On Multi-Touch Interfaces for Music Improvisation: The Blues Machine Project

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Abstract

In this work we discuss a new paradigm of making music with computers. By using a multi-touch interface, musically important effects, like bends, are allowed. By presenting only the scale notes, musicians can concentrate only in the melodic line, making easier the task of improvising, even for newbie's.

Introduction

Multi-Touch interfaces are becoming popular. And as usual, at the beginning one tries to emulate the old technology in the new one. That's why so much musical applications designed for multi-touch devices have interfaces which are simply pictures of piano keyboards (Wada 2009), guitar fingerboards (Curious Brain Inc 2009), etc.

Of course there is the strong argument that it would be easier to play the computational device if its interface would appear like that of some real instrument. But this way the computational instrument cannot compete with the one it is trying to imitate, since the usability and sound of the latter is the best possible, by definition.

We believe the flexibility of multi-touch interfaces (as display devices and input-event handlers) in conjunction with Maeda's "throw away" law of simplicity (Maeda 2006) can put computers in battle conditions.

In this work we discuss the case of Blues music. We present an interface for improvisation on the Blues scale (over a 12-bar Blues base) which is simple and clean (notes out of the scale cannot be touched) but that still allow musical effects similar those of a real instrument (the guitar): bend, vibrato and polyphonic melody are possible. We further show how this idea can be extended to other musical scales and styles.

Previous Work

Interfaces for music performance abound, even if we talk only about analog instruments. Many devices appeared with the entrance of the computer era (Roads 1992, 1996), and with the evolution of multi-touch interfaces a considerable boom of new ideas has happened (Kaltenbrunner 2009).

Some musical instruments have interfaces based on matrices of points. We can mention, for example, some types of accordions and concertinas. The disposition of notes, however, is different of ours, and we have no notice about an accordion or concertina which features a Blues scale keyboard.

We can also cite the AXiS-49 MIDI controller (C-Thru Music Ltd 2009). It is a bi-dimensional interface whose keys are hexagonal, forming a honeycomb pattern, again not alike the one we propose here.

Summarizing, we have found no musical instrument featuring a bi-dimensional multi-touch interface like that we introduce in this work. This includes modern tangible musical devices, like those listed in (Kaltenbrunner 2009).

The Blues Style

The Blues genre originated from music played/sung by slaves in the USA in the 19th century. In its modern form there are two elements very frequently used: a 12-bar chord progression and the so called Blues scale.

A commonly used 12-bar chord progression is I-I-I-I - IV-IV-I-I - V-IV-I-V. And these are the Blues scale notes: scale root, minor third, perfect fourth, augmented fourth - the blues note, perfect fifth and minor seventh.

So, as an example, if the main chord is C, the chord progression would be C-C-C-C - F-F-C-C - G-F-C-G, and the Blues scale C, D#, F, F#, G, A# (Schmidt-Jones 2009).

The Guitar Interface

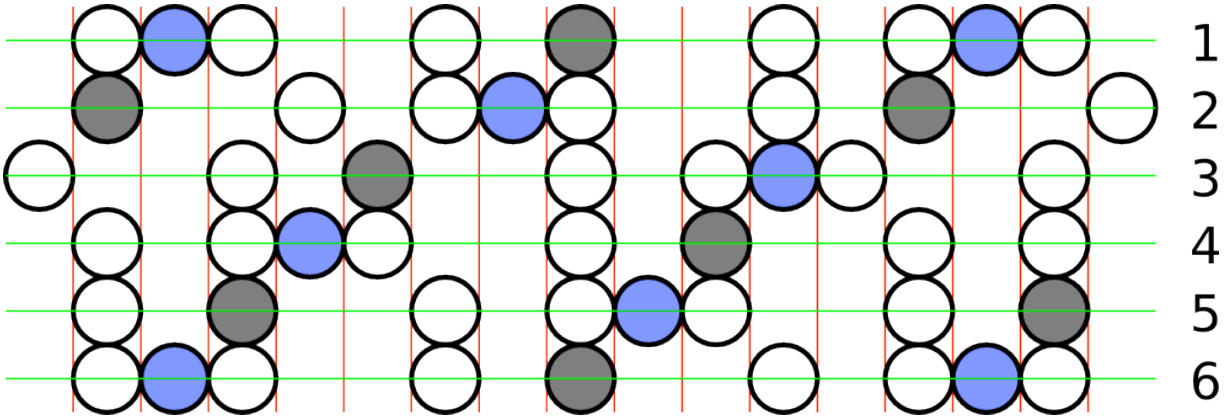

Figure 1: Blues scale at the guitar fingerboard.

