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Scordator: A digital map of all scordature

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Abstract

Scordatura is often used in stringed instruments to overcome constraints posed by their tuning. Finding the right scordatura for a particular situation may be a time-consuming task, especially for non-guitarist composers. In this contribution, we present a web application designed to show a tuning chart for any chordophone equipped with a maximum of eight strings, each tunable to a pitch in the range of a full keyboard. The application also provides visualization of the available positions for live MIDI notes within a given scordatura.

Cover Page Footnote

Lecture given at The 21st Century Guitar Conference 2021 under the title: Scordator: A Tool for Stringed Instrument Players and Composers.

Scordator: A digital map of all scordature[1]

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Scordatura is often used in stringed instruments to overcome constraints posed by their tuning. Finding the right scordatura for a particular situation may be a time-consuming task, especially for non-guitarist composers. In this contribution, we present a web application designed to show a tuning chart for any chordophone equipped with a maximum of eight strings, each tunable to a pitch in the range of a full keyboard. The application also provides visualization of the available positions for live MIDI notes within a given scordatura.

There are several situations in which tunings other than standard are required (Carvalho, 2013). There may be a need to adapt the instrument to different tones or modes: for example, to explore characteristic melismata or certain harmonic intervals used in certain cultures. On chordophones, using a scordatura is useful to overcome limitations in overlapping thirds and seconds or creating clusters, as for example when playing in contrapuntal melodic lines of a similar ambitus. On the guitar, the slow and heavy movement of the thumb leads to preferentially using it on the bass strings. This results in an excessive idiomatic emphasis of the extreme regions of lows and highs, frequently played respectively by the thumb and ring fingers, with notable restriction in the freedom of choice of homogeneous re-entrant arpeggios,[2] necessary, for example, when transcribing impressionist music. Scordatura is also necessary in repertoire that uses microtonal tunings (which were made possible by the guitar prototypes built by Daniel Friedrich and Walter Vogt). Scordatura thus expands the capabilities of the guitar, including:

- Increased possibilities of *campanella* playing;
- Distancing or approximation of contrapuntal voices by an octave;
- Creation of voice crossings;
- Creation of unisons, octave or any other harmonic intervals;
- Creation of chromatic, restricted clusters, overlapping joint interval arpeggios and diatonic progressions.

For non-guitarist composers, to create a map of the textural possibilities of scordatura – both harmonic and contrapuntal – may involve trial and error experimentation on the instrument, which is a difficult and time-consuming task. We found it necessary to develop a process to predict the effects of different tunings on the guitar's texture and textural potential. We met this need by creating the application Scordator. This involved choosing a notational system to depict those effects.

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[1] Lecture given at The 21st Century Guitar Conference 2021 under the title: Scordator: A Tool for Stringed Instrument Players and Composers.

[2] In re-entrant tunings, the strings are not all ordered from the lowest pitch to the highest pitch or vice versa.

Notational systems

Score (effect writing)

Traditional musical notation shows the musical content through a coherent expression of syntactic factors that are recognized by composers and interpreters. To play by memory requires an exhaustive memorization of the entire chart of notes to be played, whether in a melody, counterpoint or any other texture of simultaneous sounds. The player's mind is therefore not always available to concentrate on interpretational aspects.

In the second half of the 20th century a considerable number of works in scordatura emerged, namely by Carlo Domeniconi (1985), Leo Brouwer (1997) and Nuccio D'Angelo (2007). These composers adopted a mixed notation, whereby the pitches of the notes on the strings with an altered tuning are transposed to standard tuning. This results visually in an undesirable confusion of notes with close pitches – sometimes simultaneously – with some resulting in tones with an unconventional transposition and others maintaining the conventional (octave) transposition. In situations, in which the change of tuning (or instrument) is frequent (such as a recital), tablature might prove helpful in giving the player's mind space to interpret the pieces.

Tablature (action writing)

The tablature only contains information regarding the execution of the left hand. More precisely, the string and fret position of the fingers. Its applications for analysing and writing music are thus limited. The performer's response to tablature is always the same – he/she cannot choose alternative playing locations; and does not change with tuning – in this case, only the result changes.

