

My computer writes music on its own ... does yours?

Exploring a new algorithmic composition approach to generate music in real time matching tension

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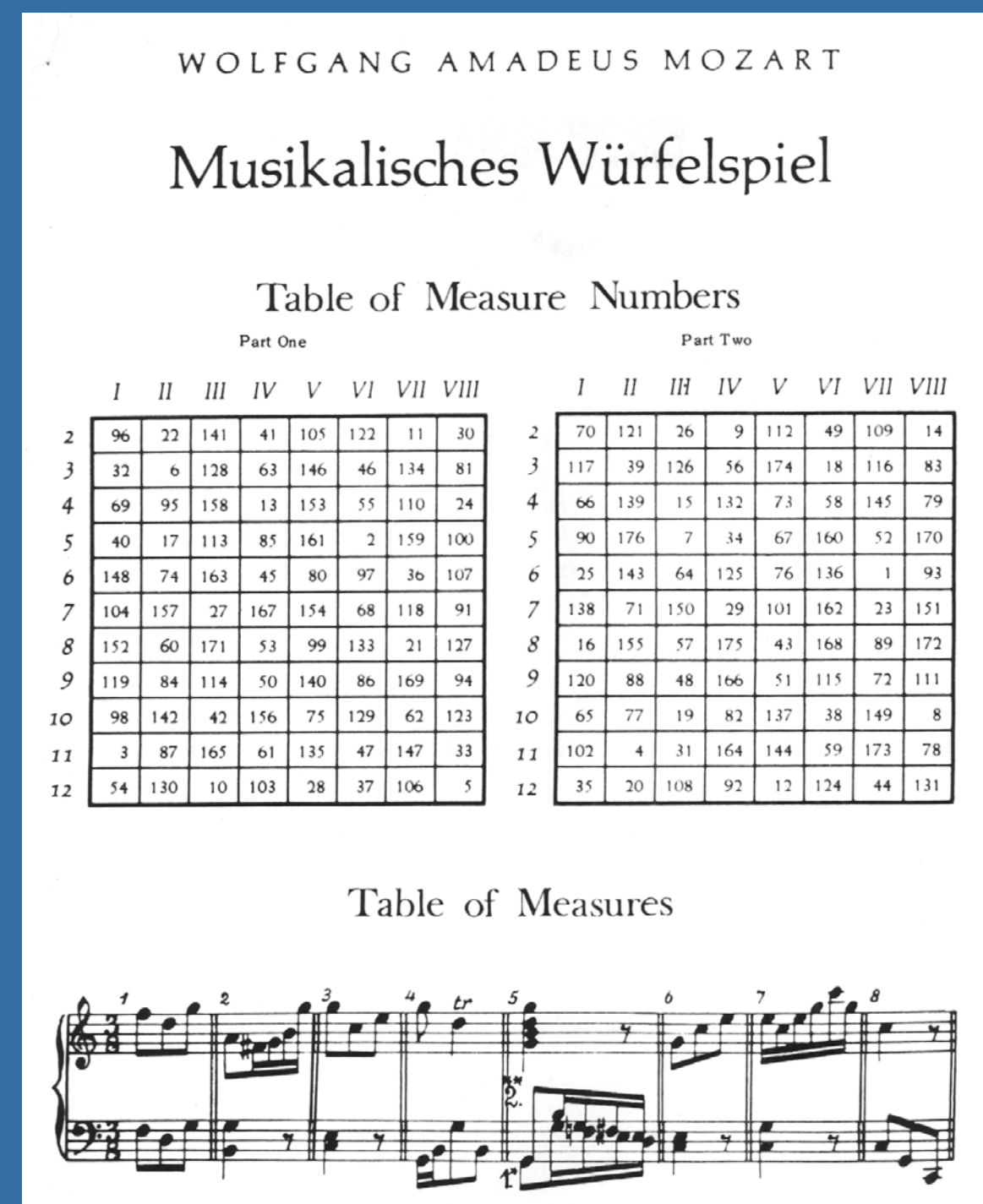
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ALGORITHMIC COMPOSITION

What is Algorithmic Composition?

Algorithmic Composition refers to the computational process of generating a piece of music according to a set of instructions [1, 2].



Why Compose Algorithmically?

Algorithmic Composition is attractive as a source of real-time, original, endless material [3], either as a final product or to provide inspiration [4], and to reduce effort, memory consumption and costs [5].

Where is Algorithmic Composition used?

Algorithmic Composition is in constant demand in markets such as those of films or video games, where music plays an essential role, both as a medium of affective immersion and as support of the interaction with narratives [6].

