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Empirical Research on Asymmetrical Rhythms in Scandinavian Folk Music: A Critical Review

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ABSTRACT

This article presents a summary and critical review of existing research on asymmetrical rhythms within the genre of Scandinavian fiddle tunes known as *springar/pols/springleik* (Norway) and *polska* (Sweden). The reviewed body of work covers a range of more or less related issues, including descriptive and prescriptive accounts of different rhythmic styles (long-average-short and short-long-average beat cycles); presentation of measured beat duration patterns, including accounts of measurement procedure; hypotheses on patterns and mechanisms of variation in beat asymmetry; and notes on the relationship between dance meter and musical meter, between rhythmic levels (measure, beat and subdivision), and between measured and experienced rhythm. The present study extracts and compares the different currents of thought on and approaches to these topics, and assesses their methodological performance and explanatory potential. Finally, some recommendations for future research are presented. It is concluded that more studies are needed to fully account for the asymmetry phenomenon. These studies should include a larger and broader set of timing data through more efficient methodologies; ethnographic and experimental research on music/dance interactions, on synchronization behavior in ensemble settings, and on the perceptual and conceptual representations of rhythm and timing among performers. It also remains to construct a theoretical model that integrates the different – and to some extent contradictory – concepts, perspectives and findings from existing research.

Keywords
musical meter, asymmetrical rhythm, Scandinavian folk music, fiddle, Hardanger fiddle, springar, polska, music theory, music analysis

This article presents a summary and critical review of existing research on asymmetrical rhythms within the genre of Scandinavian fiddle tunes known as *springar/pols/springleik* (Norway) and *polska* (Sweden). These are traditional dance tunes in triple meter with numerous variants across Norway and Sweden. Roughly speaking, the springar/polska genre can be divided into three subcategories of meter: 1) Undivided meter, in which the beats are not organized in recurrent, periodic patterns. Here, the beat forms the largest stable rhythmic unit, making it identical with the measure (1-1-1-1-1-1 etc. instead of 1-2-3 1-2-3). 2) Symmetrical triple meter, in which the periodic rhythmic structure of music and dance is defined with reference to an accentuation pattern (heavy-light-light etc.). 3) Asymmetrical triple meter, in which rhythmic structure is organized according to both accentual and durational properties of the beats.[1] The latter has attracted the interest of generations of researchers, which in part may be attributed to its peculiar rhythmic features. The most noticeable of these characteristic and genre-defining features is that the beat duration ratio is asymmetrical, meaning that all three beats within the measure have different lengths (long-average-short or short-long-average). In addition, the rhythmic framework (the meter/groove) is flexible in the sense that measures and beats may vary considerably in terms of both absolute and relative length from one part of a performance to the next without compromising the experience of flow, tempo and groove.

The focus of this article is on scholarly work which in one way or another deals with rhythm and timing in asymmetrical springar/polska tunes. This body of work covers a range of more or less related issues, including descriptive and prescriptive accounts of various asymmetrical rhythmic styles; presentation of measured beat duration patterns, including accounts of measurement procedure; hypotheses on patterns and mechanisms of variation in beat asymmetry; notes on the relationship between dance meter and musical meter, between rhythmic levels (measure, beat and subdivision), and between measured and experienced rhythm; and attempts at modelling springar/polska rhythms to account for the generative mechanisms through which beats of different lengths are produced. In the reviewed studies, these issues are not dealt with in a systematic and consistent manner and this is not to be expected given their different aims and points of departure (see below). In the present study, however, the overall aim is to extract and compare the different currents of thought on and approaches to the mentioned topics and to assess their methodological performance and explanatory potential. The body of the article consists of a presentation and critical dis-

1. The reader is encouraged to consult audio and video clips featuring springar/polska playing and dancing:
Undivided meter (a *Bleking* from Västergötland, Sweden): https://www.youtube.com/watch?v=QmsreqfhP-s
Symmetrical triple meter: (*Nordmørs-pols*, i.e. a pols from the district of Nordmøre, Norway): https://www.youtube.com/watch?v=3XAoZPWTWoM
Asymmetrical triple meter, long-average-short (*Tele-springar*, i.e. a springar from the district of Telemark, Norway): https://www.youtube.com/watch?v=GkzEitcBvc0
Asymmetrical triple meter, short-long-average (*Valdres-springar*, i.e. a springar from the district of Valdres, Norway): https://www.youtube.com/watch?v=QBdyC5JXthA

cussion of the respective researchers, followed by some recommendations for future studies. It should be noted that the author's own research (Johansson 2010) is presented and discussed alongside the other contributions. The rationale behind this way of structuring the article is to provide a complete overview of existing studies and to allow for an explicit self-critical dimension in the account of the author's own approaches.

The relevance of the present study to the wider field of rhythm research is twofold. First, it provides an overview of existing research on a phenomenon that evidently has attracted scholarly attention far beyond the circuit of Scandinavian folk music researchers (see e.g. Goldberg 2015; Jankowsky 2013; Kaminsky 2014; London & Polak 2014; Polak 2015; Trueman 2010). Second, the reflexive review of the various approaches and findings uncovers a number of issues of general relevance to the understanding of rhythmic phenomena. Concretely, questions of how to measure and visually represent rhythmic properties; of the relationship between measured, intended and experienced rhythm; of the connection between rhythmic patterns and body movement; and of how musical parameters interact in the production and perception of rhythm and timing, are not confined to the study of the springar/polska genre but are of general concern to the international community of rhythm research.

EINAR ÖVERGAARD

The Swedish folk music collector Einar Övergaard (1871-1936) was one of the first scholars who provided written reflections on the nature of the asymmetrical rhythm of springar/polska tunes. He traveled extensively and left us with transcriptions of tunes from Valdres, Gudbrandsdalen and Østerdalen in Norway, and Västerdalarna, Värmland, Hälsingland, Härjedalen, Medelpad and Bohuslän in Sweden. Generally, Övergaard was interested in the characteristics of what he considered to be "genuine fiddle music," as opposed to "quasi-improved" folk music performed by classically trained violinists.[2] He refers to criteria such as:

1. Different scales
2. Peculiar tone production, through bowing as well as finger onset.
3. Heterogeneous rhythm. "Quarter notes" with different durational value, i.e. not 1:1:1, but, for instance 1:1.5:1.25 etc.  "the beat" [groove] moves in waves  . In this way we are provided with a completely new rhythmic arrangement.[3]

Several of Övergaard's field notes touch on the variable durational relationship between beats, although he did not present his material systematically in terms of how the "heterogeneous rhythm" phenomenon characterizes different local styles. The accounts made seem to be based on general impressions from observations he made when he met and listened to fiddlers and the beat duration ratio data mentioned are based on aural estimations. However, Övergaard's observations and comments are interesting in that they pro-

2. Övergaard's own notes. Quoted from Ramsten 1982: 21-23. cf. chapter 2.1. Author's translation.
3. Övergaard's own notes. Quoted from Ramsten 1982: 23. Author's translation.

vide these issues with a historical perspective, as well as suggesting that features of rhythmic performance constitute important stylistic elements. Regarding *Västerdals-springlek*,[4] he points out that the first beat is much shorter than the other two, and that the second beat is the longest, leaving a ratio of approximately 1/2:1:3/4 for the whole measure (Ramsten 1982: 24). In another section, the same material is mentioned, now with slightly different data indicating the ratio between the three beats:

> The fact is that the three beats are not performed in even 3/4 time. The second quarter note [beat] has a longer durational value compared to the remaining ones. And particularly striking is the shortness of the first quarter note [beat]. The ratio between the beats then is approximately 1:1½:1. This groove ("takt") is emphasized in particular when playing for dancing, in that the dance steps require this (Quoted in Ramsten 1982: 206. Author's translation).

Although Övergaard's descriptions of the beat duration ratio are somewhat ambiguous, it seems clear that he considers the first beat to be the shortest. Moreover, it is interesting that he mentions the relationship to dance movements, and that a correct rhythmic performance is a requirement if the interaction between music and dance is to function properly.

EIVIND GROVEN

The Norwegian fiddler, composer, music researcher and folk music collector Eivind Groven (1901-1977) is the first Scandinavian scholar known to have measured the temporal relationship between the three beats in asymmetrical springar/polska tunes. Groven sees the uneven beat duration patterns as integrated parts of the tunes as they are learned and handed down, and as closely related to the structure of dance movements (Groven 1971). Thus, asymmetry was not a discovery made by virtue of his measurements. Rather, his investigations represent an effort to provide data about and a clearer picture of a phenomenon he is already highly familiar with as he was an active fiddler himself. Like many other scholars he refers to the inadequacy of the conventional system of notation when discussing his aims and methods:

> I mentioned that the three beats in the springar all have different durations, and that these differences can vary from village to village and are decisive for the playing dialect. If we look at a transcription of a tune, we cannot find out how large the durational differences between the beats are supposed to be. The score only indicates equal values for counting. If we are to learn a tune from a score only, we will not learn the melody correctly, as it was originally. The problem therefore is to come up with a clear picture which can provide us with a view of the wave movements of the rhythm. To record this I found (in the 1930s) a *Morse receiver* to be a useful device. […] The method was that I simply tapped the beat with my finger and got dots on a slip which was transported by the machine. The slip moved with a speed of 30mm per second. If I then measured the distance between the dots in millimeter, I got a time measurement with a precision of 1/30 seconds. Then I could measure a larger number of measures, thus arriving at a kind of average rhythm (Groven 1971: 99-100. Author's translation).

4. *Springlek* is a local term for springar/polska tunes in some parts of western Sweden. Västerdalarna is the western part of the Swedish province of Dalecarlia. For an example of Västerdals-springlek, see http://www.veoh.com/watch/v887171BbNpJa5E.

The measurements thus represent Groven's experience of beat durations as they unfold at a normal tempo without interruptions as expressed by his finger tapping. However, Groven does not discuss how he interprets the correspondence between his experience of beats and attack points in the music. In fact, any kind of correspondence or lack of such between the rhythm experienced and audible contrasts might have been decisive, since different alternatives are not discussed. Nor are we informed about the amount of effort invested in the experiment, that is, if it was performed several times, how well he had accustomed himself with the recording in question and so on. Moreover, we do not know how strongly Groven's already established understanding of the beat duration pattern influenced his interpretation during the course of the experiment (see the section on Kvifte below).

In terms of the aims of the present study, it is very interesting that Groven presents data which can be the subject of comparison. In the section quoted below, he reports data for recordings of the *Tele-springar Markensmondagen* as played by three different Hardanger fiddlers.

> I then started with "Markensmåndagen" played by Gunulf Borgen. The result was:
>
> The 1st beat uses 39% of the whole measure
> The 2nd beat uses 33% of the whole measure
> The 3rd beat uses 28% of the whole measure
> The ratio between the beats then is 39–33–28
>
> The first beat is the heaviest, the second lighter, and the last lightest.
>
> Now one would believe that it should not be that easy for another fiddler to stick to such a rhythm if he learned the tune, as they often do – by ear. To test this, I measured the same tune performed by Kjetil Løndal. And now the strange thing was revealed that the data was exactly the same: 39–33–28.
>
> I also measured the same tune played by Ånund Roheim.[5] Here, the ratio was 38–33–29. This is only a 1/15 of a second deviation from G. Borgen. From this we see how accurately the tradition takes care of every detail, how confident one can be that the feeling for tonality and rhythm is maintained over time, and how sensitive we humans are to the smallest of nuances (Groven 1971: 100. Author's translation).

