

Bach: Forerunner of the Future through Exploration of the Potential of Learned and Natural Schemata

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Much has been written about Bach's unique methods of composition and his creativity.¹ This article focuses on the principles behind the rules of musical organisation which Bach used; rules that are characteristic of later styles of a particular period or composer. These principles are presented by means of the concept of schemata ('learned' and 'natural'), a concept widely used in research into music and cognition.² Different schemata have been selected in different styles, in keeping with the aesthetic ideal³ and subject to psychoacoustic and cognitive constraints.⁴ The examples taken from Bach's

- ¹ For example R. L. Marshall, *The Compositional Process of J. S. Bach* (Princeton: Princeton University Press, 1972); Marshall, 'Bach the Progressive: Observations on his Later Work', *Musical Quarterly* 62 (1976), 313-57; Marshall, *The Music of Johann Sebastian Bach: The Sources, the Style, the Significance* (New York: Schirmer, 1989); D. Schulenberg, *The Keyboard Music of J. S. Bach* (New York: Schirmer Books, 1992); J. Butt, 'Bach's Metaphysics of Music', in Butt (ed.), *The Cambridge Companion to Bach* (Cambridge: Cambridge University Press, 1997), pp. 46-59; Butt, *Bach: Mass in B Minor* (Cambridge: Cambridge University Press, 1991); P. Williams, *Bach: The Goldberg Variations* (Cambridge: Cambridge University Press, 2001); L. Dreyfus 'Bachian Invention and its Mechanisms', in *The Cambridge Companion to Bach*, pp. 171-92; C. Wolff, *Bach: Essays on his Life and Music* (Cambridge, MA: Harvard University Press, 1991); Wolff, *Johann Sebastian Bach: The Learned Musician* (New York: Norton, 2000).
- ² For example M. Leman, *Music and Schema Theory: Cognitive Foundation of Systematic Musicology*, Berlin: Springer, 1995. The term 'schema,' which refers to principles of organisation with respect to cognitive activity, was coined by the psychologist Bartlett in 1932.
- ³ One of the important characteristics of an aesthetic ideal is the type of directionality and complexity: momentary/overall; clear/suspensive (D. Cohen, 'Directionality and Complexity in Music', *Musikometrika* 6 (1994), 27-77; 'Incorporating Natural Schemata into Musical Analysis', *Orbis Musicae* 13 (2003), 195-211).
- ⁴ D. Huron, 'Tone and Voice: A Derivation of the Rules of Voice Leading from Perceptual Principles', *Music Perception* 19 (2001), 1-64; *Music Cognition Handbook: A Glossary of Concepts* (Ohio State University School of Music, 2003).

works relate to the systematic use of schemata, even when they appear in just one piece.

My aim is to examine Bach's desire to explore the many possible manifestations of schemata on which musical organisation in the western tonal system is based, while uncovering all the different options in the western system. This exploration of schemata is in accordance with Bach's belief that 'the aim and final reason of all music should be the glory of God and the recreation of the mind; permissible declaration of the spirit' and that 'it must be possible to do anything'.⁵ Before we look at Bach's works, I will outline a few ideas on the concept of natural schemata.

The 'natural' schemata, unlike the 'learned' ones, are familiar to us from outside the realm of music and are not culture-dependent. Some examples of natural schemata are ranges of occurrence for various parameters (register, density, degrees of change, etc.) in relation to the normative range, any divergence from which causes excitement;⁶ curves of change (ascent/increase or descent/decrease, convexity or concavity, zigzag or horizontal) for different parameters; categories of operations that may be regarded as cognitive operations (contrast, shift, expansion/reduction, segregation /grouping, and equivalence);⁷ the degree of definability, as manifested in categorisation and in concurrence/non-concurrence;⁸ various types of deviations from expectations;⁹ and rarity.¹⁰

Learned schemata never appear without natural schemata. The latter are the main factor in the planning of twentieth-century music, in which learned schemata are weak or almost non-existent. Conscious attention to natural schemata is manifested in theories of sophisticated organisation.¹¹ Computers have enhanced the possibilities for controlling operations within the various parameters, often resulting in pieces which have a unique superstructure. Yet

- ⁵ H. T. David and A. Mendel, *The Bach Reader* (London: J. M. Dent and Sons, 1945); Butt, 'Bach's Metaphysics of Music', p. 57.
- ⁶ D. J. Hargreaves, *The Developmental Psychology of Music* (Cambridge: Cambridge University Press, 1986); Huron 'Tone and Voice'.
- ⁷ D. Cohen, and S. Dubnov, 'Gestalt Phenomena in Musical Texture', in M. Leman (ed.), *Music, Gestalt and Computing* (Berlin: Springer 1997), pp. 386-405.
- ⁸ D. Cohen and N. Wagner, 'Concurrence and Nonconcurrence between Learned and Natural Schemata: The Case of Johann Sebastian Bach's Saraband in C Minor for Cello Solo', *New Music Research* 29 (1) (2000), 23-36.
- ⁹ L. B. Meyer, *Emotion and Meaning in Music* (Chicago: University of Chicago Press, 1956); *Style and Music: Theory, History, and Ideology* (Philadelphia: University of Pennsylvania Press 1989); R. Granot, 'A Study of Musical Expectancy by Electrophysiological and Behavioral Measures', Ph.D. dissertation, the Hebrew University of Jerusalem, 1996.
- ¹⁰ C. C. Duncan-Johnson, and E. Donchin, 'On Quantifying Surprise: The Variation of Event-related Potentials with Subjective Probability', *Psychophysiology* 14 (1977), 456-67.
- ¹¹ P. Boulez, *Boulez on Music Today* (London: Faber and Faber, 1971); A. Vieru, *Book of modes* (Bucharest: Editura Musicala, 1993); T. Wishart, *Audible Design* (York, England: Orpheus the Pantomime, 1944); I. Xenakis, *Formalized Music* (Stuyvesant, NY: Pendragon Press, 1999).

long before the computer age, Bach used all these principles, primarily for the parameter of pitch but also for other parameters.

Many characteristic principles of styles post-date Bach but appear systematically in his works. The sonata form; significant chromatic shifts and systematic enharmonic interpretations typical of the romantic period; delayed resolution; rarity as a factor in shaping the structure; segregation and grouping on various levels; tonal and real operations and bitonality; and manifestations of complicated symmetry on various levels are discussed below.

I The principles of the sonata form as a natural schema

Many scholars have referred to Bach's use of sonata form,¹² especially with respect to some of the preludes in Book II of the *Well-Tempered Clavier*, but also with respect to his fugues (mainly in Book I). Marshall notes that 'it does not seem to be an exaggeration to place J. S. Bach in the vanguard of sonata composers'.¹³ But the only feature of sonata form they choose to emphasise is the recapitulation when it is represented by repetition of the opening theme group, even in preludes, which are not divided by a repeat sign.

The schema of what is known as sonata form represents an aesthetic ideal of 'clear overall directionality' with complexity. This ideal is best illustrated by the way the form is used in the west during the classical era.¹⁴ One basic condition for clear overall directionality is the existence of binary features, i.e. pairs of contrasting units on various levels, which are clearly related to and complement each other. The other condition has to do with the two most directional schemata – the convex curve,¹⁵ and organisation according to the 2ⁿ pattern (2+2+4+8 ...). This symmetrical schema is one realisation of the operation of segregation/grouping. Musical cultures can even be characterised by their proximity to or distance from this schema.¹⁶

Contrasting pairs to be found in the 'ideal' sonata include: exposition versus the rest (development and recapitulation), defined and distinguished by a single repetition of each and by the superstructure of the tonal centres: ABA (||:A→B:||:→A:||); main versus secondary tonal centre, where there is only

¹² For example, R. von Tobel, *Die Formenwelt der klassischen Instrumentalmusik* (Bern: Paul Haupt, 1935); C. Gray, *The Forty-eight Preludes and Fugues of J. S. Bach* (London: Oxford University Press, 1938); Schulenberg, *The Keyboard Music*; R. L. Marshall, 'Johann Sebastian Bach', in Marshall (ed.), *Eighteenth-Century Keyboard Music* (New York: Schirmer, 1994), pp. 68-123.

