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CONTENTS

RESEARCH ARTICLES

Dao Duc Thuan 539
Decolonization as a Factor for European Integration: The Example of the Indochina War

Pham Quoc Thanh 549
Asia in Human Civilization

Nguyen Thi Nhu Trang 562
Contacting with Violent Patterns and Violent Peer and Student's Violent Drift: An Application of Edwin Sutherland's Differential Association Theory

Ngo Thanh Nhan, Phan Gia Anh Thu 573
A Contribution to Teaching Vietnamese Music: Key Pitches in Context and the Pitch/intensity Contour Graph

Marek Bodziany 586
Vietnamese Immigrants in Poland - Three Decades of Experience

Dang Nguyen Anh 609
Demographic Changes in Vietnam: Challenges for Old - age Support and Implications for Social Protection Policy

Nguyen Thi Thanh Binh 619
Changes in Social Relations of Tay Ethnic People in a Northeastern Commune, 1981 - 2016

Nguyen Thi Tu Trinh, Phan Van Hoa, Tran Huu Phuc 632
Circumstantial Meanings in Behavioral Clauses in English and Vietnamese

BOOK REVIEW

Nguyen Tran Tien 647
India - Vietnam Relations: Retrospect & Prospect

ABSTRACTS IN VIETNAMESE 650

TẠP CHÍ KHOA HỌC XÃ HỘI VÀ NHÂN VĂN
ISSN 2354-1172
Tập 3, Số 5, 2017

MỤC LỤC

NGHIÊN CỨU

Đào Đức Thuận 539
Vấn đề giải thực dân - yếu tố thúc đẩy quá trình hội nhập châu Âu:
Nhìn từ chiến tranh Đông Dương

Phạm Quốc Thành 549
Châu Á trong nền văn minh nhân loại

Nguyễn Thị Như Trang 562
Ứng dụng thuyết Liên kết Khác biệt của Edwin Sutherland trong việc làm rõ
mối liên hệ giữa việc tiếp xúc với bạn bè và khuôn mẫu bạo lực
và xu hướng bạo lực của học sinh

Ngô Thanh Nhàn, Phan Gia Anh Thư 573
Một đóng góp nhỏ vào việc dạy âm nhạc Việt Nam: Mạch giai điệu và biểu đồ biến thiên giai điệu

Marek Bodziany 586
Người nhập cư Việt Nam ở Ba Lan - Ba thập kỷ trải nghiệm

Đặng Nguyên Anh 609
Biến đổi nhân khẩu học ở Việt Nam: Thách thức hỗ trợ tuổi già
và hàm ý đối với chính sách an sinh xã hội

Nguyễn Thị Thanh Bình 619
Biến đổi trong quan hệ xã hội của người Tày ở một xã vùng Đông Bắc, 1981 - 2016

Nguyễn Thị Tú Trinh, Phan Văn Hòa, Trần Hữu Phúc 632
Nghĩa chu cảnh trong câu hành vi tiếng Anh và tiếng Việt

ĐIỂM SÁCH

Nguyễn Trần Tiến 647
Quan hệ Việt Nam - Ấn Độ: Nhìn lại và hướng tới

TÓM TẮT BẰNG TIẾNG VIỆT 650

Journal of Social Sciences and Humanities, Vol 3, No 5 (2017) 573-585

A Contribution to Teaching Vietnamese Music: Key Pitches in Context and the Pitch/intensity Contour Graph

Ngo Thanh Nhan*, Phan Gia Anh Thu**

Abstract: Areas of difficulty in teaching Vietnamese traditional and folk music to non-Vietnamese include the aural-oral traditions, the use of non-Western European scales and extensive multiple pentatonic scales, their associated airs and modes, the heterophonic texture when musicians in an ensemble improvise a tune freely, and the Vietnamese-specific sentence-based poetic structure of the piece-sometimes described as non-metrical. By analyzing voices and instruments, a group of community organizers attempt to set up an initial guide for understanding and teaching Vietnamese folk music. This involves searching for original musical pieces and identifying the scales, ranges, background knowledge, melodic contour, sequences, motives, and temporal characteristics before visual representations of the pieces can be suggested for documentation. A recording of *Ru con miền Nam* "Lullaby from southern Vietnam" is fed to a peak frequency engine. This produces the pitch/intensity contour, PIC, in real time. The rhythmic patterns and metrical structure are displayed. They are further enhanced by *key pitches in context*, or **kpic**, that lays out the frequencies of occurrences of two, three, etc. adjacent pitches that reveal dominant pitch patterns in the piece. Significantly, they suggest specific characteristics therein, which help music learners to replicate the feel of Vietnamese music.

Keywords: Key pitches in context; microtone; peak frequency; pentatonic; PIC graph; pitch/intensity contour.

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1. Introduction

Teaching Vietnamese traditional and folk music to children is very challenging to any teacher, new or experienced, the authors included. One author has taught piano to children for the past 10 years. The other has taught *đàn tranh* ensemble classes for the past 9 school years. Teachers, who are in-demand, have to improvise teaching tools to compensate for the shortage of basic research in Vietnamese traditional and folk music.

This first report touches upon an analysis of one folk song using a music visualizer and natural language processing aiming at building an automate folk music pattern processor within a digital library archive system. From this paper in August 2016, our research has advanced to a synchronic study of three versions of *lý con sáo* "songs of the starling" with the help of the folklore methodology, and pitch-class arrangement in circles of fifths, side by side with the corresponding circles of chromatics, to

