

Music 680, Fall 2007: Special Topics in Music - Compositional Algorithms
Class 3: September 24, 2007 - Cage I: early works

John Cage, algorithm, and indeterminacy

algorithm in *Credo in US* (1942) and related works (the *Constructions*, etc.)
relationship of macrostructural sectioning to measure-level sectioning
content is arbitrarily/intuitively composed into these macro- and measure-level blocks
with opening sections presenting multiple materials later “developed” individually
moving around circular “series” of rhythmic values
moving clockwise or counter-clockwise around the circle, or through its center value
more choice than in a fixed tone-row but still limiting possibilities
encourages hearing structure but at the expense of local detail
indeterminacy expressed primarily in the freedom to choose different recorded excerpts
writing about the *First Construction* to Boulez in 1949:
“You know that with exposition and development (without recapitulation) and with the form (climax apotheosis (?)) etc., this Construction is 19th-century.”

algorithm in *Music of Changes* (1951)

composed as a companion piece (and competitor?) to Boulez’ *2nd Sonata*
indeterminacy is now central to the algorithmic (and aesthetic) approach
a way to free the composer from habit, cliché, and limitation
basing the technique upon charts (derived from the *Concerto for Prepared Piano*)
8 x 8 structure = 64 possibilities (suited to extraction via tossing coins / *I Ching*)
separate charts for sonority, duration, and dynamics
even though chart elements are intuitively composed, their combination is not
(and spatial notation assists with the unusual rhythmic results)
importance of timbre in sonority charts (although the piano is not prepared)
parameters determining whether chart elements are replaced after use, layering
process of layering affects duration in turn
still using large-scale rhythmic structuring techniques from *Credo* etc.
but now adding tempo change - “space” + “speed” rather than duration
tempo is also a chart-derived parameter

algorithm in *Williams Mix* (1952)

again using charts to cross-reference timbres with durations and splicing techniques
spatialization as a function of material layering
the possibility of other composers realizing the same work (taken up recently by Larry Austin)
the labor-intensive quality of both *Music of Changes* and *Williams Mix*

the aesthetics of indeterminacy

embrace and pursuit of new sounds (and forms?)
opposition to the idea of musical progression and accumulation (after Debussy?)
4’33”, the weather, and the listener’s ability to organize sound into form

...and the importance of algorithm

with perhaps the exception of 4’33”, Cage is making high-level determinations about his works

Boulez’ critique of Feldman and Cage

noting in “Alea” the pure rationalism and pure indeterminacy are sides of the same coin

but trying to retain indeterminacy in the form of interpretation
 whether in composition, where the intuitive can take on "lived necessity" over time
 and thus extending Ligeti's "decision - automatism - decision" structure recursively
 surprise and discovery as features of the compositional process
 or in performance
 "that research, which, in my view, can concentrate on the necessity of destroying
 every kind of immanent structure"
 generalized rubato; but implied/directed by the composer, not imposed by the player
 aleatoric form not as generalized but as particular bifurcations and decision points
 Boulez' own increasing role as an interpreter....

indeterminacy in Common Lisp

quasi-random numbers (uniform distribution)

```
(random 3) ; quasi-random integers between 0 and n-1
(random 1.0) ; produces random floating-point numbers between 0 and 1
```

choosing randomly from a gamut (chart)

```
(defparameter pitch-gamut (list 0 1 3 4 6 7 10 11))
(defparameter register-gamut (list 36 60 84 96))
(defparameter onset-spacing-gamut (list 0 0.1 0.17 0.77 1.34 3.17))
(defparameter duration-gamut (list 0.05 0.08 0.15 0.35 0.89 2.3))
(defparameter amplitude-gamut (list 0.2 0.3 0.35 0.4 0.9))
```

```
(defun choose-from-gamut (gamut)
  (nth (random (length gamut)) gamut))
```

```
(defun generate-chord (number-pitches pitches registers start-time dur amp)
  (if (<= number-pitches 0) nil
      (cons (new midi
              :time start-time
              :keynum (+ (choose-from-gamut pitches)
                        (choose-from-gamut registers))
              :amplitude amp
              :duration dur)
            (generate-chord (- number-pitches 1) pitches registers start-time dur amp))))
```

```
(defun gamut-chords (number-chords pitches registers onsets durations
                    amplitudes start-time)
  (if (<= number-chords 0) nil
      (let ((next-onset (+ start-time (choose-from-gamut onsets)))
            (dur (choose-from-gamut durations))
            (amp (choose-from-gamut amplitudes)))
        (append (generate-chord 3 pitches registers start-time dur amp)
                (gamut-chords (- number-chords 1) pitches registers
                              onsets durations amplitudes next-onset))))
```

```
(events (gamut-chords 20 pitch-gamut register-gamut onset-spacing-gamut duration-gamut
                    amplitude-gamut 0.0) "test.mid")
```

altering gamuts dynamically: (setf (mth 1 pitch-gamut) 2)