¹³ Marshall, 'Johann Sebastian Bach', 106.

¹⁴ The most extensive and detailed description of the characteristics of types of units on the various levels of the sonata form is found in W. E. Caplin, *Classical Form* (Oxford: Oxford University Press, 1998).

¹⁵ D. Huron, 'The Melodic Arch in Western Folksongs', *Computing in Musicology* 10 (1997), 3-23.

¹⁶ C. Sachs, *Rhythm and Tempo* (London: Dent, 1953)

one kind of relationship between A and B (unlike in a suite); exposition versus recapitulation, distinguishable only in terms of the tonality; exposition and recapitulation versus development, which are clearly distinguishable mainly with respect to order versus disorder, and which together produce a convex curve of tension (as opposed to ABA structures in some romantic music that produce a concave curve); first subject versus second subject, which in the ideal case are related and can be distinguished in terms of the tonal centres, texture, and complexity,¹⁷ with each subject appearing once in the exposition and the recapitulation and no repetitions in the same or a different scale; first half versus second half of the period.

Sonatas from different eras are different in style according to the degree to which the above conditions are fulfilled. In Mozart's works the deviations are minimal. The first condition mentioned above applies to the baroque suites, but, with respect to the second condition, there are already at least three acceptable options (instead of one) for the relationship between the tonal centres A and B. The conditions for the sonata form in the ten preludes in Book II (those made up of two repeating parts), which may be seen as being somewhere between the suite and the sonata, are explored below.

i) The preludes that approximate sonata form

A comparison of the ten preludes, in terms of the characteristics that contribute to the principles of the schemata of the sonata (see Fig.1), shows that their relationship is one of 'family resemblance'. For example, the Prelude in D Major has maximum similarity between the exposition and the recapitulation, but the second subject is not well defined thematically; the Prelude in G# Minor has the beginning of a recapitulation, i.e. similarity to the beginning of the exposition, but there is no similarity between the ends of the parts; the Prelude in G Major has a lot of similarity, relatively speaking (in six bars), between the ends of the two parts, but not at the start of the recapitulation.¹⁸

The main findings are as follows (see Fig. 1):

- 1) With respect to the tonal centres, four of the six preludes in minor keys (D#, E, G#, and A) do not follow the rules of sonata form.
- 2) In all the preludes, parts of the exposition are repeated (with the main tonality) fairly precisely in the 'recapitulation', but the subject never appears precisely (unlike in the sonata). In three of them the recapitulation follows a clear cadence.
- 3) Most of the preludes begin with a phrase type that includes an opening, a sequence, and a cadence,¹⁹ with the opening ('head') made up of a motive of ½-3 bars, first in one voice and then in the other. In the other three (in D major

¹⁷ Caplin, *Classical Form*.

¹⁸ Marshall, 'Johann Sebastian Bach', mentions only five of the ten as having sonata form.

¹⁹ Butt, *Bach: Mass in B Minor*, p. 61.

The tonal centres	Similarities (structure)	The heads	
		in the opening	reappear in the exposition (not in the sonata form!)
c → Eb	: 12 : : 16 : 	① 1̄ + 1̄	⑨ 1̄ (Eb) ⑪ 1̄ (c)
D → A	: 16 : : 24 + 16 : 	① 2̄ + 2̄ 	⑩ 1̄ (V/V)
d# → a#	: 16 : : 11 + 9 : 	1̄ + 1̄	⑨ 1̄ + 1̄ (F#) + 1̄ + 1̄ (a#)
E → B	: 24 : : 30 : 	4̄ (E) + 4̄ (B)	—
e → b	: 48 : : 60 : 	2̄ + 2̄	⑬ 2̄ (b) ⑰ 2̄ (G) 2̄ (e)
f → Ab	: 28 : : 28 + 14 : 	4̄ (≠) + 4̄ 	⑫ 4̄ (≠) + 4̄ (Ab)
G → D	: 16 : : 32 : 	3̄ (G) + 3̄ (D)	—
g# → d#	: 24 : : 16 + 10 : 	2̄ + 2̄ 	⑯ 2̄ (d#)
a → V(?)	: 16 : : 8 + 8 : 	1̄ + 1̄ (a) + 1̄ + 1̄ (e)	⑧ 1̄ (C) ⑨ 1̄ (G) ⑬ 1̄ (a)
Bb → F	: 32 : : 16 + 39 : 	1̄ 1/2 + 1/2 + (1/2)	⑳ 1̄ 1/2 + 1/2 + (1/2) (F)

Similarities (in numbers of bars)

- ┌ or └ – between the ends of the main two parts
- ┐ or ┑ – the beginnings of “exposition” and “recapitulation” (similarity between the beginnings of the main two parts, which always appears, is not indicated)
- ⊗ – Preceded by clear cadence

Heads

- The location of the dash (–), above (1̄) or below (1̄) the number, indicates the voice for the main “idea” – upper or lowest.
- In brackets – the tonal centre;
- Within a circle – the bar number.

Fig. 1. Manifestation of sonata form in the ten preludes from vol. II with the overall structure ||:A → B:||: → A:|| (A & B – the main tonal centres).

C# minor, and F minor), as in the classical period, we find various degrees of the schema 2ⁿ, with the peak in the Prelude in F Minor.

4) The beginning of the second part (the 'development') always appears in the new key (other than in the Prelude in Bb Major) and with the first subject (unlike the sonata, which has many more options and greater contrast between the development and the exposition).

5) In most of the preludes, the opening recurs in the exposition in the new key (unlike in the classical sonata). In some cases it also recurs in the original key, in a different key, or not at all (i.e. four options). With two exceptions, this does not occur in Mozart's sonatas (where there is only one option); in Haydn's the phenomenon is known to be monothematic.

Part	Subject	Tonal centre	Bar	4-bar units (a-k)		
				4 (bars)	4	4
: Exposition :	A	f		a	b	
	"Bridge"	f → Ab	8	a	(direct cont. into A')	
	A'	Ab	12	a'	b'	
	B	Ab (Descending fifth → Ab)	20	c	d	:::
: Development		Ab → eb...bb <small>local</small>	28	a	e	f
		Descending fifth → f	40	g	h	
		f → bb → f	48	i	j	
Recapitulation :	~A	f	56	ã		
	cont. of ã? introduction to B?	f	60	k		
	B	f (Descending fifth → f)	62	c	d	:::

A and B – first and second subject ... – indicates the absence of a clear harmonic degree
 a-k – 4-bar units that differ in texture and harmony □ – indicates I-V-I in a fundamental position (unusual for Bach)

Fig. 2. Sonata form of the prelude in f (vol. II) in terms of various units on four levels.

6) Only in the Prelude in F Minor is there clearly a second subject that is well defined thematically and in terms of the tonal centre.

ii) The Prelude in F Minor

This prelude is particularly relevant due to the distinction between its units, in terms of texture as well. It is examined here (see Fig. 2) in greater detail than the others so that we can understand how closely it approximates to the ideal sonata schema, and so that we can discern Bachian characteristics that help to blur the clear structure. And where is the Bachian side manifested? Answer: in uniformity despite change. Even in the exposition, where the distinction between units is greatest, there is a lot of similarity between units, in addition to extreme uniformity within each unit, as in most of the preludes in Book I. All the units have the three sub-motifs of the opening motif (see Fig. 3): the rest, the prime, and the pair of notes at an interval of a second. These appear throughout the piece with various operations.



