Computer Aided Solutions in Folksong Analysis
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1. Purpose

Why to split up folksongs? Folksongs are subdivided in smaller, plausible elements, the so-called 'phrases', to make comprehension of melodic courses und structures better and easier understood. The classification of these phrases can be done independently from other structural and formal constituents of a whole folksong, for example, the form of the song, ending tones, number of phrases, etc.

In other words, the classification of a complete folksong always needs the consideration of all these components, but the selection of too many criteria can lead to confusion. The only exception: In regions like Hungaria, which is very rich in folksongs, all structural and formal criteria can be considered, and these can lead to comprehensible and meaningful results, as shown by Bartok and Kodaly.

2. Preliminary Remarks

2.1 How to segment folksongs

In accordance with formal principles in classical music theory the following folksong is divided in two equal parts, front part/last part (Vordersatz/Nachsatz).

\[ VS \ (Vordersatz) \quad \mid \quad NS (Nachsatz) \]

Jos-ef, lie-ber Jos-ef, was hast du ge-dacht, daß du die schöne

Nun-nel ins Un-glück ge-bracht.

Figure 1

On the other hand, following the guidelines of modern ethnomusicology would partition this song into the four smallest possible logical segments.

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Sagrillo, volume 1, p. 114-115

Sagrillo, volume 1, p. 125-131
Exact rules for dividing a folksong into phrases of course do not exist. The folksongs codified in ESAC can be recorded by MIDI-keyboard or simply transformed manually in ASCII-format. In both cases dividing the entire folksong into phrases is obligatory. In case of doubt the textual structure could exceptionally be considered. The coded phrases are represented and manipulated with KEdit, which is an ASCII-compatible editor, with powerful sorting possibilities.

3. Methods of classifying folksong phrases using three steps

3.1 Preparation, using the catalogue of the phrases of Luxemburgish folksongs

Volume 2 of the referenced work is the so-called catalogue of phrases of Luxemburgish folksongs. It is assembled manually, so that similar phrases are sorted together and groups of variants are formed. It exists in two forms as follows;

3.1.1 The encoded form in ESAC/ASCII with the complete statistical and musical data.

KEY[ Nr2671 08 G 4/4 ] MEL[ 554 3...34432 6 5 0 ] //
TR[ 55433443265 ] TN[ 54343265 ]

| KEY | The identity of the phrase, with rhythm and key indications |
| MEL | The melody of the phrase |
| CUT | The identity of the entire folksong |
| AM | The range and the lowest and highest tone |
| K | The last tone |
| KK | The contour code |
| AK | The stressed tones |
| TR | The melody tones, repeated, but without rhythmical digits |
| TN | The melody tones, not repeated and without rhythmical digits |

Figure 3

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5 Sagrillo, volume 1, p. 132-133
3.1.2 Refer to the catalogue, volume 2 of the reference books, for presentation in note form.

3.2 Draft Version using ESAC

The Structure of the draft version, the phrases of the folksongs, the folksongs in their numerical order before sorting by KEdit.

Lied T0479
KEY[Nr2346 16 G 3/4] MEL[-5.1 1 -7 -6 -6 -5 -5] //
KEY[Nr2347 16 G 3/4] MEL[-5.3 3 -2 -7 -2 1 1] //
KEY[Nr2348 16 G 3/4] MEL[-5.1 1 -7 -7 -7 -6 -5 -5] //
KEY[Nr2349 16 G 3/4] MEL[-5.3 3 2 2 -6 -7 1 0] //
KEY[Nr2350 16 G 3/4] MEL[-5.1 1 -7 -6 -6 -6 -5 -5] //
KEY[Nr2351 16 G 3/4] MEL[-5.3 3 2 2 -6 -7 1 0] //

Lied T0489
KEY[Nr2354 08 G 3/4] MEL[5 +1 +1 7b 65 6 7b +1 5 0] //
KEY[Nr2355 08 G 3/4] MEL[7b 7b +1 5 5 6b 5 4 3b] //
KEY[Nr2356 08 G 3/4] MEL[3b 4 5 6b 5 3b 2 1] //

