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The Performer as Analyst

A Case Study of J. S. Bach's »Dorian« Fugue BWV 538[*]

Bruno Gingras, Stephen McAdams, Peter Schubert

This study seeks to compare the performer's output as analyst and as performer. Sixteen professional organists were invited to perform J. S. Bach's organ fugue in D Minor (BWV 538), also known as the »Dorian« fugue. Each performer recorded the fugue twice on an organ equipped with a MIDI console, which allowed precise measurement of performance parameters. Immediately after their performances, organists were invited to submit their own analyses of the piece by indicating its main formal subdivisions. A comparison of the written analyses indicated that, despite a fair amount of individual variation, performers generally agreed on the main structural boundaries of the piece. An analysis of the temporal profiles of the performances revealed that the largest tempo variations coincided with these structural boundaries. Although a significant correlation was found between the performers' degree of agreement on a formal subdivision and the average magnitude of the concomitant tempo deviation, no such correlation could be found within individual performers, suggesting that written analysis may not be the optimal strategy to determine the performer's analytical reading of a piece.

Introduction

Several studies have brought to the fore the relationship between music-theoretical analysis and performance.[1] Whereas scholars such as Wallace Berry and Eugene Narmour intimated that performers should be acquainted with the theoretical and analytical methodology proposed by theorists, these studies were met, perhaps understandably, with little interest from performers. Indeed, these authors conveyed a view that simultaneously relegated the performers to a role of simple practitioners who should heed advice from the theorist regarding the structure of the pieces they are performing, while putting structural concerns to the forefront of performance issues.[2] More recently, however, John Rink and Joel Lester have advocated a differ-

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1 Berry, *Musical Structure*; Cone, *Musical Form*; Narmour, *On the Relationship of Analytical Theory to Performance*; Rink, *The Practice of Performance*; Schmalfeldt, *On the Relation of Analysis to Performance*.

2 Cook, *Analyzing Performance*.

ent view, one that gives value to the performers' analytical insights about a piece.[3] Lester even went so far as to reverse the paradigm accepted by scholars by proposing that analysts should work from performances instead of working from the score. Leonard Meyer had already hinted at such a view in 1973 when he wrote that, although performance is the actualization of an analytical act, this analysis may very well be intuitive and unsystematic: »For what a performer *does* is to make the relationships and patterns potential in the composer's score clear to the mind and ear of the experienced listener«.[4]

However, probing the analytical insights of the performer may prove to be a difficult task for several reasons. First, the analyst and the performer are rarely the same person; moreover, they seldom share the same language, despite Janet Schmalfeldt's compelling illustration of such an ideal situation. Second, as noted by William Rothstein, music-theoretical analysis and music performance have different goals, and it would be ill-advised to subsume one activity under the other.[5] Third, investigating the performer's analytical insights as they are projected in performance necessarily entails a comprehensive exploration of the expressive dimensions of a performance, in order to determine which aspects of the musical structure were expressed and how they were conveyed.

The present study attempted to partially circumvent these problems by inviting performers to record a piece for which they were asked to provide their own written analysis and to compare their performances to their analyses. For this purpose, sixteen professional organists were invited to perform J. S. Bach's organ fugue in D Minor (BWV 538), also known as the »Dorian« fugue, on an organ equipped with a MIDI (Musical Instrument Digital Interface) console, after which they were invited to provide their written analysis of the piece by indicating its main formal subdivisions. This study intended to shed new light on the complex relationship between performance and analysis by giving preeminence to the actualized music rather than to score-based analytical readings, thus following Lester's advice to seek »ways in which analysis can be enhanced by explicitly taking note of performances, indeed by accounting them as part of the analytical premise«.[6] More precisely, it aimed to clarify the relationship between the performer's view of the piece as an analyst and as a performer by examining whether performers whose written analyses substantially differed from each other also emphasized distinct formal aspects in their performances that related to these analytical differences. To be sure, most performers' ability to report their analytical understanding of the piece in a written medium may not equal their capacity to express it in performance. However, by limiting the scope of the written analysis to the identification of large-scale formal subdivisions and comparing this to the performance, we hoped to gain substantial insights into the performers' formal conceptualizations of the piece. Furthermore, this study sought to explore a stylistic repertoire that has been relatively neglected in the

3 Rink, *Playing in Time*; Lester, *Performance and Analysis*.
4 Meyer, *Explaining Music*, p. 29.
5 Rothstein, *Analysis and the Act of Performance*, p. 238.
6 Lester, *Performance and Analysis*, p. 199.

literature on performance research, which has generally focussed on Classical and Romantic piano literature.