Groven's presentation of data derived from real measurements (rather than from general estimations) is historically interesting and potentially important to the way conceptions of rhythmic style develop in a particular milieu. In this regard, it is rewarding to note that subsequent research (Johansson 2010) has been carried out with the explicit intention of testing Groven's results. Johansson analyzed the same recording of Gunnulf Borgen's version of *Markensmondagen* and his findings clearly differed from Groven's: instead of a 39:33:28 beat duration ratio he found the values to be 34.5:34.4:31%.[6] Before commenting further on possible explanations for these divergences it should be noted that Johansson's work (which will be thoroughly presented below) is fundamentally different from Groven's in terms of aims and approaches. Groven's objective is to present *average* beat duration pat-

5. The fiddlers mentioned are among the very best and most acclaimed of their generation.
6. Gunnulf Borgen's recording of *Markensmondagen* can be found here: https://vimeo.com/177374119

terns from the different recordings. Regarding *Markensmondagen*, next to identical data were obtained from the three versions of the tune, which is interpreted as though the rhythmic precision of these fiddlers were both striking and coincident. Thus, it is implied that these patterns are well established, stable, stylistic traits; the only thing Groven has done is to confirm that this is the case. Johansson also presents average values but he does not consider these data to hold important musical information. Instead, he starts from the assumption that the durational ratio between the three beats will vary from one measure to the next, and that these variations reflect processes that are crucial to the rhythmic character and flow of the performance.

It is also worth noting that Groven does not present his raw data from which the average values were calculated. Theoretically, this means that the ratio between the three beats could have varied considerably throughout the performances and in different ways from case to case, while still generating the same averages. Moreover, the fact that neither measure length nor absolute beat length was analyzed leaves open the possibility for a range of different patterns of absolute durations. However, since Groven does not discuss this any further, we can only assume that if he had considered the variations significant, he would at least have commented upon them.

JAN-PETTER BLOM

The Norwegian anthropologist and ethnomusicologist Jan-Petter Blom has provided some theoretically well founded accounts of the rhythmic character of different springar/polska styles. His point of departure is the relationship between structures of body movements, and the production and perception of musical structures:

> My point of departure is the hypothesis that the perception and expression of musical rhythm is intimately linked to experiences of body movements, and that our concepts of rhythm are mirrored by the way in which we move our body in synchrony with music (Blom 1981: 305).

Obviously, dance is highly important in Blom's theorizations and he believes that local or regional sub-cultures represent shared conceptions of musical rhythm through collective experience and knowledge of dance. In addition to the dancers needing to coordinate their movements with each other and with the music, the fiddler has to express the rhythmic quality of the dance to communicate efficiently. Thus, a shared dance culture provides the fundamental reference on which musical understanding and interaction is based:

> A conceptualization of such implicit understandings should preferably take the concrete rhythm of the dance as its point of departure (rather than the mere abstract and generalized musical expression) and use the models of such rhythms as the basis for musical interpretation. This procedure is analogous to what conductors do to music when performing their rhythmic gestures in front of the orchestra (Blom 1981: 305).

"The concrete rhythm of the dance" is manifested through a "patterned *libration* of the body's center of gravity." Blom demonstrates how the shape of the movement over time can be visualized graphically as curves with straight lines between extremes (see Fig. 1 below). These generalized models illustrate structural or categorical stylistic differences, "i.e. a dif-

ference in *meter* constituting particular relationships between the units of movements in terms of extension, duration and speed/force (accent)" (Blom 1981: 306).

The down and up movement of dance corresponds to the concepts of action and repose, which in turn relates to the ancient terminology of *thesis* (T) and *arsis* (A), from the Greek words for "lowering" and "raising." The relationship between a falling movement, identified as a downbeat, and a raising movement (upbeat) constitutes a full libration (TA) equivalent to a dance beat, "i.e. the smallest unit of a patterned flow or rhythm" (Blom 1981: 306). Rhythm, then, is a continuous flow of down-up-down movements (TATA etc.) corresponding to dance meter. As will be evident from the model presented in the next section, Blom sees a direct correspondence between the ordinal, temporal and spatial structure of dance movements and the structure of musical rhythm. As regards beat durations, Blom specifies a guiding norm according to which the differences between the main types of Norwegian asymmetrical pols/springar styles can be described. He defines this average value as a beat duration ratio of 5:7:6 (28:39:33%), which as a preferred norm is claimed to function for most traditions (Blom 1993: 178). Accordingly, the long-average-short types are assigned the ratio of 7:6:5 (39:33:28%), which is equivalent to Groven's measurement of *Markensmondagen.*

Musical meter and dance meter

From Blom's descriptions it follows that there is potentially a difference between musical meter and dance meter. For instance, in a *Tele-springar*, there are two dance beats (TA movements) in a period (measure), while there are three musical beats. The model below is adopted from Blom (1993: 180) and illustrates librational patterns for six different varieties of pols/springar dances. Vertical lines specify musical beats, while the zigzag lines illustrate the motion of the center of gravity of the dancers along a time line, that is, dance beats. The numbers (5, 7 and 6) indicate the durational ratio of the musical beats and the bold vertical lines show the start of the period (measure) for each type. The durational relationship between dance beat phases (T:A), on the other hand, is accounted for by the varying horizontal distance between the upper and lower points on the zigzag lines.

Notably, not only relations between beats, but relations within beats, may be important aspects of rhythmic performance. In this regard, Blom writes that "rhythmic figures in the music have to be shaped in a way that they indicate the division of the beat in thesis and arsis movements." Moreover, "the music should express the durational relationship between the beat phases (T:A) so that dancer and musician experience a feeling of togetherness through a high degree of synchronization" (Blom 1993: 183-184). When interpreting the model with this aspect in mind, we notice that the status of the musical beats and subdivisions varies. For instance, the beats may be undivided, forming a part of a T:A relationship on the level above, as in the second and third beat of the *Tele-springar* and the first and second beat of the *Valdres-springar*, where the dance beat occupies two musical beats. In this case, the dance beat phases correspond to particular beat duration patterns, while it does not matter whether or how the individual musical beats are subdivided. On the other hand, there may be two dance beat phases within each musical beat, as in the remaining beats displayed in the model. In this case, the beat motifs[7] need in principle to be subdivided in accordance with this division, for

7. The term beat motif refers to the melodic and rhythmic structural design of the individual beat.

example, a 4:3 ratio for the first beat of the *Tele-springar* (Blom 1981: 310). Accordingly, undivided beat motifs would have to be "divided" by some kind of accentuation through dynamic intensification with the bow. Here, yet another analyzable aspect of rhythmic performance is actualized. However, the predictions of Blom's idealized model immediately seem difficult to reconcile with empirical observations, as no clear tendency for any particular subdivision pattern on the first beat in *Tele-springar* performances can be seen (Johansson 2010). At the same time, Blom's claim that ideally there is a correspondence between the musical articulation of rhythmic movement and the bodily movements of the dancers resonates well with what appears to be common conceptions among folk musicians and dancers in general. However, we need to investigate how these correspondences are experienced and specified, and solving this task cannot rely on durational data alone.

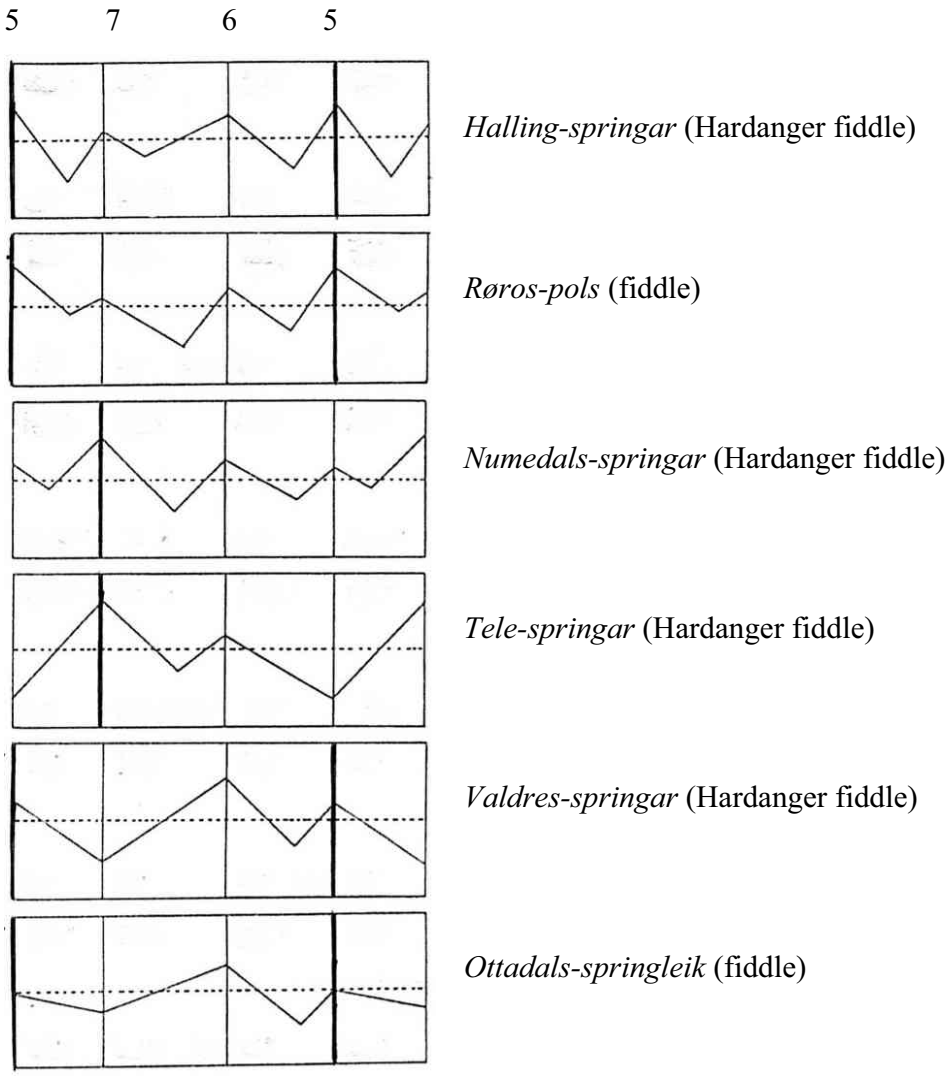

Figure 1. Blom's model of libration patterns in pols/springar dances. Adopted from Blom (1993: 180).