Lied T0490
KEY[Nr2357 08 G 3/4] MEL[3b 3b 21 7b 3b 45 0] //
KEY[Nr2358 08 G 3/4] MEL[4 6b 5 4 3b 21 0] //
KEY[Nr2359 08 G 3/4] MEL[3b 3b 21 7b 3b 45 0] //
KEY[Nr2360 08 G 3/4] MEL[4 6b 5 4 3b 21 0] //

Lied K0083
KEY[Nr2361 08 G 4/4] MEL[-5 1 1 1 1 1 3 2 1 2 0] //
KEY[Nr2362 08 G 4/4] MEL[-5 -7 2 2 2 2 2 4 3 2 3 0] //
KEY[Nr2364 08 G 4/4] MEL[43 2 2 2 2 2 6 6 5] //
KEY[Nr2365 08 G 4/4] MEL[3 1 5 5 4 3 0] //

Lied K0086
KEY[Nr2366 16 G 4/4] MEL[-5 1 3 5 6 5 5 2 3 0] //
KEY[Nr2367 16 G 4/4] MEL[3 4 3 2 2 2 2 3 2 1 0] //
KEY[Nr2368 16 G 4/4] MEL[-5 1 3 5 6 5 2 5 2 3 0] //
KEY[Nr2369 16 G 4/4] MEL[3 4 3 2 2 2 4 3 2 1 0] //
KEY[Nr2370 16 G 4/4] MEL[3 3 3 3 3 3 3 4 3 4 -7 1 0] //
KEY[Nr2371 16 G 4/4] MEL[1 1 6 6 6 5 2 5 2 3 0] //
KEY[Nr2372 16 G 4/4] MEL[3 4 3 2 2 2 4 3 5 6 0] //
KEY[Nr2373 16 G 4/4] MEL[6 5 4 3 5 0 5 4 5 5 7 6] //
KEY[Nr2375 16 G 4/4] MEL[1 2 3 4 5] 6 5 5 0 //
KEY[Nr2376 16 G 4/4] MEL[1 3 3 2 1 0] //

Lied K0087
KEY[Nr2377 08 G 4/4] MEL[-5 12 3 1 -5 4 3 2 3 0] //
KEY[Nr2378 08 G 4/4] MEL[351 2 3 5 4 6 -7 1 0] //
KEY[Nr2379 08 G 4/4] MEL[-5 12 3 1 -5 4 3 2 3 0] //
KEY[Nr2380 08 G 4/4] MEL[351 2 3 5 4 -6 -7 1 0] //
KEY[Nr2381 08 G 4/4] MEL[654# 5 3 1 6 5 4] 5 3 0 //
KEY[Nr2382 08 G 4/4] MEL[351 2 3 5 4 -6 -7 1 0] //
KEY[Nr2383 08 G 4/4] MEL[654# 5 3 1 6 5 4] 5 3 0 //
KEY[Nr2384 08 G 4/4] MEL[351 2 3 5 4 -6 -7 1 0] //
KEY[Nr2385 08 G 4/4] MEL[5 4 5 7 6 5 4 7 1 0] //

KEY[Nr – the numerical order of the phrase in the draft version

Figure 4

3.3 Computer-Aided, Numerical Sorting

Folksongs phrases are sorted by Kedit using the criteria of,
1. the range (AM = Ambitus)

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6 Sagraillo, volume 1, p. 133-134
7 Sagraillo, volume 1, p. 134-135
2. the last tone \( (K = \text{Kadenzton}) \)
3. the contour code (KK = \text{Konturkode}), a code describing the melodic course of the phrase
4. the melody of the phrase (MEL)

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Figure 5.

4 Results. Interpretation of classified folksong phrases
In the section 4.1 the structure of a catalogue of classified folksong phrases is presented. In the section 4.2 the results of this classification are illuminated. The section 4.3 briefly mentions a second study from the referenced work about formal and statistical aspects in Luxemburgish folksongs.

4.1 The Catalogue of Folksong Phrases

4.1.1 After sorting by Kedit, the first example shows the normal case, many non-similar phrases. Except for the first three lines most KEY[Rf] columns are not successively numbered or random.

