So starting with an initial state vector $\underline{v}_0$ we can get the subsequent state vectors $\underline{v}_k$ by

$$\underline{v}_k = M^k \underline{v}_0$$

Indeed, we could try to find the 'steady state' condition by

$$\underline{v}_\infty = \lim_{k \to \infty} M^k \underline{v}_0 .$$

Clearly this is computationally nuts, however, if such a steady state exists, then

$$M \underline{v}_\infty = \underline{v}_\infty \qquad (*)$$

so finding the steady state vector reduces to solving $(*)$. Some of you may recognise this as the eigenvector corresponding to the eigenvalue 1, which points to a far more computationally reasonable approach!

Returning to our composition, a viable transition matrix might be:

$$M = \begin{pmatrix} 0.2 & 0.1 & 0 & 0.2 & 0.3 & 0 & 0.1 & 0.4 \\ 0.1 & 0.1 & 0 & 0.1 & 0.2 & 0.3 & 0 & 0 \\ 0.2 & 0.2 & 0.2 & 0 & 0.1 & 0.2 & 0 & 0.2 \\ 0.05 & 0.2 & 0.3 & 0.1 & 0.05 & 0.2 & 0 & 0.2 \\ 0.2 & 0.2 & 0.2 & 0.4 & 0.1 & 0 & 0.3 & 0 \\ 0.1 & 0.1 & 0.2 & 0.1 & 0.2 & 0.15 & 0 & 0 \\ 0.05 & 0.1 & 0.1 & 0 & 0.05 & 0.15 & 0.1 & 0.1 \\ 0.1 & 0 & 0 & 0.1 & 0.1 & 0 & 0.5 & 0.1 \end{pmatrix}$$

$= p(\text{next play } G \mid \text{currently playing } E)$

There's much more which can be studied on this topic!