Interpretation of Cyclic Form in Bach's "Goldberg Variations" through Performance History[1]

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Based on quantitative and qualitative analyses of seventy-six selected recordings spanning the years 1928 to 2020, this article examines the extent to which performers interpret the "Goldberg Variations" as a cycle. To that end, possible tempo relations between the pieces have been analyzed through measurements of initial tempi, focusing on three categories: (1) progression (subsequent variations 24, 25, and 26), (2) structure (variations in a minor key: 15, 21, and 25), and (3) architectonic position (beginning and end of the cycle: *Aria* 1, variations 1 and 30, and *Aria* 2). The analytical results confirm a distinct tendency to implement tempo relations in the cycle and suggest that, with the exception of both performances of the *Aria*, such relations are implemented more frequently in the case of linear connections (between subsequent pieces) than between pieces with a strong structural relationship.

Dieser Aufsatz untersucht anhand quantitativer und qualitativer Analysen von 76 ausgewählten Aufnahmen aus dem Zeitraum von 1928 bis 2020, inwieweit Interpret*innen die ›Goldberg-Variationen‹ als Zyklus interpretieren. Dazu werden mögliche Temporelationen zwischen den Einzelstücken mithilfe von Messungen der Initialtempi analysiert, wobei der Fokus auf drei Kategorien liegt: (1) Fortschreitung (aufeinanderfolgende Variationen 24, 25 und 26), (2) Struktur (Mollvariationen 15, 21 und 25) sowie (3) architektonische Position (Anfang und Ende des Zyklus: *Aria* 1, Variationen 1 und 30 sowie *Aria* 2). Die Analyseergebnisse bestätigen eine klare Tendenz zur Umsetzung von Temporelationen im Zyklus und deuten darauf hin, dass diese – mit Ausnahme der beiden Aufführungen der *Aria* – im Falle linearer Verbindungen (zwischen aufeinanderfolgenden Stücken) häufiger realisiert werden als zwischen Stücken mit starker struktureller Verwandtschaft.

Schlagworte/Keywords: cyclic form; Goldberg Variations BWV 988; Goldberg-Variationen BWV 988; Interpretationsanalyse; Johann Sebastian Bach; performance analysis; Tempo; tempo relations; Temporelationen; zyklische Form

Introduction

When Bruno Monsaingeon asked Glenn Gould about his 1981 recording of Bach's "Goldberg Variations," BWV 998, Gould replied, "it occurred to me […], that [the 1955 recording] was very nice, but that it was perhaps a little bit like thirty very interesting but somewhat independent-minded pieces going their own way." Therefore, in his new recording, he intended to find an "arithmetical correspondence between the theme and the subsequent variations, so that there would be some sort of temporal relationship – […] there would be at least a rhythmic design that was continuous and a sense of pulse that

1 The research documented in this article was conducted as part of the project *Performing, Experiencing and Theorizing Augmented Listening* (PETAL) funded by the Austrian Science Fund FWF (P 30058-G26, 01/09/2017–31/08/2020), located at the University of Music and Performing Arts Graz (KUG) (https://petal.kug.ac.at). I would like to thank Petra Zidarić Györek and Tomislav Bužić for their support with measurements included in the database which is the basis of the present article. The research data concerning recordings of the "Goldberg Variations" compiled during the PETAL project are made available in open access at https://github.com/petal2020/petal_bach_goldberg-variations.

went through it."[2] This could be read as an aim to perform the *Variations* as *one* cyclic work (as opposed to a mere collection of thirty-two individual pieces), bringing out the interconnections between the various pieces of the cycle more consciously and clearly. While "arithmetical correspondence" and "temporal relationship" play a significant role in the 1981 recording, this aim is also reflected in a careful choice of repeats: in contrast to his 1955 interpretation, which does not contain any repeats, Gould opts for repeats in thirteen variations – the nine canonic variations as well as the four variations set in strict four-part counterpoint (variations 4, 10, 22, and 30), elucidating their mutual connection and common structural qualities.[3]

Beyond any question, the "Goldberg Variations" do constitute a cycle, primarily for the very fact that any succession of variations on a preceding theme provides a strongly interlinked cyclic form, but also, and more importantly, because they follow an elaborate compositional structure, interlocking character, virtuoso, and canonic variations, implementing musical progression and symmetry as paramount formal principles.[4] As stated by Martin Zenck, "the melody of the chaconne bass and its harmonic pillars create the outer shape […] in which the thirty variations are cast like into a mold."[5]

The cyclic shape of the work is not identifiable only through the architectonic disposition of the three types of variations mentioned above; there are further traits that link the pieces together, such as dance suite movements which relate to each other in different ways (e.g., *passepied*, *gigue*, French ouverture, *sarabande*, *menuet*, *polonaise*), genres (e.g., *fantasia*, *sinfonia*, *fugetta*, *quodlibet*), time signatures, (minor) key, number of voices, etc.[6] Any variation may be classified according to a number of parameters, simultaneously belonging to several networks of pieces.[7] In this context, the question arises to what extent its performers realize the cyclic potential of the "Goldberg Variations" inherent to its overall structure and to the individual pieces, i.e., how they handle parameters such as tempo, duration, dynamics, repeats, and harpsichord registration. The interpretation of such elements may add further layers to the correlational structures present in the cycle. In the foreword to his 1934 edition of the *Variations*, Ralph Kirkpatrick writes of the formative employment of such parameters:

> It should be noticed that this registration is intended to enhance the symmetrical arrangement of the variations, in that the same 8′ register is employed for all the canons and the same combination for the two-manual arabesques, whereas the greatest possible variety is brought to the other assorted forms, in accordance with their character.
>
> Changes of registration within the variations are quite uncalled-for; they only bring a kind of disturbing restlessness to the expression and utterly destroy the architectural symmetry. Each movement has its own tone-color […].

2 Monsaingeon 1981, cited in Martens 2007, [5].

3 See Bazzana 2001, 109–110, 289.

4 Breig 1975, 256. Kurt von Fischer and Stefan Drees (2016) also state that the *da capo* of the theme at the very end of a variation series is one of the principal means to consolidate a theme and its variations into a cohesive cycle.

5 Zenck 1985, 38 ("Die Melodie des Chaconnebasses und seine harmonischen Stützpunkte bilden die äußere Form, in die wie in ein Gefäß die 30 Variationen gegossen werden."). Translations are by the author.

6 Rampe 2008, 937–938.

7 For a more detailed depiction of the variations' disposition according to different parameters, see Utz 2017, 20, and Williams 2004, 42–43.

> This same character should be preserved in a performance on the piano, by […] employing the resources of nuance only in smaller degrees in order to enhance the declamation of individual phrases. […] However, each variation should be given a distinctly characterized color or dynamic level.[8]

This article focuses on the question: To what extent has the cyclic form of the "Goldberg Variations" been reflected in its performance history? It centers on the temporal relations between its individual pieces as performed in selected recordings. For this purpose, using tempo measurements as the main analytical criterion seems to be particularly suitable, since durational values would be of limited significance, due to the differences between performers concerning the (non-)execution of repeats.[9] Additionally, the duration of a piece is also strongly influenced by different degrees of *rubato* and *ritardando* as well as by durational choices for fermatas, and thus unsuitable for establishing relations between the main tempi of the cycle's pieces.[10]

This study is based on a database of tempo measurements created during the research project *Performing, Experiencing and Theorizing Augmented Listening* (PETAL), which focused on performance strategies in cyclic works (piano and *lied* literature). This database compiles tempo data from seventy-six selected recordings spanning the years 1928 to 2020 (Appendix, Tab. 7), measured using *Sonic Visualiser*.[11] The calculation of the main tempi for both *Arias* and variations is based on the first musical phrase formed by the first eight bass notes (G–F♯–E–D–B–C–D–G, mm. 1–8 or 1–4 respectively).[12] For the purpose of the present article, these measurements have been adjusted to exclude the first and last bass notes of the chosen sections, in order to avoid the tempo deviations occurring in *rubato* and ritardando passages. Following the principle described by Alf Gabrielsson,[13] the "main tempo" of each piece has thus been derived from the average tempo of the measures featuring the second to seventh bass notes (mm. 2–7 or 1.5–3.5 respectively; see Appendix, Tab. 8). The vast amount of data (2428 measured audio files) yielded by these measurements provides a multitude of possibilities for quantitative corpus analysis. Some conspicuous results discernible in the overview shall briefly be covered below (Tab. 1).

8 Kirkpatrick 1938, xxvi–xxvii.

9 The option of duplicating the duration of all recorded movements in which repeats are not performed is dubious, as it renders an unrealistic picture of the actual durations; in addition, seems very unlikely that performers would choose to perform a repeated section in exactly the same way.

10 See Fabian 2003, 120. In Angela Hewitt's recordings, for example, the final eighth note of variation 30 lasts eighteen seconds in 1999 and eleven seconds in 2015.

11 See Cannam/Landone/Sandler 2010. For the selection, criteria such as international dissemination, availability, and chronological representation have been taken into account.

12 Variation 16 has been measured in two parts (16a and 16b), taking different tempi for the French *Ouverture* (mm. 1–8) and the *Fughetta* (mm. 16–23) into account.

13 Gabrielsson 1999, 540: "The variation [of tempo in larger sections] is sometimes so large […] that it seems meaningless to talk of *the* tempo. A distinction may therefore be made between (a) the *mean tempo* – the average number of beats per minute across the whole piece (usually until its last note), disregarding possible variations, (b) the *main tempo* – the prevailing tempo when passages with momentary variations, such as "slow start," final ritard[ando], fermatas, and amorphous caesura are deleted, and (c) *local tempo*, which is maintained only for a short time [...]. Of course, there are borderline cases, and one has to accept that the variations of tempo […] evade simple mathematical calculation."

	Time Signature	Pulse	Mean Tempo	Maximum	Minimum	Standard Deviation (%)	Range (%)
Aria 1	3/4	♩	50.2	80.8 (Kempff 1969)	33.6 (Gould 1981)	17.8	140.3
Variation 1	3/4	♩	101.3	137.4 (Gould 1955)	54.1 (Landowska 1933	16.2	153.8
Variation 2	2/4	♩	79.3	110.5 (Gould 1955)	48.3 (Tureck 1957)	17.2	128.7
Variation 3	6/8	♩.	59.4	77.2 (Zhu 2007)	35.5 (Kirkpatrick 1958)	17.0	117.4
Variation 4	3/8	♩.	60.3	90.9 (R. Serkin 1928)	40.6 (Tureck 1957)	12.4	123.6
Variation 5	3/4	♩	134.8	178.3 (R. Serkin 1928)	83.0 (Egarr 2005)	16.2	114.7
Variation 6	3/8	♩.	47.4	81.5 (Gould 1958)	31.0 (Tureck 1957)	24.0	162.8
Variation 7	6/8	♩.	68.0	94.6 (Weissenberg 1981)	37.1 (Takahashi 1976)	15.2	154.9
Variation 8	3/4	♩	104.8	141.1 (Gould 1955)	73.7 (Leonhardt 1965)	13.9	91.6
Variation 9	4/4	♩	66.9	102.9 (Gould 1955)	40.3 (Ernst 2020)	19.8	155.6
Variation 10	2/2	𝅗𝅥	83.3	113.6 (R. Serkin 1928)	57.4 (Tureck 1998)	12.0	97.9
Variation 11	12/16	♩.	133.3	202.2 (R. Serkin 1928)	80.6 (Sokolov 1982)	16.3	150.8
Variation 12	3/4	♩	78.3	112.9 (Gould 1955)	40.5 (Asperen 1991)	23.4	179.1
Variation 13	3/4	♩	43.1	75.0 (Gavrilov 1993)	26.4 (Hayden 1976)	20.5	184.5
Variation 14	3/4	♩	93.2	127.0 (R. Serkin 1928)	73.0 (Barenboim 1992)	10.8	74.0
Variation 15	2/4	♩	29.6	42.6 (Sokolov 1982)	19.9 (Lang 2020a)	15.4	114.1
Variation 16a	2/2	𝅗𝅥	33.9	44.8 (R. Serkin 1928)	27.2 (Demus 1953)	12.2	64.7
Variation 16b	3/8	♩.	70.1	93.5 (R. Serkin 1928)	43.9 (Sokolov 1982)	13.1	113.0
Variation 17	3/4	♩	104.4	137.8 (R. Serkin 1928)	66.8 (Tureck 1998)	14.2	106.2
Variation 18	2/2	𝅗𝅥	88.6	118.9 (Newman 1971)	58.6 (Schultz 1998)	14.6	102.8
Variation 19	3/8	♪	142.8	216.1 (Gavrilov 1993)	83.6 (Li 1996)	21.8	158.5
Variation 20	3/4	♩	104.0	150.3 (Li 1996)	73.1 (Egarr 2005)	14.7	105.6
Variation 21	4/4	♩	45.1	72.1 (Schiff 2001)	27.2 (Landowska 1945)	21.5	165.4
Variation 22	2/2	𝅗𝅥	90.0	138.8 (R. Serkin 1928)	57.0 (Tureck 1998)	15.3	143.4
Variation 23	3/4	♩	93.4	129.1 (R. Serkin 1928)	60.6 (Asperen 1991)	13.1	113.2
Variation 24	9/8	♩.	74.0	107.5 (Gould 1955)	51.6 (Tureck 1957)	20.1	108.5
Variation 25	3/4	♪	49.2	77.4 (Takahashi 2004)	25.6 (Nikolayeva 1992)	19.7	202.2
Variation 26	18/16 - 3/4	♩	95.1	119.5 (Lang 2020a)	70.5 (Richter 1956)	13.1	69.4
Variation 27	6/8	♩.	71.7	92.7 (R. Serkin 1928)	47.9 (Tureck 1998)	13.1	93.4
Variation 28	3/4	♩	82.5	121.2 (Gavrilov 1993)	57.9 (Dinnerstein 2005)	13.8	109.6
Variation 29	3/4	♩	88.8	124.4 (Gavrilov 1993)	65.3 (Nikolayeva 1992)	12.9	90.4
Variation 30	4/4	♩	76.8	111.2 (P. Serkin 1994)	58.1 (Nikolayeva 1992)	14.7	91.5
Aria 2	3/4	♩	48.3	81.0 (Kempff 1969)	27.9 (Gould 1981)	20.7	189.7