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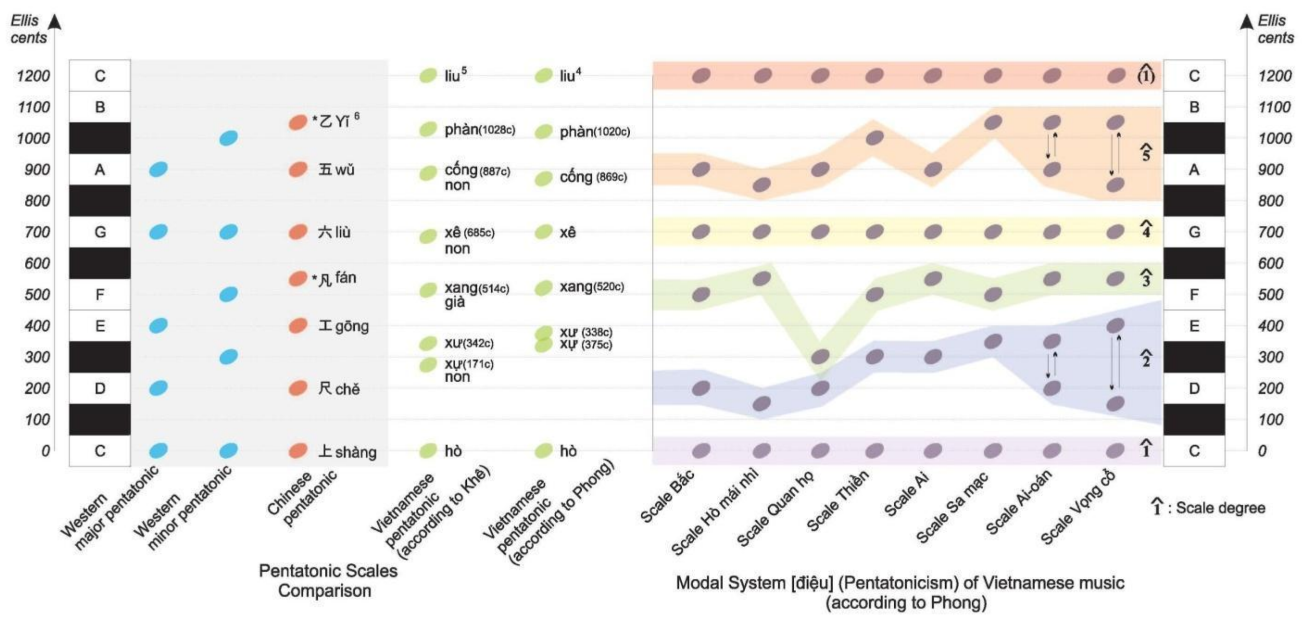
highlight the psychological reality of pentatonic systems (Phan Gia Anh Thư and Ngô Thanh Nhàn 2016, 2017).

2. Background: Theoretical vs. practical issues

The following Figure 1 summarizes the known pentatonic scales and the 8 Vietnamese *điệu* "modal systems" and *hơi* "airs." The Vietnamese northern pentatonic scale is slightly different from the Chinese and the standard western scales. For example, if *hò* is at C (at 0 Ellis *cents* [*c*]) in the Vietnamese pentatonic scale, then all other pitches are off the western tempered scale with intervals finer than semitones (100*c*), i.e., microtones. Specifically, *xự* is just below D (200*c*) at 171*c* [29*c* lower]; *xang* is just above F (500*c*) at 514*c* [14*c* higher], *xê* is just lower than G (700*c*) at 685*c* [15*c* lower], *cống* is just lower than A (900*c*) at 887*c* [13*c* lower]. Notably, the remaining pitches are significantly flatter, specifically, *xư* is flatter than E (400*c*) at 342*c* [58*c* lower], and *phàn* is flatter than B (1100*c*) at 1028*c* [72*c* lower]. Thus, no pitch in the Vietnamese pentatonic scale in this measurement aligns with the western tuners.

Figure 1: *Pentatonic scales used in the Vietnamese artistic tradition*, according to Công Xê Phổ,[1] Nguyễn Thuyết Phong (2008: 253, 255) and Trần Văn Khê (1962:189-190, 1962:195, 1966: 10)



[1] Cf. https://en.wikipedia.org/wiki/Gongche_notation 工尺譜 Gongche [*công xê phổ*] was invented by the Tang Dynasty [*nhà Đường*, 唐朝, 618–907] and became popular by the Song Dynasty [*nhà Tống*, 宋朝 960–1279]. 凡 *fán* is simply characterized as "between F and F#", and 乙 *yǐ*, "between tib and ti."

Another potential issue which may introduce microtones into the Vietnamese songs is the language specific *thanh điệu* linguistic tone system as well as *luật bằng trắc* tonal harmony. See also Jähnischen (2014). Due to the traditional poetic-music unity, the traditional and folk song's melody pitch must be in congruence with word's tone, thus creating subtle changes in diction.

The third issue comes from the Vietnamese-specific sentence-based poetic structure of the piece—sometimes described as non-metrical in free personal style—making it difficult to identify or transcribe into regular meters.

In addition, the traditional and folk musics, as we know today, belong to extensive and elaborated sets of pentatonic scales, and their associated *hơi* "airs" and *điệu* "modal systems" as shown on the right-hand side of Figure 1. Some have been partially mentioned by. Trần Văn Khê (1967:35-67), Jähnischen, (2012), Nguyễn Phú Yên (2009), Vĩnh Phúc (n.d.). Thus, to formulate a methodological approach to teach Vietnamese music is complicated due to the dynamic interplay of *hơi* "airs" and *điệu* "modal systems."

The song usually has at least one "skeletal" version and its instrumental arrangements—they are usually different. In addition, musicians of different instruments improvise a tune simultaneously in an ensemble, creating the heterophonic texture in Vietnamese music. Teachers are not usually equipped, nor required, to grasp these phenomena, less to understand their underlying principles and rules.

At this point in time, teaching students to replicate the fine arts of Vietnamese music is extremely difficult. This paper attempts to experiment in ways to study less-known musics. Using our proposed process, music teachers and music enthusiasts may only need a Vietnamese music recording in order to teach, play, analyze, and understand Vietnamese folk music. The precise measurements, done through spectrography accompanied by the discovery of the internal patterns of pitches, lay a foundation for a systematic approach.

3. Methodology—the MTVIET ensemble song analysis

By analyzing voices and instruments, a group of educational community organizers[2] attempted to prepare an initial guide for understanding and teaching Vietnamese folk music.

