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Response to Goldberg, Holzapfel, and Guillot

Introduction

At the 2015 GMTH meeting, it was my pleasure and privilege to respond to each of the three papers presented at the session on »Rhythm and Timing in Non-Isochronous Meter«, chaired by Rainer Polak. What follows below are my original responses, with a few added notes based on our subsequent exchanges at the conference. I have tried to maintain the informal tone of the session, as it was a collegial exchange and exploration of the issues surrounding non-isochronous meter in many different contexts.

Daniel Goldberg, *Timing of Unequal Beats in Bulgarian Drumming*

In his presentation, Dan Goldberg reports on a timing study of the characteristic rhythms of two pieces of Bulgarian dance music: *elenino horo* and *rŭchenitsa.* Both involve non-isochronous meters with a short-short-long beat pattern. As Goldberg notes, these are *aksak* meters, which is to say that they involve two distinct beat classes (short versus long), as opposed to isochronous meters which involve a single beat class whose subdivision pattern remains constant. Notably, the *aksak* pattern Goldberg has studied starts with the short element (a point I will return to in a moment). *Elenino horo* is a slower dance, while the *rŭchenitsa* is a good bit faster. Goldberg gathered data from multiple performances from three different regions of Bulgaria: Northern Bulgaria, Thrace, and Pirin.

First, a minor question regarding Goldberg's analytical method. He took random samples of 42 measures from each recording. While such random sampling is a standard method for many kinds of data (i.e., to avoid a sampling bias), in a musical context it may not be as appropriate, as it presumes that rhythm production is uniform over the course of the piece. But it may well not be, especially as ornamentation becomes more elaborate over the course of a performance, if tempo changes occur, etc. It may be useful to compare samples of similar length

from the same parts of each performance (beginning, middle, and end), as well as to systematically compare different parts within and across performances.

On to more substantive issues. As noted above, in *aksak* meters there are two beat classes. In this repertoire, as in others, the two different beat classes are comprised of two versus three subdivision elements, subdivisions which are often phenomenally present in the musical texture (in Goldberg's case, most are articulated by the *tŭpan* drum itself). Thus, one can give a *quantitative* definition for each beat class – two-element duplets versus three-element triplets. Alternatively, and in the absence of explicit subdivision, one can define these beats in terms of their *duration* or durational proportion, whereby the short:long ratio should aim toward a 2:3 ideal. I have argued that the 2:3 ratio is privileged, in that it gives two distinct beat classes that are perceptually distinct whether they are manifest durationally or quantitatively.[1] Other ratios do not work so well, as the durational or quantitative distinctions between the two beat classes are not as distinct, especially at faster tempos. Given the repertoire under scrutiny, Goldberg's duplet-vs.-triplet presumption is wholly warranted.

If the performance of a 2:3 based *aksak* rhythm is perfectly isochronous, then quantitative or durational metric accounting will produce the same result in terms of a timing analysis: the 2s and 3s will produce the 2:3 ratio. But of course, human timings are not perfectly isochronous, and indeed, there can be considerable variation in durational proportion while a pattern maintains its quantitative identity. Goldberg's timing analyses use the 2:3 short:long ratio as a default presumption, and he compares the produced rhythms against a temporal template in which any given beat span is to be divided (that is, 2:2:3 for the entire measure). He reduces his temporal measurements to two datums for each measure: (a) the relative length of the two short elements in comparison to each other, and (b) the length of the long element against the combined length of the two short elements. This allows one to see how the performed pattern differs from the ideal 2:2:3 timing. And to be sure, this does give a clear picture of the relation amongst the two short elements, as well as the long element versus the (combined) shorts.

There are two problems, however, with this methodological presumption. The first is that it presumes 2:2:3 as the target timing ratio. In studies of the production of both isochronous and non-isochronous subdivisions, Bruno Repp, Peter Keller, and I found that even when the target was a simple 2:1 ratio, there

1 London 2012, pp. 132–135.

was a bias in production away from that ratio toward 1.89:1, that is, a softening of the durational contrast.[2] Given that the duplet-versus-triplet identity of each metrical element is clear in Goldberg's data, and given what we know from other timing studies, one need not presume a precise 2:2:3 ideal. And to be sure, as Goldberg notes, the actual deviations from the deadpan ideal are quite small. The greatest deviation was the shortening of the long element in bar one of the *rŭchenitsa* pattern by an average of 23 ms; most other deviations were within 10 ms. It is telling, however, that the largest absolute deviation (that is, in actual milliseconds, as opposed to fractions of the beat) from the deadpan timing occurs in the faster performances, and so when considered as a percentage of the beat duration, this is a considerable amount. In the context of the two-bar pattern it may be an example of rhythmic smoothing, similar to what was reported in Repp, London and Keller (2012), as the durational reduction in the *rŭchenitsa* occurs in the middle of the two-bar rhythmic figure. Rhythmic smoothing is different from, though compatible with, group final lengthening, which in *rŭchenitsa* may be evident more in the lack of smoothing in bar 2.

