THE EXPRESSIVE FUNCTION IN WOR SONGS

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ABSTRACT

We study some musical and expressive features of traditional Wor vocal music, an ancestral gender of the Biaks (Indonesia). A core aspect in Wor songs is the expression of wonder, which Biaks have developed into an Aesthetics of Surprise [1, 2]. We describe some key structural features in the pitch and time domain used as means to express such an aesthetics. We represent the acoustic and prosodic features encoding expressive content by means of an Expressive Function which contains expressive indices with internal structure [3, 4]. We propose an augmented expressive score [5] for the transcription of unaccompanied Wor songs.

1. INTRODUCTION

We study the expressive content conveyed by traditional Wor songs. We aim at representing the musical features encoded by Expressives by means of an augmented musical score. Our data consists of vocal music from Yapen Island collected and recorded by the author and Alfons Arsai and translated into English by Izak Morin. It includes some 20 *wor* songs in the Biak language (ISO 639-3: bhw) [6, 7, 8, 9] performed *a capella* by Hendrik Arwam (tenor) – a gifted singer expert in *Wor* music – and his daughter Sara, and 4 Serewen (ISO 639-3: pmo) songs performed by Obaja Tarami (baritone), who was also the composer of some of the songs. [1] The transcription of the songs onto musical notation was done by ear. The music notation languages used to transcribe our data were "abc", [2] "lilypond" [3] and "guido". [4] *Wor* is a cover term for a gender of traditional vocal music of the Biaks [1, 2]. [5] Wor songs (*dow*) are performed as part of a ceremonial event or a feast in which singing is combined with dancing accompanied by tifa drums. Wor feasts are related to many situations of Biaks' life: Wor is used to honor an ancestor important to the community, to call for protection for children or for a person in a transition in his or her life-cycle, to evoke sympathy or sorrow, to raise anger or support, to prepare for a battle or to celebrate the victory of some warrior.

Wor comprises many different subtypes: Kankarem (introduction song), Beyuser (narrative song), Erisam (expressionist style), dow Mamun (war song), Dance songs (Sandia, dow Arbur), Kajob, Morinkin, Wonggei. For this paper we just focus in four Wor songs belonging to the narrative (Wo nayro), dance (Forine, Woresa) and expressionist (Aya ma) subtypes.

Wor music is believed to have a magical power which grants welfare and protection to Biaks. Wor ceremonies attempt to use such a power to summon the forces of nature and to tighten social bonds. To that effect, wor uses a singing style that has been described as an "Aesthetics of surprise" and wonder [1, 2]. We will return to that in section 3. A legend attributes the discovery of wor to a magical origin, related to the sound of a vine heard in the forest by an old man from the Mnuwon clan. [6] Wor has been transmitted thereafter within clans by expert singers who teach wor to their children. Biak singers believe Biaks have been protected by the wor sung by their ancestors, and they feel obliged to sing wor to protect their own children. As they express it, "If we don't sing wor, we die." [10].

Although in real performance most of the songs of our corpus would be sung by a soloist and a learners-choir in heterophonic style [1], and accompanied by tifa drums, we decided not to include drum accompaniment in our study so we could concentrate on the vocal technique of solo skilful singers who would bring out the artistic features of the

[1] A sample of the songs can be heard at:
http://www.udc.gal/grupos/ln/music_research/indonesia/biak.html

[2] http://abcnotation.com/,
https://abcjs.net/;
"abc" notation is widely used for transcribing traditional music. Digital music archives keep a large number of traditional music scores in "abc" language, which can be worldwide queried and retrieved by the incipit of the melody.
http://drawthedots.com
http://music.gordfisch.net/montrealsession/editor.php
http://poorfox.com/hymns/abc2gif.html

[3] http://www.lilypond.org,
http://lilybin.com

[4] Guido Scene Composer IDE:
http://guidolib.sourceforge.net/

[5] Nowadays, Yospan songs, accompanied by a band of string instruments and tifa, are more popular than wor among young people.