An acknowledged masterpiece, the Dorian Fugue is one of Bach's most accomplished works for the organ (Fig. 1). The New Grove Dictionary of Music and Musicians includes it among Bach's finest fugal works[7], whereas the eminent organ scholar Peter Williams mentions the »exceptional series of imitative episodes« that runs throughout the fugue, claiming that it »produces some of the most carefully argued four-part harmony in the organ repertoire«.[8] The piece is especially noteworthy for its pervasive motivic unity: indeed, most of the melodic material of the fugue, including the episodes, is derived from the first 16 measures of this 222-measure piece.

Tempo variations as a marker of structural organisation in performance

A large body of literature on performance research has established that performers tend to slow down at sectional boundaries or formal subdivisions of a piece.[9] This expressive device has been termed *phrase-final lengthening*. Moreover, it has been shown that the magnitude of the ritardando corresponds to the hierarchical importance of the boundary, with larger tempo variations associated with the major formal subdivisions of the piece.[10] Several scholars have proposed that these tempo fluctuations are a means of conveying information about the grouping structure of a piece to the listener, a model known as the *musical communication hypothesis*.[11] Eric Clarke reported that listeners were sensitive to minute changes in timing (as little as 20 ms for inter-onset intervals between 100 and 400 ms).[12] Caroline Palmer demonstrated that tempo fluctuations were, at least in part, under the performers' voluntary control, since they were smaller in inexpressive performances than in expressive performances of the same piece, and they could be modified according to the performers' interpretation of the piece.[13] Amandine Penel and Caroline Drake refined these findings by showing that performers had more control over higher-level timing patterns, which involve phrases or larger sections of a piece, than over local timing patterns, which consist of rhythmic groupings comprising only a few notes.[14] More recently, Penel and Drake demonstrated that phrase-final lengthening could be accounted for partly by perceptual and motor constraints and partly by the musical

7 Caldwell, *Keyboard Music to c1750*.
8 Williams, *The Organ Music of J. S. Bach*, pp. 68–70.
9 Clarke, *Structure and Expression*; Gabrielsson, *Once Again: The Theme from Mozart's Piano Sonata in A major*; Palmer, *Mapping Musical Thought*; Repp, *Patterns of Expressive Timing*; Shaffer, *Performances of Chopin*.
10 Repp, *Diversity and Commonality*; Shaffer/Todd, *The Interpretive Component*; Todd, *A Model of Expressive Timing*.
11 Clarke, *Structure and Expression*; Clarke, *Generative Principles*; Palmer, *Mapping Musical Thought*; Palmer, *On the Assignment of Structure*; Repp, *Diversity and Commonality*; Repp, *Expressive Timing in Schumann's »Träumerei«*.
12 Clarke, *The Perception of Expressive Timing*.
13 Palmer, *Mapping Musical Thought*.
14 Penel/Drake, *Sources of Timing Variations*.

