'ARMCHAIR CONDUCTING' ANIMATIONS FOR MOZART AND SCHUBERT

Nigel Nettheim
MARCS Auditory Laboratories, University of Western Sydney, Australia

ABSTRACT

Background. Some people respond to music with an internalized gesture rather like a conducting shape. Such conducting does not control a performance; the case is instead the opposite, in that a (real or imagined) performance controls the conducting; hence the term 'armchair conducting'. Gustav Becking (1928) closely studied such shapes, drawing them on paper as composer-specific "Becking curves". These curves on paper are, however, static; in earlier work I had implemented a computer animation of a conducting shape in an excerpt from Mozart's Piano Sonata K576 III, matched to the sound of a recording by Walter Gieseking. Computing resources facilitating this approach have only recently become available.

Aims. The main aim is to contribute an animation of a conducting curve in an excerpt from Schubert's Moment Musical No. 6, matched to the sound of a recording by Artur Schnabel, thus specifying the curve more explicitly than the technology available to Becking had allowed. A second aim is to look into the problems arising in attempting to test the validity of such animations. A final and more subsidiary aim is to examine the "composer's pulse" proposed by Clynes (1983) in relation to (a) the recorded performance nuances and (b) the Becking curves.

Method. The video track of the animation was prepared with the Matlab® computer program by successive approximation to the temporal shaping of my physical gesture. The sound of the recorded performance was added as a separate track. The nuances present in the recorded performance were also measured and analysed.

Results. The animation seems generally successful. Testing the validity of such animations is difficult and will require further work. Clynes's "composer's pulse" postulate is not confirmed by the present work.

Conclusions. Insights into composer-specific features of the musical beat have been obtained and demonstrated in computer animations, now for two composers.

1. INTRODUCTION

1.1. Composers' Musical Personalities

The object of study here is the differentiation between the musical personalities of some of the most prominent composers of Western classical music. The music of these composers (whether in sound or in thought) induces in some people an internal feeling somewhat analogous to the human pulse. So long as that pulsing remains internal it is not available for further study; various methods have therefore been used in an attempt to render it external. Two such methods are now described (for further background to this area see Shove and Repp, 1995 and Nettheim, 1996).

Becking (1928) allowed a small hand-held baton to move sympathetically to the music; this was not to *control* a performance but instead to *respond to* a performance, an important distinction which I have endeavoured to convey through the term "armchair conducting". He graphed his observed shapes as so-called "Becking Curves" specific to each of a number of composers (examples will shortly be seen).

Clynes (1983) allowed a finger to press on a "sentograph" while the subject listened to or thought the music, the pressure being recorded in the vertical (but only downward) and horizontal directions. He graphed the resulting pressure shapes. He also attempted to assign performance nuances, mainly of note length and loudness, designed to be appropriate to each given composer.

1.2 The Becking Curves for Mozart and Schubert

The Becking curve for Mozart is shown in Figure 1 (as seen by a right-handed subject). The downbeat is on the right edge of the curve. The varying thickness represents the strength applied (taking into account both agonist and antagonist muscles), but the varying velocity is not shown graphically. Becking added a verbal indication of the quality of the beating as "selbstverständlich abwärts, sorgfältig getönt" (naturally down, carefully shaded). The animation shown later will suggest more explicitly how it may be executed.

Figure 1: Becking curves for Mozart (left) and Schubert.

The Becking curve for Schubert is also shown in Figure 1. Here the so-called "downbeat", the lower part, is actually more nearly horizontal than downward. Becking took the downbeat to move towards the body; although my (and Clynes's) personal preference is for the opposite direction with an essentially unchanged shape, I have used Becking's version in what follows. Becking's verbal indication here is "führen und schwingen" (guide in and swing around).

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The question of the degree of authenticity of these curves naturally arises. Their authenticity will be assumed here as an hypothesis which might be rejected if the animations to be created prove to be unsatisfactory. I am not aware of alternative proposed curves but, if they exist, the same method could be used to investigate their implications.

1.3 Present aims

My main present aim is to show computer animations of Becking's conducting curves for Mozart and Schubert. A second aim is to consider problems of testing the animations. A third and more subsidiary aim is to compare the "composer's pulse" of Clynes with the present observations.

