A Few More Words on Jim Tenney:
The Dissonant Counterpoint Algorithm

Examples

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February 9, 2008

"Carl Ruggles has developed a process for himself in writing melodies for polyphonic purposes which embodies a new principle and is more purely contrapuntal than a consideration of harmonic intervals. He finds that if the same note is repeated in a melody before enough notes have intervened to remove the impression of the original note, there is a sense of tautology, because the melody should have proceeded to a fresh note instead of to a note already in the consciousness of the listener. Therefore Ruggles writes at least seven or eight different notes in a melody before allowing himself to repeat the same note, even in the octave."

Henry Cowell, *New Musical Resources*, 1930. Part 1, Section 4: "Dissonant Counterpoint" (pp. 41-42)

"Along with backtracking, statistical feedback is probably the most pervasive technique used by my composing programs. As contrasted with random procedures which seek to create unpredictability or lack of pattern, statistical feedback actively seeks to bring a population of elements into conformity with a prescribed distribution. The basic trick is to maintain statistics describing how much each option has been used in the past and to bias the decisions in favor of those options which currently fall farthest short of their ideal representation"

Charles Ames, "Tutorial On Automated Composition," *Proceedings of the International Computer Music Conference*, Champaign-Urbana Illinois, 1987.

Statistical and Probabilistic Techniques (Selected Writings of Charles Ames)

1996. "Thresholds of Confidence: An Analysis of Statistical Methods for Composition: Part 2: Applications." *Leonardo Music Journal*. 6:21–26.
1995. Thresholds of Confidence: An Analysis of Statistical Methods for Composition, Part 1: Theory." *Leonardo Music Journal*. 5: 33–38.
1993. "How to Level a Driver Sequence." *Leonardo Music Journal*. 3:45–52.
1992. "A Catalog of Sequence Generators." *Leonardo Music Journal*. 2:55–72.
1991. "A Catalog of Statistical Distributions: Techniques for Transforming Random, Determinate and Chaotic Sequences." *Leonardo Music Journal*. 1/1:55–70.
1990. "Statistics and Compositional Balance." *Perspectives of New Music*. 28/1: 80–111.
1987. "Automated Composition in Retrospect." *Leonardo*. 20/2:169–185.
1987. "Tutorial on Automated Composition." *Proceedings of the ICMC*, Urbana, Illinois.
1983. "Stylistic Automata in *Gradient*." *Computer Music Journal*. 7:4.

Randomly picking Yankees/Red Sox, 10 times

X X X X X X O O O O

A generalized finite state machine

$$x_n = f\left(x_{n-1}, x_{n-2}, x_{n-3}, x_{n-4}, \cdots x_0\right)$$

Very simple "history" function (pseudo-random number generator)

$$X_{n+1} = aX_n + b \ (mod\ k)$$

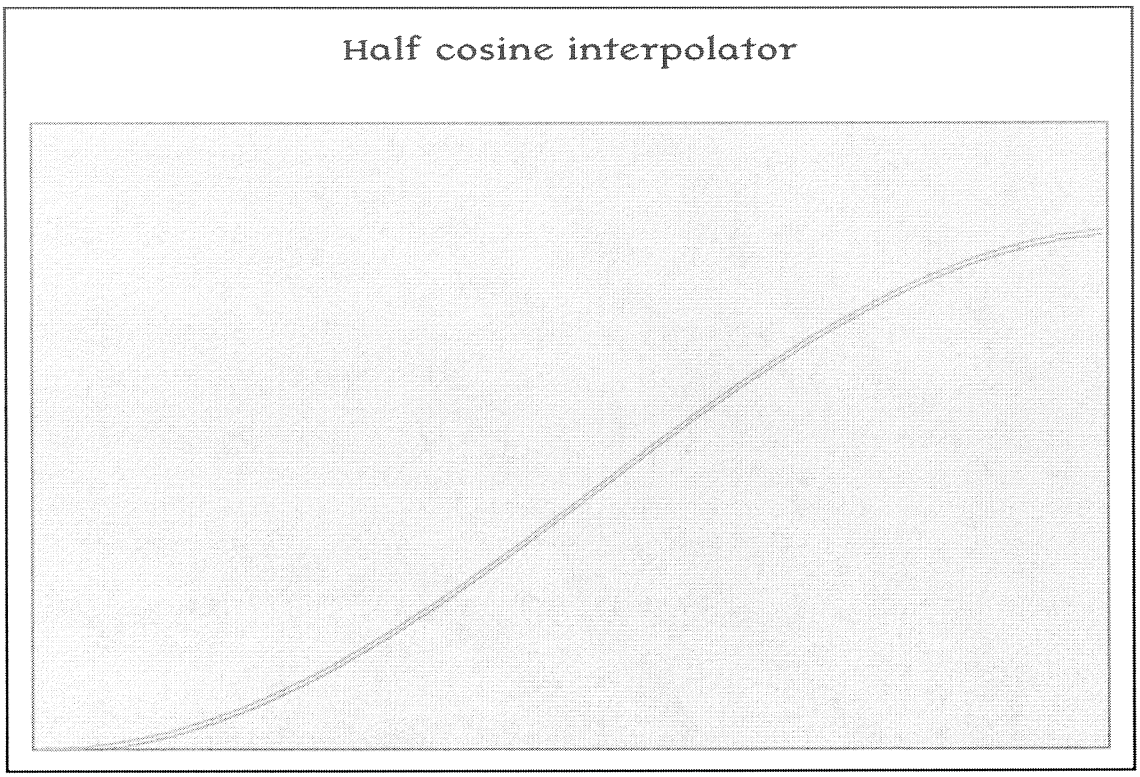
NOT a "history" function

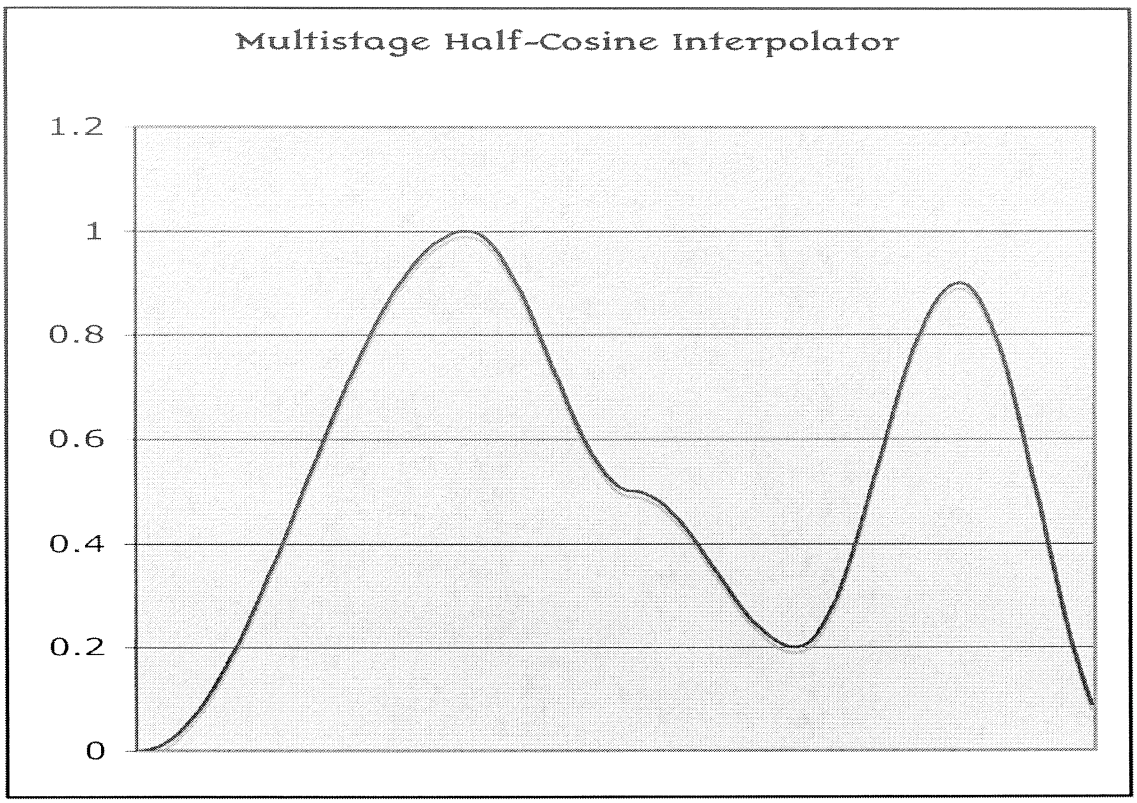
$$f(x) = x^2$$

Half-Cosine Interpolator (used in *Changes*)

$$v_t = \frac{v_1 + v_2}{2} + \frac{v_1 - v_2}{2} \cos\left(\pi * \frac{t - t_1}{t_2 - t_1}\right)$$

Tenney *half-cosine interpolation* Function
(Implemented in JMSL/Java)



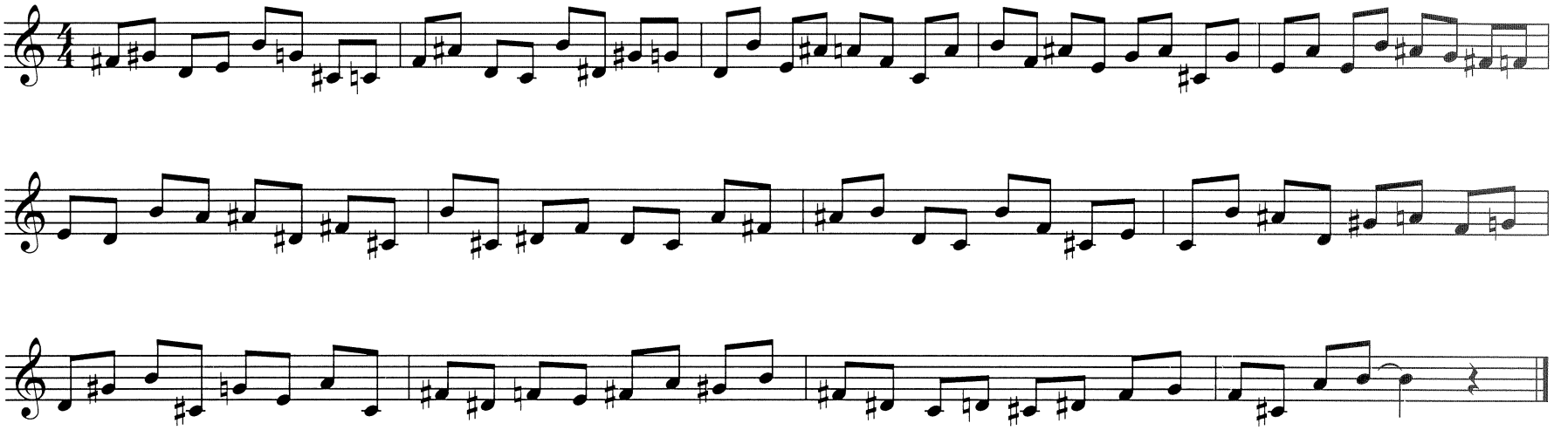

Multistage Half-Cosine Interpolator
1.2
1
0.8
0.6
0.4
0.2
0

Dissonant Counterpoint Algorithm Recipe (simplified)

1. Take N elements and associated probabilities p_n
2. Using a pseudo-random number generator, *pick an element*
3. Set the *selected* element's probability to *zero (or some very low value)*
4. *Increment* all other probabilities by some uniform or weighted amount
5. Pick *again*

Tenney: Dissonant Counterpoint Algorithm
("tenney mode" example)

(pitch classes in one octave)



A "Tenney mode," in this case, is a time-variant statistical distribution of pitch classes. When a pitch class is selected (stochastically), its probability drops to zero and increments gradually over subsequent notes.