One can see that the reduced use of the tablature and the widespread use of a single tuning with few variations are two phenomena that are very close or almost coincidental in time. This reinforces the idea that the two are linked. The almost unification of the acordatura (i.e., standard tuning) brought some significant constraints to the expansion of guitar textures in the post-Baroque era.

This analysis of the advantages and disadvantages of different notational system led us to choose using both score and tablature in parallel, since each one of them compensates for the other's deficit.

Scordator

Scordator is a web application to aid in scordatura tunings with string instruments.[3] It is based on the original concept by Paulo Vaz de Carvalho and was designed and developed by Rui Penha using p5.js.[4] It displays up to eight staves, corresponding to the strings of a given instrument, each staff showing up to 32 notes, corresponding to the positions of the 12-tone equal temperament notes playable on that string. The relative position of the notes of each string is maintained, as is the position of their first five natural harmonics. The application was designed mainly for touch-based interaction and allows for the user to change the number of strings, as well as the clefs and scordatura of each string. By default, the application includes templates for the Guitar, Bass Guitar, Ukulele, Violin, Viola, Cello and Double Bass. With a compatible browser, the application shows the various positions of each note played using either a MIDI keyboard or the MIDI output

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[3] The application is available at http://ruipenha.pt/scordator

[4] p5.js is a JavaScript library for creative coding (see http://p5js.org).

of a Digital Audio Workstation or notation software, a feature designed to help composers during the composition process.

Approaches to using Scordator

A user may either choose a scordatura (i.e., choose the open string pitches) and work with its possibilities; or arrive at a scordatura by choosing desired intervals between stopped-string or harmonics pitches, with the aim of forming certain melodic segments, aggregates or contrapuntal details. For example, to play aggregates or sequences of harmonics, which on its turn may lead to musical invention with harmonics.

Future work

Future versions of Scordator will provide:

- Suggestions for choosing the most suitable string gauge to obtain the best tension and sound balance for the instrument;
- Alternatives to execute the same design or aggregate in other regions of the fretboard (unison chart);
- A chart of the two notes bordering each selected note, located on other strings, with the aim of executing closed aggregates;
- A connection to a tablature writing program, signaling the fret and string where each note is pressed;
- A function that indicates the distance between fret wires and between strings based on previous information on the instrument's string length. This will be very useful, especially for composers, and will be complemented by a table of average hand opening capacity, finger by finger;
- A function that flags with a different colour the notes causing difficulty in difficult finger openings.

Conclusion

We presented an application that allows users to visualize the notes of any (semitonal) scordatura. This is a result that, otherwise, takes time to obtain, since one will have to plot a chart manually or test the change on the instrument, which might imply changing strings and not only their tuning. We expect that Scordator will lead to an increased use of scordatura, which will therefore increase the use of tablature.

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Paulo Vaz de Carvalho graduated in law from the University of Coimbra, in 1981. Between 1983 and 1984 he carried out studies of guitar in the Musikhochschule of Viena, oriented by Luize Walker. Between 1984-86 he studied in the the Aulnay-Sous-Bois Conservatory under the orientation of Raymon Gratien and did private studies with Roberto Aussel. In 1994 he finished his mastership in with a dissertation on "António da Silva Leite, Aspetos Selecionados da Vida e Obra"(Selected Aspects of His Life and Work). In 2005 he finished his doctorate on the theme "Pensamento Polifónico na Didática da Guitarra, do séc. XVII ao séc. XX", in the University of Aveiro. He is currently Professor in the areas of Guitar, Techniques and Literature of Guitar and Chamber Music in the Department of Communication and Art of the University of Aveiro.

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Rui Penha is a composer, media artist, and performer of electroacoustic music. He completed his PhD in Music (Composition) at the University of Aveiro. He was a founder and curator of Digitópia(Casa da Música, Porto) and has a deep interest on the relationship between music and its technology. His recent production includes interfaces for musical expression, sound spatialisation software, interactive installations, musical robots, autonomous improvisers, and educational software. More recently, Rui has focused his attention on the problems of defining and guiding artistic research. He taught at several Portuguese institutions, in both music, art and engineering faculties, and is currently an assistant professor at ESMAE and researcher at CESEM.

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