ANCIENT GREEK RHYTHM:
THE BELLERMANN EXERCISES

STEFAN HAGEL

IN the following I discuss the rhythm of the 'Bellermann instrumental pieces'. For one of these, an emendation is proposed that avoids the philological and musical problems raised by the currently accepted reading. The conclusions thus reached will be related to modern folk rhythms, and put into the context of ancient Greek rhythmic theory in general.

The collection of brief musical treatises known as 'Bellermann's Anonymi' stands out for its orientation towards musical, and especially instrumental, practice.[1] As a kind of appendix,[2] there appear, among other material, six short pieces in ancient instrumental notation, furnished with rhythmical signs, and preceded by headings indicating the number of beats per 'bar'.[3] The primary source for these is the codex Venetus Marcianus VI 10, f.197 verso, on which all other known manuscripts depend.[4]

The pitch notation of the pieces is clear enough, except for some misrepresented signs whose necessary correction is generally accepted. Ancient Greek melodic notation employs two sets of notational signs, one of which is generally used for vocal scores, the other for instrumental pieces or interludes[5] – although there are exceptions to the rule.[6] Although we have some fragments of ancient instrumental music on papyrus, the Bellermann pieces constitute our only complete examples, thanks to their transmission in the manuscript tradition. Admittedly, though, hardly any of them deserve the designation of 'music'. Two of them consist merely of permutations of four contiguous notes, and one is an octave scale, ascending and descending. The main purpose of these is apparently to exemplify different possible rhyth-

---

[1] The current standard edition is: *Anonyma de musica scripta Bellermanniana*, ed. D. Najock, Leipzig 1975. The pieces in question are contained in §97-§101; §104, corresponding, although in different order, to *DAM* N° 7-12 and *DAGM* N° 32-37.

[2] On the structure of the compilation and its transmission, cf. Pöhlmann 1975; Pöhlmann 1994, 190f.

[3] In this context, I use 'beats' in the sense of pulses (*khrónos prôtos*), generally regarded as the smallest regular time units needed to describe the rhythm of a piece.

[4] *DAGM*, 118.

[5] For an introduction to ancient notation see e.g. West 1992, 254-259.

[6] The instrumentalist Limenios notates his Paean of 128/7 BC with instrumental signs (*DAGM* N° 21); on the other hand, a line of 'vocal' notation without text on *Pap. Michigan* 2958 can hardly be anything but an interlude (*DAGM* N° 42).

126   STEFAN HAGEL

mizations of some melodic structure, and this is probably true of the remaining three items, as well. These, however, come closer to being melodies proper. Nevertheless two of them remain within the compass of a fifth; only one exploits an entire octave range. The context of the short pieces is most probably to be sought in basic instrumental instruction. The novice learnt to distinguish rhythmical patterns, and at the same time got some fingering exercises. There is little doubt that the instrument in question was the aulos, the pair of double-reed pipes so typical for the ancient Mediterranean.[1]

There are three kinds of rhythmical symbols, which mould the series of pitches provided by the notes into musical structures.[2] First there is the sign for the 'empty time' (*khronos kenos*), the rest. It takes the form of Λ. Secondly, items that are to fill two 'beats' are distinguished by the diseme bar above the note: $\overline{\text{X}}$. Unmarked notes and rests occupy one 'beat'.[3] In this respect the rhythms are very close to the principles of Greek metre, which juxtaposes short and long syllables, the latter twice the length of the former. Simpler types of vocal music maintained this basic dichotomy, and so do the instrumental Bellermann pieces. The third rhythmical symbol employed is the *stigme*, a dot placed over the *arsis*, marking the "weak", or "up-", beats against the "strong", or "down-", beats of the *thesis*.[4] Although the significance of the ancient conception and the applicability of the modern terms are disputed, there is no doubt that *arsis* and *thesis* refer to some type of accentuation actually felt by the ancients. Especially in instrumental music, this must have included a dynamic element, so that it makes good sense to transcribe the larger rhythmical units by means of modern bars.[5] It must however be kept in mind that the ancient 'bars' existed only through their constituent elements, each of which therefore contained notes or groups of notes of its own. In contrast, the bar of modern Western music serves as an abstract unit which may contain the most various rhythmical patterns of notes and rests, and even its typical accentual pattern can be overwritten by 'syncopation'.

The application of the arsis dots betrays the different way in which the ancients conceived the formation of rhythm. For us it would seem natural to mark the downbeat, and perhaps to differentiate between different hierarchical levels of downbeats. Thus, one of the most common rhythms of Western music could be notated as: x̆ x x́ x | x̆ x x́ x… Within the Greek sys-

[1] West 1992, 309.

[2] For this ancient conception of music, cf. Aristid. Quint. 1,19, p. 40,20-25 W.-I. On ancient rhythmical notation in general, see Pöhlmann 1995, 1663f.

[3] A triseme (three-time mark), which is missing from the manuscript but seems demanded by the rhythm, has been supplied over the final note of §104 by the modern editors (in this single case following Westphal 1867, Suppl. 52). But cf. p. 47 n. 3 below.

