

Golden Section in the sonatas of Domenico Scarlatti: An examination of Kirkpatrick's crux

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More than fifty years ago, performer-musicologist Ralph Kirkpatrick (1911-1984) observed a compositional phenomenon in the bi-partite sonatas of Domenico Scarlatti (1685-1757), which he termed "crux" or the point in each half where the thematic material at the ends of both halves establishes the closing tonality. The crux is thus a device with a triple function: melodic, harmonic, and structural. To date, there has never been systematic study of the position of the crux in the Scarlatti sonatas. Therefore, the main objective of this study is to examine the relationship of the position of the crux in two bodies of contrasting Scarlatti sonatas—the *Essercizi* (published 1738-1739) and the *Cantabile* sonatas—using the Golden Section (GS) as a measuring tool in order to determine (a) if GS exists and (b) if so, what are the implications.

Keywords: Golden Section; Kirkpatrick's crux; Domenico Scarlatti; proportion; sonatas

It is not uncommon that such authors who have written about compositional techniques in the Scarlatti sonatas (Benton 1952, Kirkpatrick 1953a, Halton 2002, Sutcliffe 2003, Harper 2005) have observed the wealth of inventive material that easily flowed from Scarlatti's imagination. So rich is this material that it often confounds classification (Clark 1976, Sheveloff 1985, 1986, Puyana 1987, Harper 2002), as well as chronological dating (Kirkpatrick 1953b, Longo 1906-1908, Pestelli 1967, Fadini 1978-1995). The Golden Section (GS) is a well-known proportional ratio used not only in architecture and music, but also found in Nature and in the human body (Murchie 1978, Howat 1986). The algebraic irrational number of GS is *phi*: $\phi = (1+\sqrt{5})\div 2 \approx 1.6180339887\dots$, with the geometric relationship being $(a+b)\div a = a\div b = \phi$. Thus, the Scarlatti sonatas, by virtue of their bi-partite nature and crux, lend themselves quite naturally to this kind of scrutiny.

MAIN CONTRIBUTION

Domenico Scarlatti's *Essercizi* (*E*) consist of 30 works dedicated to King John V of Portugal and published in an oversized, kingly edition by Roseingrave in London (1738-1739) shortly after Scarlatti's knighthood. With a didactic objective of developing digital dexterity, 29 sonatas are marked *allegro* or *presto*, plus the final moderate "Cat" fugue, and are catalogued by Kirkpatrick as K. 1-30. Contrarily, Scarlatti's twenty *Cantabile* sonatas (*C*) do not belong to a specific collection but rather are interspersed throughout his *œuvre*, ranging from K. 77 to K. 546. Some are multi-tempied (K. 77, 170, and 176) and reveal Domenico's predilection for florid aria-like expression, lest we not forget that he was also a virtuoso singer (Doderer 1991).

Methodology and results

The following methodology was used: (1) selection of contrasting bodies of Scarlatti sonatas, (2) identification of the lengths of *A* and *B* halves in each sonata, (3) identification of the position of the crux in *A* and *B* of each sonata, and (4) comparison of the occurrence of the crux with GS (length multiplied by 0.618034). The results of these tabulations of GS-crux correspondence are indicated in Table 1.

Table 1. *Essercizi* and *Cantabile* sonatas.

Sonata	Tempo (meter)	Length:	Crux:	GS (<i>A</i> , <i>B</i>);
		<i>A</i> + <i>B</i> (in bars)	<i>A</i> , <i>B</i> (bar nos.)	Crux (<i>A</i> , <i>B</i>)
<i>Essercizi</i>				
K.1, D minor	Allegro (4/4)	13+18=31	7, 17	8, 03; 11, 12
K.2, G major	Presto (3/8)	37+41=78	21, 62 [25]	22, 87; 25, 34
K.3, A minor	Presto (2/2)	47+47=94	27, 77	29, 05; 29, 05
K.4, G minor	Allegro (4/4)	21+18=39	13, 30 [9]	12, 98; 11, 12
K.5, D minor	Allegro (3/8)	43+47=90	23, 70 [27]	26, 58; 29, 05
K.6, F major	Allegro (3/8)	37+38=75	31, 66	22, 87; 23, 49
K.7, A minor	Presto (3/8)	73+82=155	31, 121	45, 12; 50, 68
K.8, G minor	Allegro (3/4)	24+23=47	16, 41	14, 83; 14, 21
K.9, D minor	Allegro (6/8)	26+34=60	16, 50	16, 07; 21, 01

Key. Red: direct correspondence (DC); blue: close correspondence (+2 bars; CC), green: inverted correspondence (proportion of GS-crux between the halves; IC); []=bar position in section; ()=bar length variant due to first and/or second ending (See full color version at www.performance-science.org.)