[6] The legend says that after that experience, Mansar Mnuwon became the first expert of wor. The story has been described as follows:

> "Late one night, while he was hunting in the forest, the man suddenly heard voices high in a tree. In vain, he scanned the branches for the source of the noise. When he sat down to rest, the music swelled. Startled, he grabbed a vine that was coiled around the tree, and the voices dividid into two choruses. The vine's flowers were singing the song! To keep the voices from sinking into the soil at sunrise, the man cut down the vine. He took it home and ate the leaves and became the first Biak clever at singing wor." [2, 90]

	mode	interval	song
1	C D E G A	2 2 3 2 3	Ayama
2	D E G A C	2 3 2 3 2	Wo nayro; Ae yasoba
3	E G A C D	3 2 3 2 2	–
4	G A C D E	2 3 2 2 3	–
5	A C D E G	3 2 2 3 2	–

Table 1. Pentatonic scales.

music.

2. MUSICAL FEATURES

The features that contribute to build and articulate the structure of our songs are: The scaling of the octave interval, the intervals with a functional value, and syntactic units such as motives, phrases, intermediate and final cadences.

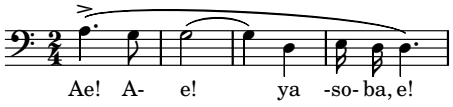
2.1 Scales, Pitch-Class Sets and Interval Vectors

The songs in our corpus are built using anhemitonic pentatonic and tetratonic scales, with no intervals of a semitone between any two consecutive notes. Although intervals of a semitone or even of a smaller size may occur as ornamental notes, they do not have a structural role. In section 2.1.1 we focus on pentatonic scales and in section 2.1.2 on tetratonic ones.

2.1.1 Pentatonic scales and modes

The anhemitonic pentatonic scale is built from the section 0-4 in the cycle of fifths (C G D A E), pitch class set $\{0, 2, 4, 7, 9\}$. The smallest interval between any two consecutive notes is a tone interval. [7] Scales are built with a pattern of alternating intervals with size of 2 and 3 semitones. Starting with a pitch class 0, the structure of interval sequence is 2 2 3 2 3. Depending on which note is taken as the first one of the scale, those sounds can be organized in five different modes or rotations, each mode with a particular flavour associated. In a pentatonic scale there are 5 possible different modes (cf. table 1). In wor songs, a mode is an arrangement of sounds around a nuclear tone, taken as the ground or tonic sound. [8] A tone is prominent if it is the last sound in a final cadence of a song. The nuclear tone can be viewed as the pitch that marks the point of rest in a song.

(1) Ae ae! Yasoba (mode 2: d e g a c)



(2) Ayama (mode 1: f g a c d)

[7] However, our songs do not use the whole pentatonic scale with intervals of the same size (C D E F# G#).

[8] Although any of those modes can be transposed, in Wor songs transpositions depend on the natural register of the voice of a singer rather than on musical composition criteria.

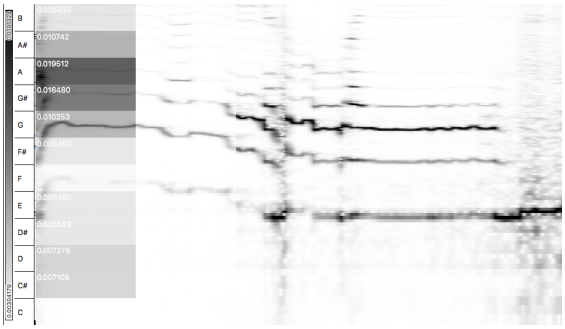
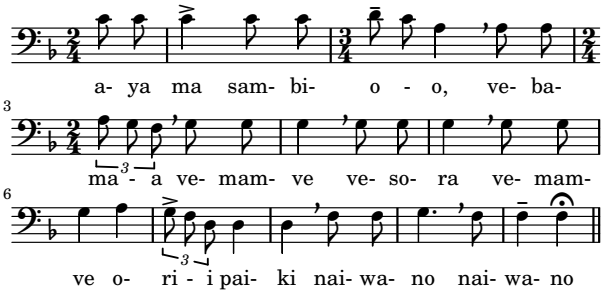


Figure 1. Ae yasoba e: chroma.