The procedure consists of several successive steps: selecting, graphing, identifying, key pitches in context (or ***kpic***) analysis, and application. First, selected pieces must be well-known among community members. Because many songs have a history of version development, there are multiple versions. The most authentic or the most popular version is selected, in that order of priority. Second, the chosen version is fed through a software program to obtain a more precise visual representation of its music recording. This presentation includes: lyrics, a music staff, note assignment, significant microtones, phrases, and how each pitch fluctuates due to *vibrato*, *thanh điệu* tones, and articulations. We call this representation a pitch contour graph. Third, we identify the piece's key and the base scale (i.e. *hò*), and its voice range through collecting frequencies of occurrence of the song's pitches. This step helps with transposition and improvisation when needed. From the graph, it is now

[2] The authors thank the *Mekong Traditional Vietnamese Instrumental Ensemble Troupe* (MTVIET) for the ideas coming from a discussion on March 4, 2016.

easier to select a skeletal version of the performed piece. Fourth, from the sequence of pitches that constitute a music piece, one would like to know how pitches are strung out, how pitch string patterns are formed, and how different pitches "seek" the others. The process is called *key pitches in context*, or ***kpic***. We finally apply ***kpic*** analysis of the piece to each music phrase, first of two adjacent pitches, then three adjacent pitches, etc. in order to determine the highest frequencies of occurrence of these strings. This step helps determine preferred sequences of pitches in a music piece. The obtained data from the previous four steps is hoped to help the teachers prepare challenging exercises, and the students understand the inner structures of the music, esp. non-Vietnamese studying Vietnamese music.

4. Data description and results—a lullaby

In this paper, *Ru con miền Nam* "Lullaby from the South" was chosen for a demonstration.

4.1. Selecting

4.1.1. Versions of the lyrics

There are different lyric versions for this lullaby, many of them created by great composers, four of which are in Section *Núi Mẹ* "Mother Mountains" by Phạm Duy (1964). Nevertheless, the following version is still the most popular and is considered a masterpiece.

		Tentative translation:
"*Gió mùa thu… mẹ ru mà con ngủ…*	1.	Autumn breeze helps Mother to lull her baby to sleep.
Năm … canh dài…	2.	Five times the timekeeper had struck
Năm … canh dài,	3.	for ten hours straight,
thức đủ vừa năm…	4.	I have been up all ten.
Hỡi chàng… chàng ơi!	5.	Oh, lover… please, lover!
Hỡi người… người ơi!	6.	Oh, man… please, man!
Em nhớ tới chàng.	7.	I am thinking of you,
Em nhớ tới chàng!	8.	I really miss you!
Hãy nín… nín đi, con!	9.	Hush… don't cry, baby!
Hãy ngủ… ngủ đi, con!	10.	Go to sleep… sleep well, baby!
Con hời mà con hỡi!	11.	Oh child, please hush, oh baby!
Con hỡi, con hời…	12.	Oh child, please hush, oh baby!
Con hỡi, con hời, hỡi con!"	13.	Baby, please baby, oh please!"

Curiously, most other anonymous lyric versions of the lullaby[3] and 4 versions from Phạm Duy tell different stories as to where the father is at the moment of her distress.

4.1.2. Versions of the music

The chosen version for analysis here is the most popular (and refined) version—on Youtube (retrieved at

[3] 3 versions can be found at http://dotchuoinon.com/2015/01/18/dan-ca-dan-nhac-vn-hat-ru-con-mien-nam/.

https://www.youtube.com/watch?v=xGHLTQzib3Y on March 4th, 2016), sung by Bích Tuyền, accompanied by Hoàng Thịnh on a *đàn bầu* "monochord", date unknown. A *dạo* "promenade" of *đàn bầu* "monochord" takes up the first 30 seconds and a recital of a *ca dao* of four six-eight syllable verses takes up the first 1:50 minutes before the main song continues for another 1:23:20 minutes. The main song sung by Bích Tuyền was extracted in m4a and mp3 format for demonstration. We call this extracted recording *Ru con*, for short.

4.2. Graphing—The pitch/frequency/intensity contour graph

The analysis of the spectrogram of the *Ru con* input is graphed with values on a vertical axis indicating the frequency in *hertz* (Hz), the pitch name in Ellis *cents* (c), intensity in *decibels* (dB), and values on a horizontal axis indicating time in *milliseconds* (*ms*). This can be called a frequency/pitch/intensity contour of the song. With greater computer power compared to a melograph by Cohen & Katz (2009) and Benetos and Dixon (2012), the following set of figures is generated by *Sonic Visualiser*, a freeware "for viewing and exploring audio data for semantic music analysis and annotation" (Cannam and Queen Mary 2015), and similarly by *Praat*, "a computer program with which you can analyze, synthesize, and manipulate speech, and create high-quality pictures" (Boersma and Weenink 2013).

For example, at point 9.139 *sec* into the recording, the peak frequency spectrogram pane shows the following data:

