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Performance analysis and Chopin's mazurkas

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• **ABSTRACT**

Reporting on work carried out in conjunction with Andrew Earis and Craig Sapp, this paper introduces recently developed approaches to the analysis of recorded music, illustrating them in terms of selected Chopin mazurkas. Topics covered include the stylistic characterisation and aesthetic values of Paderewski's playing of Op. 17 No. 4, contrasted with performances from the last quarter of the twentieth century, as well as relationships between different pianists' interpretations of Op. 68 No. 3. A possible performance genealogy of performances of the latter is proposed, in which recordings by Rubinstein and Cortot play a key role, while clustering based on Pearson correlation of tempo data yields relationships supported in one instance by documented teacher/pupil relationships. Representing the early outcomes of a more extended research project, these findings are encouraging in that it appears possible to draw meaningful conclusions from the consideration only of tempo data. The current phase of the project is also working with rhythmic and dynamic data, which should significantly enhance the potential for objective modelling of musically meaningful relationships.

This is an early report[1] on a project currently being undertaken under the auspices of CHARM, the AHRC Research Centre for the History and Analysis of Recorded Music (based at Royal Holloway, University of London). The project is a collaboration between Craig Sapp, Andrew Earis, and myself, and involves the development and application of computational methods for analysing what is becoming a large corpus of recordings of Chopin's mazurkas, dating from 1912 to the present day. At the time of writing we have about 1 700 individual mazurka performances, including 30 complete sets as well as many selections and individual mazurkas; it is evidence of the extraordinarily wide dissemination of even quite

(1) This paper was presented at the "Chopin in Paris: the 1830s' conference organized by the Narodow Instytut Fryderyka Chopina (Warsaw, 29 November-2 December 2006), and will appear in the conference proceedings. It is published here by kind permission of the Narodowy Institut Fryderyka Chopina.

obscure recordings today that the vast majority of these have been taken from commercial, though often hard to source, CDs. The purpose of this paper is to provide a snapshot of the work that has been done to date and of what is planned; the fact that the work is at a relatively early stage means that the primary focus is on working methods rather than substantive musicological conclusions, though I hope to hint at some of those as well.

The project has a number of related aims, of which the broadest might be described as knowledge transfer. We are making use of techniques and approaches developed within computer science, but most of these have already been assimilated within the subdiscipline of computational (empirical, systematic, cognitive) musicology: the knowledge transfer to which I refer is from this specialist subdiscipline to mainstream musicology. A central aim of the Mazurkas project, then, is to illustrate how computational techniques can help to provide answers to mainstream musicological questions, and to open up questions which do not figure strongly on the mainstream musicological agenda but arguably should. A prime example of the latter is the study of music as performance, and indeed the rationale for the establishment of CHARM is the need to place the study of music as performance at the heart of a discipline which has historically treated music as primarily a form of writing, an obscure form of literature. There are practical reasons why musicology has been oriented more towards the visible than the audible manifestations of its subject matter: it is only recently that serious work has begun on providing the kind of finding aids for recordings that have long been taken for granted in score-based musicology (CHARM is itself running a major on-line discographical project), and more recently still that computer-based environments have been developed which make it possible to navigate and browse recordings with anything approaching the flexibility that you take for granted in studying a score. (I shall illustrate one such environment in this paper.) But there are also conceptual barriers to the development of a musicology of performance, and the Mazurkas project is intended to address these too.

In one sense the study of music as performance is part and parcel of the shift within musicology as a whole towards reception history; performance is self-evidently a form of interpretation, in just the same way as are critical or historical writing about music, iconographic representations, or TV and film adaptations. Musical performance studies can in other words be seen an expression of interest in the social usage of music, and in the meaning that is created in the act of performance. But there is also a sense in which a musicology of recordings entails what in another context (Cook, forthcoming) I have called changing the musical object. In saying this I am referring to the difference between working on notated and acoustic texts, but I am also referring to something else: the concept of the musical work that informs such study. Dominant musicological approaches treat performance as in effect a supplement to the notated work, with the latter being conceived as the embodiment of the composer's authority. (It is hardly necessary to

point out that Chopin's music is particularly resistant to the idea of the definitive musical text on which such approaches are based: see Kallberg, 1996, chapter 7.) Translated into the language of music theory, this results in analysis that asks how the structure embodied in the score is, or should be, translated into performance, how performers project, express, or exceptionally subvert structure. This «page to stage» approach, as drama theorists put it, seeks in effect to understand a given performance (recorded or otherwise) as a direct response to the score, in what one might term a vertical relationship comparable with the vertical dimension of philological stemmata. In each case this dimension represents a flow of authority, though I will not pursue that point here.

But in the real world, of course, performers forge their interpretations — and listeners hear them — just as much in response to other performers' interpretations. It follows from this that a well developed musicology of performance must concern itself as much with the horizontal as the vertical dimension within which performances signify. It must concern itself, that is, with comparison, focussing analysis on the network of relationships between different performances and not — or at least not just — on the relationship of each performance to the score. This idea of a comparative musicology may have a distinctly retrospective ring. And it doesn't stop there, because analysing performances other than through the mediation of the score entails reviving and repurposing an idea which was central to musicology in the first half of the twentieth century but subsequently marginalised: that of style analysis. The mid-century turn away from style analysis, and more generally from comparative musicology, was a reaction against the perceived colonialist or imperialist associations of comparative musicology, and more particularly the racialist appropriations of style analysis on the part of Nazi (or Nazi-influenced) musicologists: the result was an insistence on context almost to the exclusion of any other considerations, expressed in the one case through the replacement of comparative musicology by ethnomusicology, and in the other by structural analysis.[2] (For the ethnomusicologists the only valid context of interpretation was the individual cultural community; for the structural analysts it was the individual musical work.) It follows that a fully fledged musicology of performance can hardly develop without some rehabilitation of not just the methods but the concept of style analysis. That goes far beyond anything I can deliver in this paper, but it establishes a direction for the work I shall describe.

The funded stage of the Mazurkas project lasts two years and the first year was mainly taken up with technical development, including software to capture timing and dynamic information (both down to single-note level), and the establishing of the necessary data structures and work routines to support the research. The first stage in the development of the data capture software enabled us to extract the timings of beats (and hence of what is generally called tempo, but I shall come back

(2) For a fuller version of this argument see Cook (2006).

to that); this forms the basis of all the work which I shall present in this paper, but we are now moving on to the analysis of rhythmic and dynamic information.

Essential to any kind of working routine for performance analysis is what I referred to as the ability to navigate and browse recordings - to move backwards and forwards in them, to locate a specific point and compare it with the same point in other recordings, and to incorporate within this working environment such other analytical annotations or representations as will support close observation of the acoustic text. We use *Sonic Visualiser* for this purpose: a sound navigation and visualisation program developed within the last year at the Centre for Digital Music, Queen Mary, University of London (with some input from CHARM).[3] As Figure 1 shows, *Sonic Visualiser* uses the familiar — and not particularly informative — waveform representation, but enables you to add a number of significant navigational features, including piano roll score notation together with bar lines and numbers. You can also incorporate the again familiar tempo graph in which (in this case) higher means faster and lower means slower; widespread in the developing literature of performance analysis, such graphs have always suffered from the problem that it is difficult to match them to the experience of listening to the music — a problem which *Sonic Visualiser* overcomes, because the entire representation scrolls as the music plays. (*Sonic Visualiser* also provides a wide range of other facilities ranging from annotation to spectrographic analysis, but the features shown in Figure 1 are the essential ones for working with piano music.) In addition to the standard playback controls you can navigate by dragging the waveform forwards or backwards against the vertical cursor, and the box over the small waveform at the bottom (which you can also drag) shows where you are in the complete soundfile. Since you can run multiple copies of *Sonic Visualiser*, you can work with different recordings in different windows.