Fig. 3. Unification in the sonata form in the prelude in f (vol. II) by means of three sub-motifs characteristic of Bach (bar numbers within circles).

The sub-motif of a rest causes choppiness. This subject (in bar 20) flows the most smoothly, because it is absent only from the upper voice of the second subject. This is what sets it apart from the first subject.

II Deviation from expectations

Here four characteristics of deviation from expectations that appear systematically in the romantic period are explored: divergence from the normative range of occurrence, chromatic shift and enharmonic interpretation, delayed resolution, and rarity. The various factors may be concurrent or nonconcurrent (which in itself may produce complexity and tension).

i) Divergence from the natural schema of the normative range of occurrence

Many of the rules of Palestrina counterpoint, which call for calm, can be expressed as avoiding divergence from normative ranges. In contrast, in Chopin's works we find maximum evenness (for instance, in the Funeral March, the momentary harmonic progression I→VI and the rhythm are repeated in 31 bars), along with sudden changes in register, intensity, and so on. Bach's tremendous evenness is prominent in various respects.²⁰ Here I will mention two examples of contrast with respect to the direction of the divergence, one on the overall and the other on the immediate level. The first is the contrast between the *St Matthew Passion* and the *B Minor Mass* in terms of the general characterisation of their movements: the duration of each movement, the tonal centres, and the texture. The *St Matthew Passion* is marked by enormous variety, whereas the mass has maximum uniformity. The other example is the contrast between the melody of the first and second Kyries in the mass. The first has numerous skips (which create levels of latent polyphony), whereas the second does not have a single one.


ii) Chromatic shifts and enharmonic interpretations

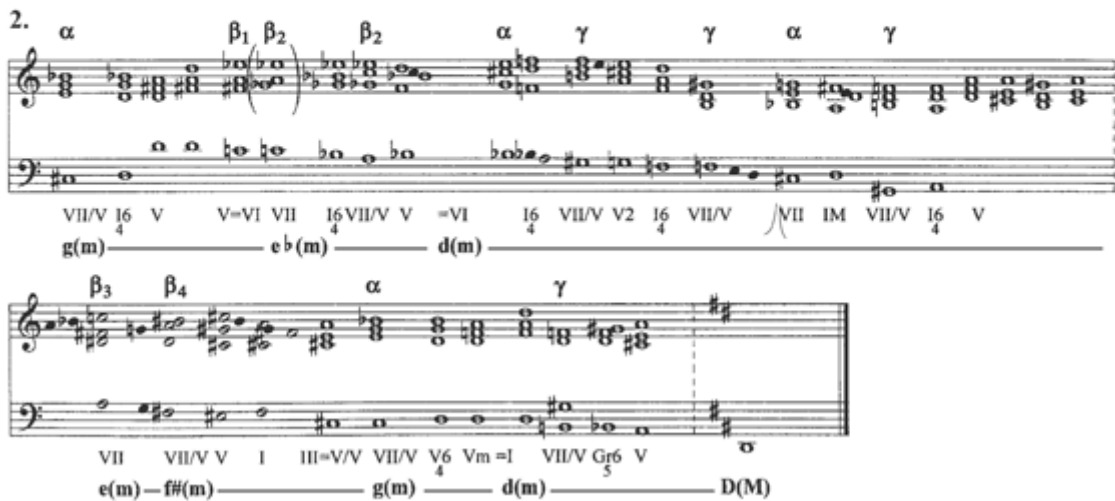
Chromaticism is very common in baroque music but, when combined with enharmonic interpretation, it became established and stylised mainly in the romantic period – so much so that one can speak of Schubertian chromatic style, Chopin's style, Brahmsian style, and so on. A good example is found in Schubert's music. It recurs in many of his later pieces and gives us a momentary sense of fainting, as in the lied 'The Guide Post' ('Der Wegweiser'), from the *Winterreise*. We can discern two principles here. One is a chromatic shift of one or more notes in the dominant, which is the most directional, chord. This shift sends us to distant tonal centres. The other is the systematic use of enharmonic interpretations of augmentation or diminution (the 'wandering chords,' to use Schoenberg's term).²¹ Both principles are conspicuous in 'The Guide Post'. The second is realised at the start of the coda, where the text speaks of going to the afterworld, where direction, 'before' and 'after,' are meaningless. And what does the music express? Schubert uses three interpretations of a single diminished chord. This is an extraordinary example of 'translating' a text into music (see Fig. 4.3).

²⁰ Bach's extreme uniformity captivated Schoenberg, who saw the uniformity in the various appearances of the one dodecaphonic line.

²¹ Arnold Schoenberg, *Structural Functions of Harmony* (London, Williams and Norgate, 1954).

1. The three diminished chords — α , β , γ — and the four enharmonic interpretations of β (β_1 - β_4) in the piece
2. Harmonic analysis of the piece on the most immediate level with the diminished chords α , β , and γ marked.
3. The analogy to Schubert. 4. Overall structure of the “Confiteor”.

1.  Numerous diminished chords and enharmonic interpretations convey a sense of uncertainty befitting the afterlife, as in Schubert (3).

2. 

3. Schubert: From “The Guidepost” (Winterreise)

Yet I see a guidepost standing
 Ever more before my face
 To a path my feet commanding
 That no traveller can be traced
 [a reference to the afterlife]



4. General structure of the “Confiteor,” piece no. 19 (the end of the Credo)

concurrence and nonconcurrence between textual units (a-d) and musical units (I-III; III splits into a-g): two interpretations of text c – from death to resurrection.

Music parts	I (F# minor fugue)			II (blurred)	III (Quasi-fanfare on D)		
	[120]				[26]	[105]	
bars	subject A [15 ^{1/2}]	subject B [15 ^{1/2}]	A and B [90]		α [35] (i + ii + iii) [9] [7] [16]	β [28] (i + iv + ii) [9] [11] [8]	γ [45] (iii + iv) [26] [19]
Text	a	b	a and b	c			d

Text: a. Confiteor unum baptisma b. in remissionem peccatorum
 c. et expecto resurrectionem mortuorum d. et vitam venturi saeculi. Amen.

Fig. 4. Strong deviation from expectation typical to Schubert: harmonic progressions in the middle section of the “Confiteor” (in the text: “et expecto resurrectionem mortuorum”).

And Bach? He uses all the chromatic types,²² but what is interesting for our purposes is the regular organisation of the deviations, as in Schubert's works, as well as the verbal context of death (see Fig. 4). In the last part of the 'Credo' in the *B Minor Mass*, in the middle part of the 'Confiteor' (consisting of three parts; see Fig. 4.4), where the text refers to death and the expected resurrection ('Et exspecto resurrectione mortuorum'), Bach uses all the means used by Schubert and even expands them. In the blurred section (see Fig. 4) he brings in all three possible diminished seventh chords (as opposed to one in Schubert's work), including one with all four enharmonic interpretations (as opposed to three in Schubert). He then proceeds from this vague section to the opposite extreme – the section in D major with a minimum of chords: the tonic and the dominant. Interestingly, he continues with the same text but gives it a different interpretation. In the middle section he uses the music to underscore death; in the last section it stresses resurrection.

iii) Delayed resolution

Delayed resolution, which is related to expectation/realisation, is one artistic means of shaping types of directionality. Recent experiments have shown that it is of great importance in determining the perception of time (it lengthens the subjective sense of time).²³ It may appear on various levels, blur directionality, and cause complexity and tension, but when it is entrenched and appears as a familiar schema – as in the classical period, in which the first half ends on the dominant and the second half on the tonic – it contributes to clear directionality. Delayed resolutions are particularly noticeable in romantic music. For example, in Chopin's Mazurka in A Minor (Opus 17, no.4), the tonic appears only in bar 20. We can even speak of methods of delaying a resolution that are characteristic of Chopin.²⁴ In Brahms' Rhapsody for Piano (Opus 79, no.1) in B minor, which has the structure ABA + coda, the tonic in B does not appear until bar 89 (out of 93 bars in part A).