[4] On the question why the weak position came to be marked, cf. Winnington-Ingram 1955, 79 n.3.   [5] Cf. West 1992, 133f; also Pöhlmann 1995, 1667.

tem, nothing of this kind was possible. The dots could only be applied to one level of rhythmization, and consequently the writer of a score had to decide which of the possible levels was most appropriate.

An example of a four-time rhythm like that above is the *Anon. Bell.* §100. Here each permutation of the four notes employed is furnished with a sequence of two non-dotted and two dotted notes, so that the first pairs are marked out as rhythmically prominent: x x ẋ ẋ | x x ẋ ẋ… The most straightforward interpretation of such a scheme would seem to be that the first couple of notes are accentuated, while the second are not, to be transcribed as x́ x́ x x | x́ x́ x x… From a musical viewpoint, however, this seems very awkward. Plausibly in such cases the higher level of hierarchy was distinguished, and the lower level left to be understood.[1] Here two 'feet' of internal division into equal parts (1:1, which ancient rhythmicians called 'dactylic') are combined to the larger unit of a 'dipody' (also 'dactylic', since it consists of two equal parts, as well). The accent of one 'foot' will have been x́ x.[2] Therefore the superposition of this unmarked low-level x́ x with the marked high-level x͡x x͡x is most probably nothing other than our familiar x̆ x x́ x | x̆ x x́ x…, or, e.g., $\frac{2}{4}$ ♫ ♫ | ♫ ♫ …

Such an analysis is confirmed by the practice observed in *Anon. Bell.* §97. Here two uneven iambic feet ◡– (1:2) are combined to form even metres, or 'dipodies', of ◡–◡–, (1+2):(1+2) = 1:1. This is what Aristoxenian theory calls an 'iambic dactyl' (δάκτυλος κατ' ἴαμβον).[3] Again the dots are applied on the higher level, that of the dipody, to distinguish its second foot as the *arsis*. But this is written in an abridged form. Instead of the expected ◡–◡̇–̇,[4] only the

---

[1] A similar case of rhythmical information to be inferred from the context is the division of two notes below a triseme in the Seikilos inscription (*DAGM* N° 23): "In the groups ◠̇ϕ the time-value must obviously be divided up ♪ ♩ in accordance with the underlying iambic metre" (*DAGM*, 91).

[2] Aristid. Quint. 1,14, p. 35,2-8 W.-I., gives only the variants with initial *thésis* for the dactylic rhythms built of two parts of equal duration (simple proceleusmatic = pyrrhich ◡◡̇, simple spondee – –̇, greater spondee ◡◡̇), while distinguishing between different orders elsewhere. The appearance of rhythms like our ◡◡◡̇◡̇ (double pyrrhich) shows how intimately connected Aristides' abridged rhythmical theory is with notational practice. Note that Aristox. *Rhythm.* 17, p. 10,23-26 Pearson, does not concern the present question, because it focuses on the possible numeric divisions abstracted from their respective arrangements. When Aristoxenus, *Rhythm.* 31, p. 16 P., excludes the pyrrhich as a rhythmical foot, he is apparently guided by the observation that the rapid succession of shorts does not lend itself to a consistent rhythm of x̆ x | x̆ x …, but calls for, or automatically creates in the mind, a higher level of hierarchy, which combines the pyrrhichs into pairs or triples.

[3] *P.Oxy.* 2687 II 3f, p. 37 P.; Aristid. Quint. 1,17, p. 38.5f W.-I.

[4] For such 'full' notation cf. *P.Berlin* 6870.18f (*DAGM* N° 17); the Seikilos inscription (*DAGM* N° 23); *P.Mich.* 2958.2 (*DAGM* N° 42); *P.Oxy* 3162 (*DAGM* N° 55; trochaic); *P.Yale* CtYBR Inv. 4510 (*DAGM* N° 41; choriambic); *P.Oxy* 3161r.1.7-9 (*DAGM* N° 53; choriambic?). For the 'abridged' version, *P.Oxy* 2436 (*DAGM* N° 38), and, probably with a different approach, *P.Vienna* G 13763 (*DAGM* N° 15).

128   STEFAN HAGEL

final long receives the *stigme*: ‿—‿∸.[1] This is only possible if there was no danger of erroneously treating the preceding short as carrying an accent. Obviously, for the inventors of this practice the regular iambic environment precluded accented shorts altogether; in other words, the accent of the iambic foot fell on its long.[2] Thus we have to transcribe the overall rhythm of §97, there notated x x̄ x ẋ̱ | x x̄ x ẋ̱, as something like x x̱́ x x x̱́ x | x x̱́ x x x̱́ x …, or, in modern bars with upbeat, $\frac{6}{8}$ ♪| ♩♪ ♩♪| ♩♪ ♩… The rhythm of §104 was perhaps the inverted form of this, with the main accent on each second long; but there only two dots have survived, curiously both on the first short of the iambic dipody. On a newly published Michigan papyrus, a triple time rhythm is notated with *stigmaí* applied at the low-level: x ẋ ẋ | x ẋ ẋ …[3] Conceivably this is an indication of slower tempo, in which the single accents were not so close together as to create a hierarchy between them, or at least not one that was felt dominant: $\frac{3}{4}$ ♩♩♩| ♩♩♩… or slow $\frac{3}{8}$ ♪♪♪| ♪♪♪…