Figure 1 shows the notes of the Blues scale on part of the real guitar fingerboard with the default tuning (E, A, D, G, B, E, from the 6th to the 1st string). A very common exercise (one that guitar students learn early in a guitar course) is to improvise on the Blues scale listening to a 12-bar Blues base.

There are five different patterns to learn, which overlap each other to form the arrangement shown in Figure 1. Besides learning the patterns, one important difficulty is that the guitarist can not turn off notes lying out of the Blues scale, what could prevent the playing of all ``wrong'' notes. We said *wrong* in quotes because music is an art, and as such there is no rule that can not be violated. In many cases, however, a musician chooses some scale and tries to build phrases over it. The point is that memorizing (and, more importantly, embodying) a given scale is a process that takes long time and considerable effort.

Despite this difficulty, regarding performance the electric guitar is a very rich instrument, in the sense that musicians are allowed to apply many different effects, especially bends, hammer-on's, pull-off's and slides, in the case of Blues music. So it would be interesting to preserve these possibilities in a computational musical instrument.

The Blues Machine Interface

Using computer software to simulate traditional musical instruments is a difficult endeavor. Unfortunately, without special hardware components, the task of producing reasonable sounds becomes cumbersome, since mouse and keyboard were not designed to be interfaces for musical performance.

So, although computers are largely used in today's music production, we still can not play them, in the sense we play the guitar, for example.

Blues Machine (http://www.visgraf.impa.br/bm/) is a project whose main guiding point was to make the computer a musical instrument. That task has become easier with the emergence of multi-touch interfaces, since they permit many of the effects we have

mentioned in the last section. The bend effect, for example, can be obtained by touching the screen and sliding the finger up or down. Sliding up and down repeatedly produces vibratos. The distance between the touchdown point and the current finger point in a slide movement determines the amount of pitch shift.

And, by definition, multi-touch interfaces allows the user to play many notes at the same time, something that actually occurs very often in music performance in general.

We also would like a musical instrument easy to learn. The way we found was to simplify the playing experience by presenting only the Blues scale, in a way more friendly than that of the guitar fingerboard.

It turns out that we came up with the scale pattern shown in Figure 2. That pattern was obtained by simply aligning vertically the notes of the scale at the guitar fingerboard's pattern, as shown in Figure 3. An interesting fact to observe is that the arrangement of notes in Figure 2 can be seen as a tiling of the plan with especially designed *Blues-scale tiles*, as clarified in Figure 4. This behavior is due the fact that the guitar is an instrument tuned in fourths, i.e., the tune of the string below the x-th string is the perfect fourth the x-th string's tune (except for the 3rd string).