Bach uses numerous methods to delay the resolution for various lengths of time. The example above of enharmonic interpretation (see Fig. 4) delays the resolution to D.²⁵ A simple example in the Chaconne for Violin Solo (see Fig. 7) is the delay in the appearance of the last note in the melodic line (the tetrachord Bb to F) – a line that is repeated many times throughout the piece. A more dramatic delay is found in the Chaconne at the end of the first part of three, which ends conspicuously in bar 124 on the leading note C#. The resolution comes only eight bars later, at the end of the recurrence of the opening phrase and the start of the second part in the major key (bar 133).

²² Butt, *Bach: Mass in B Minor*, p. 81.

²³ M. G. Boltz, "Time Judgment of Music Endings: Effect of Expectancies on the "filled Interval Effect", *Perception and Psychophysics* 46 (1989), 409-16.

²⁴ W. Rothstein, 'Ambiguity in the Themes of Chopin's First, Second and Fourth Ballades', *Integral* 8 (1994), 1-50.

²⁵ Butt, *Bach: Mass in B Minor*, p. 100.

In the D Minor Fugue in Book II, the subject of the fugue that appeared at the beginning with no clear cadence is fully resolved only at the end of the fugue. In the introduction to the aria in section no. 58 of the *St Matthew Passion*, resolutions are delayed by means of momentary deviations from expectations, which creates excitement and a focus on the moment. An entrenched delay in the resolution is inherent in a typical coda of Bach's minor-key pieces. It is considered an expansion of the tonic with an ending on a major tonic (with a Picardy third). More specifically, the formula follows a clear cadence with V, while the tonic, in contrast to what we would expect, appears as V₇/IV. The resolution is delayed in accordance with the formula V→I_M⁷=V/IV→IV→VII→I_M, against the backdrop of the pedal point, resulting in a sense of open cadence.²⁶ It expresses a retreat and completion and reflects 'Bach the Believer'. In the 'Chromatic Fantasy' the formula is greatly extended; in the C# Minor Fugue in Book I, which has three subjects, the formula includes the first and third subjects in F# minor (!), which emphasises the open cadence as a sort of V of F# minor. And finally, an extreme case of a systematic delayed resolution is found in the D# Minor Fugue, in which all of the last five cadence points, up to the conclusion, (V→I) are on V and the feeling is one of cyclic movement (see Fig. 5).

iv) Rarity

Rarity is one of the means used to add emphasis and excitement.²⁷ It may be regarded as a factor that can compete with causes of excitement derived from properties of the events. Rarity is especially meaningful when it is connected to common events in a piece (rare events that are not characteristic of the piece are irrelevant and meaningless). Various types of rarity have been used during different periods in history. Many composers of contemporary music use a state of 'supersaturation' with regard to the density of various parameters, as a rare event taking part in shaping the structure of the piece.²⁸

Bach uses most types of exciting rarity to shape the superstructure. Five examples are discussed below. First is the C Minor Fugue from Book I, which has been analysed many times in different ways and is considered extremely orderly: the main subject and the two countersubjects are repeated almost unchanged, and there are clear episodes.²⁹ Figure 6 shows that the structure of the fugue is determined by symmetry, rarity, and intensification.

²⁶ This formula is found in Bach's theoretical writings. See David and Mendel *The Bach Reader*, p. 389.

²⁷ This has been proven in ERP (Event-Related Potential) experiments, i.e. tests of brainwave responses to various stimuli (Duncan-Johnson and Donchin, 'On Quantifying Surprise').

²⁸ S. G. Horenstein, 'Supersaturation: A Phenomenon in Contemporary Music: On the Background of the Perception of Time', Ph.D. dissertation, the Hebrew University of Jerusalem, 2004.

²⁹ Schulenberg, *The Keyboard Music*, pp. 170–72.

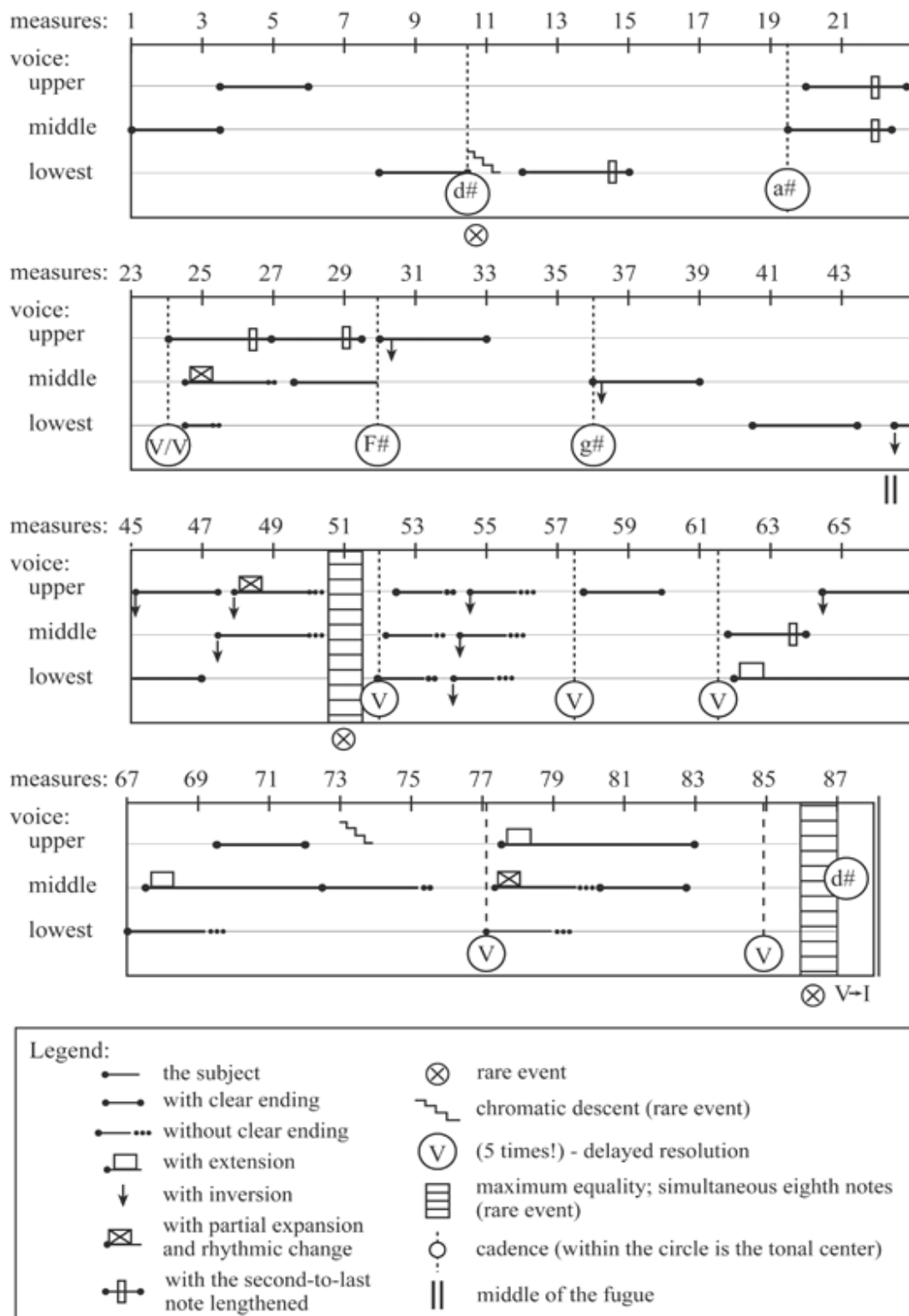


Fig. 5. The D# minor fugue in three voices from vol. I: the various appearances of the subject, which is the only source of the fugue (the others are derived by segregation and grouping)(see Fig. 9); rare events, symmetry (44+44) and delayed resolution.