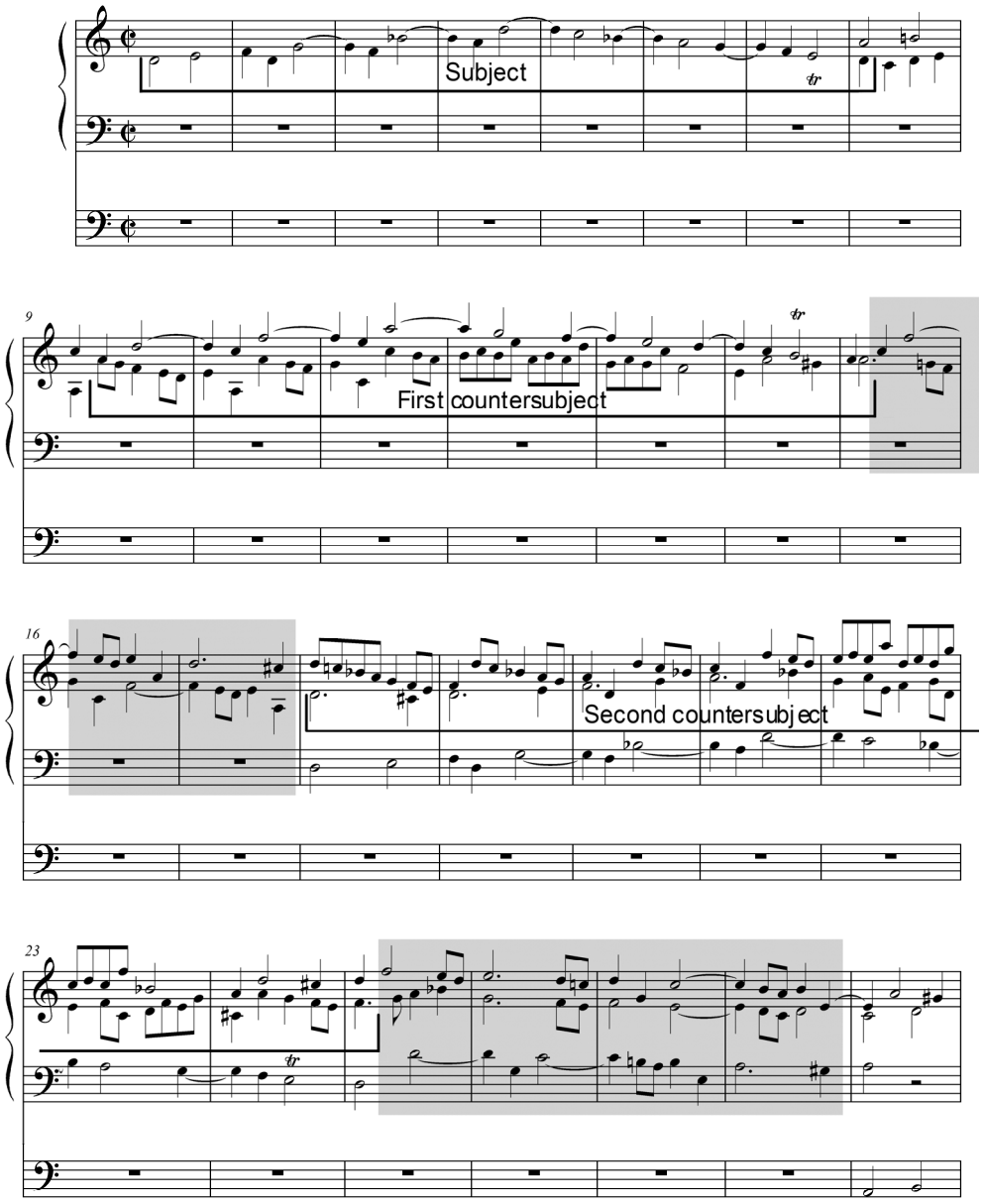

Figure 1: J.S. Bach, Fugue in D Minor, BWV 538 (»Dorian« fugue), mm. 1–29. Only the first appearance of the subject and of each countersubject is indicated. Grey areas correspond to codettas.

communication model.[15] While further research is necessary to fully elucidate the role of phrase-final lengthening in expressive performance, there is sufficient evidence to posit a clear relationship between the timing variations applied by performers and the formal structure of the piece. Furthermore, it may be surmised, following Palmer's observations, that different interpretations of a piece would be characterized by different timing patterns. The present study, which was based on these assumptions, focussed on the relationship between the temporal patterns employed by performers and their analytical readings of the Dorian fugue. The use of MIDI technology, which has enabled the quantitative analysis of performance parameters, allowed an objective description of the interpretive details associated with each performance.

Method

Sixteen organists (two female, fourteen male; aged 24–59 years) were invited to participate in the experiment. All performers were professional organists from the Montreal area or organ students at McGill University in Montreal. Nine of them had previously won one or more prizes at national or international organ competitions.

The choice of the piece was communicated to performers at least four weeks in advance. Most organists were already familiar with this piece. No directives were given regarding the interpretation. Each organist was asked to play two performances of the fugue. Immediately after their performances, the organists were invited to fill out a questionnaire and submit their own analyses of the piece, indicating its main formal subdivisions. The entire experiment lasted approximately one hour for each performer.

Performances were recorded on the Casavant organ of the Church of St. Andrew & St. Paul in Montreal, Quebec, Canada. This five-manual organ (five keyboards and a pedal board) was built in 1931, and the console was restored in 2000, at which time a MIDI system was installed by Solid State Organ Systems. All performances were recorded using the same registration, which was established in consultation with the performers.