Beat duration patterns – guiding norms and principles

In addition to the tendency for a normal value in beat duration patterns (the 5:7:6 ratio), Blom mentions variation, and the potential musical and contextual aspects with reference to which this variation might be explained. He also suggests that variation in the degree of asymmetry follows a predictable pattern:

> The degree of difference varies from one local tradition to another, but is also dependent on the tune and fiddler, and on the social occasion. A fast tempo tends to make the rhythm more symmetrical compared to a slower tempo. A normative description of the asymmetry therefore will only serve as guidance […] On the other hand, the variation in the degree of asymmetry follows a certain system and is therefore predictable. All measurements of the asymmetry in the tunes (see Blom 1981) show namely that the lengths of the 1st [short] and 2nd [long] beats vary proportionally, and that the 3rd [average] beat remains stable around 1/3 of the measure length (Blom 1993: 177-178).[8]

The notion that the longest and the shortest beat are proportional adjusted certainly deserves further investigation (see the sections on Kvifte and Johansson), as does the notion that a faster tempo tends to make the rhythm more symmetrical. Moreover, considering that music and dance are supposed to correspond by the durational relationship between the beats being the same, it is tempting to speculate whether variation in musical beat length can find its equivalence in a corresponding variation in dance beat length, although this particular aspect of music/dance interaction is not addressed by Blom. More generally, although he broaches variation by indicating a co-variation between the shortest and longest beat, the variations in themselves are not assigned any particular meaning, that is, it is not discussed whether timing variations may be an important part of a good performance and not just an unavoidable consequence of other aspects. Also, while variables such as tempo, tune and fiddler are considered in connection with the issue of variation in asymmetry, we are left with no clues as to how the mechanisms of timing might work in relation to these and other variables. In other words, what is missing is a theoretical and empirical underpinning of the mechanisms through which timing within a certain rhythmic framework is achieved, that is, according to which principles a rhythmic sequence may be temporally shaped given a particular musical/dance meter. Any attempt to account for such mechanisms would necessarily involve examining both how melodic rhythm is shaped in accordance with a certain springar/polska groove (which is independent of the particular realization in question), and how unique characteristics of melodic-rhythmic architecture affect and constrain this process. This latter aspect of performance timing is not discussed by Blom, and although he seems to imply that melodic-rhythmic patterns are in some way shaped to fit the rhythmic framework within which they occur, he does not attempt to explain *how* this is accomplished.

More generally, although Blom's descriptions and interpretations are convincing, it could be added that the idiomatic logic of performing springar/polska rhythms on the fiddle/Hardanger fiddle also should be considered on its own terms. Arguably, the temporal organization of melodic rhythm cannot be fully understood by referring to the principle

8. A notable weakness in this study is that the measurements referred to are stated to be approximations and Blom provides no details regarding method in addition to this (see Blom 1981).

that durational patterns are determined by the rhythmic structure of dance. At the least, several other mechanisms and principles need to be taken into account. For instance, the precision with which performers replicate temporal patterns of springar/polska rhythms that conform neither to any generalized dance meter nor to an average beat durational pattern in the performance concerned (see the sections on Ahlbäck and Johansson) suggests that one needs to expand the analytical scope in the search for explanations. First, very high precision in performance timing cannot possibly be achieved by synchronization with some external time-keeper as long as this reference is not stable and predictable. Second, given that temporal variations are systematic in some way without conforming to the (mathematical) model that predicts co-variation between the long and short beats, other structuring principles need to be considered if we are to understand the temporal shaping and organization of springar/polska rhythms.

INGMAR BENGTSSON

The Swedish musicologist Ingmar Bengtsson has contributed significantly to the scientific study of micro-rhythmic relationships. He has also written specifically about the rhythmic characteristics of the Swedish polska style, and the problems associated with transcription and score representation (Bengtsson 1974). Like the other researchers mentioned, Bengtsson observes that "polska playing characteristically contains rhythmic features which are not at all apparent in normal notation" (Bengtsson 1974: 22). He also recognizes that these dialectal characteristics are features which may distinguish between local traditions, different players and even individual tunes. Thus, the importance of rhythmic performance at any stage in the history of these styles remains uncontradicted by all researchers dealing with these issues. In this connection, Bengtsson identifies two aspects of the problem of describing the rhythmic styles of polska playing:

> …firstly, to try to establish *what* the rhythmical characteristics consist of (either observing how they are perceived, what acoustic correlates they have, or both), more precisely to establish which such factors are characteristic (not incidental) and describable, and secondly, to answer the question *how* the observations can be suitably described, either by means of normal notation together with a set of diacritic symbols, or in some other manner (Bengtsson 1974: 22).

It is noticeable that the implications of Bengtsson's views of transcription are also interesting in connection with the conceptualization of these styles as performance practices. His main point is that polska tunes should be notated in triple time, rather than with time signatures which are alternative (5/8, 9/16, etc.) or variable (shifting between 3/4 and 5/8 for instance). The latter alternative he dismissed on the grounds that changes between different time signatures within the same tune give a false picture of the music, "for as a rule it is not at all a question of intentional changes of meter, but of deviations from the code's triple-time norm which are characteristic of so-called oral traditions" (Bengtsson 1974: 29). Bengtsson choosing to insist on triple-time notation as preferable for polska tunes is then rationalized with reference to two interrelated premises. First, time-value symbols and time signatures should be used in the simplest way to symbolize the rhythmical "triple-

time grammar" of the style. Second, the finer nuances of timing should be described by using symbols different from the ones belonging to the traditional notation system (Bengtsson 1974: 30). Referring to Walter Wiora (1938), he argues that the interpretive flexibility of conventional time-value symbols should be seen as an advantage, rather than as a limitation that calls for alternative notation representing exact durations in the music:

> What he [Wiora] has in mind is an essential feature of our notational code as it has for long been used. The symbols […] only appear to represent "exact" time-value relationships 2 : 1, 4 : 1 etc.; in reality they are more to be regarded as (relative) *time-value classes* related to particular musical codes. It is first in stylistic situations where many different time-value classes are used within the same musical structure […] that the tolerance latitudes shrink […] The flexibility of the normal time-value symbols is an *advantage* that should be utilized, not eliminated! (Bengtsson 1974: 29).

Thus, simple notation does not imply simple rhythmic performance, but a variable, flexible/elastic rhythm which should not be tied to a norm by detailed transcriptions. The implications of such a view on notation thus extend beyond simple practical concerns related to working with transcriptions, in that they are also coincident with a particular conceptualization of these styles as performance practices. In this connection it should be mentioned that Bengtsson emphasizes variation in beat length to a greater extent than most of the other researchers discussed. He also mentions what he calls "expected fluctuations" in tempo conditioned by the melodic structure, for example, a prolongation of the first and last measure of four-measure motifs.[9] Johansson (2010) makes similar observations in his analyses, but rejects the notion of tempo fluctuations. Instead, he introduces the concept of *rhythmic reshaping,* suggesting that rhythmic variability in the springar/polska genre should be understood in terms of shorter and longer units rather than in terms of faster and slower segments (see below).

Analysis and interpretation

Bengtsson's initial reflections are based on measurements performed on two versions of *Hurven,* a springar/polska tune recorded by the fiddler Johan Hollseter from Trysil.[10] In addition to the observation of an extension of the initial and final measures, he notices that the first beat is short almost throughout, but that it tends to be shorter within measures starting with a triplet. In average values, the beat duration pattern is short-long-long (29-35-36%), but in several measures he also observes a short-long-average pattern, similar to the common conception of the *Valdres-springar* meter. Regarding the subdivision of beat motifs divided into two, he notices that the second beat tends to be performed with something resembling a triplet division (60/40), while the third beat demonstrates a tendency to have a dotted rhythm (75/25). Bengtsson does not proceed, however, to interpret how these subdivision patterns might be related to motivic context and other factors. For instance,

9. Such structurally conditioned variations are a well recognized phenomenon in other styles as well, as, for instance, in the "typical slowing down at the end of phrases in classical music from the Romantic period" (Honing 2001: 50).
10. Trysil is a village near the Swedish border in the south-eastern part of Norway. The local term for the springar/polska style here is *runnom*. Johan Hollseter's rendering of *Hurven*, recorded in 1969, represents what later has been categorized as asymmetrical triple meter with a short first beat.

the difference might be related to a different status being assigned to the two types of beat motifs respectively. Arguably, the last tone of the third beat motifs (see the arrows in Fig. 2) appears more as a kind of "pick-up" to the following measure, than as a melody tone in the same sense as the last tone of the second beat motifs. To take this further one could relate it to playing technique and bowing pattern, indicating that the short "pick-up" is necessary if the fiddler is to come out right, that is, with a down stroke on the following note. Thus, as melodic-rhythmic events, these beat motifs are potentially very different, and cannot be compared in any musically meaningful way with reference to durational data only.

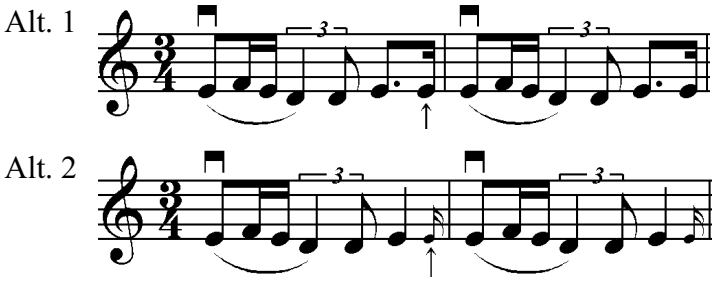

Figure 2. Excerpt from *Hurven* played by Johan Hollseter. Comparison between two alternative notations. Audio sample 1. Audio samples 1-4 can be found here: https://vimeo.com/211649065.

Another example Bengtsson refers to is two fiddlers' versions of a four-measure passage of the tune *Furubom's polska (Boda-polska)*.[11] Again, he observes extensive variation in the length of all three beats, especially the second. In this respect, Bengtsson suggests a potential correspondence between the number of tones in a beat and beat length. For instance, he finds that replacing a figure with two subdivisions with a figure with four subdivisions tends to result in a prolongation of the beat. This type of correspondence between beat length and the density and complexity of beat motifs also forms a central point of orientation in Johansson's analytical work (see below).

Asymmetry or flexible triple meter?

Striking about Bengtsson's way of treating this topic is that he does not seem to share the assumption that the basic rhythmic structure (meter) of these styles is asymmetrical (with a short-long-average or long-average-short beat duration pattern). Instead, his reasoning is based on the premise that the variations observed, or "dialectal peculiarities", are to be considered to be "deviations from the [polska] code's triple-time norm", and belonging "to another 'code stratum'" (Bengtsson 1974: 29). An important question in this context is to what extent these differences found within the theoretical literature can be related to differences in the musical practices which it refers to. Is it, for instance, the case that the *Boda-polska* (cf. *Furubom's polska* analyzed by Bengtsson) is characterized by constant rhythmic variations and deviations, leaving a "triple-time norm" as a reasonable reference, while the

11. *Boda-polska* is commonly described as having a short first beat with a heavy accent on the second beat. The two fiddlers performing this tune are Hans-Jonas and Röjås-Erik. Bengtsson does not provide detailed information about these recordings except for noting that they are taken from *Svenskt Visarkiv* (The Centre for Swedish Folk Music and Jazz Research).

Tele-springar is characterized by a (more or less) stable asymmetrical beat pattern (Blom, Groven)? Or, is the difference to be found in the researchers (Groven, Blom and Bengtsson's) conceptions and descriptions of these styles? Both assumptions may hold some truth and should be critically examined. With regard to the latter, we need to bear in mind that the theory/praxis configuration may form a critical aspect of stylistic change within our contemporary musical lives.