This brings me to my second methodological quibble. It would be good to see the timing profile of not only all three beats, but of the subdivisions as well (in so far as this data can be obtained), for that would tell us where within each beat the metrical compressions and rarefactions take place. This in turn would give us a clearer sense of the relation between kinematic-/performance-driven timing alterations – so called ›obligatory timing‹ (things get stretched out when they are more difficult due to the interpretation of extra elements, or require more bimanual coordination) – versus structural alterations that correspond to accents in the dance and/or musical figure, versus performer- or region-specific habits of expressive timing.

Two more concluding observations. Goldberg wonders about the relevance of the very small differences in duration, as well as the very small deviations from an ideal timing profile he documents in his study, as they are near the limits for rhythmic discriminability, and »if musicians truly cannot detect such differences, their ability to produce these differences and their motivation to do so are inexplicable«. Two rejoinders here. The first is from Goldberg's own data: if the musicians truly couldn't detect such differences, then it is unlikely he would have found such consistent results (note the very small extent of the standard deviations in his timing profiles); such stability requires a clear timing

2 Repp/London/Keller 2012.

target as well as mechanisms which correct for deviations from that target. So at some level, the musicians Goldberg studied really are sensitive to very small timing differences. And as Bruno Repp has shown, in rhythm production tasks our ability to detect and correct timing errors can occur at a subliminal level, with deviations as small as 3–5 ms producing phase correction responses.[3]

Goldberg also speculates about the influence of tempo on the production of these different timing patterns, and of course, his survey rhythmic pattern (*rŭchenitsa* vs. *elenino horo*) is confounded with tempo (faster vs. slower). He wonders if »the action of playing these different rhythms« is affected by tempo – and doubtless it is (as per my remark on ›obligatory‹ aspects of timing above). But Henkjan Honing has also shown that characteristic expressive timings (such as ›swung‹ patterns in jazz) do not scale with tempo – that is, as the tempo changes, so too does the timing ratio.[4] I am not sure this is quite analogous here, because there really is a rather different pattern of alteration in *elenino horo* vs. *rŭchenitsa*, whereas Honing would have found differences in the ›depth‹ of the pattern of lengthening and shortening, as opposed to differences in the actual pattern, as Goldberg has shown.

In sum, Goldberg's study has shown that the *tŭpan* players do many of the same things as western classical musicians in their performances. They do not play deadpan rhythms, but instead employ stable, characteristic patterns of expressive timing. Expressive timing is used for many of the same purposes, including rhythmic smoothing and marking of group boundaries. Expressive timing is related to bodily/mechanical aspects of performance, but may also be a hallmark of regional or historical styles. Most of all, it underscores how an empirical approach can refine our theoretical, ethnographic, analytical, and historical understanding of musical rhythm.

André Holzapfel, *A Corpus Study on Rhythmic Modes in Turkish Makam Music and Their Interaction with Meter*

In his paper, André Holzapfel examines the distribution of note onsets in a corpus of Turkish *makam* music. He specifically examines examples which employ one of six *usul,* the Turkish term for rhythmic mode. Each mode is associated with a non-isochronous metrical type.

3 Repp 2000.

4 Honing 2007.

Holzapfel's main results are two-fold. On the one hand, he found a strong statistical correspondence between the distribution of note onsets in each subset of his corpus and the characteristic rhythmic mode – most note onsets in the *makam* melodies coincided with the strokes of the *usul*. On the other hand, there was little differentiation amongst the most prominent onsets: the ›downbeat‹ was not the location with the most event onsets, nor was any hierarchy apparent amongst them, as has been found in studies of western music.[5]

I was pleased to see this result. First, I have suggested that non-isochronous meters do not require the accentual differentiation of beats that we typically find in isochronous meters.[6] This is because without such accentual differentiation, in an isochronous meter like 4/4, the structure of a metrical cycle is undefined; one simply has a string of beats. By definition, however, non-isochronous meters give a clear sense of the metric cycle, as in the *aksak* meter in Holzapfel's study: 2-2-2-3-2-2-2-3-2-2-2-3. We may not know which element is the downbeat/head of the metric cycle, but the presence of a nine-element cycle is not in doubt. And second, Rainer Polak, Nori Jacoby, and I found a similar result in a survey of Malian drumming music.[7]