The audio signal was recorded through two Boehringer ECM 8000 omnidirectional microphones. The audio and MIDI signals were sent to a PC computer through a MOTU audio interface. Audio and MIDI data were then recorded using Cakewalk's SONAR software and stored on a hard disc. The MIDI data from the performances were then matched to a symbolic representation of the score using a new matching algorithm that was specifically designed for this project. This matcher allows a precise note-to-note mapping of a performance note to a score note. Furthermore, it identifies errors and recognizes ornaments. The use of automated methods was necessary since the score of this fugue contains 2701 notes.

15 Penel/Drake, *Timing Variations in Music Performance*.

Results

Analytical readings of the Dorian fugue in the literature

Table 1 presents a detailed overview of the formal structure of the Dorian fugue. The main sections, as proposed by Williams, are indicated in Roman numerals, while recurring episodes are identified by letters, and cadences by the abbreviations PAC (for *perfect authentic cadence*) and IAC (for *imperfect authentic cadence*).[16] Williams notes that »each middle entry is preceded by a strong perfect cadence«[17]; he also lists the fugue's recurring canonic episodes (identified as »Episode A« in Table 1), some of which produce striking verticalities which have been said to »defy harmonic analysis«[18], as one of its unusual features. These episodes, whose material is derived from the codetta of the exposition (see Fig. 1), appear no less than 13 times in the fugue, each recurrence using different intervals of imitation. In addition to the association between cadences and subject entries noted by Williams, which underscores the role of cadences as sectional articulators, the exhaustive development of a motivic core presented in the opening measures, as well as the increasingly contrapuntally dense recurrences of the canonic episodes, all correspond neatly to Lester's model of heightening levels of activity in Bach's compositional process.[19]

According to some scholars, the Dorian fugue contains a clear example of a counter-exposition: thus, Paul Walker notes that »the four entries of alto (bar 43), soprano (57), tenor (71) and bass or pedal (81) can be said, by virtue of their entering in the same order as in the exposition but with exchanged starting notes, to constitute a counter-exposition«[20]; a similar observation had already been made by Ebenezer Prout.[21] Although Williams' analysis does not explicitly identify a counter-exposition, we may assume that he does not consider the entries in mm. 43, 57, 71, and 81 as middle entries; in any case, these entries are not preceded by perfect authentic cadences.

Performers' written analyses

On average, performers identified 7 formal boundaries (range: 3 to 16). A total of 21 different subdivisions were identified. Each of these boundaries was selected on average by 34% of the performers, with a percentage of agreement ranging from 93.8% (15 of 16 performers identifying a given measure as a boundary) to 6.3% (only one performer identifying a given measure as a boundary).[22] As can be seen in

16 Williams, *The Organ Music of J.S. Bach*, pp. 68–70.

17 Ibid., p. 70. It is likely that Williams does not treat the entries in mm. 43, 57, 71 and 81 as middle entries (see next paragraph).

18 Bullivant, *Fugue*, p. 104.

19 Lester, *Heightening Levels of Activity*.

20 Walker, *Counter-exposition*.

21 Prout, *Fugal Structure*, p. 148.

22 Boundaries marked within a range of two measures were considered to be the same; such variability was observed only for two boundaries (mm. 57–58 and 203–204), these markings were conflated together to measure 58 and 204 respectively. All other formal subdivisions were assigned to the same measure by all performers who indicated them.

