GMTH Proceedings 2015

herausgegeben von
Florian Edler, Markus Neuwirth und Immanuel Ott

Gegliederte Zeit

15. Jahreskongress der Gesellschaft für Musiktheorie 2015 Berlin

herausgegeben von
Marcus Aydintan, Florian Edler,
Roger Graybill und Laura Krämer

Druckfassung: Georg Olms Verlag, Hildesheim 2020
(ISBN 978-3-487-15891-4)

Andre Holzapfel

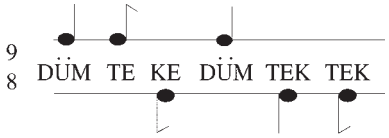
A Corpus Study on Rhythmic Modes in Turkish Makam Music and Their Interaction with Meter

This paper analyzes rhythmic aspects of notated compositions of Turkish *makam* music. Specifically, it investigates how rhythm as created by the notated melodies is related to the underlying rhythmic mode, which is referred to as *usul* (plural: *usuller*) in Turkish *makam* music. To this end, I examine how note events are distributed within the cycle defined by the *usul*.

1. Structure of the *usul*

In Turkish *makam* music, melodic modes (*makam*) define scale material and melodic progression, while most compositions of Turkish *makam* music are based on a single rhythmic mode (*usul*). An *usul* defines a pattern of left- and right-hand drum strokes, such as the one notated in Example 1. The upper line denotes right-hand strokes, while the lower line denotes left-hand strokes. The strokes with the greatest emphasis are labelled ›*düm*‹. These rhythms are the basis for the temporal elaboration within a composition, and the basic assumption of this paper is that they provide a guideline for the shape of an implicit metrical hierarchy. The period of an *usul* can be obtained by counting the number of metric subdivisions (*zamanlar*), nine in the shown example, at the metrical level below the tactus level. At the tactus level, the beat – at least for a short *usul* as the one depicted in Example 1 – could be defined by the usually non-isochronous stroke positions, or a subset thereof. It is important to point out, however, that the notions of beat and tactus have no immediate equivalent in Turkish oral music theory. Educational practice in Turkish *makam* music emphasizes the importance of internalizing the usually non-isochronous stroke patterns for the understanding of a piece, while counting the isochronous (subdivision) sequence that determines the length of the *usul* plays no role at all. Incidentally, *usuller* with periods of two and three *zamanlar* are an exception

to this outlined hierarchy, since they have strokes on all subdivisions; in those cases, the subdivision and tactus levels coincide.



Example 1: Symbolic description of the *usul Aksak*. The upper line denotes right-hand strokes, while the lower line denotes left-hand strokes. The strokes with the greatest emphasis are labelled ›*düm*‹. The regular subdivision (*zamanlar*) are at the eighth-note level, and define the period of the *usul* (nine *zamanlar* for *Aksak*).

In the course of my work and studies in Turkey (2008–2015), I made an effort to understand the way musicians conceive of the *usul*. However, the only categories that occur frequently are those of short *usul* of length from 2 to 15, and the long *usul* of length from 16 to more than 100. As an alternative to this categorisation, the Turkish composer and musicologist Suphi Zühdü Ezgi (1869–1962) has proposed a distinction between simple *usul* (of length 2 and 3), and the longer compound *usul*.[1] However, throughout my years of music studies in Turkey, I only once encountered a master who would apply this framework, which seems rather like an attempt to impose a mathematical system that lacks any relation to the oral music theory of Turkish *makam* music. In particular, it is worth pointing out that all distinctions between even and odd meters – in the sense of differentiating between even and odd periods – seem foreign to Turkish music cultures. No such distinction was ever made by any of my music teachers or colleagues in the academia, and to the best of my knowledge, such a distinction cannot be found in any scholarly source on Turkish rhythm either.

