EXPLORING THE MUSIC OF TWO MASTERS OF THE TURKMEN DUTAR THROUGH TIMING ANALYSIS

David Fossum
Brown University
dcfossum@gmail.com

Andre Holzapfel
Boğaziçi University, Istanbul
andre@rhythmos.org

ABSTRACT

In this paper, we analyze onset characteristics to try to identify important differences between two famous Turkmen dutar performers in terms of patterns of timing. We first analyzed annotated onset data for equivalent excerpts from recordings by these two musicians. We then analyzed unannotated onset data for a larger set of entire recordings. These analyses showed several conclusions. First, during introductory strumming outside the context of a composed melody, the two have different timing habits. Mylly aga is more consistent and Pürli aga more varied in terms of recurring inter-onset-intervals (IOIs). Second, during through-composed melodies, the timing profiles of the two musicians are very similar. This perhaps reflects the traditional Turkmen emphasis on preserving the form of traditional compositions in great detail and the attention paid to strumming technique. Finally, we found that automatically derived representations of rhythmic patterns, referred to as pulsation matrices, could be useful for identifying departures from typical timing patterns, which we could then analyze in order to understand such variations and their possible significance.

1. INTRODUCTION

The Turkmen dutar is the most popular traditional instrument in Turkmenistan, a former Soviet republic in Central Asia. It is a two-stringed, fretted lute which is strummed without a pick, using a variety of right-hand techniques. Virtuosos in some parts of the country have developed a repertoire of complex, through-composed pieces which have traditionally been transmitted orally through master-disciple lineages. In Turkmenistan, musicians and listeners often focus on right hand strumming style and technique in their discussions of dutar performances. Rhythm and timing are thus emphasized in evaluations of playing style.

In this paper, we analyze onset characteristics to try to identify important differences between famous performers in terms of patterns of timing. We will focus specifically on perhaps the two most prominent dutar players of the 20th century: Mylly Tamyradow (1885-1960), and Pürli Saryÿew (1905-1970). According to local convention, we will refer to these two as Mylly aga and Pürli aga, respectively. Mylly aga enjoys a reputation as a heritage-bearer, a great teacher who preserved old versions of traditional pieces and passed them on unchanged to students who would be leaders of the next generation of dutar greats. He is also celebrated for his unsurpassed technical mastery of the instrument. Pürli aga, by contrast, is known as an innovator and stylist, and is often credited with improvising new passages in traditional compositions, constantly exploiting spaces for variation and development on the fly. For more details on the Turkmen dutar and its players, please refer to Fossum (2010).

We took two different approaches in order to identify differences and similarities between Mylly aga and Pürli aga in terms of their timing habits. The first applies a semi-automatic approach, in which onsets are first determined using a signal analysis software, and these detected onsets are then corrected manually. Using this first method, we are able to focus on short excerpts played by both musicians and compare the timing of onsets observed for the two musicians in a representation that summarizes the observed Inter-Onset-Intervals (IOI) in a histogram. The second approach uses a representation presented in Holzapfel (2013), referred to as pulsation matrix. A pulsation matrix can be derived from an audio signal without any annotation, and allows therefore for an inspection of rhythmic properties in larger sections of audio.

2. ANALYSIS METHODS AND RESULT SUMMARY

For the first semi-automatic analysis, we selected portions of these musicians recordings, annotating the onsets identified by Sonic Visualizers [1] automatic onset detection feature. For the automatic detection, we applied the note onset detector from the Queen Mary plug-in set, using Spectral Difference with maximum sensitivity as a parameter choice. Due to this choice of parameters, annotation is necessary as the automatic detection in this software sometimes identified onsets that did not correspond to the right hand strokes that we considered meaningful for our timing analysis. We used this annotated data to create summary inter-onset interval histograms (IOI-H) of the recorded segments in question and compare how the two performers had played a collection of sections of musically identical phrases.

This approach allowed us to draw several conclusions. First, when looking at introductory portions of a piece, when the musicians perform a kind of open strumming that is free of melodic content, the two musicians have statistically significantly differences in timing habits. But, second, when we compared the musicians playing through-composed melodic phrases, from a statistical standpoint, it appears that Turkmen musicians attend to timing accuracy to such a level of detail that identifying meaningful timing variations is not feasible using the chosen approach

[1] http://www.sonicvisualiser.org/

for detecting and summarizing onset times in a recording. While the pulsation matrix for different phrases was quite distinct, the profiles for each musician playing the same phrases was similar, with a few exceptions which we will discuss.