Section	Measure number	Structural function	Cadence
I	1	Subject entry, alto (D minor)	
	8	Subject entry, soprano (A minor)	
	9		IAC D minor
	15	Codetta	
	18	Subject entry, tenor (D minor)	PAC D minor
	25	Codetta	
	29	Subject entry, pedal (A minor)	
	36	End of exposition; Episode A	
	43	Subject entry, alto (A minor)	
	49	Episode A (derived from the codetta)	
	57	Subject entry, soprano (D minor)	
	58		IAC D minor
	64	Episode B (chromatic sequence)	
	67	Episode A	
	71	Subject entry, tenor (A minor)	
	78	Episode A	
	81	Subject entry, pedal (D minor)	IAC D minor
	88	Episode A	IAC D minor
	92	Episode C (derived from Episode A)	
	95	Episode A	
II	101	Subject entry, stretto soprano / pedal (F major)	PAC F major
	108	Episode C'	
	111	Episode A	
	115	Subject entry, tenor (C major)	PAC C major
	124	Episode A	
	130	Subject entry, stretto alto / tenor (G minor)	PAC G minor
	138	Episode A	
	146	Subject entry, tenor (B flat major)	PAC B flat major
	152	Episode D (ascending chromatic)	
	156	Episode A	
	160	Episode E (scalar passages in contrary motion)	
	162	Episode A	
III	167	Subject entry, stretto pedal / alto (D minor)	PAC D minor
	175	Episode B	
	178	Episode A (with pedal trill)	
	188	Subject entry, soprano (A minor)	PAC A minor
	194	Episode D' (descending chromatic)	
	197	Episode E	
	203	Subject entry, stretto soprano / pedal (D minor)	PAC D minor
	204		IAC D minor
	211	Episode A	PAC D minor
	219	Dominant pedal in D minor; homophonic texture	
	222		PAC D minor

Table 1: Overview of the formal structure of the Dorian fugue. Sections labelled following Williams' analysis (*The Organ Music of J. S. Bach*). Episodes are identified by letters. IAC: imperfect authentic cadence; PAC: perfect authentic cadence.

Figure 2, the four subject entries in stretto on mm. 101, 130, 167, and 203 received the greatest agreement as structural boundaries; we note that m. 101 and 167 correspond to the beginning of sections I and II in Williams' reading of the piece. Approximately half of the performers also identified boundaries at mm. 36 (which corresponds to the end of the exposition), 81 (which corresponds to the last subject

entry of the counter-exposition according to Walker), and 188. A number of formal subdivisions were mentioned only by one or two performers: these generally corresponded to the beginning of episodic sections (m. 64, 88, 138, 162, 211) or to subject entries that were not preceded by cadences (m. 43 and 71).

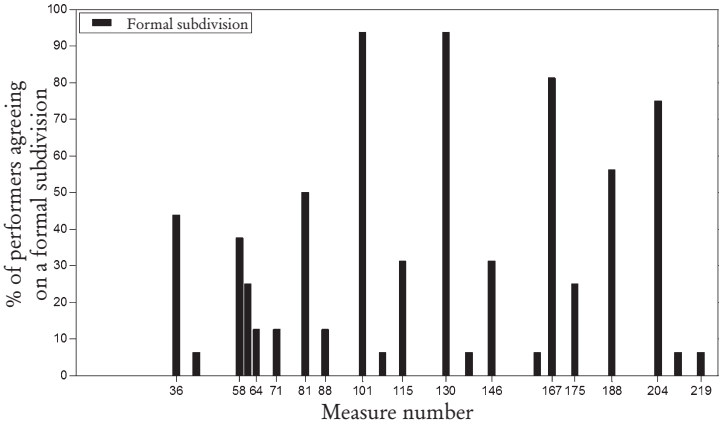

Figure 2: Performers' identifications of formal subdivisions in the Dorian fugue.

Comparing analysis and performance

General overview of the performances

Since each organist recorded two performances, a total of 32 performances were analyzed. Global tempi ranged from 41 to 61 beats per minute (BPM), with a mean global tempo of 52 BPM (the half note was taken as the beat since the piece is written in cut time). In comparison, Jesper Jerkert found tempi ranging from 52 to 64 BPM in CD recordings of the Dorian fugue from four internationally known organists.[23] The error rate (wrong notes or missing notes) was very low: the mean error rate (wrong notes and missing notes) across all performances was 0.44% (~12 wrong or missing notes out of 2701), and 31 of the 32 performances had less than 1% (~27) of errors. Performances were heavily ornamented: 7.6% of all performance notes were identified as ornamental for an average of 18 ornaments per performance (mostly trills).

Analysis of the temporal profiles of the performances

For each performance, the local tempo was computed for each quarter note. The quarter note was chosen as a unit since note onsets can be found on practically each quarter note beat throughout the piece, except for the first 8 measures. Temporal profiles were thus obtained for each performance. High correlations were observed

23 Jerkert, *Musical Articulation in the Organ*, p. 6.

between the temporal profiles, indicating a high degree of similarity among the temporal profiles of different performers. In order to examine general tendencies across performances, a »typical« temporal profile was generated by averaging local tempo values for each quarter note over all 32 performances (Fig. 3).