Processes of historical change in the rhythmic style of Turkish *makam* music have been documented extensively by Owen Wright,[2] and more recently by Jacob Olley.[3] Both focus on an instrumental genre, the *Peşrev,* for which notations that originate from various periods throughout the last four centuries are available for analysis. Owen Wright documents a process of augmentation of the rhythmic cycle for *Peşrev* in a long *usul* called *devr-i kebir.* In this process, the number of time units (*zamanlar*) of the *usul* is doubled (in this specific case, from 14/4 to 28/4), and within one augmented cycle, the original *usul* pattern is

1 Özkan 1990.
2 Wright 1988.
3 Olley 2016.

performed two times. Wright documents how this augmentation is accompanied by an increased density of notes in more recent notations of the same pieces. One possible reason for this change might be the introduction of increasingly slower tempi throughout the centuries, at least for this specific part of the repertoire. Recently, Olley has proposed that processes of editorial practices might have led to changes in notation as well.

While the previous corpus-based research on Turkish *makam* music has focused mainly on instrumental repertoires and long *usul* cycles, this article will focus on vocal music and short melodic cycles. Even though the available material covers a more limited range of historical periods, previous research has described an increasing Westernisation of rhythmic style in Turkish *makam* music.[4] The present paper will focus on the relations between the *usul* pattern and the onset positions of the notes that describe the melody of the song. The goal is to provide insights into how the distribution of note onsets in a cycle compares to results previously documented for Eurogenetic music repertoire.

2. *Usul* in the context of other music cultures

If we compare the *usul* with rhythmic modes that occur in other cultural contexts, the common properties of rhythmic modes emerge, as well as their distinct characteristics. To begin with a general definition of terminology, the common element among many theories of musical time is the separation of rhythm and meter.[5] Rhythm is regarded as a property of music, while meter is seen as a mental framework that helps humans to comprehend the structure of what is being observed.

According to Martin Clayton in his book on rhythm in Indian music,[6] the inference of meter is determined by both cultural background and universal psycho-physiological properties. Clayton observes that the rhythmic modes of Hindustani music (*tāl)* share many properties with common definitions of meter, since they have a hierarchical structure and serve as a framework for rhythmic design. However, he stresses that one of the levels in the hierarchy is often non-isochronous. Furthermore, he points out that the inference of the *tāl* is less subjective than that of meter in Eurogenetic music; for instance, it is illustrated

4 Holzapfel 2015.

5 Refer, for instance, to Kolinski 1973, and Lerdahl/Jackendoff 1983.

6 Clayton 2000, p. 199.

by clap patterns. The inference of the *tāl* by listeners is based on the recognition of these clap patterns and characteristic drum patterns called *thekā*, and »*tāl* is usually determined absolutely objectively by convention.«[7]

In the context of music from the Balkans, Constantin Brăiloiu was the first to apply the Turkish term *Aksak* to all forms of rhythms that combine basic short rhythms forming periods of 2 and 3 units.[8] While the term Aksak refers to a specific *usul* in Turkish *makam* music (shown previously in Example 1), it has served as a general marker for many rhythms in the Balkans. The term ›additive rhythm‹ was coined by Curt Sachs[9] to refer to a series of durations based on units of unequal length. In the context of music of the Balkans, Daniel Goldberg[10] has taken up this notion and proposed certain transformations of the durational patterns as inherent properties of additive rhythms. He observes such transformations in recent commercial recordings of Serbian folk music. As another example from the Balkans, we can refer to the Greek *Rembetiko* music, which is characterised by many rhythms with a period of nine units; these rhythms could be referred to as *Aksak* or additive rhythms, in the sense that they combine basic building blocks of 2 and 3-unit periods. However, transformations of these rhythms rarely occur within one piece; rather, one specific permutation of the short-short-short-long rhythms serves as a stable basis for a song. In addition, Goldberg's study on performance practice in Balkan musics questions simple 2-to-3 ratios between the short and long building blocks, and describes a wide range of timing flexibility in actual performances.[11]

Turkish, Balkan, and Indian music cultures represent three examples where non-isochronicity must be an inherent property of meter. Furthermore, the explicit conceptualization of underlying metrical-rhythmic concepts (*usul*, *tāl*) seems to be a connection between Turkish *makam* and Hindustani music. In contrast to Hindustani music, however, percussion in Turkish *makam* music marks the *usul* strokes in a very stable way. It remains to be discussed whether existing models of meter are able to provide an adequate theoretical framework for these musics, without marking them as ›complicated‹, ›odd‹, ›oriental‹, or in some other sense as the ›Other‹. This essay represents an initial contribution to such a discussion.