In the headings these simple rhythms are characterized merely according to their extension: §100 is called a four-beat (*tetrasemos*), §97 and §104 are six-beats (*hexasemos*; *kolon hexasemon*). The remaining three items are of a more sophisticated kind. In §99 we are presented with a 'twelve-beat' (*dodekasēmos*). The definition of such an extended rhythm implies that it cannot be analyzed into equal smaller structures. For instance, a 'twelve-beat' rhythm should not consist of two similar parts of six primary time-units each, nor of four similar parts of three beats. The distribution of *stigmai* confirms this. In the manuscript, the two 'bars' of the short piece are marked as follows (dashes indicating rests):[4]

x̄ x ∸ ẋ x ẋ ẋ x ∸ x̄
x̄ x ∸ ẋ ẋ x ẋ x ∸ x̄

The patterns are identical, with the exception of one dot, which is placed first above the sixth, but afterwards above the fifth sign. The first variant implies a transcription as x̱́ x x́ – x x́ x x x́ – x̱́ x. In such an extended bar, there are no repeating standard elements such as the iambic foot, which carry their low-level rhythm within themselves. As a consequence, it is the basic divisions that must be distinguished by the *stigmai* – and any possible higher level of organization eludes us. The above pattern is nicely analyzed into 'pulse groups', elements of two and three time units with initial accent. Within such a paradigm it can be written down as the series 2-3-3-2-2. Quite patently there is no repeating pattern, and the qualification as a *dodekasēmos* is perfectly justified.

---

[1] Cf. Wagner 1921, 293.   [2] Aristid. Quint. 1,16, p. 36,2 W.-I.

[3] Johnson 2000; *DAGM* Nº 61.

[4] The diseme above the first note is a necessary emendation (Westphal 1867, Suppl. 50), guaranteed by the uniform pattern of rests.

The alternative dotting of the second 'bar' would be transcribed as s x́ x x́ – x x́ x x x́ – x́ x, resulting in a division of 2-4-2-2-2. As an ancient Greek rhythm, this makes little sense. If we had nothing but that bar, one would naturally conjecture the loss of another dot that split the sequence of four into two couples; and then, the metre would fall apart into three *tetrasemoi*[1] (or perhaps two *hexasemoi*). The division given by the first 'bar' must therefore be preferred; if anything, it preserves the original rhythm. Here is a tentative transcription into Western rhythmical notation:[2]

$$\quad \downarrow\,|\,{}^6_8\,\,\flat\gamma\flat\,\overline{\flat\flat}\,|\,{}^3_4\,\flat\gamma\downarrow\,\downarrow\,|\,{}^6_8\,\flat\gamma\flat\,\overline{\flat\flat}\,|\,{}^3_4\,\flat\gamma\downarrow\,\|$$

Yet regardless of the reconstruction another point deserves attention. All four rests are unequivocally marked with *stigme*. Indeed, a rest on a strong position is not easily compatible with the ancient conception of rhythm, except at the end of and between larger rhythmical segments.[3] Especially in instrumental pieces of a more complex rhythm, all downbeats must make themselves heard – there is no other way for one specific rhythm to establish itself, as opposed to other possible divisions. Finally, we should acknowledge that the rests with their fixed place at the second and last but one position play an important role for the character of the rhythm, which is however not accounted for by ancient rhythmical theory (at least as far as we know it).

It may appear that there is less hope for the restoration of the original punctuation of §101. In the manuscript it is titled 'eight-beat' (*oktasemos*), but written in four lines of nine time-units each:

$$x \overset{\cdot}{-} x \,\dot{x} \,x \,x \,\dot{x} \,\bar{x}$$
$$x \overset{\cdot}{-} x \,\dot{x} \,x \,x \,x \,\bar{x}$$
$$x \overset{\cdot}{-} x \,\dot{x} \,x \,x \,\dot{x} \,\bar{x}$$
$$x \,x \,x \,x \,x \,\dot{x} \,x \,x \,\dot{x}$$

The first and third are consistently dotted. Of their scheme, the second line omits the last *stigme*. The last line has none of the first five notes marked,

---

[1] The staff transcription in *DAM* uses such four-beat bars (N° 11, cf. p. 40, and the time signature ${}^3_2$ in West 1992, 309). Similarly, in *DAGM*, 119, the assumption of regular iambic or dactylic beat in the larger rhythms is not drawn into question. Apparently the editors searched for the smallest repeating units that correspond to the beat count of the headings not only in the rhythm as such, but also in its instantiation as a specific distribution of longs, shorts, and rests (analogous to the Arab rhythmic modes, *iqā'āt* or *awẓān*). Such an approach is however contradicted by their treatment of §101, where between their assumed eighteen-beat bars there is equivalence between rests and notes, as well as between a long and two shorts.