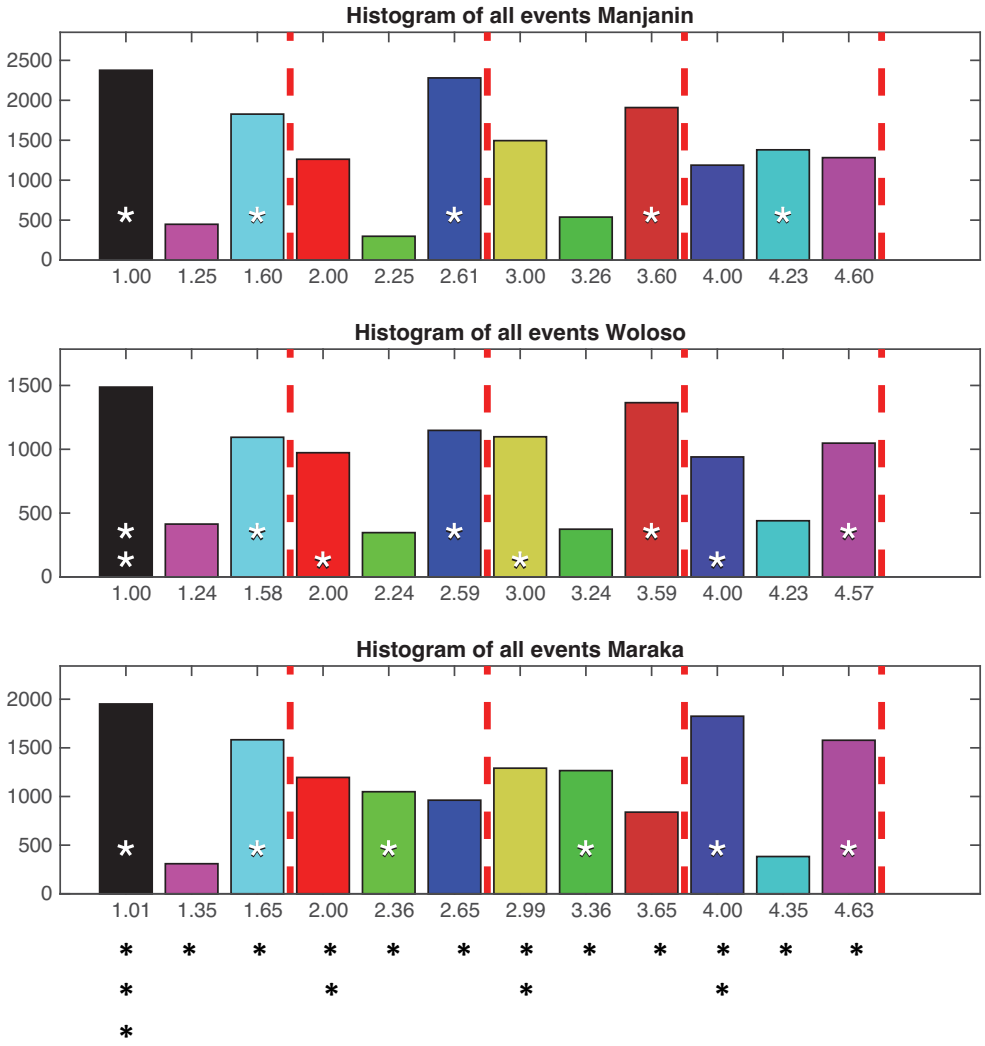
Example 1 shows the distribution of onsets in each of three pieces in our Malian percussion music corpus. As in Holzapfel's study, our histograms reveal the characteristic hook/timeline part for each piece (analogous to the *usul* in *makam* patterns), but do not evidence any accentual differentiation amongst the beats of the meter, or any consistent differentiation amongst the subdivisions of the beat. Just as in the *makam* pieces, the statistical distribution of drumstrokes does not coincide with the metric hierarchy.