Figure 1 actually shows the beginning of Vladimir Ashkenazy's 1975 recording of the Mazurka Op. 17 No. 4, alphabetically the first of the 30 recordings for which we currently have data.[4] His deep rallentando through bar 3 and effectively unmeasured pause on the second beat of bar 4 is typical of the performances of this Mazurka evidenced by our collection: the point that this is a premonition of the end of the piece is not lost on anybody. What is not typical is the way in which, instead of setting the main tempo at bar 5, the beginning of the Mazurka proper, Ashkenazy gradually picks up speed, reaching his main tempo only during the course of bar 6. And what lends significance to this is that Ashkenazy does it quite consistently in linking different sections: Figure 2, for example, shows how he links the A and C

(3) http://sonicvisualiser.org/; training materials for musicological purposes (which explain how to generate the features shown in Figure 1) are available at www.charm.rhul.ac.uk/content/svtraining/gettingstarted.html.

(4) Establishing recording or first release dates is not always straightforward and dates cited are approximate.

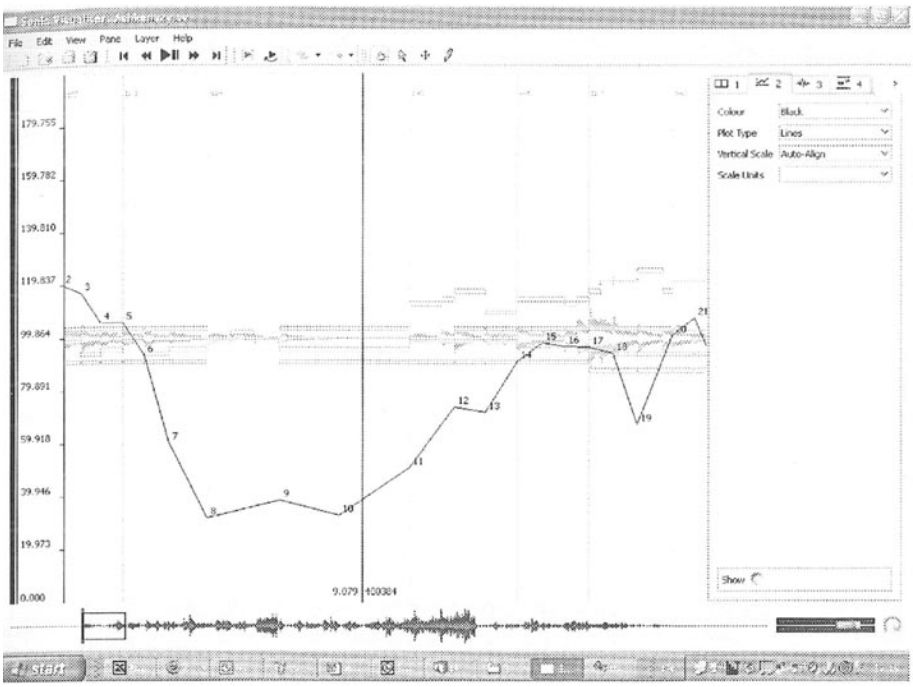

Figure 1.

Ashkenazy, recording of Op. 17 No. 4 (1975), bars 2-8 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig1.mp3).

sections around bar 61. (Figure 3 shows how I am labelling the sections.) This consistent practice amounts to a strategy, one imagines consciously pursued, for overcoming what might be seen as a key performance problem posed by Op. 17 No. 4: the lack of coherence that can result from the very disjunct series of phrases of which the mazurka consists. Of course the same might be said of any of the earlier mazurkas. But the tenderly expressive, introspective character of this mazurka in particular — a quality which one might or might not wish to ascribe to the music as composed, but which seems universal in the music as performed during the age of recording — mandates very marked rallentandi at every transition between sections, meaning that the problem of coherence is more pressing in this mazurka than in most. Ashkenazy's strategy for linking sections is a solution to this problem because by overlapping the section break the rallentando-accelerando sews the sections together, while at the same time allowing the realization in full of the expressive potential of the formal cadence.

Ignacy Jan Paderewski's 1912 recording of the same transition, by contrast, also realizes the music's expressive potential — it is almost as if measured, musical time stops — but, as Figure 4 shows, he picks up tempo for the C section without any

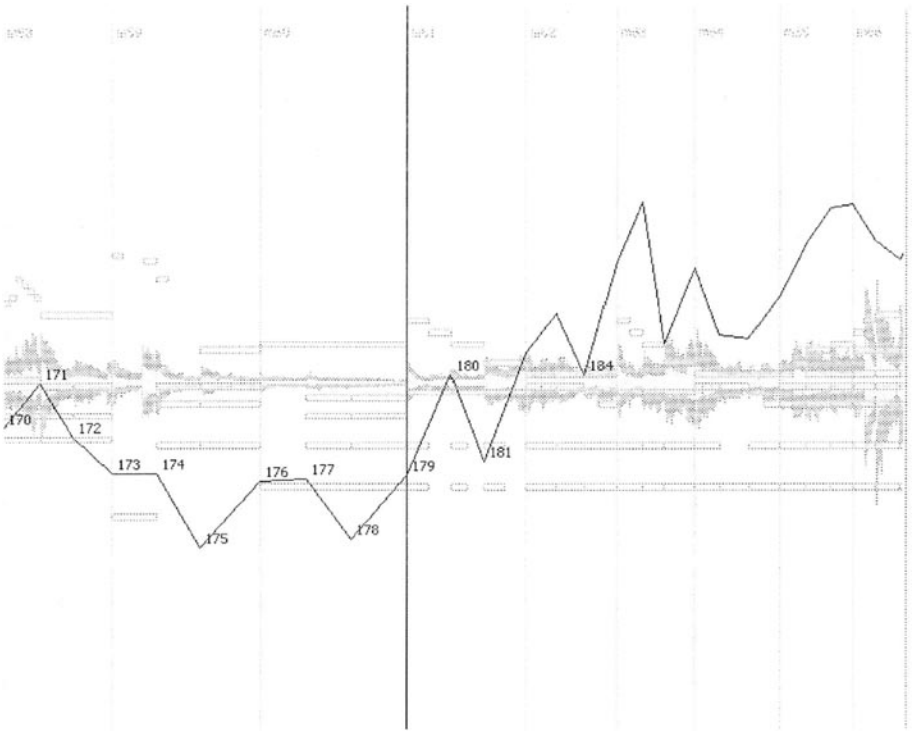

Figure 2.

Ashkenazy, recording of Op. 17 No. 4 (1975), bars 58-66 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig2.mp3).

attempt at a transition, and he does the same elsewhere. No solution for Ashkenazy's problem of coherence is offered, but I would argue that this is because for Paderewski there is no such problem in the first place. One reason for this is no doubt that Paderewski's tempo is so much faster than Ashkenazy's or indeed anyone else's. (That, by the way, is a very obvious feature which tempo graphs can lead one to overlook.) There is an almost universal trend for mazurka performance to slow down during the age of recording, and Op. 17 No. 4 is no exception (Figure 5);[5] it stands to reason that the slower you play a strongly sectional piece of music, the harder you have to work to ensure continuity across sections. But I would claim that there is also an aesthetic issue here, or even an ontological one, and I shall attempt to make the case by comparing some other aspects of Paderewski's playing of Op. 17 No. 4 with that of more recent pianists.

(5) It should be noted that duration, and hence tempo, figures for 78rpm discs (in particular) are approximate, since neither speed of revolution nor tuning were standardised. But the possible inaccuracy is not sufficient to affect the argument.

1	Introduction	A minor
5	A	
13	A'	
21	A	
29	A'	
37	B	
45	A	
53	A'	
61	C	A major
69	C'	
77	C	
85	C'	
93	A	A minor
101	A'	
109	D	
117	D	
126	Coda	

Figure 3.
Op. 17 No. 4, sectional designations.