For the automatically obtained IOI representations, the pulsation matrices, we analyzed a number of entire recordings of each performer. While we were able to focus on specific phrases using a limited sample size using our first approach, in the second fully automatic approach we were able to analyze a larger duration of recordings. By inspecting the obtained results, we hoped to spot locations in the composed pieces in which the two players differ regarding to their rhythmic style. The approach used the same method as was applied in Holzapfel (2013), where as a first step an onset function is computed that takes large magnitudes in the vicinity of strokes by the dutar players. Then autocorrelations of this onset function are computed in small shifting windows of 2s length with a hop size of 0.2s, which provides us with a pulsation matrix that has the time of the audio recording on its x-axis, and the estimated IOI on its y-axis. Since our manually annotated data showed that the maximum duration between two onsets is 0.5s, we restrict the visualization of the obtained pulsation matrix to this range. We give a simple artificial example in order to explain the visualization in form of the pulsation matrix: In Figure 1 we depict a pulsation matrix that was obtained from a simple sequence of noise bursts of 8s length. Until the middle of this artificial example, only bursts with IOI of 0.2s and 0.4s exist, and in the second half a strong fast component at 0.1 is added. The bright areas indicate these active IOI.

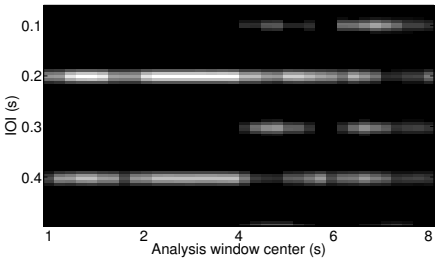
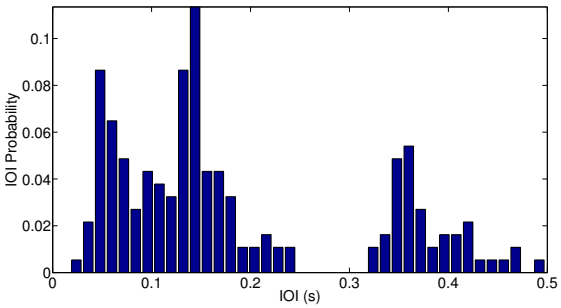
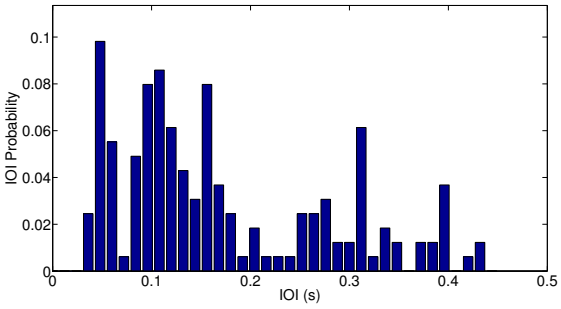


Figure 1: Artificial example of a pulsation matrix that was obtained from a simple sequence of noise bursts of 8s length.

This approach confirmed what we found in our analysis of the shorter melodic phrases: that this method of visualizing timing reveals how similarly, from a broader point of view, these musicians play the same piece, and how comparing pulsation matrices of different pieces shows the extent to which the pieces look rhythmically distinct from each other. However, this approach does allow us to scan a large number of pieces and visually identify occasional moments when one musician momentarily diverges meaningfully from the usual pulsation matrix.



(a) Mylly aga



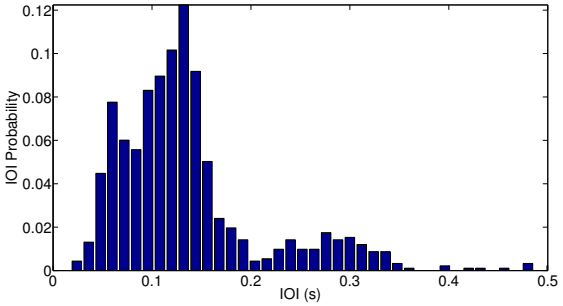
(b) Pürli aga

Figure 2: Summary IOI Histograms for introductory strumming (kakuw), derived from pieces in 2/4 time.