at Time range: 9.139 — 9.233 *sec*

Peak Frequency: 183.2 — 185.187 *Hz*

— Bin Frequency: 172.266 — 183.032 *Hz*

Peak Pitch: F♯3-18*c* — F♯3+2*c*

— Bin Pitch: F3-23*c* — F♯3-18*c*

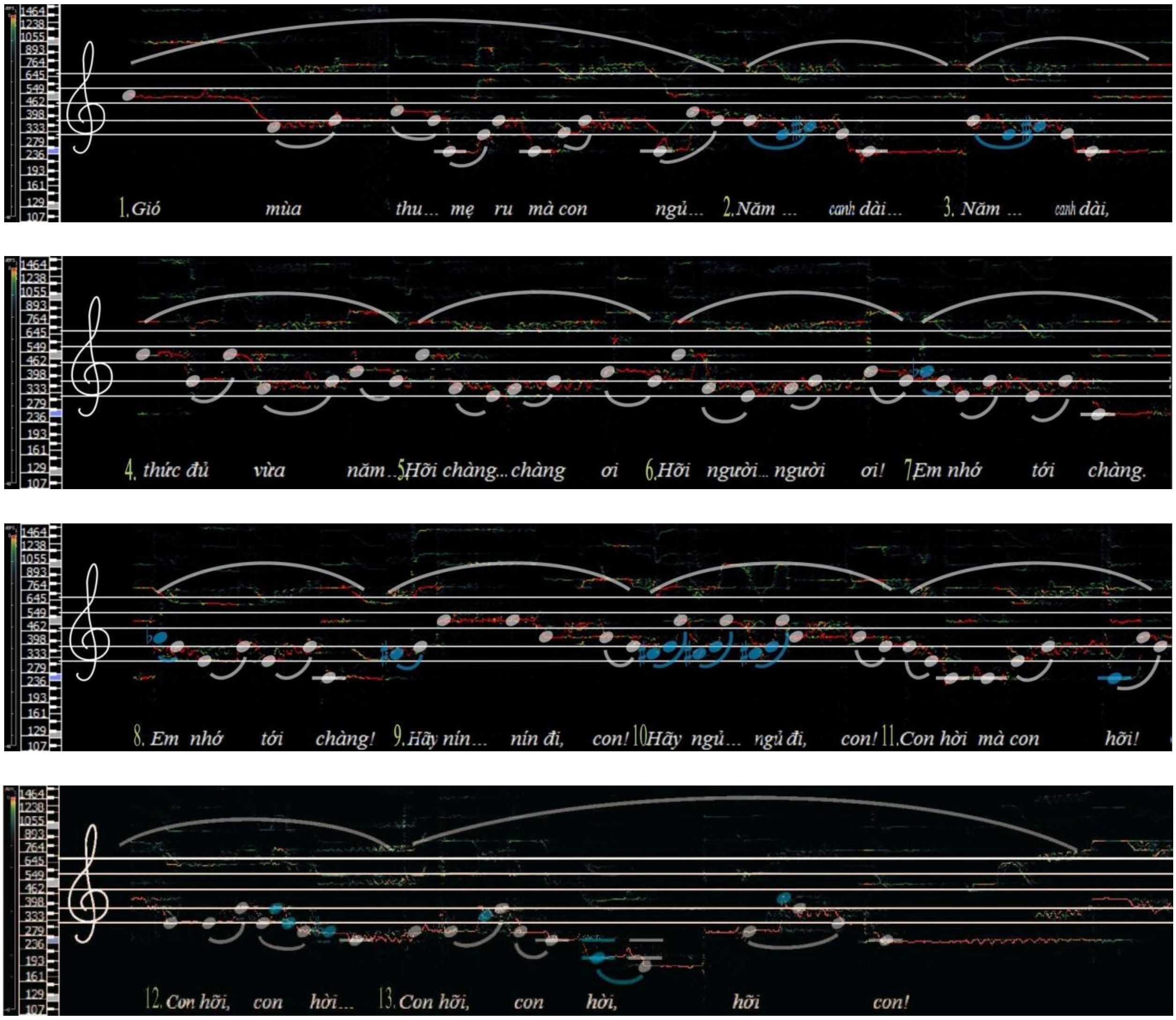
dB: -36 — -29

— Phase: -1.63752 — 2.1971

Analysis by the *Silvet Note Transcription*[4] plugin does not seem to identify pitches, pitch onsets and offsets distinctly due to low level recording of input where all channels are mixed. Manual intervention is thus required in this case. A music staff layer was superimposed on the pitch contour thanked to its Ellis measurement, and music notes were then assigned at onsets of spectrographic pitches with significant duration (by Phan Gia Anh Thư). The graph, which is long, cut into 4 pieces to fit the page in Figure 2, represents graphically what was actually sung (and spoken) on a familiar music staff. We call it the enhanced pitch/intensity contour graph (PIC graph) of *Ru con*.

[4] Shift-Invariant Latent Variable Transcription (Silvet), a Vamp plugin from Queen Mary, University of London for polyphonic music, listens to audio recordings of music and tries to work out what notes are being played.

Figure 2: *A pitch contour graph of Ru con with a superimposed music staff.*



4.3. Identifying

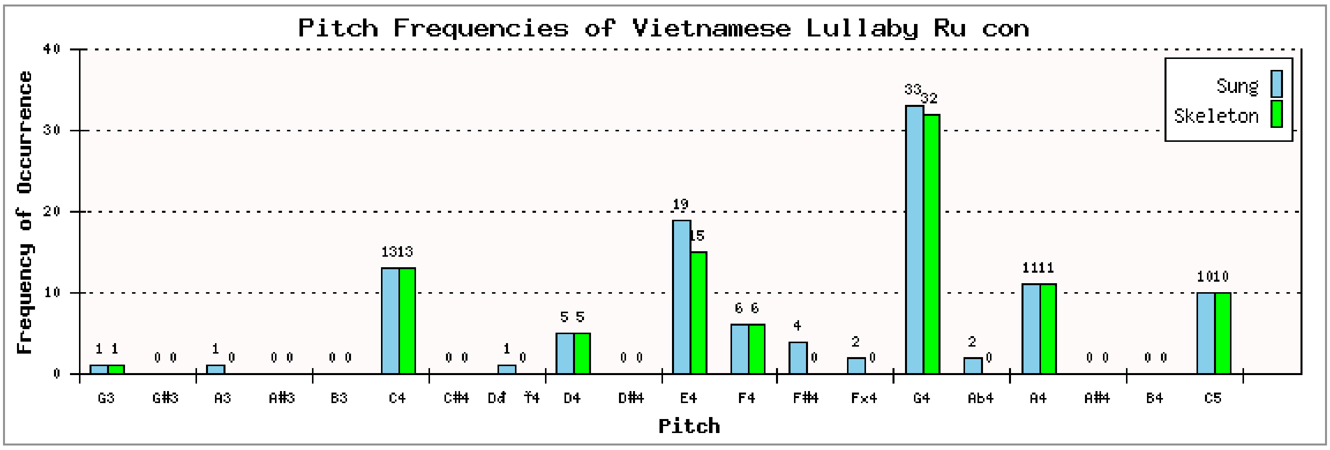
The song of *Ru con* consists of 108 pitches – identified from its PIC graph – and lasts for 1:23:20 minutes.

4.3.1. Phrasing

The lyric of the lullaby is composed of 6 sentences. The melody can be decomposed into 13 music phrases, blocked by over-arched phrase marks covering the lyric line under the PIC graph of Figure 2. A music phrase is thus identified by the corresponding lyric phrase, and further broken by lyric repetitions. A performed music phrase, stripped of decorations, linguistic tone deviations, performance variations as well as the artist's dialectal and idiolectal styles, while its duration is kept intact, is called a skeletal phrase. Skeletal versions of songs are widely used in traditional music schools, usually printed in song books, and played in an ensemble as the music theme.