7 Ibid.
8 Brăiloiu 1951.
9 Sachs 1953, pp. 23–25.
10 Goldberg 2012.
11 Goldberg 2015.

3. Description of the corpus

A corpus of notated melodies of Turkish *makam* music may offer insights into how note events relate to the underlying rhythmic mode of the *usul*. Furthermore, the distribution of notes within an *usul* cycle might reveal how the meter in these compositions is shaped.[12] In the analysis within this paper, a corpus consisting of 913 compositions of Turkish *makam* music was used. The compositions span several stylistic periods, with the majority of pieces composed between the 18th and 20th centuries. All compositions are available from the collection of Kemal Karaosmanoğlu[13] in MIDI form. The actual performances of this music usually contain several melodic instruments and vocals (in the case of vocal pieces) in heterophonic combination, and often also include percussive instruments that mark the progression of the *usul*. However, this notated corpus of vocal pieces contains (as typically is the case for this music) only the basic melody of the composition and no percussion. The songs were chosen from the six *usul* classes that are listed in Example 2. The distribution of songs among the six rhythmic modes and the number of bars (N_{Cycles}) and notes (N_{Notes}) in each class are shown in Example 2, in the second, third, and fourth columns, respectively. The last two columns (denoted as Beats and *Mertebe*) define the time signature in which the *usul* is usually notated, for instance, 9/8 for *Aksak*.

CLASS	N_{Songs}	N_{Cycles}	N_{Notes}	Beats	Mertebe
AKSAK	249	11665	105427	9	8
CURCUNA	123	6718	50120	10	8
DÜYEK	172	7527	55994	8	8
SEMAI	72	6362	18734	3	4
SOFYAN	244	8979	73766	4	4
TÜRK AKSAĞI	53	3528	19870	5	8

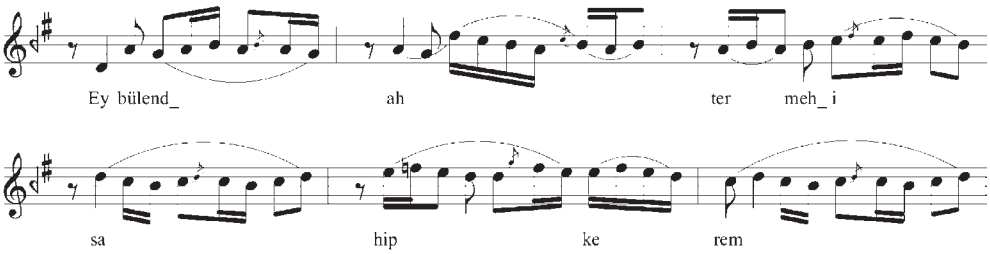
Example 2: Some properties of the corpus used for the analysis

In order to determine how the note onsets in a composition relate to the strokes of the *usul*, all MIDI files are sampled on a sixteenth-note grid. Then, all note onset positions are determined relative to the *usul* cycle of the piece. This process is illustrated in Examples 3 and 4. Example 3 displays six bars from a composition

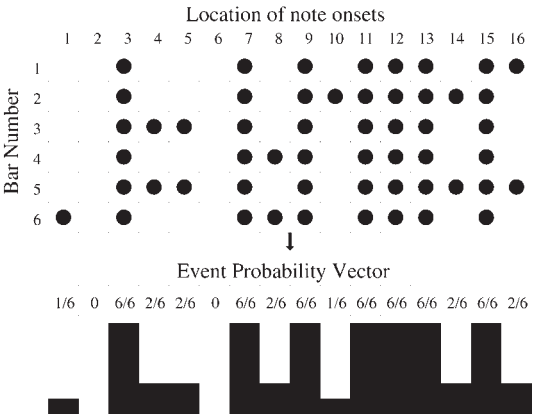
12 This insight is derived from Palmer/Krumhansl 1990.

13 Karaosmanoğlu 2012.

in the *usul Düyek*. *Düyek* is usually notated as 8/8, and therefore one bar will be discretized into 16 metrical positions. The notes of the six bars are assigned to the 16 metrical positions as depicted in the note matrix in the upper part of Example 4.