Table 1: Bach, "Goldberg Variations": mean tempo, maximum and minimum tempo, relative standard deviation, and relative range in seventy-six selected recordings from 1928 (Rudolf Serkin) to 2020b (Lang Lang)

Table 1 depicts the fastest and slowest recordings for each piece, their relative standard deviation (SD) from the respective mean tempo value and the relative range (difference between maximum and minimum tempo values, expressed as a percentage of the main tempo). Variation 14 (10.8%), variation 10 (12.0%), variation 16a (12.2%), and variation 4 (12.4%) stand out for having the lowest SD values, while variation 16a (64.7%), variation 26 (69.4%), and variation 14 (74.0%) have the lowest range; variation 14 and variation 16a therefore stand out concerning both parameters. The recording of variation 14 made by Angela Hewitt 1999 (Audio Ex. 1a: ♩= 93.2 bpm) matches the mean value (93.0 bpm) most closely; the fastest and slowest recordings of this variation are performed

by Rudolf Serkin 1928[14] (Audio Ex. 1b: 127.0 bpm) and Daniel Barenboim 1992 (Audio Ex. 1c: 73.0 bpm) respectively. The low SD values combined with the low range show that ostensibly, most performers seem to agree on a similar tempo choice for this variation. Rolf Dammann describes variation 14, the second to last variation of the first half of the cycle, as a *pezzo di bravura* (although not to be played "excessively fast"), focusing on *mobilità*, *agilità* and *prontezza*;[15] possible reasons for the relatively low mean tempo value might be found in the technical challenges of this piece, such as hand-crossing, left-hand *arpeggi*, trills, etc. For variation 16a, the recording matching the mean tempo value (33.9 bpm) most closely is the interpretation of Ton Koopman 1987 (Audio Ex. 2a: 𝅗𝅥 = exactly 33.9 bpm). The fastest and slowest recordings are by Rudolf Serkin 1928 (Audio Ex. 2b: 44.8 bpm), and Jörg Demus 1953 (Audio Ex. 2c: 27.2 bpm) and Barenboim (27.6 bpm) respectively. Here, one cause for the strong overlap in tempo choices among the selected recordings might be the dignified *French Ouverture* character, as well as the fact that variation 16a serves as a festive opening piece to the second half of the cycle.[16]

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio01a_Hewitt1999.mp3

Audio Example 1a: Bach, "Goldberg Variations," Hewitt 1999, variation 14 (mm. 1–8) (Bach, "Goldberg Variations," Angela Hewitt, CD Hyperion Records Limited, ℗&© 2000, Track 15)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio01b_Serkin1928.mp3

Audio Example 1b: Bach, "Goldberg Variations," R. Serkin 1928, variation 14 (mm. 1–8) (Bach, "Goldberg Variations," Rudolf Serkin, CD Archiphon ARC-105, ℗&© 1992, Track 1)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio01c_Barenboim1992.mp3

Audio Example 1c: Bach, "Goldberg Variations," Barenboim 1992, variation 14 (mm. 1–8) (Bach, "Goldberg Variations," Daniel Barenboim, DVD EuroArts, © 2012)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio02a_Koopman1996.mp3

Audio Example 2a: Bach, "Goldberg Variations," Koopman 1987, variation 16a (mm. 1–8) (Bach, "Goldberg Variations," Ton Koopman, CD Erato Disques S.A, ℗ 1988, Track 17)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio02b_Serkin1928.mp3

Audio Example 2b: Bach, "Goldberg Variations," R. Serkin 1928, variation 16a (mm. 1–8) (Bach, "Goldberg Variations," Rudolf Serkin, CD Archiphon ARC-105, ℗&© 1992, Track 2)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio02c_Demus1953.mp3

Audio Example 2c: Bach, "Goldberg Variations," Demus 1953, variation 16a (mm. 1–8) (Bach, "Goldberg Variations," Jörg Demus, LP Westminster WL-5241, ℗&© 1992, Side A)

14 The Rudolf Serkin recording stems from Welte-Mignon piano rolls. Yet, since it is the product of an artist's interpretation, it shall nevertheless be taken into account in this study. For the question of the reliability of performance parameters in piano roll recordings see, among others, Bausch 2019.

15 Dammann 1986, 154.

16 This prompts the question (which shall here remain largely unanswered due to obvious constraints) if those "Goldberg" performers who have also made recordings of Bach's Partita No. 4 BWV 828 – the *Ouverture* of which bears a strong resemblance to variation 16a – apply an analogous interpretative concept to both pieces (the main pulse in both cases is the half note). For example, the tempo chosen for the beginning of the Partita by Jörg Demus in 1963 (30.2 bpm in mm. 2–4) is only 9% faster than his choice for variation 16; Ralph Kirkpatrick's Partita tempo in 1958 (29.9 bpm) is virtually the same (only 3% lower) as his variation 16 from the same year (30.8 bpm). Conversely, Trevor Pinnock's Partita recording from 1983 (27.8 bpm) features a significantly lower tempo (by 46%) compared to his variation 16 recorded in 1980 (40.5 bpm).

On the other end of the spectrum, variation 6 (24.0%), variation 12 (23.4%), variation 19 (21.8%), and variation 21 (21.5%) strike the eye as having the highest SD values, whereas variation 25 sees an exceptionally high range (202.2%). For variation 6, the interpretation matching the mean tempo value (47.4 bpm) most closely is the recording by Alexis Weissenberg 1981 (Audio Ex. 3a: ♩. = 47.3 bpm). The fastest tempo choices appear in Gould 1958 (Audio Ex. 3b: 81.5 bpm) and Andrei Gavrilov 1993 (79.9 bpm), the slowest in Rosalyn Tureck 1957 (Audio Ex. 3c: 31.0 bpm) and Demus 1953 (31.1 bpm). These stark differences could be rooted in different approaches to the notation of the piece. While Gould and Gavrilov both take the whole bar (3/8) as the main pulse, essentially turning the variation into a *passepied*, Tureck and Demus both play it as a *menuet*, the pulse here being the eighth note. The two other 3/8 variations also raise this question: while variation 19 also features a relatively high SD value (21.8%), variation 4 appears to show almost no conceptual "disagreements" (12.4%), confirming a shared interpretation as a *passepied*.[17]

The mean tempo for variation 25 which exhibits the highest range value (202.2%) is 49.2 bpm, matched most closely by Igor Levit 2015 (Audio Ex. 4a: ♪ = 49.0 bpm); its fastest recording is presented by Yūji Takahashi 2004 (Audio Ex. 4b: 77.4 bpm), its slowest by Tatiana Nikolayeva 1992 (Audio Ex. 4c: 25.6 bpm). A comparison of the mean tempo values between pianists and harpsichordists shows that the pianists (mean tempo: 46.9 bpm) tend to play this variation considerably slower (by 11.7%) than the harpsichordists (mean tempo: 53.1 bpm; Fig. 1). On the whole, the interpretations of variation 25 made by the harpsichordists rarely (and after 1985, never) undercut the overall mean tempo value (Fig. 2). The trend lines show that there is a tendency among the harpsichordists to increase the tempo of variation 25 over the course of time, while the data for the pianists shows a trend in the opposite direction.

This gradual decrease suggests a romanticized approach to the interpretation of this variation by the pianists. Wanda Landowska calls this variation, the third and last variation in G minor, "the supreme pearl of this necklace – the black pearl":

> In its somber shimmerings, all the restlessness of the romantics may be already discerned. This richly ornamented adagio is overwhelming with the poignancy of its feverish chromaticism. Is not this nostalgic and plaintive curve toward the sixth the same as that later to be rediscovered by Chopin and the Wagner of *Tristan*?[18]

Similarly, Jörg Demus states that Bach "surprises […] us in the adagio variation No. 25, the crown of the work, with an egregiously audacious, expressive – I'd almost say: romantic – chromaticism, not to be found until later with Franck and Reger."[19] In the same vein, Glenn Gould describes variation 25 to be evocative of "the languorous atmosphere of an almost Chopinesque mood-piece," its "wistful, weary cantilena a master-stroke of psychology."[20] Quite unlike these three viewpoints, Rolf Dammann traces the *affectus dolorosus* displayed in this variation to narrow and diminished intervals frowned upon in the seventeenth century, the repeated *pianto* motif in the bass, and the *exclamatio* depicted by the soprano.[21]

17 See also Rampe 2008, 937 f.

18 Landowska 1965, 217.

19 Demus 1976, 56: "[Bach] überrascht […] uns in der Adagiovariation Nr. 25, der Krone des Werkes, durch eine unerhört kühne, ausdrucksstarke – fast hätte ich gewagt zu sagen: romantische – Chromatik, die man erst wieder bei Franck und Reger findet."

20 Gould/Page 1982, cited in Martens 2007.

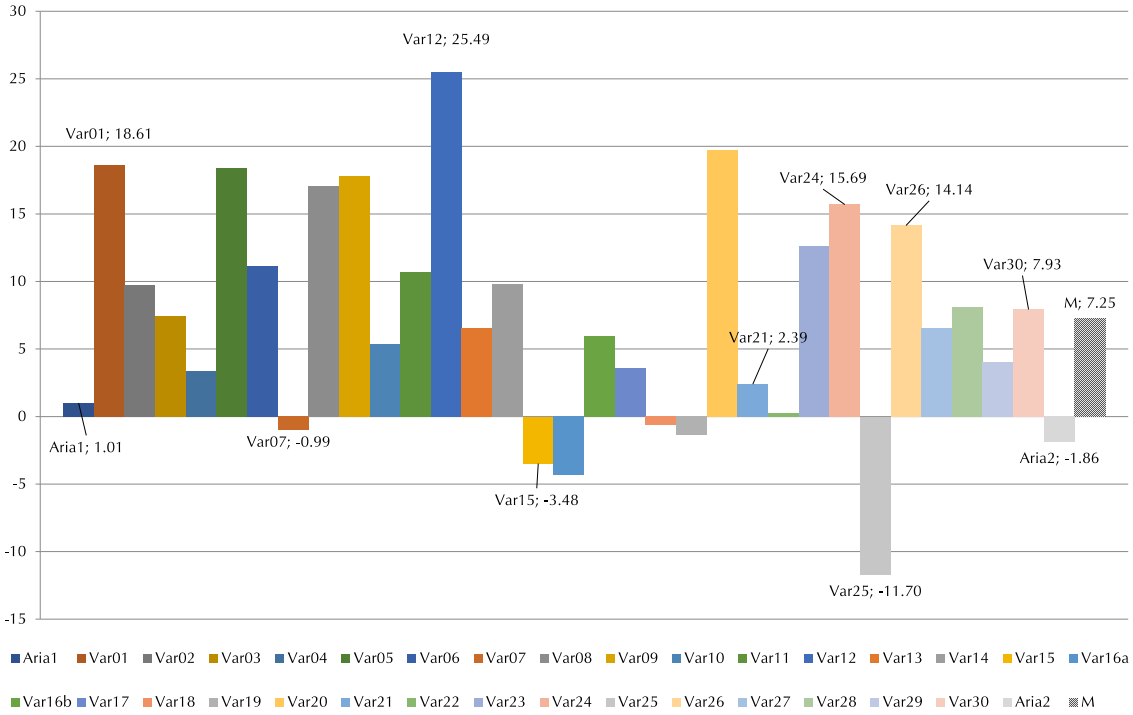


Figure 1: Bach, "Goldberg Variations," mean tempo differences (in %) as displayed in the recordings made by pianists vs. harpsichordists

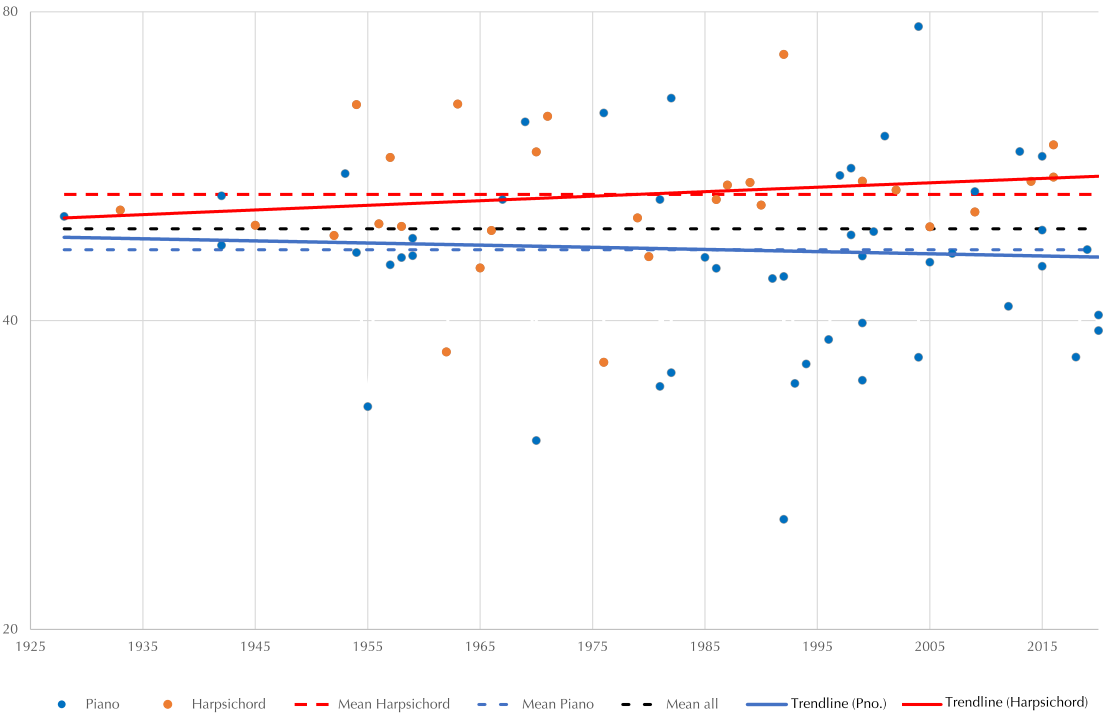


Figure 2: Tempo trend lines for variation 25, pianists vs. harpsichordists

21 See Dammann 1986, 208, 211, 215.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio03a_Weissenberg1981.mp3

Audio Example 3a: Bach, "Goldberg Variations," Weissenberg 1981, variation 6 (mm. 1–16) (Bach, "Goldberg Variations," Alexis Weissenberg, EMI Classics 5 75952 2, ℗ 1982 © 2001, Track 7)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio03b_Gould1958.mp3