For the most part, the largest rallentandos coincided with authentic cadences (indicated by dotted lines in Figure 3). On the other hand, a number of important rallentandos corresponded to features that may not be considered by music theorists as main formal subdivisions of the piece (although some performers identified them as such), such as the recurrences of Episode A in mm. 78 and 138 or the dominant pedal in m. 219. The important rallentando observed at m. 196 could be related to the performers' phrasing of the scalar passages of episode E. However, considering that both hands have to skip an octave at the very beginning of m. 196 (the only passage in the fugue which presents such a difficulty), it is likely due in part to motor constraints (Fig. 4).

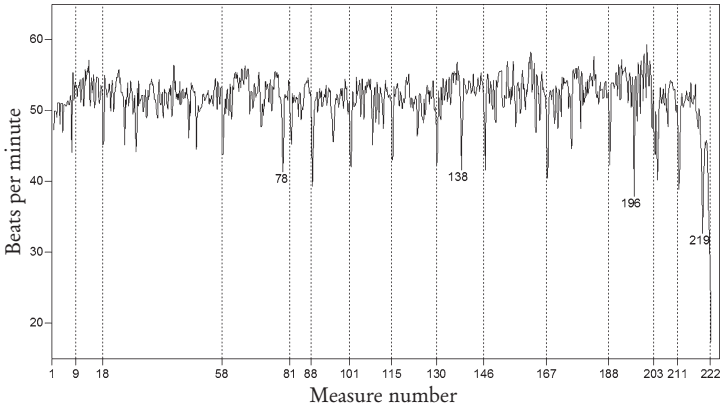

Figure 3: Average tempo profile for the performances of the Dorian fugue. Cadences are indicated by dotted lines (the cadence in m. 204 is not shown). Large temporal deviations that do not correspond to cadences are indicated by their measure number.

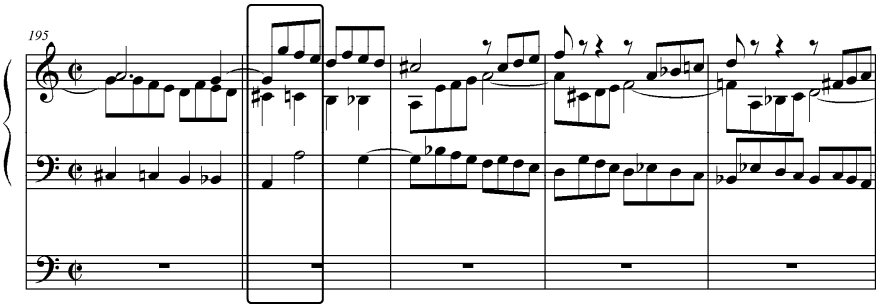

Figure 4: Dorian fugue, mm. 195–199. The boxed area corresponds to the octave skip in both hands.

In order to compare the relative importance of the rallentandos across different locations in the piece, we evaluated the magnitude of each rallentando as the relative difference in tempo between the inflexion points in the tempo curve, that is, from

the time the tempo began to slow down to where it begins to accelerate again. Thus, for each performance, rallentandos were identified by their beginning point and ending point at the quarter-note level. Since the beginning points and ending points of rallentando patterns did not necessarily coincide exactly for different performances, we chose to consider timing patterns at the level of the measure; this allowed for a more straightforward comparison between performances, while providing a one-to-one mapping with the measure numbers identified in the formal analyses. The largest rallentando for a given measure was defined as the rallentando with the largest tempo differential whose ending point was located within that measure. Figure 5 represents the average size of the largest rallentando observed for each measure across all performances, expressed in percentage of the initial tempo (the tempo at the first inflexion point of the tempo curve). Again, we observe that the largest rallentandos coincided with structural points such as cadences, although mm. 78, 138, 196, and 219 were also characterized by important tempo variations as previously seen.

