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Performing proportion: Crux awareness in Scarlatti interpretation

Nancy Lee Harper[1], Tomás Henriques[2], and Rosalind Halton[3]

[1] Department of Communication and Art, University of Aveiro, Portugal
[2] Department of Music, Buffalo State College, USA
[3] Department of Music, University of Newcastle, Australia

This study aims to determine if crux occurrence in Scarlatti's K. 159 sonata conforms to a *golden section* or other proportionate position as found in other sonatas and, if so, is interpreted thus by performers.

Keywords: Scarlatti; crux; golden section; performance; background/ foreground tempi

Performer-scholar Ralph Kirkpatrick identified a compositional phenomenon in the majority of the Domenico Scarlatti sonatas, which he termed "crux": "the point in each half where the thematic material at the ends of both halves establishes the closing tonality" (Kirkpatrick 1953, p. 255). Thus, the crux has a triple function: melodic, harmonic, and structural. In previous research that compared Scarlatti's *Essercizi* and *Cantabile* sonatas, a very high incidence of golden section proportion (GS) was found at the crux's occurrence (Harper 2007), regardless of the character (Halton 2002). Also, in a sonata with GS proportion (K. 380), it was determined that performers consciously or unconsciously react to this proportion by expressing it in both foreground (surface) and background (structural) tempi (Harper and Henriques 2008). Using digital audio editors, the current study obtains data from a control group and an experimental group in performance of the Sonata in C Major, K. 159 "La caza", in order to measure performance consistency and tempo-crux perceptions.

MAIN CONTRIBUTION

Scarlatti's Sonata in C Major, K. 159 was chosen due to its structural proportions and easy accessibility. In 6/8 and with a range of D-d"', it is marked *allegro* in various manuscripts. This bi-partite sonata is 64 measures long (26

Table 1. Crux proportions.

Crux Proportions	*Length (L)*	*Phi or GS L x .618034*	*Crux*	*Differential Crux-phi*	*Conclusions*
A1 (1st half)	26 measures	16, 068884 =16	ms. 13	16-13= 3 measures	mirrored to second half
B1, A1 (2nd half)	38 measures	23, 485292 =23	ms. 52 (26)	26-23= 3 measures	mirrored to first half
A' Recap. only	21 measures	12, 978714 =12,9	ms. 9	12,9-9= 3,9 measures	close to mirror proportion

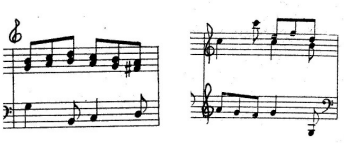

*Figure 1.*The crux in A and B sections.

bars+38 bars) or 128 measures with the repetitions and no first or second endings. In the overall AB form, the B part consists of B+A' (or rounded binary form with developmental aspects and recapitulation), which may be seen with repetitions as: [A1] [A2] [B1, A3,] [B2, A4]: A2=repeat of A1, B2=repeat of B1, A3=variant of A1 in recapitulation, A4=repeat of A3. The crux appears in measure (ms.) 13 (A section) and in ms. 52 (=ms. 26 of that section or ms. 9 of the recapitulation).

Before measuring the placement of the crux, a one measure discrepancy was found in various manuscripts and editions in the first half (ms. 16); this had to be considered with the logical conclusion that Scarlatti's copyist accidentally omitted it because of its repetitious nature. Gilbert's *Urtext* edition was chosen because of the logical symmetry of the sonata's halves.

The *phi* or golden section measurement of each half was taken in order to compare with the crux position (Table 1). Although GS proportion is not present, a mirrored symmetrical proportion is found: the crux occurs three measures before *phi* in the first half and three measures after *phi* in the second half. A proportion of +3 measure-differential (almost 4 measures) occurs when exclusively measuring the crux position of the recapitulation.

Table 2. Real-time comparisons at key moments (in seconds).