1. KEY[Rf0120 08 G 2/4 ] MEL[-5222 123_ //]
2. KEY[Rf0121 16 G 2/4 ] MEL[-5_22 1_23_ //]
3. KEY[Rf0122 08 G 2/4 ] MEL[-5_22 2 2212 3_ //]
4. KEY[Rf0084 08 G 6/8 ] MEL[-5 2222 3_0_ 0//ßßß]
5. KEY[Rf0108 16 G 2/4 ] MEL[-5_1_51_2 3_ //]
6. KEY[Rf0118 16 G 4/4 ] MEL[-5-5-5_5 1_1_2 -5_ 3_ //ßß]
7. KEY[Rf0130 16 G 4/4 ] MEL[-5_112 221_6-6-5_ 1_2_3_0 //]
8. KEY[Rf0131 16 G 4/4 ] MEL[-5_1_112_1-7-6-5_ 1_2_3_0 //]
9. KEY[Rf1995 16 G 2/4 ] MEL[-5_1_111_7_1_2_5_ 2_2_1_2_ 3_0_ //ßßß]
10. KEY[Rf0227 08 G 4/4 ] MEL[-5 111_232_1_0 //]
11. KEY[Rf0278 08 G 4/4 ] MEL[-5_5_1_1_3_3_212_ //]
13. KEY[Rf2691 08 G 4/4 ] MEL[1_55555_35_5_665_0 //]
14. KEY[Rf2347 16 G 4/4 ] MEL[-5_5_3_33_2_3_ 2_1_6-5_ //]
16. KEY[Rf0179 08 G 4/4 ] MEL[-5_3_3_2_2_1111_5_ //ßßß]
17. KEY[Rf2340 16 G 4/4 ] MEL[-5_3_1_1_5_5_6_4_ //]
18. KEY[Rf2208 16 G 2/4 ] MEL[3b_3b_4_4_ 3b_7b_3b_3b_4_4_ 3b_1_0_ //]
19. KEY[Rf3304 08 G 2/4 ] MEL[3b_14_3b_7b_6b_4_3b_2b_1_ //]
20. KEY[Rf3058 16 G 4/4 ] MEL[5_6_5_4_4_4_1_0_ //]
21. KEY[Rf3132 08 G 4/4 ] MEL[1_3_5_5_65_4_3_21_ //ßßß]
22. KEY[Rf1455 08 G 4/4 ] MEL[-7b_1_2_3b_2b_1 3b_5_4_3b_2_1_0_ //]
23. KEY[Rf1442 16 G 2/4 ] MEL[5_1_2_3b_2_1_7b_1_7b_1_ //ßßß]

KEY[Rf] – the sequence of the phrase in the definitive catalogue

4.1.2 Figure 7 shows the result of numerical sorting illustrating that the numerical sorting and the definitive form of the catalogue are rather close.

1. KEY[Rf2636 08 G 2/4 ] MEL[1355 5_6_5_4_4_4_ //]
2. KEY[Rf2643 16 G 2/4 ] MEL[1_3_5_5_5_5_5_6_5_5_4_4_4_ //]
3. KEY[Rf2644 16 G 2/4 ] MEL[1_3_5_5_5_5_6_5_5_4_4_4_ //]
4. KEY[Rf2645 08 G 4/4 ] MEL[13_5_5_5_65_5_4_4_ //]
5. KEY[Rf2647 08 G 4/4 ] MEL[13_5_5_5_65_5_4_4_ //]
6. KEY[Rf2649 16 G 6/8 ] MEL[13_5_5_5_65_5_4_4_0_ //]
7. KEY[Rf2650 16 G 6/8 ] MEL[13_5_5_5_65_5_4_4_ //]
8. KEY[Rf2615 16 G 2/4 ] MEL[1_3_5_5_5_5_5_4_4_3_4_ //]
9. KEY[Rf2648 08 G 4/4 ] MEL[13_5_5_5_65_5_443_4_ //]
10. KEY[Rf2652 08 G 3/4 ] MEL[32_1_365_5_4_ //]
11. KEY[Rf2651 08 G 3/4 ] MEL[1_3_5_5_654_4_ 6554_ //]
12. KEY[Rf2655 16 G 3/4 ] MEL[1_3_5_3_6_5_5_4_ //]
13. KEY[Rf2656 16 G 3/4 ] MEL[1_3_5_3_6_5_5_4_ //]

Figure 6: Examples of numerical sorting

8 Sagrillo, volume 1, p. 138
4.1.3 Figure 8 shows a situation, where sorting by KEdit leads to a definitive extract of the catalogue. No further manual classifying needs to be made. This can be seen by the successive KEY numbers.