While the developing analytical literature on performance tends to focus on issues of structural interpretation, often on a relatively large scale, there is a strong argument that large-scale structure is to a high degree hard-wired into music as composed, and that the performer's ability to generate musical meaning depends much more on the handling of details. (Another way of saying this is that the analytical literature on performance reflects the agenda of score-based analysis rather than that of performance.) Certainly there are striking differences between the ways in which different performers handle the embellishments so characteristic of Op. 17 No. 4, and we can take bar 31 as a representative example, considering a number of recordings in reverse chronological order. Charles Rosen and Fou Ts'ong, whose recordings respectively date from (around) 1989 and 1978, represent the virtuosic option: the little notes are fitted in effortlessly, without deflecting the tempo. Ashkenazy's 1975 recording (Figure 6) adopts a strategy rather similar to the one he uses for linking sections: he takes the last beat of bar 30 and the first of bar 31 slowly, enabling him to extract expressive charge from the first few grace notes, but then accelerates strongly, completing the fioratura with as much virtuosity as Ts'ong or Rosen. By contrast, both Cortot (1951) and Paderewski do the opposite: they begin bar 31 at the prevailing speed, but slow down so that the third beat becomes massively prolonged. (Figure 7 shows Paderewski's performance.) The effect is not just of bringing out expressive meaning, but of a kind of causality: the little notes at the musical surface progressively impact the tempo. Whereas Ts'ong's and Rosen's performances of this bar construct tempo as an essentially inflexible framework, a

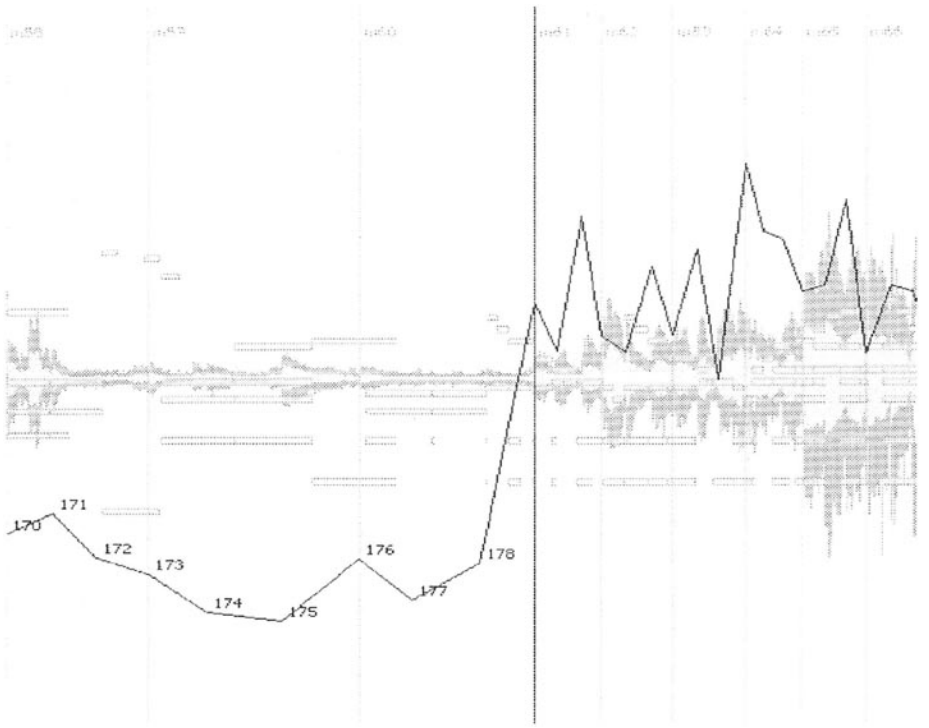

Figure 4.

Paderewski, recording of Op. 17 No. 4 (1912), bars 58-66 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig4.mp3).

pre-existing medium independent of what may be contained within it, for Cortot and Paderewski it is as if the tempo is wrapped round the content of the music and takes its shape: here the medium is the message. To put it more succinctly, the relationship of temporal frame and content is top-down in Rosen and Ts'ong but bottom-up in Cortot and Paderewski.

A rather similar point can be made regarding the grace notes in bars 118, 120, and 122 (what I have called the D section, although there is a sense in which the whole of bars 109-133 is a coda). More recent performers (Rosen is a good example) again fit in the grace notes cleanly and effortlessly, without deflecting the tempo. Paderewski, helped by his faster basic tempo, adds value to this passage: as the intervals following the a^2 increase from diminished to perfect twelfth and then to minor thirteenth, so Paderewski progressively prolongs the a^2. He translates the increasing physical distance to be traversed across the keyboard into timing. It is not just that the tempo is wrapped round the content, as I said of bar 31. It is also that the music is projected less as a sonic object to be generated by means of the modern

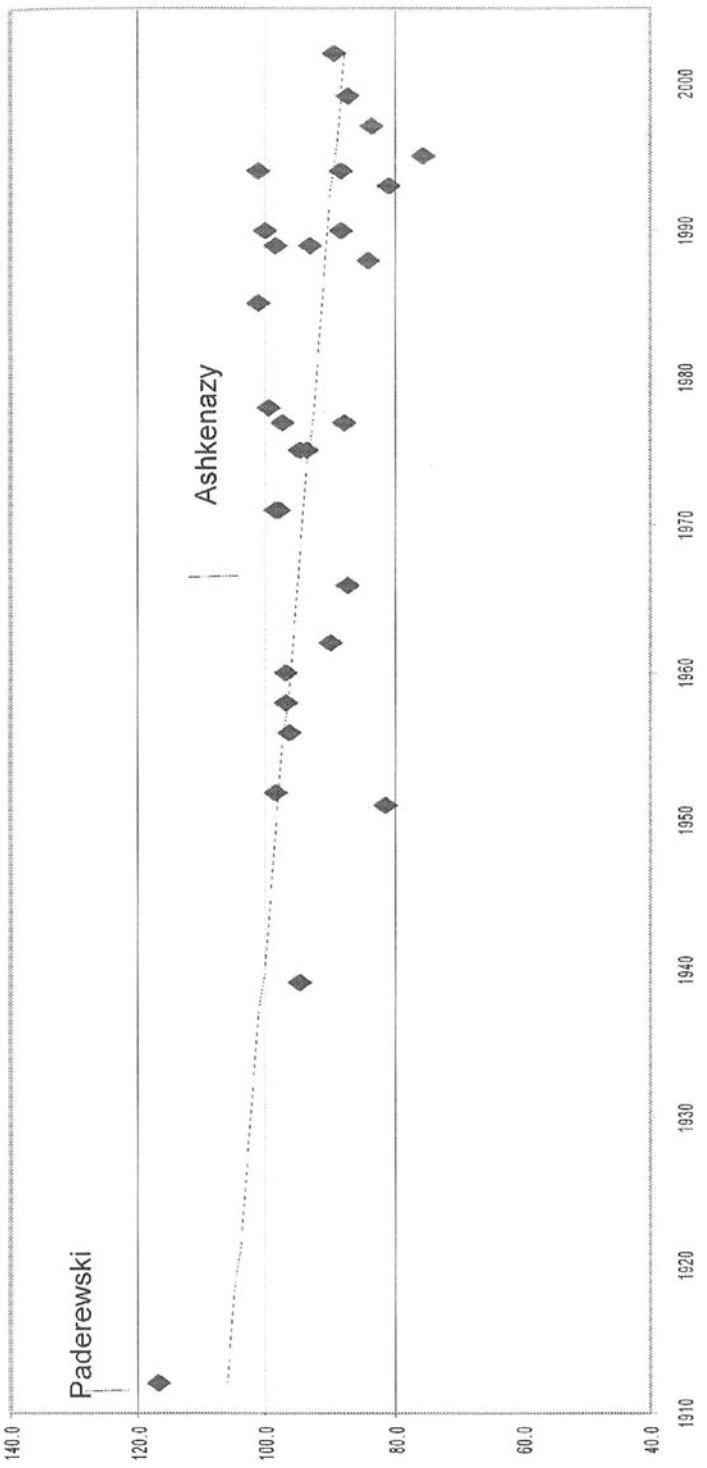

Figure 5.
Average tempi in recordings of Op. 17 No. 4.