4.3.2. The voice range, pitch classes, and frequencies of occurrence of pitches

Figure 3: *Frequencies of occurrence of pitches in Ru con*



From the pitch contour graph above, the range of *Ru con* is from G^3 to C^5, one and a half octaves, as shown on the x-axis in Figure 3 above.

Ru con, 108 pitches (or music notes) long, is comprised of 13 distinct pitches, with no B's. There are two microtones, F♯+25*c* and D♭-25*c*. Frequencies of occurrence of these 13 pitches show the dominant presence of G, C, E, F and A as evidenced by their frequencies of occurrence, shown in parentheses: pitch class G (34) with G^4 (33) and G^3 (1), pitch class C (23) with C^4 (13) and C^5 (10), pitch E^4 (19) and pitch class A (12) with A^3 (1) and A^4 (11). Pitch D^4 (5) only appeared in the last two phrases. The skeletal version consists of 93 pitches and maintains the same properties as the performing version. The skeletal pitch classes are C, D, E, F, G and A.

4.3.3. The note and scale determination in the lullaby

This *hexatonic* song of C, D, E, F, G and A has a strong *pentatonic* and southern *điệu* property:

— The first 11 phrases of *Ru con* contain no D's or B's-resulting in the interplay of G, A, C, E and F, with *vibrato* on G and C. That seems to suggest a southern *điệu* "modal system" in *hơi oán* "mourning air";

— In the last 2 phrases, pitch D^4 appears 5 times, but no F's or B's, while still with strong *vibrato* on G and C-resulting in the interplay of C, D, E, G and A. That seems to suggest perhaps the southern *điệu* "modal system" in *hơi khách* or *hơi bắc* "northern air".

These observations lend additional help to determine the choice of pitches for the skeletal music version, the manner of tuning the *đàn tranh* for this song, the change of airs while playing, and the arrangement of different ensemble voices, or style bindings in free improvisations.

4.4. Key pitches in context (kpic) analysis

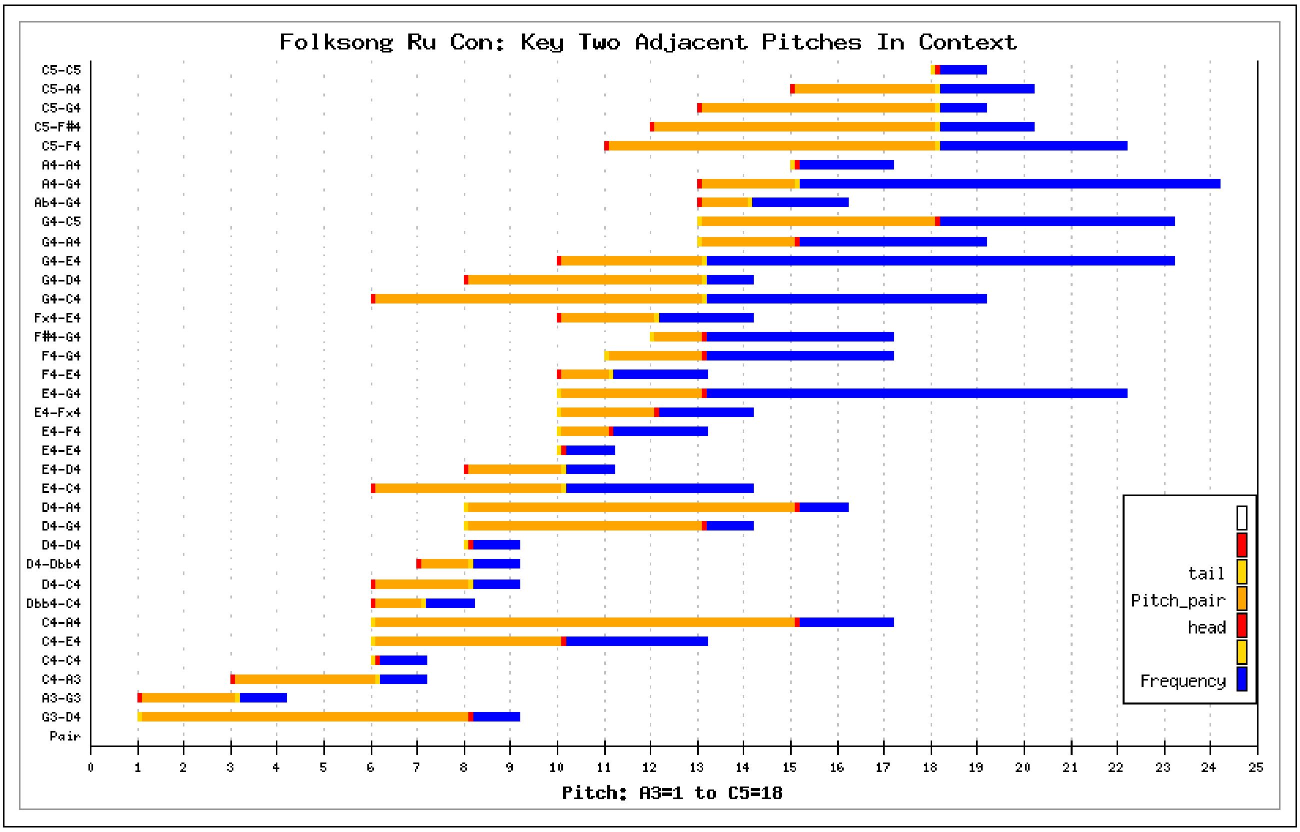
Key pitches in context, or ***kpic***, is an algorithm (borrowed from informatics, *key words in context*) to discover the internal pitch regularities in a music piece. The ***kpic*** patterns below show the tendencies of some pitches immediately following one specific pitch. Thus, ***kpic***[x_1 x_2... x_n …] represents the frequencies of occurrence of a string of *n* adjacent pitches, where $2 \leq n \leq 8$, 2 is the shortest string and 8 is the longest string of *Ru Con*. A pitch, after being delivered, tends to suggest other specific pitches of a music piece. A ***kpic***, thus, in this paper, is a function, fed by identifiable pitches (in *cents*) from the pitch contour of a performed music piece, giving frequencies of occurrence of two, three, four, five, etc. adjacent pitches. In this demonstration, we feed the performed version of *Ru con*, to ***kpic***.