On the basis of his strong results, Holzapfel then asserts that the pattern of note onset distribution »implies a less stratified meter« (less stratified in comparison with traditional western isochronous meters). Here I am not so sure, and here is where I would urge some caution in Holzapfel's interpretation of his data – just as I would urge caution in the interpretation of the data Rainer, Nori, and I have collected and examined. While the rhythmic surface is equivocal in terms of metrical hierarchy, that does not entail that the listener's perception of that surface is similarly equivocal. As Holzapfel points out, in my own work I argue for certain metrical interpretations of non-isochronous rhythms based on (a) hierarchic well-formedness, and (b) a desire to avoid syncopation and

5 See Palmer/Krumhansl 1990.

6 London 2012, chapter 8 and passim.

7 London/Polak/Jacoby 2016.



Example 1: Histogram of event onsets (drumstrokes) in a corpus of three *Jembe* drumming pieces. All three pieces are in 12/8; dashed lines indicated the boundaries of the triplet which comprises each beat. Asterisks indicate the metric positions which correspond to the characteristic ›hook‹ rhythm of each piece.

to maximize the alignment of the rhythmic surface with note onsets. Let me say that I think that Holzapfel and I are both wrong. I still hold to my first concern – in a well-formed meter, one does not conflate metrical levels – but I have learned, thanks to my collaborations with Rainer Polak and others, that avoiding syncopation and/or seeking the simplest metrical interpretation is not always required or desirable. A four-beat interpretation of the Ewe ›bell pattern‹ is a clear example of this. Likewise, and as can be seen in Example 1 above, in many instances the locations with the highest distribution of strokes are the off-beats prior to the (metrically accented) beat. If we accept that in these cases the listener's endogenous sense of meter is not simply given by the rhythmic surface, it then follows that, at the very least, listeners of *makam* music may employ metrical frameworks that are more stratified than Holzapfel's data suggests – indeed, it may be that the extent to which most western listeners hear metric strata has been overstated. Of course, the listener's sense of meter still has to relate to the rhythmic surface in a coherent and stable fashion, but some metrical interpretations of a rhythmic surface may require greater ›metrical effort‹ than others.

The broader caution to be taken from Holzapfel's very thorough study is this: knowing the probability that a note may or may not occur is not the same thing as knowing its accentual status. In some styles they may be strongly related, while in others they may not be – and *makam* music seems to be a case in point. Holzapfel's data shows both the benefits and limits of ›data driven‹ interpretations of meter, tonality, and other perceptually-emergent features of music.

Gérald Guillot, *Anisochrony and Polymetry in Afro-Brazilian Musical Aesthetics*

Gérald Guillot has given us a rich look at anisochrony and (perhaps) polymeter in Afro-Brazilian music. I have said »perhaps« here, for as Guillot has pointed out, I do not believe that polymeter – that is, hearing two distinct meters at the same time – is possible. Thus I will focus my remarks here on our disagreement, namely, on the possibility of polymeter, or quasi-polymetric characterizations of the aggregate rhythmic patterns that Guillot has observed in a range of Afro-Brazilian music.

Let me start with where I think we are in broad agreement: that meter is a kinetic framework. I have previously characterized meter as a form of entrain-

ment, and I have focused on the how our entrainment modulates our attention and expectation of events, based on research in rhythmic attention and synchronization. I will now expand/refine this characterization of metric entrainment to include both perception and action, that is, as sensorimotor entrainment. Meter is a dynamic framework that guides both our perception and action, or more precisely, our interaction with the music as it unfolds in time. That interaction may a simple as tapping one's foot as one listens, or may be as complex as a band leader soloing while noticing the extent to which the audience is dancing along to the music.

Guillot proposes that in ensemble performance, it may be possible for two players to be »in different meters« while maintaining coordination in their performance, and I agree that this is perfectly possible. This requires certain structural correspondences between the two meters in question, precisely the sort of coordination Guillot has beautifully diagrammed. I think our disagreements are two. The first is whether individual performers (or listeners) are able to hear/embody two meters at once. If we think of meter as a form of sensorimotor entrainment – a timing framework that guides both perception and action – then polymeter would involve a listener or performer having two such timing frameworks operating at once. Now Guillot doesn't quite make this claim, but rather argues for ›dynamic poly-synchronization‹ where a given rhythm (the »aggregate produced by multiple performers«) can afford multiple metric orientations and engagements. With this I would agree, as two or more interlocking parts can produce a more complex rhythmic pattern, one which could then give rise to a metrical type that differs from the meter implicated from each individual part alone (see London 2012 on metric families and metrical types). But Guillot goes on to suggest that this poly-synchronization may be indicative of a true polymeter, and in support of this claim, he cites the late Jeff Pressing's paper on the various qualities of »Black Atlantic« rhythm.[8] However, Pressing himself, in a paper that he co-authored with Jeff Summers and Jon McGill, showed that this does not involve polymeter per se.[9] Pressing and his colleagues analyzed the covariance between the hands in bimanual polyrhythmic performance, and showed that one hand dominated the timing of the polyrhythmic pattern, such that the other hand's timing was determined by it – though the expert percussionists in Pressing's study were, as Guillot notes, able to switch hands and patterns independently. More recently, Eve Poudrier and Bruno Repp found that when

8 Pressing 2002.

9 Pressing/Summers/McGill 1996.

presented with polyrhythms of varying complexity in a divided-attention task, musicians could use a composite rhythm for simple polyrhythms, but were unable to track more complex beat streams.[10] Thus, the empirical evidence we have suggests that polyrhythms are heard/comprehended in the framework of a single meter.