[2] Note that the modern metres imply a rhythmical primacy of their first elements, which in the case of such extended rhythms must not be imposed on the ancient pieces.

[3] Cf. e.g. *DAGM* N° 39.8f.

and the *stigme* over the sixth is out of phase with the first and third lines. The
dot above the final note could be explained by the fact that the long note at
the end of the other lines is here resolved into two shorts. Thus the double
rhythm, which is implicit in x̄ = x́ x, would have to be indicated explicitly as
xẋ = x́ x (the same analysis of a single long without *stigme* before another
thesis has been made above for §100).[1] But we will see that another explana-
tion is preferable.

First of all, the discrepancy between heading and apparent extension has
to be accounted for. Palaeographically most convincing is E. Pöhlmann's
emendation to *oktokaidekasemos*, 'eighteen-beat'.[2] If it is accepted, the four
lines of the manuscript must be combined into two large 'bars':

<div align="center">

x ⏑̄ x ẋ x x ẋ x̄ x ⏑̄ x ẋ x x x x̄

x ⏑̄ x ẋ x x ẋ x̄ x x x x x ẋ x x ẋ

</div>

If we are to take the notion of eighteen primary beats as the smallest re-
peating unit seriously, the apparent inconsistency of the fourth line be-
comes a prerequisite, in order to make the internal division of odd and even
lines dissimilar. The identical notation of the first parts points to their rhyth-
mical division as 2-2-3-2.[3] The *stigmai* at the start of the second line indicate
that the second halves begin in a similar way with two pairs.[4] Thus there re-
mains only one possible variant: that with the triple at the end, 2-2-2-3. And
indeed this is the division indicated by the extant dots in the last line. Ac-
cording to this analysis, several *stigmai* have of course been lost (above the
last and last but two notes of line two, and the second and fourth notes of
line four), but all existent dots seem to be placed correctly. The entire se-
quence of 2-2-3-2-2-2-2-3 runs as follows:

It must however be kept in mind that one cannot have great confidence in
this restoration. What we have shown is that the transmitted positions of

---

[1] Correspondence of xẋ and x̄ is exemplified in *P.Mich.* Inv.1250 (*DAGM* Nº 61), where x̄ ẋ
alternates with x ẋ ẋ.

[2] *DAM* Nº 12. The error is most easily explained by the assumption of a source in which
the numbers were written as numerals: ⟨ι⟩η′σημος.

[3] Note that triples x́ xx are here punctuated as trochaic feet (x x ẋ ≈−⏑), while they ap-
pear as x ẋ ẋ in §99. Whether there was any actual differentiation or these are just different
writing conventions, we do not know.

[4] A start with 2-3- is excluded if the notation of triples by dotting only the third note is con-
sistent within the piece. One might object that the identical position of the dots may be due
to a copyist's idea of consistency. But there are so many cases of obvious contradictions from
one line to another that such a wrong emendation can be ruled out almost with certainty.

the *stigmai* are consistent; whether they are the original ones, remains an-
other question. At any rate, it is encouraging that, instead of contradicting
each other, they did give rise to a true eighteen-time rhythm; a feat that a
random set of dots would not likely accomplish.

The piece that remains to be considered, §98, is the longest of all. At the
same time, its appearance in the standard editions diverges more from the
manuscript than any other. This is because the editors have adopted much
of the interpretation of R. Westphal,[1] recognized as a fell emendator of an-
cient musical sources. In the codex the four lines are introduced as *hen-
dekasemos*, "eleven-beat". Accordingly, three of them consist of eleven
notes, none of which is marked as double-long by diseme. Yet the second
line contains twelve notes. Westphal consequently extended the other three
by conjecturing diseme signs above their final rests, thus introducing the on-
ly long rests in all the Bellermann pieces.[2] One notices that this presuppos-
es the loss of three diseme marks within one piece, while in all the other ex-
ercises together only two seem to be missing.[3] The heading had to be
changed accordingly, from 'eleven-beat' to 'twelve-beat'.[4] Subsequently the

[1] Westphal 1867, Suppl. 50.

[2] That the long rest was typical mainly for supplementing the rhythm at catalectic verse
end is shown by its designation as *prósthesis*, 'addition' (Aristid. Quint. 1,18, p. 39,1f. W.-I.).

[3] Missing are the diseme signs over the last but two note of §97 and the first note of §99.
The implied distribution is utterly improbable; if no additional philological arguments are
provided why these of all diseme signs should have been omitted, it can be rejected at a sig-
nificance level of 0.25%:

diseme is	missing	present	
§98	"3"	0	p = 0.0022 (Fisher's exact test)
rest	2	26	

Apart from the diseme signs, a triseme may or may not be missing from the final note of
§104; perhaps the piece just breaks off here. At any rate, its total length of five dipodies seems
very awkward. All other exercises have an even metarhythmical structure (6 'bars': §97, §100;
4 'bars': §98; 2 'bars': §99, §101), and so do the two vocal pieces of comparable length and
regularity: the Seikilos inscription (*DAGM* N° 23) comprises eight metres, musically and lin-
guistically governed by a strict binomial hierarchy; and the Invocation of the Muse (*DAM*
N° 24) is built in a strikingly similar way.

