



# Generative Grammars for Real-Time Composition

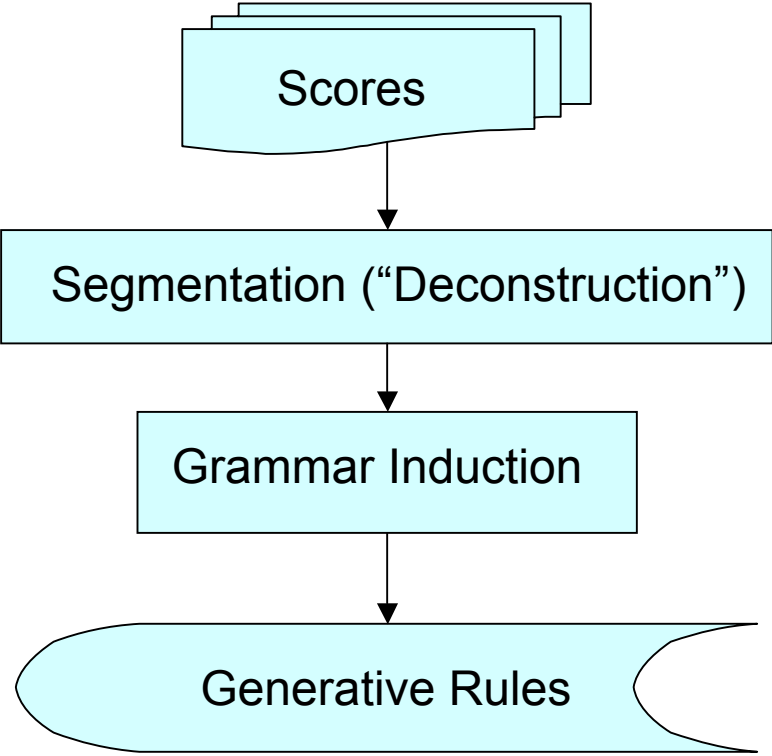
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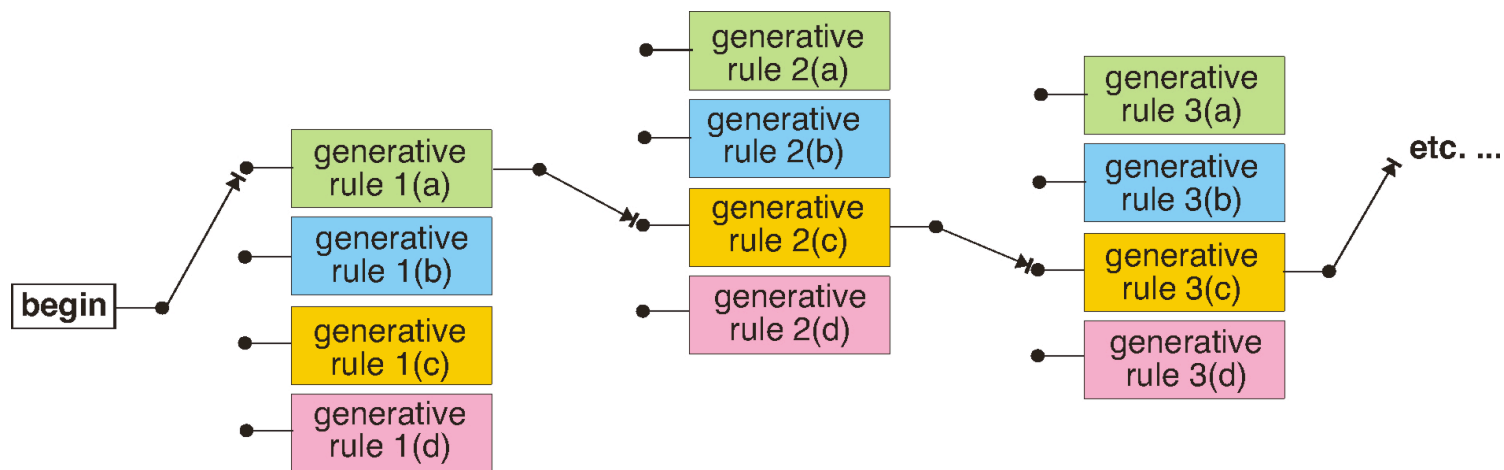
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The generative system composes sequences of short sections of music using the grammars. Each section is generated by a rule selected from  $n$  sets of grammatical rules, each corresponding to a different musical style.