Audio Example 3b: Bach, "Goldberg Variations," Gould 1958, variation 6 (mm. 1–16) (Bach, "Goldberg Variations," Glenn Gould, CD West Hill Radio Archives WHRA-6038, ℗&© 2011, Track 7)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio03c_Tureck1957.mp3

Audio Example 3c: Bach, "Goldberg Variations," Tureck 1957, variation 6 (mm. 1–16) (Bach, "Goldberg Variations," Rosalyn Tureck, CD EMI Classics 09647-2, ℗ 1958 © 2008, CD 1, Track 7)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio04a_Levit2015.mp3

Audio Example 4a: Bach, "Goldberg Variations," Levit 2015, variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Igor Levit, CD Sony Music Entertaiment Inc. 88875140142, ℗ 2015 © 2016, Track 26)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio04b_Takahashi2004.mp3

Audio Example 4b: Bach, "Goldberg Variations," Takahashi 2004, variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Yūji Takahashi, CD Avex Classics AVCL-84069, ℗&© 2014, Track 26)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio04c_Nikolayeva1992.mp3

Audio Example 4c: Bach, "Goldberg Variations," Nikolayeva 1992, variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD Hyperion Records Limited A66589, ℗&© 1992, Track 26)

Methodology

Based on the information obtained through the database, specific variations which stand out through extreme values have been examined. Cyclic interpretation, however, is rooted in the relations between a cycle's parts. There is a variety of criteria that might be singled out when comparing such parts; for this article, three different dimensions have been selected in order to examine different possibilities of cyclic interpretation in the "Goldberg Variations." Each of these models focuses on a small group of variations exhibiting specific criteria which establish possible linear and non-linear tempo relations:

1. a progression-based analysis focuses on a constellation of variations based on their progression from one to the next, i.e., as a sequence of pieces (variations 24 to 26)
2. a structure-based analysis examines a constellation of pieces that share a certain interlinking criterion, in this case the minor key (variations 15, 21, and 25)
3. a position-based analysis investigates the pieces framing the cycle (*Arias* 1 and 2 and their adjacent variations 1 and 30), based on their functional relevance to cyclic symmetry.

As argued by David Epstein, the concept of proportional tempo suggests that in works of multiple movements, "all tempos are intrinsically linked via a common pulse":

> The relationship arises from the organization of the work as a unified and coherent whole in which all movements, all ideas, stem from underlying formative concepts of shape. […] These relationships of tempo can be concisely expressed by whole-number (integral) ratios.[22]

Notably, these ratios are generally integral and of a low order (1:1, 1:2, 2:3, 3:4, or the inverse, occasionally 1:3) and do not seem to exceed 3:5, 5:6, or their inverse; Epstein explains that this principle results from phrase synchrony in proportionally related tempi.[23] As the remaining discussion will demonstrate, this argument is confirmed by the tempo measurements of the PETAL database. Tempo relations for each set of pieces (examined in pairs) are depicted in color-coded tables indicating percent values (Tab. 2). The percentage value representing a tempo relation between two variations indicates a specific mathematical proportion which can also be understood as a relationship between note values. A proportion between tempo A and tempo B (A:B) is calculated by dividing the main tempo value B by the main tempo value A (B/A, expressed as a percentage). Thus, a tempo A of 120 bpm and a tempo B of 60 bpm (proportion 2:1) is expressed by a percentage of (–)50% (60/120 = 0.5). This allows us to understand all tempo proportions in their progressional context: we see how tempo B relates to tempo A or how tempo A evolves into tempo B. To facilitate interpretation of the tables, all negative percentage values are rendered as absolute (positive) numbers.

green (0%)	**1:1**	**1:1**
	0%↔[-]10%	0%↔10%
orange (50% / 100%)	**2:1**	**1:2**
	[-]45%↔[-]55%	80%↔120%
purple (67% / 200%)	**3:1**	**1:3**
	[-]62%↔[-]72%	180%↔220%
blue (33% / 50%)	**3:2**	**2:3**
	[-]28%↔[-]38%	40%↔60%
gray (25%)	**4:3**	
	[-]20%↔[-]30%	

Table 2: Color-coded tempo relations and their respective percentage values

The second and third columns in Table 2 indicate the tolerance range for each relation. This range has been defined around (rounded) mathematical "core" values: 1:1 = 0%, 2:1 = (–)50%, 1:2 = 100%, 3:1 = (–)67%, 1:3 = 200%, 3:2 = (–)33%, 2:3 = 50%, and 4:3 = (–)25%. The percentages denote the proportional increase/decrease from tempo A to tempo B. Further proportions (such as 3:4, 33%) have not been taken into account, as they do not suggest musically sensible relations between time signatures in this cycle. With the exception of proportion 1:1 (tolerance range: 20%, ±10%), a range of 10% (±5%) has been defined for all relations of the second column (negative percentage values; in all these cases tempo B is slower than tempo A), while the third column (positive values, indicating that tempo B is faster than tempo A) includes a range of 20% (±10%) for the 2:3 relation and a 40% (±20%) range for those two relations which center around a "core" value of 100% or higher (1:2, 1:3). Consequently, a tempo relation of 2:1 be-

22 Epstein 1995, 101.

23 Ibid.

tween a tempo A of 60 bpm and a tempo B of 30 bpm (half tempo) would also apply if tempo B falls within the range of 27 bpm ([–]55%) and 33 bpm ([–]45%). In the same manner, a tempo relation of 1:3 between a tempo A of 60 bpm and a tempo B of 180 bpm would also be identified if tempo B falls within the range of 168 bpm (+180%) and 192 bpm (+220%). These color-coded percentage values and their respective musical ratios as indicated in Table 2 will be key elements in the comprehension of the following analyses.

In his historically informed study about composed tempo relationships in the "Goldberg Variations," Ulrich Siegele develops a theory where all tempi within the cycle are related to the tempo of the first *Aria* through a "principal value" *p*, defined as 57.6 bpm, and its multiples/fractions.[24] While a detailed discussion of this theory cannot be carried out in this article, the tempo relations calculated by Siegele have been included in the tables below in order to enable a comparison of actually performed tempo relations to this theoretical system.

Cyclic Interpretation I: Progression-based Analysis (Variations 24–26)

The sequence of variations chosen for this analytical model (Ex. 1) stands out through a specific combination of SD and range values: variation 25 is highlighted by having the highest range value (202.2%), whereas variation 26 displays the second lowest range value (69.4%) and a fairly low SD value (13.1%); in addition, variation 24 and variation 25 exhibit a relatively high SD value. Such a unique progression from two variations with a high SD value to a variation with both SD and range values at the lower margin (see the SD pattern *red/red/green* in Table 1), can only be found in one other instance: variations 12–14. Therefore, the "solo movements"[25] variation 13 and variation 25 have not only their 3/4 time signature and *sarabande tendre* characteristic[26] in common, but are also linked through a unique pattern in the database. Interestingly, performers tend to make very heterogenous tempo choices for variations 12–13/24–25 but clearly agree on a main tempo as far as variation 14 and variation 26 are concerned.

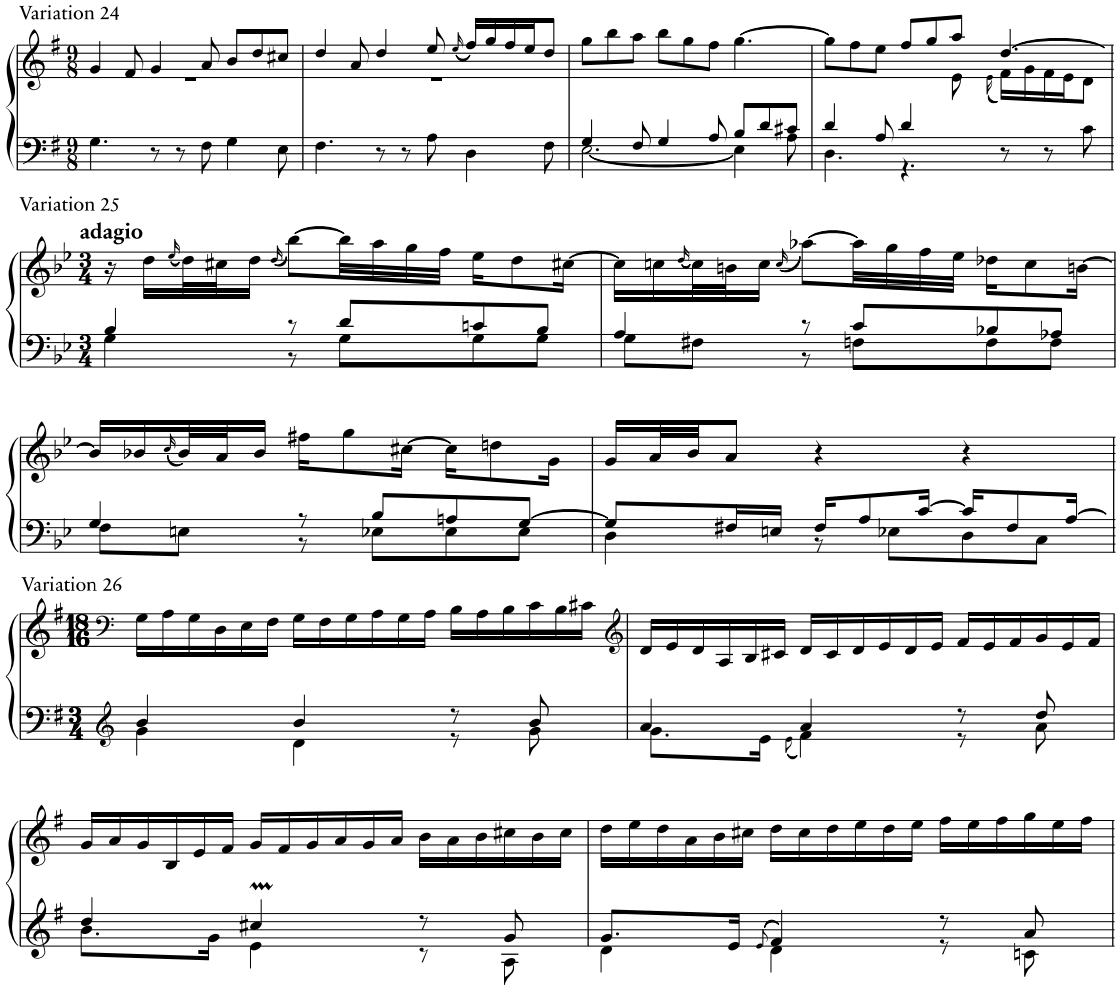
At the same time, variation 25, as the center of the chosen sequence, also holds an interesting position within the cycle in terms of its compositional genesis. Werner Breig speculates that the cycle might originally have been planned to comprise only twenty-four variations (and therefore no further canons after variation 24, the canon at the octave); Karol Berger remarks that "when Bach oversteps the limits of the octave, he suggests that the series could go on forever."[27]

24 See Siegele 2014, 21–25.

25 Williams 2004, 51.

26 Rampe 2007, 937–938.

27 Breig 1975, 254, and Berger 2007, 101.



Example 1: Bach, "Goldberg Variations," variations 24, 25, and 26 (mm. 1–4)

	Var. 24 (♩.)	Var. 25 (♪)	Var. 26 (♩)	25:24 (%)	26:25 (%)	26:24 (%)
Rudolf Serkin 1928	54.0	50.6	108.4	6	114	101
Landowska 1933	88.5	51.3	91.6	42	79	4
Norton 1942	81.5	52.9	115.5	35	118	42
Arrau 1942	63.2	47.4	95.2	25	101	51
Landowska 1945	76.4	49.5	85.6	35	73	12
Kirkpatrick 1952	55.5	48.4	89.3	13	84	61
Demus 1953	55.8	55.6	91.5	0	64	64
Ahlgrimm 1954	52.7	65.0	91.9	23*	41	74
Gould 1954	96.0	46.6	111.2	51	139	16
Gould 1955	107.5	33.0	114.0	69	246	6
Richter 1956	59.1	49.7	70.5	16	42	19
Silver 1957	74.5	57.7	90.3	23	57	21
Tureck 1957	51.6	45.3	81.3	12	79	58
Gould 1958	103.4	46.1	110.6	56	140	7
Kirkpatrick 1958	62.0	49.4	91.3	20	85	47
Gould 1959	101.4	48.1	109.6	53	128	8
Sultan 1959	75.0	46.3	93.7	38	102	25
Marlowe 1962	61.3	37.3	83.3	39	123	36
Gát 1963	65.4	65.0	106.8	0	64	63
Leonhardt 1965	58.3	45.0	88.9	23	98	53
Picht-Axenfeld 1966	65.3	49.0	75.8	25	55	16
Rosen 1967	57.5	52.5	115.6	9	120	101
Kempff 1969	61.9	62.5	83.1	1	33	34