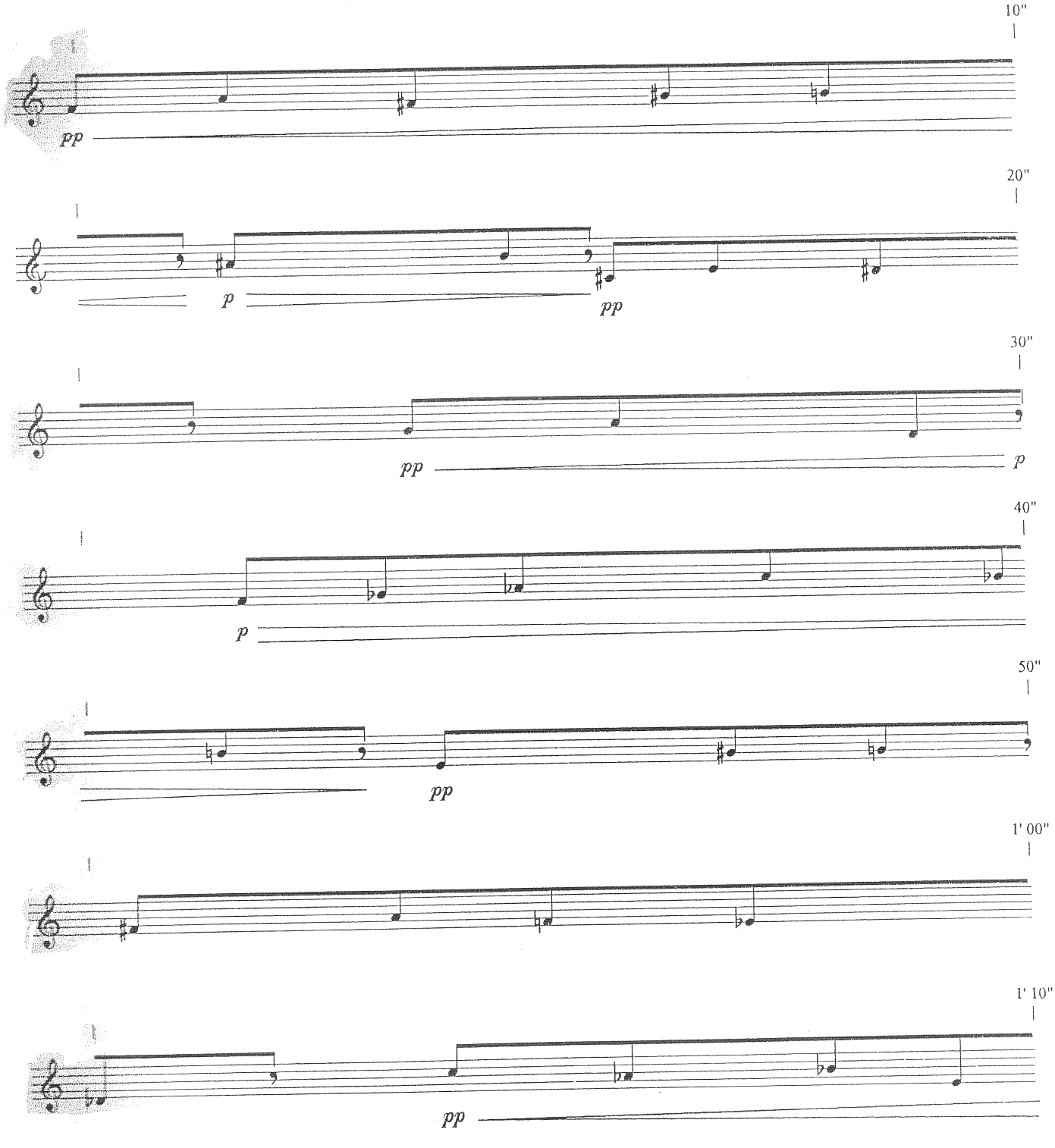
(This example is written in Java, using Nick Didkovsky's JMSL, and my probabilistic mode library.)

polansky
9/20/07

SEEGERSONG # 2
for solo flute or alto flute

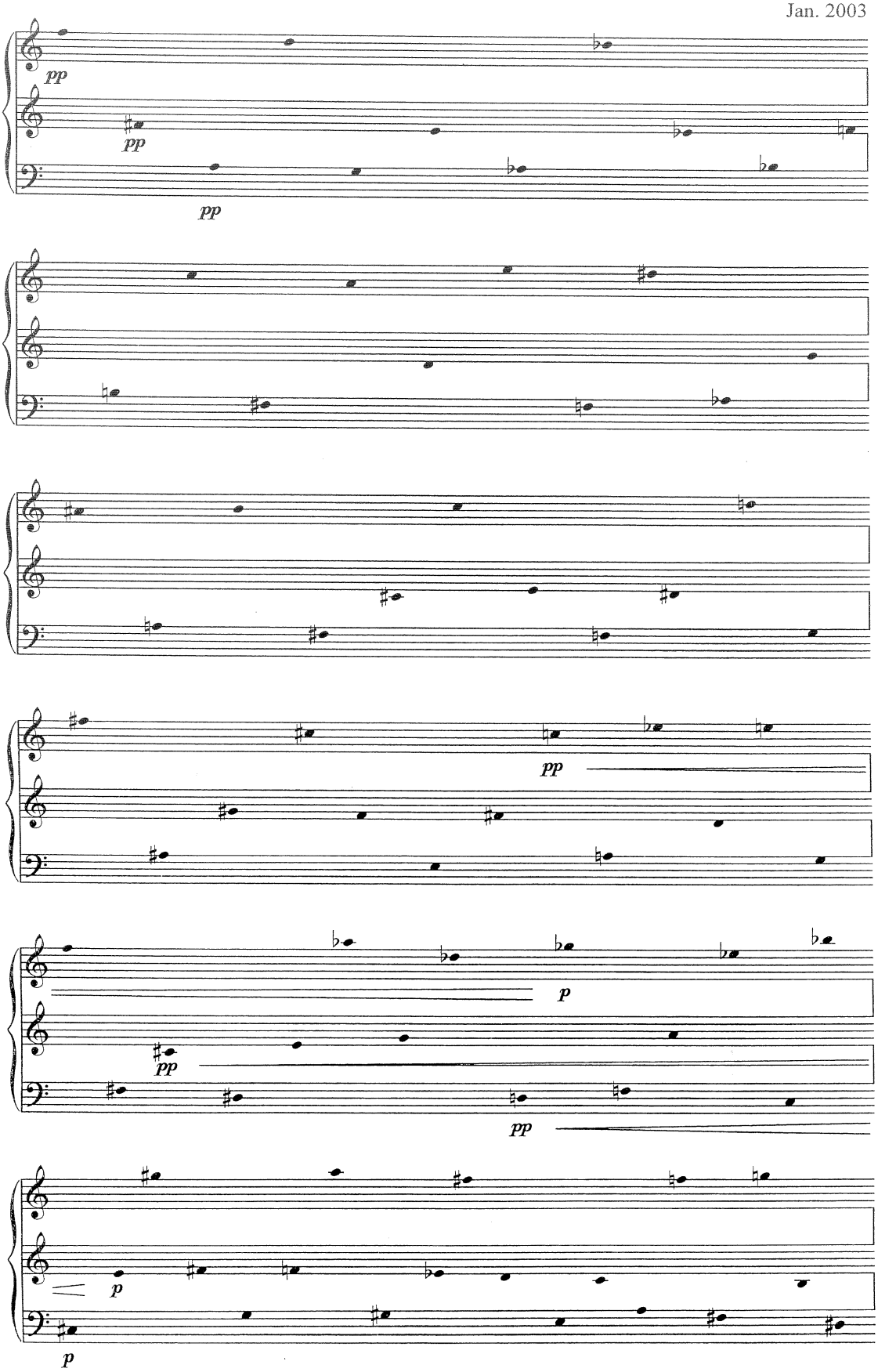
James Tenney

October 1999

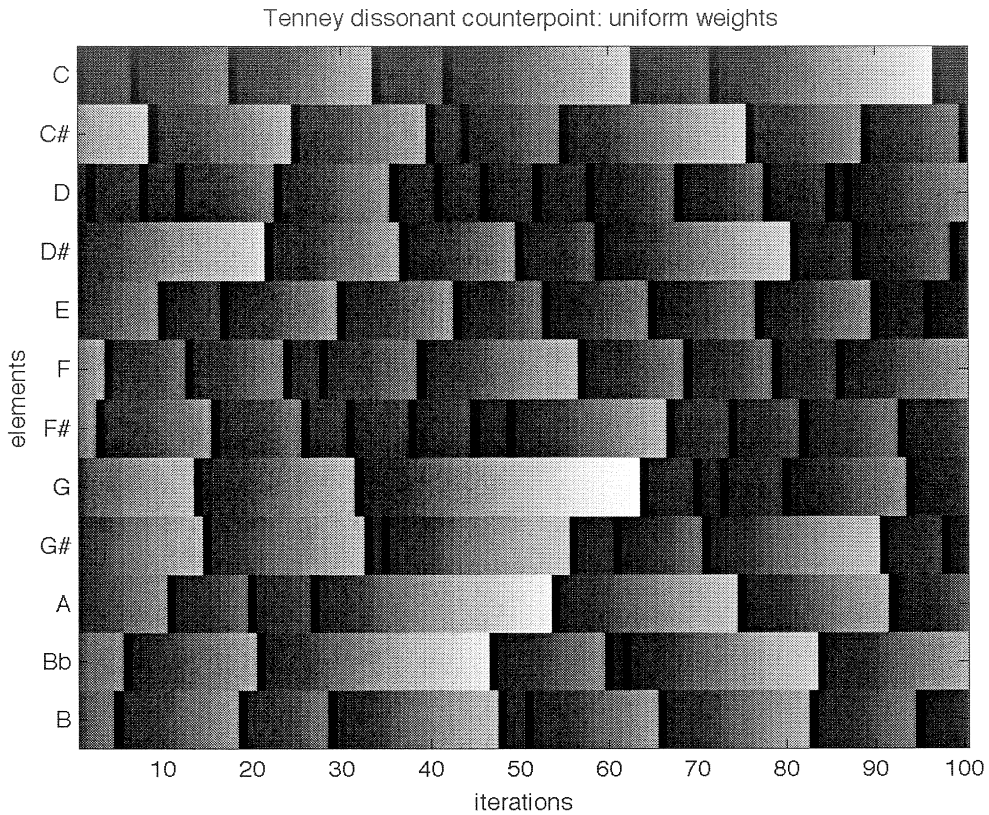


To Weave (a meditation)