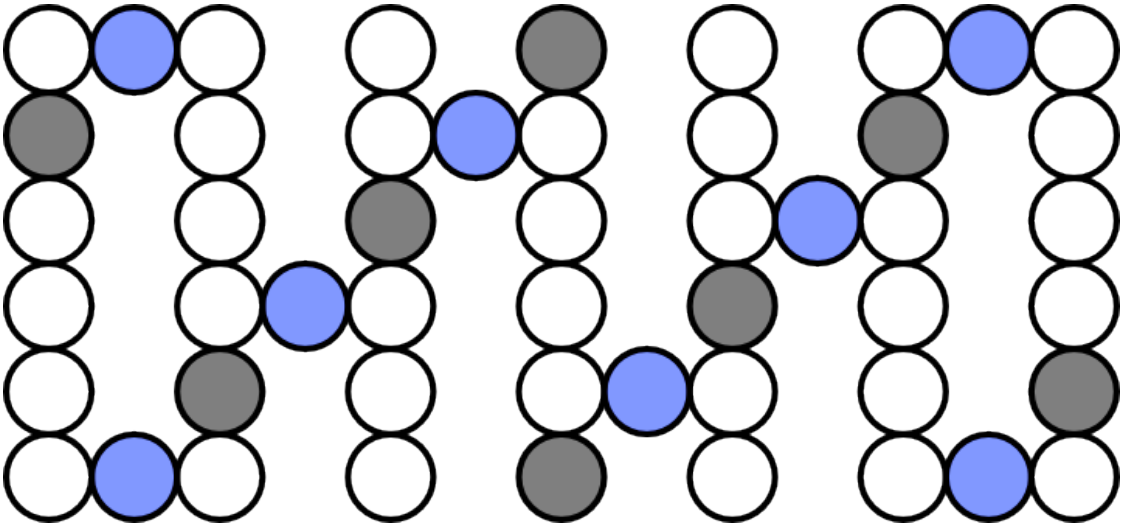

Figure 2: Blues scale at the Blues Machine's interface.