Richter 1970	67.9	58.4	78.0	14	34	15
Newman 1971	91.7	63.3	96.2	31	52	5
Hayden 1976	68.4	36.4	100.5	47	176	47
Takahashi 1976	101.6	63.7	100.4	37	58	1
Gibbons 1979	88.2	50.4	86.2	43	71	2
Nikolayeva 1979	86.0	30.6	88.6	64	190	3
Pinnock 1980	67.8	46.2	89.2	32	93	32
Weissenberg 1981	77.1	52.5	94.4	32	80	22
Gould 1981	92.0	34.5	111.8	62	224	22
Schiff 1982	96.3	65.9	93.9	32	42	2
Sokolov 1982	59.5	35.6	95.5	40	168	60
Chen 1985	73.7	46.1	96.3	37	109	31
Gilbert 1986	70.8	52.5	83.5	26	59	18
Tipo 1986	64.8	45.0	100.5	31	123	55
Koopman 1987	76.0	54.2	76.1	29	40	0
Jarrett 1989	61.2	54.5	78.7	11	44	29
Asperen 1991	52.4	51.9	73.9	1	43	41
Feltsman 1991	88.0	44.0	93.6	50	113	6
Barenboim 1992	104.4	44.2	109.5	58	148	5
Nikolayeva 1992	88.1	25.6	79.6	71	211	10
Verlet 1992	62.2	72.7	83.2	17	14	34
Gavrilov 1993	99.8	34.7	114.2	65	229	14
Peter Serkin 1994	65.9	36.3	108.8	45	200	65
Li 1996	80.9	38.3	101.3	53	164	25
Vladar 1996	78.3	55.4	94.8	29	71	21
Schultz 1998	53.9	48.5	87.6	10	81	63
Tureck 1998	55.8	56.3	78.4	1	39	41
Belder 1999	56.4	54.7	80.4	3	47	43
Hewitt 1999	67.2	46.2	97.7	31	111	45
Koroliov 1999	78.3	35.0	76.5	55	119	2
Schirmer 1999	71.7	39.8	98.6	45	148	37
Perahia 2000	81.4	48.9	99.7	40	104	22
Schiff 2001	90.1	60.5	86.6	33	43	4
Haugsand 2001	62.5	53.6	94.2	14	76	51
Pescia 2004	72.8	36.8	95.8	49	160	32
Takahashi 2004	81.6	77.4	78.5	5	1	4
Dinnerstein 2005	98.5	45.6	119.2	54	161	21
Egarr 2005	61.6	49.4	73.9	20	50	20
Zhu 2007	87.5	46.5	98.8	47	112	13
Staier 2009	82.1	51.1	99.1	38	94	21
Marsoner 2009	72.2	53.4	99.0	26	85	37
Ishizaka 2012	75.3	41.3	99.5	45	141	32
Denk 2013	92.7	58.5	111.1	37	90	20
Hill 2014	67.8	54.7	94.9	19	74	40
Hewitt 2015	62.0	45.2	99.7	27	121	61
Levit 2015	85.2	49.0	96.2	42	96	13
Schiff 2015	84.8	57.8	84.1	32	45	1
Esfahani 2016	58.3	59.4	102.8	2	73	76
Schornsheim 2016	71.5	55.2	90.9	23	65	27
Kim 2018	71.0	36.9	112.7	48	206	59
Ernst 2020	56.8	46.9	112.2	17	139	98
Lang 2020a	63.4	39.1	119.5	38	206	89
Lang 2020b	73.5	40.5	118.8	45	193	62
Siegele	57.6	57.6	86.4	0	50	50
Mean Tempo	74.0	49.2	95.1	34	94	29

Table 3: Bach, "Goldberg Variations," tempo relations between variations 24, 25, and 26

Tempo Relations between Variations 24 and 25

Tempo Relation 1:1 (0–10%): 24 (♩.) = 25 (♪) (green)

As shown in Table 3, eleven recordings display the same tempo or same basic pulse in both variations. The recordings of Demus 1953 (Audio Ex. 5a: 24 = 55.8 bpm; 25=55.6 bpm) and József Gát 1963 (24 = 65.4 bpm; 25 = 65.0 bpm) exhibit the lowest difference in this category (0% difference).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio05a_Demus1953.mp3

Audio Example 5a: Bach, "Goldberg Variations," Demus 1953, variation 24 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Jörg Demus, LP Westminster WL-5241, ℗&© 1992, Side B)

Tempo Relation 2:1 (45–55%): 24 (♩.) = 25 (𝅘𝅥𝅯) (orange)

The *orange* cells indicate fourteen recordings where the pulse (dotted quarter note) of variation 24 equals the sixteenth notes of variation 25. The recording of Vladimir Feltsman 1991 (Audio Ex. 5b: 24 = 88.0 bpm; 25 = 44.0 bpm) matches this proportion most closely (50%).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio05b_Feltsman1991.mp3

Audio Example 5b: Bach, "Goldberg Variations," Feltsman 1991, variation 24 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Vladimir Feltsman, CD Music Masters, Inc., ℗&© 1992, Tracks 25, 26)

Tempo Relation 3:2 (28–38%): 24 (♩.+♩.+♩.) = 25 (♩) (blue)

In eighteen recordings, a whole bar of variation 24 equals a quarter note of variation 25. András Schiff 2001 (Audio Ex. 5c: 24 = 90.1 bpm; 25 = 60.5 bpm) matches this proportion exactly (33%). In two cases, the calculated percentage classifies recordings into both the *blue* (3:2) and *grey* (4:3) ranges: both Koopman 1987 and Stefan Vladar 1996 fit right between the two relations but are minimally closer to *blue*.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio05c_Schiff2001.mp3

Audio Example 5c: Bach, "Goldberg Variations," Schiff 2001, variation 24 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," András Schiff, CD ECM Records ECM 1825, ℗&© 2003)

Tempo Relation 3:1 (62–72%): 24 (♩.+♩.+♩.) = 25 (♪) (purple)

The five *purple* cells indicate recordings in which a whole bar of variation 24 equals an eighth note in variation 25. The recordings by Gavrilov 1993 (24 = 99.8 bpm; 25 = 34.7 bpm) and Gould 1955 (Audio Ex. 5d: 24 = 107.5 bpm; 25 = 33.0 bpm) match this proportion most closely.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio05d_Gould1955.mp3

Audio Example 5d: Bach, "Goldberg Variations," Gould 1955, variation 24 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Glenn Gould, CD Sony Classical, Inc., ℗ 1956/57, Tracks 25, 26)

Tempo Relation 4:3 (20–30%): 24 (♪) = 25 (𝅘𝅥𝅯) (grey)

In eleven recordings, an eighth note in variation 24 equals a thirty-second note in variation 25. The recordings by Claudio Arrau 1942 (24 = 63.0 bpm; 25 = 47.7 bpm) and Edith Picht-Axenfeld 1966 (Audio Ex. 5e: 24 = 65.3 bpm; 25 = 49.0 bpm) both match this proportion exactly (25%). The recording by Isolde Ahlgrimm 1954 (24 = 52.7 bpm; 25 = 65.0 bpm) mathematically yields a percentage which fits into this range, but does not display a 4:3 relation. Since Ahlgrimm is the only performer who plays variation 25 more than 10% faster than variation 24 (resulting in a positive percentage value), the mathematical result cannot be applied here. In this case, the inverted calculation (24:25) shows a (musically irrelevant) 5:6 tempo proportion.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio05e_Picht-Axenfeld1966.mp3

Audio Example 5e: Bach, "Goldberg Variations," Picht-Axenfeld 1966, variation 24 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Edith Picht-Axenfeld, LP Erato E1036, ℗ 1979 Editions Costallat France, Side B)

Tempo Relations between Variations 25 and 26

Tempo Relation 1:1 (0–10%): 24 (♩.) = 25 (♪) (green)

The interpretation by Takahashi 2004 (Audio Ex. 6a: 25 = 77.4 bpm; 26 = 78.5 bpm) is the only recording (single green cell: 1%) expressing this proportion, with variation 25 and variation 26 following the same tempo or same basic pulse.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio06a_Takahashi2004.mp3

Audio Example 6a: Bach, "Goldberg Variations," Takahashi 2004, variation 25 (mm. 1–4), variation 26 (mm. 1–4 (Bach, "Goldberg Variations," Yūji Takahashi, CD Avex Classics AVCL-84069, ℗&© 2014, Tracks 26, 27)

Tempo Relation 1:2 (80–120%): 25 (𝅘𝅥𝅯) = 26 (♩) (orange)

In twenty-one recordings, a sixteenth note in variation 25 equal a quarter note in variation 26. Arrau 1942 (101%) matches this proportion most closely (Audio Ex. 6b: 25 = 47.4 bpm; 26 = 95.2 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio06b_Arrau1942.mp3

Audio Example 6b: Bach, "Goldberg Variations," Arrau 1942, variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Claudio Arrau, CD BMG Classics 74321 845 932, ℗ 1988, Tracks 26, 27)

Tempo Relation 2:3 (40–60%): 25 (♩) = 26 (♩+♩+♩) (blue)

The *blue* cells indicate fifteen recordings in which a quarter note in variation 25 equals a whole bar of variation 26. The recording by Richard Egarr 2005 (Audio Ex. 6c: 25 = 49.4 bpm; 26 = 73.9 bpm) matches this proportion exactly (50%).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio06c_Egarr2005.mp3

Audio Example 6c: Bach, "Goldberg Variations," Egarr 2005, variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Richard Egarr, CD Harmonia Mundi USA – HMU 907425.26, ℗&© 2006, CD 2, Tracks 10, 11)

Tempo Relation 1:3 (180–220%): 25 (♪) = 26 (♩+♩+♩) (purple)

In six recordings, an eighth note of variation 25 equals a whole bar of variation 26. The recording by Peter Serkin 1994 (Audio Ex. 6d: 25 = 36.3 bpm; 26 = 108.8 bpm) matches this proportion exactly (200%).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio06d_Serkin1994.mp3

Audio Example 6d: Bach, "Goldberg Variations," Peter Serkin 1994, variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Peter Serkin, CD RCA Victor Red Seal – BMG Classics 09026 68188 2, ℗&© 1996, Tracks 29, 30)

Tempo Relations between Variations 24 and 26

Tempo Relation 1:1 (0–10%): 24 (♩.) = 26 (♩) (green)

The *green* cells indicate seventeen recordings in which variation 24 and variation 26 follow the same tempo or same basic pulse, e.g., Koopman 1987 (Audio Ex. 7a: 24 = 76.0 bpm; 26 = 76.1 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio07a_Koopman1996.mp3

Audio Example 7a: Bach, "Goldberg Variations," Koopman 1987, variation 24 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Ton Koopman, CD Erato Disques S.A, ℗ 1988, Tracks 25, 27)

Tempo Relation 2:3 (40–60%): 24 (♪) = 26 (♪) (blue)

In fifteen recordings, an eighth note in variation 24 equals an eighth note in variation 26, e.g., Ketil Haugsand 2001 (51%) (Audio Example 7b: 24 = 62.5 bpm;26 = 94.2 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio07b_Haugsand2002.mp3

Audio Example 7b: Bach, "Goldberg Variations," Haugsand 2001, variation 24 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Ketil Haugsand, CD Simax PSC 1192, ℗&© 2002, Tracks 25, 27)

Tempo Relation 1:2 (80–120%): 24 (𝅘𝅥𝅯) = 26 (triplet ♪) (orange)

The recordings by Rudolf Serkin 1928 and Charles Rosen 1967 (Audio Ex. 7c: 24 = 57.5 bpm; 26 = 116.6 bpm) equate a sixteenth note of variation 24 to a triplet eighth note (if viewed in 3/4 time signature, i.e., an eighth note if viewed in 18/16 time signature) of variation 26.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio07c_Rosen1992.mp3

Audio Example 7c: Bach, "Goldberg Variations," Rosen 1967, variation 24 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Charles Rosen, CD Sony Music Entertainment Inc. – SBK 48173, ℗ 1969, Tracks 25, 27)

Tempo Relations between Variations 24, 25, and 26

As depicted in Table 3, performers use various strategies to create a tempo relation between the variations of a group: some only establish a relation between one pair of variations (thirty-one of seventy-six: 41%), some between two pairs of variations (twenty of seventy-six: 26%), or between all three variations of this group (twenty-one of seventy-six: 28%); the latter case shall be examined more closely below. Only four of seventy-six examined recordings (5%) do not follow any specific relation.

In the recordings by Arrau 1942, Kirkpatrick 1958, and Gustav Leonhardt 1965, the constellation of tempo relations **4:3** (24–25), **1:2** (25–26), and **2:3** (24–26) (*grey/orange/blue* pattern, as depicted in Table 3) implies the following relations: An eighth note in variation 24 equals a thirty-second note in variation 25; a sixteenth note in variation 25 equals a quarter note in variation 26; and an eighth note in variation 24 equals an eighth note in variation 26. In other words, an eighth note in variation 24 equals a thirty-second note in variation 25, which in turn equals an eighth note in variation 26: 24 (♪) = 25 (𝅘𝅥𝅯) = 26 (♪). In these three recordings, the performers thus choose the eighth note in variation 24 as the common denominator for this three-variation sequence (Audio Ex. 8a: Leonhardt 1965: 24 = 58.3 bpm; 25 = 45.0 bpm; 26 = 88.9 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08a_Leonhardt1965.mp3

Audio Example 8a: Bach, "Goldberg Variations," Leonhardt 1965, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Gustav Leonhardt, CD Teldec 8.43632, ℗ 1965 © 1987, Tracks 25, 26, 27)

By contrast, Takahashi 2004 chooses the same tempo for the main pulse (as denoted by the time signatures) of all three variations: 24 (♩.) = 25 (♪) = 26 (♩). While the mean tempi of all seventy-six recordings (Fig. 3; see Tab. 1) for these three variations suggests a triangular pattern fast–slow–fast (74.0–49.2–95.1 bpm), Takahashi's tempo choices implement a sort of linear tempo design, unique among all examined recordings. This horizontal balance allows for the presumption that the exceptionally high tempo of variation 25 (highest tempo value among all selected recordings) has been consciously chosen to approximate the (nearly identical) fast tempi of variations 24 and 26 (24 = 81.6 bpm; 5 = 77.4 bpm; 26 = 78.5 bpm; *green/green/green* pattern in Table 3, Audio Ex. 8b). This creates an interpretation which reduces the contrast between the three variations to a minimum (resulting in tempo proportions 24:25:26 = 1:1:1), in spite of variation 25 being a somber piece located between two serene variations. Takahashi thus avoids the tempo-related contrast effect which is heard most strongly in Nikolayeva 1992 (between variation 24 and variation 25) and Gould 1955 (between variation 25 and variation 26). That is to say, not unlike Arrau, Kirkpatrick, and Leonhardt, Takahashi lets the notated pulse (♩.) of variation 24 determine the tempo of this three-variation sequence, but his execution differs in the proportional alignment of variation 25.