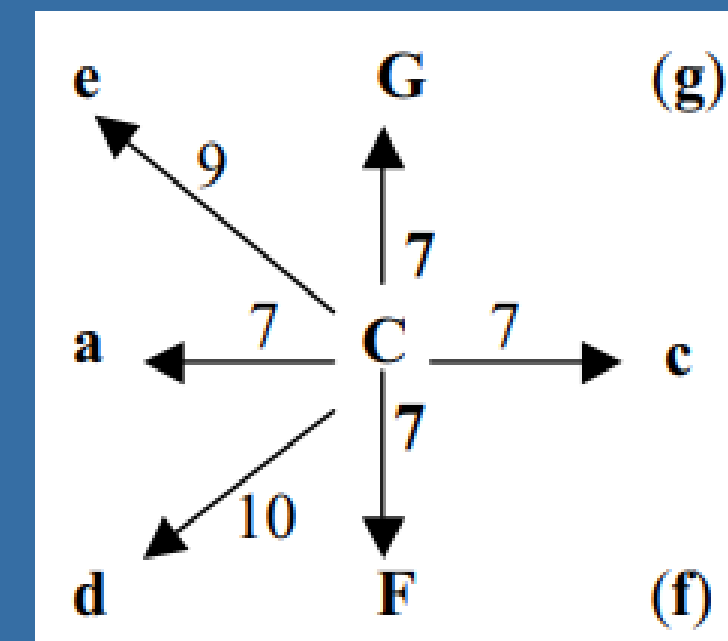
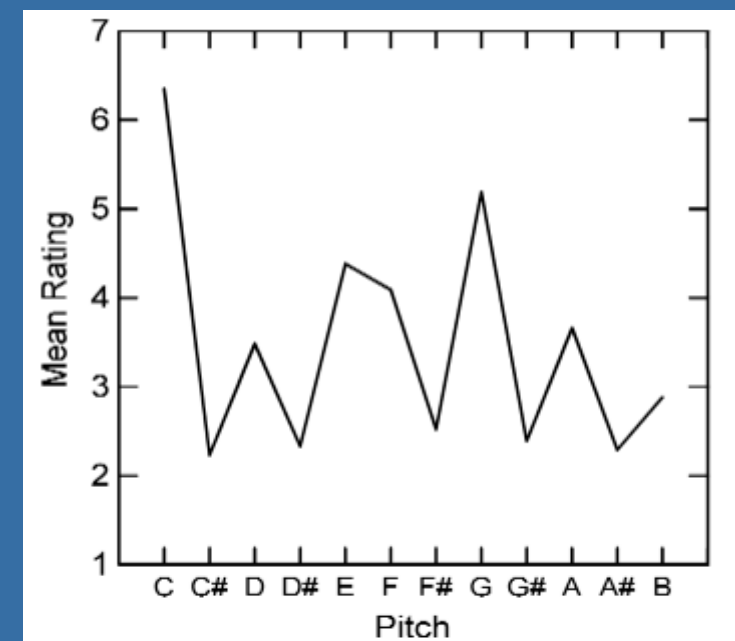
Which is the next step within Algorithmic Composition?

Algorithmic Composition has been embraced by the field of artificial intelligence in the past decades [1, 2, 7]. However, the music generated by most of these studies lacks specific intention and so can sound meaningless. To address this issue, algorithmic composition systems should evaluate and refer to a specific feature, such as musical tension [7].

MUSICAL TENSION

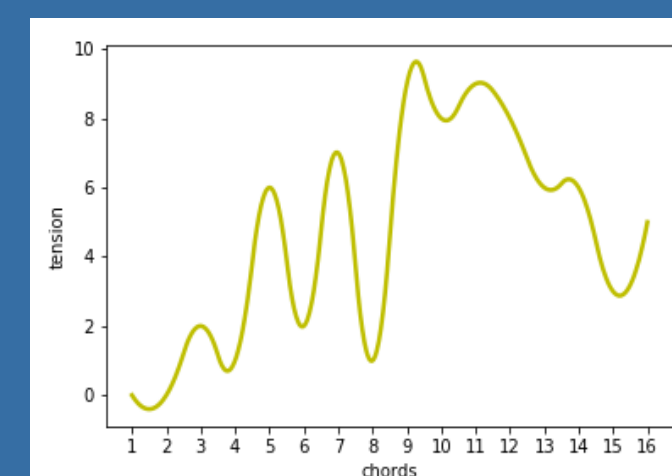
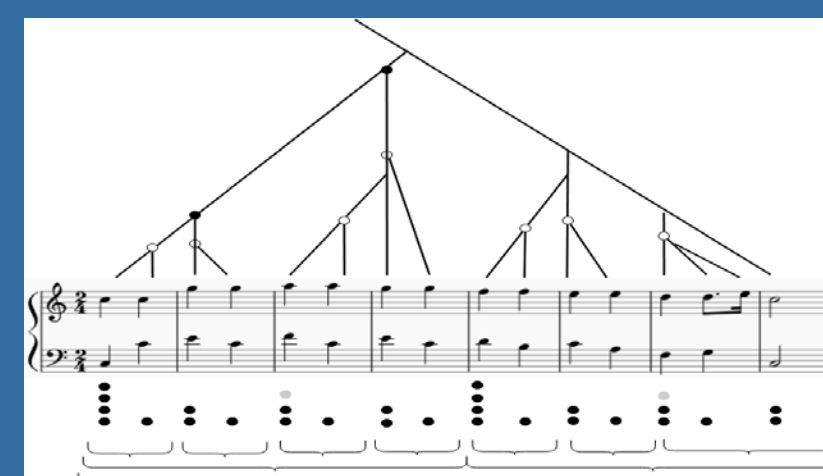
What is Tension in Music?