Example 3: Six measures of a composition in *usul Düyek*

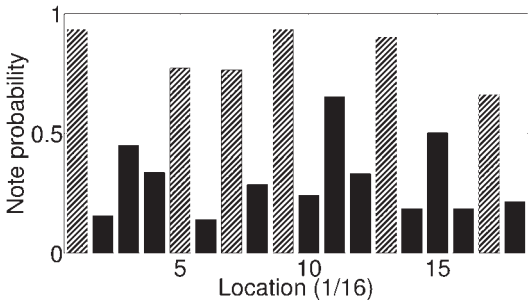


Example 4: Computation of event probabilities from note onsets in the composition depicted in Example 3

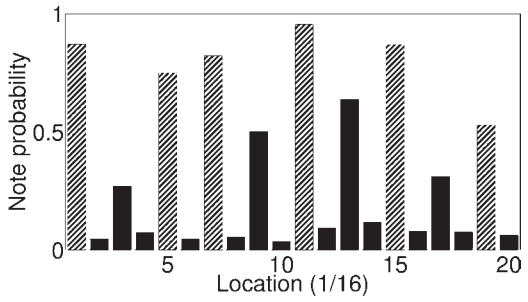
For a group of compositions sharing the same underlying *usul*, we can calculate the probability of an onset for each metrical position. As shown in the lower part of Example 4, we derive these probabilities by determining the percentage of all observed bars (in this case, the six measures shown in Example 3) that have an onset at the particular position. This procedure can be extended to a larger number of measures, for instance by taking into account a complete collection of pieces. The resulting vector with the length defined by the *usul* contains probability values, and I will refer to this vector as an ›event probability vector‹. Each element in an event probability vector takes on probability values between 0 and 1. (A value of 1 would denote that for the chosen set of pieces there is always a note onset in this location within the *usul* cycle.)

4. Results

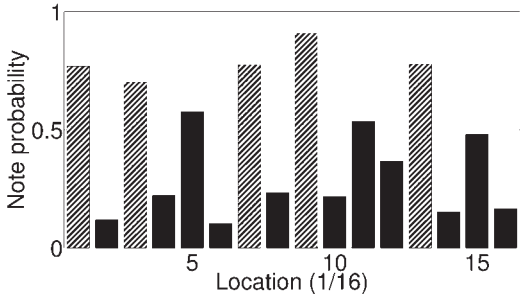
In Examples 5–7, I depict the event probability vectors for three of the six chosen *usul*, measured using the data described in Example 2.[14]



Example 5: Event probability vector for *usul Aksak*. Accents that coincide with an *usul* stroke are shown with gray shading.



Example 6: Event probability vector for *usul Curcuna*. Accents that coincide with an *usul* stroke are shown with gray shading.



Example 7: Event probability vector for *usul Düyek*. Accents that coincide with an *usul* stroke are shown with gray shading.

14 For more detailed analysis of this data, see Holzapfel 2015.

We can observe that at locations which coincide with *usul* strokes (striped bars), high peaks in the probability vectors of the *usul* appear. This indicates that at the instances of strokes in the *usul* pattern, notes are very likely to occur in a composition. However, we observe that in most cases, note probabilities do not decrease consistently from high-intensity to low-intensity stroke positions (comparing strong ›*düm*‹ and weaker ›*ke*‹ strokes[15]), and that the ›*düm*‹ strokes on the first accent of the cycles are not characterized by higher note probabilities than other ›*düm*‹ strokes in the cycle. This might either imply that the stratification of the underlying meter is less strong than observed for Eurogenetic music (for instance, as seen in a study by Caroline Palmer and Carol L. Krumhansl[16]), or that the note onsets of the analyzed Turkish *makam* melodies often form contra-metric patterns – i.e, patterns that are syncopated or shifted against the underlying *usul* strokes.

It is important to keep two further aspects in mind that support the development of a metrical structure out of a performance, and that are not taken into account by studying only note onsets as in this paper. First, it has been documented that inceptions of melodic phrases in the same repertoire have a strong relation to the *usul* strokes, by coinciding almost exclusively with strong strokes.[17] Second, in most performances of the analyzed vocal songs, the instrumental accompaniment emphasizes the rhythmic structure of the *usul*, which further alleviates the apparent lack of stratification that emerges from the melodic-note onsets only.

