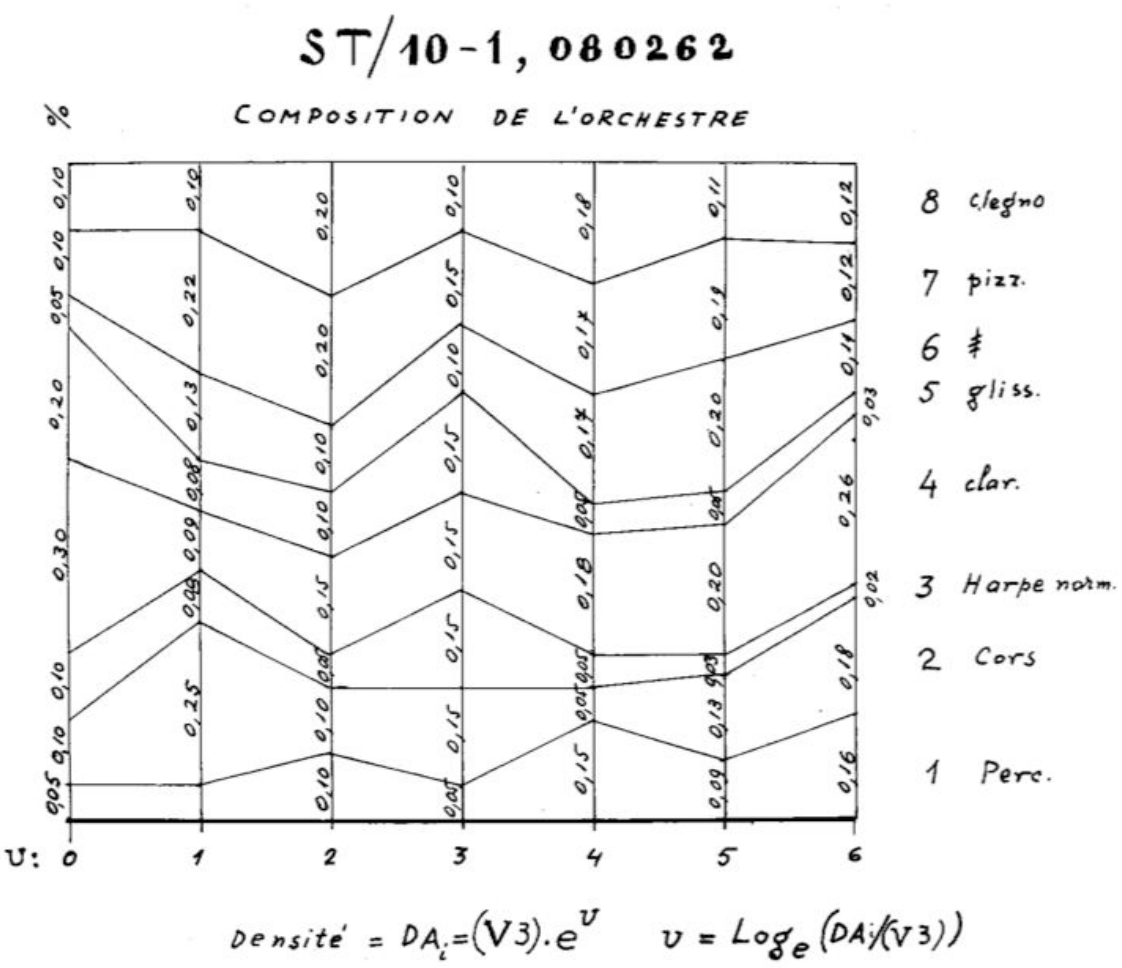
- 1962: *ST/10-1, 080262* (1956-1962) was premiered at IBM France
- Numerous related ST compositions were created
- 1965: Complete program, in Fortran, published and distributed (Xenakis 1965)

12.9. The Stochastic Music Program and Density

- Employed density as a compositional parameter at many levels
- Method

    1. Duration of each movement is determined
    2. The mean density of notes during a movement is calculated (in events per unit of time)

3. Percentage of events given to each timbre class is determined



Source: Xenakis (1971). © Scott Foresman/Pearson. All rights reserved. This content is excluded from our Creative Commons license. For more information, see http://ocw.mit.edu/fairuse.