[4] Other than in the case of §101, there is hardly any palaeographical motivation for this.
The underlying assumption is that the headings were not part of the tradition, but inferred
from the pieces. The responsible compiler would have had sufficient expertise to account
for diseme and, what is more, to analyze the continuous writing of §104 into the appropri-
ate six-time metre, but would have failed to recognize the twelve signs of §98.2, stupidly con-
structing an 'absurd' rhythm of eleven. He would have worked from a better exemplar than
the extant codex in §99 (still reading the diseme above the first sign), which would however
have included the hopelessly maimed version of §98 without any diseme marks. All this set
aside, the apparent nature of the pieces as illustrating different rhythms makes it entirely
unlikely that they were not accompanied by their headings from the beginning.

caption of §99 was altered to ἄλλος δωδεκάσημος, *"another* twelve-beat".[1]
In total, this are five emendations, introduced mainly to get rid of a rhythm
of eleven time units, a monstrosity to the ethnologically untroubled mind
of the nineteenth-century scholar.[2]

Of course there is a much more straightforward solution to the problem.
From a proper arrangement of the score it springs to the eye immediately.
This time, however, we will have to include the ancient note signs, as well.
In the following chart the four lines of §98 are set out with equally spaced
notes, the rests being distinguished by frames:

What is wrong with line two is not only the number of signs: towards the
end of the line, the rests are out of phase. In the other two exercises that
contain rests at all, we have seen that their position within the bar is always
consistent (though a rest can alternate with a note on the up-beat, as in §101).
Thus it is not only clear that the second line contains some surplus note, but
also where we ought to find it, namely between the first two rests. The
palaeographical explanation suggests itself. There are two pairs of identical
notes which may be due to dittography: F Ḟ and Ŀ Ŀ. Whether we should
delete the Ḟ or a Ŀ cannot be determined with absolute confidence; but the
distinction maintained by the copyist between a dotted and a simple F
speaks for the deletion of Ŀ. In any case, the resulting rhythm is the same.
This is the restored piece, as far as the notes are concerned:

Once more, far from all *stigmai* are extant; the first line contains none at all.
So we must again try and assemble the dots from the single lines, in the hope
that they combine to an intelligible pattern. The results are printed at the
bottom of the above score. Just as in the previous piece the lines contradict
each other nowhere. We get another nice rhythm built of alternating cou-
ples and triples, of the form 2-3-2-2-2.[3] This analysis is substantiated by the

---

[1] *DAM* Nº 11.   [2] Cf. West 1992, 3.
[3] The notation of triples is parallel to §99 (cf. n.25 above).

fact that here, too, all rests fall on unaccented beats.[1] As to be expected for
such a complex rhythm, its transcription into the modern bar system is trou-
blesome, but does perhaps help in appreciating it as a genuinely musical
structure:

$$♪\, \gamma \mid \tfrac{3}{8}\ ♪♪♪ \mid \tfrac{2}{4}\ ♪\gamma ♫ \mid ♪\gamma \mid ♪\gamma$$
$$\mid \tfrac{3}{8}\ ♪♪♪ \mid \tfrac{2}{4}\ ♪\gamma ♫ \mid ♪\gamma \mid ♫$$
$$\mid \tfrac{3}{8}\ ♪♪♪ \mid \tfrac{2}{4}\ ♪\gamma ♫ \mid ♪\gamma \mid ♫$$
$$\mid \tfrac{3}{8}\ ♪♪♪ \mid \tfrac{2}{4}\ ♪\gamma ♫ \mid ♪\gamma \mid\mid$$

It remains to recall the palaeographical advantages of the proposed emen-
dation. The deletion of a dittography is nothing remarkable. In exchange,
we can abandon all the complicated hypotheses that come with the as-
sumption of a twelve-beat rhythm. No diseme has to be added, and all the
titles can remain just as the codex has them. On top of this, we achieve con-
sistency in the application of *stigme*: not a single dot need be deleted.

There is another prerequisite of any correct analysis which we have not
yet mentioned. Since the 'bars', of whatever extension, are to be concate-
nated, they must end on an *arsis* if they start from a *thesis*, and vice versa.
This is another criterion which a set of randomly displaced dots is not like-
ly to fulfil in all cases. But it is fulfilled by our three reconstructed complex
rhythms – another indication that they are not far off from the truth.

