

Timbre Control by Modulation of the Partial Tone Structure Using a Cellular Automata

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Algorithmic Composition
Unconventional Computing for Music

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Idea

Using a Cellular Automata to:

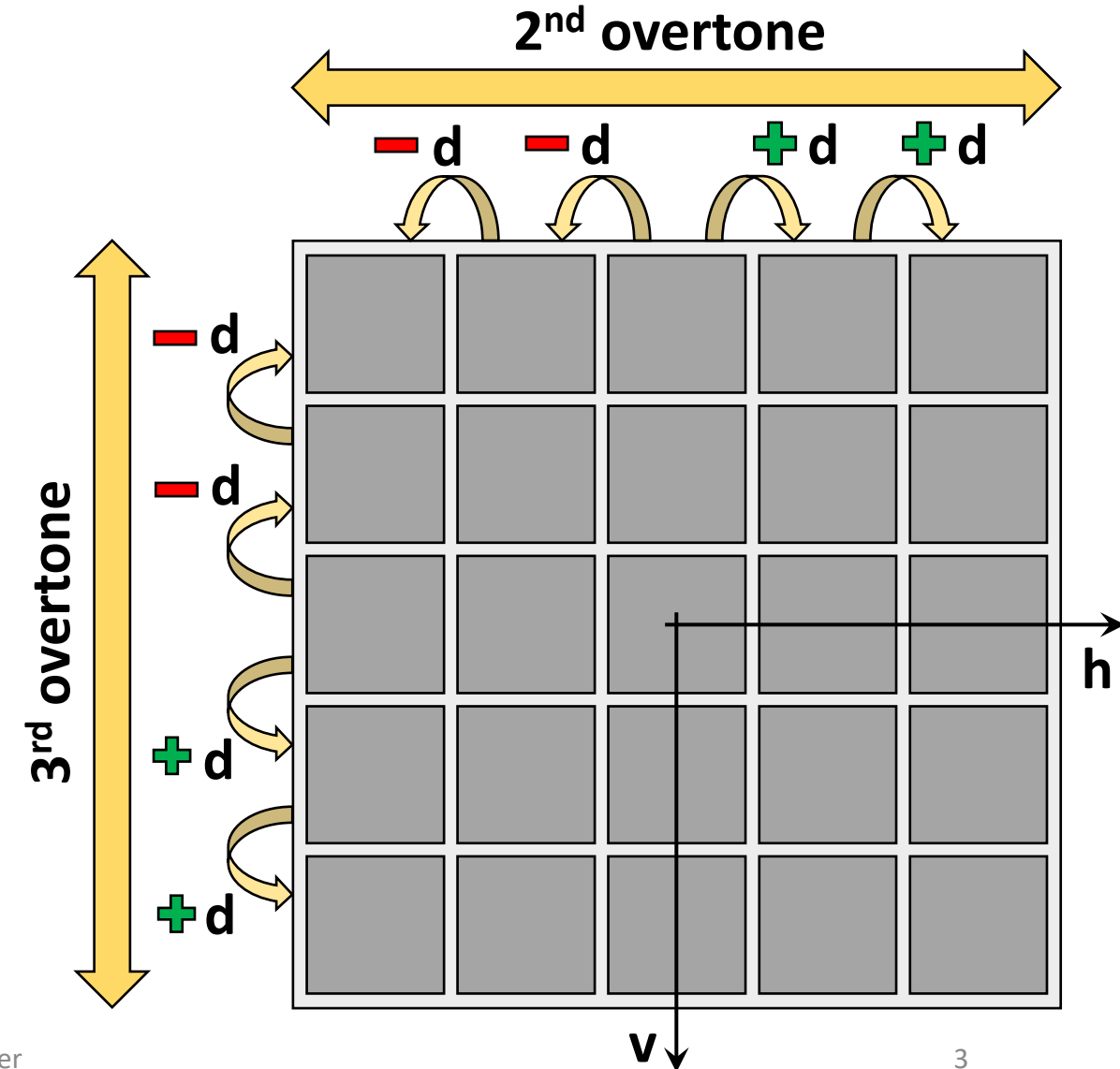
- Modulate the partial tone structure of tones by shifting frequency of 2nd and 3rd overtone
- Control other compositional parameters such as
 - Pitch of the tone
 - Tempo
 - Dynamics of the tone
 - Delay, Attack, Decay, Sustain of the Tone
 - ...

Modulation of the Partial Tone Structure

Determination:

- Fundamental: f_1 $\hat{A} = 0$
- 2nd overtone: $f_2 = (2 + h \cdot d) \cdot f_1$ $\hat{A} = 1$
- 3rd overtone: $f_3 = (3 + h \cdot d) \cdot f_1$ $\hat{A} = 1$
- 4th overtone: $f_4 = (4 + h \cdot d) \cdot f_1$ $\hat{A} \ll 1$
- 5th overtone: $f_5 = (5 + h \cdot d) \cdot f_1$ $\hat{A} \ll 1$
- 6th overtone:
- 7th overtone:
- 8th overtone:
- 9th overtone: ...