Method of measurement

For the measurements discussed in this section Bengtsson used the melody-writer MONA, and a device for registering complex sound events called POLLY (see Bengtsson 1967 and Bengtsson et al. 1972). These analogue registrations of sound sequences make it possible to calculate the relative duration of musical events from a visual graph. The problem with this method does not necessarily concern the ability of these devices to capture the finer nuances of a rhythmic performance but that it seems to be taken for granted that the critical points in the graphs obtained represent musical onsets as they are experienced by the musician and/or a competent listener. As has been demonstrated repeatedly, this is not necessarily the case given the ambiguity of the rhythmic-dynamic articulation in fiddle playing (Johansson 2010; Kvifte 2004). Thus, these devices are not necessarily "improving our ability to make detailed analyses and descriptions" (Bengtsson 1974: 22) unless we use them in combination with a musically competent reading of the rhythmic course of events.

SVEN AHLBÄCK

Sven Ahlbäck is a music researcher and teacher at the Royal College of Music in Stockholm. The importance of his contribution to rhythm research is in this context considered to be wide-ranging in that it forms a central part of the teaching of talented and potentially influential Swedish and Norwegian folk musicians. Ahlbäck (1995) presents a typology of polska rhythms (meter) based on accentuation pattern, tempo, characteristic subdivision structure, and the durational relationship between the beats. Here, the aspect of beat duration ratio in asymmetrical styles will be given most attention, and this parameter of Ahlbäck's typology is treated in a way which deserves to be critically examined.

Alternating meter – categorical variation in beat level timing

Basically, Ahlbäck is referring to the two main types of asymmetrical springar/polska tunes, that is, the short-long-average and long-average-short variants. However, instead of describing these meter types as stable patterns with small variations (cf. Blom), he sees them as alternating between symmetrical (3:3:3) and strongly asymmetrical (2:4:3/4:3:2 or 22:44:33/44:33:22%).[12] These values are not to be understood as limits within which gradual variations occur during performance, as the music is considered to alternate between two different meters. Moreover, this alternation is not thought to be being approximate as the 2:4:3 ratio is stated to be performed with a 10ms accuracy (Ahlbäck 1995: 8).

12. Ahlbäck has mainly researched Swedish polska styles.

The way Ahlbäck chooses to represent these rhythmic features in a score clearly reflects his basic conception of the asymmetry phenomenon and implies a constitutive relationship between the subdivision and beat level timing. By using 9/16 notation he is able to communicate both the asymmetry and the alternating meter through the way the notes are grouped within the measure (see Fig. 3 below). The asymmetry on the beat level here becomes a direct equation of the architecture and placement of the beat motifs, that is, something that resembles so-called Balkan rhythms or additive rhythm (Kvifte 1999). Thus, in its prototypical form this model suggests that completely different processes are at work compared to the model in which the measure is seen as simply divided into three beats of unequal length, regardless of the density and architecture of the beat motifs (see the discussion of Kvifte's article below). Figure 3 below shows the second strain of an *Orsa-polska* (Sweden) played by Gössa Anders Andersson (1878-1963)[13] and notated by Ahlbäck (1995) and should demonstrate the principle through which beat durations are constituted. To illustrate clearly the alternating meter, numbers have been added to indicate the shifting durational ratio between beats.

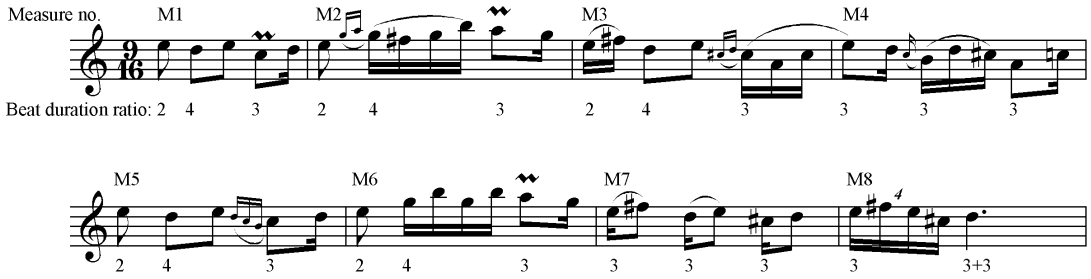

Figure 3. Excerpt from an *Orsa-polska* played by Gössa Anders Andersson. Adopted from Ahlbäck (1995). M1, M2, etc. indicate measure numbers.

Compared to Bengtsson's thoughts about the notation/performance relationship, this represents a fundamentally different approach, in that the "fine structure in the duration patterns" (Bengtsson) is in fact reproduced in the score. When considering alternative notation, Bengtsson concluded that: 1) changes between different time signatures give a false picture of an intentional change of meter; 2) a detailed notation of duration values might conceal the grammatical peculiarities of the basic code; and 3) with reference to its capacity of being potentially normative, notation should not attempt to represent the actual values of rhythmic performance. These objections aside, the usefulness of Ahlbäck's approach will be discussed further with the above transcription as reference.

As we can see, the only exception from a simple, additive subdivision model (cf. Balkan rhythms) is the quantized figure with four sixteenth notes in the last measure. This figure might possible be seen as accelerated, something which would resonate with the idea that the total duration of the beat motif may be adjusted, independent of its formal architecture. However, when listening to a recording of this tune with Gössa Anders and his daughter

13. Audio: https://vimeo.com/179864532.

Gössa Anna,[14] the second beat of M6 seems to be far more "accelerated," thus suggesting the opposite of what the transcription reveals. Measurements confirm that this is the case: the second beat of M6 is much shorter than the first beat of M8. It should be noted that this is not a vague tendency or random variation: the average length (four occurrences) of the second beat in M6 is 453ms with only 4ms deviation between the shortest and longest version, while the average length of the first beat in M8 is 555ms with 8ms spread. Besides demonstrating the high temporal precision with which a performer may replicate a certain melodic-rhythmic sequence, this observation suggests that one take a closer look at the odd distribution of beat durations implied by Ahlbäck's transcription of this tune. The shift between the strongly asymmetrical M3, where a beat motif with duple subdivision is supposed to be played twice as short on the second beat compared to the first beat, and the symmetrical M4, seems particularly unlikely; and as suspected, measurements indicate that this is not how this two-measure motif is performed. Figure 4 below shows beat duration data (%) from measurements of the first occurrence of this motif (top line) compared to the predictions of Ahlbäck's model (bottom line).[15]

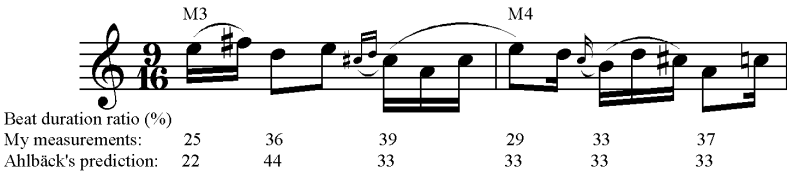

Figure 4. Two-measure motif from an *Orsa-polska* played by Gössa Anders Andersson (cf. Fig. 3). Audio sample 2 (https://vimeo.com/211649065).

In conclusion, there certainly is variation in asymmetry in Gössa Anders' playing, but it appears as if Ahlbäck's description of these variations is exaggerated. Moreover, although a performer might alternate between different beat duration patterns with a high degree of precision, there is no particular reason to believe that this is achieved through guidance from a durational or ratio-based model (2:4:3 and 3:3:3). In other terms, the ability of a performer to repeat a melody with exactly the same durational values should not be confused with the ability to adjust the duration of melodic-rhythmic events in accordance with some generalized model. Nor is a simple, additive subdivision model a sufficient explanation for the accurateness of performance timing: beat motif durations are hardly determined only by their formal architecture. For instance, while complex beat motifs with multiple subdivisions may be difficult to play fast enough to make them short, thus being "preset" by absolute constraints, it is certainly no problem to shorten or lengthen simpler or undivided ones. Moreover, rhythmic variation often equals some kind of restructuring of beat motif architecture (symmetrical vs. asymmetrical triplets etc.), something which might affect beat duration as well. Thus, the presumption that the temporal structure of springar/polska tunes is constrained by a particular set of non-flexible rhythmic building blocks does not appear to reflect the reality of rhythmic performance. In sum, the processes

14. It is not known which one of three available recordings of this tune Ahlbäck transcribed. However, it has to be emphasized that these versions are very similar in terms of rhythmic articulation and timing.
15. The measurements are performed manually with the aid of sound editing software.

of performance timing cannot be accounted for either by a simple predictive beat duration ratio model or an additive subdivision model.

Notation and normative description

Though the predictions implicit to Ahlbäck's method of notation do not seem to be empirically supportable, it needs to be recognized that his transcription sounds, when played back by a computer, a lot more like an *Orsa-polska* than does a conventional transcription in 3/4 time. Somewhat paradoxically, then, the most important objection against the 2+4+3/16 alternative is perhaps the *apparent* concordance with the sounding music. In short, the possibility to express the variation in asymmetry might lead us to believe that these transcriptions actually represent beat durational and subdivision patterns as they are performed, and the mechanisms through which these rhythmic patterns are produced. Although in some cases they might, the 2:4:3 durational categories generally represent extreme values rarely encountered in traditional recordings. The risk of cementing a constructed, unnatural rhythmic pattern is therefore obvious, and to the extent that transcriptions may be normative, this is an undesirable alternative. The observation that there are recordings in which the 2:4:3/4:3:2 pattern can be found is of course interesting and should not be ignored, even if this may turn out to be a modern phenomenon. At the same time, given the fact that some of the musicians performing springar/polska tunes in this way possess a theoretical knowledge explicitly grounded on this conception of rhythm/asymmetry, it is interesting to speculate to what extent the appropriation of theoretical models of rhythm might influence stylistic change (see the section on Kvifte below).

TELLEF KVIFTE

Kvifte holds a professorship at the Department of Traditional art and folk music at the University College of Southeast Norway. In addition to general questions of rhythm and groove, he has dealt specifically with the asymmetrical styles of springar/polska playing (Kvifte 1999), systematically and critically examining existing theories and assumptions about the subject. Through this work, Kvifte extracts four main hypotheses from the existing research within the field. These hypotheses concern *variation* in asymmetry and how this phenomenon might be explained. Below the main points of these alternative explanations are briefly summarized.

Four hypotheses

The average value hypothesis (*middelverdihypotesen*) refers to Blom's work (see above), according to which the long beat is supposed to steal time from the short one, while the medium beat remains average (33%) in length. Thus, the rhythmic flexibility is centered around the shifting relationship between the long and short beat.

The second hypothesis (*enerhypotesen)* relies on the One as a stable point, that is, the distance from the onset of the first beat of a measure to the start of the subsequent measure is supposed to remain constant, while the relative length of the beats in between varies. Kvifte argues that since the beats are of unequal and varying length, the perception and

control of tempo cannot rely on the beat level, as is the case in many other styles (cf. beats per minute (bpm) as a tempo indicator). Thus, the lowest level capable of defining tempo is hypothesized to be the measure level. This, however, turns out to be difficult to combine with the average value hypothesis. Given the short-long-average variant, the two principles will theoretically coincide, as the variable point is supposed to be the onset of the second beat. But with long-average-short meter, there is conflict in that the variable point between the short and long beat is supposed to be stable according to the second hypothesis.