In general terms, the fugue is highly symmetrical; it is made up of two parts of equal length (A and B in Fig. 6), followed by a cadence and a coda. Each part may be considered to consist of three sections that begin with the appearance of the subject. Rarity is involved in seven ways in shaping the structure of the fugue, together with symmetry and intensification.

Further examples of rarity include the extraordinarily symmetrical E Minor Fugue in Book I, which is composed of two parts and a coda, each part ends at its nineteenth bar on parallel octaves! This is certainly a rare case of divergence from the normative rules (see Fig. 12). In the D# Minor Fugue from Book I (87 bars altogether), all the voices appear homophonically with maximum density of eighth notes (ten in a row) in bars 50-51, before the cadence on V, which is repeated five times, and at the end (bars 85-86).³⁰ There is also a one-time descending chromatic line from I to V in the bass voice, from the end of bar 10 to the beginning of bar 13 (see Fig. 5). In the Chaconne we find rare peaks of various kinds: of blurred harmony (phrase 21, bars 81-84; see Fig. 7), of pitch (phrase 22, bar 87), and of density (phrase 44, bar 176); peaks of pitch at the end of each of the three parts; and so on.

III Segregation and grouping

This is a general operation, as stated above, since both segregation and grouping may be associated with various other operations. It has many manifestations and varies from style to style in accordance with the aesthetic ideal (here we will not go into the meaning of the various manifestations). The absence of this operation outside the west is conspicuous. The most extreme example of non-segregation or predetermined relationships is the modal framework, in which every mode is defined by a number of musical and non-musical components. In some styles today, segregation and grouping are a main concept. Bach exploits the operation to the fullest to achieve an enormous variety of directionality and complexity.

Bach mainly carried out this operation in the following ways.

- 1) Segregating a subject into sub-units and repeating them in various ways, with or without an operation.
- 2) Segregating the relationship between harmony and melody, so important in western tonal music. The deliberate shattering of this relationship is very noticeable beginning with Debussy, but we find it as early as Chopin (e.g. in the Nocturne in C Minor, Opus 48, no.1) and even Beethoven (in the first movement of the Moonlight Sonata, it appears as a conspicuous rare event; in the melody of the recurrent harmonic phrase $I \rightarrow N_6 \rightarrow V \rightarrow I$, twice (bars 16-17, 52-53) with the harmony $V/IV \rightarrow I \rightarrow V/IV$ and numerous dissonances).

³⁰ Rarity by means of uniformity of all voices and maximum density in a polyphonic section is fairly common with Bach, for instance in the fugue in the second Kyrie from the B Minor Mass, in the D Major Fugue in Book I, and in the First Invention.

Overall structure

A		B	cadence	coda
(14 bars)		(14)	($\frac{1}{2}$)	($2\frac{1}{2}$)
measures: 1 voice:		15 	29 \otimes_7 V→I	29 $\frac{1}{2}$ "Bach the believer"
measures: 7 voice:		20 	Legend: 	
measures: 11 voice:		26 $\frac{1}{2}$ \otimes_5 \otimes_6 \otimes_7 — y — y — y		

Two very common, prominent motives ((1) and (2) not shown in the figure)

- (1) The opening of the subject ($\overset{\alpha}{\text{V}} \overset{\beta}{\text{I}}$) - a mordant (α) and an ascending second (β), with a skip between them; occurs in all episodes but the third (c); only in bar 25-26 with descending β .
- (2) The opening of the first countersubject (in bar 3) - a scale with 16th that fills the "space" between the two levels in the main subject; occurs in all the episodes, with a shortening and expansion in the descent and ascent.

Rarity (\otimes 1-7) in the structure

- \otimes 1 - Does not include motive (1)
- \otimes 2 - Peak of pitch (C_5)
- \otimes 3 - Three occurrences of motive (1) with descending second (inversion of β)
- \otimes 4 - In the bass, scale (motive 2) appears ascending and descending as one convex curve
- \otimes 5 - The subject appears in the lowest register
- \otimes 6 - Silence in all three voices
- \otimes 7 - Homophonic cadence

Intensification (<) in A, in B, and in the piece as a whole (A<B)

- At the end of A are two \otimes s.
- B contains a development of the episodes and five \otimes s.

Delayed solution, retreat and completion in the coda "Bach the Believer":

V→(I_M (V/IV) - IV-II-VII-I_M)
 I - - - - - organ point

Fig. 6. The C minor fugue from vol. I: symmetry, rarity and intensification in an orderly fugue (the main subject and both countersubjects are repeated almost unchanged and there are clear episodes).

Phrase 21

a

b

Gr V7:V V6 VII7:IV V:IV IV6 Gr VII:I V:I
 VII \flat $\frac{4}{3}$ V7 I6 VII V7 IM6 VII \flat $\frac{4}{2}$ VII - - - V 16

V IV I

- a. On the immediate level – a monophonic nondirectional descending line with 21 thirds and three augmented seconds; on the levels of the upper and lowest peaks – two repeated diatonic lines (descending tetrachords) with a delay in the target note (F) of the upper line.
- b. The harmony combines a common harmonic pattern (descending second [V → IV] with secondary degrees) with salient dissonances (marked by \square in the upper staff).

Fig. 7. Rare harmonization and delay of resolution in the chaconne for violin solo: an extreme combination of directionality and uncertainty in phrase 21.

- 3) Segregating a unit on the immediate level so that its parts embrace the entire piece. The idea of expansion of a group of notes from micro to macro is emphasised by Schenkerian analysis. An interesting example of this is found in Brahms' Rhapsody for Piano, Opus 79, no. 1.
- 4) Grouping units so that they are related by 'family resemblance'.

Case 1

In most of the fugues Bach breaks down the subjects and uses their parts as raw material for the entire piece.

The extremely orderly C Minor Fugue in Book I, for instance (see Fig. 6), is organised on the basis of two motifs: the start of the main subject and the start of the first countersubject (scale). These are combined through the use of all the operations – contrast, shift, expansion, and reduction – to form a splendid structure.

The first invention – the Invention in C Major in Two Voices – is based on three sub-motifs derived from the opening motif (which lasts the equivalent of $2\frac{1}{2}$ quarter notes). In the Prelude in F Minor from Book II (see Fig. 3), Bach breaks down the opening motif into three micro-motifs that recur with various operations. One example of maximum use of a single unit is found in the D# Minor Fugue in Book I, which is based entirely on one subject, with no counter-subject or episodes. Bach breaks down the subject in various ways and performs different operations on each separately (see Fig. 8).

1. The subject

2. Possibility of hearing it in $\frac{3}{4}$

3. Some of Bach's segregations of the subject

4. A musical phrase obtained from combinations of subunits a, b, and c (in example 3) following numerous operations

Fig. 8. Segregation and grouping of the only subject of the fugue in D# minor (vol. I).

Cases 2 and 4

In the Chaconne for Violin Solo, Bach segregates the harmony from the melody and combines them in various ways. He also breaks the opening subject down into various components (see Fig. 10) (harmony, melody, the bass line, rhythm) and creates a series of units (periods of eight bars) related to each other by 'family resemblance', with each unit sharing a different factor with the next. The relationship thus obtained is so open that it reaches the point of almost total segregation, and then, to maintain balance, Bach presents a series of variations, all based on the same harmony.