The three pieces with extended 'bars' preserve rhythmical patterns that
are not known from other ancient musical documents. Nevertheless their
general approach, to group notes into pairs and triples by means of *stigme*,
is paralleled by instrumental notation on two papyri. Firstly, there are the
couple of instrumental pieces on the Berlin Papyrus. The first of these uses
a dactylic rhythm, structurally identical to the slow 'spondaic' movement of
the vocal Paean that precedes it on the same document.[2] Its constituents are
basically dactyls of the form $\bar{x}\ \dot{x}\ \dot{x}$, whose last element is frequently divided
into two 'semishorts'. At several places the first long is also resolved into two
notes. In this kind of regular even rhythm the distinction between dipodic
and 'monopodic' notation is not so straightforward. The present piece can
be analyzed into dactylic feet, with their accent on the long element and no
substantial further internal division. The perception of such a rhythm
would call for a rapid tempo. Against such an assumption speaks the split-
ting of the shorts into two notes, which would imply the existence of du-
rational elements two levels below the lowest perceived accentual pattern.
Since this is very unlikely, one is pressed to suppose a comparatively slow

[1] In contrast, the transcriptions in *DAM* and *DAGM* imply rests at accented positions.
[2] *P. Berlin* 6870: *DAGM* N° 50 (Paean); N° 51 (first instrumental piece); N° 52 (second
instrumental piece). The latter are separated by another vocal excerpt (N° 17).

tempo, in which the dactyls are internally structured as x̆ x x́ x, just as in §100 of the Bellermann exercises. The notation is then of the high-level kind. The lower level is created by the slow motion; thanks to the even rhythm it need not be marked.[1] In any case, the employment of the *stigme* is similar to the short 'dipodic' Bellermann rhythms.

Quite different, and much more interesting for our topic, is the second instrumental piece on the Berlin Papyrus. It is composed from modules of five beats, which in turn consist of pairs and triples. E. Pöhlmann has shown that such a rhythm corresponds closely to the *paion epibatos* described by Aristides Quintilianus.[2] Still the piece is not merely a series of similar bars of that kind, but alternates between different internal divisions of the five-time units into 2-3 or 3-2. From the fragmentary remains the repeating structure has been determined as

x ẋ x ẋ x̄ x̄ ẋ x x̆ x̄ x̄

This corresponds to an accent pattern of

x́ x x́ x x x́ x x x́ x x́ x x x́ x

and can be described by the scheme 2-3–3-2–3-2. The notation is clearly of the same kind as in the extended Bellermann exercises. In the terminology of their headings, this is apparently a 'fifteen-beat'.[3]

As in the other Berlin instrumental piece, some of the downbeats are split into a pair of shorter notes.[4] These may or may not be taken as evidence to a slower tempo.[5] At several places, rests are found. Just as in the exercises,

---

[1] A modern 4/4 metre seems an accurate rendition of both the paean and the first instrumental piece: 𝄴 ♩|♩♪♪|♩♪♪|♪♪♪♪|♩ 𝄽 (the distribution of bars in *DAM* and *DAGM* is to be preferred over that in West 1992, 317-319).

[2] *DAM*, 104f, with reference to Aristid. Quint. 1,16, p. 37,5-12 W.-I.

[3] Note that the metre consists of fifteen beats, but of thirty melodic *protoi khronoi*, since the beat is sometimes split into two notes. 'Beats' as bodily movements that indicate the rhythm (*semata*) on the one hand and notes (*phthongoi*) on the other belong to different categories; cf. Aristox. *Rhythm.* 9, p. 6 P.

[4] The analysis in Johnson 2000, 34-36, produces a split downbeat and a sequence of four 'semishorts' that is entirely unlike the character of the rest of the piece. Furthermore, it creates a pattern of 3-2–2-3, while elsewhere the paeons are arranged so that a sequence of 2-2 does not occur. The interpretation of *DAGM* appears therefore preferable.

[5] In contrast to the preceding piece, these 'semishorts' are only one level below the notated rhythm, so that no inference can be drawn from this side. Nor does the similarity to the *paion epibatos* imply a slow tempo (pace *DAGM*, 173), since the time value of the 'long' of Aristoxenian rhythmical analysis depends on the tempo instead of determining it (Aristoxenian theory here calls for the 'long' as the basic unit because two 'shorts' cannot be divided into *thesis* and *arsis*; cf. n.13 above. I presume that this advanced chapter in Aristides goes back to Aristoxenian treatises, while the non-Aristoxenian pyrrhic in the list of feet derives from later conflation with metrical theory; cf. also Aristides' cautious acceptance of an epitrite rhythm, 1,14, p. 33,30 W.-I., which is refused by Aristoxenus, *Rhythm.* 35, p. 16-19 P.).

all of these fall on unaccented positions, which further confirms the preceding analysis.

It appears therefore that the Berlin Papyrus unites high-level notation of rhythms that are built of simple recurring feet (first instrumental piece) with low-level notation of extended patterns, ultimately consisting of groups of two and three pulses (second instrumental piece). In this respect it is surprisingly similar to the Bellermann appendix. If the assumption is warranted that the papyrus stems from a rhythmician's treatise,[1] this work was perhaps not of an entirely different hue as the source of the Bellermann exercises. Admittedly, these are much shorter and definitely less musical than the Berlin fragments. Probably they also belong into a more practical context of instruction than the mixture of vocal and instrumental scores of the papyrus. In any case, their approach to rhythm is identical, and based on a notational practice that is intimately related to Aristoxenian theory.