Bayesian model selection may be employed in order to determine whether the songs summarized by the event probabilities in Examples 5 to 7 may be assigned to underlying *usul* patterns with a high degree of confidence. Bayesian model selection provides a more accurate method than measuring histogram correlation as done by Palmer and Krumhansl. In brief, Bayesian model comparison provides a tool for determining which out of a set of models is most likely to have created a data observation, without assuming certain model parameter values. In our case, a ›data observation‹ is the notation of a composition, and six models describe the individual *usuller*.[18] Such an analysis results in the matrix shown

15 The differentiation of the stroke intensities cannot be exactly quantified, but there is an agreement that ›*düm*‹ has the highest intensity, and ›*ke*‹ the weakest.

16 Palmer/Krumhansl 1990.

17 Karaosmanoglu 2014.

18 For further detail on the implementation of the model comparison, the reader is referred to Holzapfel 2015.

in Example 8, which gives the correct *usul* of the songs in its rows, and the *usul* models in its columns. (If there were no ambiguity, all songs would be correctly assigned to the models, resulting in a matrix with 100 on the diagonal, and 0 elsewhere.) By looking at the underlined values on the diagonal of the matrix, it becomes apparent that all *usul* models M_1 to M_6 seem to be very strongly related to the compositions, since the values on the diagonals are consistently the largest in each row. Large values off the diagonals, shown in bold type in Example 8, usually relate cycles with equal length, or lengths that differ by a factor of 2.

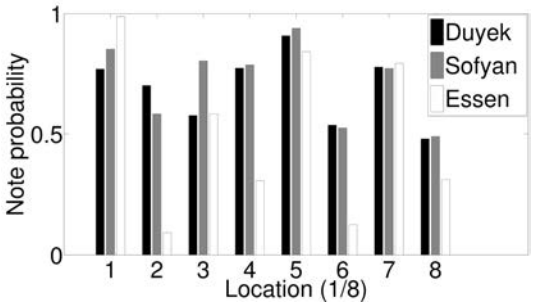
	M_1	M_2	M_3	M_4	M_5	M_6
Ak.(9/8)	94.4	0.8	0.8	0.8	**2.0**	1.2
Cu.(10/8)	0.0	88.6	0.8	0.0	0.0	**10.6**
Dü.(8/8)	1.2	0.0	61.6	0.0	**36.6**	0.6
Se.(3/4)	2.8	0.0	0.0	90.3	**6.9**	0.0
So.(4/4)	3.7	0.0	**13.9**	2.0	79.9	0.4
Tü.(5/8)	1.9	**11.3**	0.0	0.0	5.7	81.1

Example 8: Model comparison: percentages of the most likely models M_k for songs of the classes given in the rows of the matrix. The diagonal denotes the true model for the class (underlined). The highest percentage of mis-classification is printed in bold numbers.

Regarding relations with meter in Eurogenetic music, it is interesting to compare the two *usuller* that could be counted as a 4/4 meter with event probabilities obtained by David Temperley[19] for the Essen collection of European folk songs. This comparison is illustrated in Example 9. It is apparent that the only accent with a clearly higher event probability for the Essen collection is the downbeat (that is, the first accent of the cycle). Compared with the European folk songs, the Turkish songs place more events at metric locations that could be expected to have a lower-level metrical accent (locations 2, 4, 6 and 8) within the Eurogenetic 4/4 meter.[20]

19 Temperley 2010.

20 This supports either the existence of a difference between the underlying metrical frameworks for Turkish *makam* music and Eurogenetic metrical frameworks, or might otherwise indicate that note onsets in Turkish music are not as strongly related to metrical hierarchy as in Eurogenetic music. This observation incorporates a point made by Justin London in his response to this paper (see pp. 422–432).



Example 9: Comparison of the event probabilities for the *usul Düyek* and *Sofyan* with the probabilities as documented by Temperley (2010) for the Essen folk song collection