In view of Guillot's particular hypothesis, while two players may each have their different ›personal meters‹ in producing a joint rhythm – provided certain constraints are met, such as a shared density referent and/or a common metric cardinality relative to that density referent – this does not mean that both players are »hearing two meters at once«. Likewise, for someone listening to such rhythms, these patterns are likely to display metric ›multi-stability‹, and afford different modes of metric entrainment – but listeners and fellow musicians can only maintain one meter at a time.

My second disagreement, and perhaps it isn't a disagreement at all, is with respect to the co-metric/contra-metric distinction Guillot appropriates from Kolinski (1973). The more I think about this, the more it seems to me that this is a false dichotomy (which is perhaps Guillot's point). The falsehood stems from a failure to make clear a distinction between rhythm – the actual pattern of events produced by a musician and/or heard by a listener – and meter, the endogenous perception/action framework that guides our musical behavior. While it is true that some rhythms may be perfectly congruent with the metric entrainment that guides their production (as when one produces a simple and constant four-beat pattern), for the most part, almost all rhythms are contrametric to some degree, as they do not perfectly align with and/or reinforce the »organized pulsation functioning as background for rhythmic design«.[11] Kolinski's characterization of meter implies that ›pulsation‹ is a kind of phenomenal attribute of music. Thus, for Kolinski, metrical ›pulsations‹ and rhythmic patterns are two aspects of the sounding music that one must tease apart, like mutually reinforcing or interfering waves, and that leads to categorical distinctions between ›metric‹ and ›contrametric‹ rhythms.

Rather than Kolinski's notion of co- versus contra-metric rhythms, I prefer to consider the degree of alignment between the phenomenal rhythm (with its attendant phenomenal stresses and articulations) and our mental/endogenous metric entrainment (which has its own structural regularities). Thus, ›metric‹ vs. ›contrametric‹ are not separate categories, but anchors of a continuum re-

10 Poudrier/Repp 2013.
11 Kolinsky 1973, p. 499.

garding the alignment between a phenomenal rhythm and the pattern of our entrainment. Now of course there is a mutual relationship – our metric entrainment arises due to the presence of a phenomenal rhythm, and a change in the rhythm we hear may force us to change our metric entrainment. The ›poly-synchronization‹ Guillot describes may well involve a tension between two different meters (each held by a different listener or performer) relative to a joint or composite rhythm – and what may be readily congruent with one meter may be largely non-congruent with the other (and vice-versa). This is in accord with recent findings of Rainer Polak, Nori Jacoby, and I, where we found that metric stability was an emergent property of the timing interactions amongst the players in a Malian drumming ensemble.[12] While different members of the ensemble played different parts with varying degrees of ›contrametricality‹, their rhythmic stability and precision was dependent upon a mutually shared and created metrical framework, which was evident in their stroke placement, variability, and patterns of covariance.

Concluding remarks

There are two broader points that emerge from these three papers. The first is the importance of cross-cultural research for music theory and analysis. The music of any single style or cultural tradition tends to occupy a limited area of the ›design space‹ for rhythm, melody, harmony, timbre, and so forth. Thus, to the extent to which we would like our theories and analyses of any particular piece or corpus of music to rest on general principles, we need the awareness of the broader extent of the rhythm (or melody, harmony, etc.), beyond what we find in ›music of interest‹ for any given study. Goldberg has shown us a different kind of tempo rubato in his study of expressive timing in *tŭpan* playing, Holzapfel has shown us that the alignment between accents and meter in *makam* does not seem to work the same way as in Mozart, and Guillot has shown that microtiming, contrametrical rhythmic patterns, polyrhythms, and meter, are both more interrelated and more deeply problematized in some musical styles and practices than in others.

The second broader point, which is exemplified in all three papers, is the value of empirical research. Whether it involves careful timing measurements of

12 Polak/London/Jacoby 2016.

individual pieces (as in Goldberg's and Guillot's papers) or compiling data from a representative corpus (as in Holzapfel's work), empirical methods prevent us from reflexively responding to the music we are studying. While cross-cultural research gets us to listen to music and musical styles outside of our familiar, western musical traditions (whether art or popular musics), empirical study helps us to hear both familiar and unfamiliar music with new ears.

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