Our songs use the anhemitonic pentatonic mode 1 (“Aya ma”) and mode 2 (“Ae! Yasoba”), both symmetrical. Mode

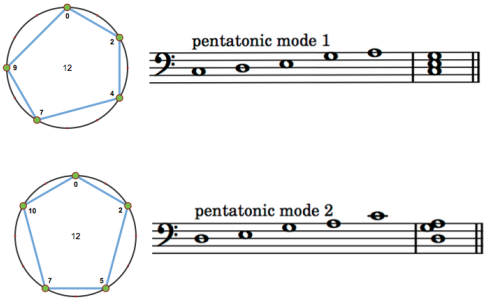


Figure 2. Pentatonic scales.

2 is very frequent in the songs we collected. The implicit tonic chord in mode one is CEG, and in mode two is the suspended DGA.

2.1.2 Anhemitonic tetratonic

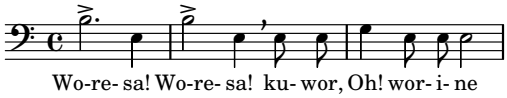
Tetratonic scales seem to be generated as gapped anhemitonic pentatonic [11]. Our songs use the tetratonic asym-

	mode	interval	song
1	C D E G (A)	2 2 3 5	Forine
2	D E G A (C)	2 3 2 5	Yasoriso
3	E G A C (D)	3 2 3 4	–
4	G A C (D) E	2 3 4 3	–
5	A C D E (G)	3 2 2 5	Woresa

Table 2. Tetratonic scales.

metrical mode 1 (“For ine”), the symmetrical mode 2 (“Yasoriso” and the asymmetrical mode 5 (“Woresa”).

(3) Woresa (tetratonic 5: e g a b)



Mode 1 has the implicit major chord CEG(D). Mode 2 the suspended tonic chord DGA. Mode 5 has the implicit minor chord ACE(D).

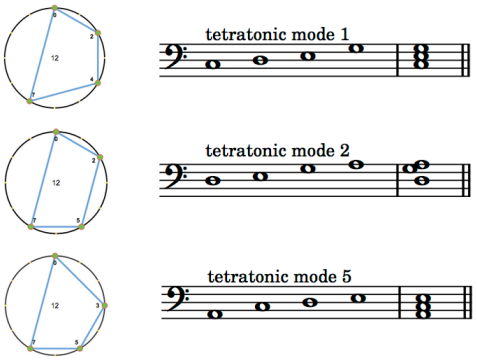


Figure 3. Tetratonic scales.

In table 3 we summarise the interval vectors of pentatonic and tetratonic scales used in our songs.

prime form	scale	i-vector	sym
{0,2,4,7,9}	penta 1	[032140]	+
	penta 2		+
{0,2,4,7}	tetra 1	[021120]	-
	tetra 5		-
{0,2,5,7}	tetra 2	[021030]	+

Table 3. Interval vectors of pentatonic and tetratonic scales

2.2 The structure of the songs

The songs are generated from some motive with a melodic or rhythmic prominent characteristic. Such motives are subject to variations which make them grow into articulated phrases.

Phrases

The phrase is a syntactic unit consisting in some integrated musical events. We use the definition of phrase in [12, 3]:

> “...a unit approximating to what one could sing in a single breath.”

The phrase ending may be marked by a combination of features:

1. Rhythmic reduction. The notes at the end of a phrase may have a longer duration.
2. Melodic relaxation through a drop in pitch.
3. The use of some characteristic descending sequence associated to the end of a phrase.
4. The use of a nuclear tone in a mode.
5. A fading-out amplitude envelop.

Rhythm

The rhythm of the songs follows the metrics and the expressive structure of the words.

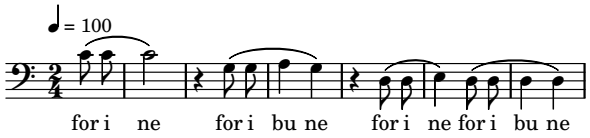
Range

The range of the rising and falling contour of the phrases is between a pentachord, and a heptachord in the final cadences.

Motives

In the song “Forine”, the main motive is an anapaest rhythmic feet ○ ○ ●. The motive is repeated three times. Each time with a descending pitch

(4) “For ine”: rhythmic motive



The initial phrase of song “Wo nayro” is made of 2 motives: a wonder motive, expressed by an exclamative surprise-like utterance on E (cf. figure 4), which is answered at a perfect fifth below by a motive with an ascending-descending contour (ABA).