5. Conclusion

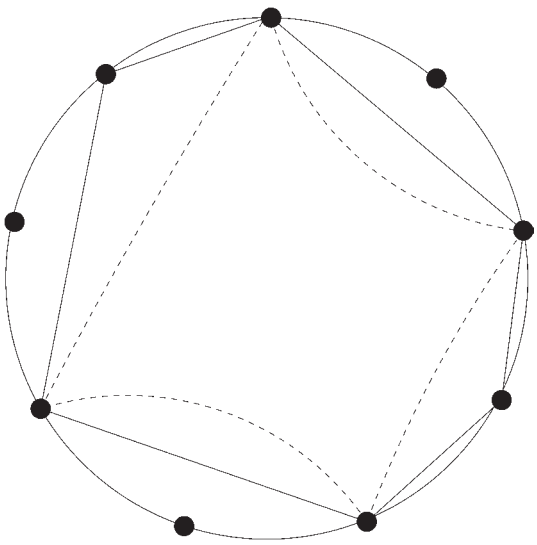
Using a large corpus of compositions of Turkish *makam* music, this essay has investigated the way in which note onsets relate to the underlying *usul*. The way note events are distributed within an *usul* cycle is highly related to the rhythmic mode. Relations between musical events and underlying metrical-rhythmic concepts are well-documented for Eurogenetic musics, but explorations of this relation remain to be done for other musics of the world. Further analyses could be performed using notated corpora (for instance, transcriptions of performances), or even using field recordings, with the aid of signal processing methods and onset annotations.

In the context of Turkish music, it appears reasonable to regard the *usul* stroke patterns as a guideline for determining which pulse positions of the subdivision (*zamanlar*) are to be given particular stress within a composition. Indeed, a complete hierarchical metrical model for this music might be derived by looking at all the differently weighted event probabilities in order to define metrical accent on all possible locations in the bar. To this end, Justin London describes a set of rules and constraints that enable one to incorporate non-isochronous pulses into a metrical hierarchy.[21] In Example 10, I depict a 9-cycle for *Aksak*, and in Example 11, a 10-cycle for *Curcuna usul*. The black polygons show the rhythm marked by the *usul* strokes. According to the well-formedness constraints by London, the black polygons do not form a proper higher metrical level within the N-cycle, since they involve neighboring pulses on the N-cycle. The geometric

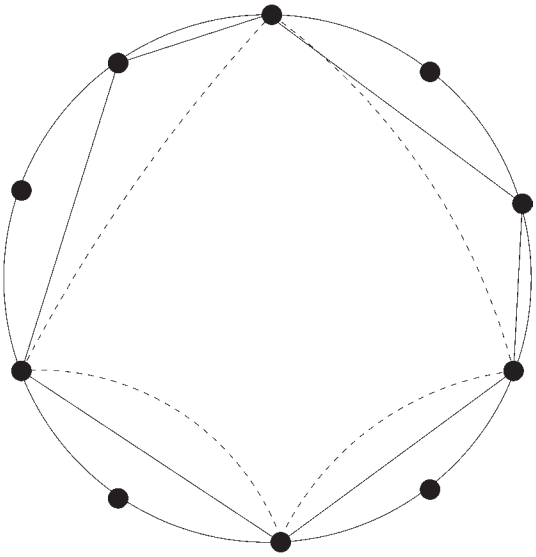
21 London 2004, pp. 125 ff.

shapes drawn with dotted lines denote rhythms that are obtained by leaving out the weaker strokes of the *usul*. While these form proper tactus levels according to well-formedness rules and maximum evenness, they cause a contradiction with the related event probability vectors: for *Aksak*, this would imply that the second and the fourth element of the 9-cycle are on the same metrical layer. However, the fourth element receives a note onset probability that is about twice as large as for the second, as can be seen by comparing the height of the bars at locations 7 and 3 in Example 5, respectively. This indicates that there is no simple relation between onset probability and metrical level for *Askak usul*, and similar observations can be obtained for the 10-cycle *Curcuna* in Example 11.

It is not clear how best to deal with such problems; Turkish compositions are clearly metered, with the defined two levels being the subdivision (*zamanlar*) and the metrical cycles. However, how the intermediate (beat) level might be structured in accordance with metrical models remains to be investigated. In this context, it is interesting to observe that rhythms in Turkey, just as in other parts of the world, are rather described in a syllabic way than counted. This might imply that the Eurogenetic model of a metrical hierarchy, which is strongly related to the idea of counting rhythm, does not capture rhythmic concepts of some other cultures very well.



Example 10: Illustration of *usul Aksak* as 9-cycle. Solid lines denote the *usul* stroke cycles, and dashed lines denote reductions obtained by removing *ke*-strokes.



