Music Plus One

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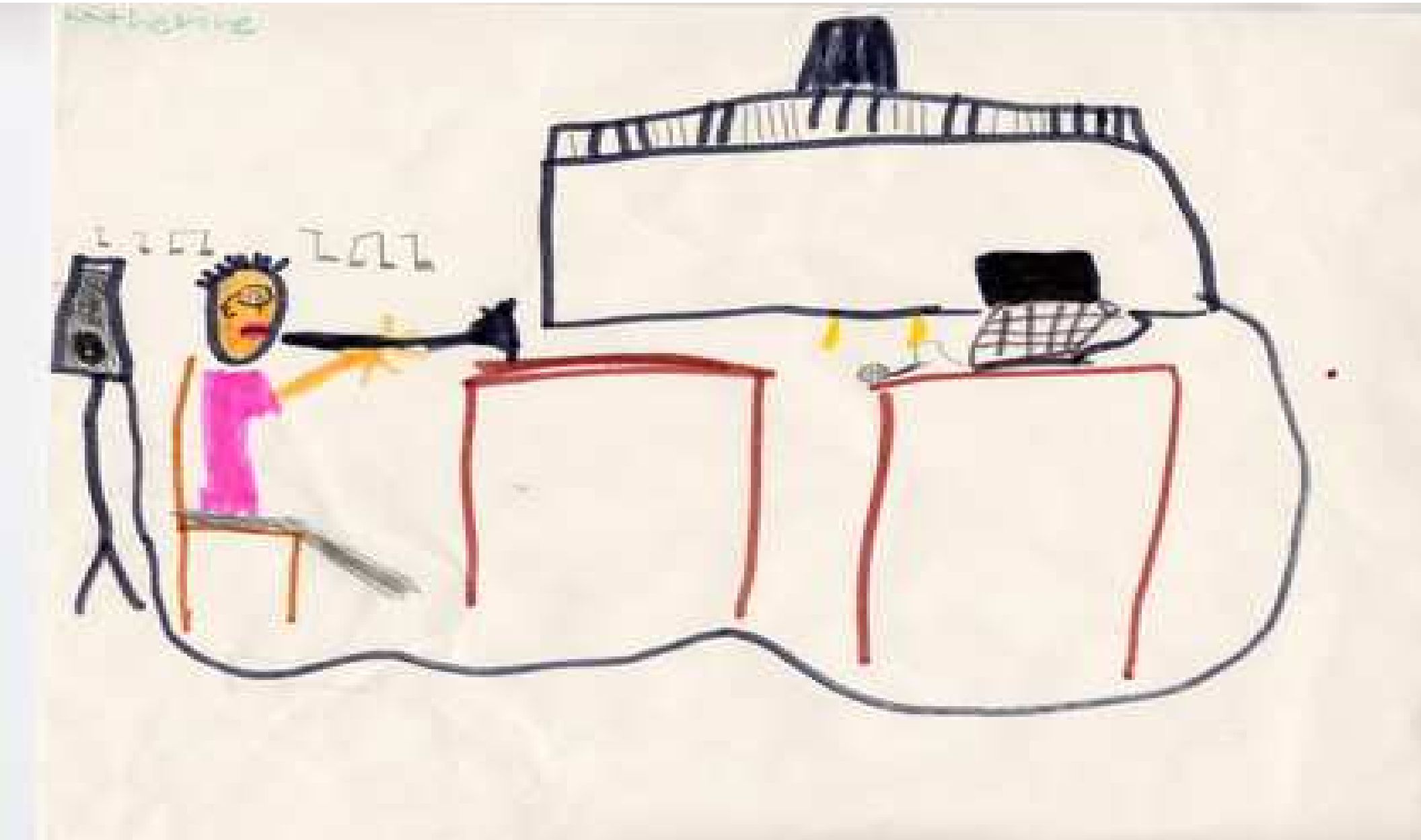
My Dream: Orchestra in a Box