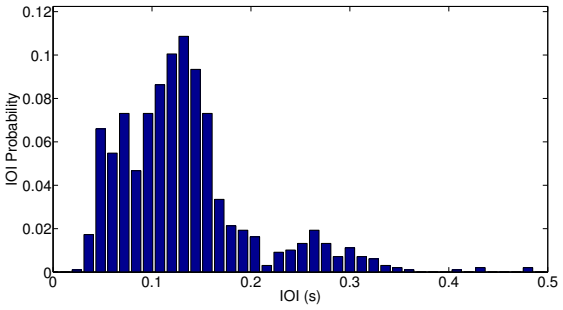
3. ANALYZING ANNOTATED TIMING DATA

Turkmen dutar players always begin a performance of a traditional piece by strumming the strings of the dutar open and then playing a short cadential formula. Such an introduction, called a *kakuw*, is not specific to the piece that is about to be played. Performers improvise the kakuw by stringing together stock rhythmic formulae. Kakuw affords an important opportunity for analysis in that it allows us to see the timing patterns of musicians outside the context of a melody. The musicians are just strumming the strings of the dutar to establish the metrical framework for the approaching composition. Musicians strum the kakuw in a meter that corresponds to that of the piece they are about to play.

For our first analysis, we visualized the timing profile for a number of introductory kakuw performances by each musician when they were playing in the same meter, 2/4. We analyzed 4 such introductions by Pürli aga and 4 by Mylly aga. What this analysis revealed was that Mylly aga was remarkably consistent in the typical inter-onset intervals that recur in his strumming of kakuw. Across different pieces, both tended to play at a consistent tempo, with the same few IOIs appearing over and over for Mylly aga, and a large variety of changing patterns appearing for Pürli aga. We conducted a statistical test to evaluate if the changes in IOI are likely to be generated by exponential distributions with parameters that are different for the two players. The result was a significantly higher variation in consecutive IOI values for Pürli aga. In Figure 2a and Figure 2b, respectively, we show the two summary IOI Histograms which depict the more stable IOI for Mylly aga, and clearly more multi-modal IOI Histogram for Pürli aga.

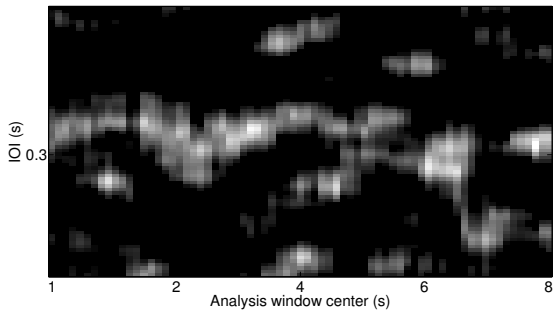


(a) Mylly aga

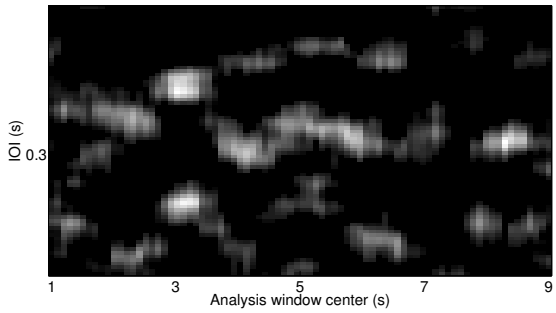


(b) Pürli aga

Figure 3: Summary IOI Histogram of a collection of the same melodic phrases played by both players.



(a) Mylly aga



(b) Pürli aga

Figure 4: Pulsation matrices for Mylly and Pürli aga playing the same excerpt from Ene.

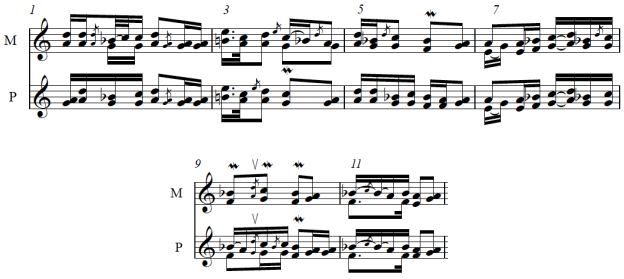


Figure 5: Transcription of a passage of Ene in which Pürli aga disrupts the timing profile. Beats are numbered for reference in analysis below.