The foot-tapping hypothesis (*trampehypotesen*) refers to the usual ways in which a performance is accompanied by a regular tapping of the beat. The possible correspondence suggested is that variation in asymmetry is concentrated on the beat position where fiddlers are not tapping their foot. This, however, presupposes that the fiddler only taps two beats, and although this might be considered the most usual way, the theory excludes instances when all three beats are tapped. Given the circumstance that one taps on the first and third beat in short-long-average meter, there is a correspondence with the average value hypothesis. But in a *Tele-springar* (long-average-short), where the fiddlers generally tap on one and two, this is not the case. Here the rhythmic flexibility needs to be located in the relationship between the average and short beat to lend support to the foot-tapping hypothesis. These objections, however, do not necessarily mean that this hypothesis cannot tell us something about the asymmetry phenomenon. It is only if we are looking for a general principle, accounting for all asymmetrical styles of springar/polska playing, that we need to dismiss this alternative. It could be added, however, that it cannot be assumed without any problematization that the potentially constitutive influence between foot tapping and melodic rhythm works in a particular direction, that is, that the first beat is flexible because there (sometimes) is no foot tap on the second beat, rather than the other way around.

The libration pattern hypothesis (*sviktkurvehypotesen*) refers to Blom's descriptions and illustrations of libration patterns in dancing. Kvifte suggests the possibility of a correspondence between rhythmic variability and certain aspects of these patterns of movement. Complete librations (T:A patterns) are here suggested to be more stable than each of the phases (T or A) respectively. As Blom has shown, in some cases there is a difference between dance meter and musical meter. In a *Numedals-springar*, where this is not the case, all three musical beats correspond to a complete down-up movement (dance beat), which according to the libration pattern hypothesis would indicate a relative stability on all (musical) beat positions. A *Tele-springar*, in which there are only two dance beats, however, should demonstrate variability when there is a correspondence between the musical beat position and the transition between down and up movement, that is, between the second and third beat (see Fig. 1). In other words, the third beat onset is determined to be the most variable position, while the sum of the second and third beats (a complete dance beat) should be stable. A *Valdres-springar* consequently will have the second beat onset as the most variable position. In the case of a *Tele-springar*, this hypothesis coincides with the foot-tapping hypothesis.

Testing the hypotheses

As Kvifte points out, none of the earlier investigations specifically aims to test any of the hypotheses, and to do so would require a greater set of data than is available from the few

measurements which exist. His own data is derived from measurements performed on two recordings of the *Valdres-springar Raklekjølken* (short-long-average) played by Trygve Bolstad, and a *Numedals-springar* called *Musehaugen* (long-average-short) recorded by Arne Olsen. Notably, only short sections containing a few measures from the recordings in question are analyzed. Consequently, Kvifte is not actually testing the hypotheses, but demonstrating how they *can be* tested (see Kvifte 1999: 410). This demonstration follows the path of three models of calculation, which will be briefly mentioned below:

First, by determining variation in period length measured from the first, second and third beats respectively, it is possible to evaluate and compare the different hypotheses. For instance, the hypothesis that the One remains a stable point would be confirmed by results showing that the period length measured from the first beat is less variable than the period length measured from the second or third beat.

Second, by measuring and calculating the relative extension of the beats within a measure, it is possible to determine where and how much the different units vary in relation to each other. By virtue of this perspective, evaluating the average value hypothesis is straightforward: one of the beats should occupy around 33% of the measure, while the length of the remaining two beats should vary proportionally according to a "give-and-take principle."

Third, potential patterns of co-variation can be examined, that is, to what extent two variables change simultaneously. For instance, if it is a fact that the long beat steals time from the short beat, then a prolongation of the long beat should make the short beat correspondingly shorter.

Kvifte concludes that his measurements and calculations do not clearly support any of the hypotheses, and although he demonstrates some tendencies in favor of the average value hypothesis, there are too few data to make any solid claims. Without considering the implications of these hypotheses any further at this point, there seem to be merit in Kvifte's assertion that even though they do compete in some respects, they may all represent factors which to a varying degree are active in shaping the rhythmic patterns.

Measurements – precision and relevance

Regarding the question of how and with what level of precision to measure musical rhythm, Kvifte has some interesting reflections. Comparing Groven and Bengtsson's measurements, he argues that although the latter might appear more exact by involving the automatic detection of the physical aspects of sound, this is not necessarily the case. It all depends on what one wishes to measure and the correspondence between the physical measurements and the experienced rhythm:

> If it is the experienced rhythm one wants to measure it is easy to argue that Groven's method is the most accurate. Groven knows that his registrations have a direct correspondence to the experience of rhythm, while Bengtsson has to interpret a graph made by a machine. Thus, he cannot know for sure which signs in the graph correspond to experienced beats. Furthermore, the relationship between the start of a tone (physically represented on a graph […]), when the tone is *perceived* to start, and when the beat is perceived to start, is not always obvious. This can be especially apparent when fast grace notes are performed: should they be interpreted as on or before the beat? (Kvifte 1999: 418-419).

In this context, the concept of experienced rhythm and its relation to measured rhythmic onsets needs some further contextualization and nuancing. One alternative is that a detailed survey (using whichever technology available) taking into account the experience of rhythm will demonstrate the same results as did Groven's analysis. Second, there may be divergences between these results due to deviations between where Groven marked the beat positions and where he intended them to be located. Third, there may be deviations due to different conceptions of the relationship between perceived contrasts in sound and perceived beats (cf. Kvifte's comment on grace notes). There is also the rather spectacular alternative that there is no direct relationship at all between melodic rhythm and experienced beats for which it is possible to account. A less spectacular alternative, however, is that there is a great *tolerance* for deviations between perceived onsets and the tapping of beats. In other words, although perceived as dissimilar, different beat onset patterns may account for the same experience of groove. This alternative does not seem improbable at all, but we need to add a very important factor, namely the researcher's preconceptions. Without these, the results from a Groven-type analysis could be expected to spread in all directions. Given the hypothesis that Groven possessed what was at the time an already well-established understanding of the beat pattern of *Tele-springar,* and that deviations between this pattern and perceived onsets were not considered to be important enough, there may be many potential realizations which result in equivalent analytical data.[16] From this, the problem of referring to experienced rhythm without discussing this concept any further should be obvious.

Method of measurement

Kvifte's method of measurement is well described and combines a "Groven-approach" with a "Bengtsson-approach." The music is recorded into a sequencer program. When playing back the tune, Kvifte marks the beats by playing them on a MIDI keyboard. The sequencer records the MIDI data from his rhythmic performance and both audio streams are played back simultaneously to ensure there is synchronization. If deviations are perceived between experienced beats and his recorded markings, Kvifte can move the markings back and forth to synchronize them with the music. He also mentions the possibility of watching a sound graph, placing the marker where he believes the beat to be located, and playing back the sound from this point. It is not entirely clear, however, how the relationship between the different procedures is to be understood. In short, what is the point of first playing the beats on a keyboard, thereby representing experienced rhythm, if these data are in any case going to be corrected afterwards? If measurements of experienced rhythm are taken to imply observations made from the position from which beats are normally experienced, then these measurements will naturally include the small "errors" (tolerance) which the final procedure is supposed to correct. From this perspective, a discussion is lacking about why precision should be increased beyond this level. If, on the other hand, the deviations are considered to be misinterpretations due to insufficient attention and precision, then the results from the initial part of the procedure will bear no significance as long as they do not correspond to the more detailed analysis.

16. An additional alternative would be that one does not really perceive the onsets as diverging from the pattern because of the strong preconception directing one's rhythmic experience.

Durational categories and expressive variation

The relationship between durational categories and expressive aspects of performance in these styles was initially discussed by Bengtsson. Kvifte, however, questions the assumption that the rhythmic patterns of springar/polska tunes result from (more or less systematic) "deviations from the code's triple-time norm" (Bengtsson 1974: 29). Instead, he discusses the possibility that listeners and musicians perceive three different categories (long, average and short), that is, that the basic norm in itself is asymmetrical. Kvifte attempts to illuminate this by referring to the data obtained from measurements, from which the relative stability of the three beat positions can be calculated. He concludes that there are no unambiguous tendencies in favor of any of the three beats. Some of the measurements suggest that it is difficult to distinguish between the "long" and the "average" beat, while others seem to indicate that the "average" and the "short" beat are not clearly differentiated by duration. In spite of this ambiguity, Kvifte suggests that the short beat position could be seen as constituting a category of its own. He does this by referring to the relative stability of the short beat position and, not least, to the accounts of musicians.

Kvifte also briefly addresses the question of the extent to which the beat durations measured and beat categories are related to different conceptions of rhythm and style. For instance, he mentions the potential difference in musical conceptions between musicians who learn the asymmetrical rhythm both as dancers and musicians, and those who learn the same rhythms without this connection to dance. He also suggests that the use of notation might have an important influence on the way musicians experience rhythmic structure. For instance, he observes a striking correspondence between Ahlbäck's 2:4:3-3:3:3 notation and the way in which some Swedish folk musicians do in fact perform the polska rhythm, that is, with a "Balkan-type" asymmetry with isochronous subdivisions and alternating meter (see Kvifte 1999: 426-427). As Kvifte notes, this is a qualitatively different way of rhythmic organization compared to styles in which the asymmetry is experienced as constant, and in which this temporal organization of the beat level determines the timing structure of subdivisions, rather than the other way around. Finally, Kvifte briefly mentions an alternative strategy which is to capture whole measures as rhythmic *gestalts* with different forms of internal organization, for instance by using categories such as long, short and average (Kvifte 1999: 428). The implications of this alternative are not discussed any further by Kvifte, but it can be noted that the model has some bearing on Johansson's notion of a top-down process of temporal organization in springar/polska playing (see below).

CARL HAAKON WAADELAND

The Norwegian musicologist and jazz musician Carl Haakon Waadeland has contributed significantly to rhythm research through his project on *rhythmic frequency modulation* (Waadeland 2000). He is also the only researcher who has taken a modeling approach to the study of springar/polska rhythms. The overall goal of his project is "*to formulate a new description of musical rhythmic activity, through which gestural aspects of performed rhythm are taken crucially into account*" (Waadeland 2000: ii, italics in original). This ambition is brought into focus by an attempt to model actual rhythmic behavior within different styles as processes of continuous transformations of rhythmic structure. Waadeland argues that

conventional attack-point rhythm description, being based on information about discrete points on a one-dimensional axis, is not a valid representation of rhythmic performance. This argument is premised on the persuasive assumption that rhythmic performance is "created through an interaction between the musician and his instrument, expressed as continuous movements in time and space. The musical performance as such is thus basically a continuous, multi-dimensional phenomenon" (Waadeland 2000: 115). On this basis he presents a model which transforms structures of attack-point rhythm into structures of gestural rhythm represented by movement curves (see the illustrations in Figs. 5 and 6 below). The modeling process is presented in two steps which represent two levels or separate models where the latter is dependent on the former. The first step is the construction of a model of metronomic performance of rhythm (MPR), in which a structure of discrete durations derived from note values is transformed into a structure of movements. The second step is the construction of a model of live performance of rhythm (LPR) in which the model MPR is naturally embedded by acting as basis for the modulation. Expressive timing is represented through the model LPR by applying "a technique of *rhythmic frequency modulation* to the elements of MPR, creating movement curves which represent rhythmic performances characterized by various deviations from metronomic regularity" (Waadeland 2000: 174.).