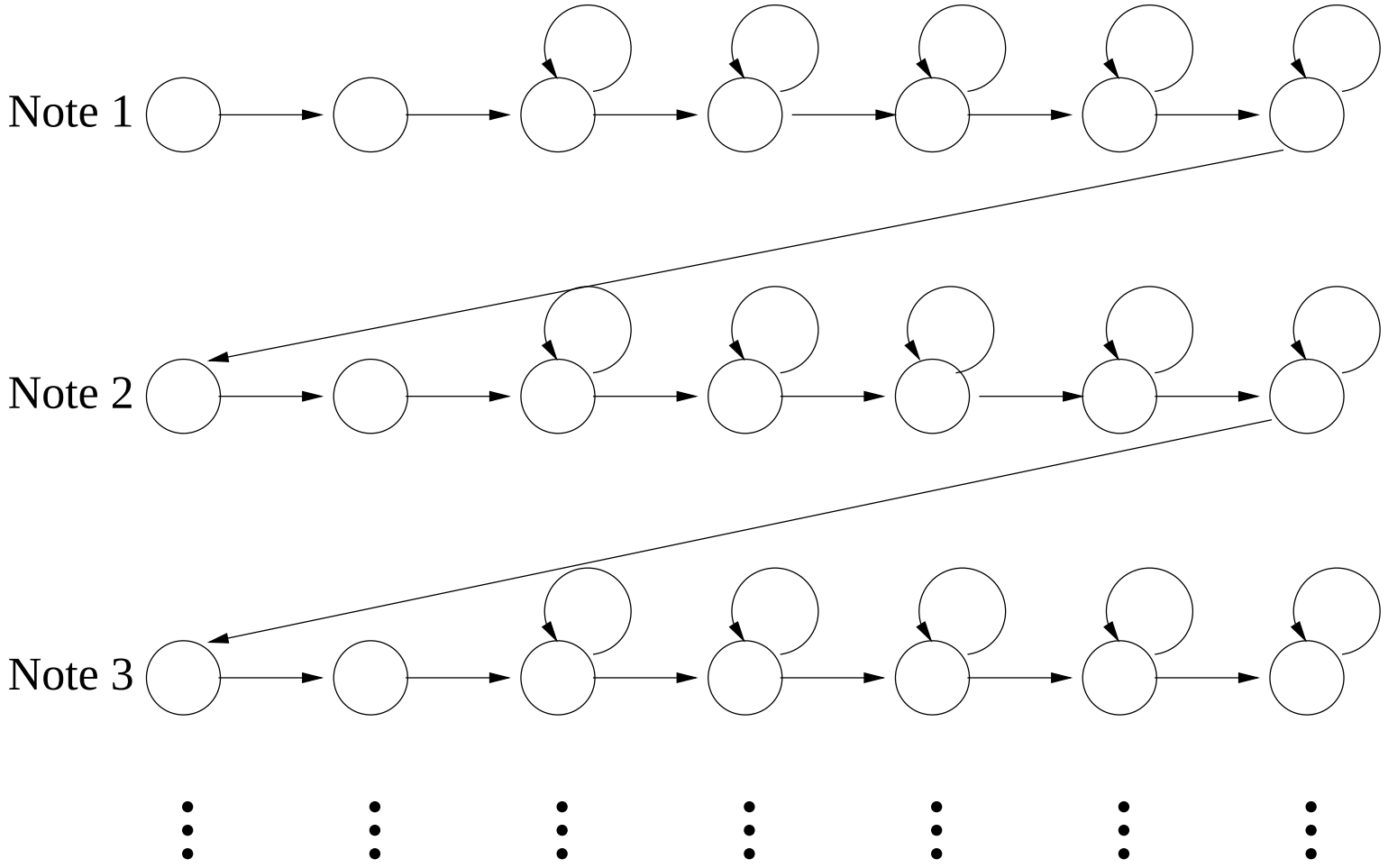
Create computerized orchestral accompaniment that *follows* and *learns from* the soloist.