James Tenney
Jan. 2003

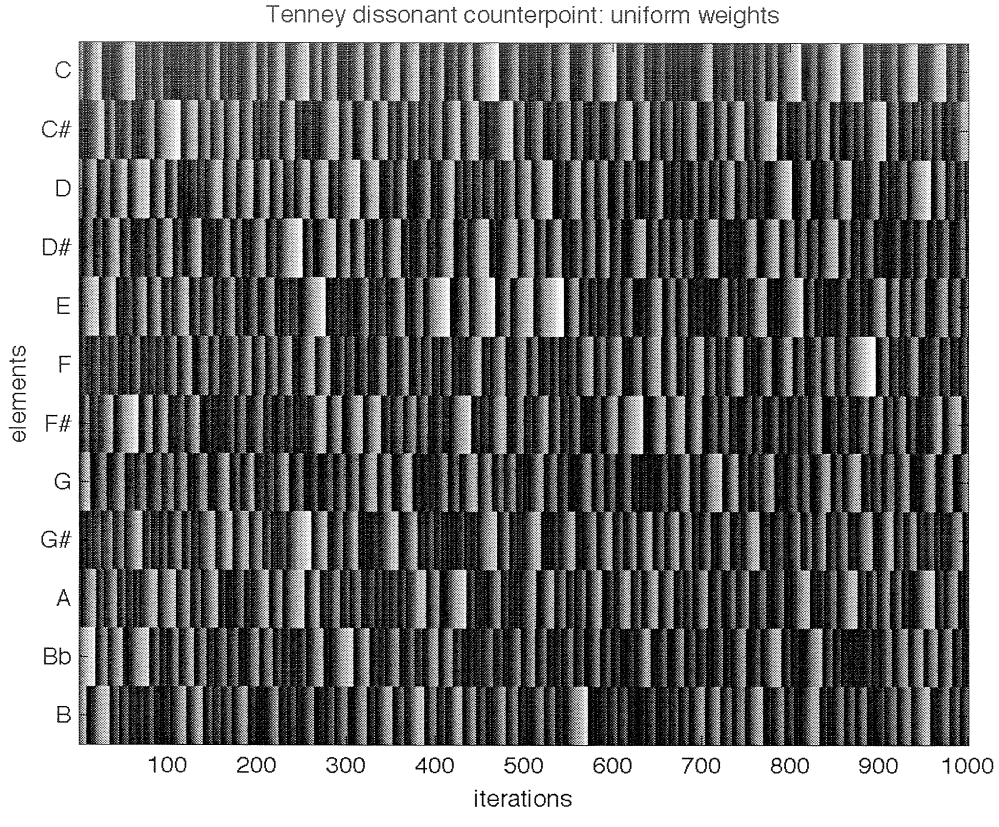


100 Trials (uniform weights)

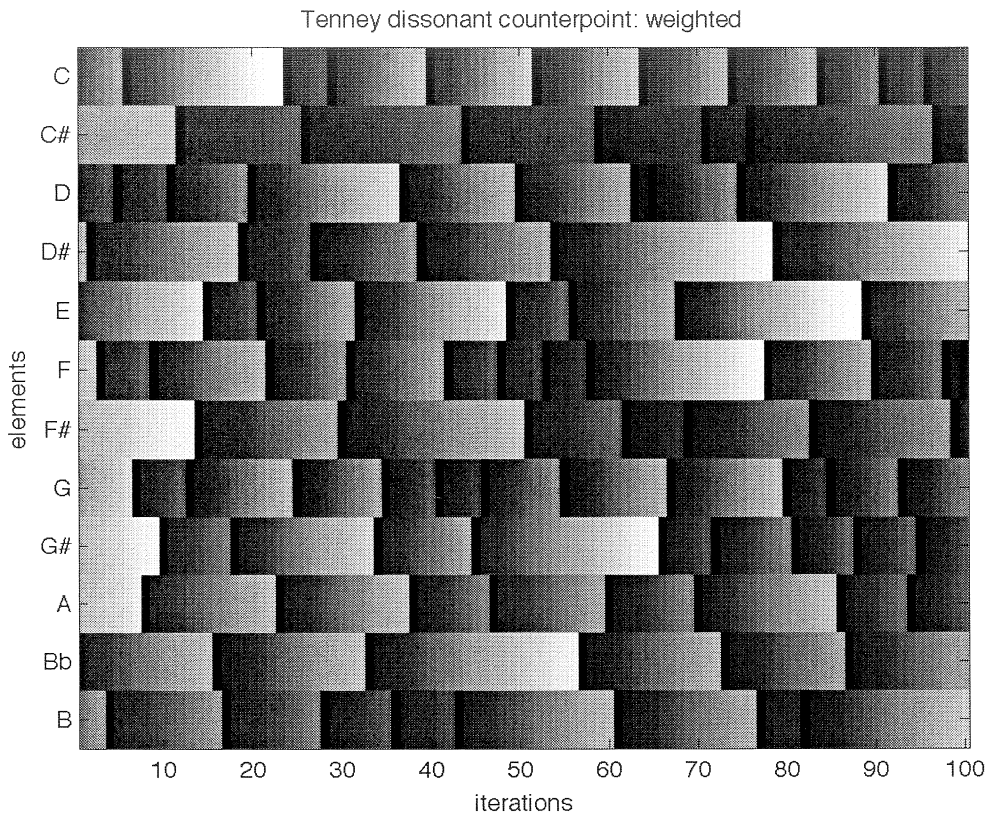


(The darker the color, the lower the probability. Edges indicate selection)

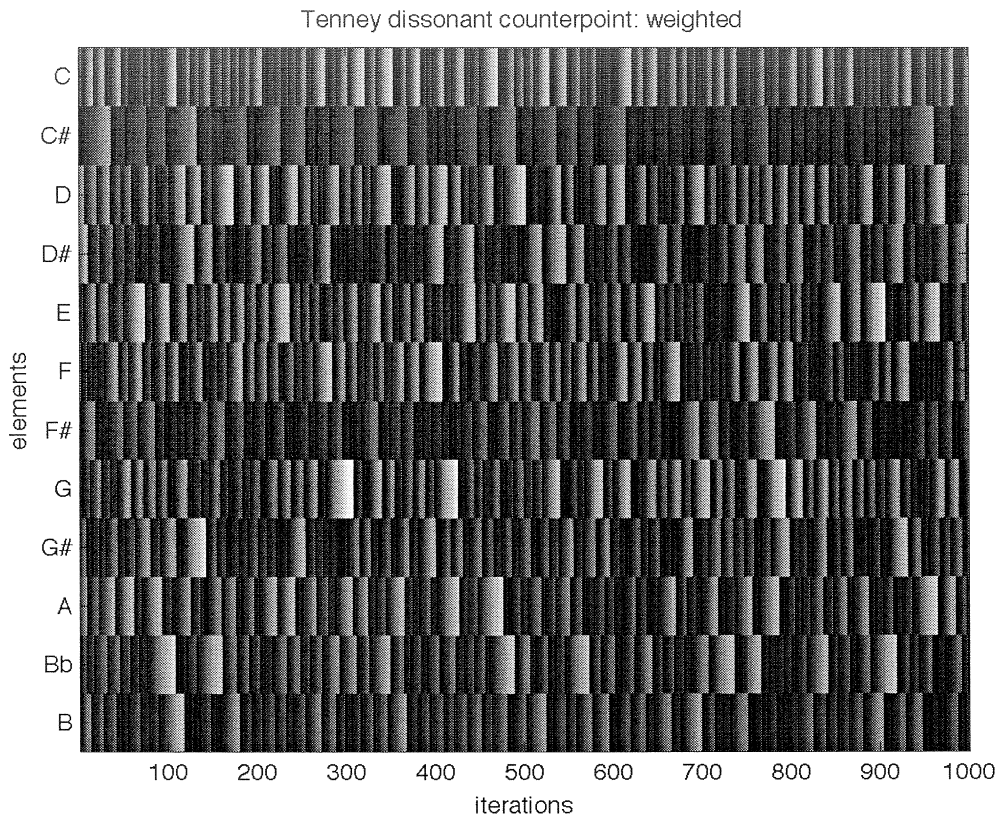
1000 Trials (uniform weights)