Modelling springar/polska rhythms

In Waadeland's words, the models MPR and LPR are supposed to make it possible to "describe representations of expressive timing as non-linear continuous transformations of rhythmic structure. Subject to this interpretation our models reflect processes by which conceptualized musical information, through an interaction of cognitive skills and motor skills, is transformed into live performances of music" (Waadeland 2000: 240). In other words, what is stated is that the model reflects how actual durations are affected by the expressive intention of a performer acquainted with a particular style of rhythmic performance. Interestingly, the *Tele-springar* and *Valdres-springar* are among the examples of styles used as a means to illustrate the model. Waadeland has not measured beat durations in actual springar/polska performances, but uses Blom's (1993) idealized model as reference, that is, the 7/18 (long) – 6/18 (average) – 5/18 (short) proportional ratio. He first presents a "neutral", unmodulated melody in symmetrical triple meter; the well-known Norwegian melody *Kjerringa med staven* (Fig. 5)[17]:

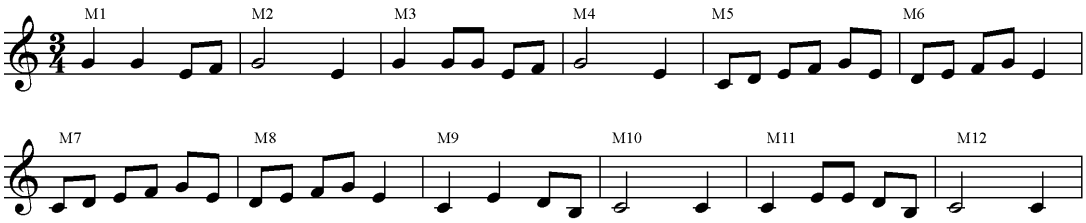

Figure 5. *Kjerringa med staven.* Adopted from Waadeland (2000: 213).

17. *Kjerringa med staven* is not a *Tele-springar*. Instead, this "neutral" melody is used to illustrate the transformation from symmetrical to asymmetrical triple meter.

The graphical representation in Figure 6 below is taken from Waadeland and displays the movement curve associated with a metronomic performance of *Kjerringa med staven*.

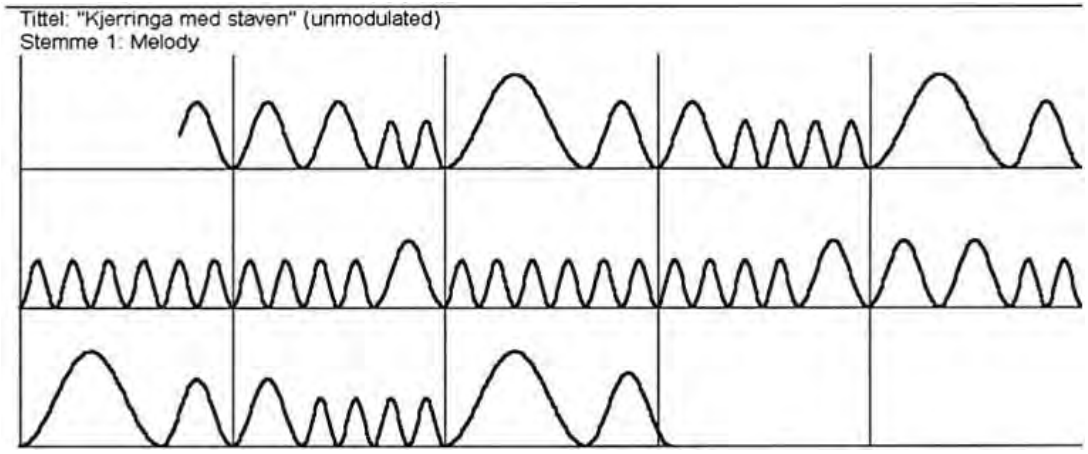

Figure 6. Movement curve for *Kjerringa med staven*, symmetrical (MPR) version. Waadeland 2000: 213.

Waadeland then presents a simulation of a rhythmic performance according to the *Tele-springar* style (long-average-short). As evident from Figure 7, the long and short beats are now stretched and compressed respectively.

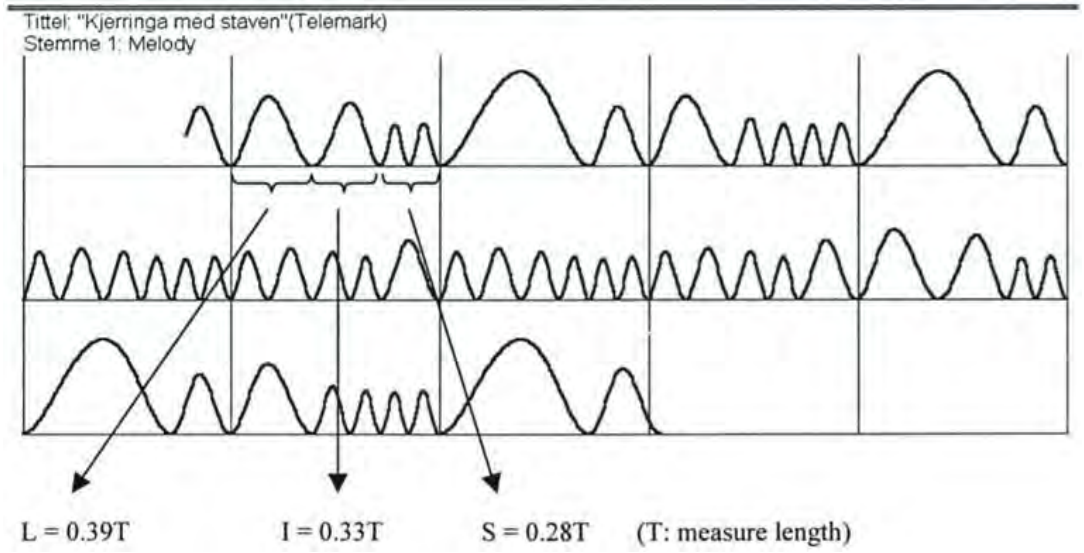

Figure 7. Movement curve for *Kjerringa med staven*, asymmetrical (LPR) version. Waadeland 2000: 214.

On a surface level, the graphical and sounding[18] representation of a *Tele-springar* groove might seem sensible enough at first sight. However, it remains to consider whether the

18. The theoretical models are translated into sounding rhythm syntheses. These are represented on a CD which accompanies the book.

model provides an accurate portrayal of this groove, including the "transformation" process through which it is supposed to be generated. The first point to be noted is that the striking variability is not represented. Ideally, the model should contain all factors that might affect the output (i.e. the movement curve). Examples may include local stylistic differences (Groven, Blom), overall tempo (Blom), covariation between long and short beats (Blom, Kvifte), relationships between subdivision architecture and beat duration (Bengtsson, Ahlbäck, Johansson), and various contextual factors, for example, structurally salient transitions (Bengtsson, Johansson). In more general terms, a central premise in Waadeland's approach is that the duration of rhythmic events is controlled by an organizational framework which is independent of the (unique) melodic-rhythmic course of events that makes up a springar/polska performance. This conception is not easily made congruent with the notion that the melody (i.e. the melodic rhythm) constitutes the basic groove-forming element. More precisely, although the organizational influence of a generalized rhythmic framework needs to be acknowledged, it is also important to consider the interaction of this framework with melodic rhythm. In contrast, Johansson's work is almost exclusively concerned with how the unique motivic and sectional structuring of a tune/performance exerts influence on rhythmic components and their relationships, which is also problematic (see below).

The second problem with Waadeland's model concerns how beats of different lengths are generated. As evident from Figure 7, Waadeland suggests that this is achieved by stretching/compressing the beats to longer and shorter durations without the proportional ratio between subdivisions within each beat motif being affected. There are two implications of this. 1) The relationship between rhythmic levels is one-directional: beat durations are adjusted to a predefined (5:7:6) ratio. 2) Beat motifs are scaled according to local tempo shifts (long beat = slow, short beat = fast). According to Johansson (2010), none of these predictions appear to account for rhythmic behavior in real springar/polska performances. One of his key findings is that beat durations are not controlled independently from the architecture of the beat motifs involved. There are also question marks over the generative mechanisms that supposedly are at work in the production of unequal beat durations, that is, continuous and rapid shifts between different local tempi (see Fig. 8 below). Although it might seem logical to assume that a short beat equals a fast beat, there are some basic problems with such a conception. Most notably, the tempo shift version of *Kjerringa med staven* sounds rather strange. As Johansson (2010) has demonstrated, it also seems very difficult (if not impossible) to shift between slow and fast beats, that is, to scale the beat motifs to different total durations without affecting their internal structure of relative durational values. An alternative would be to explain stretching and compressing in terms of prolonging/shortening certain individual tones, rather than slowing down/speeding up whole beats. Figure 9 demonstrates how such an alternative version might look like in notated form.

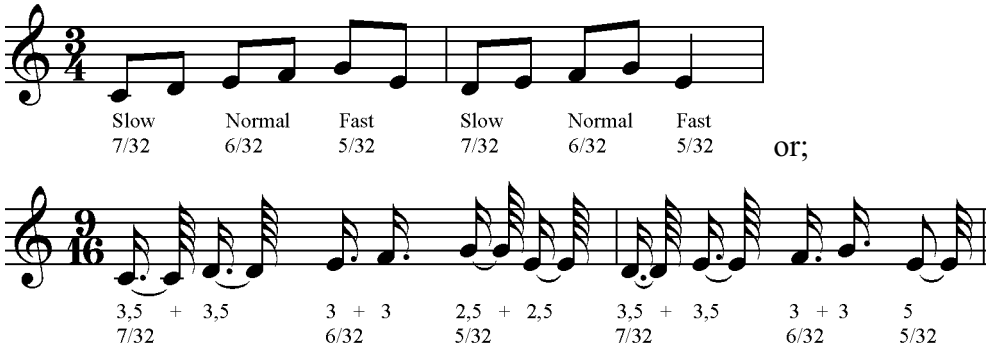

Figure 8. *Tele-springar* version of M5-6 of *Kjerringa med staven* according to a local tempo shift model. Audio sample 3.

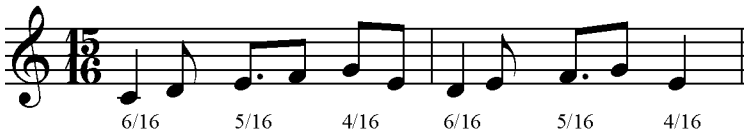

Figure 9. *Tele-springar* version of M5-6 of *Kjerringa med staven* according to a tone prolongation model. Audio sample 4. The 15/16 notation (6+5+4/16) is used in order to obtain an approximation of the idealized Tele-springar meter by means of standard notation symbols.