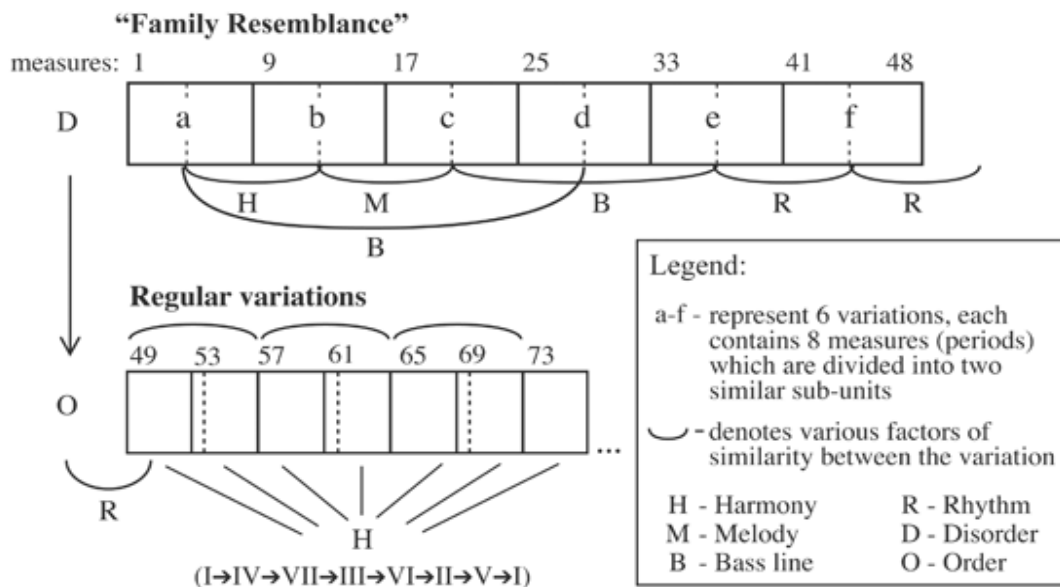


Fig. 9. Segregation and grouping: two types of repetition in the opening of Bach's chaconne for violin solo.

Cases 1 and 3

A special example is the C# Minor Fugue in Book I, which has three subjects (see Fig. 10). All three of these subjects may be viewed as derived from a virtual melody that is one realisation of a schema that Bach uses often (as we saw before): head (opening), sequence, and cadence. Here the 'head', which is the first subject, is a manifestation of the 'cross motif', which is full of tension and appears in various pieces by Bach with many operations: inversions, expansions, and reductions. (Some examples are the subject of the second 'Kyrie' from the *B Minor Mass* and the B-A-C-H motif.) The sequence (second sub-unit) is the second subject, and the cadence, which is the third subject, is a closing formula typical of Palestrina counterpoint in the fifth species of the Dorian mode. Bach 'breaks down' the virtual melody (which never appears in full) and uses its components to assemble the entire fugue (see Fig. 10).

In connection with this fugue, it is worth mentioning the principle of intensification, which is very typical of Bach.

Another example of expansion (in case 3) is found in the Prelude in E \flat Minor, which is based on the harmonic schema on the immediate level

I \rightarrow IV \rightarrow VII \rightarrow I (a common opening formula, along with I II₂ V_{6,5} I). This schema, which appears in the opening, also underlies the coda; it recurs in this prelude many times and embraces the entire piece.

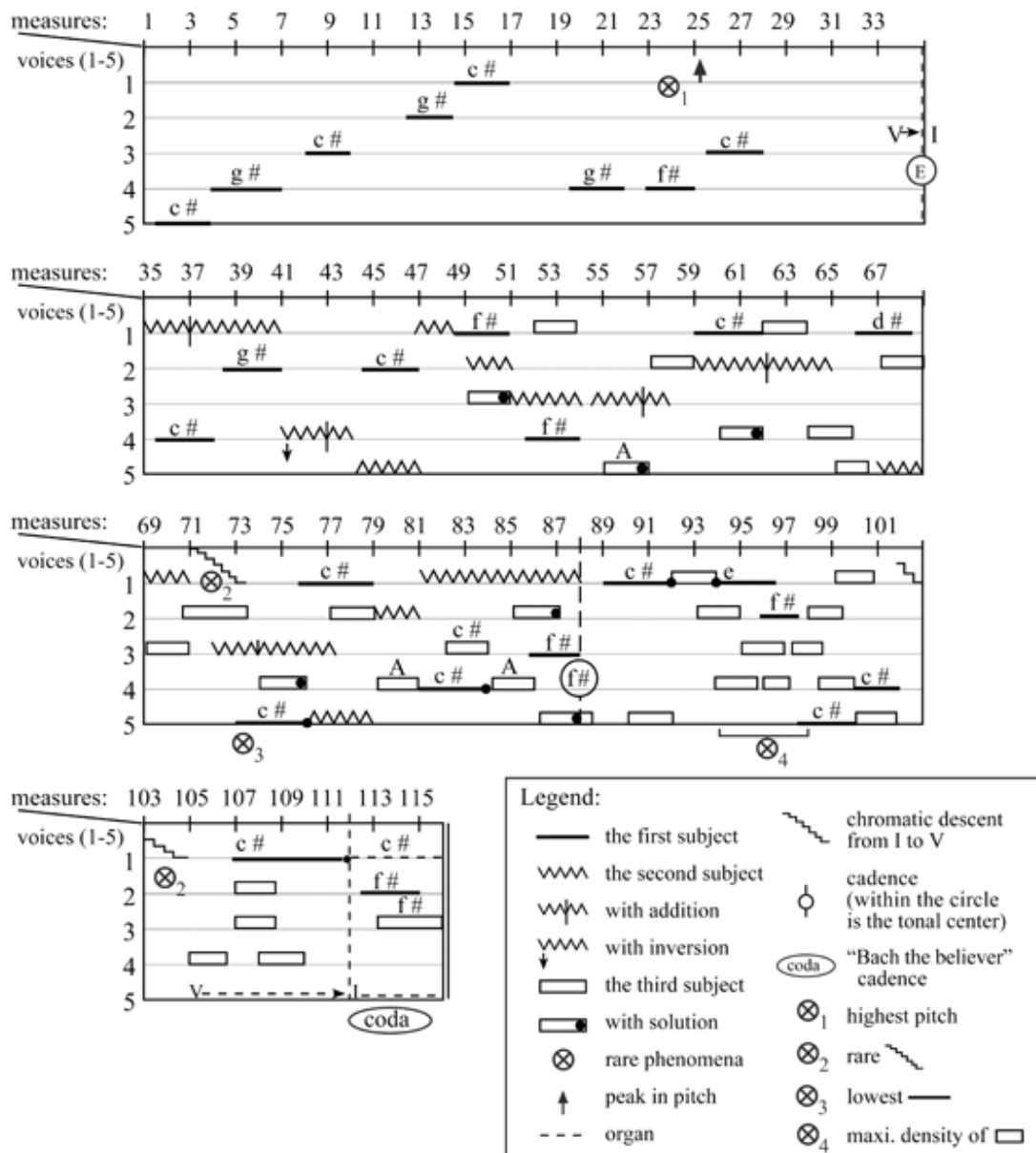
IV Real operations and bitonality

In tonal music all the operations are tonal, if we ignore the real answers in fugues. If they are real, the system of seven is broken. In dodecaphonic music, which has to do with the system of twelve (i.e. without all the schemata that relate to the system of seven), the operations are real. In Bach's works, almost all the operations are tonal, but there are some isolated, instructive cases of real operations. For example, in variation 25 in G minor from the *Goldberg Variations*, the second bar contains a real shift of the opening from G minor to F minor.