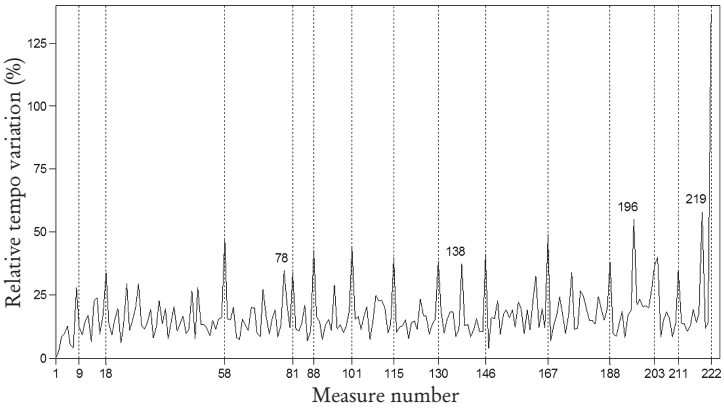

Figure 5: Average rallentando profile for the performances of the Dorian fugue. Cadences are indicated by dotted lines (the cadence in m. 204 is not shown). Large temporal deviations that do not correspond to cadences are indicated by their measure number.

Comparing individual analyses with tempo profiles

A direct comparison between the performers' analyses and their temporal profiles shows that most of the formal subdivisions identified by performers were associated with important tempo variations (Fig. 6). In fact, 14 of the 20 largest tempo variations identified corresponded to formal subdivisions identified by the organists, and two other (m. 203 and m. 163) were one measure away from formal boundaries identified by performers. Most of the formal subdivisions that were not characterized by important rallentandos (m. 36, 43, 61, 64, 71, 108) were also not named by a large number of performers. Incidentally, we note that, except for m. 36, none of these subdivisions coincided with a cadence or with a statement of Episode A, while 17 of the 20 largest tempo variations corresponded either to cadences or to statements of Episode A. A significant correlation was found between the proportion of performers who agreed on a formal subdivision and the magnitude of the tempo

variation associated with this formal subdivision (Spearman *rho* = 0.43, $p < .05$, df = 19), indicating that the more agreed-upon subdivisions, which were presumably the most structurally important ones in the minds of the majority of performers, were characterized by larger tempo variations.

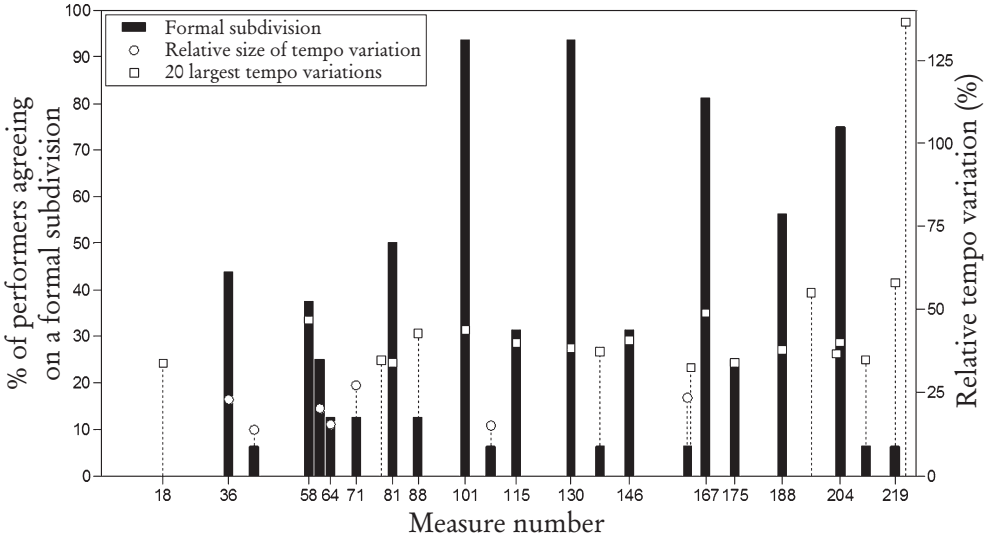

Figure 6: Comparison between the rallentando profiles and the formal subdivisions identified by performers. The relative size of the tempo variation associated with each formal subdivision is indicated by an open circle. The 20 largest tempo variations (including those which do not correspond to formal subdivisions) are indicated by open squares.

However, it is worth noting that a few of the larger rallentandos were *not* associated with a formal subdivision identified by the performers. For instance, measure 18 corresponds to a subject entry in the tenor, which is preceded by a strong authentic cadence in D minor. Even though performers were clearly reluctant to identify this as a formal subdivision in their written analyses, since it is located halfway through the exposition and only 18 measures into the piece, they emphasized this subject entry by a relatively large rallentando. As mentioned above, the large ritardando observed at m. 196 may correspond to a technical difficulty related to parallel octave skips in both hands; nonetheless, this upward registral shift may also have structural implications, which implies that the sudden tempo change may be brought about both by motor considerations and by an expressive intent on the part of performers.