If a song is a skeletal piece, void of lyrics, written in tempered music notes, broken into phrases, while keeping the entire duration of the music piece intact, then ***kpic*** shows its regular internal patterns of pitches in its simplest form. If ***kpic***'s of a skeletal version and ***kpic***'s of its performed version are similar, we say the skeletal version keeps the patterns of adjacent pitches intact.

4.4.1. kpic[x_1 x_2] of two adjacent pitches in Ru con

We call a di-pitch a string of two adjacent pitches in this discussion of *Ru con*. The skeletal version, in this case, covers 93 pitches out of the performed version of 108. The results show:

Figure 4: *Di-pitch patterns in the performed version of Ru con*



— ***kpic*** of di-pitches in performed version, 35 patterns, total 96 di-pitches;

— ***kpic*** of di-pitches, counted in pitch classes, 30 patterns, total 96 di-pitches;

— ***kpic*** of di-pitches in skeletal version, 27 patterns, total 81 di-pitches.

For example, ***kpic***[G C] = 11 means that a pitch class G immediately followed by pitch class C occurs 11 times in the performed version of *Ru con*. A graph of 35 di-pitches is shown with their frequencies of occurrences in Figure 4.

The data on ***kpic*** for di-pitches show that there is not much difference between the performing version and the pitch class version, because the song really stays in one octave, i.e. from C^4 to C^5, except for two pitches, A^3 and G^3. The dominance of di-pitch patterns pools around G^4, i.e. ***kpic***[G^4 C] = 11 (but ***kpic***[C^5 G^4] = 1), and ***kpic***[G^4 E^4] = 10 is almost the same as ***kpic***[E^4 G^4] = 9, and ***kpic***[A^4 G^4] = 9 while ***kpic***[G^4 A^4] = 4. Movements between G and E total 19, between G and A total 13, and between G and C total 12, are all dominant. The ***kpic***'s among G A C E pairs is 44 out of the entire piece of 96 di-pitches, which is about half of the song. This observation using ***kpic***'s helps the students to learn improvisations with the song *Ru con*.

4.4.2. kpic[x_1 x_2 x_3], frequency of occurrence of three adjacent pitches in Ru con

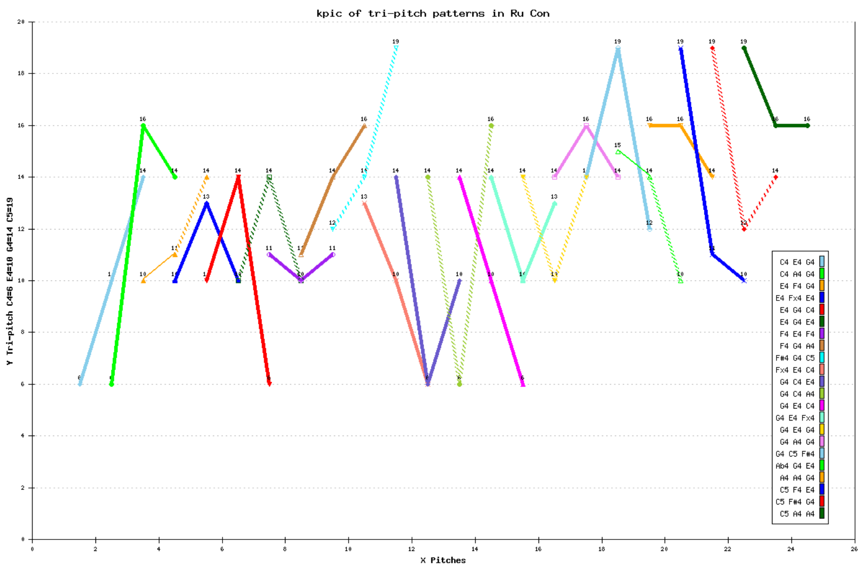
We call a tri-pitch a string of three adjacent pitches in this discussion. The number of tri-pitch patterns in *Ru con* remains the same as with di-pitch patterns, which is 35. The data shows:

— ***kpic*** of tri-pitches in performed version, 44 tri-pitch patterns, total 82 tri-pitches;

— ***kpic*** of tri-pitches in pitch classes, 42 tri-pitch patterns, total 82 tri-pitches;

— ***kpic*** of tri-pitches in skeletal version, 35 tri-pitch patterns, total 66 tri-pitches.

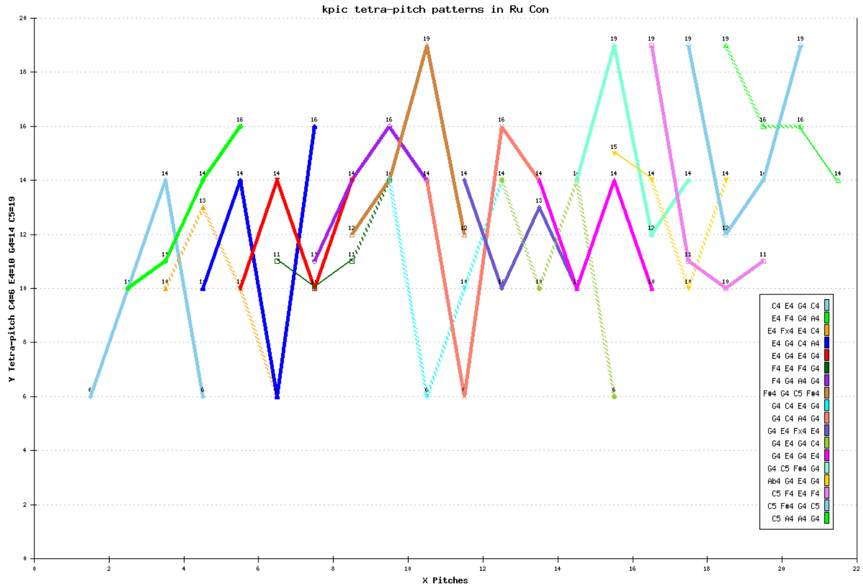
Figure 5: *Tri-pitch patterns in the performed version of Ru con*



kpic of tri-pitches higher than 3, among the performed version, or the pitch class version, and its skeletal version seems to agree with tri-pitches, C^4-E^4-G^4, C^4-A^4-G^4, E^4-G^4-C^4, E^4-G^4-E^4, F^4-G^4-A^4, F#^{4}-G^4-C^5, G^4-E^4-C^4, G^4-C^4-A^4, G^4-E^4-G^4 and G^4-A^4-G^4, and C^5-G^4-C^5 in the skeletal version.