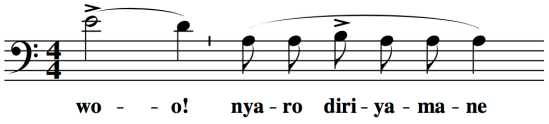


Figure 4. Wo! Nyaro diriyamane.

3. THE EXPRESSIVE FUNCTION

The meaning conveyed by Wor songs is structured in two hierarchical layers: The lexical and the expressive structure. The Lexical Structure is generated from predicative items that describe events denoting truth conditional content. The Expressive Structure conveys affective or communicative contextual content with no truth conditional value. It is built from an expressive function that projects the lexical structure onto an expressive utterance.[9] Both lexical and expressive structures differ musically in pitch and intensity features and in pauses marking phrasal structure.

Some of the linguistic items encoding expressives documented in wor lyrics include: interjections (*wo*, *ae*) expressing wonder, surprise, or desire.[10] The expression

[9] The expression structure has been related to an allegedly early stage in the evolution of human language, which could be shared by some animal vocalisations, such as the language of birds [13].

[10] Interjections and affective vocalisations are holistic expressions that cannot be analysed in subcomponents. They show the property of descriptive ineffability [4], which captures the fact that it is difficult to describe their content by means of a linguistic paraphrase.

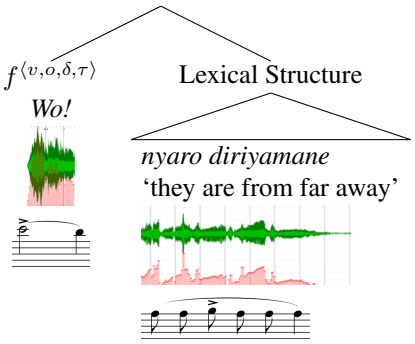
of wonder is a prominent feature in the aesthetics of wor songs, characterised as an "aesthetics of surprise" [2, 1]. Attention-getters [14] expressed with a verb in imperative mood (*woresa* 'stand up'; *wafyeri* 'dance') or by nominal phrases (*for ine* '(light) this fire'). Those are invitations to dance or to participate in some way in the wor ceremonial feast. Topic markers (*ma*) pointing to the experiencer of a contemplative event (*aya ma* 'I-TOPIC').

We represent the expressive function f_{exp} by means of expressive indices with an internal structure [3, 4]. Indices form the tuple $\langle v, o, \delta, t \rangle$ with v standing for the voice of the agent uttering the expressive, o the object (who, what) to which the expressive is orientated, δ the degree of the expressive, t the time interval [15] (onset, offset) of the duration of the expressive. The expressive function f_{exp} takes an utterance - projected from the lexical structure u_{lex} - and yields an expressive utterance u_{exp}.

$$f^{\langle v,o,\delta,\tau \rangle}(u_{lex}) = u_{exp} \quad (1)$$

In the tree below the expressive structure is obtained by projecting a lexical context C_{lex} – which conveys the content of an utterance generated from items in the lexical structure with truth-conditional meaning – onto an expressive context C_{exp}.

(2)



The musical features of expressives are the ones associated with call-like vocalisations (attention-getters), screams, or conative speech acts (incitations to action). The indices v, o, δ, τ of the expressive function may be related with some of the following emphatic features:

- High register within a scale.
- Sustained mora sounds bearing ornamental fluctuations in pitch, as the one expressing *Wooo!* in the song "Wo! nyaro" (cf. figure 5).
- Intensity of the signal. In figure 6 the intensity of the signal of the expressive is measured as the RMS value of the waveform.
- Repetitions, sometimes with an additional reinforcing segment (for ine, foribune).

By contrast, the pitch range of the melodic contour for the lexical structure is almost monophonic and in a low register within a scale. Furthermore, the phrasing and the rhythm follows the metrics of the words. In the table 4 we summarise musical features differentiating expressives from lexicals.

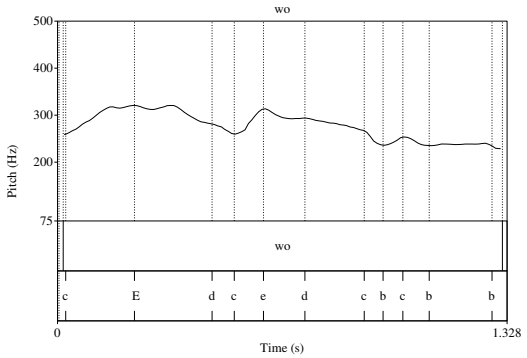


Figure 5. Melismatic ornamentation in "Wo! nayro".