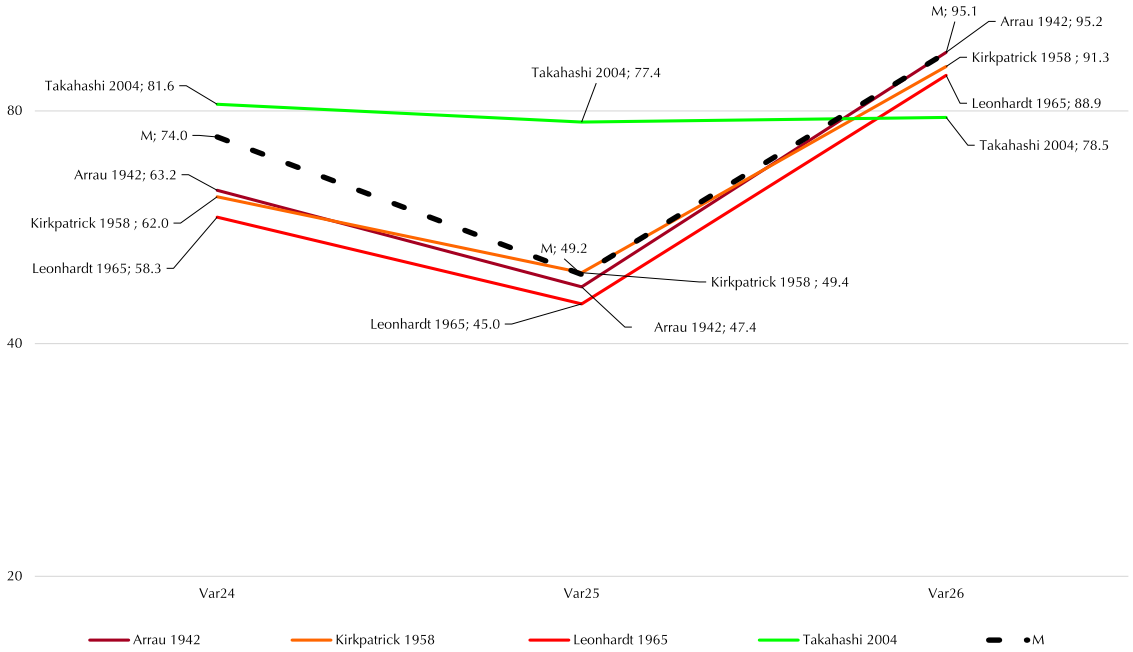


Figure 3: Tempo graph for variations 24, 25, and 26 (*grey/orange/blue* and *green/green/green* patterns)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08b_Takahashi2004.mp3

Audio Example 8b: Bach, "Goldberg Variations," Takahashi 2004, variation 24 (mm. 1–4), variation 25 (mm. 1–4, variation) (Bach, "Goldberg Variations," Yūji Takahashi, CD Avex Classics AVCL-84069, ℗&© 2014, Tracks 25, 26)

In Takahashi's recording of 1976 all three variations are equally interconnected through tempo relations, but unlike the 2004 recording, the tempo for variation 25 is considerably slower (*blue/blue/green* pattern in Table 3, Audio Ex. 8c: 24 = 101.6 bpm; 25 = 63.7 bpm; 26 = 100.4 bpm). This allows variation 24 and variation 26 (both played pointedly faster than in 2004) to act as a framework for the minor variation. Unlike the near-horizontal progression of the later recording, this choice results in a symmetrical pattern (inverted triangle; **3:2:3**, Fig. 4), with the proportions between 24–25 and 25–26 mirroring each other: 24 (♩.+♩.+♩.) = 25 (𝅗𝅥) = 26 (♩+♩+♩).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08c_Takahashi1976.mp3

Audio Example 8c: Bach, "Goldberg Variations," Takahashi 1976, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Yūji Takahashi, CD Denon – Columbia Music Entertainment COCQ-84162, ℗ 1977 © 2006, Tracks 25, 26, 27)

Apart from Takahashi 1976, five other recordings constituting a *blue/blue/green* pattern (Anthony Newman 1971, Schiff 1982, Koopman 1987, Schiff 2001, and Schiff 2015), two recordings with an *orange/orange/green* pattern (Feltsman 1991 and Evgeni Koroliov 1999), and two recordings with a *purple/purple/green* pattern (Nikolayeva 1979 and 1992) equate the main pulse of variation 24 to the main pulse of variation 26, resulting in a *green* third column: 24 (♩.) = 26 (♩). At the same time, the relations between adjacent variations (24–25 and 25–26) match as well: While the *blue* pattern equates a quarter note in variation 25 to a whole bar of both variation 24 and variation 26, the *orange* con-

stellation equates a sixteenth note in variation 25 to the main pulse of both variation 24 (♩.) and variation 26 (♩): 24 (♩.) = 25 (𝅘𝅥𝅯) = 26 (♩); the purple constellation finally equates an eighth note of variation 25 to a whole bar of both variation 24 and variation 26: 24 (♩.+♩.+♩.) = 25 (♪) = 26 (♩+♩+♩). Therefore, these three types of constellations again result in an inverted triangle pattern (Fig. 4, Audio Ex. 8d: Feltsman 1991: 88.0–44.0–93.6 bpm).

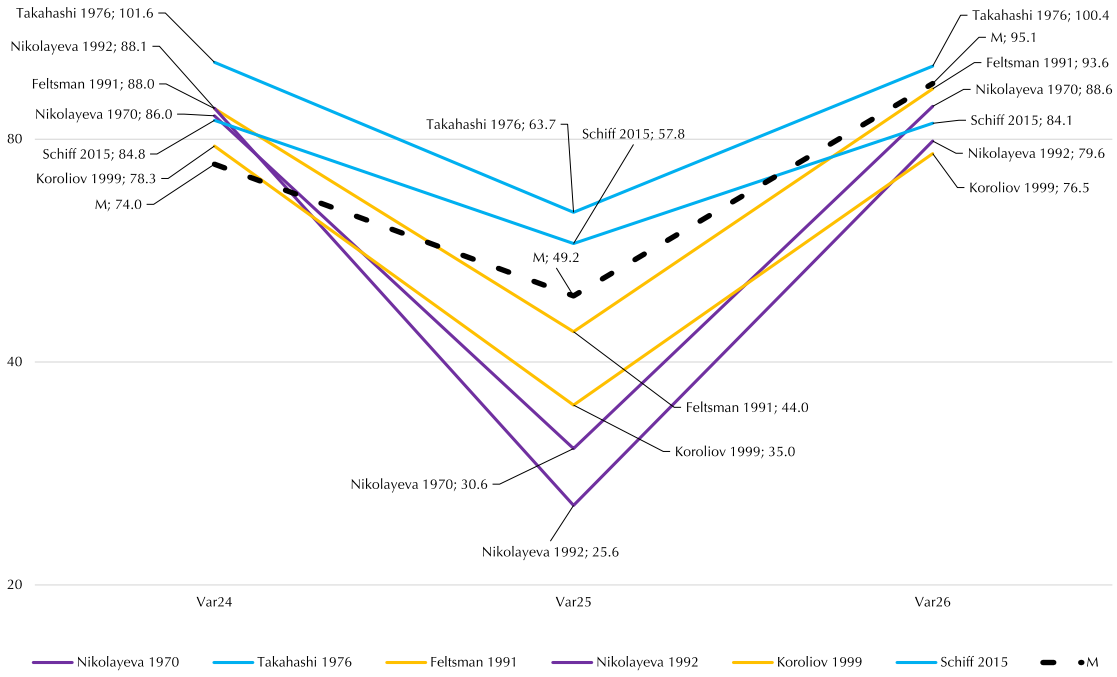


Figure 4: Tempo graph for variations 24, 25, and 26 (*blue/blue/green*, *orange/orange/green*, and *purple/purple/green* patterns)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08d_Feltsman1991.mp3

Audio Example 8d: Bach, "Goldberg Variations," Feltsman 1991, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Vladimir Feltsman, CD Music Masters, Inc., ℗&© 1992, Tracks 25, 26, 27)

Interestingly, all three recordings by Schiff (1982, 2001, and 2015) follow this concept. While in general, the tempi of variation 24–26 become slower with each recording (1981: 96.3–65.9–93.9 bpm; 2001: 90.1–60.5–86.6 bpm; 2015: 84.8–57.8–84.1 bpm), Schiff maintains their tempo proportions, asserting the relations between the pieces (blue/blue/green pattern) (Audio Ex. 8e: Schiff 1982: 96.3–65.9–93.9 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08e_Schiff1982.mp3

Audio Example 8e: Bach, "Goldberg Variations," Schiff 1982, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," András Schiff, CD Decca 417 116-2, ℗ 1983 © 1986, Tracks 5, 6)

Nikolayeva's 1992 recording displays the slowest tempo for variation 25 among all examined recordings (25.6 bpm); her 1979 recording features the second slowest tempo (30.6 bpm; Audio Ex. 8f). Both recordings fall into the *purple/purple/green* pattern.

Therefore, Nikolayeva's "very slow" tempo choice for variation 25 (in both recordings) is not simply "romantically influenced": it ostensibly follows an interpretative concept which creates a striking proportion between the variations. The *purple* pattern strongly highlights the minor variation in its position and further sharpens the triangular shape introduced by the *blue* pattern (purple: 24:25:26 = 3:1:3 versus blue: 24:25:26 = 3:2:3 versus orange: 24:25:26 = 2:1:2). (Audio Ex. 8f: Nikolayeva 1979: 86.0–30.6–88.6 bpm)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08f_Nikolayeva1979.mp3

Audio Example 8f: Bach, "Goldberg Variations," Nikolayeva 1979, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD JVC Victor Japan VICC40126/7, ℗&© 1992, Tracks 25, 26, 27)

Apart from the aforementioned patterns which establish a direct link between all three variations by continuously equating the note value of a variation to its successor (e.g., Arrau 1942: 24 (♪) = 25 (𝅘𝅥𝅯) = 26 (♪)), there are patterns which apply tempo relations between all three pieces by changing the determining note value with the progression from variation 25 to variation 26. This is the case with Bob von Asperen 1991 and Pieter-Jan Belder 1999, whose interpretations create a *green/blue/blue* pattern (2:2:3, Fig. 5): 24 (♩.+♩.) = 25 (♪+♪) = 26 (♩+♩+♩). Here, the two relations depend on a reframing of the note value of variation 25 (♪ → ♩), shifting the proportion in creating the link to variation 26 (Audio Ex. 8g: Belder 1999: 56.4–54.7–80.4). The *green/blue/blue* pattern reflects Siegele's suggestions (**2:2:3**);[28] conversely, the mean tempo values create a blue/orange/[none] pattern, suggesting a proportion of 24:25 = 3:2 and 25:26 = 1:2 (i.e., 24:25:26 = 3:2:4, see below).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08g_Belder1999.mp3

Audio Example 8g: Bach, "Goldberg Variations," Belder 1999, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Pieter-Jan Belder, CD Brilliant Classics 92284, © 2006, CD 2, Tracks 25, 26, 27)

Such reframing processes also take place in three other sets of recordings. In recordings of a *green/orange/orange* pattern (Fig. 5), e.g. in Rudolf Serkin 1928 and Rosen 1967, the note value of variation 25 is shifted from an eighth note to a sixteenth note: 24 (♩.) = 25 (♪) → 25 (𝅘𝅥𝅯) = 26 (♩); 24 (𝅘𝅥𝅯) = 26 (triplet ♪), resulting in the proportion 1:1:2: 24 (♩.) = 25 (♪) = 26 (♩+♩). As a result of the 25:24 proportion being **1:1** (*green*) the 24–26 tempo relation matches the 25–26 tempo relation. Similar to the *green/blue/blue* pattern, variations 24 and 25 follow an identical pulse, but the *green/orange/orange* pattern results in a higher contrast between 25–26 and 24–26, since it follows a sharper proportion (**1:1:2**) than *green/blue/blue* (**2:2:3**) (Audio Ex. 8h, Rosen 1967: 57.5–52.5–115.6).

28 See Siegele 214, 249–251.

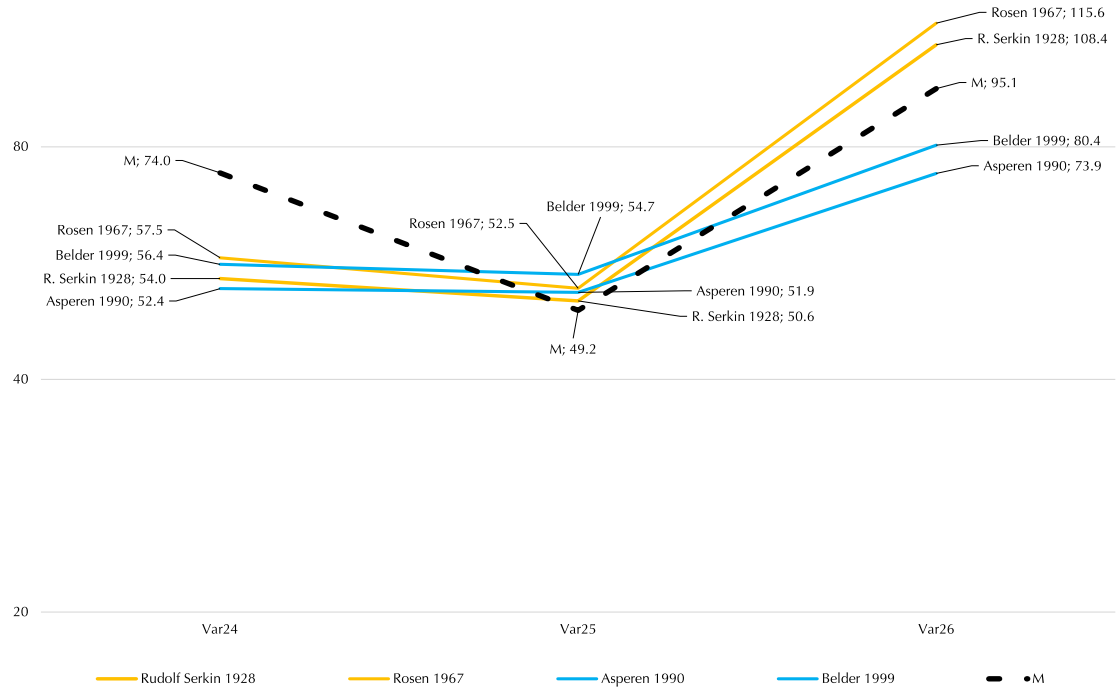


Figure 5: Tempo graph for variations 24, 25, and 26 (*green/blue/blue* and *green/orange/orange* patterns)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08h_Rosen1992.mp3

Audio Example 8h: Bach, "Goldberg Variations," Rosen 1967, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Charles Rosen, CD Sony Music Entertainment Inc. – SBK 48173, ℗ 1969, Tracks 25, 26, 27)

Depending on the distribution of the 26:25 tempo proportion within its percentage range, the 26:24 proportion may fall into a pattern replicating the 26:25 ratio (or not), and vice versa. For example, in Thomas Schultz 1998, the 26:25 percentage (81%) is located at the margin of the designated range (*orange*: 80–120%), causing the 26:24 proportion (63%) to remain outside of the *blue* range (40–60%). Such a situation emerges in Tureck 1998 as well: the percentage of the 26:24 proportion (41%) lies near the lower margin of the chosen range (*blue*: 40–60%), resulting in a "near miss" for the 26:25 proportion (with 39% located just below the *blue* range). Arguably, since these deviations are a result of the deliberately chosen percentage ranges, these two recordings nonetheless match the aforementioned relation patterns (Schultz: *green/orange/[orange]*, Tureck: *green/[blue]/blue*).