The final part of this short investigation must therefore be devoted to placing our newly established rhythms into the context of ancient rhythmical lore. Since from Aristoxenus' relevant works only the most introductory chapters survive, we depend mostly upon the report of Aristides Quintilianus.[2] This Roman-era writer, who draws on several strands of older theory, distinguishes between compound, non-compound, and mixed rhythms. The non-compound, or simple (*haplous*), variety uses one kind of foot throughout. Aristides' example are the *tetrasemoi*, which we have encountered in the Bellermann exercises as well as, probably, in the Berlin papyrus. 'Mixed rhythms' are characterized by their ambiguity as regards the level of primary analysis: they are analyzed sometimes into primary elements (*khronoi*), sometimes into smaller rhythmical elements (*rhythmoi*). The *hexasemoi* provide the example. The inference is probably that while four-beat rhythms are unequivocal as regards their internal division, six beats can form a dipody as well as a single iambic (2:4) or dactylic (3:3) foot. The compound rhythms, finally, consist of more than one kind of foot: in a sense, they represent a mixture of different rhythms. As his example Aristides names the *dodekasēmoi*. Thus he confirms that the extended rhythms of the Bellermann exercises must not be cut into equal pieces. The compound rhythms are further classified as either 'syzygies' or 'periods', the former consisting of two (different) 'feet', the latter of more than two.

Furthermore, maximal extensions of the single rhythmical types were recognized.[3] An equal (dactylic) rhythm may contain from four to sixteen beats (corresponding to operational times of 2+2 to 8+8), a double (iambic)

---

[1] *DAGM*, 173.   [2] Aristid. Quint. 1,14, p. 34,19-35,2 W.-I.

[3] Psellus, 12, p. 24 P.; Frag. Neap. 14, p. 28f. P.; Aristid. Quint. 1,14, p. 34,4-15 W.-I. (with a smallest dactylic motion of 2=1+1, the non-Aristoxenian pyrrhich)

rhythm from three to eighteen (1+2 to 6+12), a hemiolic (paeonic) rhythm from five to twenty-five (2+3 to 10+15). What this refers to, is not entirely clear. From the figures it seems that mainly rhythms with similar divisions at different levels are concerned: the minor units of 8+8 are probably once more dactylic, 6 and 12 contain once more an iambic element, and 10+15 is apparently built of paeonic five-beat modules.

Of our instrumental pieces none exhibits such a recursive structure. Closest to it is the second item from the Berlin papyrus, all of whose elements are similarly paeonic. Nevertheless, they seem assembled into an iambic metastructure of $1{:}2 = (2{+}3){:}((3{+}2) + (3{+}2))$.

Another chapter of Aristides work is devoted to a loose top-down algorithm by which the possible rhythmical divisions can be found for any given 'bar' length.[1] This is done by iterating through the possibilities of splitting the given beat number into two parts greater than two. If the resulting numbers correspond to a rhythmical scheme, they are accepted as a possible solution; if not, they are subjected to the same procedure. The details are not entirely clear; either Aristides forgot to mention that a pair of notes is always accepted, or the recipe for checking a set of resulting numbers against each other is missing. Furthermore, practical application demands that the procedure be iterated for large units, even if they already do apply for the criteria (this seems to be implied by the mutilated sentences towards the end of the chapter). In accordance with Aristides' rules, our reconstructed rhythms could be construed as follows:

$$
\begin{aligned}
\S98{:}\quad & 11 = 2 + 9 & = 2 + 3 + 6 & = 2 + 3 + 4 + 2 \\
& 11 = 5 + 6 & = & 2 + 3 + 4 + 2 \\
\S99{:}\quad & 12 = 8 + 4 & = 5 + 3 + 4 & = 2 + 3 + 3 + 4 \\
& 12 = 2 + 10 & = 2 + 6 + 4 & = 2 + 3 + 3 + 4 \\
\S101{:}\quad & 18 = 9 + 9 & = 4 + 5 + 4 + 5 & = 4 + 3 + 2 + 4 + 2 + 3
\end{aligned}
$$

This is of course not a further confirmation of our analysis – any halfway rhythmical structure can be arrived at by such a procedure. But for appreciating the rhythmical diversity of ancient music it is essential to bear in mind that ancient theory devised means for deriving any possible rhythm for any given extension. In such a system an eleven-beat rhythm is not at all awkward. In practice its shape is not recognized by its extension, but by the typical alteration of double and triple beats. In this respect its structure of 2-3-2-2-2 is neither more nor less regular than the 2-3-3-2 or 3-3-4 beats which Aristides construes as possible ten-beat rhythms.