2. METHOD

The first task was to select score excerpts suited to the present purpose. That task was undertaken by means of an extensive study of the works of the two composers, attempting to match the scores to the Becking curves with the aid of "fingerprints" for each composer (Nettheim, 1998, 2003a). Whereas any composer may write neutral material such as repeated notes or simple scale passages, the present excerpts were instead chosen to be as typical of the composer as could be managed (although the conducting of neutral material in the manner of different composers can also be instructive). The scores of the chosen excerpts are shown in Figures 2 and 3.

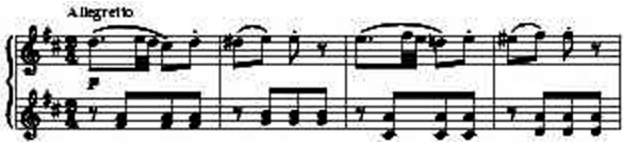

Figure 2: Mozart Piano Sonata K576-III bars 1-4.

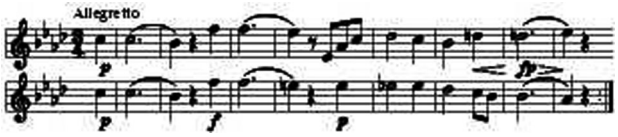

Figure 3: Schubert Moment Musical D780/6 bars 1-16 (melody only shown).

The next task was to select, for each chosen score excerpt, a recorded performance suited to the purpose of matching the sound to the curve. The selections were Gieseking (1954) and Schnabel (1937). For private research, an imagined rendition could be substituted for a sounded one, but sound is needed for conveying the results explicitly to others and for matching note onsets to curve locations. The onset times of each tone in the selected performances were measured by slow-motion replay (1/7 speed), using the computer programs Musicians CD Player© and Goldwave©; these measurements were needed not to construct the animations but to allow the subsequent locating of the tone onsets along the curves.

To implement a conducting curve it is necessary to decide upon the number, B/C, of notated bars per conducting curve. This may in general be 1, ½ or 2 (or perhaps rarely another value); this question was discussed at length in Nettheim (1998). In selecting the present examples I endeavoured to make sure that B/C was especially clear, and here I simply state my determination of 1 for the Mozart excerpt and 2 for the Schubert excerpt; thus each 'real' bar of the Schubert excerpt comprises two notated bars.

The task of constructing an animation was approached using the Matlab® computer program to produce a video track frame by frame, to which I then added the audio track. I proceeded by successive approximation to the appearance of my conducting beat. As each excerpt spans several curves of slightly different durations, I began by seeking to optimize the video for the first curve alone; I then adjusted that animation to accommodate the duration and character of each of the following curves. Once the real-time animation for the whole excerpt seemed satisfactory, I played it back in slow motion (1/7 speed), the video track being slowed with Matlab®, the audio track with Musicians CD Player©. This enabled the locating of the tone onsets, which were then represented on static diagrams, one diagram for each curve.

3. RESULTS

The animations for the respective composers' excerpts are shown in real time in Videos 1 [MozGies.wmv] and 2 [SchubSchnab.wmv] and in slow motion (1/7 speed) in Videos 3 [MozGiesSlow.wmv] and 4 [SchubSchnabSlow.wmv]. (Videos showing my simultaneous conducting and playing of the Mozart excerpt were included in Nettheim, 2003b.) Tone onsets mapped to curve locations are shown in Figures 4 and 5 (note numbers are indicated; the dot size is proportional to the curve thickness).

4. DISCUSSION

4.1 Animations and mappings

By contrast with the static Becking curves as drawn on paper, the animations relate those curves directly to sound excerpts, and are to that extent more fully specified. The animations may therefore find application in music education. However, the associated feeling quality is experienced only upon implementing the conducting oneself.

The onset locations for the Mozart excerpt (Figure 4) show the downbeat note beginning to sound only near the bottom of the 'armchair' conducting gesture (this may not be so in conducting to control a performance). The 32nd notes, characteristic of Mozart at that bar location, seem to "help" the motion around the upper rounded portion. The division of the phrase into two sections (bars 1-2, 3-4) is also reflected in the onsets. The Schubert onset locations (Figure 5) show the upbeat note sounding at the pointed end. The Figures do not directly show the varying velocity seen in the videos.

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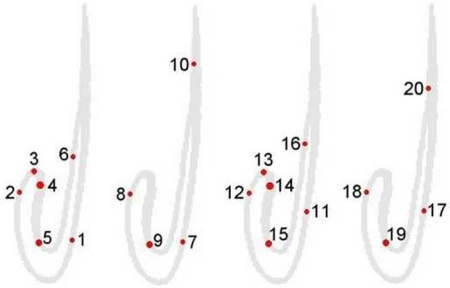

Figure 4: Tone onset locations on each conducting curve, derived from Video 3 (Mozart / Gieseking).