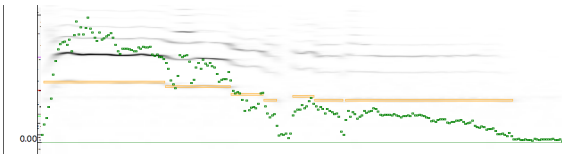


Figure 6. Intensity of the Expressive energy in "Ae! Ae! Yasoba".

4. LYRICS

(5) Gender: Erisam. Tribal expression of the self.

Aya ma sambio ve-ba-ma ve-mam ve
1SG TOP myself who-big who-look to

ve-so.ra ve-mam ve or-i paik-i
who-follow who-look to sun-3SG moon-3SG

na-i-wa no na-i-wa no
3PL.INAN-SPC-over.there LOC 3PL.INAN LOC

'Here I am myself grown up looking at that distant sun and moon.'

(6) Gender: Erisam

Ae ae ya-so ba e awin e
EXP EXP 1SG-follow not EXP mother EXP

be-o marbui ker o ma ya-far-fnak
give-me marbui little.piece EXP so 1SG-play

ya-frar kamsar o ya-so ve Kurudu ve
1SG-run kamsar EXP 1SG-go to Kurudu to

va-ri vari
side-the side

'Mother, let me go to the other side of the island, to the village of Kurudu, so I can play with a piece of marbu.'

Musical Feature	Expressive	Lexical
Pitch register	high	low
Duration	emphatic	speech metrics
Accent	intense	regular pulse
Envelop	sharp	not sharp

Table 4. Musical features of expressive and lexical structure

(7) Gender: Ceremonial wor

For ine for ibune insos-e wa-fyeri
fire 3SG.SPC fire 2SG.SPC girl-PL 2SG-dance

wa-susu wa-kababen o
2SG-move.backward 2SG-make.burn EXP

'This fire, light this fire. Girls, dance, move forth and backwards, make a big fire and dance.'

(8) Gender: Ceremonial. The singer incites a woman to dance and sing around the fire.

Wores-a wores-a ku-wor o wor
2SG-stand 2SG-stand 1DU.INC-sing song

ine bae bin ve-na wore wo
3SG.SPC EXP woman who-has songs EXP

wores-a ku-wor o wor ine bae
2SG-stand 1DU.INC-sing song 3SG.SPC EXP

'Stand up; lets you and I sing this song. Come on, woman who sings. Stand up, lets sing this song.'

5. AN AUGMENTED EXPRESSIVE SCORE MODEL

The interconnected research of composers, performers, artists scientists and engineers taking place since 1945, and the need for designing an accurate language to represent the results of such interactive research has stimulated the invention of new music notation technologies. Recent scoring systems that have created a language capable of meeting such artistic and scientific demands can be classified according to the following aims:

a) Notation languages aiming at being a tool for the design of contemporary composition scores. Examples of such systems are BACH [16], implemented as a library in Max/MSP; [11] Another is ENP [17], built in the lisp orientated visual programming language PWGL. [12] ENP has a GUI with direct editing capabilities. ENP enables to construct scores in both mensural and non-mensural time. The score can be augmented with graphical annotations of a large kind of different sorts: expression marks for performance directives, or analysis annotations for motives, harmonic progressions, or Schenker style graphs, pitch-class set. Non-standard expressions include groups, canvas-expressions, score-BPF. It is a powerful tool for the design of contemporary compositions. However, in its actual state it is not possible to synchronise mensural and non-mensural notation or symbolic notation and audio signal.

b) Notation systems aiming at representing musical analysis: Those include the powerful signal visualiser and artistic graphic designer tool EAnalysis. [13] Another recent analysis model [18] is a computer implementation of Lerdahl and Jackendoff's GTTM. [14] The interactive GTTM analyser and the GTTM database with 300 monophonic pieces are available online. [15] c) Notation systems designed to follow agents in live performances: Antescofo. [16] d) Notation systems capable of synchronising diverse multimedia objects. One of such systems is INScore [19], which provides an OSC API for designing interactive augmented music scores. The music score, symbolise in guido language, is projected into a scene, where it may be augmented with audio or video signals, bitmap or vectorial images. Time is the core driving feature and the interactive elements are related by means of a mapping algorithm. This system can be used in multi-agent live scoring performances.