4.4.3. kpic[x_1 x_2 x_3 x_4], frequency of occurrence of four adjacent pitches in Ru con

Figure 6: *Tetra-pitch patterns in the performed version of Ru con*



We call a tetra-pitch a string of four adjacent pitches in this discussion. The number of tetra-pitch patterns in *Ru con* is significantly higher than that of tri-pitch patterns of 35. The data shows:

— ***kpic*** of tetra-pitches in performed version, 47 patterns, total 70 tetra-pitches;

— ***kpic*** of tetra-pitches in pitch classes, 45 patterns, total 69 tetra-pitches;

— ***kpic*** of tetra-pitches in skeletal version, 37 patterns, total 54 tetra-pitches.

The following ***kpic*** patterns, above 3, show C^4-E^4-G^4-C^4, E^4-G^4-E^4-G^4, F^4-G^4-A^4-G^4, G^4-E^4-G^4-E^4. There is not much difference between the performed version, the performed version counted by pitch classes, and the skeletal version.

4.4.4. kpic[x_1 x_2 x_3 x_4 x_5], frequency of occurrence of five adjacent pitches in Ru con

We call a penta-pitch a string of five adjacent pitches in this discussion. The number of penta-pitch patterns in *Ru con* is lower than that of tetra-pitch patterns. The data shows:

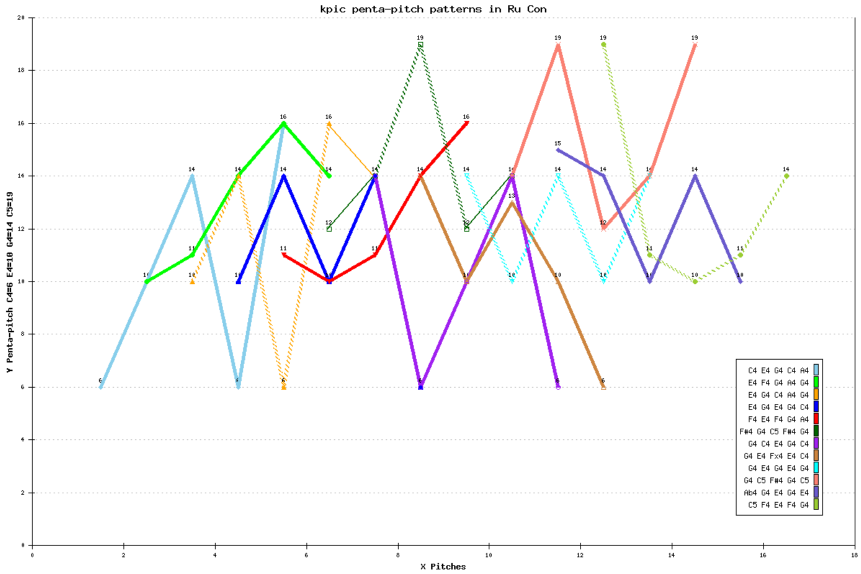
— ***kpic*** of penta-pitches in performed version, 43 patterns, total 56 penta-pitches;

— ***kpic*** of penta-pitches in pitch classes, 43 patterns, total 56 penta-pitches;

— ***kpic*** of penta-pitches in skeletal version, 34 patterns, total 43 penta-pitches.

Most of the penta-pitch patterns occur only once, a few twice, which suggest repeats. There is not much difference between the performed version, the pitch class version, and the skeletal version.

Figure 7: *Penta-pitch patterns in the performed version of Ru con*



We note in general that ***kpic***[x_1 x_2... x_n], $2 \leq n \leq 8$ for *Ru con*, exhausts all possible strings of adjacent pitches when *n* starts to be equal to the number of pitches of the shortest phrases (3 in the skeletal version, 5 in the sung version of *Ru con*) and reaches those of the longest phrases (7 in *Ru con*). Patterns of di-pitches and tri-pitches are strongest with G^4: all 11 tri-pitch patterns involve G^4.

The fact that ***kpic*** results are found to be similar in the skeletal version and the performed version of *Ru con* tells us that the skeletal version seems to retain meaningful melodic nuances of the performed version. Of course, this is only an initial exercise. More research is required, but the results of the experiments with PIC graph and ***kpic*** on *Ru con* are encouraging.

5. Conclusion

The MTVIET song analysis attempts to formulate reliable means to aid teachers of Vietnamese traditional and folk music, while attending to the needed *finesse* of Vietnamese music. In this paper, we have developed the pitch/intensity contour graph, or the PIC graph, using a peak frequency spectrogram generated by a spectrographic software, such as *Sonic Visualisation*, or *Praat*, superimposed by a music staff and assigned identifiable pitches with note heads. From the enriched PIC graph, we then cut the performed version of the music piece into phrases, define its corresponding skeletal version, and feed both versions to *key pitches in context* algorithm, or ***kpic***, to discover the recurrent pitch string patterns in the piece. In this paper, we apply these procedures to *Ru con miền Nam*, a lullaby from southern Vietnam, sung by Bích Tuyền, and obtained from Youtube.

The enriched PIC graph tells us that *Ru con miền Nam* consists of 108 distinct pitches, broken into 13 phrases in the pentatonic *điệu nam* southern "modal system" (evidenced by a strong *rung vibrato* on G and a weak *vibrato* on C). The skeletal version displays evidence of *hơi oán* "mourning air" in the first 11 phrases (scale C E F G A) modulating to *hơi khách* "northern air" (scale C D E G A) in the last two-phrase cadence. The ***kpic*** analysis of *Ru con* confirms the dominant role of pitch classes G and C on the entire piece with a strong presence of E and A.