Our next analysis visualizes timing profiles for the two musicians playing the same melodic phrases, the same excerpts from a traditional composition. This analysis revealed several things. First, when we compare the timing profile for the two musicians playing the same phrases, they look strikingly similar. This reflects the fact that the musicians are conservative in guarding the form and rhythmic characteristics particular to the traditional compositions they play. We illustrate this in Figures 3a and 3b, summary IOI Histograms of the musicians playing a set of the same melodic phrases.

Comparing the timing profile of the same musician playing phrases from two different pieces reveals that the timing profile changes according to the piece much more so than according to the musician playing it, at least as far as this method of analysis is able to illustrate.

4. ANALYZING NON-ANNOTATED TIMING DATA OF ENTIRE RECORDINGS

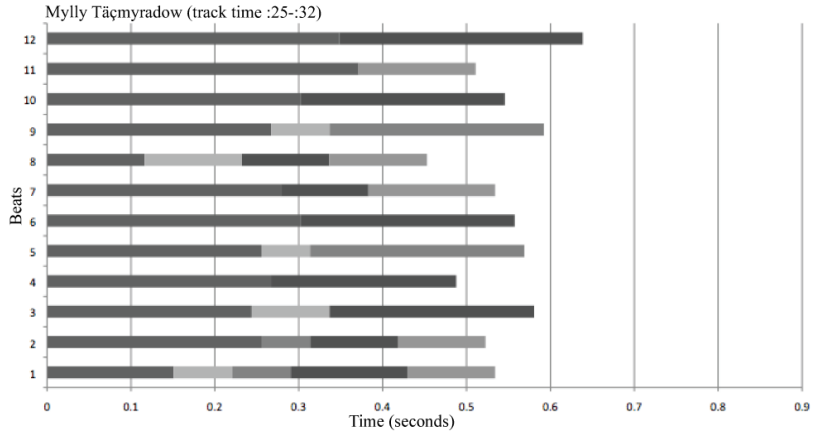
In addition to these analyses of select excerpts from these musicians recordings, we also created IOI representations in the form of pulsation matrices for entire recordings, without annotating the timing data. While the unannotated data was not as accurate in terms of consistently representing the timing of the right hand strokes that we wanted to isolate, it allowed us to scan a larger body of data, comparing the two musicians recordings of the same pieces to spot moments of divergence from each other.

We found that Pürli aga occasionally disrupted the usual timing profile by dramatically shortening or elongating a beat in the music. These moments were rare but may be nonetheless perceptually significant for listeners of Turkmen music who describe Pürli aga as a spontaneous performer who varies material more so than Mylly aga does. One such moment appears in the piece Ene. An IOI Histogram of Mylly agas performance of this excerpt is shown in Figure 4a.

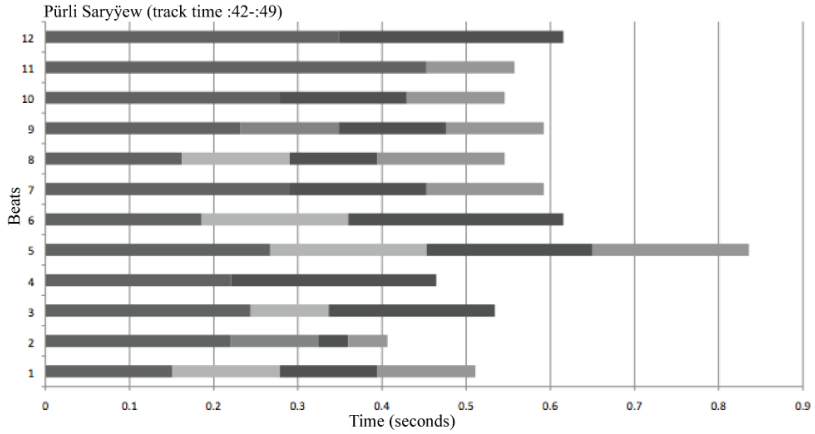
In Figure 4b, at the 3 second mark, the histogram of Purli agas performance reveals a disruption of the glowing white line that marks an otherwise consistently recurring IOI in this piece.