Real time	*Crux A1 ms. 13*	*Crux A2 ms. 13 (39)*	*End A1 ms. 26*	*End A2 ms. 26 (52)*	*End B1 ms. 43 (95)*	*End B2 ms. 43 (107)*	*Crux A3 ms. 52 (88)*	*Crux A4 ms. 52 (116)*	*End A3 ms. 64 (90)*	*End A4 ms. 64 (128) Total duration*
Asperen MM=128	11,294	35,357	23,713	47,790	65,435	102,401	73,318	110,197	84,748	125,991
Crudelli MM=126	11,379	35,861	24,403	48,774	66,685	105,434	74,537	113,202	87,077	128,896
Nicolson MM=120	11,834	36,628	24,883	50,000	68,579	108,028	76,761	116,186	87,077	131,788
Halton MM=113	13,506	42,483	28,587	57,613	79,386	123,419	88,519	132,452	102,235	149,432
Pogorelich Model MM=112	13,304	41,196	27,942	56,550	77,080	122,082	86,063	131,248	101,065	149,316
Harper MM=110	13,542	42,468	28,742	57,543	78,539	124,424	88,085	134,061	103,112	153,162
Tilney MM=110	14,252	44,176	30,048	59,786	81,062	125,922	90,541	135,561	104,998	153,074

Performers' proportion

Technical problems prevented the comparison of equal live (experimental group) and commercial recordings (control group): five commercial recordings (harpsichord, fortepiano, modern piano) were used and two live studio performances (harpsichord, modern piano). The performers of the live recordings knew of the position of the crux, although it is unknown whether the performers in the commercial recordings were aware of the position of the crux and chose deliberate interpretations.

Real time and equalized time timings

Using audio digital editors, time readings of performances of all performers were taken at several key moments (Table 2): crux A1, A2, end of A1, end of A2, end of B1 (end of modulatory part in ms. 43), end of B2, crux A3, crux A4,

Table 3. Equalized time comparisons at key moments (in seconds).

Real time	*Crux A1 ms. 13*	*Crux A2 ms. 13 (39)*	*End A1 ms. 26*	*End A2 ms. 26 (52)*	*End B1 ms. 43 (95)*	*End B2 ms. 43 (107)*	*Crux A3 ms. 52 (88)*	*Crux A4 ms. 52 (116)*	*End A3 ms. 64 (90)*	*End A4 ms. 64 (128) Total duration*
Asperen length ratio=0,843	13,326	41,814	28,166	56,640	77,502	121,351	86,779	130,556	100,412	149,316
Crudelli ratio=0,863	13,086	41,423	28,266	56,665	77,274	122,082	86,290	131,081	100,861	149,316
Nicolson ratio=0,882	13,256	41,323	28,156	56,607	77,641	122,370	86,962	131,547	101,000	149,316
Halton ratio=1,007	13,506	42,483	28,587	57,613	79,386	123,419	88,519	132,452	102,235	149,316
Pogorelich MODEL ratio=1,000	13,304	41,196	27,942	56,550	77,080	122,082	86,063	131,248	101,065	149,316
Harper ratio=1,0257	13,784	41,333	28,001	55,983	76,540	121,289	85,861	130,693	100,523	149,316
Tilney ratio=1,0251	13,784	42,950	29,296	58,324	79,053	122,823	88,286	132,262	102,393	149,316

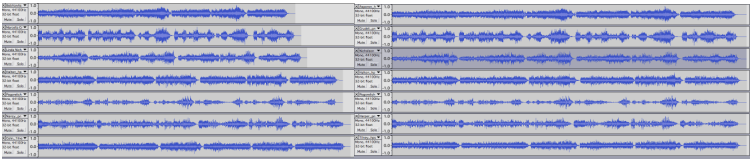

Figure 2. Real time and equalized timings; Pogorelich and Halton were the same in real time; all recordings were adjusted to Pogorelich's model for equalized timings. (See full color version at www.performancescience.org.)

end of A3, and end of A4. This information gave foreground or surface tempo measurements. Tempo and real time timings ranged from MM 110 to MM128 and from 125.991" to 153.074". To determine the internal or background

Table 4. Real time/reference model time: table ratio comparisons at key moments.