Audio Resynthesis through Phase Vocoding

- Phase vocoding demo
- Statement of problem

Off-line Listening with HMM



Given *complete* performance: $y_1, \ldots, y_K$, let

$$\text{note}_n = \arg\max_k P(X_k = \text{start}_n | Y_1 = y_1, \ldots, Y_K = y_K)$$

Mark Kaplan on Saint Saëns: Introduction and Rondo Capriccioso (022 mm. 309)

On-Line Listening

Given frames $y_1, y_2, \ldots$ *one at a time*, determine note onset times $\{\text{note}_n\}$ with as little lag as possible.

For each note n

1. Wait until

$$P(X_k \geq \text{start}_n | Y_1 = y_1, \ldots, Y_k = y_k) > \tau$$

and suppose k^* is the first such frame

2. Then

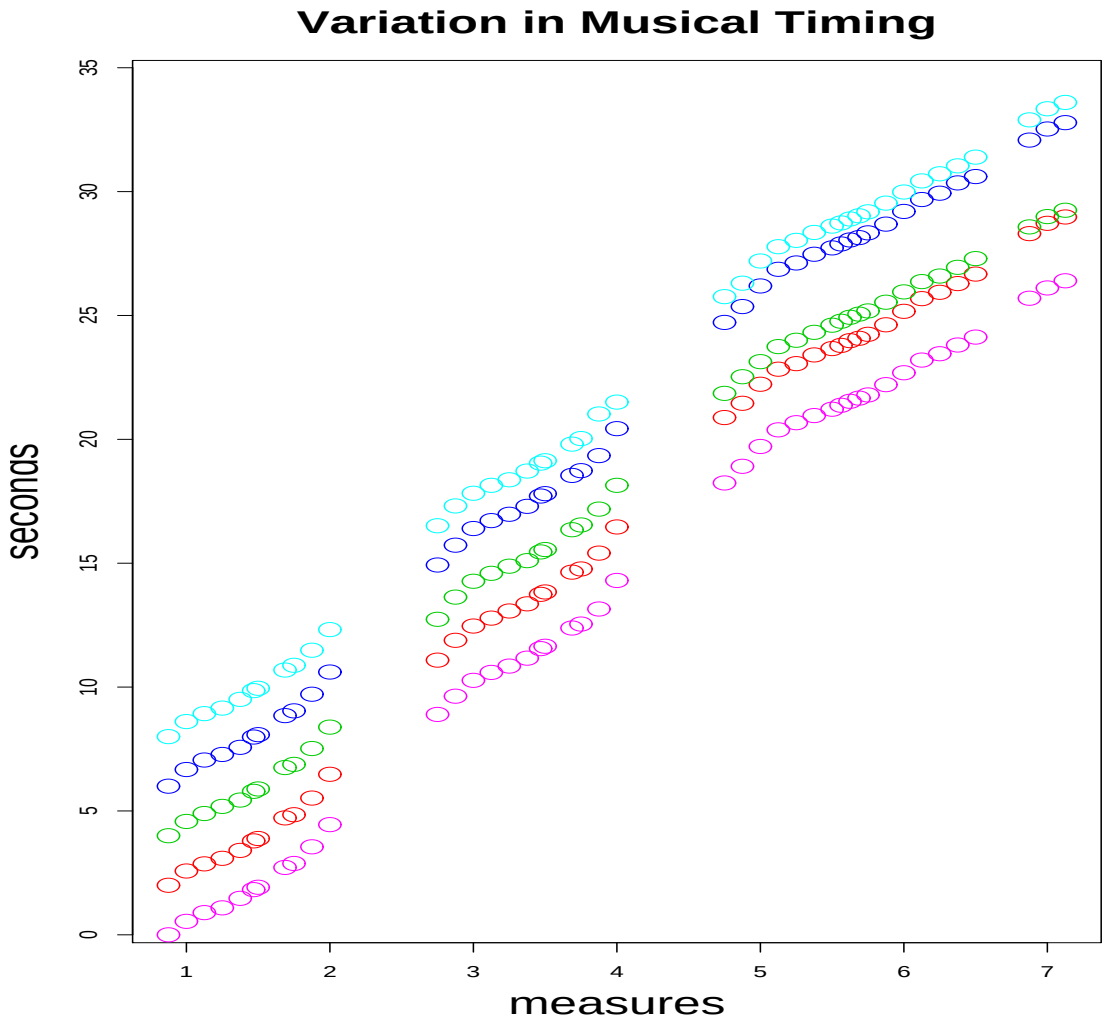
$$\text{note}_n = \arg \max_{k \leq k^*} P(X_k = \text{start}_n | Y_1 = y_1, \ldots, Y_{k^*} = y_{k^*})$$