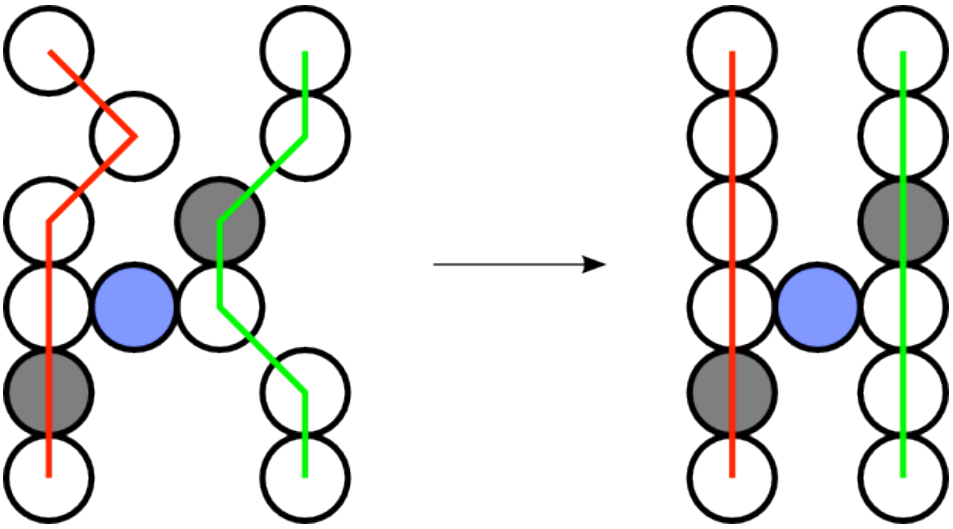

Figure 3: Alignment of part of the Blues scale pattern

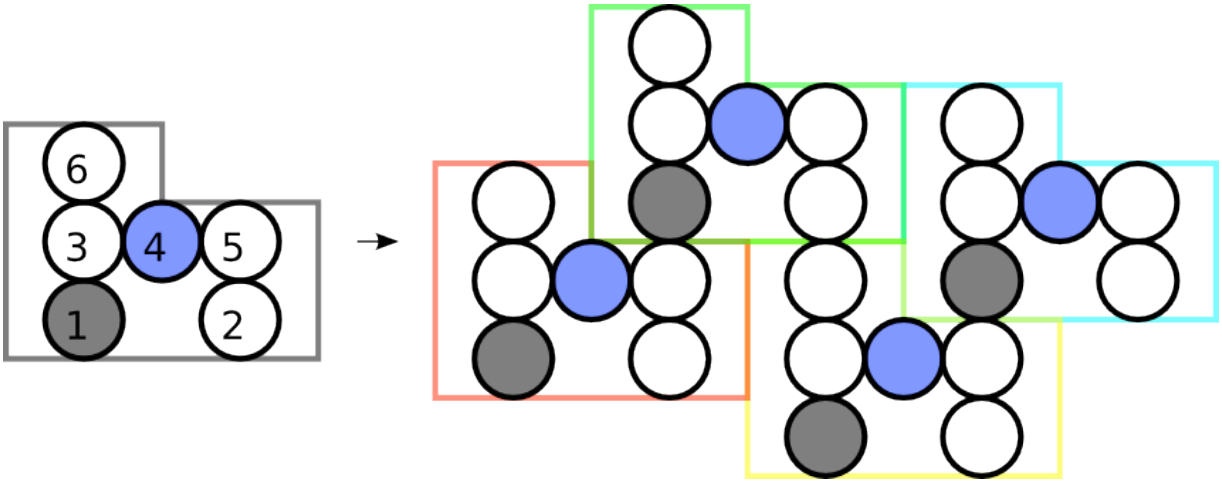

Figure 4: Tiling the plan with Blues scale tiles. Numbers in the pattern on the left represent the following Blues scale notes: (1) scale root, (2) minor third, (3) perfect fourth, (4) augmented fourth (blue note), (5) perfect fifth and (6) minor seventh.

Implementation

We implemented the above idea in two different multi-touch devices: one with a large 40x30cm screen (http://www.visgraf.impa.br/bm/), and the other a smart-phone with a 480x320px screen (http://www.impa.br/~cicconet/bluesmachine/).

The hardware of the former is based on the *Reactable* project (Reactable Systems 2009). The Reactable has a tangible multi-touch screen interface for interaction, what can be realized by many players at the same time, in the context of collaborative electronic music performance. Under the hood, i.e., underneath the screen, there is a projector and a video camera. A computer vision framework (Kaltenbrunner and Bencina 2009) tracks (by means of the video camera) finger positions and send them to the application software. The projector displays the interface and user-interaction feedback.

Figure 5 shows the realization of our proposed interface on the Reactable. Note that in our implementation of the hardware there are real strings mounted upon the screen (Figure 6 gives a closer look). This extra component has a conceptual and practical function: to bring back the real guitar tangibility, so important in the playing experience. The bend effect, for example, is limited by the elastic properties of the strings. The form factor is also important here: a 40x30cm screen size allows comfortable performance, in the sense that it's big enough for bend effects and small enough to allow the playing of two or three notes without hands global movement.