The *blue/orange/blue* pattern reframes the note value of variation 25 from a quarter note to a sixteenth note: 24 (♩.+♩.+♩.) = 25 (♩) → 25 (𝅘𝅥𝅯) = 26 (♩); 24 (𝅘𝅥𝅯) = 26 (𝅘𝅥𝅯), creating a **3:2:4** proportion: 24 (♩.+♩.+♩.) = 25 (♩) = 26 (♩+♩+♩+♩), e.g., in Eunice Norton 1942 and Hewitt 1999. One recording, Ji-Yong Kim 2018, forms an *orange/purple/blue* pattern, shifting the note value of variation 25 from a sixteenth note to an eighth note: 24 (♩.) = 25 (𝅘𝅥𝅯) → 25 (𝅘𝅥𝅯) = 26 (♩+♩+♩); 24 (𝅘𝅥𝅯) = 26 (𝅘𝅥𝅯). This generates a **2:1:3** proportion: 24 (♩.+♩.) = 25 (𝅘𝅥𝅯) = 26 (♩+♩+♩).

As mentioned above, the mean tempo values (74.0–49.2–95.1 bpm) suggest a pattern which relates variation 24 to variation 25 in a **3:2** tempo relation, and variation 25 to variation 26 in a **1:2** relation, with the proportion 26:24 not following any discernible

(integer) ratio[29] – creating a pattern which displays only two connections (*blue/orange/[none]*; 24: 34%; 25: 94%; 26: 29%). Strikingly, six performers among the examined recordings match this binary pattern: as reflected by Grete Sultan 1959, Trevor Pinnock 1980, Weissenberg 1981, Pi-hsien Chen 1985, Andreas Staier 2009, and Jeremy Denk 2013. These interpretations equate a whole bar of variation 24 to a quarter note in variation 25, and a sixteenth note in variation 25 to a quarter note in variation 26; Pinnock's interpretation matches the percentages of the mean tempo values most closely (Audio Ex. 8i: 24: 32%; 25: 93%; 26: 32%; 67,8–46,2–89,2 bpm). The recordings by Norton 1942 and Hewitt 1999 correspond to this pattern as well, but relate variation 24 to variation 26 in a **2:3** proportion (as described above).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio08i_Pinnock1980.mp3

Audio Example 8i: Bach, "Goldberg Variations," Pinnock 1980, variation 24 (mm. 1–4), variation 25 (mm. 1–4), variation 26 (mm. 1–4) (Bach, "Goldberg Variations," Trevor Pinnock, CD Archiv Produktion 415 130- 2, ℗ 1980 Polydor International, CD 2. Tracks 25, 26, 27)

Cyclic Interpretation II: Structure-based Analysis (Variations in G minor: Variations 15, 21, and 25)

Evidently, the main reason for choosing to analyze variations 15, 21, and 25 as a group (Ex. 2) is the fact that they are the only minor variations in the cycle. As Rolf Dammann illustrates, the strict three-part canons of variations 15 and 21 could be seen as pieces of the *prima pratica*. In contrast, the expressive and highly rhetorical "solo" melody of variation 25, set to a two-part accompaniment, constitutes an instrumental paradigm of the *seconda pratica*.[30] But in addition to that, these variations also feature significant SD and range values: variation 15 exhibits the lowest mean tempo value of all pieces (29.6 bpm; followed by variation 16a: 33.9 bpm; both are located at the center of the cycle); variation 21 has one of the highest SD values and a relatively high range; variation 25, as mentioned previously, possesses a very high SD and the highest range value (most likely also due to its inherent expressivity).

Moreover, variations 15 and 25 are the only pieces of the cycle with added tempo indications (15: *Andante* and 25: *Adagio*).[31] This suggests that it was a necessity for Bach to provide tempo indications only in those cases where a tempo could not be derived from common meter and musical structure. Conceding that Italian tempo markings have also been interpreted as denoting mood, Bernard Sherman argues that

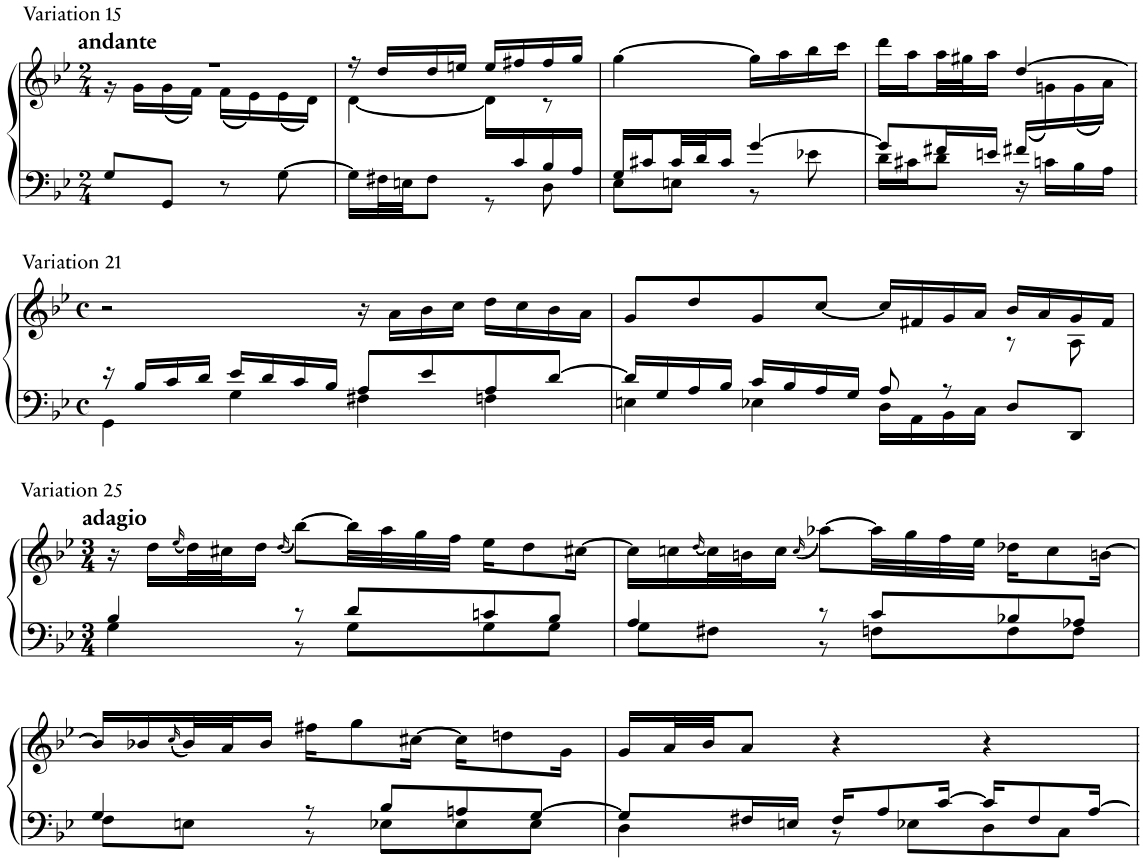
> for Bach the term Andante slowed the tempo somewhat compared to what it would be without the marking. […] [The] Andante marking may be considered cautionary, warning musicians not to play it as quickly as a movement in common time would normally go. […] [It] could refer to a

29 The proportion 3:4 between variations 24 and 26 is mathematically discernible but musically irrelevant.

30 See Dammann 1986, 208.

31 Variation 16 (*Ouverture*) and variation 22 (*Alla breve*) also feature inscriptions indirectly indicative of tempo; interestingly, variation 22 features the lowest difference in tempi between pianists and harpsichordists (see Fig. 1).

steadiness or evenness of execution; Bach often uses it in movements with at least one line, usually the bass, moving in continuous quavers (or semiquavers).[32]



Example 2: Bach, "Goldberg Variations," variations 15 (mm. 1–4), 21 (mm. 1–2), and 25 (mm. 1–4)

While variation 21 is, on average, played slightly faster (by 2.5%) by those performers who are pianists (mean tempo, pianists: 45.5 bpm; mean tempo, harpsichordists: 44.4 bpm; see Fig. 1), both variations 15 and 25 are interpreted more slowly by pianists than by harpsichordists. This is only the case with seven pieces in total; on the whole, the pieces of the cycle have been performed 7.2% faster by pianists. Whereas variation 15 shows only a slight difference (3.5%; mean tempo, pianists: 29.2; mean tempo, harpsi-

32 Sherman 2000, 459–460. Analogously to the juxtaposition of variation 16a and the beginning of Partita No. 4 (see footnote 16), the tempo marking *Andante* suggests another comparison: that between variation 15 and the *Andante* of the *Italian Concerto* BWV 971 (main pulse = quarter notes in both pieces). For example, in Egarr's 1995 recording of the *Concerto*, he chooses virtually the same tempo for the *Andante* (35.1 bpm in mm. 4–7) as for variation 15 in his 2001 recording (34.3 bpm; i.e. only 2% slower). Gould's 1981 tempo for the *Concerto* movement (20.9 bpm) is equally similar to his variation 15 of the same year (21.5 bpm). Likewise, Kirkpatrick makes a similar choice in his 1959 *Concerto* recording (34.2 bpm) to his variation 15 from the year before (31.3 bpm; only 8% slower). Grigory Sokolov, whose 1982 interpretation of variation 15 is the fastest of all examined recordings (42.6 bpm) is 17% faster than his 2011 choice for the *Italian Concerto* (36.7 bpm). On the other hand, Sylvia Marlowe's 1958 choice for the *Concerto*'s *Andante* (41.6 bpm) shows a significant difference compared to her 1962 interpretation of variation 15 (23.0 bpm; 47% slower). A further interesting comparison of variation 15 to a structurally similar piece could be made with Prelude No. 24 in B minor from the *Well-Tempered Clavier*, Book I (BWV 869).

chordists: 30.2); variation 25 exhibits a significant discrepancy (as outlined above): it is performed 11.7% slower by pianists (mean tempo, pianists: 46.9; mean tempo, harpsichordists: 53.1). This may imply that harpsichordists tend to interpret the inscriptions *Andante* and *Adagio* differently than pianists, possibly due to their inherent experience with and practice of early music, while a reason for the pianists' slower approach could reflect a tendency to interpret tempo indications in a more "modern" way.

This set of three variations in a minor key (variation 15: 2/4; variation 21: 4/4; variation 25: 3/4; all three in a binary structure) only allows for two meaningful ratios: **1:1** (*green*) and **2:1** (*orange*), as depicted in Table 4.

	Var. 15 (𝅗𝅥.)	Var. 21 (♪)	Var. 25 (𝅗𝅥)	21:15 (%)	25:21 (%)	25:15 (%)
Rudolf Serkin 1928	38.5	56.9	50.6	48	11	31
Landowska 1933	27.9	31.6	51.3	13	62	84
Norton 1942	26.8	52.2	52.9	95	1	98
Arrau 1942	32.5	45.4	47.4	40	4	46
Landowska 1945	27.7	27.2	49.5	2	82	79
Kirkpatrick 1952	30.3	56.6	48.4	87	14	60
Demus 1953	22.8	38.2	55.6	68	46	144
Ahlgrimm 1954	33.7	45.1	65.0	34	44	93
Gould 1954	27.6	57.3	46.6	108	19	69
Gould 1955	31.0	42.6	33.0	37	23	6
Richter 1956	27.8	46.5	49.7	67	7	79
Silver 1957	27.3	46.2	57.7	69	25	112
Tureck 1957	25.5	36.4	45.3	43	24	78
Gould 1958	29.9	57.7	46.1	93	20	54
Kirkpatrick 1958	31.3	66.2	49.4	111	25	58
Gould 1959	28.7	49.7	48.1	73	3	68
Sultan 1959	29.4	49.1	46.3	67	6	57
Marlowe 1962	23.0	31.2	37.3	36	19	62
Gát 1963	37.9	44.7	65.0	18	45	71
Leonhardt 1965	26.2	32.1	45.0	23	40	72
Picht-Axenfeld 1966	31.6	49.4	49.0	56	1	55
Rosen 1967	34.6	54.3	52.5	57	3	52
Kempff 1969	29.8	42.4	62.5	42	47	110
Richter 1970	30.5	53.1	58.4	74	10	91
Newman 1971	32.1	48.3	63.3	50	31	97
Hayden 1976	22.2	34.7	36.4	56	5	64
Takahashi 1976	30.3	47.5	63.7	57	34	110
Gibbons 1979	33.2	40.0	50.4	21	26	52
Nikolayeva 1979	26.0	30.6	30.6	18	0	18
Pinnock 1980	28.4	30.2	46.2	6	53	63
Weissenberg 1981	28.9	43.0	52.5	49	22	82
Gould 1981	21.4	46.8	34.5	119	26	62
Schiff 1982	41.3	64.4	65.9	56	2	60
Sokolov 1982	42.6	30.3	35.6	29	17	16
Chen 1985	28.2	50.9	46.1	80	9	63
Gilbert 1986	34.3	50.3	52.5	47	4	53
Tipo 1986	31.9	54.7	45.0	71	18	41
Koopman 1987	33.3	51.0	54.2	53	6	63
Jarrett 1989	31.8	45.4	54.5	43	20	72
Asperen 1991	25.0	37.4	51.9	s50	39	108
Feltsman 1991	25.7	38.4	44.0	50	14	71
Barenboim 1992	28.1	50.7	44.2	80	13	57