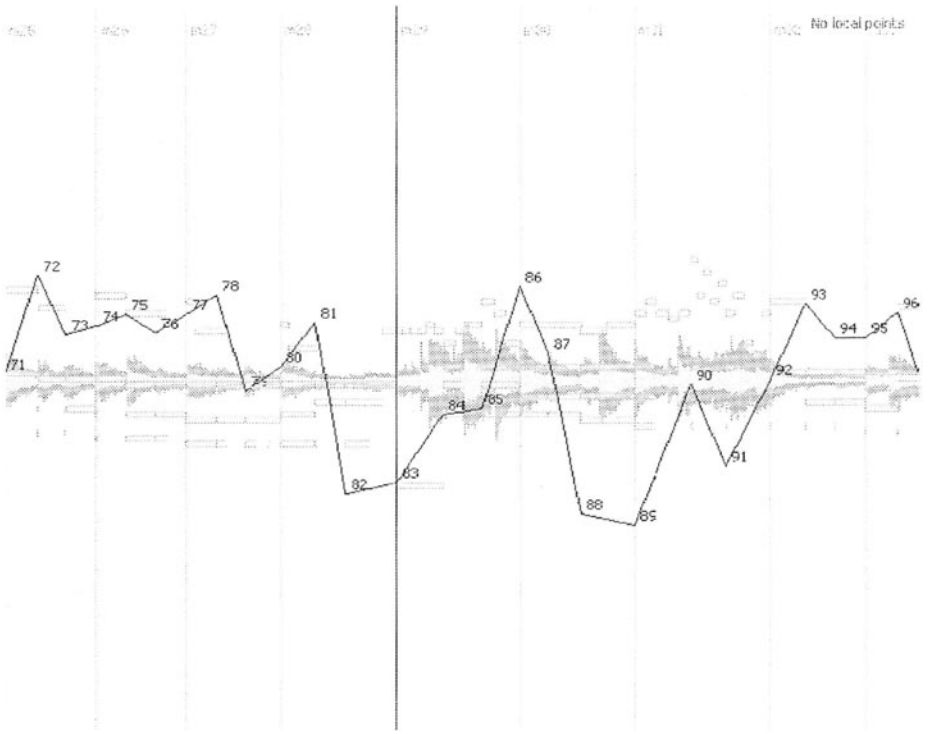

Figure 6.

Ashkenazy, recording of Op. 17 No. 4 (1975), bars 25-33 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig6.mp3).

all-purpose piano technique, and more as an embodied act, an event taking place at a particular time and place of which the sound on the recording is the trace. Coupled to the rapid tempo, light articulation, and dry sound of the piano (in part perhaps an artefact of the acoustic recording process), the effect is to generate an intimate space, to reduce the experienced distance between performer and listener.

The point can be made by comparing the ways in which Ts'ong and Paderewski play the climax in bars 91-2. The slower tempo and more resonant acoustic which Ts'ong's recording shares with most others from the later twentieth century is sufficient in itself to denote the larger space of the modern concert hall and the concomitant separation between performer and audience, and Ts'ong's performance of the climax completes the effect: it has a swagger and rhetorical boldness, a sense of drama, that is at home in the modern concert hall but that would be an intrusion in, say, a domestic setting. That is not the case of Paderewski's comparatively understated performance, which might be heard as substituting a quality of nostalgia for Ts'ong's drama. (It is easy to hear the tradition of the salon in Paderewski's

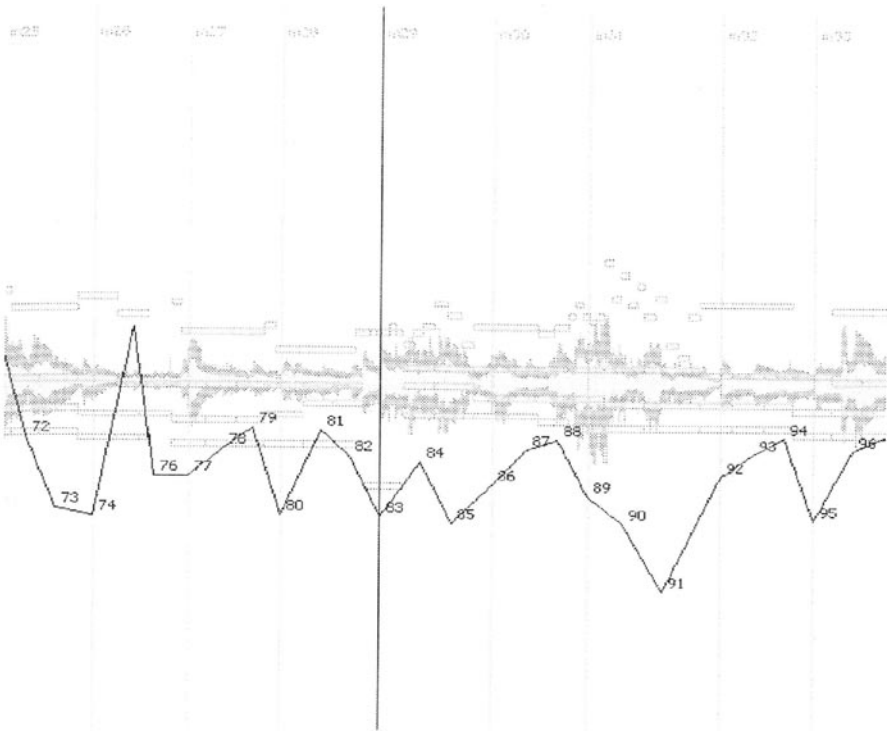

Figure 7.
Paderewski, recording of Op. 17 No. 4 (1912), bars 25-33 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig7.mp3).

playing, whether there are historical grounds for saying this or not.) And, to bring this argument back to its starting point, my claim is that the problem of coherence which Paderewski does not recognise is created by the extended hearing lines, so to speak, of the modern concert hall and all the features of performance practice that come with it: slower tempi, dramatic rhetoric, and the rest. When the performer is so far removed from the listener, coherence no longer subsists so strongly in the event, in the sense of community and shared temporality through which (in Alfred Schutz's memorable words) «performer and listener [...] are growing older together while the musical process lasts» (Schutz, 1974, pp. 174-5). Instead it has to be conveyed or constructed purely through the medium of sound: trace of event gives way to construction of a sonic object. And if the problem of coherence — the problem on which the modern discipline of music analysis was built — was in part a product of the modern concert hall, it was redoubled by the development of recording technologies that effectively divorced sound from event. The recordings of Paderewski, whose pianistic style was moulded in the last years of the nineteenth century, provide a glimpse of how music was performed before the age of recording.

Have I so far said anything that could not have been said on the basis of close listening with a CD player? Possibly not, but it would have been far harder that way. For reasons that I have already explained, the qualities of individual performances emerge from the act of comparing them with others, and the CD player does not allow you to do close comparative listening. Again, the on-screen tempo graph may not exactly lead you to hear things you otherwise wouldn't (you might be suspicious if it did), but it can certainly refine and stabilize your perceptions, as well as providing a means of communicating them to others. And in any case, academic disciplines depend not so much on what one *can* do in principle, but on what one can *conveniently* do in practice, and the environment illustrated in the examples so far turns close observation of recordings into an everyday working method. At the same time, extracting beat information does open up quite new possibilities of working with a corpus of recordings, and I can introduce these possibilities by asking one of the most obvious questions for our project.

Figure 8 shows the beginning of the C section of the Mazurka Op. 17 No. 4 from Charles Rosen's 1989 recording. The section begins at bar 61, and Rosen's playing of the next few bars represents a textbook example of how to play a mazurka. It is often said that the mazurka rhythm involves emphasizing the second beat, but in terms of agogic accentuation this is not necessarily the case: although Rosen makes his second beats substantially longer than the third in bars 62 and 64-6, they are more or less equal in bars 61 and 63, and there are performers whose mazurka rhythms consistently make the third beat longer than the second. (An example is Ignaz Friedman in his 1930 performance of Op. 67 No. 4.) It would be more accurate, then, to define mazurka rhythm in terms of the abbreviation of the first beat — a formulation which immediately suggests that it should be thought of not so much as a rhythm, but rather as a relationship between rhythmic events and a metrical framework against which they are dislocated. It is evident from this that the term «mazurka rhythm» is an over-simplification of a more complex reality, and I have no doubt that dynamic emphasis and articulation also play an essential role in defining mazurka style. Nevertheless the simple definition of mazurka rhythm in terms of the abbreviation of the first beat will suffice to make a further salient observation.