(Mark on 004)

Anticipating the Musical Future

Hopeless to build reflexive system.

Lot to be learned from rehearsal:



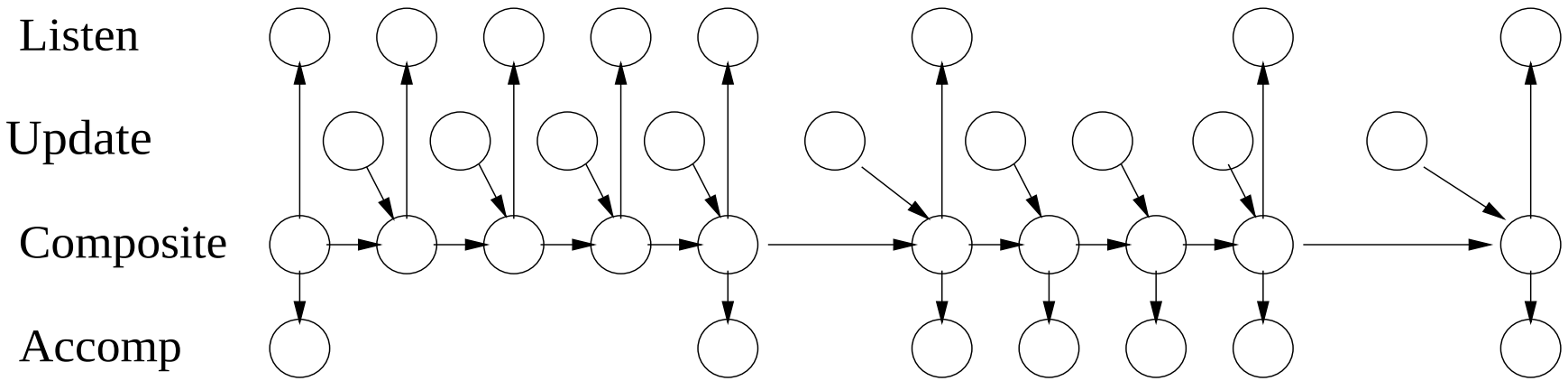
Modeling Musical Evolution

Let

$$t_n = \text{tempo (secs/meas) at } n\text{th note}$$
$$s_n = \text{onset time in secs of } n\text{th note}$$

Model:

$$\begin{pmatrix} t_{n+1} \\ s_{n+1} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \text{length}_n & 1 \end{pmatrix} \begin{pmatrix} t_n \\ s_n \end{pmatrix} + \underbrace{\begin{pmatrix} \tau_n \\ \sigma_n \end{pmatrix}}_{N(\mu_n, \Sigma_n)}$$



How can I break your system?

Live demonstration on

Mendelssohn: Violin Concerto, Mvmt 1

John Sanderson, Indiana Univ. Jacobs School of Music, violin soloist

(untrained model)

The Real Problem

John Sanderson on

Lalo: Symphonie Espagnole, Mvmt 1

(trained model)