The real operation is particularly noticeable in Duet 803. This duet has the structure ABA, where A is a very limited, simple fugue with no chromatics, while B is a development of parts of the subject in A and is full of accidentals, due to the real shifts and real inversions in it. Because each melodic line is itself tonal, a sense of bitonality is created. The result is maximum stretching of the boundaries of the tonal framework (see Fig. 11).

V Symmetry

Symmetry may relate to the micro or macro, to the superstructure, or to occurrences on the immediate level. Styles differ in terms of the types of



*A virtual melody, which is a realization of one of the models – contains the three subjects

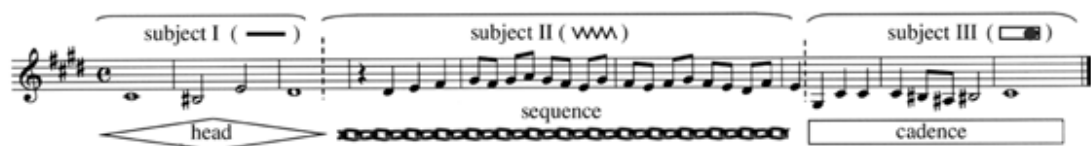
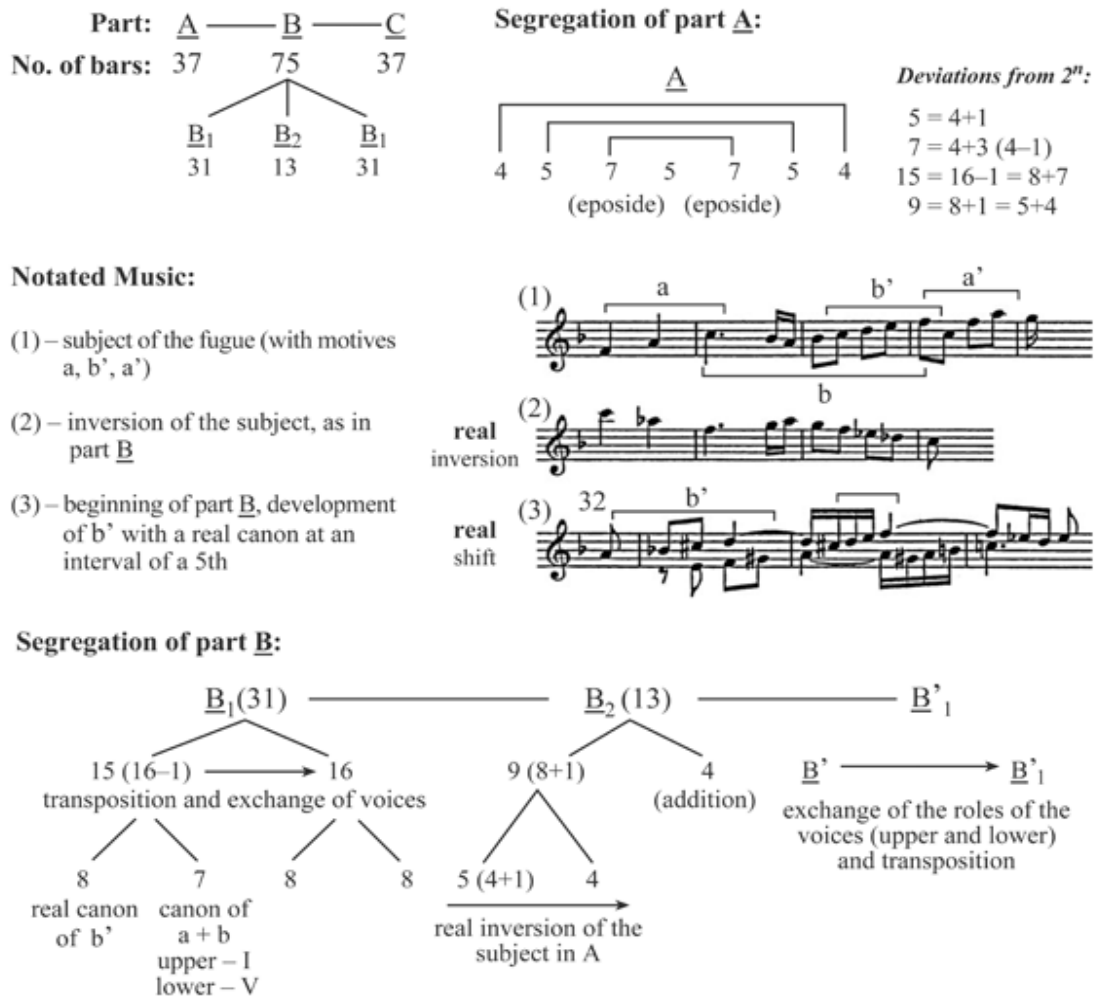


Fig. 10. The C# minor fugue in five voices from vol. I: segregation and grouping – three subjects that may be viewed as derivatives of virtual melody*; with intensification and significant rare events.



\underline{A} – small simple diatonic fugue; \underline{B} – “development” of \underline{A} , with multiple tonal centres, highly chromatic, with real operations and bitonality

\underline{a} – motive composed of a triad; \underline{b} – motive composed of successive seconds

The various units follow 2^n with modifications (additions or deletions) in addition to symmetry.

Fig. 11. A combination of symmetry (retrograde not on the immediate level and 2^n with deviations) and real operations in duet no. 2, BWV 803.

symmetry and types of deviation from symmetry.³¹ Much has been written about symmetry in Bach’s works, both in the structure of relatively small pieces such as preludes and fugues,³² and in superstructures such as that of the *St Matthew Passion*³³ (which resembles the symmetry in Brahms’ *Requiem*

³¹ D. Cohen, and J. Cohen, 'Symmetry in Music: A Historical Perspective', *Symmetry, Culture and Science* 10 (1-2) (1999), 89-126.

³² W. Werker, *Studien über die Symmetrie im Bau der Fugen und die motivische Zusammengehörigkeit der Präludien und Fugen des wohltemperierten Klaviers von Johann Sebastian Bach* (Wiesbaden: Sandig, 1969).

and Penderecki's *Jerusalem*); the *B Minor Mass*; ³⁴ the *Goldberg Variations*; ³⁵ *The Art of Fugue*; ³⁶ *The Musical Offering*; ³⁷ the *Passacaglia in C Minor*; ³⁸ the *Chaconne for Violin Solo*; ³⁹ and more. Interestingly, most of these structures are not repeated! Here I would like to show some extreme cases of symmetry found in Bach's fugues.

1) In the fugue of the second 'Kyrie' in the *B Minor Mass*, the contrast between the two subjects is obvious: the first subject appears only in minor with a concave curve (opening with the cross motive) and the second is entirely major with a convex curve (opening with syncope). Each of them appears thirteen times in the fugue, which is divided into two more or less equal and overlapping parts. The first part contains only the first subject (six times). The second part is an intensification of the first in various respects (as in the *D# Minor Fugue*; see Fig. 6).

2) As we saw before, the *C Minor Fugue* from Book I (see Fig. 6) also has interesting symmetry (although of a different type) with intensification.

The greatest symmetry, which may be unmatched anywhere, is in the *E Minor Fugue* in Book I (see Fig. 12). Not only is it divided into two equal parts (19+19 bars) related by a switch in the functions of the hands, each part ending with a rare appearance of parallel octaves, but each part is further split into two on four levels, with the units interrelated in all possible operations. Thus the overall structure may be regarded as 2^n , with tiny additions that mess up and thereby perhaps highlight the 2^n , just as dissonance highlights consonance. All the units are made up of four elements constituting three pairs of contrasts that are meaningful in tonal music: chord/second; chromatic/diatonic; large interval (sixth)/step (second). These contrasts contribute to symmetry by their very essence (see Fig. 12).