The pitch contour graph clearly shows a series of microtones in this piece, marked as F♯+25*c* and D♭-25*c* related to the modal *vibrato* of G and C. We suspect that these microtones are mode-dependent and could represent the characteristic feel of Vietnamese music. The PIC graph also shows the behavior of Vietnamese linguistic tones on the melody throughout the piece. For example, the influence of linguistic tones is evidenced in the first note of the PIC graph of *Ru con*, C^5, sung for a duration of 2.6*sec*. The voice seems to stay at tone *ngang* "high level" for *gio* "ash" but spikes abruptly towards the end to D^5 for 0.20*sec*, turning tone *ngang* into tone *sắc* "high rising" to assert *gió* "breeze." In addition, there are strong vibrations of the voice over the pitches, G^4 and C^5 (Phan Gia Anh Thư and Ngô Thanh Nhàn 2016). These two observations require future in-depth research with a much larger data set including their accompanying PIC graphs and *key pitches in context* analyses.

Finally, the PIC graph brings music researchers closer to the raw data. Weaknesses of using spectrograms for music study, remarked upon in many scientific forums, such as raised by Emmerson (2006), are duly noted. However, it does give us measurable information about silence (rests), pitch and rest durations, and intensity of each pitch, etc. which potentially show the metrical structure as well as the rhythmic patterns of a piece. We shall leave these important subjects for future research.

References

Boersma, Paul and Weenink, David. 2013. *Praat: doing phonetics by computer [Computer program]*. Version 6.0.17 (http://www.praat.org/). Retrieved 21 April 2016.

Cannam, Chris and Queen, Mary. 2015. *Sonic Visualiser*, release 2.5, © 2005–2015, University of London, (http://www.sonicvisualiser.org/). Retrieved 21 April 2016.

Cohen, Dalia and Katz, Ruth. 2009. "Melograph." *Grove Music Online*. *Oxford Music Online*. Oxford University Press. Updated 9 Nov 2009 (http://ezproxy.library.nyu.edu:4211/subscriber/article/grove/music/18359). Retrieved 24 May 2016.

Benetos, Emmanouil and Dixon, Simon. 2012. "A Shift-Invariant Latent Variable Model for Automatic Music Transcription." *Computer Music Journal* 36.4: 81-94.

Emmerson, Simon. 2006. "Appropriation, exchange, understanding." Presented at EMS: Electroacoustic Music Studies Network, China, Beijing.

Jähnischen, Gisa. 2012. "Âm nhạc tài tử Nam bộ: Một lối tư duy âm nhạc của người phương Nam" [The Art of Đờn Ca Tài Tử and Styles of Improvisation]. Edited by Vietnamese Institute for Musicology. Hanoi: Vietnamese Institute for Musicology: pp. 163–177 (http://aejjrsite.free.fr/goodmorning/gm174/gm174_AmNhacTaiTuNamBo.pdf). Retrived April 2016.

Jähnischen, Gisa. 2014. "Melodic relativisation of speech tones in classical Vietnamese singing: the case of many voices." *Jahrbuch des Phonogrammarchivs der Österreichischen Akademie der Wissenschaften*, 4. Göttingen: Cuvillier: pp. 180–194 (https://www.academia.edu/9017378/Jähnichen_Gisa_2014_._Melodic_Relativisation_of_Speech_Tones_in_Classical_Vietnamese_Singing_the_Case_of_Many_Voices._Jahrbuch_des_Phonogrammarchivs_der_Österreichischen_Akademie_der_Wissenschaften_4._Göttingen_Cuvillier_pp._180_194). Retrieved April 2016.

Nguyễn Phú Yên. 2009. "Tìm hiểu thang âm ngũ cung trong âm nhạc Huế." [A study in pentatonic scales in the music of Huế]. *Chim Việt Cành Nam* (http://chimviet.free.fr/vanhoc/nguyenphuyen/ngphuyen_ngucungHue1.htm). Retrieved April 2016.

Nguyễn Thuyết Phong and Campbell, Patricia Shehan. 1990. *From rice paddies and temple yards: Traditional music of Vietnam*. Danbury, CT: World Music Press.

Nguyễn Thuyết Phong. 2008. "Vietnam." pp. 247–290 in *The Garland Handbook of Southeast Asian Music*, edited by T. Miller, & S. Williams. New York: Routledge. Reprinted in T. Miller, & S. Williams, S. *The Garland Encyclopedia of World Music: Southeast Asia*, 4:444–517. New York, NY: Garland Publishing, Inc.

Phạm Duy. 1964. *Trường ca Mẹ Việt Nam*. Cf. http://www.tuanpham.org/EnglishLyricsFull.htm, retrieved March 8, 2016.

Phan Gia Anh Thư, and Ngô Thanh Nhàn. 2016. "An initial analysis on the interactions of Vietnamese linguistic tones and Vietnamese folk music," paper presented in Section 2: Cultural Resources, *The 5th International Conference on Vietnamese Studies: Sustainable Development in the Context of Global Change*, Vietnam National University. Vietnam, Hanoi. December 15-18, 2016.

Phan Gia Anh Thư, and Ngô Thanh Nhàn. 2017. A graphic presentation and preservation of Vietnamese storytelling music, presented at the *128th Annual American Folklore Society, Community: Resistance, Reclamation, and Re-Creation*, Minneapolis, MN. October 18-21, 2017. Tracking No. AFS2017-242.

Trần Văn Khê. 1962. *La musique viêtnamienne traditionelle*. Paris, Presses Universitaires de France.

Trần Văn Khê, 1966. Vài ý kiến về thất cung thiên nhiên và việc dùng *comma* để đo cung bực trong nhạc Việt [Some opinions on the natural octave and the use of comma to measure steps in Vietnamese music]," *Nghiên Cứu Việt Nam*, Huế, No. 3, Fall 1966, p. 10.

Trần Văn Khê. 1967. *Les traditions musicales: Viêt-nam*. Institut International d'Êtudes Comparatives de la Musique. Paris: Buchet-Chastel.

Vĩnh Phúc. (n.d.). "Hệ thống Điệu và Hơi trong nghệ thuật ca–đàn Huế." *Chim Việt Cành Nam*. (http://chimvie3.free.fr/54/vinhphuc_cahue.htm). Retrieved April 2016.