Apparently, then, ancient Greek music forms part of a musical stratum of even and uneven song and dance rhythms which is still commonly found

---

[1] Aristid. Quint. 1,18, p. 39,3-25 W.-I.

from the Balkan regions over most of Greece into Anatolia, the Near East and beyond the Caucasus; Arab music is perhaps responsible for its having spread into Africa, as well.[1] Eleven-beat rhythms seem not at home in Greece today; but one encounters them in Macedonia, as well as an occasional uneven division of twelve beats.[2] Modern Greek folk music also exhibits another characteristic that we have deduced for ancient Greek instrumental music: while the realization of the upbeat may vary, the rhythmical skeleton of the downbeats is always present.[3]

All in all, the scanty remains of ancient instrumental music suggest that ancient rhythm was not so unfamiliar, after all. In vocal music, however, the coincidences are partly hidden beneath the regularizations that the nature of the ancient Greek language imposes on the rhythmical structure. As a consequence the rhythmical patterns of song could cover merely a subset of the instrumental variety. Only in instrumental music can the pulses surface to such a degree as they do in most of the Bellermann pieces. In song – except in highly refined kinds of poetry – no similar sequences of (almost) exclusively short syllables are available. The rhythm of Greek speech is largely determined by the regular occurrence of longs,[4] and while these could be prolonged to some extent when set to music, the rhythmical value of the shorts could not be varied much. It is the superimposition of such a language on a system of various even and uneven, symmetric and asymmetric rhythms that created the 'metres' of ancient Greek poetry.

Austrian Academy of Sciences

BIBLIOGRAPHY

Brandl 1995 = R.M. Brandl, 'Griechenland. C. Volksmusik und Tänze', in *Die Musik in Geschichte und Gegenwart*, Sachteil 3., Kassel[2] etc., 1688-1705; 1710-1712.

Buchanan 2001 = D.A. Buchanan, 'Bulgaria. II. Traditional Music', in *The New Grove Dictionary of Music and Musicians* I-IV, London[2], 570-583.

[1] Cf. Dauer 1988, 148f. For Greece, cf. the overview in Brandl 1995; for Bulgaria, Buchanan 2001; for Turkey, Reinhard 1998, citing rhythms of 5, 6, 7, 8, 9, 10, 11, 12, 16, 18, 20, and 21 pulses. Isolated occurrences of uneven rhythms in Europe, including the *Zwiefache* of often considerable complexity, leave the possibility open that they were widespread in ancient Europe (Dauer 1988, 151). Greek melodic structures may point to a very similar geographical embedding (West 1992, 390).

[2] Marina; Bukite, Gankino, Stankino: $11 = 2+2+3+2+2$, with similar divisions in Bulgarian folk music (note the single triple pulse); Kucano oro: $12 = 3+2+2+3+2$. Source: http://www.folkloretanznoten.de/. In Bulgaria the collision of the two triples in twelve-beat rhythm is exemplified: $12 = 3+2+2+2+3$ (Buchanan 2001, 582).

[3] Brandl 1995, 1704.

[4] Cf. the reconstruction of Ancient Greek speech rhythm in Devine-Stephens 1994, 92-156.

DAGM = E. Pöhlmann - M. L. West, *Documents of Ancient Greek Music*, Oxford 2001.

DAM = E. Pöhlmann, *Griechische Musikfragmente*, Nürnberg 1960.

Dauer 1988 = A. M. Dauer, 'Derler 1: Ein System zur Klassifikation von Rhythmen. Musiktheoretische und musikhistorische Aspekte', *Jazzforschung* 20, 117-154.

Devine - Stephens 1994 = A. M. Devine - L. D. Stephens, *The Prosody of Greek Speech*, New York - Oxford.

Johnson 2000 = W. A. Johnson, 'New Instrumental Music from Graeco-Roman Egypt', *Bull. Am. Soc. Papyrol.* 37, 17-36.

Pighi 1941-59 = G. Pighi, 'Ricerche sulla notazione ritmica greca', *Aegyptus* 21, 1941, 189-220; 23, 1943, 169-243; 39, 1959, 280-289.

Pöhlmann 1975 = E. Pöhlmann, review of D. Najock, *Drei anonyme griechische Traktate über die Musik. Eine kommentierte Neuausgabe des Bellermannschen Anonymus*, Göttingen 1972, in *Musikforschung* 28, 482f.

Pöhlmann 1994 = E. Pöhlmann, 'Musiktheorie in spätantiken Sammelhandschriften', in A. Bierl - P.v. Möllendorff - S. Vogt (edd.), *Orchestra. Drama, Mythos, Bühne*, München, 182-194.

Pöhlmann 1995 = E. Pöhlmann, 'Griechenland. A. Antike Musik', in *Die Musik in Geschichte und Gegenwart*, Sachteil 3., Kassel² etc., 1627-1676; 1705-1709.

Reinhard 1998 = U. Reinhard, 'Türkei. III. Volksmusik', in *Die Musik in Geschichte und Gegenwart*, Sachteil 9., Kassel² etc., 1015-1058.

Wagner 1921 = R. Wagner, 'Der Berliner Notenpapyrus', *Philologus* 77, 3f.; 256-310.

West 1992 = M. L. West, *Ancient Greek Music*, Oxford.

Westphal 1867 = R. Westphal, *Metrik der Griechen* I: *Griechische Rhythmik und Harmonik*, Leipzig², Suppl. 50ff.

Winnington-Ingram 1955 = R. P. Winnington-Ingram, 'Fragments of Unknown Greek Tragic Texts with Musical Notation: The Music', *Symb. Osl.* 31, 29-87.