Persian Music Scalator

Sonic College,
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Module: Future Sound
Arash Pandi

One of the first experiments on generating/ modulating sound and music based on Persian scales has been started in 60's by the Iranian musician, composer and conductor "Alireza Mashayekhi" [1] who is also the pioneer of Persian Symphonic Music. He composed the piece "Shur op.15"[2] in 1968 in the sonology institute at University of Utrecht, when he was studying Electronic and Computer Music.

He's used different analogue synthesis techniques such as Additive and subtractive synthesis, noise generating and electronic modulating of recorded sounds using FM and AM modulation.[3] Hearing this piece and some other records from him and Atta Ebtekar and some other musicians who tried to mostly do modulation on Persian traditional music motivated me to start studying the scales and system of Persian music and think of a midi-based system that will allow the musicians to compose and improvise through the Persian scales.

There's not much written source about the Persian music theory; as many important books about music got destroyed or burned during the invasion of Iran in the past, but from the late 19th and early 20th century some efforts have been taken to get to a standard common written system that everyone agrees. Also there's still some discussion about the details in the system such as assigning a half of semitone to exactly 50 cents all the time or it should be less or more in some cases, but the general system of scales and intervals has been accepted among most musicians today. I based my research on two important books, one from the 80's and the other one is a very new release and more as a reference for Persian musicians. [4] & [5]

Before I go through the details of the project I will explain a bit about the theory behind Persian music:

Persian music consist of 7 "Dast'gah" (scales or modes) which two of them have secondary sub-scales called "Av'az" (the meaning is Tune, Singing, Song, etc). There is more than 200 short melodic movements called "Gusheh" (the meaning is Corner, Angle, etc) inside these modes (Dast'gah) which the musicians use to improvise in a mode or move through the other modes. The whole system of this classification is called "Radif" (the meaning is Row, Series, etc).

A typical performance consists of the following elements:

 "pīshdarāmad" (Intro- a rhythmic prelude which sets the mood),
"darāmad"(rhythmic free motif),
"āvāz"(improvised rhythmic-free singing),
"taṣnīf"(rhythmic accompanied by singing, an ode),
"Chahārmeżrāb"(rhythmic music but rhythmic-free or no singing),
"reng"(closing rhythmic composition, a dance tune),

The study of the techniques of the old persian musicians and also the structure of the main traditional instruments such as "T'ar, Setar, Kamancheh" reveals to us that the Persian Instrument players were not able to play any mode (dast'gah) from any place on the instrument and they also couldn't transpose different modes from one note to another, except in a range of "The Perfect Fourth". This is probably the reason that these modes (dast'gah) are divided by two four notes called Tetrachords. So there's two tetrachords in an octave; Downward and Upward tetrachords.

Considering the C Major Scale, we will have:

C   D   E   F   G   A   B

First Tetrachord (Downward) : C – D – E – F
Second Tetrachord (Upward) : F – G – A - B

In each tetrachord there are some notes that have more or less value than the others, or even other roles.
One of them is the Tonic note or "**Shahed**". Shahed is the main axis of the Dast'gah and Maqam.
Morteza Hannaneh is his book "The Lost Scales" describes the Shahed tone:

" Shahed is the sound (tone) that first of all has been played and heard more than the other tones in a musical motif, and secondly as soon as being played and repeated and changed with the tones before/ after itself, the properties of that Dast'gah would reveal in the listener's mind. For this reason, there's a section called "Dar'amad (Intro)" for each Dast'gah which includes the Shahed tone and it's alteration with the other tones in approximately a perfect fourth range."

* Shahed can be thought as the tonic of the mode or scale. It's usually the first note of the scale but sometimes is the other tones, like 3rd or 4th .

The other important tone is the "Ist" tone (means "stop"). Ist is an additional/ Secondary axis of a Dast'gah which during the piece, there are occasionally stops on that note. The equivalent of the importance of this note is the Dominant in western music theory with this difference that in western music the dominant is always the 5th but in Persian music it could be any tone.
The point is that the Ist note of a tetrachord/ mode could be the Shahed of another one and through moving the importance and the role of Shahed and Ist to the other notes, we can slowly move between those short melodic movements (Gusheh) which sometimes have different Shahed and Ist notes than the main Scale (Dast'gah) and consequently we can move through different scales without really transposing the whole scale.
Here's a small example of the Shur Dast'gah which is the most common mode to play because of many possibilities inside it:
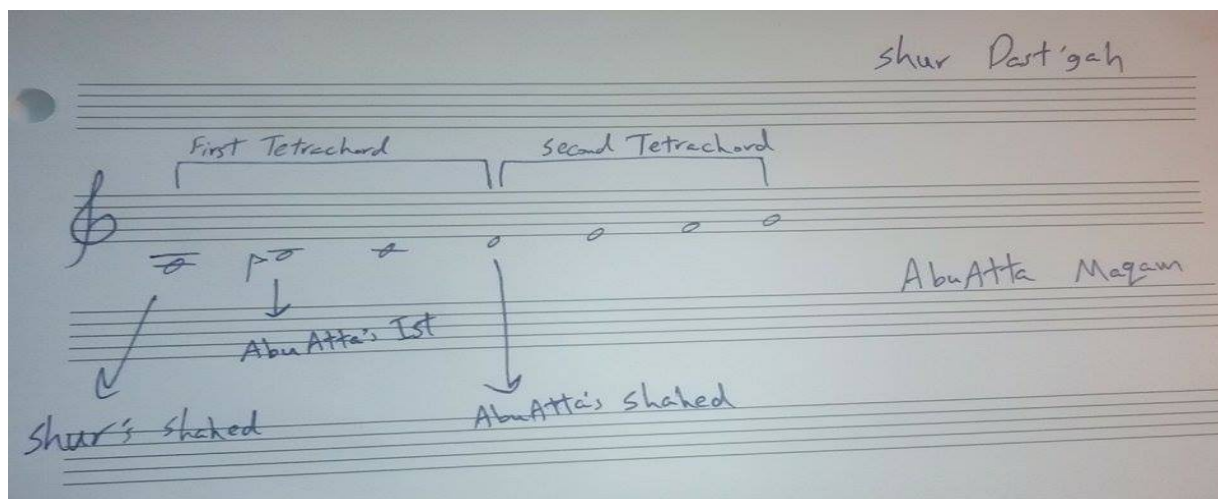
This is a Shur scale with "A" as the tonic or Shahed. There's another sub-scale called "AbuAtta"