The latter process, in which certain tones are prolonged, can hardly be described as a variation in tempo. Instead, the beat motifs are reshaped in ways that correspond to different beat durations. Intuitively, and according to how fiddlers actually perform *Tele-springar* tunes, this is a more realistic representation than the tempo shift version. It needs to be emphasized, however, that the intention is not to predict exactly how the reshaping process might work (it can take infinite forms) but to illustrate the interdependence between rhythmic levels (beat and subdivision timing).

Finally, as Kvifte (1999) noted there are reasons to question the fundamental premise that "conceptualized musical information" equates to a hypothetical metronomical and symmetrical rhythm, meaning that asymmetry is the result of an expressive transformation rather than functioning as the basic rhythmic framework within which the expressive structure of temporal and intensive values are chiseled out. In terms of the generative mechanisms behind performed rhythms, there seems to be little justification for the assumption that the temporal structure of the asymmetrical grooves is derived from a symmetrical/metronomical (MPR) rhythmic model through time (durations of events) being added to and subtracted from this imagined reference structure. Instead, it might be convincingly argued that asymmetrical grooves such as the *Tele-springar* and *Valdres-springar* constitute autonomous frameworks with a coherent rhythmic logic of their own.

MATS JOHANSSON

Mats Johansson is professor at the Department of Traditional art and folk music at the University College of Southeast Norway. His PhD thesis (2010), represents an attempt to challenge and revise existing approaches to the asymmetry phenomenon. Johansson's central claim is that musical time (in this case the duration of tones, beats and measures) should not be treated as an autonomous structural and expressive parameter with a system of its own:

> […] models based on purely temporal relationships ignore fundamental aspects of how rhythm is produced and perceived. […] The (more or less explicit) assumption that performance timing can be explained in terms of the constraints of musical time itself runs counter to the intuitive notion that musical parameters are interconnected and thus mutually influential, experientially as well as somatically (Johansson 2010: 98, 249).

The claim that rhythm/time cannot be understood with reference to its own constraints is supported with reference to empirical observations and heuristic reasoning. Johansson's analyses (see below) document vast variability in the absolute and relative durations of beats and measures: viewed from a measure-by-measure perspective, the data is chaotic with no evident patterns of covariation (the long beat "stealing" time from the short one etc.; cf. the sections on Blom and Kvifte). "On the other hand, a closer analysis shows that the seemingly irregular patterns of durations are interrelated with aspects of musical structure (motivic and sectional division) and the use of expressive devices (ornamentation, dynamics, double stops, etc.) in ways that make the performance internally consistent" (Johansson 2010: 7). From these observations, he argues that an adequate analysis of the generative mechanisms behind measured durations has to take into account the mutual influence between organizational (rhythmic style/groove/meter), architectural (the actual shape of melodic-rhythmic segments) and contextual (the location of rhythmic elements within the melodic-rhythmic structure) factors. Within this analytical framework, temporal patterns (e.g. a particular configuration of beat durations) are treated as the output of a process rather than as a stylistic feature or quality in itself. To further support this claim, Johansson evokes the notion that musical parameters interact and overlap in infinite ways. For instance, duration and accentuation are converging features (Clarke 1987): measured variations in timing may be experienced and intended as accentual (weight distribution) rather than temporal qualities. Moreover, the melody, including its various transformations through ornamentation, generates fluctuations in beat durations that could hardly be considered intentional as a particular distribution of time points (Johansson compares this to the intrinsic/passive timing of a spoken sentence and its variations). Ultimately, Johansson defines the process of performance timing in terms of the dynamic integration of all musical elements (rhythm, time, timbre, melody, dynamics) into a coherent ("well-formed") whole, as opposed to in terms of the direct control of time/durations per se (Johansson 2010: 248).

Method of measurement and analytical approach

Johansson takes a manual, albeit technologically assisted approach to measure the duration of rhythmic events (tones, beats, measures and longer sections). Using standard sound-

editing software, he estimates and marks the points in the sound graph that correspond to the start/end of the unit concerned and then measures the distance between the points. He acknowledges that the fiddle produces sound images which are challenging to account for in terms of rhythmic onsets and that identifying the attack points between which to measure beat durations is a matter of interpretation rather than mere observation. However, he also claims to compensate for these sources of uncertainty by means of a consistent measurement procedure, making the same decision of placement in all comparable occurrences (cf. e.g. Kvifte's comment on the interpretation of grace notes above). While this approach ideally allows for a certain degree of comparability, Johansson does not resolve the problem that the relationship between physical onset, measurements and experienced rhythm cannot be analytically determined (cf. the section on Kvifte). A similar objection can be directed against the level of precision with which the analysis operates: the temporal resolution of measurement data is in milliseconds, which is far beyond the threshold for listeners' perception of timing differences (Clarke 1989). In response to this quandary, Johansson proposes that "very small temporal nuances are considered important to the quality of melodic-rhythmic flow, without necessarily being detectable as durational variations" (Johansson 2010: 119). He also argues that the precision with which rhythm is produced may be considerably higher than that of a listener attempting to detect such details (ibid.). Although both these points might be valid, they presuppose that "very small temporal nuances" actually can be captured by the analysis, which in turn needs to be removed from the context of normal listening. Finally, the tediousness of the measurement procedure inevitably implies a limitation in terms of the number of items analyzed, which in turn pertain to issues of representativity (see below).

Johansson's analysis of measurement data consists of three steps: 1) A statistical treatment of beat and measure duration data viewed from a measure-by-measure perspective. 2) A more interpretative approach, exploring the relationship between timing data and the melodic-rhythmic structure of the performances. This involves comparing various motivic segments to examine how different architectural characteristics and contextual factors are interconnected with measured durational data. The latter also includes 3) analyzing the relationship and interaction between rhythmic levels, particularly between subdivision timing and beat level timing. Among other things, Johansson presents detailed analyses of how the architecture and performance of ornaments and triplets are interconnected with beat durations.

Case studies and results

Johansson analyzes three recordings in their entirety: the *Tele-springar Markensmondagen* played by Gunnulf Borgen (long-average-short asymmetry), a *Vågå-springleik* after Hans Holen played by Leif-Inge Schjølberg (short-long-average asymmetry), and the *Tele-springar Igletveiten* played by Bjarne Herrefoss (long-average-short asymmetry). In addition, he uses analyses of smaller segments from other performances to highlight certain arguments.

In terms of average values, the beat duration pattern is clearly asymmetrical in all performances analyzed. However, the spread (standard deviation) for each beat is shown to be very large (ranging between 5.4 and 8.2 percentage points) and a number of measures contradict the "prescribed" beat duration ratio (e.g. a long first beat in short-long-average

asymmetry). Johansson basically dismisses the relevance of these average values. His argument is that if the mean represents an intended rhythmic behavior, we are left with the counterintuitive explanation that the temporal precision with which the fiddlers operate is very low. This, he argues, would be impossible to reconcile with the abundant observations of rhythmic precision and consistency within the performances analyzed. The relationship between inconsistency and consistency, or Johansson's findings in general, can be summarized in the following points:

- The overall tempo is consistent, meaning 1) that comparable longer sections (including the whole tune when repeated) have the same total duration, and 2) that rhythmic density/the rate of melodic-rhythmic activity is constant (see below).
- Beat duration fluctuations are not compensated for within the measure by, for example, a "prolongation" of one beat being accompanied by a "shortening" of a neighboring beat (cf. Blom 1981, 1993; Kvifte 1999). Instead, the measure stretches out and contracts as a result of the "addition" or "subtraction" of rhythmic-temporal material.
- There is a close correspondence between motivic structure and timing patterns: the motifs as a whole (generally two-measure motifs), as well as their individual measures, have a timing profile of their own. As a rule, the timing profile is replicated with precision whenever the same segments reoccur in another part of the performance.
- The melodic-rhythmic architecture of individual beats affects and constrains their durational properties: Undivided or otherwise simply structured beat motifs are flexible in length and their duration is primarily determined by stylistic and contextual constraints. The duration of architecturally complex beat motifs with numerous subdivisions is instead determined by absolute constraints. In these cases, beat duration is set to exceed a certain threshold (a beat with four or more notes cannot be played short) and is inflexible by being temporally locked by mechanisms of motor automatization.
- Rhythmic levels are mutually interdependent in that variations at one level are linked to variations at other levels: 1) There is an alignment between variation in beat duration and the proportional temporal values within the beat motif. For instance, short versus long triplets correspond to the relationship between symmetrical and asymmetrical triplets (see also the section on Waadeland and the comparison between a local tempo shift model and a tone prolongation model). 2) Adding or subtracting rhythmic information (e.g. by playing a trill on a note or not) corresponds to a lengthening or shortening of the beat/measure (cf. the second point above).
- The interaction between rhythmic levels (see the previous point) implies that the process which results in different beat durations should not be described in terms of tempo metaphors (faster/slower, acceleration/retardation, etc.), but as *rhythmic reshaping*.

Johansson synthesizes his findings through the concepts of top-down and bottom-up processes of performance timing. The top-down process entails that the duration of individual rhythmic events is an intrinsic component of the larger gesture (motif/phrase) of which they form a part, such as when speaking a sentence without any conscious consideration of the (very precise) timing of individual syllables. The bottom-up process, then, relates to the

fourth and fifth points above: alterations of melodic-rhythmic architecture at the individual beat motif level affect the duration of beats and measures.

It is noticeable that these explanations are largely incompatible with the notion that beat duration patterns (whether more or less consistent) are the result of an intentional matching (or mismatching) with a preconceived beat ratio model. Instead, Johansson insists that precision and consistency in timing is a result of the interaction between a top-down gestalt processing and a bottom up, additive mechanism. In this scenario, event timing is largely a passive parameter. The active domain of performance timing, then, mainly concerns some generalized intention to maintain "a well-formed groove." This sense of groove may or may not be conceived of in terms of durational features. Additionally, or alternatively, the active/intentional domain of performance action is related to a sense of coherence in overall melodic-rhythmic and dynamic-accentual contour with little or no concern for a particular configuration of beat durations. The problem with this model is its reliance on intuitive reasoning and the corresponding unaccountability of the findings. It is also problematic that "well-formedness" is defined negatively: "the guiding constraints on rhythmic performance may be thought of as arbitrarily specified criteria of well-formedness which are negotiated according to the principle that boundaries are determined negatively, that is, by evaluating whether the performance is recognized as well-formed or not" (Johansson 2010: 241). This is arguably a convenient way of not having to provide an explanation of how well-formedness is achieved, including detailing the structural and performative features of which a well-formed groove consists.

Issues of representativity

Johansson makes some grand claims which, if taken to their logical extreme, contradicts not only all previous research into the asymmetry phenomenon but also the practical common sense of many musicians and dancers. Concretely, it may well be that the observed patterns of beat durations in springar/polska playing cannot be explained in terms of an intentional (or not) matching with a predefined temporal grid. However, such a grid may still be an important point of orientation in musical performance and interaction. Johansson acknowledges this point to some extent but underplays its relevance and exaggerates the notion of intrinsic/passive timing. A related point is that the sample size and selection arguably is not sufficient to make strong generalizations about performance timing in springar/polska playing. In this sense, Johansson's research represents as much an outline of an analytical model/method as it presents empirical evidence in favor of particular descriptions of existing springar/polska grooves.