Nobody plays in mazurka rhythm throughout; there are other factors governing performers' shaping of time, such as the rallentando by which Rosen signals the end of the B section in bars 59-60 of Figure 8. (The tempo graph does not lie: you almost have the impression that he flicks a switch at bar 61.) Figure 9, which has been generated directly from the beat data for Op. 17 No. 4, makes the point. In the upper chart, each small square represents one bar of the music on the horizontal axis, and one recording on the vertical axis (there are 30 recordings, of which Rosen's is the twenty-second down; the bottom row represents the average of all these recordings). The square is blue when the first beat is more than 5% longer than either of the other beats, red when it is correspondingly shorter, and white when the values are more or less equal (which is not often the case). In short, red squares mean

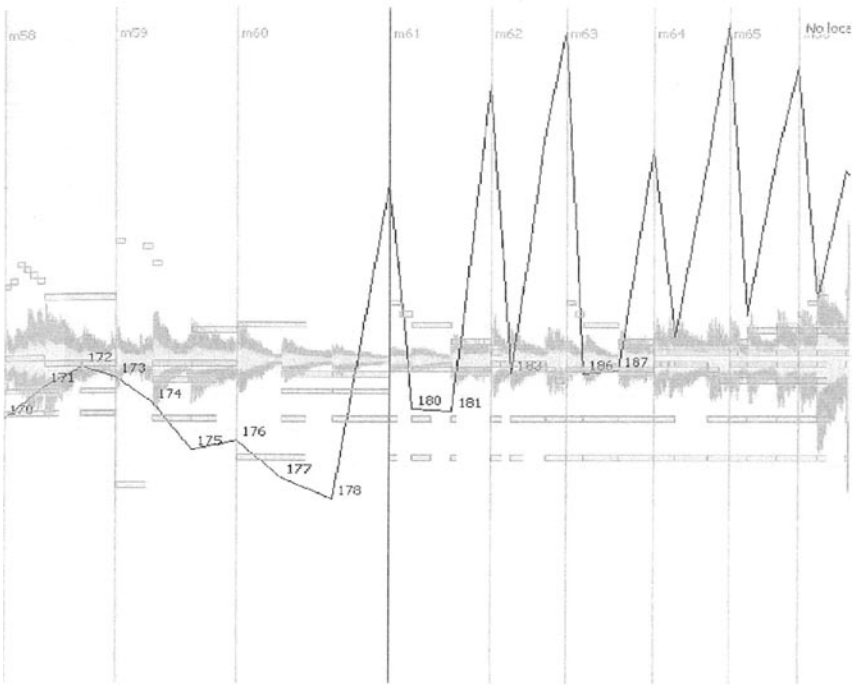

Figure 8.

Rosen, recording of Op. 17 No. 4 (1989), bars 58-66 (www.charm.rhul.ac.uk/content/resources/ms1/cook.fig8.mp3).

that performers are playing in mazurka rhythm, as I have defined it, while the other squares mean they are not. Out of the 133 bars of Op. 17 No. 4, there are just nine which everybody plays the same way, eight of these being in mazurka rhythm. But there are clear patterns, and these become clearer in the lower chart, which represents the same data as the upper one, only in smoothed form. Most obvious is the band of red that coincides with the appearance of B in bar 37: this is the only place where everybody plays two successive bars the same (three in the case of every pianist but one). Everybody, that is to say, gives this section a strong mazurka characterization, though the effect becomes weaker as the section progresses. This suggests that mazurka rhythm is being used rather as themes are used in sonata and other through-composed music, to characterize the onset of a new section and so underscore what might be termed formal downbeats — in other words, that it has a semiotic function. There is some tendency in the lower chart for bands of red to occur every four bars, suggesting that something similar also happens at phrase level.

As for the other sections, D is played predominantly, and C sometimes, in mazurka rhythm. But in general A is not played in mazurka rhythm; the purest bands of blue are found in A sections. This may come as no surprise. Jim

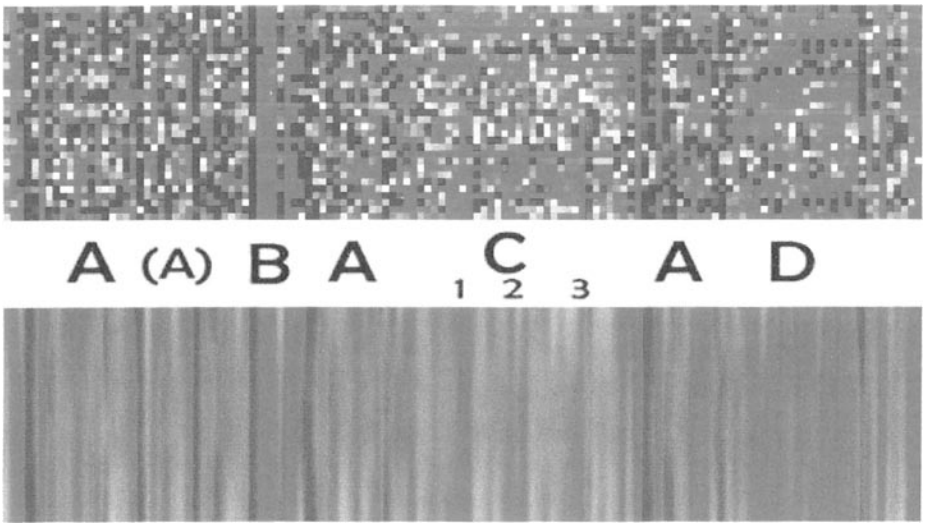

Figure 9.
Performances of mazurka rhythm in Op. 17 No. 4.

Samson (1996, p. 117) writes of Op. 17 No. 4 that the ornamental melodic style of A is «so seldom found in the mazurkas that we might be tempted to question the genre. Here we have an early instance in Chopin of generic interpenetration.» Figure 9 clearly indicates that, for the community of pianists, the sense that A is not mazurka-like extends to its rhythmic identity: in this way the generic interpenetration which Samson ascribes to the score more or less corresponds to the interpenetration of playing styles inscribed in the recorded evidence. But the «more or less» should not be overlooked. The upper part of Figure 9 shows that there is substantial room for interpretation, that what is in terms of the score the same music may be played in mazurka style, or it may not — which is to say that very different music may be created out of the same notation. Is mazurka style then a product of composition or of performance? I can't answer this question properly, but I think I know what shape a proper answer would take: mazurka style subsists in a potential that is inscribed to a greater or lesser degree in the notation (for example in terms of the dislocation between rhythm and metre to which I referred), and which in performance may be realized to a greater or lesser degree, and not necessarily in predictable ways. In short, it is co-determined by composer and performer.

Actually that applies to all music in performance, and the same point is illustrated in a different way by the Mazurka Op. 68 No. 3. Again we can start with a performance problem: the relationship between the outer sections, which improbably combine the qualities of mazurka and march, and the folkloristic *Poco più vivo* section. Adrian Thomas (1992, p. 155) writes that the *Poco più vivo* section

«betrays its unadorned oberek origins with an insouciant ease», and what one might term the unmediated nature of the folkloristic reference is enough in itself to create problems from a traditional aesthetic stance. Quite how that translates into terms of performance is not so obvious (do you play it less as music than as an evocation of music, and how would you recognize that in a tempo graph?), but there is a more basic problem of interpretation. For most performers the folkloristic material demands to be taken much faster than the outer sections (Chopin's tempo direction is a gross understatement of twentieth-century performance practice), but the faster you take it, the more unbalanced the relationship between the sections becomes: 32 plus 16 bars for the outer sections, 12 for the *Poco più vivo* section. The problem is at its most obvious when the sections are played at very different tempi but at a relatively constant tempo within each section: the tempo graph at the bottom of Figure 10 shows that Idil Biret, whose recording appeared in 1990, takes the outer sections at below 90 MM, with the pause at bar 24 marking the only major inflection, but the *Poco più vivo* section at an average tempo of well over 200 MM. (The faint line in the tempo graph is the average of all the performances for which we have data.) This gives rise to the following strange proportions: first section, 67 seconds; *Poco più vivo* section, under 11 seconds; final section, 37 seconds.

The triangular chart at the top of Figure 10 is what we call a «timescape» (by analogy with the «keyscapes» which Sapp developed in the course of his doctoral research). It represents exactly the same data as in the tempo graph below it, but in a different manner. On both the horizontal and vertical axes there are as many data points as there are beats in the piece, coloured according to whether they are shorter than, equal to, or longer than the average. The horizontal dimension represents time, as the alignment with the tempo graph indicates, but on the vertical dimension each data point is the average of the two adjacent data points on the row below, with red representing faster and blue representing slower tempi. (Average tempi are green, which by definition is the colour of the very top data point in the triangle, since that represents the average tempo of the entire piece.) The extent to which tempi visible at the musical surface (the bottom edge of the triangle) persist upwards within the triangle provides a measure of the extent to which they dominate the various sections of the music.