Musical Tension relates to the degree of expectation within a musical context. In the Western music tradition, said context is called *tonality*, where notes and chords are given a specific role. In this way, tonality can be seen as a hierarchy, according to how important these roles are. From this hierarchical point of view, the more important a note or chord is in a given tonality, the more it is expected to be played, so the less tense it is perceived, and vice versa [8].



How to model Tension in Music?

Musical Tension has proven to depend on harmonic [9], melodic [10] and rhythmic features [11]. Harmonically, tension depends on the distance between chords within tonality. Melodically, tension depends on the distance between melodic notes, their direction and role within tonality. Rhythmically, tension depends on the duration of chords and on the speed of change when going from one chord to the next.



MUSIC GENERATOR

What is the Music Generator?

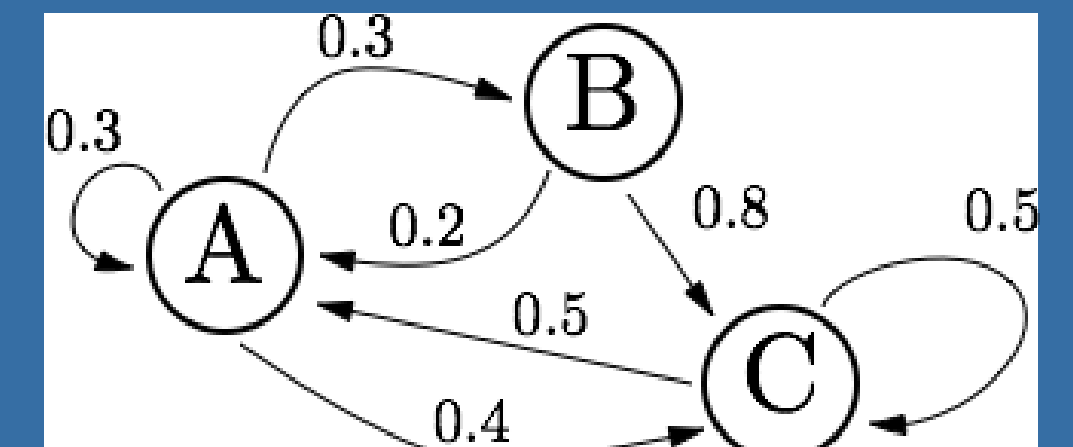
The Music Generator is a system designed by the author to generate music in real time matching a given tension level.

How does the Music Generator work?

Taking into account the theoretical models of tension within tonality [9-13], quantitative tension values can be calculated for any possible sequence of notes or chords.

The tension values of the sequences can be transformed into probabilities according to how close they are to the input tension level. In this way, in a low tension scenario, the more important a chord is within tonality, the more likely it is to be generated, and vice versa.

The Music Generator has been implemented as a stochastic model where the chords and notes to be generated, and their durations, are selected based on the above mentioned probabilities.



Does the Music Generator match people's perceptions?

Ten musicians and ten non-musicians were recruited to participate in an evaluation of the system. They were asked to listen to a collection of pieces of music generated by the Music Generator. Three pieces were presented at a time. Participants were asked to select which they perceived as being the most and the least tense. The agreement between a participant's and the system's labelling was defined as equal to 1 if the system's tension label was the same as the participant's, 0 otherwise.

	Min M	Med M	Max M	Average M	Min NM	Med NM	Max NM	Average NM
Harmony	0.84	0.70	0.92	0.82	0.52	0.40	0.54	0.49
Melody	0.42	0.40	0.92	0.58	0.46	0.50	0.76	0.57
Both	0.68	0.64	0.94	0.75	0.60	0.58	0.78	0.65
Average	0.65	0.68	0.93		0.53	0.49	0.69	

The study showed high correlation between the input levels of tension and the tension perceived by the participants.