The aims that have guided our modelling of a music score system for Wor songs have been:

- To provide an analysis of the compositional techniques used in traditional Wor songs.
- To account for the relation between speech and song instantiated in Wor vocal music.
- To fix the music and the text of Wor songs in order to contribute to preserving the rich musical heritage of the Biaks.

We model the music score of Wor vocal music as an Augmented Expressive Score (AES) with the dynamic structure of a bottom up directed tree. Figure 7 illustrates AES applied to the song "Woresa". In the AES model, the indices of the expressive function $f^{\langle v,o,\delta,\tau\rangle}$ are located at the vertices of the tree.

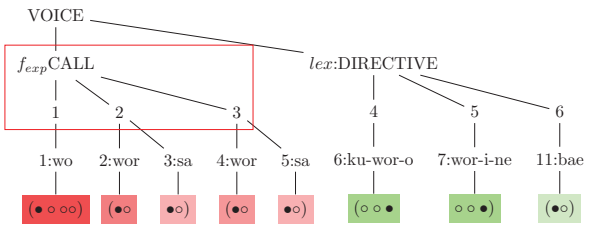


Figure 7. Augmented Expressive Score for "Woresa".

[11] http://www.bachproject.net/home
[12] http://www2.siba.fi/PWGL/
[13] http://logiciels.pierrecouprie.fr/?page_id=402
[14] GTTM provides a generative abstract representation of classical tonal music in 4 levels: (a) Grouping structure; (b) Metrical Structure; (c) Time-span binary tree, which captures the core melodic items; (d) Prolongation binary tree, which captures tension and relaxation.
[15] http:www.gttm.jp
[16] http://repmus.ircam.fr/score-following

0.038895	1.400212	wo
1.487725	2.168383	wor
2.259138	3.007862	sa
3.056481	3.798723	wor
3.850582	4.589583	sa
4.657649	4.800263	ku
4.800263	5.020667	wor-o
5.429062	5.578158	wor
5.610571	6.158339	ine
6.158339	8.112801	bae

Table 5. Time intervals

- The voice index (v) names the highest vertex (VOICE).
- The expressive function item (f_{exp}) is represented at a vertex annotated with a label specifying the semantic content of the expressive (f_{exp}CALL).
- The time index (τ) is represented at the numbered vertices. The τ level relates an audio signal interval with a graphical score segment. The number n labelling each τ vertex (1 through 6 in the example) stands for an index in a relational database, which specifies the intervals (onset, offset) of the temporal duration of the audio signal for each syllable of the lyrics (table 5). We apply the mapping algorithm propose in [20] to relate the time interval and the graphic segment.
- The red and green coloured nodes at the bottom of the tree represent the δ index of the expressive function, with the gradation of colour standing for the degree of energy of the expressive.

We implement our AES model in Max/MSP.

6. CONCLUSIONS

A key aesthetic feature of Wor traditional songs is the expression of wonder, conveyed through linguistic and musical means. We have proposed that the linguistic and musical expressive items are part of an Expressive Structure which is built on top of a Lexical Structure bearing truth-conditional meaning. The expressive structure is obtained by applying an Expressive Function f_{exp} to an utterance conveying truth-conditional lexical content u_{lex}. We represent the expressive function by means of indices with internal structure $f^{\langle v,o,\delta,\tau\rangle}$. We map those indices onto the musical features represented in an augmented score.

Abbreviations

1 = first person; 2 = second person; 3 = third person; AN = animate; DU = dual; EX = exclusive; EXP = expressive; INAN = inanimate; INC = inclusive; LOC = locative; PL = plural; POS = possessive; REL = relativiser; SG = singular; SPC = specific; TOP = topic; VBLZ = verbaliser; VOC = vocative;

Acknowledgments

We would like to express our gratitude to Mercedes Bernacer, Willem Burung, David Gil, Carmen Lage, Francesca Merlan and Alan Rumsey.

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