Nikolayeva 1992	24.8	31.6	25.6	28	19	3
Verlet 1992	35.5	47.9	72.7	35	52	105
Gavrilov 1993	23.0	36.4	34.7	58	4	51
Peter Serkin 1994	28.7	33.1	36.3	15	10	26
Li 1996	22.7	46.6	38.3	105	18	69
Vladar 1996	31.5	59.8	55.4	89	7	76
Schultz 1998	30.5	28.8	48.5	6	68	59
Tureck 1998	27.8	45.3	56.3	63	24	103
Belder 1999	26.7	41.8	54.7	57	31	105
Hewitt 1999	31.5	49.9	46.2	58	7	47
Koroliov 1999	24.9	43.4	35.0	74	19	40
Schirmer 1999	27.2	43.7	39.8	61	9	46
Perahia 2000	32.0	51.7	48.9	61	5	53
Schiff 2001	38.5	72.1	60.5	87	16	57
Haugsand 2001	29.2	47.0	53.6	61	14	83
Pescia 2004	25.6	52.9	36.8	106	30	44
Takahashi 2004	36.4	48.9	77.4	34	58	113
Dinnerstein 2005	25.4	31.9	45.6	26	43	80
Egarr 2005	34.3	49.4	49.4	44	0	44
Zhu 2007	28.1	43.8	46.5	56	6	66
Staier 2009	30.3	46.9	51.1	55	9	69
Marsoner 2009	29.0	45.6	53.4	57	17	84
Ishizaka 2012	29.1	34.1	41.3	17	21	42
Denk 2013	33.6	46.5	58.5	38	26	74
Hill 2014	30.5	43.6	54.7	43	26	79
Hewitt 2015	29.5	43.9	45.2	49	3	53
Levit 2015	32.3	52.0	49.0	61	6	52
Schiff 2015	35.0	66.0	57.8	88	12	65
Esfahani 2016	33.7	50.6	59.4	50	17	76
Schornsheim 2016	31.0	49.0	55.2	58	13	78
Kim 2018	26.5	35.2	36.9	33	5	39
Ernst 2020	24.9	41.4	46.9	66	13	88
Lang 2020a	19.9	28.1	39.1	41	39	97
Lang 2020b	21.4	29.8	40.5	39	36	89
Siegele	28.8	28.8	57.6	0	100	100
Mean Tempo	29.6	45.1	49.2	52	9	66

Table 4: Bach, "Goldberg Variations," tempo relations between variations 15, 21, and 25

Tempo Relations between Variations 15 and 21

Tempo Relation 1:1 (0–10%): 15 (♩) = 21 (♩) (green)

In three recordings, a quarter note in variation 15 equates a quarter note in variation 21, i.e., both variations share a main pulse, e.g., in Wanda Landowska 1945, Pinnock 1980, and Schultz 1998. In the recording by Landowska 1945 (27.7–27.2 bpm), the tempi of both variations match almost exactly, making her tempo of variation 21 the slowest among all examined recordings (Audio Ex. 9a).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio09a_Landowska1945.mp3

Audio Example 9a: Bach, "Goldberg Variations," Landowska 1945, variation 15 (mm. 1–4), variation 21 (mm. 1–2) (Bach, "Goldberg Variations," Wanda Landowska, CD RCA Victor Gold Seal – BMG Classics, ℗&© 1992, CD 1, Tracks 16, 22)

Tempo Relation 1:2 (80–120%): 15 (♪) = 21 (♩) (orange)

In thirteen recordings, an eighth note in variation 15 equals a quarter note in variation 21, e.g., in Norton 1942 (26.8–52.2 bpm; 95%) and Cecilia Li 1996 (Audio Ex. 9b: 22.7–46.6 bpm; 105%).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio09b_Li1996.mp3

Audio Example 9b: Bach, "Goldberg Variations," Li 1996, variation 15 (mm. 1–4), variation 21 (mm. 1–2) (Bach, "Goldberg Variations," Cecilia Li, CD Bayer Records/Amati 9602/1, ℗&© 1996, Tracks 16, 22)

Regarding the question whether the main pulse in variation 15 is to be derived from an eighth note or a quarter note, the performers' choices concerning the tempo relations between variation 15 and variation 21 might offer some insight into their view of the matter. Those applying a **1:1** relation have assessed the quarter note of variation 15 as the main pulse (putting their tempo choices for variation 21 among the slowest of all recordings); those implementing a **2:1** relation have chosen the eighth note as the main pulse of variation 15.

Tempo Relations between Variations 21 and 25

Tempo Relation 1:1 (0–10%): 21 (♩) = 25 (♪) (green)

The twenty-six green cells indicate recordings where a quarter note in variation 21 equals an eighth note in variation 25, as it is the case in the recordings by Nikolayeva 1979 (30.6–30.6 bpm) and Egarr 2005 (Audio Ex. 10a: 49.4–49.4 bpm), both with exactly 0% deviation.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio10a_Egarr2005.mp3

Audio Example 10a: Bach, "Goldberg Variations," Egarr 2005, variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Richard Egarr, CD Harmonia Mundi USA – HMU 907425.26, ℗&© 2006, CD 2, Tracks 6, 10)

Tempo Relation 1:2 (80–120%): 21 (♩) = 25 (♩) (orange)

One recording, Landowska 1945, equates a quarter note in variation 21 to a quarter note in variation 25, using the same main pulse for both pieces (Audio Ex. 10b: 27.2–49.5 bpm). All other interpretations which feature a relation for 21–25 choose a **1:1** ratio (as reflected in the mean tempi 45.1–49.2).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio10b_Landowska1945.mp3

Audio Example 10b: Bach, "Goldberg Variations," Landowska 1945, variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Wanda Landowska, CD RCA Victor Gold Seal – BMG Classics, ℗&© 1992, CD 1, Tracks 22, 26)

Tempo Relations between Variations 15 and 25

Tempo Relation 1:1 (0–10%): 15 (♩) = 25 (♪) (green)

The two green cells indicate recordings where a quarter note in variation 15 equals an eighth note in variation 25, as in the recordings by Gould 1955 (31.0–33.0 bpm) and Nikolayeva 1992 (Audio Ex. 11a: 24.8–25.6 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio11a_Nikolayeva1992.mp3

Audio Example 11a: Bach, "Goldberg Variations," Nikolayeva 1992, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD Hyperion Records Limited A66589, ℗&© 1992, Tracks 16, 26)

Tempo Relation 1:2 (80–120%): 15 (♪) = 25 (♪) (orange)

In twenty recordings, an eighth note in variation 15 equals an eighth note in variation 25, e.g., Lang 2020a (Audio Ex. 11b: 19.9–39.1 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio11b_Lang2020a.mp3

Audio Example 11b: Bach, "Goldberg Variations," Lang 2020a, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Lang Lang, CD Deutsche Grammophon B089TWSBDT, ℗&© 2020, Tracks 16, 26)

Tempo Relations between Variations 15, 21, and 25

As depicted in Table 4, there are seventeen recordings (23% of the examined recordings) that do not suggest any specific tempo relations, whereas in fifty-four recordings (71%) only one relation, in four recordings (5%) two relations, and in only one recording (1%) three tempo relations can be observed. The recording by Norton 1942, as the only recording showing three relations, follows a symmetric pattern (**1:2:2**): 15 (♪) = 21 (♩) = 25 (♪). Not only is the eighth pulse of variation 15 a determining factor for the tempo choice for the other minor key variations, its character and atmosphere have been applied to the other two: the *Andante* is interpreted in a very stable tempo and without any substantial *rubato*. The same flow is discernible in variation 21 and variation 25 (Audio Ex. 12a: Norton 1942: 26.8–52.2–52.9 bpm –).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12a_Norton1942.mp3

Audio Example 12a: Bach, "Goldberg Variations," Norton 1942, variation 15 (mm. 1–4), variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Eunice Norton, CD Norvard Recordings 0005-2, ℗&© 2000, Tracks 16, 22, 26)

Out of the four recordings showing relations between two variations, two follow the same pattern (*orange/green/[none]*): Chen 1985 and Vladar 1996. These two performers match an eighth note in variation 15 to a quarter note in variation 21, and a quarter note in variation 21 to an eighth note in variation 25. Although this relation would suggest that the eighth note in variation 25 equals the eighth note in variation 15 (tracing a **1:2:2** tempo pattern), the distribution of values near the margins of the percentage ranges for the 21:15 and 25:21 proportions does not allow 25:15 to match the *orange* pattern (Chen: 21:15:

80% – 25:21: 9% – 25:15: 63%; Vladar: 21:15: 89% – 25:21: 7% – 25:15: 76%), so that the proportion applies only in a chronological direction: 15 (♪) → 21 (♩) → 25 (♪) (Audio Ex. 12b: Vladar 1996: 31.5–59.8–55.4 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12b_Vladar1996.mp3

Audio Example 12b: Bach, "Goldberg Variations," Vladar 1996, variation 15 (mm. 1–4), variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Stefan Vladar, CD Preiser Records 90771, © 2009, Tracks 16, 22, 26)

Karl Richter's 1970 recording also features two tempo relations but forms a different pattern: *[none]/green/orange*. Here, a quarter note of variation 21 equals an eighth note of variation 25, and the eighth notes of variation 15 and variation 25 match: 21 (♩) = 25 (♪); 15 (♪) = 25 (♪). Consequentially, one would assume that the use of this relation would automatically equate an eighth note in variation 15 to a quarter note in variation 21, resulting in a **1:2:2** tempo proportion, as implied in Chen and Vladar. But since the *green* percentage value for 25:21 is 10% and therefore at the margin of the corresponding percentage range, the expected (*orange*) ratio for 21:15 doesn't apply (74%). Richter's 1956 recording matches the **1:1** percentage bracket for 25:21 somewhat more closely (7%) but features a "near miss" for an *orange* 25:15 proportion (79%) (Audio Ex. 12c: 30.5–53.1–58.4 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12c_Richter1970.mp3

Audio Example 12c: Bach, "Goldberg Variations," Richter 1970, variation 15 (mm. 1–4), variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Karl Richter, CD Deutsche Grammophon 445 057-2, ℗ 1972, Tracks 16, 22, 26)

The proportion for 15–25 displayed in Landowska 1945 (79%) puts her on the threshold to a **1:2** tempo relation, which, given a higher tolerance regarding the 80–120% range, would result in a linear set tying together all three variations (as approached in Norton 1942). In contrast to Norton's tempo relations (15 (♪) = 21 (♩) = 25 (♪); *orange/green/orange*, **1:2:2**), Landowska however equates the quarter notes of *all three* variations (15 (♩) = 21 (♩) = 25 (♩); *green/orange/[orange]*, **1:1:2**). This pattern conforms to the one suggested by Siegele.[33] Consequently, Landowska's 1945 interpretation is the only one among all examined recordings which chooses a uniform tempo for the pulse of all three pieces (referring to a quarter note in all three cases, as denoted by the time signature of each variation: 2/4 – 4/4 – 3/4). This choice results in her remarkably slow tempo for variation 21, the slowest among all seventy-six recordings (Audio Ex. 12d: 27.7–27.2–49.5 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12d_Landowska1945.mp3

Audio Example 12d: Bach, "Goldberg Variations," Landowska 1945, variation 15 (mm. 1–4), variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Wanda Landowska, CD RCA Victor Gold Seal – BMG Classics, ℗&© 1992, CD 1, Tracks 16, 22, 26)

A comparison between variation 15 and variation 25 reveals a seemingly contradictory aspect: As mentioned earlier, these are the only two variations with a tempo indication: *Andante* for variation 15 and *Adagio* for variation 25. These inscriptions would suggest

33 See note 28.

Andante to be played at a palpably faster tempo than *Adagio*, yet, contrary to expectation, twenty of seventy-six recordings equate the notated pulses (quarter notes) of both variations (see Table 4, 25:15, *orange*), with Norton 1942 and Lang 2020a approximating this proportion (100%) most closely (Norton: 98%, Lang: 97%). These two performances – while audibly basing both variations on virtually the same pulse – show a remarkably dissimilar approach to character and atmosphere, resulting in two very different expressions of the same ratio: Norton maintains the dignified pace and flow from the *Andante* in variation 25, essentially cutting both pieces from the same "fabric" (Audio Ex. 12e: 26.8–52.9 bpm). Lang executes variation 15 at a steadily walking pace before creating a strong contrast in moods by incorporating a fair amount of *rubato* in the *Adagio*, shaping time in a more liberal manner to achieve a different level of expression (Audio Ex. 12f: 19.9–39.1 bpm).[34]

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12e_Norton1942.mp3

Audio Example 12e: Bach, "Goldberg Variations," Norton 1942, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Eunice Norton, CD Norvard Recordings 0005-2, ℗ 2000, Tracks 16, 26)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12f_Lang2020a.mp3

Audio Example 12f: Bach, "Goldberg Variations," Lang 2020a, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Lang Lang, CD Deutsche Grammophon B089TWSBDT, ℗&© 2020, Tracks 16, 26)

Another significant observation concerning variation 25 is the strikingly low number of **1:1** relations between variation 15 and variation 25: Gould 1955 and Nikolayeva 1992 are the only performers to equate an eighth note in variation 25 to a quarter note in variation 15, with both interpretations choosing conspicuously low tempi for variation 25, Nikolayeva's 1992 choice being the slowest, Gould's 1955 choice the third slowest tempo. While in her 1979 recording, Nikolayeva matches the similarly slow tempo of variation 25 (which is the second slowest choice for this variation among all examined recordings: 30.6 bpm) to that of variation 21 (Audio Ex. 12g: 30.6 bpm), her 1992 tempo for variation 25 (25.6 bpm, slowest recording) equals that of variation 15 (Audio Ex. 12h: 24.8 bpm). This is also the case for Gould: in his 1955 recording, the tempo choice for variation 25 (33.0 bpm) matches that of variation 15 (Audio Ex. 12i: 31.0 bpm); in his 1959 recording, it equals the tempo of variation 21 (49.7 bpm), which results in a much more flowing tempo for variation 25 (Audio Ex. 12j: 48.1 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12g_Nikolayeva1979.mp3