Example 11: Illustration of *usul Curcuna* as 10-cycle. Solid lines denote the *usul* stroke cycles, and dashed lines denote reductions obtained by removing *ke*-strokes.

References

Brăiloiu, Constantin, »Le rythme Aksak«, in: *Revue de Musicologie* 33/99–100 (1951), pp. 71–108.

Clayton, Martin, *Time in Indian Music: Rhythm, Metre, and Form in North Indian Rāg Performance* (Oxford monographs on music), Oxford 2000.

Goldberg, Daniel, »Playing with Sums: Reconsidering Additive Rhythm in Balkan Music«, in: *2nd Conference on Analytical Approaches to World Music*, London 2012.

Goldberg, Daniel, »Timing Variations in Two Balkan Percussion Performances«, in: *Empirical Musicology Review* 10/4 (2015), pp. 305–328.

Holzapfel, Andre, »Relation between Surface Rhythm and Rhythmic Modes in Turkish Makam Music«, in: *Journal for New Music Research* 44/1 (2015), pp. 25–38.

Karaosmanoğlu, Kemal, »A Turkish Makam Music Symbolic Database for Music Information Retrieval: SymbTr«, in: *Proceedings of ISMIR – International Conference on Music Information Retrieval*, Porto 2012.

Karaosmanoğlu, Kemal/Bozkurt, Barış/Holzapfel, Andre/Dişiaçık, Nilgün D., »A Symbolic Dataset of Turkish Makam Music Phrases«, in: *Proceedings of the 4th Workshop on Folk Music Analysis,* Istanbul 2014.

Kolinski, Mieczyslaw, »A Cross-Cultural Approach to Metro-Rhythmic Patterns«, in: *Ethnomusicology* 17/3 (1973), pp. 494–506.

Lerdahl, Fred/Jackendoff, Ray, *A Generative Theory of Tonal Music*, Cambridge, MA 1983.

London, Justin, *Hearing in Time: Psychological Aspects of Musical Meter*, Oxford 2004.

Olley, Jacob, »Rhythmic Augmentation and the Transformation of the Ottoman Peşrev, 18th-19th Centuries«, in: *Rhythmic Cycles and Structures in the Art Music of the Middle East*, ed. Zeynep Helvacı, Ralf Martin Jäger and Jacob Olley, Würzburg 2016.

Özkan, İsmail Hakkı, *Türk mûzikîsi nazariyatı ve usûlleri: kudüm velveleleri* (Kültür serisi 41), Istanbul 1990.

Palmer, Caroline/Krumhansl, Carol L., »Mental Representations for Musical Meter«, in: *Journal of Experimental Psychology* 16/4 (1990), pp. 728–741.

Sachs, Curt, *Rhythm and Tempo: A Study in Music History*, New York 1953.

Temperley, David, »Modelling Common-practice Rhythm«, in: *Music Perception* 27/5 (2010), pp. 355–376.

Wright, Owen, »Aspects of Historical Change in the Turkish Classical Repertoire«, in: *Musica Asiatica* 5 (1988), pp. 1–108.

KTH Royal Institute of Technology

Holzapfel, Andre. 2020. “A Corpus Study on Rhythmic Modes in Turkish Makam Music and Their Interaction with Meter” [Eine Korpusstudie über rhythmische Modi in der türkischen Makam-Musik und deren Interaktion mit dem Metrum.] In *Gegliederte Zeit. 15. Jahreskongress der Gesellschaft für Musiktheorie Berlin 2015* (GMTH Proceedings 2015), edited by Marcus Aydintan, Florian Edler, Roger Graybill and Laura Krämer. Hildesheim, Zürich, New York: Olms Verlag, 393–405. https://doi.org/10.31751/p.199

SCHLAGWORTE/KEYWORDS: computational musicology; computergestützte Musikforschung; corpus study; Korpusstudie; Makam; metre; Metrum; nicht-isochron; non-isochronous; rhythm; Turkish makam music

eingereicht / submitted: 20/07/2018

angenommen / accepted: 20/07/2020

veröffentlicht (Druckausgabe) / first published (printed edition): 28/09/2020

veröffentlicht (Onlineausgabe) / first published (online edition): 04/12/2022

zuletzt geändert / last updated: 27/11/2022