The image displays a musical score for piano, consisting of three systems of music. Each system is written for two staves: a treble clef staff on top and a bass clef staff on the bottom. The music is in common time (C). The first system is labeled 'beethoven' on the left and 'schumann' on the right. The second system is labeled 'beethoven' on the left, 'schumann' in the middle, and 'beethoven' on the right. The third system is labeled 'schumann' on the left and 'beethoven' on the right. The notation includes various rhythmic values, accidentals, and dynamic markings.

## Synthesis: (re)combinatorial composition

Style-replication based on David Cope:

*The genius of great composers, I believe, lies not in inventing previously unimagined music but in their ability to effectively reorder and refine what already exists.*

On this assumption, that composing or improvising is just a re-ordering of existing material, we develop a simple improviser that transfers a part of the musical task to the computer.

# Combinatorial composition

- Can work on notes, chords, bars.
- Find an acceptable continuation of music.
- Uses harmony, melody, phrase structure.
- Possibly spectral information. (to be developed)

(see web page)

# Style blending

- Mixing slices: 'the patchwork opus'?
- Projection vs. simple mixing?

# Phrase structure + transitions

S => incip bar bar bar bar bar cadence2bar

incip => '((equal-slot 'composer eeg-composer)  
(equal-slot 'bartype 'incip))

bar=> '((equal-slot 'composer eeg-composer)  
(equal-slot 'pitchclass prev-pitchclass)  
(equal-slot 'type 'bar)  
(close-slot 'pitchleading prevpitchleading))



# Similarities & copies

Similarities:  $SS \rightarrow S S'$

$S' \rightarrow$  '(generate-pitch-class-abstract generated-S)

result:

$S ==$  '((incip (close-slot 'pitchclass '(0 5 8)))  
    (bar (close-slot 'pitchclass '(...)))  
    etc...)

Copies:  $SS \rightarrow Shc Sfc$

$Shc \rightarrow$  '(incip bar bar bar bar bar halfcad)

$Sfc \rightarrow$  '(copy-generated)

S is now '((bar (equal-slot 'id 102)) (bar ....) [...] (full-cadence))

# One-dimensional control



Musical score for two pieces. The top system features a tempo marking of quarter note = 100. The first piece, by Schumann, is in 2/4 time and consists of a single melodic line in the treble clef. The second piece, by Tom Turpin, is in 2/4 time and consists of a single melodic line in the bass clef. Both pieces are in the key of D major.



Musical score for a piece by Scott Joplin. The score is in 2/4 time and consists of two staves: a treble clef staff and a bass clef staff. The piece is in the key of D major and features a complex, syncopated melody in the treble clef and a supporting bass line in the bass clef.

# Multi-dimensional control

System always orders possibilities to harmonic, melodic and rhythmic distance.

This ordering calculates euclidean distance from different axis; those axis can be weighted by input controls.

$$R = \sqrt{(w_1 * h)^2 + (w_2 * m)^2 + (w_3 * r)^2}$$

# Multi-dimensional control

The image displays a musical score for piano, divided into three distinct sections. The first section, labeled 'Joplin', is in common time (C) and begins with a tempo marking of quarter note = 400. The second section, labeled 'Turpin', continues in the same time signature. The third section, labeled 'Schumann', is in 3/4 time. The score is written for piano with a grand staff (treble and bass clefs). The Joplin section features a complex, syncopated melody in the right hand and a rhythmic accompaniment in the left hand. The Turpin section shows a more melodic line in the right hand and a bass line in the left hand. The Schumann section features a flowing, arpeggiated melody in the right hand and a simple bass line in the left hand.

Joplin

Turpin

Schumann