4. For each event, the starting time point within the movement is calculated

5. From previously selected timbre classes, an instrument is chosen

6. A random chromatic pitch is chosen (as a shift of the instrument's previous note)

7. The duration of the note is determined based on an instrument-specific mean

8. The events dynamic contour is selected form a list of 44 options

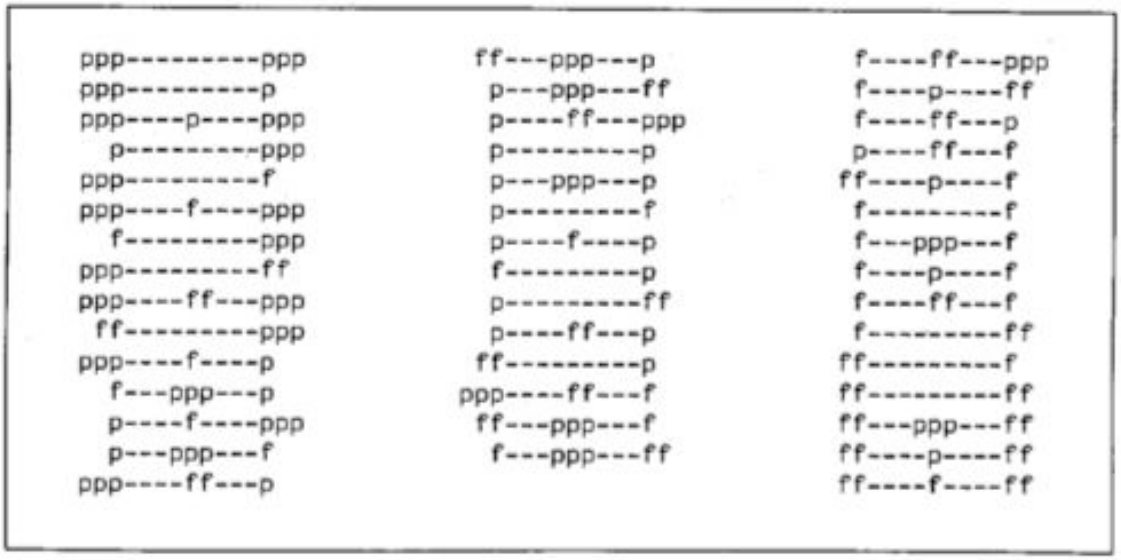


Fig. 56 Table of the 44 dynamic forms: a linear combination of 4 mean dynamic values, *ppp, p, f, ff*.

12.10. Listening: Xenakis

- Xenakis, ST-10, 1962
- Xenakis, Atrées, 1960

- Xenakis, ST-48, 1967
- Xenakis, ST-4

12.11. Reading: Xenaxis, Free Stochastic Music

- Xenakis, I. 1971. "Free stochastic Music." In *Cybernetics, art and ideas*. J. Reichardt, ed. Greenwich: New York Graphic Society. 124-142.
- Numerous publications include related/identical material
    - Xenakis, I. 1965. "Free Stochastic Music from the Computer. Programme of Stochastic music in Fortran." *Gravesaner Blätter* 26.
    - Xenakis, I. 1992. *Formalized Music: Thought and Mathematics in Music*. Indiana: Indiana University Press.

- How does Xenakis describe the public reaction to the use of computers in music?
- Xenakis describes mental mechanisms: are these just rules or mathematics?
- Xenakis imagines two new roles for contemporary composers: what are they?
- What are some of the advantages that Xenakis offers through the use of electronic brains?

12.12. Composing with Densities using TM TimeFill and a Noise Instrument

- TM LineGroove produces non-overlapping, linear events
- TM TimeFill will fill a time region with events, where position within the time span is determined by a ParameterObject
- Total number of events is determined by a ParameterObject
- Look at TM TimeSegment for a way to divide a texture into segments, each with independent fill densities
- Command sequence:
  - emo cn
  - tmo tf
  - tin a 80
  - tie t 0,30
  - *total event count is defined as static texture parameter, not a ParameterObject*

    tie s3 600
  - *start position within texture normalized within unit interval*

    tie d0 rb,.3,.3,0,1
  - *durations are independent of start time*

    tie r cs,(mv,a{.01}b{1.5}c{3}:{a=20|b=1|c=1})
  - *must reduce amplitudes*

    tie a ru,.5,.9
  - eln; elr; elh

12.13. Composing with Densities using TM TimeFill and a Single Sample

- Total number of events is determined by the combination of two ParameterObjects with IterateCross
- Command sequence:
  - emo cn
  - tmo tf
  - tin a 32
  - *set a file path to an audio file*

    tie x6 cf,/Volumes/xdisc/_sync/_x/src/martingale/martingale/audio/27980-high-slow.aif
  - *start position within audio file in seconds*

    tie x5 ru,0,1
  - *vary a low pass filter start and end frequencies*

    tie x2 mv,a{200}b{1000}c{10000}:{a=6|b=2|c=1}

    tie x3 mv,a{200}b{1000}c{10000}:{a=6|b=2|c=1}
  - *total event count is defined as static texture parameter, not a ParameterObject*

    tie s3 500
  - *start position within texture normalized within unit interval*

    tie d0 ic,(rg,.2,.1,0,1),(rg,.7,.1,0,1),(bg,rc,(0,1))
  - *durations are independent of start time*

    tie r cs,(whps,e,(bg,rp,(5,10,15)),0,.010,.100)
  - *must reduce amplitudes*

    tie a ru,.1,.3
  - eln; elr; elh

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