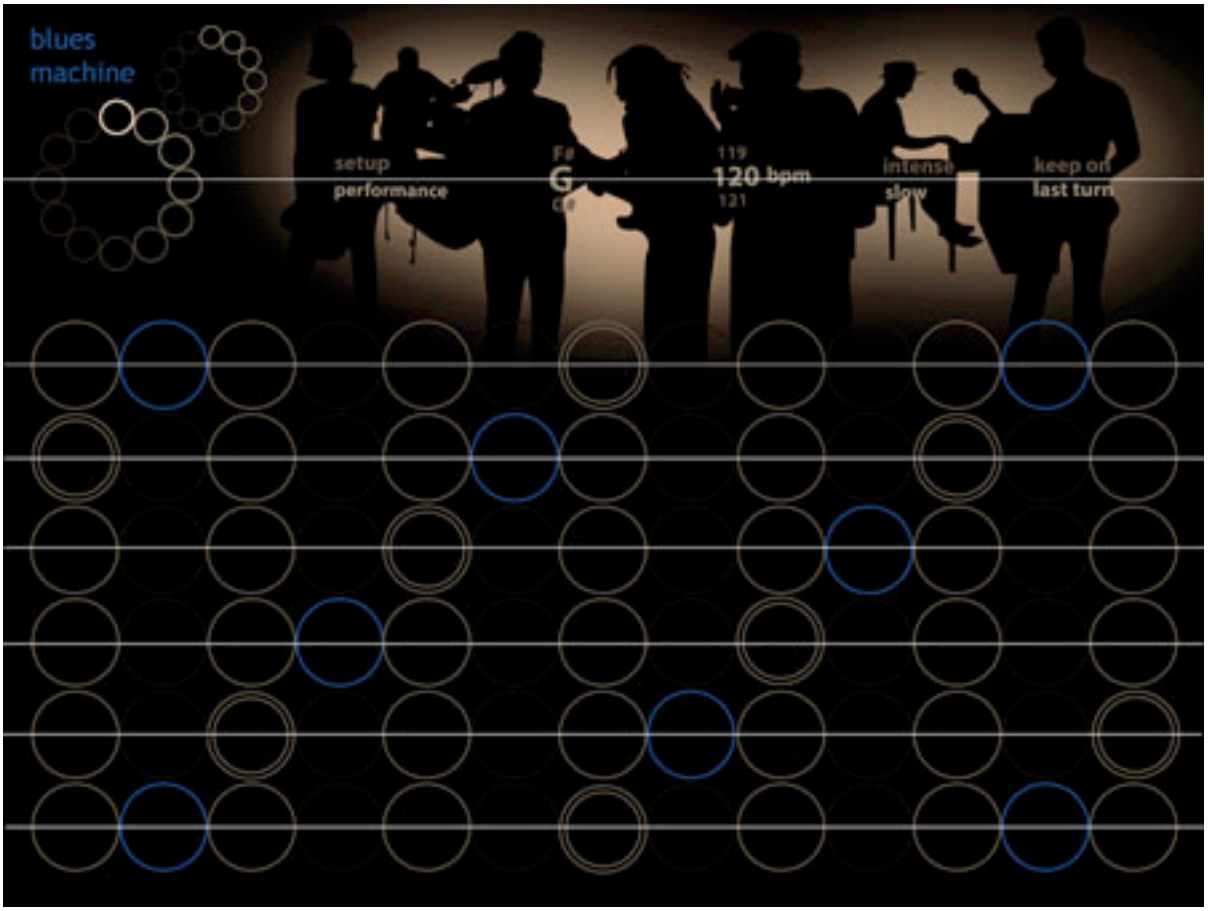

Figure 5: Interface of the Blues Machine's Reactable version.

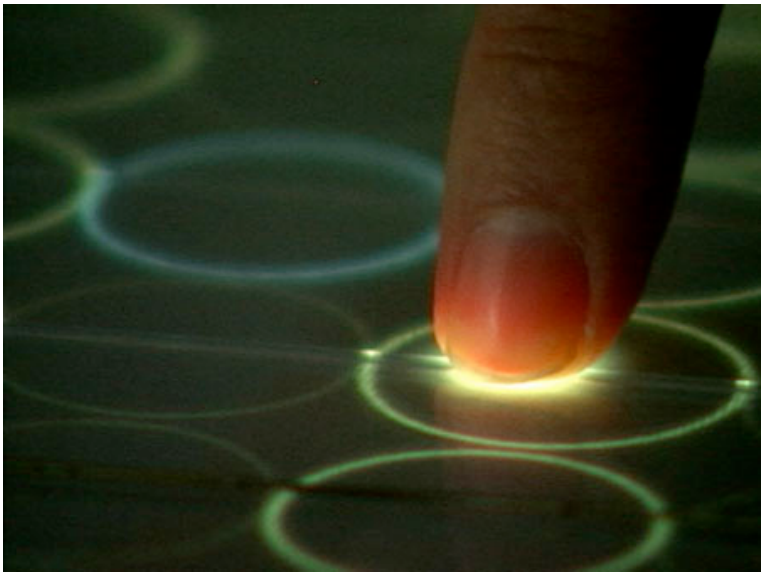

Figure 6: Real strings are mounted upon the screen showed in Figure 5.

Both implementations have some kind of configurable accompaniment. The user can chose key, tempo, etc, which is helpful if he/she wants to play by him/her-self. The smart-phone version (Figure 7) has a separate screen for setup, while the other presents a unified interface.