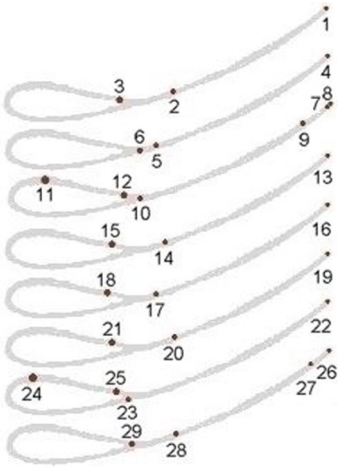

Figure 5: Tone onset locations on each conducting curve, derived from Video 4 (Schubert / Schnabel).

4.2 Problems of testing

The informal impression of myself and some others is that the animations shown here are reasonably successful. Indeed, for a musician sensitive to the character of the composers and performances involved, little need might be felt for formal testing of the results, but from the scientific point of view such testing is desired. The difficulty of testing the animations arises from the fact that three stages, in this order, led to the finished product: (a) Becking's curve; (b) a performer's rendition; (c) my animation, given (a) and (b). If a subject were asked to evaluate the animations, the response would confound the effects of the three stages.

To test the Becking curves, (a), without reference to (b) and (c), nevertheless requires subjects to carry out the conducting according to the curves, thus using their own chosen real or imagined performance and animation. Such a test would assume sufficiently sensitive subjects; indeed, the same design could be used for the opposite purpose: testing the sensitivity of subjects assuming the authenticity of the curves. A valid test of this kind therefore seems difficult to design.

Assuming (a), the authenticity of the curves, several performances, (b), could be tested without reference to (c). Subjects evaluate the performances in relation to their understanding of the curve, again assuming sufficient sensitivity on the part of the subjects. This seems more straightforward, yet unwanted variables may enter such as the quality of the sound recording and of the piano, and the exact playback speed.

Assuming (a) and (b), the success with which the animations, (c), have been implemented could be tested. Subjects could rate one or more animations produced by one or more researchers; animations manipulated in an attempt to introduce falsity could also be included. But it is difficult to assume (a) and (b), for subjects might not have the same conceptions of them, so they would in effect be judging all three stages at once. To the extent that the animations were then judged to be satisfactory, all three stages would be vindicated; but if they were judged unsatisfactory, it would not be clear at which stage or stages improvement was needed.

The claimed composer-specific feature of the animations could perhaps also be tested. The researcher could implement an animation for one composer's curve using the music of another composer, though this is an unnatural musical task. Another method would be to mismatch sound tracks and video tracks, but adjustment would be needed for the total duration and, moreover, for the varying duration of the constituent bars. The ('real') metres of the excerpts would need to be the same, for the conducting reflects the metre. My two attempts so far used different metres, those favoured by the respective composers (as determined in Nettheim 1998, 2003a); this was done deliberately in order to facilitate the best possible characterization of each composer. In further work, animations will be prepared in the same metres for different composers, which may allow valid testing of composer-specificity.

It remains to mention that testing the present animations has not so far been carried out. Testing may be more valuable after a third composer has been included, following current work on a Beethoven animation.

5. RELATION TO CLYNES'S "COMPOSER'S PULSE"

Clynes (1983) also followed Becking's lead, adopting, however, only the general idea that conducting shapes are composer-specific, and not taking up any of the details of Becking's work. Clynes prescribed performance nuances via modifications of duration and loudness to be applied to the notes of each bar depending upon their location within the bar. My present research is not primarily concerned with the prescription of performance nuances, but the nuances and their relation to the conducting curve necessarily arise in the performances used for the curve animation. The nuances of timing in the Gieseking and Schnabel excerpts had already been measured (see section 2) and the opportunity will now be taken to compare them with the nuances prescribed by Clynes (1983) for Mozart and Schubert respectively. (Loudness is difficult to measure when several notes are sounded simultaneously, and will not be studied here.)

Mozart. Gieseking's duration factors for the 4 bars of the excerpt are shown as percentages in Table 1. These factors are applied to the equal nominal values for the two counts of each bar. Clynes's simple duple pulse duration factors are finally shown (Clynes, 1983, p.162).