KEY[Rf2282 08 G 6/8 ] MEL[1 1 11 -5 3 11 //
KEY[Rf2283 08 G 6/8 ] MEL[1 1 11 -5 3 11 //
KEY[Rf2284 08 G 3/4 ] MEL[1 1 -5 33 3 1 //
KEY[Rf2285 08 G 3/4 ] MEL[1 1 -5 3 3 1 //
KEY[Rf2286 08 G 3/4 ] MEL[1 1 -5 3 3 1 0 //
KEY[Rf2287 08 G 3/4 ] MEL[1 1 -5 3 3 1 //
KEY[Rf2288 16 G 3/4 ] MEL[1 1 -5 3 3 3 1 //
KEY[Rf2289 16 G 4/4 ] MEL[1 1 -5 3 3 3 3 3 1 1 .0 //
KEY[Rf2290 08 G 3/4 ] MEL[1 1 -5 3 3 1 //
KEY[Rf2291 16 G 3/4 ] MEL[1 1 -5 5 1 2 3 1 1 //
KEY[Rf2292 08 G 2/4 ] MEL[1 1 -5 3 3 3 1 1 //

Figure 8

4.2 Interpretation of the Catalogue

The following explanation of the melodic course in Luxemburgish folksongs can of course not be exhaustive. Nevertheless the main characteristics will be explained.

4.2.1 phrases with an ending character

4.2.1.1 at the end of a song

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9 Sagrillo, volume 1, p. 137
10 Sagrillo, volume 1, p. 136
11 148-155
The most typical phrase with the leading tone before the tonic at the end of a song.

4.2.1.2 inside a song

A phrase with ending character at the end of the third phrase of a four phrase song

4.2.2 the leading tone (seventh degree) and its significance

4.2.2.1 the leading tone inside the phrase

It exists in different forms:
the leading tone alternating with the tonic: 1-71
extension of the formula 1-71: 21-7-6-71
the leading tone rotating with the sixth degree: -6-71-6
the leading tone as seventh degree without leading function: 6765
the leading tone inside a ascending melodic line: -5-6-7123

The leading tone is accentuated in the third and the last phrase of the following song as the highest tone in the melodic course. The high tonic at the end of the third phrase has no effect on the melodic progression.
4.2.2.2 the leading tone at the end of the phrase

The leading tone as last tone of a phrase

and even as ending tone of a complete song

K01089  Eins! lebt ich so glücklich! (1-4), S. 106

Figure 11

Figure 12

Figure 13
4.2.3 triad phrases

Triad phrases form a very important and large part of the catalogue. Most songs make use of the main triad (135) their appearance is very varied, suborder triads are not often used. The following song is constructed largely using triads.

Three different triad figures are predominant:

Triads at the beginning of the phrase are numerous and various. They mostly commence without an upbeat.

Frequent types of triads at the beginning of phrases with upbeat: they often begin with the lower fifth degree.

Triads also occur inside phrases. In this case they begin and end with one or more non-triad tones. Triads at the end of phrases consequently are preceded by one or more non-triad tones.

4.2.4 The phrase type 12345/67+165 is a characteristic for the folksongs of Luxembourg. It can exist together as one long phrase or as two separated, but immediately following short phrases, with or without the lower fifth degree as an upbeat.

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13 176-204
14 Sagrillo, volume 1, p. 205-221
Well-known examples; the German folksongs: *Fuchs, du hast die Gans gestohlen* or *Alle meine Entchen* or the following Luxembourg folksong from a traditional procession.

The short phrase 12345 often exists alone without 67+165, this one being logically anticipated by 12345. This subsequent phrase can never be found at the beginning of a song, but sometimes it can be preceded by a different opening.