100 Trials (weighted increments)

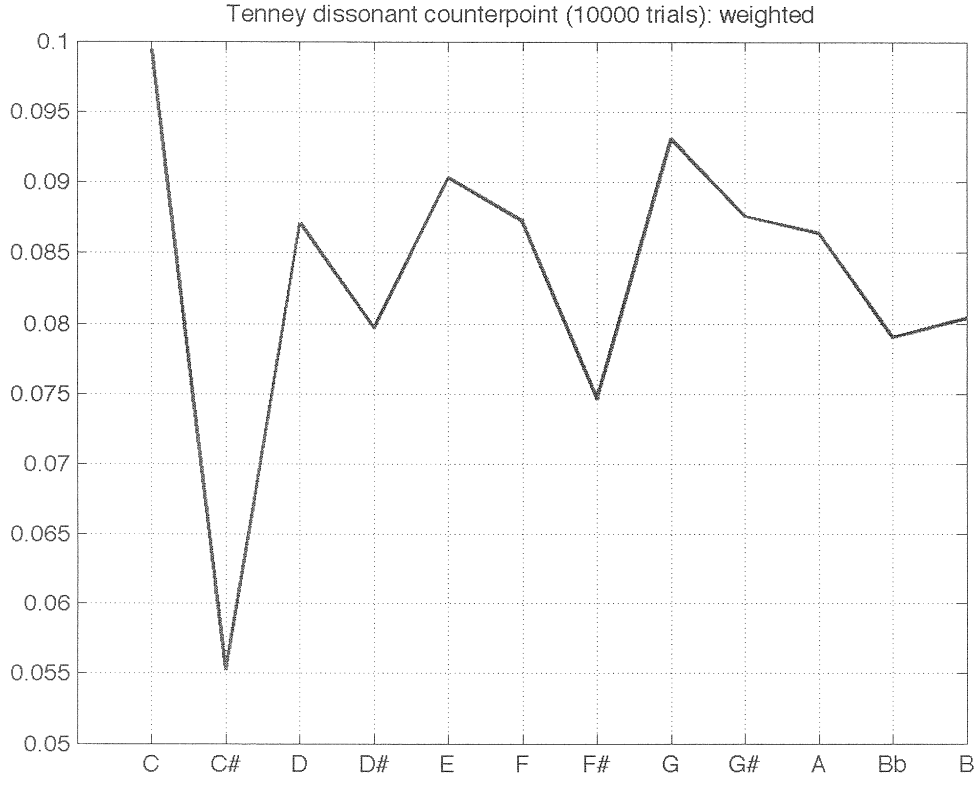


1000 Trials (weighted increments)



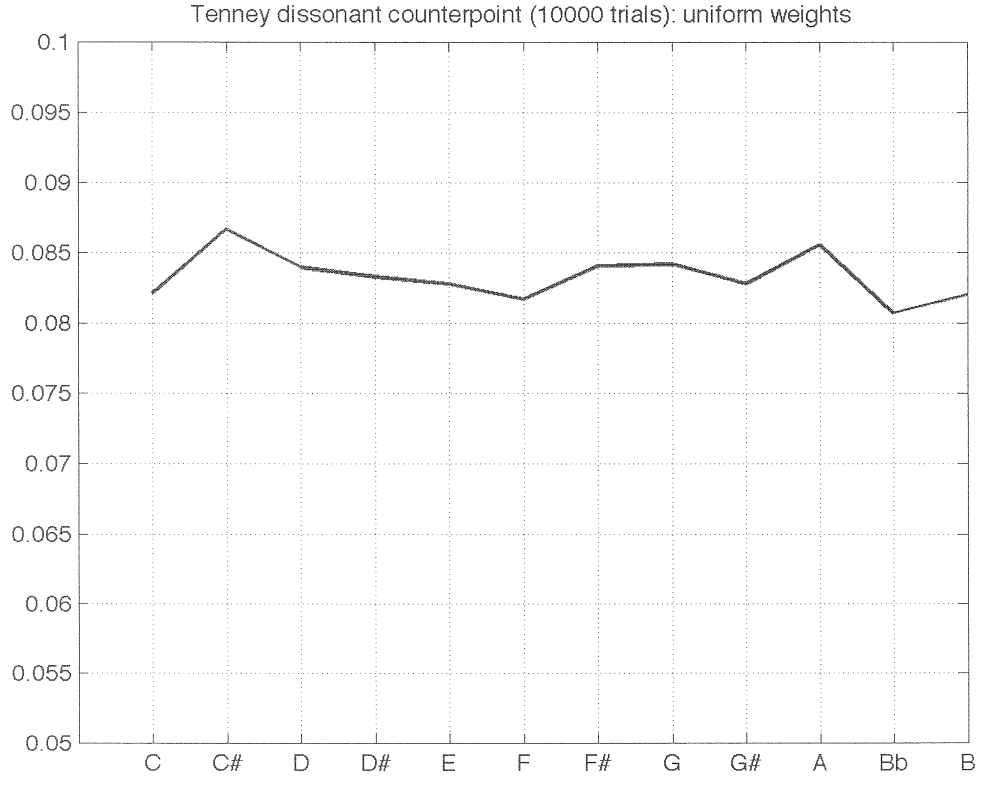
Histogram of Output Statistics

Dissonant Counterpoint Algorithm with increment values weighted by a "consonance curve"



Histogram of Output Statistics

Dissonant Counterpoint Algorithm with equal increment values



Appendix 1:

Selected *interloods*
(*tenneytoods* and *tooaytood #15a-c*)

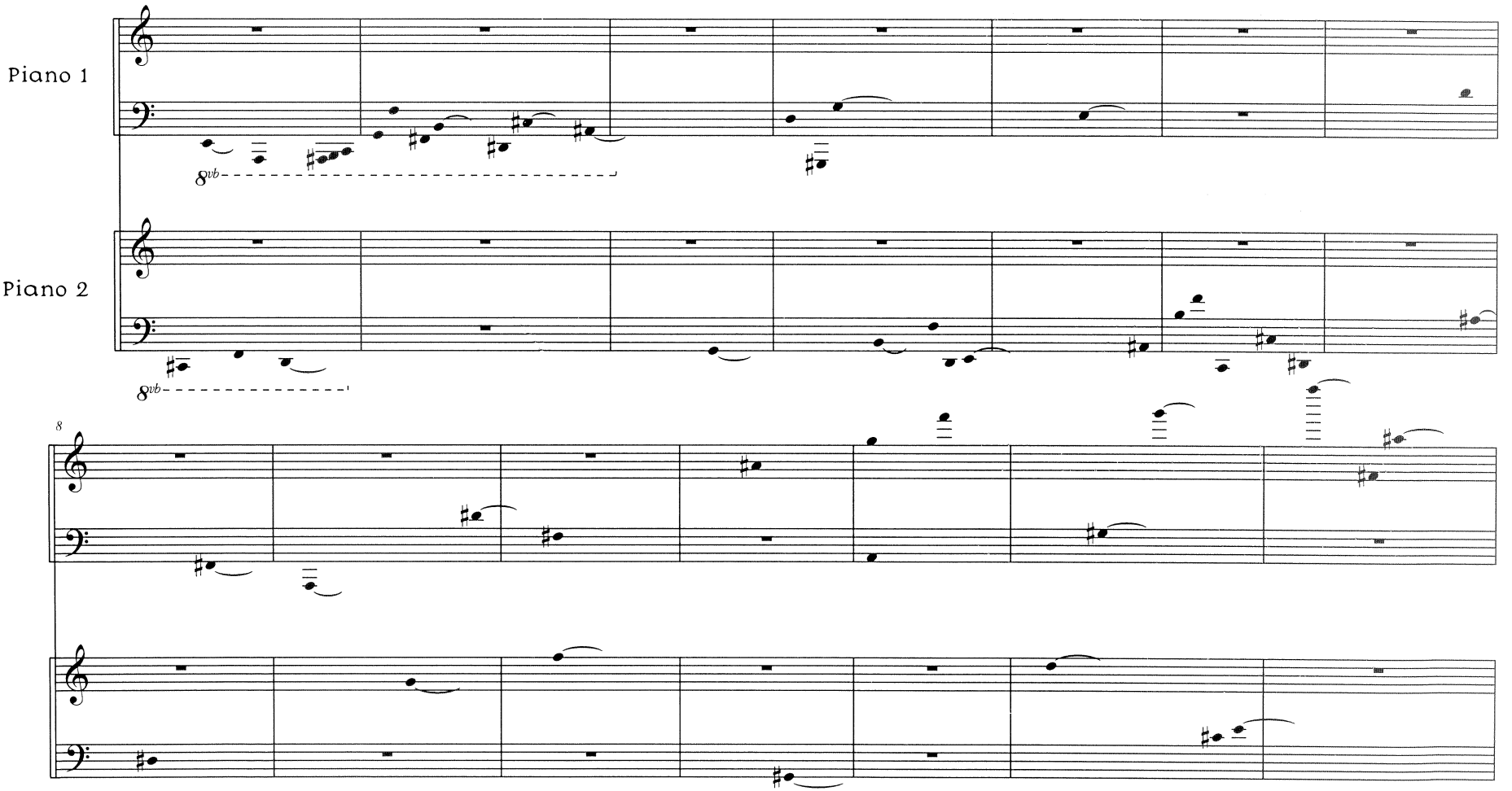
from *3 Pieces for 2 Pianos* (Polansky, 2007)
for Joe Kubera and Sarah Cahill
Commissioned by the Barlow Foundation

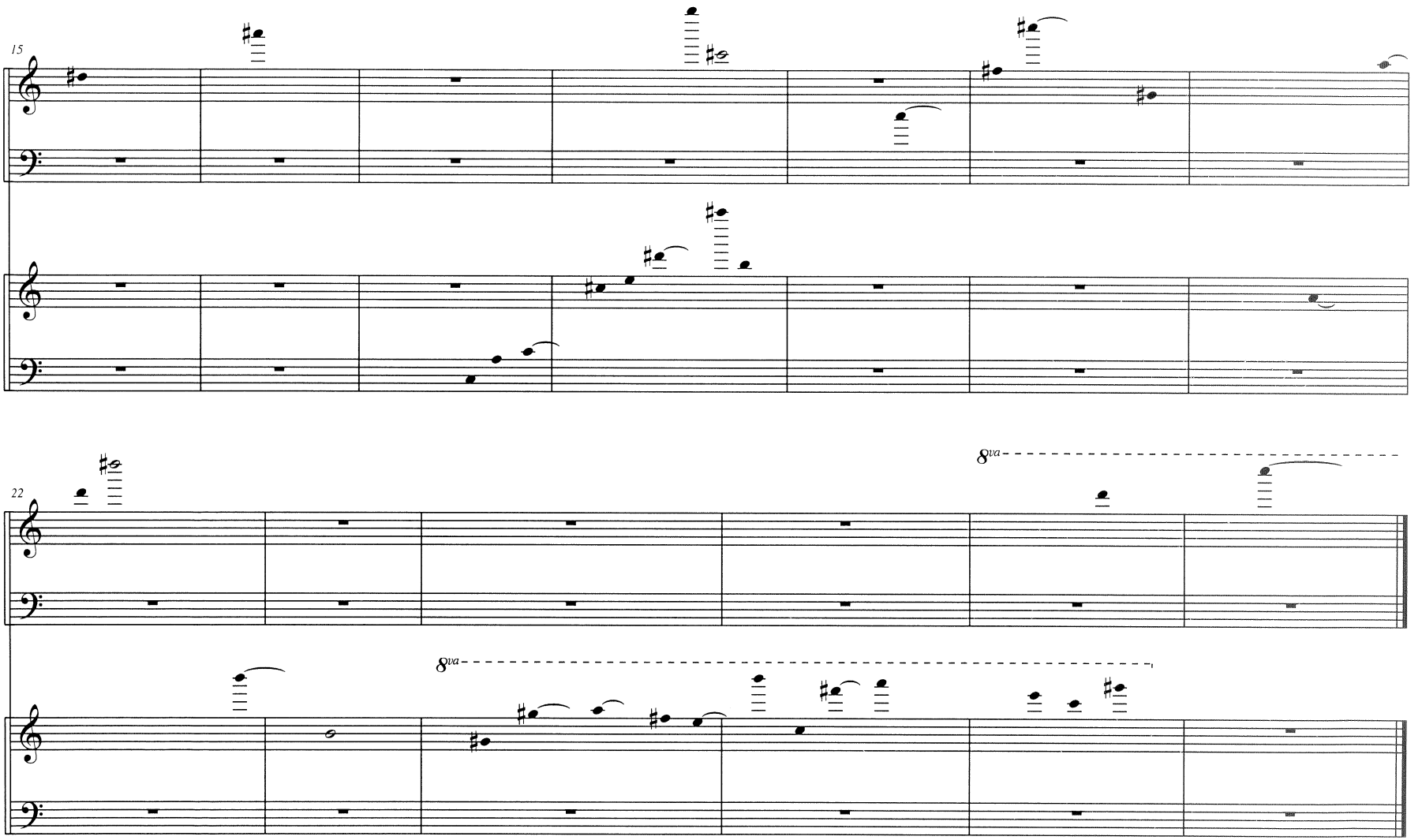
(these short *interloods* are from the third of the three pieces, and each uses the Tenney dissonant counterpoint algorithm in a slightly different way)