If we look at a transcription of this section of Ene, we can explain this disruption of the pulse as a microtiming device Pürli aga uses to draw out the phrasing of the melody. The following graphic (Figure 6) charts the durations, in seconds, of each stroke and beat in this passage.

Here Pürli agas beat 5 is more than double the length of his beat 2. What accounts for such dramatic shifts in tempo? The reason for this truncation of the beat is that it



(a) Mylly aga



(b) Pürli aga

Figure 6: Chart graphing the IOIs in a phrase of Ene as performed by Mylly aga (top) and Pürli aga (bottom). Lengths of each bar on the graph represent one beat (one quarter note in the transcription in Figure 5); shaded segments of each bar represent an IOI within the beat.

helps to stress the ensuing downbeat. In this case the emphasized downbeat, the chord b-e, constitutes a variation on the main tune. The earlier (standard) appearances of this melody are shown in Figure 6a.

In the passage we just heard, both performers have replaced the progression d-c-d at beat 3 with e-c-d, holding the e for a dotted 16th note to emphasize both the pitch climax and the fact that this represents a deviation from the norm for the tune. While both musicians hold this note, Pürli aga even further emphasizes it by rushing the previous beat to create an anticipatory flourish. We might call this anticipatory flourish a kind of microtiming device.

Pürli aga employs a contrasting microtiming device just three beats later, in the elongated beat 5 illustrated in the graph we just saw. Again, the melodic context reveals the apparent logic behind such timing: the melodic phrase is set to resolve to the tonic a during beats 6 and 7. Anticipating this, Pürli aga taps on the temporal brakes, so to speak. He does so not only by holding the first note in the beat, but also by playing four more or less even 16th notes at this reduced rate, ensuring that the listener hears this as a tempo shift rather than a mere fermata. The precadential positioning of the device is perfectly placed to help the melody shed some excess momentum before settling on the tonic. A pleasing byproduct of this precadential deceleration is its syncopated-sounding disruption of the expected pulse.

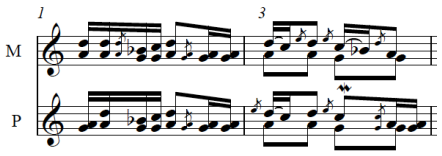


Figure 7: Transcription of an earlier permutation of the phrase depicted in Figures 5 and 6.

Such microtiming devices as precadential deceleration and anticipatory flourishes may offer another focal point of microtiming analysis. If we could identify a limited set of such devices and track their appearance across many performances, what patterns would emerge from this data? Do Mylly aga and Pürli aga have favorite microtiming devices or employ them characteristically at particular moments? How do listeners interpret such habits, if they notice them? Turning to the theme of transmission, we might ask which microtiming devices seem to get transmitted and survive

across time, what the particular microtiming habits of a musical lineage are, and whether musicians seem to perceive particular microtiming devices as an essential part of a traditional piece to be preserved.

One potential use for creating automatically derived pulsation matrices, then, would be to allow for scanning over a large number of pieces and identifying such moments when they appear. Then a closer analysis of the phrase in question could allow us to consider how the microtiming device compares to other examples we find and draw conclusions about any patterns in the recurrence of such devices.

5. CONCLUSIONS

Our analysis revealed several aspects of timing in Turkmen dutar performance, at least as regards two of the most famous musicians, Pürli aga and Mylly aga. First, during introductory strumming outside the context of a composed melody, the two have different timing habits. Mylly aga is more consistent and Pürli aga more varied in terms of recurring IOIs. Second, during through-composed melodies, the timing profiles of the two musicians are very similar. This perhaps reflects the traditional Turkmen emphasis on preserving the form of traditional compositions in great detail and the attention paid to strumming technique. Finally, we found that creating IOI Histograms could be useful for identifying departures from typical timing patterns, which we could then analyze in order to understand such variations and their possible significance.

6. ACKNOWLEDGEMENTS

Andre Holzapfel is supported by a Marie Curie Intra European Fellowship (PIEF-GA-2012- 328379).

7. REFERENCES

Fossum, D. (2010). Turkmen dutar and the individual. Master's thesis, Wesleyan University, Middletown, CT.

Holzapfel, A. (2013). Tempo in Turkish improvisation. In *Proceedings of the 3rd Workshop on Folk Music Analysis*, Amsterdam, Netherlands.