In Figure 10 the timescape actually provides very little information that is not evident from the tempo graph: the outer sections are below average tempo while the *Poco più vivo* section is above average tempo, and there is very little transition between it and the outer sections, so that average tempi emerge only as a result of the calculations. (That is to say, at no point does Biret play at the overall average speed of her performance, which is 110 MM.) But timescapes become much more informative when you compare different performances, and Figure 11, based on Artur Rubinstein's 1966 recording, provides a very different picture. Here there is much less of a slow-fast-slow conception than in Biret: the red coloration of the *Poco più vivo* section does not extend upwards nearly as far as in Figure 10, and the

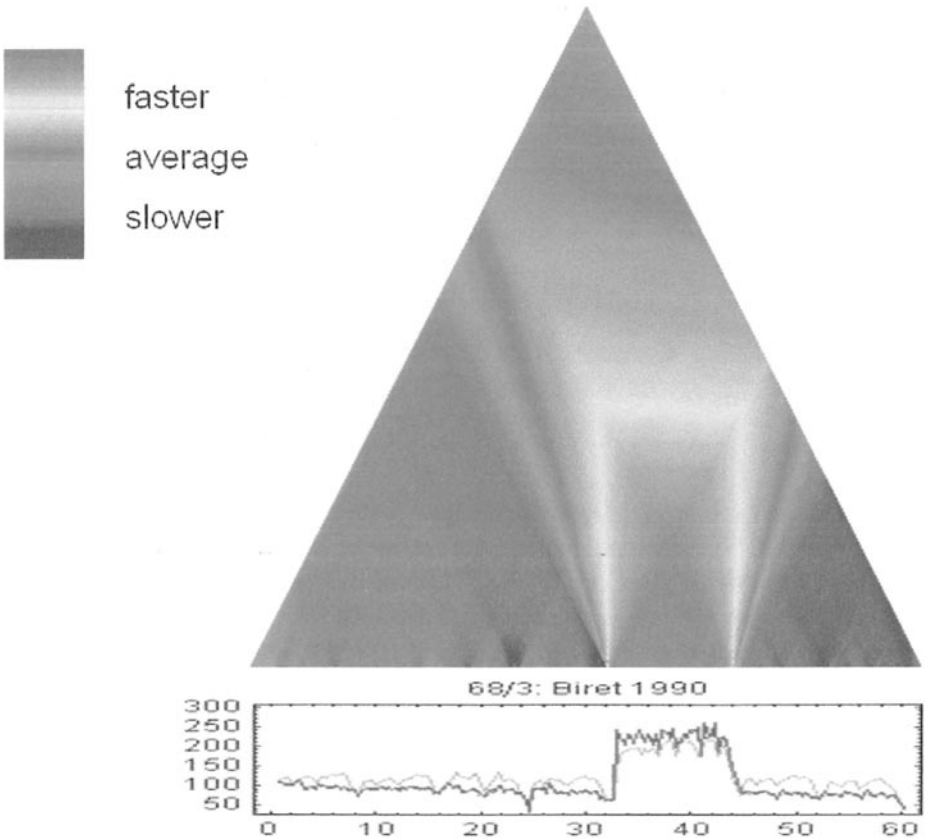

Figure 10.
Timescape and tempo graph of Biret's recording of Op. 68 No. 3 (1990).

boundary between the sections is less well defined. On the other hand there is far more variegation right across the surface of the music, representing the high level of local tempo shaping, largely coordinated with phrase structure, which characterizes Rubinstein's recording as a whole. The timescape in short reveals an interpretation that de-emphasizes the contrasts between the various sections, both by limiting the tempo differences between them (Rubinstein plays the outer sections at around 130 MM and the *Poco più vivo* at just under 160), and by superimposing a variegated surface of light and shade over the whole.

Op. 68 No. 3 is in fact a perhaps relatively rare instance when raw tempo graphs can reveal something significant about performance strategy, once again not so much when they are viewed individually but when they are compared with one another. In Figure 12 I have sorted thumbnail tempo graphs of a group of recordings of Op. 68 No. 3 by eye, taking Rubinstein's recordings, which have formed one of the key reference points for twentieth-century Chopin performance, as my starting point.

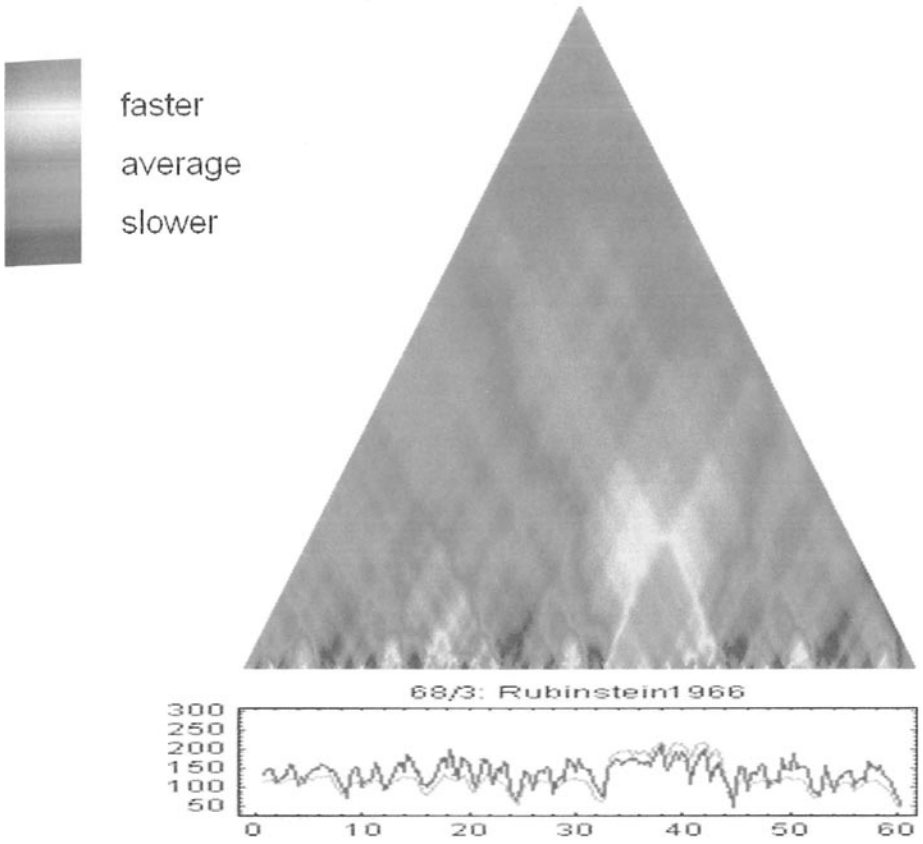

Figure 11.
Timescape and tempo graph of Rubinstein's recording of Op. 68 No. 3 (1966).

(Within each column the recordings are arranged chronologically.) If there is one feature that above all characterizes Rubinstein's interpretation of Op. 68 No. 3, at least in relation to other twentieth-century interpretations, it is the de-emphasis of the contrast between sections to which I have just referred. But if Rubinstein's 1966 recording marks the high point of this tendency, as visible in the first column, it is his 1938 one that seems to have made the greatest impact on other pianists, and each of the next three columns makes this point in relation to a different aspect of the 1938 recording. The common feature in the second column is the tendency to accelerate throughout the *Poco più vivo* section, which amounts to something more than the widespread tendency to play the introductory bars 33-6 a little slower than what follows. The third column picks out those recordings which additionally feature Rubinstein's drop in speed for the final part of the first section (bars 25-32): in Frederick Chiu's 1999 recording the combination of these two features creates the visual impression of a continuous accelerando linking this section and the *Poco più*

vivo, which would represent an alternative solution to the issue of coherence if one could be confident that the visual impression translates into an aural one. (The eye is sensitive to the profile created by the peaks in a way that I am not sure the ear is.) And the fourth column is based on another feature of Rubinstein's 1938 recording, the high level of local tempo change to which I have again already referred.