interlood
tenneytood
(no rhythms)

polansky

any tempo, dynamics, articulations



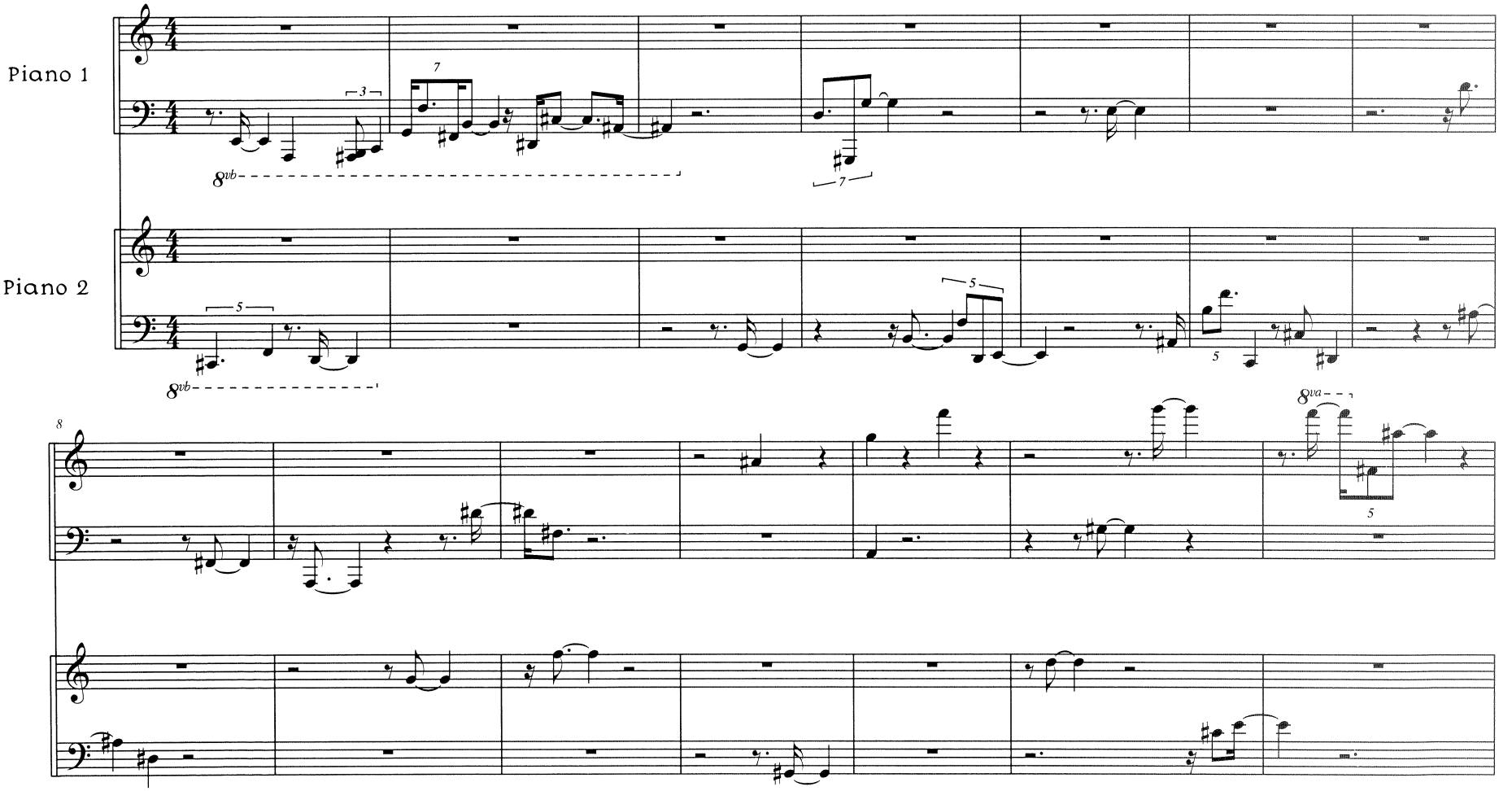


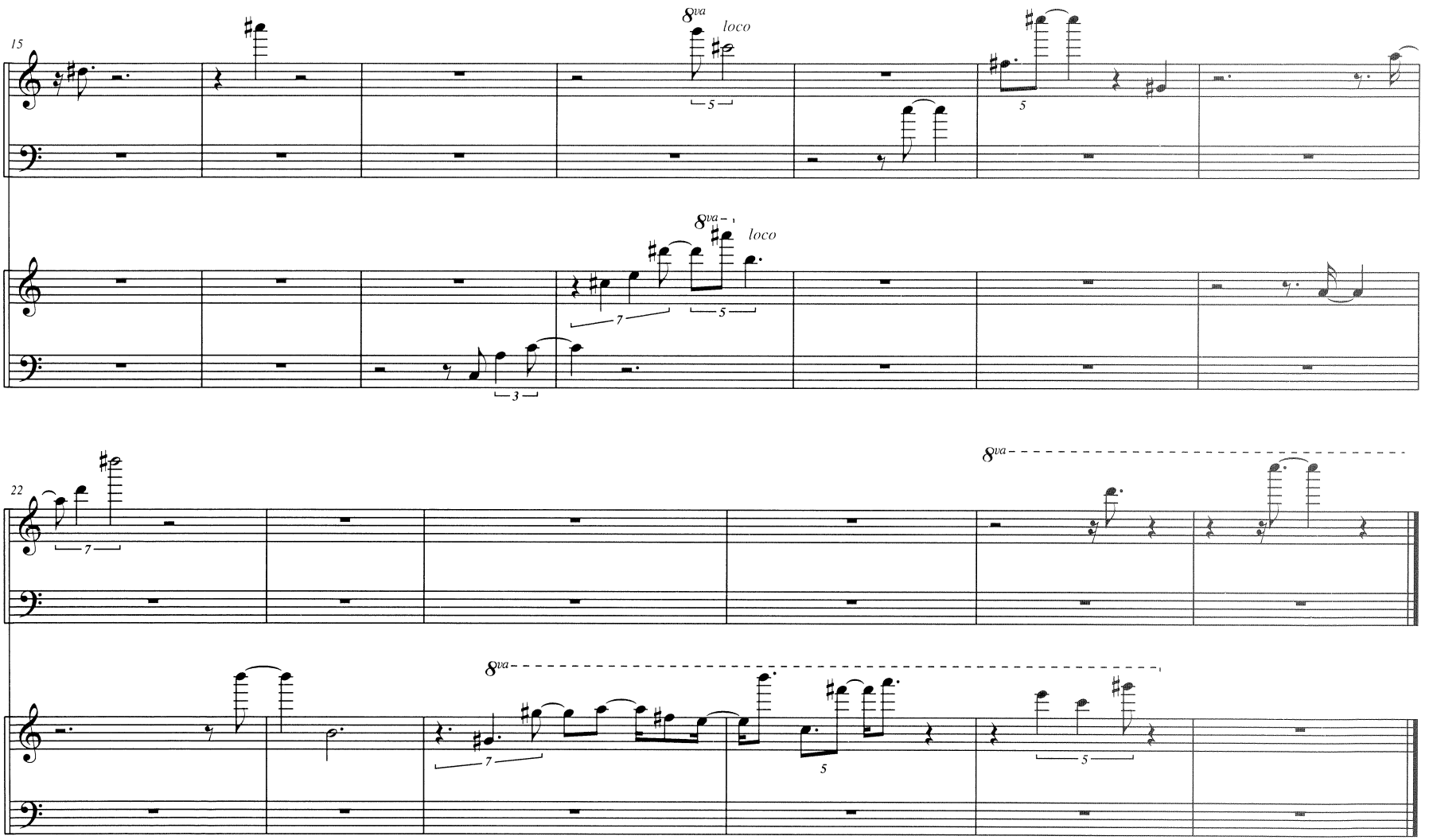
lp
8/21/07, hanover
rev. 8/31/07

interlood
tenneytood

polansky

any tempo, dynamics, articulations