Real time/ reference model time	*Crux A1*	*Crux A2*	*End A1*	*End A2*	*End B1*	*End B2*	*Crux A3*	*Crux A4*	*End A3*	*End A4*
Asperen length ratio=0,843	0,8490 >0,843	0,8582 >	0,8486 >	0,8450 >	0,8489 >	0,8387 >	0,8589 >	0,8396 -	0,8385 >	149,316
Crudelli ratio=0,863	0,8553 <(...)	0,8704 >	0,8733 >	0,8624 <(...)	0,8651 >	0,8636 >	0,8660 >	0,8625 -<(...)	0,8615 <(...)	149,316
Nicolson ratio=0,882	0,8895 >	0,8891 >	0,8905 >	0,8841 >	0,8897 >	0,8848 >	0,8919 >	0,8852 >	0,8820 >	149,316
Halton ratio=1,007	1.0157	1,0312	1,0230	1,0187	1,0299	1,0109	1,0285	1,0091	1,0115	149,316
Pogorelich MODEL ratio=1,000	13,304 1,000	41,196 1,000	27,942 1,000	56,550 1,000	77,080 1,000	122,082 1,000	86,063 1,000	131,248 1,000	101,065 1,000	149,316
Harper ratio=1,0257	1,0178 <!	1,030 >(...)	1,0286 >(...)	1,0159 <!	1,0189 <!	1,0191 <!	1,0234 <!	1,0214 <!	1,0214 <!	149,316
Tilney ratio=1,0251	1,0712 >(...)	1,0723 >(...)	1,0753 >(...)	1,0572 >(...)	1,0516 >(...)	1,0314 >(...)	1,0520 >(...)	1,038 >(...)	1,0389 >(...)	149,316

tempi of the performances, all recordings needed to be equalized to the same tempo-length. Pogorelich's recording was chosen as the model (Table 3) due to the steady and musical consistency of the performance (MM=112; 149,316"). Recordings longer than Pogorelich's were compressed; if shorter, expanded. When compressed, the time modification ratio is a number smaller than the model ratio of 1.000, and when expanded, it is larger than the model (Table 4).

Table 4 shows that when one compares the length-ratios of the recordings that were time-modified with the analysis ratios at the chosen key points that, in most cases, the performers tend to modify their overall tempo at those key points so as to stay closer to an underlying temporal framework that favors a clear, well-measured tempo. In the expanded recordings (Asperen, Crudelli, Nicholson), ">" indicates a convergence toward the reference model, or rather the analysis ratios that are larger than the length ratios indicate that the expansion of time is happening slightly faster around the analysis points (crux, etc.) and is going faster in order to catch up to the reference. The indication of (...) means that the result is contrary to the prediction. Thus, comparisons

and analysis of length ratios reveal that Nicholson's performance has the highest rate of convergences toward the timings of the model at 100%: Asperen=88%, Harper=77%, Crudelli=55%, and Tilney=0%.

IMPLICATIONS

It is concluded that: (1) although the crux does not fit into direct GS proportions, the symmetrical mirrored relationship between the two halves of the sonata of three measures is significant, (2) when repeats are made by the performers, the length of the A section corresponds to the occurrence of the crux in the B section (52 measures), making a strong case for the necessity of the repeats, and (3) regardless of live or commercial recordings or choice of instruments, there occurred two performances of the same duration: Pogorelich (piano, commercial/model performance), Halton (harpsichord, live performance). We may infer that there is a proportional sense of crux by composer and by performers, which is evident in both foreground (surface) and background (structural) tempi.

Address for correspondence

Nancy Lee Harper, Department of Communication and Art, University of Aveiro, Campus Santiago, 3810-193 Aveiro, Portugal; *Email:* harper@ua.pt

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