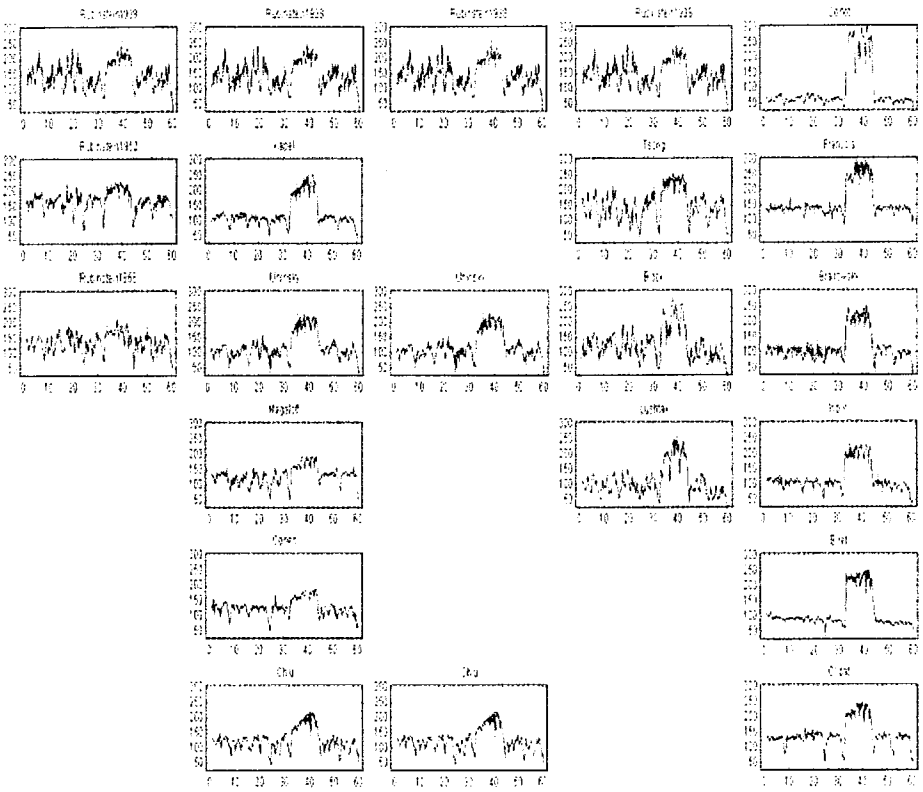

Figure 12.
Tempo graphs of recordings of Op. 68 No. 3, arranged by category.

If the recordings in the first four columns of Figure 12, developing different aspects of Rubinstein's seminal pre-war recording, represent a mainstream in the interpretation of Op. 68 No. 3, then the right hand column represents something quite different. Biret's 1990 recording, which I contrasted with Rubinstein's 1966 recording, appears towards the bottom of the column, and while her tempi within each section are steadier than the others, the degree of contrast she creates between the tempi of the sections is by no means exceptional. As can be seen, the first performer within our collection to adopt this strategy is Alfred Cortot, whose 1951

recording (made when he was in his mid 70s) pulls the first section down to a little above, and the final section to just below, 60 MM, a staggeringly slow tempo which turns the outer sections into something less like a march than a hymn. Cortot's tempo in the *Poco più vivo* section varies a great deal (his profile here resembles some of those in the fourth column): on average he takes it at about 225 MM, but at one point he broaches 300 MM. All this gives rise to durations of 95, 11, and 56 seconds for the respective sections. This, it seems to me, is a truly radical performance in which the now quite inappropriately named *Poco più vivo* effectively ceases to be a section in any traditional sense based on formal balance: it comes across more as a brief, passing vision of another world. The impossibility of assimilating the performance within a conventional formal aesthetic based on coherence prompts speculation as to whether Cortot perhaps saw Op. 68 No. 3 — which is believed to date from 1830 — as a kind of dirge prompted by the 1830 Warsaw revolution of that year, or if not that, then some other, possibly hackneyed, programmatic interpretation that transforms the *Poco più vivo* section into an evocation of Chopin's lost homeland. (In other words, Cortot plays the *Poco più vivo* less as music than as an evocation of music, and so I have answered my own question.) Seen this way, the subsequent recordings in the final column of Figure 12 adopt Cortot's basic strategy, but they tend to do so in a more watered down manner; without the radical edge, the extremity that marks Cortot's performance, the interpretational problem with which I began can be seen as reasserting itself.

All objectively generated visualisations are highly selective: they leave out most of the information about the performance, yet if well chosen can bring critical aspects of it into focus. (To put it another way, their value depends not on their truth but their relevance.) I hope to have demonstrated that even such simple visualisations as those in Figure 12 can generate interpretive hypotheses that take you back to the recordings with questions to which the recordings can now provide the answers. And that is important, because the essential thing in analysing music isn't so much knowing how to answer the questions — you can always find an answer if you want it badly enough — but knowing what questions to ask in the first place.

At the same time, it might seem almost perverse to rely on comparison by eye when you have the data and can therefore evaluate relationships using quantitative techniques. Nothing is easier than to generate a Pearson correlation matrix for the twenty recordings of Op. 68 No. 3 for which we currently have data, showing the degree of similarity between the tempo profiles of each. Reading such a matrix in numerical form is not so easy, however, so Figure 13 presents the essential information in visual form: for each recording, it shows the recording to which it is most similar, with the degree of similarity being shown by the colours. In making these calculations we have included an average tempo profile — a simple mathematical averaging of each data point across all the recordings — and it can be seen that, as might be expected, in most cases recordings are more similar to the average than to any other recording. (Or perhaps one shouldn't expect it, since it

suggests that most pianists avoid modelling their performances too closely on other pianists', contrary to recurrent critical complaints about the homogeneity of modern performance style.)

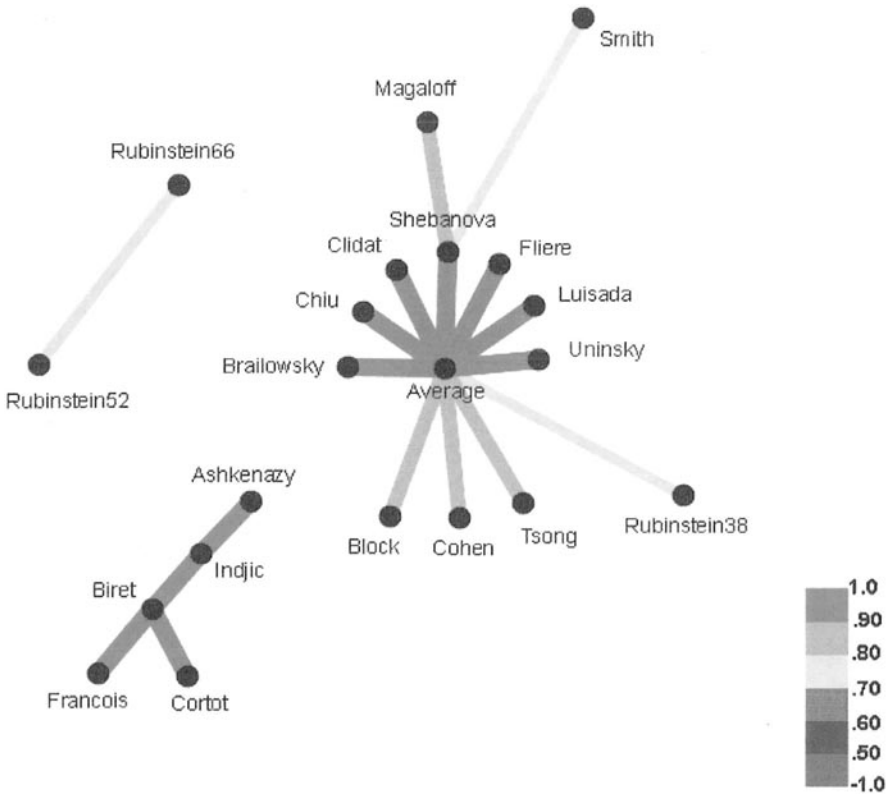

Figure 13.
Correlation network for recordings of Op. 68 No. 3.