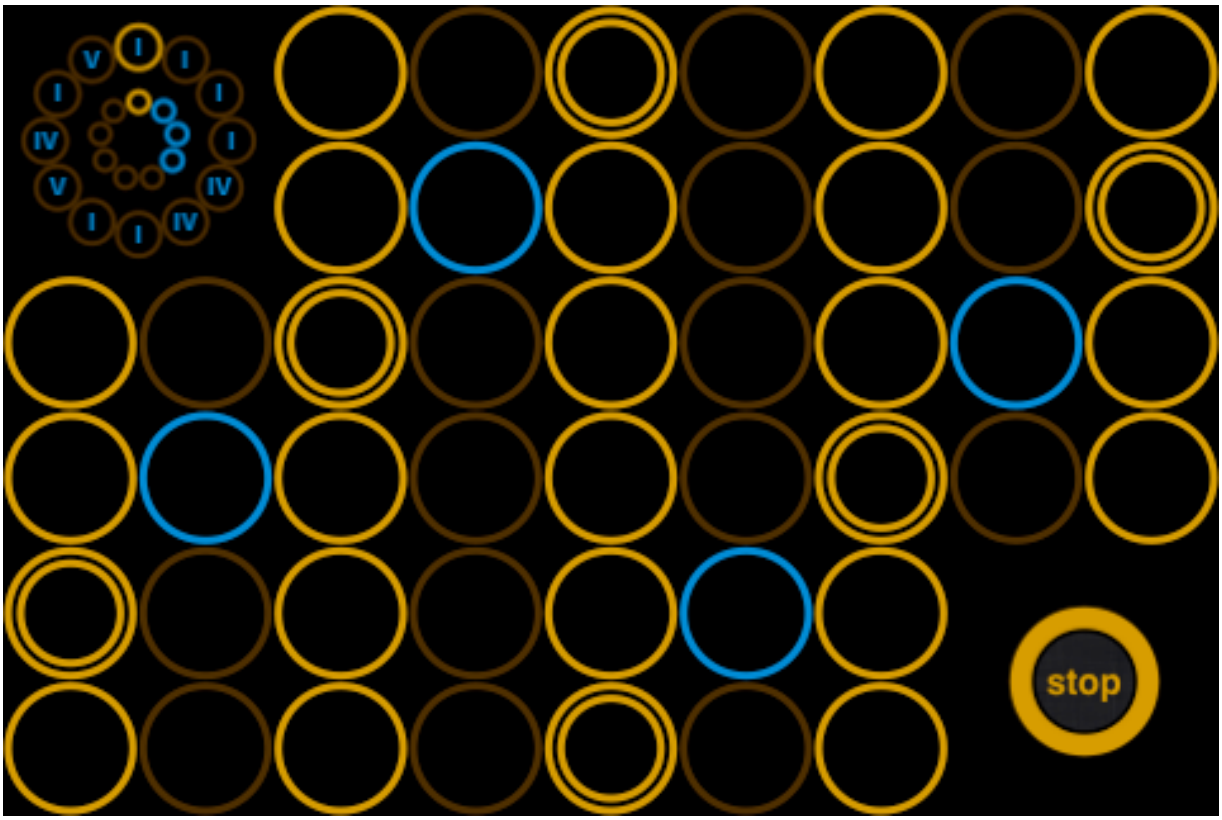

Figure 7: Interface of the Blues Machine's smart-phone version.

Other Scales

The Blues scale is just one between many others. We found, however, that the same idea applies to other scales, and we present here two of them.

Let us remember that the Blues scale is nothing more than the minor pentatonic scale with an extra note, the augmented fourth (blue note).

By removing the blue notes of the pattern shown in Figure 2 we get what can be seen in Figure 8. Observe that there is no void space in this case.