³³ For example, N. S. Josephson, 'Formale symmetrie und freizyklische Gesamtstruktur in einigen Vokalkompositionen Johann Sebastian Bachs', *Jahrbuch des Staatlichen Instituts für Musikforschung Preussischer Kulturbesitz*, (2000), 150-74.

³⁴ Butt, 'Bach's Metaphysics of Music'; Wolff, *Bach: Essays*; Josephson, 'Formale symmetrie'.

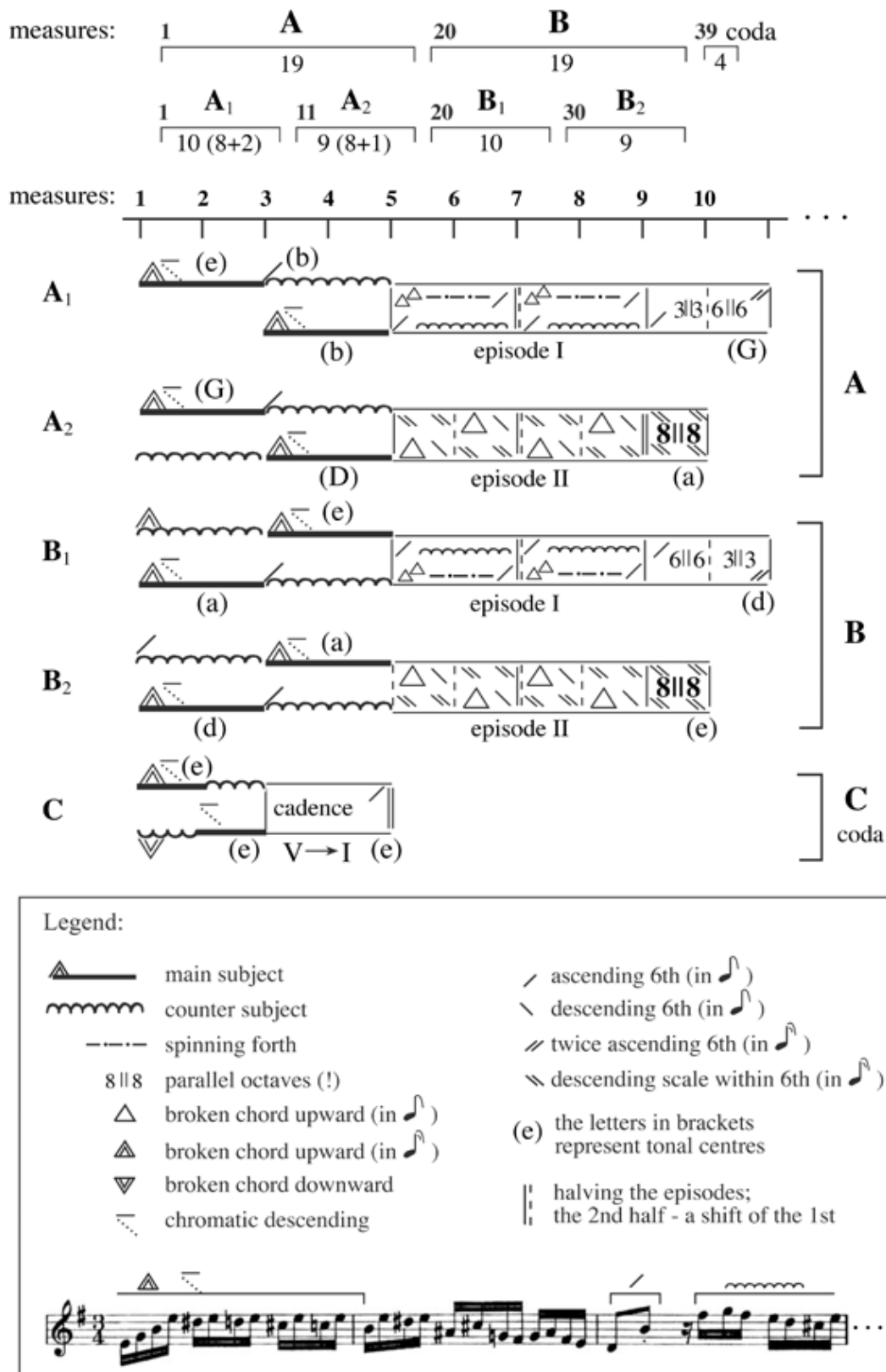
³⁵ H. Jander, 'Rhythmic Symmetry in the Goldberg Variations (April 1966)', *Musical Quarterly* 5(4) (1991), 188-93; Schulenberg, *The Keyboard Music*; V. Cohen, 'Interrelationships among the Canons of J. S. Bach's Goldberg Variations', *Israel Studies in Musicology* 6 (1996), 115-32.

³⁶ Y. J. Trede, 'Beobachtungen zu Zeitstruktur und Formanlage der mehrthematichen Satze in Johann Sebastian Bachs *Kunst der Fuge*', *Dansk arbog for musikforskning* 24 (1996), 11-29; W. Wiemer, 'Eine unbekannte Frühfassung des 'Contrapunctus 2' im Autograph der *Kunst der Fuge* – mit einigen Anmerkungen zur Grossform des Werks', *Die Musikforschung* 34/4 (1981), 413-22; Wolff, *Bach: Essays*.

³⁷ Fladt, H., *Quaerendo invenietis: Versuch über J.S. Bachs Musikalisches Opfer* (Frankfurt am Main: Fischer, 1985).

³⁸ D. Mulbury, 'Bach's Passacaglia in C Minor: Notes Regarding its Background, Essence, and Performance', *Quarterly Journal of the Riemenschneider Bach Institute, USA* 3/3 (1972), 12-20.

³⁹ J. F. Eiche, (ed.), *The Bach Chaconne for Solo Violin: A Collection of Views* (Urbana, IL: American String Teachers Association, 1985).



4) An extreme case of slightly more developed symmetry, which also has to do with an ABA and retrograde structure, is found in the duet BWV 803 (see Fig. 11). ABA appears on the overall level when the contrast between B and A is chromatic, with real operations, rather than diatonic. Parts A and B are each further divided symmetrically and relate to 2^n , with some deviations, as in the E Minor Fugue. The division of B, not all of which is shown in the see Figure, is especially complex. As for the complementary contrasts, we can add tonal/real operations to the chromatic/diatonic and triad/second contrasts.

Conclusion

Rather than attempt to summarise the features of baroque style or of Bach's style here, I have discussed salient phenomena in the light of the principles of natural schemata that are prominent in later styles. Some of the examples occur as exceptions in Bach, since he could not completely free himself from the restrictions of the style of his own period. It should not surprise us that he was criticised in 1737-1739 by the theoretician Johann Adolf Scheibe, who complained about 'stylistic confusion', 'excessive expressiveness', 'overuse of counterpoint', 'excessive ornamentation', 'insufficient distinction between primary and secondary', and 'reliance on mathematics': i.e. too much complexity and deviation from norms. But the exceptions confirm Bach's tremendous impulse to try all the possibilities inherent in learned and natural schemata. This impulse also contributed to his special accomplishments in pieces that do not deviate much from the style of his period or else relate to earlier periods; it is these accomplishments that had a great influence on later musicians. Features can be found in Bach's works that are typical of later periods (e.g. Schubert). However, the fact that they are typical of later periods is not necessarily specifically due to Bach's direct influence, but the result of the natural development of the styles in accordance with the ideals of the period or composer.

Bach indeed achieved what he set out to do: to express through his music the idea of 'How manifold are Your works, O Lord!'