The most significant relationships between recordings, clearly, are those which are closer than the relationship of either recording to the average. That Rubinstein's 1952 and 1966 recordings are similar to one another isn't so surprising (though neither is particularly close to his 1938 recording). More interesting is the other cluster, which strongly links Ashkenazy with Indjic, Indjic with Biret, and Biret with both François and Cortot. What are we to make of this cluster? Is there external evidence against which we might triangulate the correlation? It is never so hard to find connections between pianists: Ashkenazy studied at Moscow Conservatory, where Alexander Borovsky had earlier taught, and Borovsky was Indjic's first teacher. Again, Eugen Indjic is a French-American pianist who lives in Paris, so the link with

Idil Biret (Turkish but French-trained), Samson François, and Alfred Cortot is plausible enough. But among the last three there is a much more substantial link: Biret and François were both pupils of Cortot!

Of course this is a rather simplistic criterion for evaluating pianistic style: pupils don't necessarily play like their teachers. (But then again, they often do, or they retain certain aspects of their teachers' style while changing others.) And more generally, I am enough of a traditional musicologist to resist the idea that complex cultural constructs such as performance style can be reduced to something as simple as a mathematical correlation. So my first inclination was to find a way of explaining away these all too plausible connections. Indjic, Biret, François, and Cortot all appear in the third column of Figure 12, which is to say that they all play the *Poco più vivo* section much faster that the outer sections, and with little transition between them: maybe, I reasoned, this gross feature outweighs any more subtle dimensions of style, so that the correlations merely tell you what you can already see from Figure 12. There is an easy way to test this: repeat the correlation, but this time using the data for only bars 1-32, thereby eliminating the effect of the relationship between sections. This time there is only one cluster, and it is smaller, but significant: Ashkenazy, Indjic, and Biret. Whatever musically significant information such correlations convey — and it will take more work to form a clear view of that — it's evidently not just the fact that some pianists play the middle section of Op. 68 No. 3 much faster than the outer sections.

I think it is actually quite impressive that one can get musically meaningful information at all from so impoverished a data set as I have been working with in this paper. Tempo is, to be sure, a key performance parameter, and one that in effect summarizes many different aspects of interpretation. (It can be argued on this basis that in order to understand performance timing you need to break it down into these different aspects and analyse each separately, but I will not go into that here.) Yet tempo, as we experience and describe it when talking about music, is not the same as a set of beat durations. It is easy to demonstrate this: MIDI performances generated on the basis of beat information sound thoroughly unconvincing in the absence of the rhythmic, dynamic, and articulation information that also feed into the experience of tempo. Articulation, to be sure, remains the aspect of piano recordings most resistant to empirical study. But as I said at the beginning, we are now collecting and will shortly begin to analyse rhythmic and dynamic data. And at that point the approaches I have described in this paper, and others, should become capable of yielding more musically discriminating information than has been possible up to now. The real work is just beginning.

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• El análisis de la interpretación y las mazurkas de Chopin

Como resultado de un trabajo en equipo desarrollado por Adrew Earis y Craig Sapp, este trabajo plantea aproximaciones recientemente desarrolladas para el análisis de música grabada, ilustrándolas con una selección de mazurkas de Chopin. Los temas tratados incluyen la caracterización estilística y los valores estéticos de la interpretación de Paderewsky de la N° 4, Op. 17, contrastada con interpretaciones del último cuarto del siglo XX, así como las relaciones entre diferentes interpretaciones pianísticas de la N° 3, Op. 68. Se propone una posible genealogía interpretativa de la última — N° 3, Op. 68 —, en la cual las grabaciones de Rubinstein y Cortot juegan un papel clave, mientras que el grupo basado en la correlación Pearson de los datos de *tempo* está relacionado con ejemplos documentados de relación profesor/alumno. Estos tempranos hallazgos de un proyecto de investigación más amplio, se ven animados por la posibilidad de extraer conclusiones significativas partiendo solamente de datos de *tempo*. La siguiente fase del proyecto está trabajando también con datos de ritmo y dinámica, que aumentarán el potencial de extraer modelos de relaciones musicales significativas.

• L'analisi dell'esecuzione e le mazurche di Chopin

Sulla scorta del lavoro condotto in collaborazione con Andrew Earis e Craig Sapp, il presente articolo introduce gli approcci sviluppati di recente all'analisi di musica registrata, illustrandoli in riferimento ad una selezione di mazurche di Chopin. Gli argomenti trattati includono la caratterizzazione stilistica e i valori estetici dell'interpretazione da parte di Paderewski dell'op. 17 n. 4, in confronto ad esecuzioni dell'ultimo quarto di Novecento, come pure i rapporti fra le interpretazioni di differenti pianisti dell'op. 68 n. 3. Per quest'ultima si propone una possibile genealogia delle esecuzioni, dove le incisioni di Rubinstein e di Cortot rivestono un ruolo chiave, mentre il raggruppamento basato sulla correlazione di dati temporali da parte di Pearson dà luogo a relazioni supportate in un caso da documentati rapporti insegnante/allievo. Rappresentando i primi risultati di un più esteso progetto di ricerca, tali esiti sono incoraggianti nella misura in cui appare possibile trarre conclusioni significative dalla considerazione dei soli dati di tempo. La fase attuale del progetto lavora anche su dati ritmici e dinamici, i quali dovrebbero accrescere in modo considerevole il potenziale di modellazione oggettiva di relazioni musicalmente significative.

• Analyse de l'interprétation sur la base de certaines Mazurkas de Chopin

Dans cet article, nous décrivons un travail fait avec Andrew Earis et Craig Sapp et présentons des méthodes récemment mises au point pour l'analyse de musique enregistrée sur la base de *mazurkas* de Chopin. Nous examinons les caractéristiques

stylistiques et les valeurs esthétiques de l'interprétation de l'op. 17 nº 4 par Paderewski que nous comparons avec des interprétations du dernier quart du vingtième siècle aussi bien que les rapports entre les exécutions par différents pianistes de l'op. 68 nº 3. Quant à ce dernier, nous proposons une généalogie possible de l'interprétation, où celles de Paderewski et de Cortot jouent un rôle essentiel. Sur la base de la corrélation Pearson des données sur le tempo, on arrive à des rapports entre des groupes qui sont corroborés dans un cas par des données concernant des relations entre maître et élève. Ces résultats représentent les premières conclusions d'un projet de recherche plus vaste et sont encourageants dans la mesure où il semble possible de tirer des conclusions utiles simplement sur la base de données concernant le tempo. Dans la phase actuelle du projet, nous travaillons aussi sur le rythme et la dynamique, ce qui devrait largement étendre le potentiel de modélisation de rapports significatifs sur le plan musical.

• Performanzanalyse und Chopins Mazurken

Dieser Artikel berichtet über gemeinsame Untersuchungen in Zusammenarbeit mit Andrew Earis und Craig Sapp. Dabei werden am Beispiel ausgewählter Chopin-Mazurken kürzlich entwickelte Analysemethoden für Musikaufnahmen vorgestellt. Die behandelten Themen umfassen die stilistische Charakterisierung und den ästhetischen Wert von Paderewskis Spiel von op. 17, Nr. 4, welches mit Darbietungen aus den letzten 25 Jahren des 20. Jahrhunderts kontrastiert wird. Weiterhin werden Beziehungen zwischen den verschiedenen Interpretationen von op. 68, Nr. 3 durch mehrere Pianisten untersucht. Vor diesem Hintergrund wird eine mögliche Interpretationsgenealogie vorgeschlagen, wobei den Aufnahmen von Rubinstein und Cortot eine Schlüsselfunktion zukommt. Durch Pearson-Korrelationen von Tempodaten werden Gruppenbildungen erreicht, die zu derartigen Beziehungen führen und in einem Fall auch durch nachweisbare Lehrer-Schüler-Beziehungen unterstützt werden. Die vorliegenden frühen Ergebnisse eines umfassenderen Forschungsprojekts sind ermutigend, da Untersuchungen von Tempodaten möglicherweise bereits bedeutsame Schlussfolgerungen zulassen. In der derzeitigen Phase des Projekts werden auch rhythmische und dynamische Daten untersucht, die das Potential für objektive Modellierungen von musikalisch bedeutsamen Beziehungen maßgeblich steigern könnten.