SUGGESTIONS FOR FUTURE RESEARCH

Given the relatively weak empirical foundation of existing studies, the most important priority for future research clearly is to gather more data. This includes at least the following areas:

1. Measurements and analyses of recordings featuring different styles of springar/polska playing. These should cover performances by different musicians, at different times and

in different situations (e.g. playing for dancing). Notably, there is also a need for more efficient methodologies to build a larger data set, for example, more advanced forms of automatic detection of onsets and other rhythmic information.

2. Ethnographic data on how performers make sense of performance timing and its associated concepts (groove, flow, phrasing, accentuation, timing/sound relationships and any other aspect of rhythmic performance). For instance, in Johansson's research there is no consideration of rhythmic intentions or how fiddlers perceive temporal relationships in the music. Correspondingly, Groven, Blom, Kvifte, Bengtsson, Ahlbäck and Waadeland seem to take for granted a direct correspondence between measured durations and rhythmic intentions, an assertion for which there is no empirical evidence. On the contrary, there is much to indicate that the intentional component of rhythmic performance concerns accentuations as much as durations (a "long" beat is often intended and conceived of as a heavy beat etc.).
3. Ethnographic and experimental data on music/dance interactions. It seems indisputable that dance holds the code to a culturally valid interpretation of springar/polska music. Additionally, the relationship between music and dance is often described as a dynamic and mutually interactive interplay, suggesting the need for studying the range of potential temporal-spatial points of reference for the music/dance interaction, including how rhythmic synchronization is conceptualized among performers.[19]
4. Ethnographic and experimental data on synchronization behavior among musicians playing springar/polska music in ensemble settings. Such data, combined with interviews, may hold information about concepts of rhythm and timing by making explicit knowledge that would otherwise remain tacit or automatic. Concretely, to a different degree than in traditional solo playing, when playing together – particularly in unusual settings (e.g. fiddle and percussion) – the participants need to relate to and "define" rhythmic features to maintain a state of coherence.
5. Ethnographic attention to learning practices: to reach a comprehensive understanding of springar/polska grooves and their associated concepts, it seems crucial to explore how performers learn their craft: how particular skills and knowledge are internalized by means of explicit and implicit learning. Importantly, processes of learning should not be examined merely in terms of how they serve the accomplishment of a pre-defined goal: that of mastering a particular rhythmic style. Arguably, practices of learning are also formative and transformative of the stylistic features under investigation (e.g. rhythmic variability/flexibility).

Among the theoretical challenges left unsolved is to construct a model that integrates the different – and to some extent contradictory – concepts, perspectives and findings from existing research. At first glance, Johansson's proposition of an interaction between organizational, architectural and contextual factors may seem a promising candidate. However, it remains to explain how this interaction works. This is indeed a difficult task and the main reason for this is that organizational influence is by no means limited to temporal

19. While some studies have been done on the relationship between springar/polska music and dance (e.g. Haugen 2014; Kaminsky 2014), there is much to be done in terms of connecting movement data and auditive data.

relationships. Few fiddlers or dancers would agree that a proper *Tele-springar* groove is achieved merely by producing beats of a particular subdivision and durational ratio. Rather, durational properties converge with accentual/dynamic, melodic and other qualities into a multiparametrical experiential image. Such an image surely exerts organizational influence on rhythmic behavior and understanding, but not necessarily in a way that can be measured and calculated. One implication of this notion is that theoretical propositions need to be carefully defined and clearly limited in scope. Concretely, quantitative models may well (and should) predict certain patterns of correlations between the mentioned factors (overall rhythmic coding – melodic-rhythmic architecture – contextual properties) and express these in terms of durational properties. However, any such model has to be supplemented by qualitative analyses and assessments, which in turn need to be ethnographically informed. Without such contextualization of measurement data, there is no guarantee that the model is consistent with relevant regimes of knowledge and their associated conceptual and experiential categories.

A related theoretical problem is to model the relationships and interactions between intrinsic/passive and active/intentional timing. Again, heuristic reasoning may well make a convincing case for the existence of such interactions while it remains to express these in more quantitative terms. Yet a related issue concerns how tempo is controlled: if everything is flexible and there is no isochronous reference, how can longer sections and the whole tune (spanning minutes) be precisely timed? Johansson (2017) has suggested that since rhythmic segments (a particular ornamental figure, a sequence of triplets, a two-measure motif, etc.) are internally consistent, there is no need for isochronicity. Instead, these segments – when successively combined – will add up coherently at higher levels (the first round, the second round, the whole tune) without the process relying on a stable underlying reference. He also proposes that "the flexible elements may be included in the equation on the terms that they occur continuously, that variation resides within certain limits, and that smaller internal variations cancel each other out over the course of longer sections" (ibid.: 48). However, this is once again an interpretative statement, not a specific theoretical prediction with defined conditions that allow for testing. What are also lacking are attempts to explain how a generalized tempo reference (i.e. playing a tune slow, fast or somewhere in between) is implemented in the overall process of performance timing. In general, tempo shifts (or choosing whatever tempo for the performance) involve some very complex operations since timing does not scale proportionally with tempo and since different rhythmic elements appear to scale by different factors (Desain & Honing 1993). In springar/polska music, the overall temporal irregularity complicates this even further. That is, this "complexity" is clearly not a problem for seasoned performers, which makes it more evident that it is a theoretical challenge rather than a practical one.

Finally, it is crucial to consider how empirical and theoretical findings within springar/polska research might be generalized beyond the immediate context in which these findings were made. Comparative studies including what is known as non-measured (unmetered) music are of particular interest, considering that there might be close parallels to the springar/polska styles in terms of how the music is temporally structured. The same goes for the irregular but coherent timing of spoken gestures found in speech rhythm research (see Thomson & Jarmulowicz 2016). More generally, the question should be asked whether

the phenomenon of springar/polska playing and dancing might tell something fundamental about the human ability to produce, control and adapt to complex temporal environments. An interesting enquiry in this regard is whether a "melodic" conception of rhythmic structure – as opposed to one based on clock-like mechanisms – is more important to rhythm production and perception than generally assumed, and if so, how such an alternative model might be construed. These are truly intriguing questions that should fuel further research for years to come.

REFERENCES

Ahlbäck, Sven 1995. *"Karaktäristiska egenskaper för låttyper i svensk folkmusiktradition. Ett försök till beskrivning."* Stockholm: Kungliga Musikhögskolan.

Bengtsson, Ingmar 1967. "On melody registration and 'Mona'." *Elektronische Datenverarbeitung in der Musikwissenschaft.* Regensburg: 136-174.

Bengtsson, Ingmar; Tove, Per-Arne & Thorsén, Stig-Magnus 1972. "Sound analysis equipment and rhythm research ideas at the institute of musicology in Uppsala." *Studia instrumentorum popularis* 2: 53-76.

Bengtsson, Ingmar 1974. "On notation of time, signature and rhythm in Swedish polskas." *Studia instrumentorum musicae popularis III.* Stockholm, Musikhistoriska museet: 22-31.

Blom, Jan-Petter 1981. "The dancing fiddle." In Blom, Jan-Petter, Nyhus, Sven & Sevåg, Reidar (eds.): *Slåttar for the Harding fiddle. Norwegian folk music, vol. 7.* Oslo, Universitetsforlaget: 305-312.

Blom, Jan-Petter 1993. "Rytme og frasering – forholdet til dansen." In Aksdal, Bjørn & Nyhus, Sven (eds.): *Fanitullen. Innføring i norsk og samisk folkemusikk.* Oslo, Universitetsforlaget: 161-184.

Clarke, Eric F. 1987. "Categorical Rhythm Perception: An Ecological Perspective." In *Action and Perception in Rhythm and Music*, edited by Alf Gabrielsson, 19–33. Stockholm.

Clarke, Eric F. 1989. "The perception of expressive timing in music." *Psychological Research* 51 (1): 2-9.

Doğantan-Dack, Mine 2006. "The body behind music: precedents and prospects." *Psychology of music* 34 (4): 449-464.

Goldberg, Daniel 2015. "Timing Variations in Two Balkan Percussion Performances." *Empirical Musicology Review* 10 (4): 305-328.

Groven, Eivind 1971. "Musikkstudiar – ikkje utgjevne før. 1. Rytmestudiar." In Fjalestad, Olav (ed.): *Eivind Groven. Heiderskrift til 70-årsdagen 8. oktober 1971.* Oslo, Noregs Boklag: 93-102.

Haugen, Mari Romarheim 2014. "Studying Rhythmical Structures in Norwegian Folk Music and Dance Using Motion Capture Technology: A Case Study of Norwegian Telespringar." *Musikk og Tradisjon* 28: 27-52.

Honing, Henkjan 2001. "From time to time: The representation of timing and tempo." *Computer Music Journal* 25 (3): 50-61.

Jankowsky, Richard C. 2013 "Rhythmic Elasticity and Metric Transformation in Tunisian Stambeli." *Analytic Approaches to World Music* 3 (1).

Johansson, Mats 2010. *Rhythm into Style: Studying Asymmetrical Grooves in Norwegian Folk Music.* PhD thesis. University of Oslo.

Johansson, Mats 2017. "Non-Isochronous Musical Meters: Towards a Multidimensional Model." *Ethnomusicology* 61 (1): 31-51.

Kaminsky, David 2014. "Total Rhythm in Three Dimensions: Towards a Motional Theory of Melodic Dance Rhythm in Swedish Polska Music." *Dance Research* 32 (1).

Kvifte, Tellef 1999. "Fenomenet 'Asymmetrisk Takt' i Norsk og Svensk Folkemusikk." *Studia Musicologica Norvegica* 25: 387–430.

Kvifte, Tellef 2004. "Description of Grooves and Syntax/process Dialectics." *Studia Musicologica Norvegica* 30: 54–77.

London, Justin & Polak, Rainer 2014. "Timing and Meter in Mande Drumming from Mali." *Music Theory Online* 20 (1).

Polak, Rainer 2015. "Pattern and Variation in the Timing of Aksak Meter: Commentary on Goldberg." *Empirical Musicology Review* 10 (4): 329-340.

Ramsten, Märta (ed.) 1982. *Einar Övergaards folkmusiksamling*. Stockholm, Svenskt Visarkiv/Almqvist & Wiksell International.

Thomson, Jenny & Jarmulowicz, Linda (eds.) 2016. *Linguistic Rhythm and Literacy*. Philadelphia, John Benjamins Publishing Company.

Trueman, Daniel 2010. "Clapping Machine Music Variations: A Composition For Acoustic/ Laptop Ensemble." *International Computer Music Conference Proceedings*, vol. 2010.

Waadeland, Carl Haakon 2000. *Rhythmic movements and movable rhythms. Syntheses of expressive timing by means of rhythmic frequency modulation*. Doctoral dissertation. Department of Musicology. Norwegian University of Science and Technology. Trondheim.

Wiora, Walter 1938. "Die aufzeichnung und herausgabe von bolksliedweisen." *Jahrbuch für Volksliedforschung* 6.