Table 1 (cont.)

<i>Sonata</i>	<i>Tempo (meter)</i>	<i>Length: A+B (in bars)</i>	<i>Crux: A, B (bar nos.)</i>	<i>GS (A, B); Crux (A, B)</i>
K.10, D minor	Presto (3/8)	36+39=75	21, 45	22, 25; 24, 10
K.11, C minor	Allegro (4/4)	14+14=28	10, 24 [11]	8, 65; 8, 65
K.12, G minor	Presto (4/4)	24+24=48	19, 44	14, 83; 14, 83
K.13, G major	Presto (2/2)	54+59=113	29, 84	33, 37; 36, 46
K.14, G major	Presto (12/8)	19+24=43	12, 36 [17]	11, 74; 14, 83
K.15, E minor	Allegro (3/8)	54+58=112	28, 87	33, 37; 35, 85
K.16, Bb major	Presto (2/2)	59+53=112	34, 91 [32]	36, 46; 32, 76
K.17, F major	Presto (3/8)	55+74=129	35, 104	33, 99; 45, 73
K.18, D minor	Presto (4/4)	27(28)+25(26)= 52(53)	18, 44 [16]	16, 69; 15, 45
K.19, F minor	Allegro (2/4)	38+54=92	16, 58	23, 49; 33, 37
K.20, E major	Presto (2/4)	64+38=102	37, 88 [24]	39, 55; 23, 49
K.21, D major	Allegro (3/8)	74+76=150	53, 129	45, 73; 46, 97
K.22, C minor	Allegro (2/4)	36+42=78	19, 63 [26]	22, 25; 25, 96
K.23, D major	Allegro (4/4)	32+38=70	14, 51-52	19, 78; 23, 49
K.24, A major	Presto (4/4)	36+30=66	20, 57	22, 25; 18, 54
K.25, F# minor	Allegro (2/4)	45+42=87	30, 75	27, 81; 25, 96
K.26, A major	Presto (3/8)	68+80=148	48, 121 [53]	42, 03; 49, 14
K.27, B minor	Allegro (3/4)	31+37=68	11, 47	19, 16; 22, 87
K.28, E major	Presto (3/8)	57+72=129	29, 100 [43]	35, 23; 44, 50
K.29, D major	Presto (4/4)	48+39=87	24, 66	29, 67; 24, 10
<i>Cantabile</i>				
K.77, D minor	Moderato e cantabile (3/4 and 3/8 Minuet)	17+30=47, 20 (13)+20=40; 47+40=87	11, 31; 60, 79 = 87	10, 51; 18, 54 (Cant.) 12, 37; 12, 37 (Minuet)
K.132, C major	Cantabile (3/4), Andante (3/4)	37 (38)+39=76	25, 65	22, 87; 24, 10
K.144, G major (Albero?)	Cantabile (2/2)	18+16=34	12, 28 [10]	11, 21; 9, 89
K.170, C major	Andante moderato e cantabile (2/2), Allegro (3/8)	46 (And. mod. e cant.) + 99 (Alleg.)=192	Not bi-partite (And. mod. e cant.); 85 [39], 117[71] (Alleg.)	n/a (And. mod. e cant.) 24, 10; 72, 31 (Alleg.)
K.176, D minor	Cantabile andante, Allegriissimo (alternating 2/2 and 3/8)	20 (Cant.)+50 (Alleg.)+37 (Cant.)+85 (Alleg.)=192	(Cant.) 11 (Alleg.) 37[17] (Cant.) 89[19] (Alleg.) 124[17]	12, 36 (Cant.); 10, 51 (Alleg.); 22, 87 (Cant.); 52, 53 (Alleg.)

Table 1 (cont.)