A further question that we sought to address in this study was the extent to which analytical readings of the piece were related to the temporal profiles for individual performers. Given that performers were free to interpret or analyze the piece as they wished, it was difficult to assess directly whether a performer who identified a structural boundary emphasized it to a greater extent in his or her performances than a performer who did not. Nevertheless, this relationship could be examined indirectly by comparing the temporal deviations of performers who labelled a specific measure as a formal subdivision to those of performers who did not. In order to conduct meaningful comparisons, these analyses were conducted

only on formal subdivisions for which there was a substantial degree of disagreement (i.e., between 20% and 80% of performers indicated a subdivision), so that a minimum of four performers either did or did not identify a given measure as a formal subdivision. These subdivisions corresponded to mm. 36, 58, 61, 81, 115, 146, 175, 188, and 204 (see Figure 6). Statistical analyses (t-tests) conducted for each of the subdivisions listed above showed that no significant difference was found in the average size of the rallentandos between the performers who analyzed a section as a boundary and those who did not.

Discussion

The results presented here illustrate that there was a good agreement between the formal subdivisions indicated by organists in their written analyses and the temporal profiles observed in their performances. Cadences and recurrences of Episode A were highlighted by large variations in tempo, whereas other formal elements identified by performers, mostly those that did not correspond to cadences or to statements of Episode A, were not emphasized by means of temporal variations.

The present study did not establish an unequivocal correlation between individual organists' written analyses and the temporal profiles of their performances, even though a significant correlation was found between the level of agreement on a formal subdivision and the local tempo variations associated with this subdivision averaged across all performances. This may be because performers viewed the written analysis as a separate task from the performance. Indeed, although we have shown that the temporal profiles were clearly informed by the structure of the piece, it does not necessary follow that each performer's written analysis of the piece corresponds to his or her performance. It is likely that most performers felt compelled to indicate formal subdivisions that corresponded to what they were taught in music analysis courses, rather than what they felt was specific to the Dorian fugue. A case in point is the contrast between the importance given to measure 36, which corresponds to the end of the exposition (traditionally seen as an important formal subdivision in fugal forms), in the written assessments, and the absence of an important tempo variation associated with this measure in most performers' temporal profiles. Conversely, most performers refrained from labelling recurrences of episodes as important formal subdivisions, presumably because episodes are generally not considered to be structural boundaries in traditional fugal analysis; yet, several performers clearly emphasized the return of Episode A through important tempo variations in their performances. Indeed, music-theoretical analysis is often seen as a rigorous and prescriptive exercise, where there is little margin for individuality, and performers may have felt compelled to produce an analysis that conformed to academic standards. On the other hand, although performance may well be regulated by expectations and norms, it represents a more convenient vehicle for the expression of individual interpretations. To simplify, we may say that whereas performers sought to analyze a particular piece, in this case the Dorian fugue, in conformity to a »formal archetype« of the fugue in their written analyses, they strove to highlight the unique and striking features of this piece in their performances.

Although one goal of the present study was to gain insight into the performers' individual interpretations of the formal structure of the piece, it appears that the methodology used here encouraged conformity to an academic model of analysis. The relationship between analysis and performance should perhaps be investigated by means of a different strategy: for instance, by asking performers to indicate formal subdivisions while listening to a recording of the piece, unwanted associations with written analysis, and its concomitant norms and expectations, could be avoided.[24] Indeed, an in-depth investigation of the relationship between analysis and performance should aim to obtain a performer's representation of a piece's structural hierarchy, which is unmediated by verbal processes, with the intent of comparing this representation to its actual musical realization.

While methodological improvements may be required, we believe that the experimental procedure outlined in this article represents a fruitful paradigm for the investigation of the relationships between analysis and performance, which could potentially be applied to the study of other expressive parameters, such as articulation and dynamics, as well as other levels of musical structure, for instance phrases, themes, or motives, and finally to other musical genres.

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24 See Cook, *Analysing Performance*, pp. 250–252, for a discussion of the role of the verbal and written tradition in the relationship between music analysis and performance.

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