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Notes	Gieseking	Notes	Gieseking	Clynes
d''+e+d	92.0	e''+f#+e	92.0	100.0
c''#+d	107.8	d''+e	108.4	100.0
d''#+e	102.4	e''#+f#	103.0	100.0
e''	97.8	f''#	97.0	100.0

Table 1: Percent of nominal durations for the notes in Gieseking's performance of Mozart's K576-III, and Clynes's prescription.

Gieseking's values differ considerably not only from Clynes's values but also among themselves. Of course, Clynes's pulse values need not alone determine the nuances applied in a finished performance, but no exceptional considerations seem to apply here. The differences are significant, as can be judged by comparison with the differences appearing in Clynes's Beethoven values (97.5, 103.5; ibid, pp.134, 162). On looking more closely, it is seen that in bars 1 & 3 Gieseking's middle note of the bar (c''# & d'') comes a little early, but in bars 2 & 4 (e'' & f''#) a little late (a graphical rendering of the nuances is provided in Nettheim, 2003b, Fig. 3). Closer examination still would require some speculation on musical effects, e.g. that the 32nd notes in bars 1 & 3 bind the following 8th-note more closely to the previous one, or that the appoggiatura on the downbeat of bars 2 & 4 delays the progress through those bars. The timing of the finer divisions of each bar could also be studied (Clynes, 1995, p.286), but that could not affect the main point already made.

Schubert. Schnabel's duration factors for the 8 'real' bars (16 nominal bars) are shown in Table 2. Clynes's hierarchical compound duple pulse is formed from the component simple duple and simple triple pulses (ibid, pp.161-163). Taking Clynes's parameter m=0.7 produces the pulse duration factors (103.8, 110.5, 104.9, 92.5, 98.5, 93.5) for the 6 divisions; these are averaged over the divisions for the given bar locations to produce the factors for the corresponding notes (e.g. {103.8+110.5+104.9}/3 = 106.4).

Notes	Schnabel	Notes	Schnabel	Clynes
c''	—	c''	106.8	93.5
c''	102.2	c''	95.7	106.4
b'b	98.9	b'b	101.7	95.5
f''	95.8	f''	109.5	93.5
f''	108.4	f''	98.4	106.4
e''b+e'b	93.3	e''n	106.0	95.5
a'b+c''	110.1	e''n	92.8	93.5
d''b	89.8	e''b	95.3	107.1
c''	103.6	e''b	101.1	104.9
b'b	99.0	d''b	98.1	95.5
d''n	118.7	c''+b'b	112.8	93.5
d''n	99.1	b'b	102.4	106.4
e''b	97.9	a'b	—	95.5

Table 2: Percent of nominal durations for the notes in Schnabel's performance of Schubert's D780/1, and Clynes's prescription.

Here again the performer's duration nuances differ greatly from Clynes's prescribed ones, both in size and direction, as well as between bars. It is possible to look further into this by studying first the duple pulse dividing each 'real' bar into halves, thus before the subsequent division of each half into thirds. It is readily found that the duple pulse does not match Schnabel's values, which already rules out a matching of the compound pulse.

Clynes's notion that a compound pulse is formed hierarchically from simple pulses is not confirmed by the present performance data, and is positively ruled out if the Becking curves are followed even approximately, for the curves are not comprised of portions having similar behaviour. Both the Mozart and Schubert curves are pointed at one end and rounded at the other (Becking's basic notion of "Type I", ibid), which precludes their division into portions of the same Type and thus precludes hierarchical formation.

Conclusion on Clynes's "composer's pulse". Clynes's prescribed duration nuances differ greatly from those observed in the performances studied here (a similar conclusion was reached in Repp, 1990 in respect of a Beethoven movement). It is conceivable that Clynes's values, in conjunction with suitable loudness nuances, could lead to alternative convincing performances of the two composers' music; nevertheless, Clynes's theory and prescriptions are not confirmed here. It seems more likely that the local music-analytical or compositional circumstancesÑrhythmic, melodic, harmonic, contrapuntal, textural, formal and other such factorsÑare the main determinants of performance nuances. It would then be the composer-specific usage of those factors (a property not of any one bar but of the collected works) that leads to composer-specific performance nuances and conducting curves. A beginning study of that usage is seen in Nettheim (1998, 2003a).

6. CONCLUSIONS AND FUTURE WORK

Animations of 'armchair conducting' seem to have produced satisfactory results for excerpts from Mozart and Schubert, but formal testing has not so far been carried out. The animations may in any case have methodological significance. Clynes's prescription of performance nuances as "composers' pulses" are not confirmed here.

Work on the animation of conducting curves for other composers is currently under way.

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