<i>Sonata</i>	<i>Tempo (meter)</i>	<i>Length: A+B (in bars)</i>	<i>Crux: A, B (bar nos.)</i>	<i>GS (A, B); Crux (A, B)</i>
K.208, A major	Adagio e cantabile (4/4)	14+11=25	11-12, 22-23[8-9]	8, 65; 6, 80 overlap
K.277, D major	Cantabile andantino (2/2)	23+17=40	20, 36[13]	14, 21; 10, 51
K.304, G major	Andante cantabile (2/2)	25(26)+26=51	16, 40(41)	15, 26; 16, 07
K.308, C major	Cantabile (2/2)	35+29=64	21, 50[15]	21, 63; 17, 92
K.347, G minor	Moderato e cantabile (2/2)	27+20=47	20, 38[11]	16, 69; 12, 36
K.474, Eb major	Andante e cantabile (3/4)	28+26=54	12, 32	17, 30; 16, 07
K.478, D major	Andante e cantabile (3/4)	61+54=115	28, 71	37, 70; 33, 37
K.481, F minor	Andante e cantabile (2/2)	35+31=66	26, 57[22]	21, 63; 19, 16
K.485, C major	Andante e cantabile (2/2)	30+25=55	25, 49	18, 54; 15, 45
K.490, D major	Cantabile (2/2)	48+45=93	25, 70	29, 64; 27, 81
K.507, Eb major	Andante e cantabile (2/4)	72(73)+58=130(131)	41, 99	44, 50; 35, 85
K.534, D major	Cantabile (4/4)	19+16=35	10, 26[7]	11, 74; 9, 89
K.536, A major	Cantabile (2/2)	35+30=65	16, 48	21, 63; 18, 54
K.544, Bb major	Cantabile (3/4)	22+19=41	12, 31[9]	13, 60; 11, 74
K.546, G minor	Cantabile (3/8)	54+54=108	29, 81	33, 37; 33, 37

IMPLICATIONS

Similarities and differences result. What is striking is that in both *E* and *C*, regardless of tempo, close direct correspondence (DC) GS-crux proportions result (21% *E* and 20% *C*; a total of 10 of 49 sonatas, or 20%). Summing DC and close correspondence (CC) in *E*, without duplicating sonatas, the GS-crux relationship is more than half or 55% (K. 1, 2, 3, 4, 8, 9, 10, 11, 14, 16, 18, 20, 22, 25, 26, 28; 16 of 29 sonatas). If indirect correspondence (IC) is added, then GS-crux rises to 69% (20 of 29 sonatas). The same procedure in *C* with no IC present yields 65% in 13 distinct sonatas (K. 77, 132, 144, 170, 176, 208, 288, 304, 308, 347, 481, 534, 544; 13 of 20 sonatas) The total for *E* and *C* based on DC plus CC is 59% (29 of 49 sonatas) and based on DC plus CC plus IC is 67% (33 of 49 sonatas). While *C* may be freer and improvisatory, these

Table 2. Summary.

<i>Sonatas</i>	<i>Direct correspondence (DC)</i>	<i>Close correspondence (CC)</i>	<i>Inverted correspondence (IC)</i>
<i>Essercizi</i> (n =29)	21% (6 sonatas): K. 2, 4, 9, 16, 18, 20	48% (14 sonatas), 34% (10 sonatas): K. 1, 2, 3, 4, 8, 10, 11, 14, 16, 18, 22, 25, 26, 28	14% (4 sonatas): K. 5, 15, 24, 29
<i>Cantabile</i> (n = 20)	20% (4 sonatas): K. 77, 144, 304, 308	50% (10 sonatas), 45% (9 sonatas): K. 132, 170, 176, 208, 277, 308, 347, 481, 534, 544	0% (0 sonatas)

Key. Red: overlapping sonatas; blue: calculation without duplication. (See full color version at www.performancescience.org.)

sonatas tend to show more frequent GS intersection in both halves than *E*. No GS-crux relationship in total sonata length was found. Rare, symmetrical sonatas are inconclusive (K. 3, 11, 12, 77, 546). The fact that K. 144, perhaps attributed to Albero, has GS in both halves could make authorship questionable or could show similar techniques.

From this initial study of less than 10% of Scarlatti's keyboard works, it seems that Scarlatti's proportional sense is strongly aligned to GS-crux placement, consciously or not. I propose to make a further, systematic GS-crux calculation of the remaining 500+ sonatas. Thus, new light may be shed upon the dubious chronology of the sonatas and their stylistic treatment, including Scarlatti's fervour for implied polymetric usage, 3-bar phrases in triple meter, the mixing of cultural elements, as well as other aspects, in these wonderful and complex musical offerings.

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