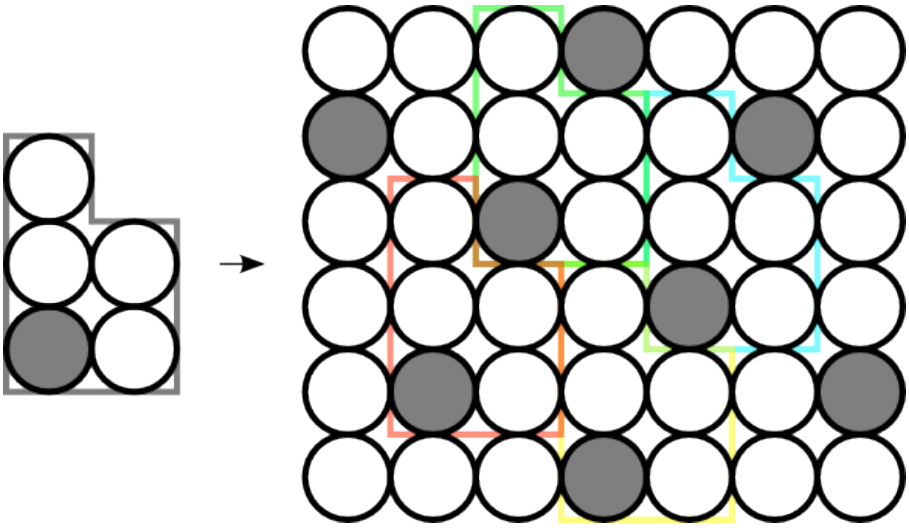

Figure 8: Tiling the plan with minor-pentatonic scale tiles.

Lastly, Figure 9 shows the configuration of the major-diatonic scale, which has seven notes. Again there is no void space.

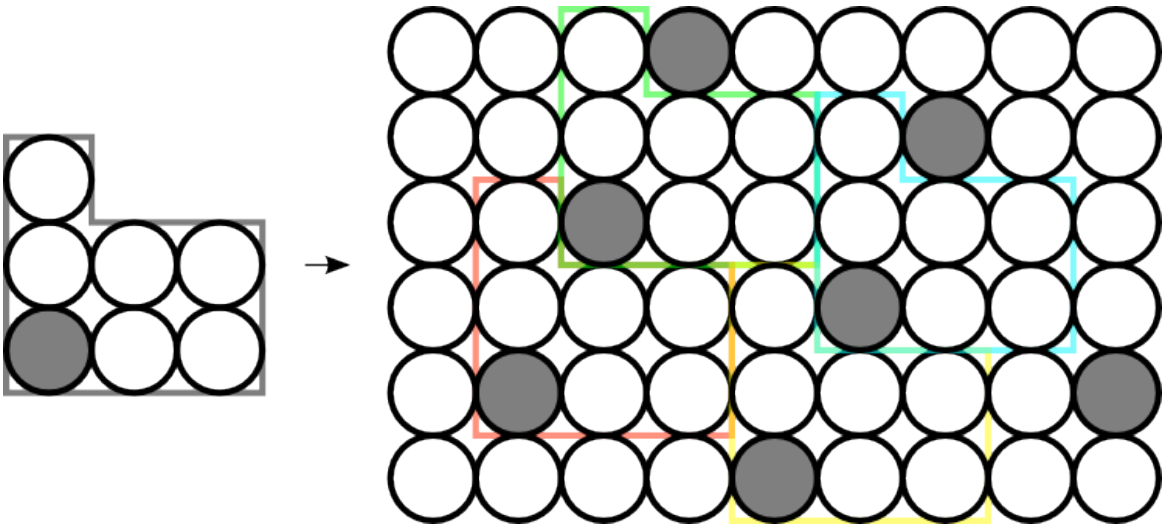

Figure 9: Tiling the plan with major-diatonic scale tiles.

As many music genres have particularly related scales, analogs of the Blues Machine could be implemented for those styles. The major-diatonic, for example is very common

in pop, rock and country music.

Future Work

There are many questions that can be investigated regarding the kind of interface we have presented.

Firstly, by making use of the computational environment flexibility, it would be interesting allowing the musician to navigate between scales. It is usual, for example, when improvising Blues, to build phrases in both the minor (default) as well as the major Blues scale. So the interface could present the possibility of changing from one scale to another at performance time.

Another idea is to build a game, where the player (in all the senses of the word) is invited to repeat phases shown by the system, or even improvise with those phrases, performing the so called call-and-response a very common behavior in improvised music.

Thirdly, the bi-dimensional nature of the proposed interface gives rise the possibility of experimenting bi-dimensional automatic composition algorithms. Dozens of bi-dimensional stochastic process can be found in the field of probability theory, and one of them could be a good model for music improvisation in styles like the Blues.

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