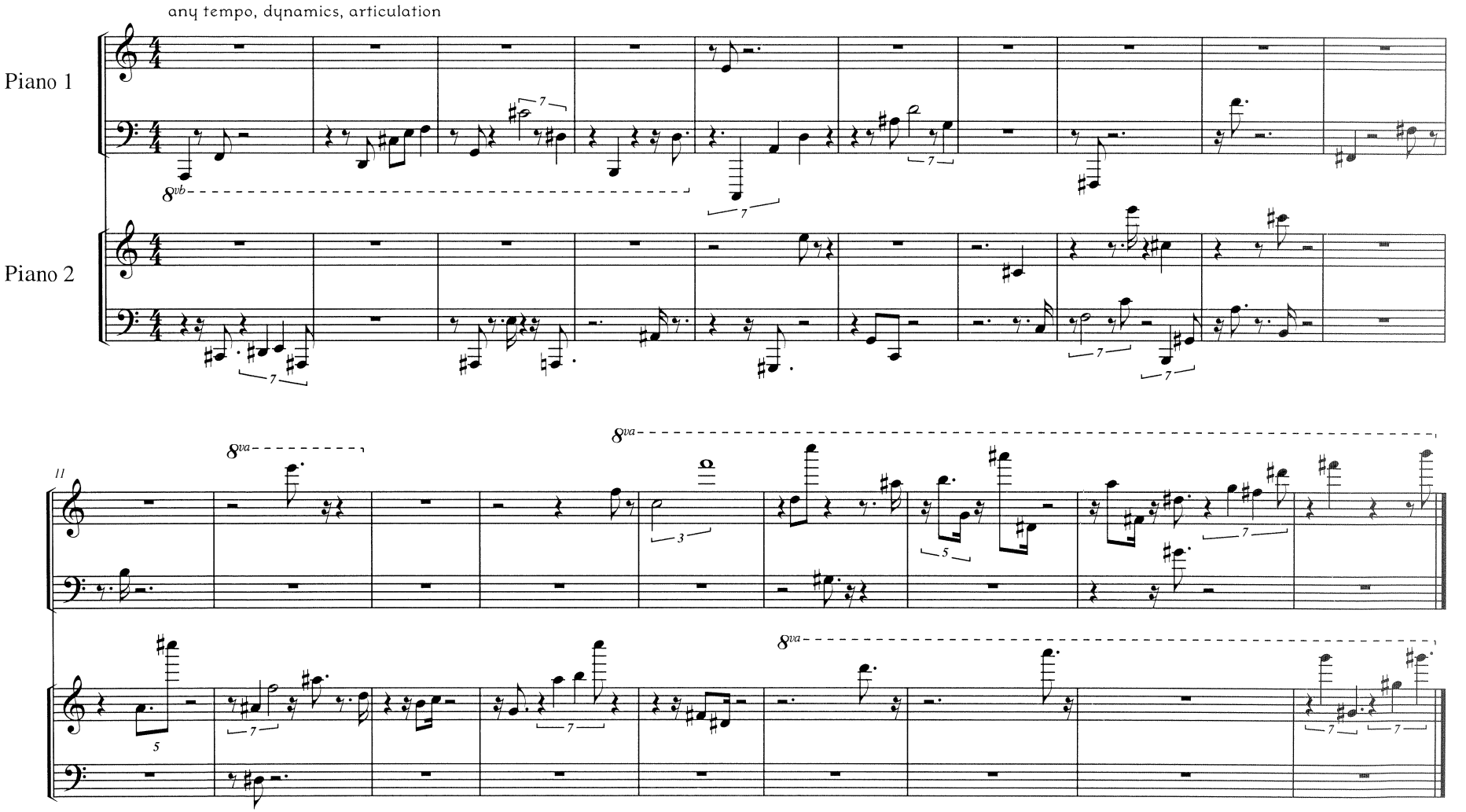




lp
8/21/07, Hanover
rev. 8/31/07

interlood
tenneytoodtoo

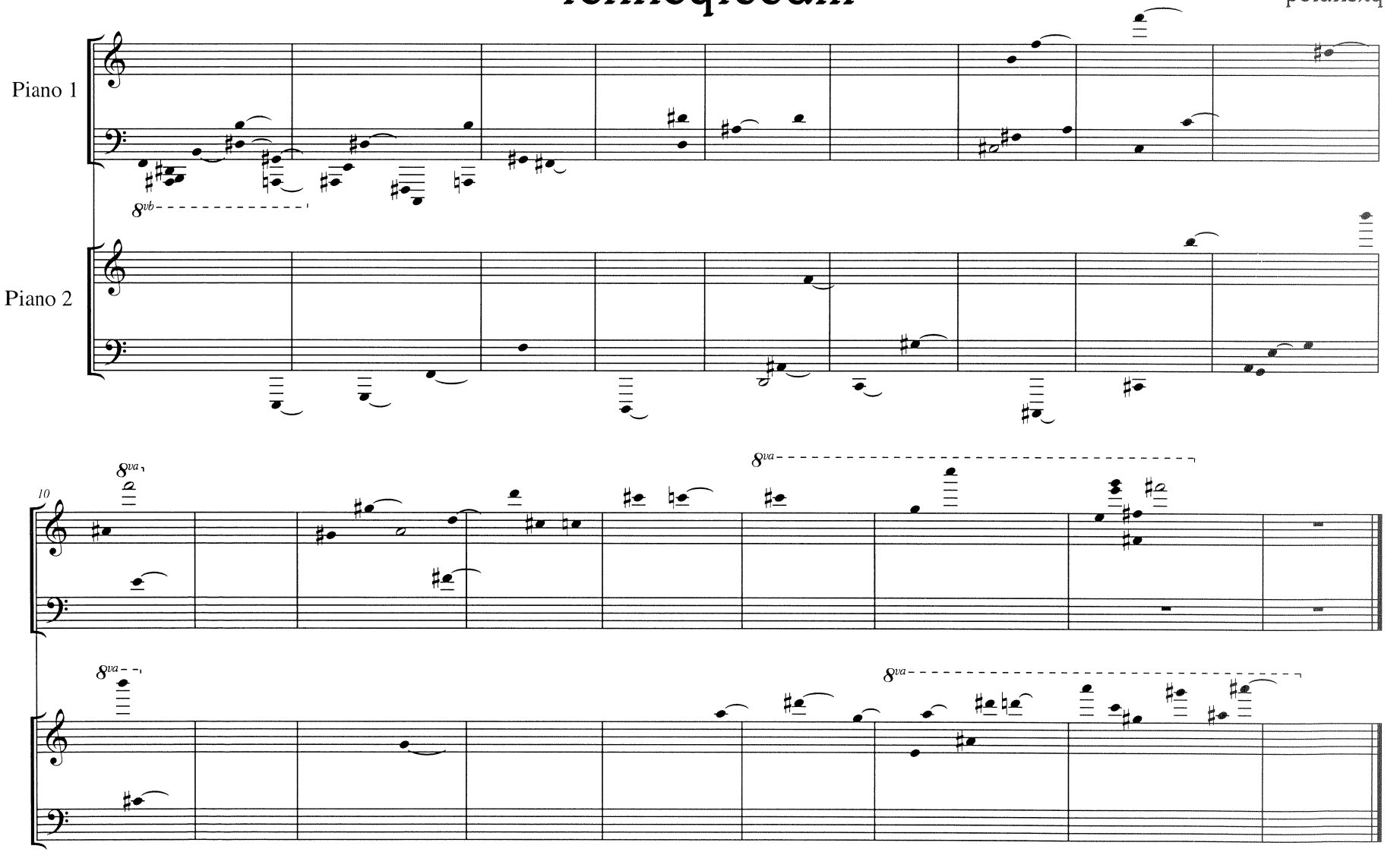
polansky



lp
hanover, 8/20/07
rev. 8/31/07

interlood
tenneytoodiii

polansky

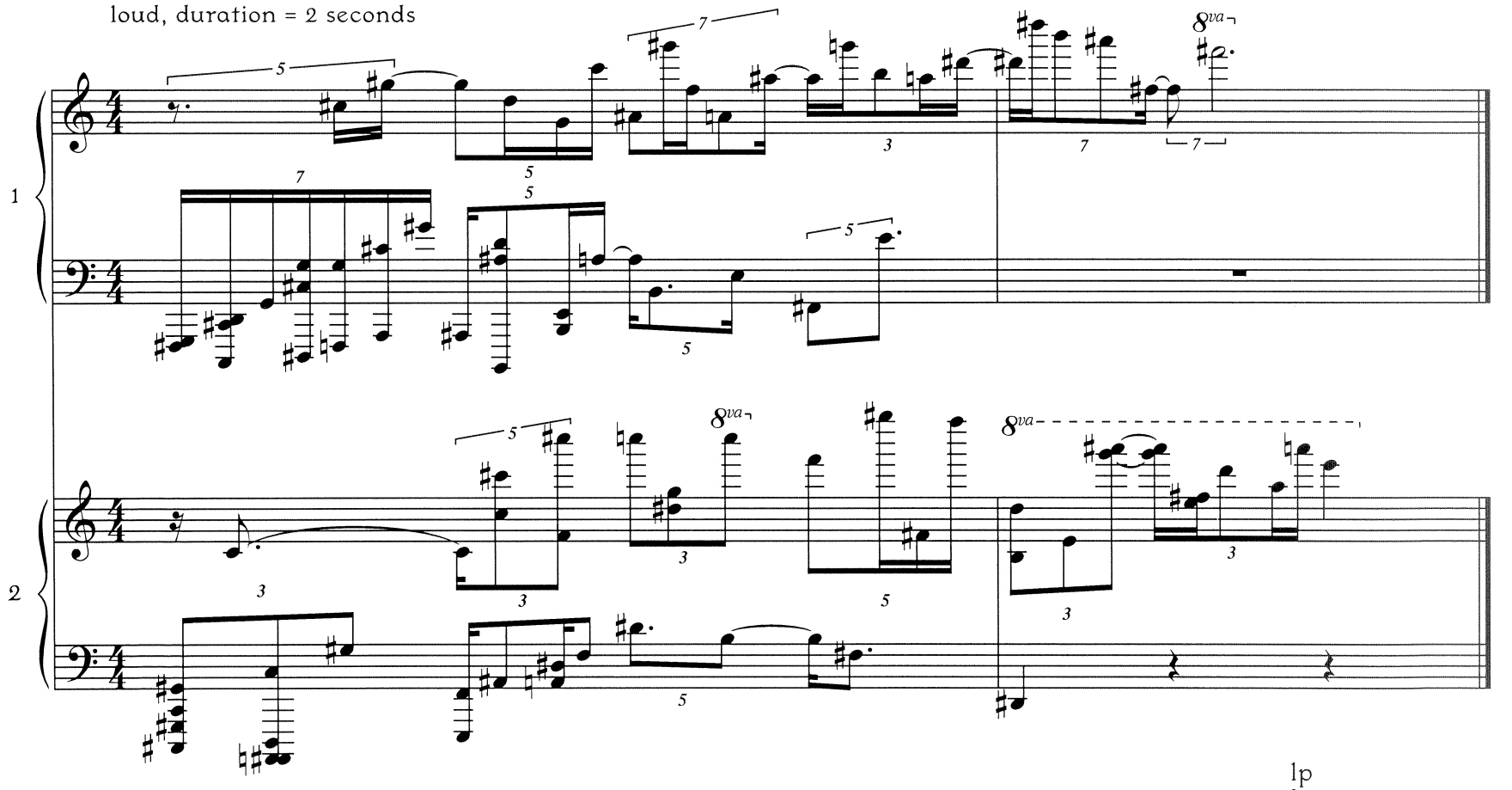


(any dynamics, articulations, tempi)