⇒ Individual parameter

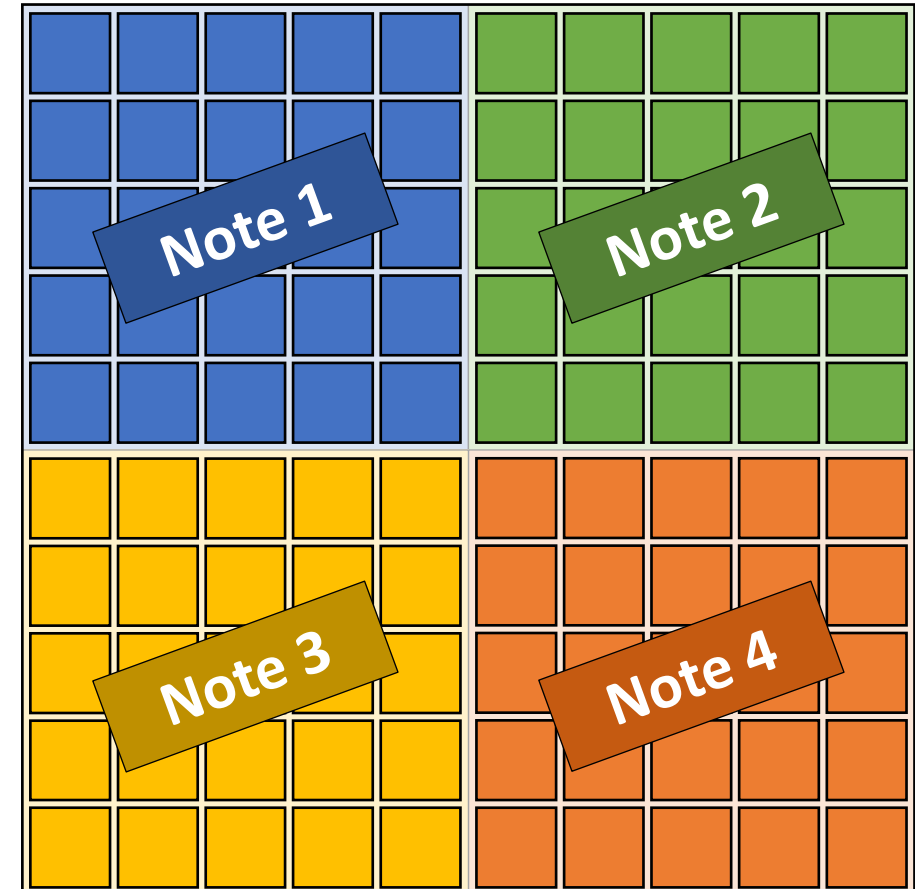


Pitch of the Tone

Determination:

- Based on the associated area of the living cell (“affiliation”)

⇒ Regional parameter



Tempo Regulation

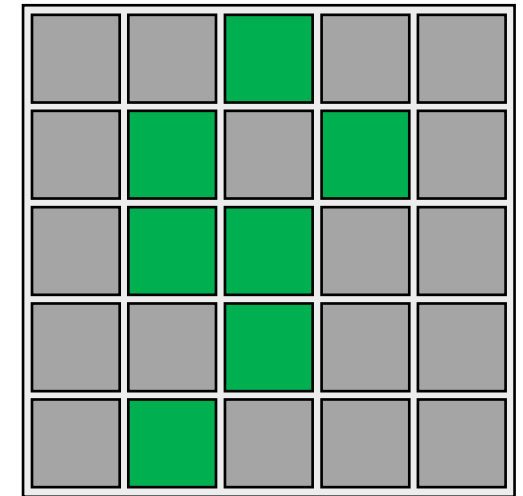
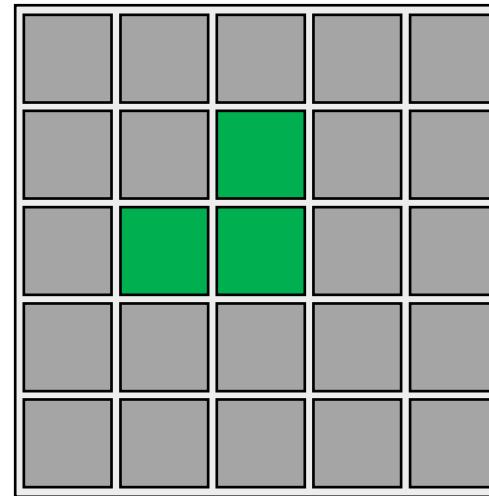
Determination:

- Based on the total amount of living cells on the whole grid (“population”)

Correlation:

- \searrow population \Rightarrow tempo \searrow
- \nearrow population \Rightarrow tempo \nearrow

\Rightarrow Global parameter



Dynamics of the Tone

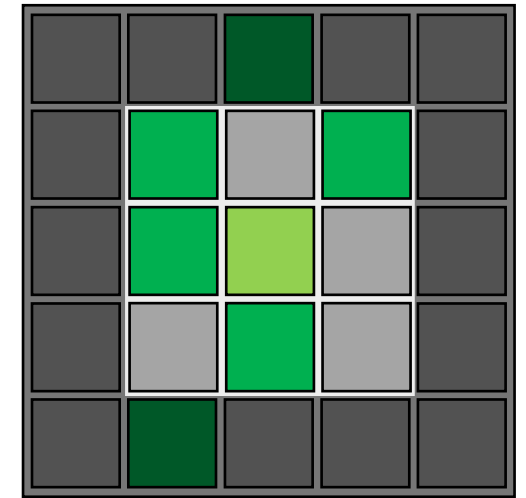
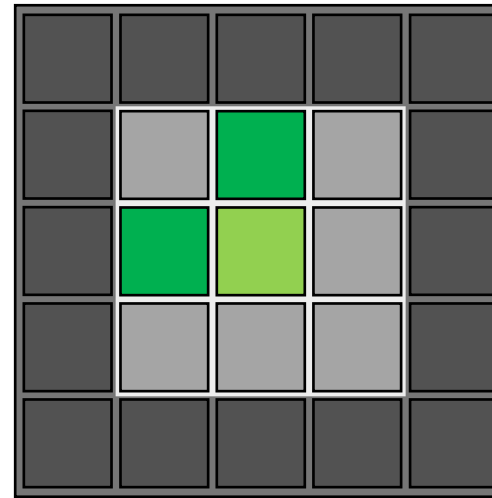
Determination:

- Based on the amount of living surrounding cells (“neighbors”)

Correlation:

- \searrow neighbors \Rightarrow dynamics \searrow
- \nearrow neighbors \Rightarrow dynamics \nearrow

\Rightarrow Individual parameter



Delay, Attack, Decay, Release of the Tone

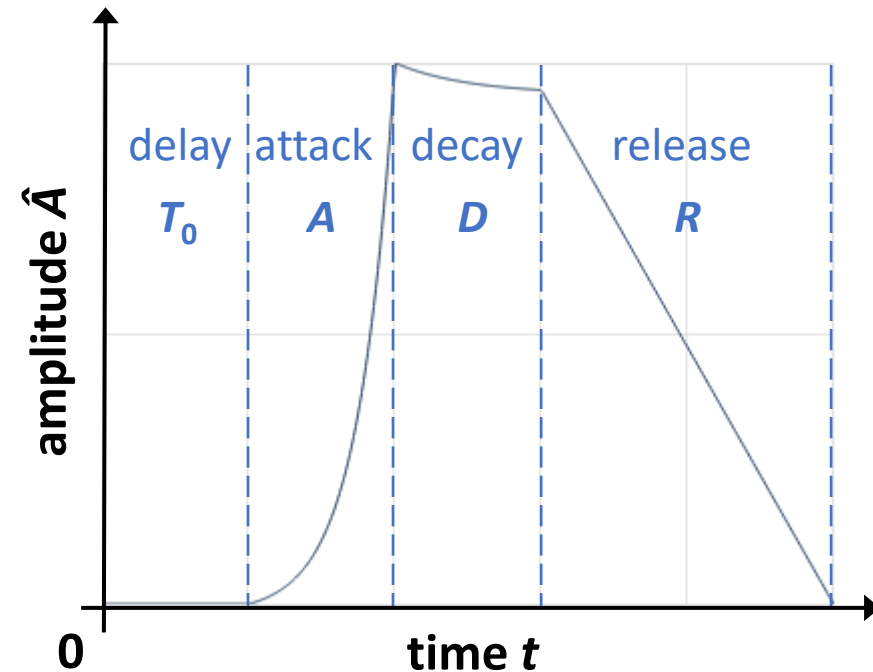
Determination:

- Cell's state compared to previous iteration ("maturity")
- "neighbors"

Correlation:

	Maturity		Neighbors	
	↘	↗	↘	↗
T_0	↘	↗	↘	↗
A	↘	↗	↗	↘
D	↘	↗	↗	↘
R	↗	↘	↘	↗

⇒ Individual parameters



Further Parameters

Other parameters controlled by the Cellular Automata:

- Reverberation
- L/R Balance

⇒ Individual parameters

Demonstration