The sequence 1234565 with the sixth degree as culminating tone is a further intermediate variant.
4.2.5 About 10% of the phrases have limited ranges\textsuperscript{15}, i.e. ranges of a major third or less. The question to be answered is, whether phrases of this kind are autonomous or if they are elements of a larger melodious correlation.

4.2.5.1 The next song starts with a phrase of limited range. It is independent – it ends with the tonic – but can be considered as the starting point of the melodic progression.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure21.png}
\caption{Figure 21}
\end{figure}

4.2.5.2 In contrast to this the final phrase of the following song is to be considered as a brief concluding annex.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure22.png}
\caption{Figure 22}
\end{figure}

4.2.6 The melodic rotation 565\textsuperscript{16}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure23.png}
\caption{Figure 23}
\end{figure}

This melodic sequence 565 is called a rotation, because in most cases the melody turns within these limits of tone, and the average range of the phrases does not exceed a sixth.

\textsuperscript{15} Sagrillo, volume 1, p. 222-228
\textsuperscript{16} Sagrillo, volume 1, p. 229-246
The next chart illustrates that the melodic rotation 5-65 is most important in comparison with other possibilities of tone sequences 5-65.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>165</td>
<td>126</td>
</tr>
<tr>
<td>265</td>
<td>40</td>
</tr>
<tr>
<td>365</td>
<td>58</td>
</tr>
<tr>
<td>465</td>
<td>148</td>
</tr>
<tr>
<td>565</td>
<td>420</td>
</tr>
<tr>
<td>765</td>
<td>327</td>
</tr>
</tbody>
</table>

Figure 24

4.2.6.1 In the folksongs of Luxembourg four types of the melodic rotation 565 can be found, the melodic rotation standing alone in the phrase.

Song T0372, first phrase

Figure 25

the melodic rotation as upbeat or at the beginning of the phrase.

Song T0203, first phrase

Figure 26

the melodic rotation 565 inside the phrase

Song K1130, second and third phrase

Figure 27

and the melodic phrase at the end of the phrase
4.2.6.2 There exist multiple prolongations of the tone sequence 565. The next chart proves that tone connections with the sequence 5-65, i.e. beginning with the fifth degree are the most significant.

<table>
<thead>
<tr>
<th>Tone Sequences</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>56543</td>
<td>103</td>
</tr>
<tr>
<td>6543</td>
<td>147</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>250</strong></td>
</tr>
<tr>
<td>5653</td>
<td>67</td>
</tr>
<tr>
<td>653</td>
<td>95</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>162</strong></td>
</tr>
<tr>
<td>56542</td>
<td>37</td>
</tr>
<tr>
<td>6542</td>
<td>39</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>76</strong></td>
</tr>
<tr>
<td>56532</td>
<td>7</td>
</tr>
<tr>
<td>6532</td>
<td>2</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

4.3 Interpretation of the Formal Structures of Luxemburgish Folksongs

In the interpretation of the melodic courses formal aspects were deliberately disregarded. In a further chapter from the reference books\(^{17}\), the relationship between phrases, i.e. the formal aspect, is taken into account. The form features FOT (form of pitch) and FOR (form of rhythm) of ESAC are used separately. For that reason the statements about form refer either to rhythmical or to pitch characteristics. Statements about a general form, combining rhythmical and pitch aspects cannot be assumed, because ESAC software does not support this alternative. Normally the determination of musical form depends on subjective evaluation. Attempts of interpretation with objective, rational or even mathematical computer programmes mostly lead in a blind alley.

In contrast to this, the statistical results of the studies analysing intervals, tone degrees, rhythms and ending tones furnished by the software package of ESAC\(^{18}\) are precise and satisfying.

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\(^{17}\) Sagrillo, volume 1, p. 247-283

\(^{18}\) Sagrillo, volume 1, p. 284-297
5 Future

The reference books work on classifying folksong phrases of one region – Luxemburg – and give a broad knowledge about the individuality of Luxemburgish melodies. It would be very instructive to compare the musical language of folksongs of further regions among themselves in order to find out idiomatic particularites. Requirements: the folksongs must be comparable, and the data have to be prepared uniformly.19

19 Sagrillo, volume 1, p. 315-317.