which is one of the 4 Tunes or A'vaz inside the Shur scale which in the old times were an independent mode/ sclae. You can see that the Maqam of AbuAtta has a different Shahed (Tonic) than the Shur scale.

In persian music there's two more signs for showing the intonation: Sori and Koron

Sori : Change the pitch of the note to a half-semi tone higher. (quarter tone!)
Koron : Change the pitch of the note to a half-semi tone lower.

In real world there's no movement as a quarter tone, but there's three more intervals:
1. Mid-Major intervals: if we decrease a quarter form a tone or add a quarter to a semitone.
2. Extra-Major/ Perfect : if we add a quarter to a tone or to a perfect interval. (4th , 5th etc.)
3. Less-Minor /Perfect : if we decrease a quarter from the perfect or minor intervals.

As mentioned before there's several discussion about the amount of a quarter in cents, and if it should be the same all the time or not, but because of making the project as straight as possible i've considered all the quarters as 50 Cents.
I chose the midi approach for the system mostly because of the possibilities of Midi between the musicians and also different midi-compatible hardware/ softwares and the wide range of opportunities it will open. There are several problems in this case which I will point out while describing how the patch works.
The first problem was the intervals which are less or more than semitones and I had to use the pitch-bend data to control the quarter tone changes. This limited the interface to be monophonic interface which is not a sad news as the persian music was mostly monophonic and only in the last decades some composers have tried to harmonize the persian music, so its still a work in process.
For making the scale work, I have set a system which I send exact pitch-bend data along with note pitch and velocity with every note. I've calculated the pitch-bend amount with the ableton live's pitch-bend data and that's why an amount of "8192" in MaxMsp's pitch bend is equal to Zero in Live and then i've calculated the Koron and sori differences and send them separately whenever there's a Koron or Sori in the scale.
There's a problem here because the more we go into the scales and specially the short melodies (Gusheh), the more alteration happens and it requires to change some tones a quarter lower or higher and play them as natural notes quickly. I have made the standard 12 old scales (Maqam) with the tonic of G which I had to assign some of the Korons or Soris to the black keys due to the existence of the natural note and the quarter lower or higher in the scale. It could also turn out as a knob or button for triggering the Koron or Sori changes.
There's an arpeggiator section in the subpatch "P MidiController" which is supposed to simulate some of the movement around "Shahed" and "Ist" note and also to present the idea of tetrachords.
In order to get the right feeling and atmosphere of a scale, it's crucial to play these scales in a range of 4 or 5 notes, as usually there's no move bigger than fifth in persian music played by players. In the upper arpeggiator you can choose from 5 tetrachords that exist in the Shur scale and the difference is that in each tetrachord the first note is the Shahed of that Av'az or melody, meaning that we're moving the tonic from the first note in the scale to the fifth note which will open the way to move through the other scales.
The other arpeggiator at the bottom is more like a technical arpeggiator, designed for more creative rhythms and melodies which may sound Persian or not depending on which notes are held down or how many and how. Notice that with holding down the notes that are not in the scales (for example the balck keys on keyboard) you can make many random rhythmic figures.
This is a demo of using arpeggiator as tool for helping the musicians to choose the most famous melodic & rhythmic figures that exist in the "Radif Books" or to try experiment new ones throughout the scale.

References Used in this project:

1. http://en.wikipedia.org/wiki/Alireza_Mashayekhi
2. https://www.youtube.com/watch?v=re5i6RPGLT8
3.An Analysis of "Shur" Op.15, AlirezaMashayekhi, 2010 Reza Sabooni
4."Analysis of Persian Music's Radif " 2013 - by Farhad Fakhrodini
5. " The Lost Scales " 1988 – by Morteza Hannaneh
6. http://www.sotesound.com/
7. "Electronic Music and Sound Design - Theory and Practice with Max/MSP - volume 1"
Paperback – December 1, 2010 by Alessandro Cipriani (Author), Maurizio Giri (Author)