lp
hanover, 6/21/07
rev. 8/31/07

interlood
viitviiiiniiiivii
(tooaytood #15a)

polansky

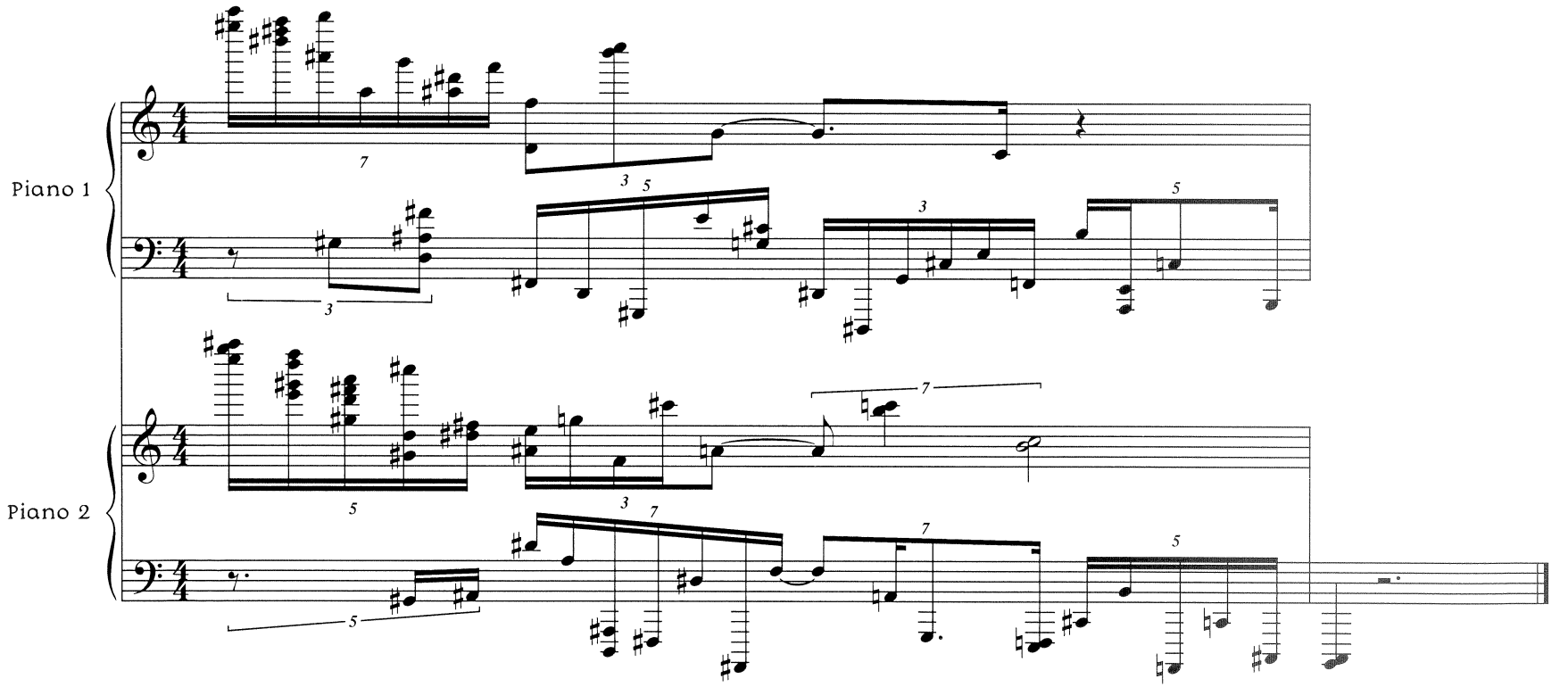


lp
hanover, 8/23/07
rev. 8/23/07

interlood
viiitviiiiiniiivii(ii)ivgp
(tooaytood #15b)

polansky

quiet, small, reflective, powerful; duration = 2 seconds (and one note)

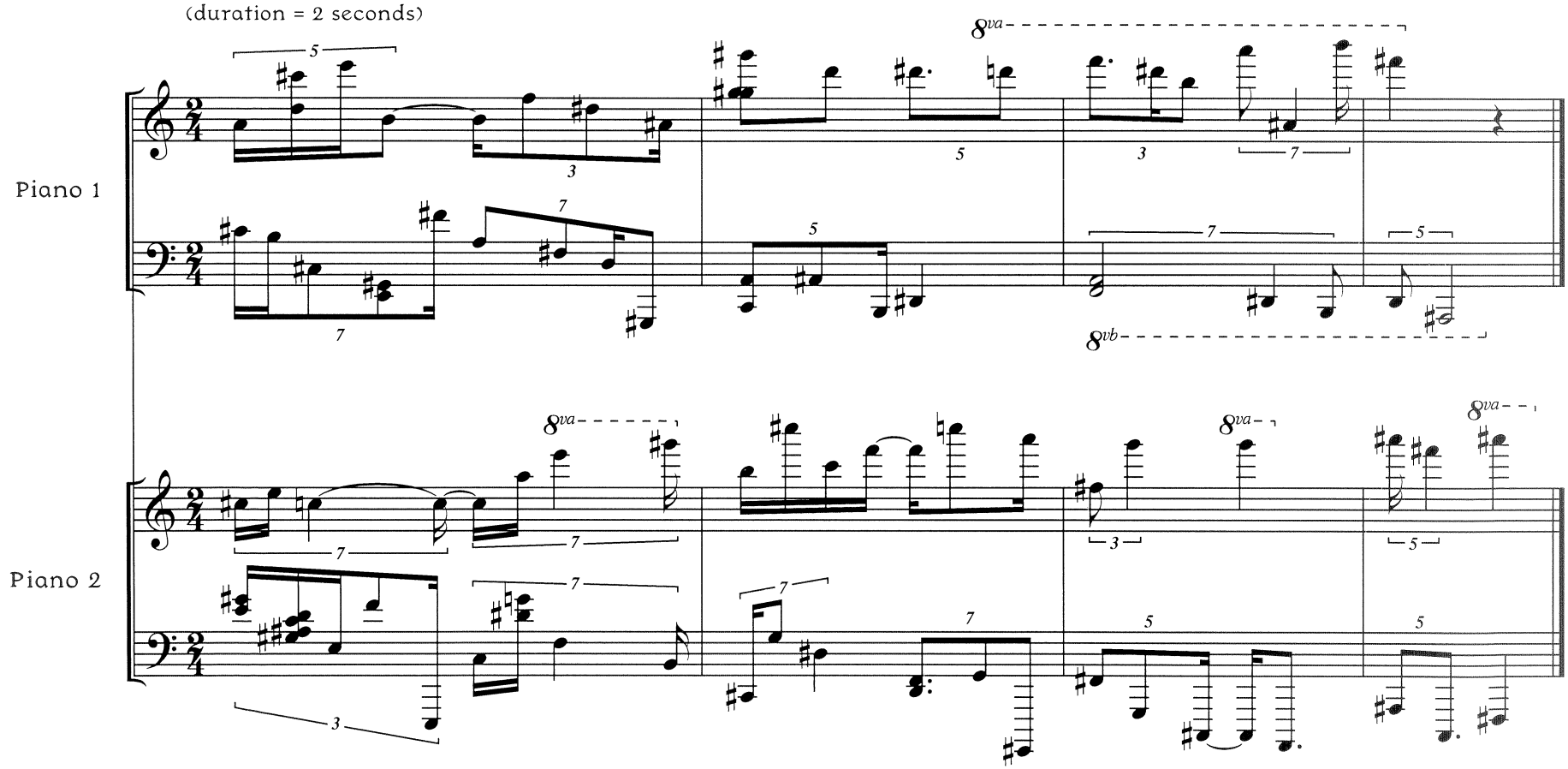


lp
hanover, 8/23/07
rev.8/25/07

for grace paley:
"That is, to tell their stories as simply as possible,
in order, you might say, to save a few lives."

interlood
viiitviiiiniiivii(iii)
("moving out")
(tooaytood #15c)

polansky



lp, hanover, 8/30/07
rev. 8/31/07

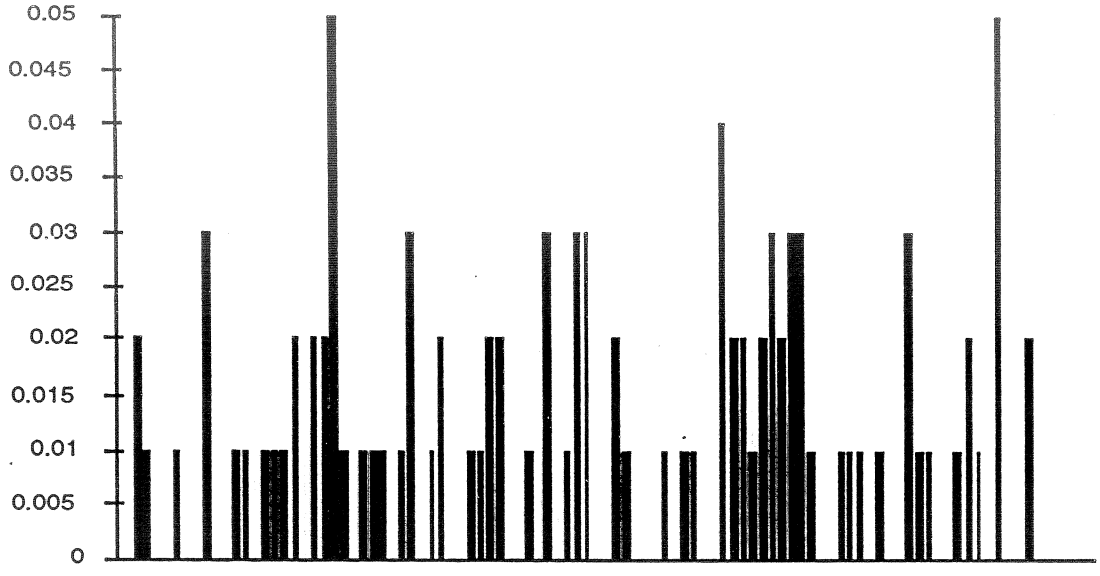
Appendix 2:

Histograms of a Pseudo-Uniform Number Random Number Generator

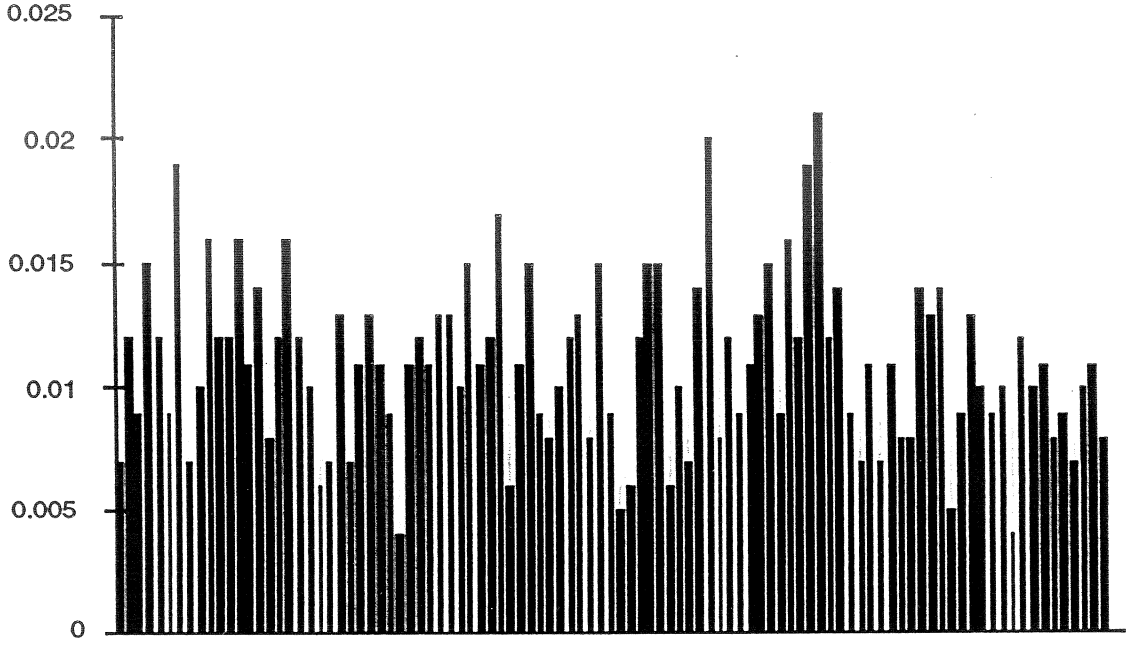
(old class notes, Dartmouth College, ca. 1991)

Simple Experiment: "All my trials"
Standard deviations: 100 (.0016), 1,000 (.003), 10,000 (.001), 100,000 (.0001), 1,000,000 (.000001)

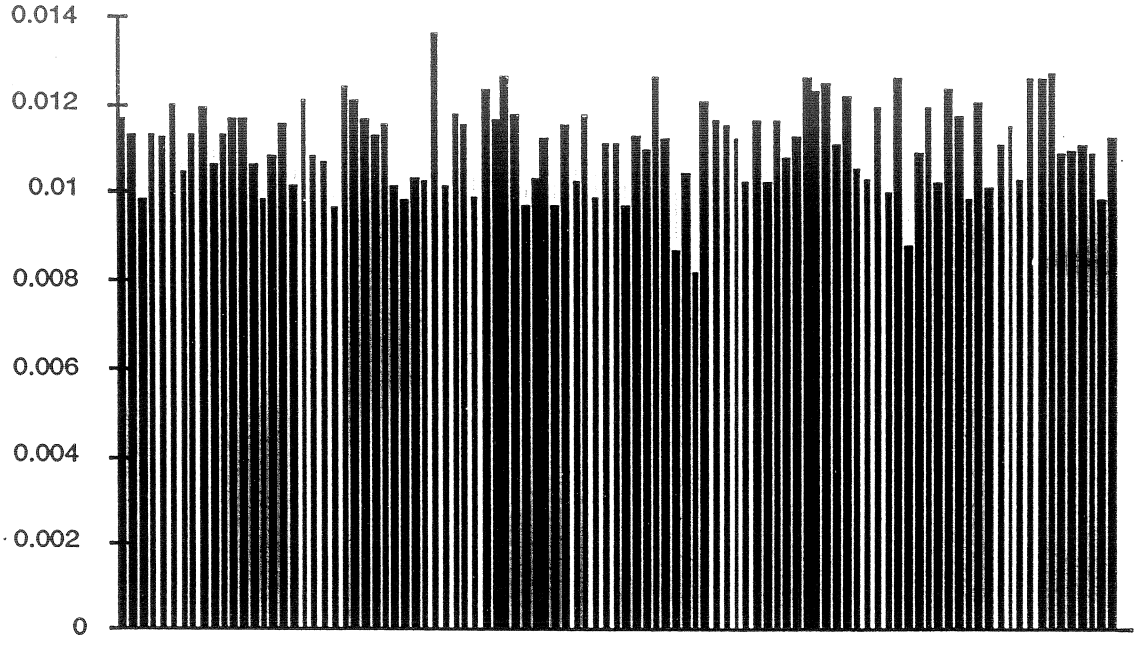
Hundred trials



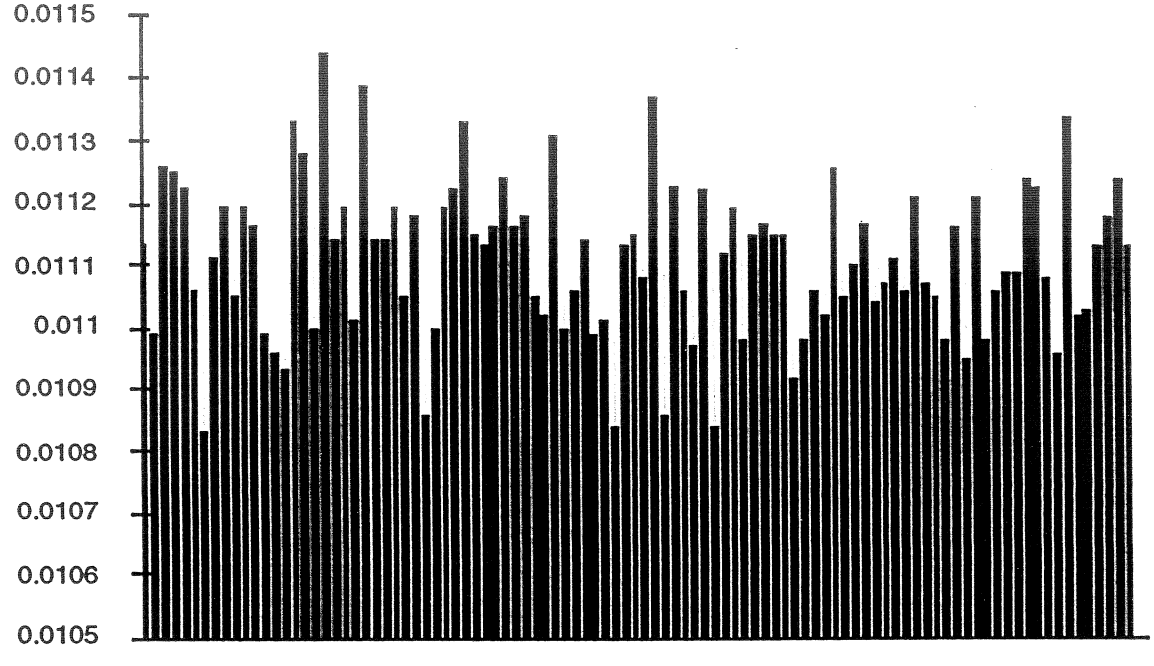
Thousand trials

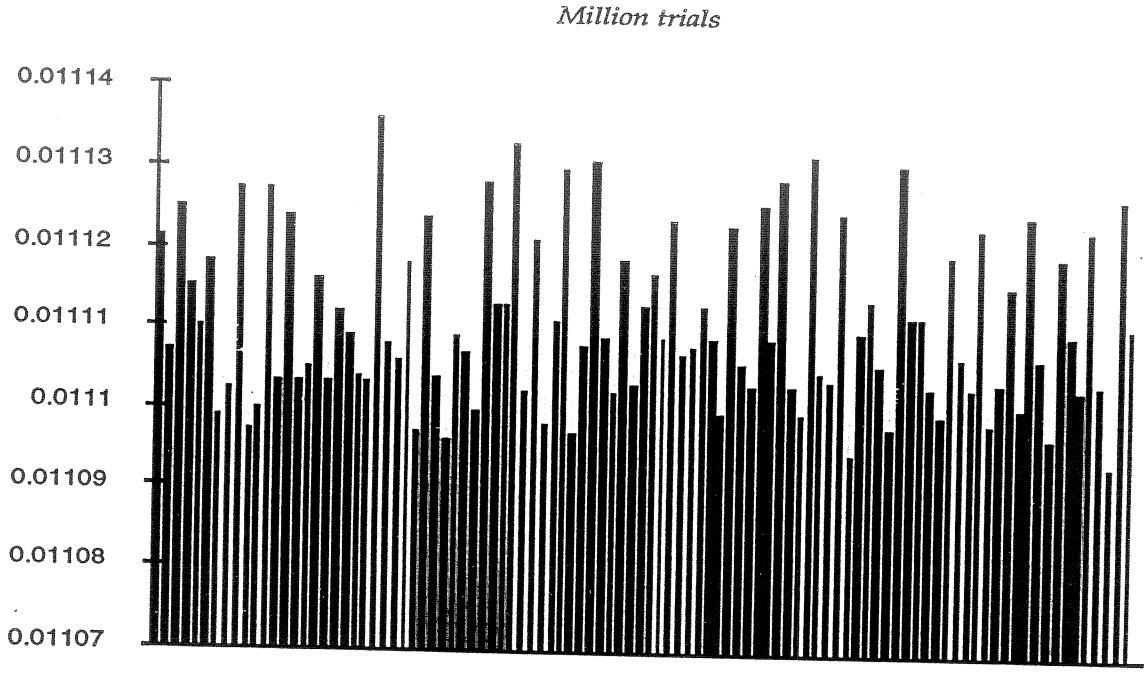


Ten thousand trials



Hundred thousand trials




Million trials
0.01114
0.01113
0.01112
0.01111
0.0111
0.01109
0.01108
0.01107