Audio Example 12g: Bach, "Goldberg Variations," Nikolayeva 1979, variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD JVC Victor Japan VICC40126/7, ℗&© 1992, Tracks 22, 26)

34 Lang Lang's recordings display the slowest and second slowest tempo choices for variation 15 among all examined recordings: Lang 2020a (live recording) = 19.9 bpm and Lang 2020b = 21.0 bpm. Including 1% deviation for 2020b, both recordings create a direct relation to variation 25.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12h_Nikolayeva1992.mp3

Audio Example 12h: Bach, "Goldberg Variations," Nikolayeva 1992, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD Hyperion Records Limited A66589, ℗&© 1992, Tracks 16, 26)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12i_Gould1955.mp3

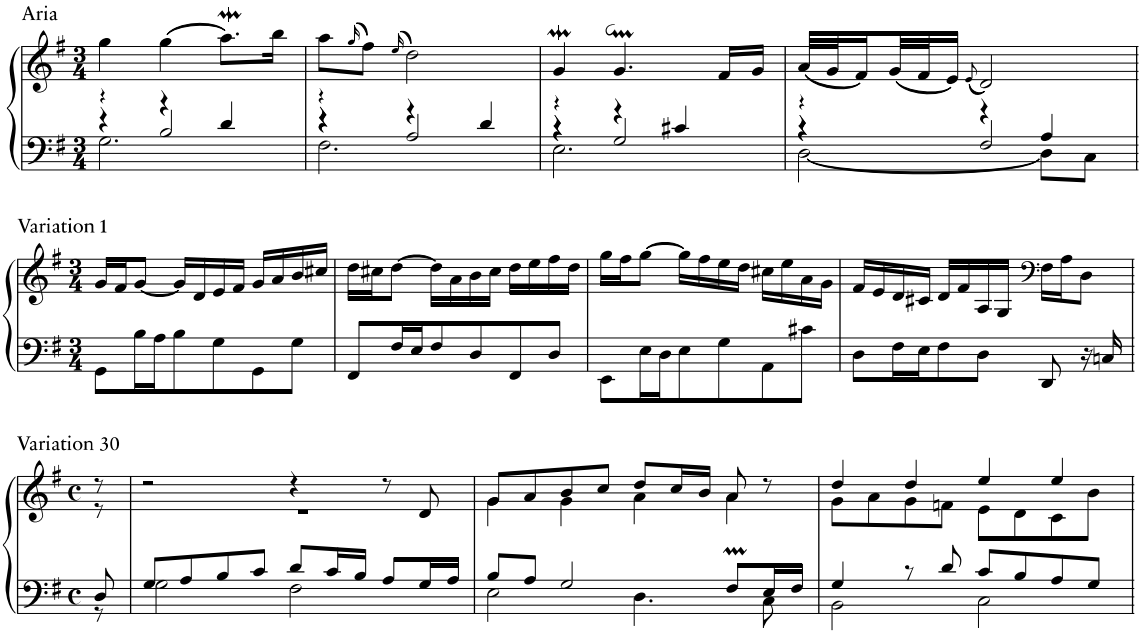
Audio Example 12i: Bach, "Goldberg Variations," Gould 1955, variation 15 (mm. 1–4), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Glenn Gould, CD Sony Classical, Inc., ℗ 1956/57, Tracks 16, 26)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio12j_Gould1959.mp3

Audio Example 12j: Bach, "Goldberg Variations," Gould 1959, variation 21 (mm. 1–2), variation 25 (mm. 1–4) (Bach, "Goldberg Variations," Glenn Gould, CD Sony Classical 52685-2, ℗&© 1993, Tracks 22, 26)

Cyclic Interpretation III: Position-based Analysis (Beginning and End)

Undisputedly, the strongly interlinked symmetrical disposition of the "Goldberg Variations" offers a multitude of possible relations to be examined in terms of position-based (cyclic) qualities. For example, the symmetrical structure of 1+15+15+1 pieces invites a detailed examination of the cycle's middle and the tempo relations across the middle axis (mainly the relations between variations 14 to 17). In this final analysis, however, I will place the focus on the beginning and end: on both *Arias* and their (adjacent) variations (Ex. 3).



Example 3: Bach, "Goldberg Variations," *Aria* (mm. 1–4), variations 1 (mm. 1–4) and 30 (mm. 1–3)

The following tempo relations have been examined: *Aria* 1–*Aria* 2, *Aria* 1–variation 1, variation 30–*Aria* 2, and variation 1–variation 30 (Table 5). These combinations provide further information on possible arcs between the first and last positions of the cycle, as executed in the selected recordings.

	Aria 1 (♩)	Var. 1 (♩)	Var. 30 (♩)	*Aria* 2 (♩)	*Aria* 2 : *Aria* 1 (%)	Var. 1 : *Aria* 1 (%)	Var. 30 : Var. 1 (%)	*Aria* 2 : Var. 30 (%)
Rudolf Serkin 1928	70.4	127.9	91.7	61.4	13	82	28	33
Landowska 1933	49.1	54.1	83.2	47.9	2	10	54*	42
Norton 1942	61.3	118.9	80.9	61.2	0	94	32	24
Arrau 1942	47.7	113.0	78.8	49.1	3	137	30	38
Landowska 1945	45.5	63.0	81.0	44.2	3	38	29*	45
Kirkpatrick 1952	53.8	99.3	71.1	52.0	3	84	28	27
Demus 1953	41.3	98.0	76.5	39.9	3	137	22	48
Ahlgrimm 1954	57.4	109.4	76.5	58.3	2	91	30	24
Gould 1954	43.8	110.0	67.8	39.3	10	151	38	42
Gould 1955	63.6	137.4	91.2	59.0	7	116	34	35
Richter 1956	52.7	77.5	72.1	52.7	0	47	7	27
Silver 1957	41.5	81.2	68.5	46.9	13	96	16	32
Tureck 1957	34.0	74.2	66.8	35.6	5	119	10	47
Gould 1958	59.9	126.1	88.5	60.2	1	111	30	32
Kirkpatrick 1958	55.6	98.2	79.0	52.8	5	77	20	33
Gould 1959	60.1	122.2	79.6	57.9	4	103	35	27
Sultan 1959	50.0	108.9	83.4	46.0	8	118	23	45
Marlowe 1962	40.7	75.6	79.5	40.3	1	86	5	49
Gát 1963	49.6	113.8	83.6	57.5	16	129	27	31
Leonhardt 1965	45.7	66.3	65.4	43.0	6	45	1	34
Picht-Axenfeld 1966	47.5	91.1	68.3	47.1	1	92	25	31
Rosen 1967	51.1	106.9	75.7	46.3	10	109	29	39
Kempff 1969	80.8	95.4	67.9	81.0	0	18	29	19
Richter 1970	57.2	85.3	82.0	59.2	4	49	4	28
Newman 1971	56.5	135.2	95.3	58.8	4	139	30	38
Hayden 1976	46.7	80.9	85.6	39.2	16	73	6	54
Takahashi 1976	61.6	120.7	81.9	63.2	3	96	32	23
Gibbons 1979	58.7	100.9	75.8	56.4	4	72	25	26
Nikolayeva 1979	51.1	105.9	66.0	55.4	8	107	38	16
Pinnock 1980	43.6	94.2	59.8	42.8	2	116	36	29
Weissenberg 1981	45.5	124.4	62.7	42.5	7	173	50	32
Gould 1981	33.6	82.2	73.3	27.9	17	145	11	62
Schiff 1982	58.1	104.5	102.0	60.2	4	80	2	41
Sokolov 1982	57.2	118.6	72.8	57.4	0	107	39	21
Chen 1985	66.0	117.2	61.5	57.7	13	78	47	6
Gilbert 1986	49.3	88.6	74.3	46.5	6	80	16	37
Tipo 1986	55.5	102.5	66.3	51.7	7	85	35	22
Koopman 1987	42.6	103.5	68.7	41.2	3	143	34	40
Jarrett 1989	40.7	80.4	66.3	42.9	5	98	18	35
Asperen 1991	39.9	95.2	62.1	37.3	7	139	35	40

Feltsman 1991	41.6	109.2	71.9	40.9	2	163	34	43
Barenboim 1992	49.5	101.4	79.4	44.1	11	105	22	44
Nikolayeva 1992	56.3	104.7	58.1	51.8	8	86	45	11
Verlet 1992	75.2	88.3	64.9	66.4	12	17	26	2
Gavrilov 1993	42.7	115.2	80.9	42.7	0	170	30	47
Peter Serkin 1994	51.0	107.1	111.2	46.1	10	110	4	59
Li 1996	39.0	103.0	77.6	40.2	3	164	25	48
Vladar 1996	49.2	108.6	92.6	41.1	16	121	15	56
Schultz 1998	44.7	105.3	63.2	44.8	0	136	40	29
Tureck 1998	46.0	71.3	67.2	39.1	15	55	6	42
Belder 1999	38.2	94.6	59.5	41.6	9	147	37	30
Hewitt 1999	51.1	113.5	70.5	48.4	5	122	38	31
Koroliov 1999	44.6	105.3	86.4	41.3	7	136	18	52
Schirmer 1999	38.6	89.5	73.3	34.8	10	132	18	52
Perahia 2000	52.8	104.4	82.5	48.9	7	98	21	41
Schiff 2001	61.5	104.1	107.0	60.2	2	69	3	44
Haugsand 2001	49.9	86.0	74.5	45.8	8	72	13	38
Pescia 2004	46.9	109.9	97.4	42.2	10	134	11	57
Takahashi 2004	60.0	85.5	66.1	78.1	30	42	23	18
Dinnerstein 2005	40.3	110.9	72.2	34.8	14	175	35	52
Egarr 2005	51.3	77.1	78.9	51.3	0	50	2	35
Zhu 2007	46.6	109.1	80.8	44.6	4	134	26	45
Staier 2009	49.1	101.8	65.1	43.5	11	107	36	33
Marsoner 2009	47.5	123.4	85.3	47.6	0	159	31	44
Ishizaka 2012	42.2	103.7	68.3	38.4	9	146	34	44
Denk 2013	56.0	110.3	78.9	56.1	0	97	28	29
Hill 2014	54.4	94.6	68.2	51.3	6	74	28	25
Hewitt 2015	47.9	117.0	72.3	42.6	11	144	38	41
Levit 2015	49.4	104.8	84.2	49.8	1	112	20	41
Schiff 2015	55.8	100.7	100.8	55.4	1	80	0	45
Esfahani 2016	52.2	97.9	79.5	50.3	4	88	19	37
Schornsheim 2016	52.2	104.1	76.5	50.9	2	100	27	33
Kim 2018	41.0	108.5	83.1	37.6	8	165	23	55
Ernst 2020	39.2	122.3	73.1	28.5	27	212	40	61
Lang 2020a	46.1	102.1	59,4	35.2	24	121	42	41
Lang 2020b	39.7	96.8	60.1	34.1	14	144	38	43
Siegele	57.6	57.6	57.6	57.6	0	0	0	0
Mean Tempo	50.2	101.3	76.8	48.3	4	102	24	37

Table 5: Bach, "Goldberg Variations," tempo relations between *Aria* 1, variation 1, variation 30, and *Aria* 2

Tempo Relation *Aria*–*Aria* da capo (*Aria* 1–*Aria* 2)

Tempo Relation 1:1 (0–10%): Aria 1 = Aria 2 (green)

A collation of *Aria* 1 and *Aria* 2 shows that fifty-nine recordings – about 78% of all examined recordings – display the same tempo for both arias; the mean tempo values of both arias strongly resemble each other (*Aria* 1 = 50.2 bpm; *Aria* 2 = 48.3 bpm).

The high number of recordings equating the tempi is hardly surprising given the fact that *Aria* 2 is simply the *Aria da Capo* è *Fine*, as indicated in the first print, in which the *Aria* was only printed once at the very beginning of the "Goldberg Variations," prompting the performer to return to the first page at the end of a performance.[35] As a consequence, the cycle closes with a "memory of its beginning," conforming to the Baroque convention of repeating the first piece of a variation cycle at its end.[36]

> This repeat of the Aria seems itself to say something about the strange power of great music, for as one hears it a final time, its aura is different. It has changed from a greeting to a farewell, from elegantly promising to sadly concluding. But how can that be, when the notes are the same and even the manner of playing them need not have changed?[37]

This introduces the question which interpretational choices are offered by the remaining 22% of performers who do not play both *Arias* in the same tempo, i.e., whose interpretations display a tempo deviation above 10% (seventeen recordings): Silver 1957, Gát 1963, and Takahashi 2004 choose a faster tempo for *Aria* 2 (Fig. 6), with Takahashi displaying a considerable tempo difference: *Aria* 2 is played 30% faster in relation to *Aria* 1 (Audio Ex. 13a: 60.0–78.1 bpm). Remarkably enough, Takahashi's 1976 recording starts out at virtually the same tempo as in 2004 (61.6 bpm) and maintains it in *Aria* 2 (63.2 bpm), generating a *green* **1:1** relation.

Out of the remaining fourteen recordings which assign a slower tempo to *Aria* 2, two interpretations stand out: Ernst 2020 and Lang 2020a. These two recordings display the largest difference between both arias (Ernst: 27%, Audio Ex. 13b: 39.2–28.5 bpm; Lang: 24%, Audio Ex. 13c: 46.1–35.2 bpm). Until 2020, the largest tempo difference between *Aria* 1 and *Aria* 2 was the one performed by Gould 1981 (17%; Audio Ex. 13d: 33.6–27.9 bpm). Coincidentally, both of these choices constitute the slowest tempi for the respective *Arias* among all examined recordings (Fig. 7). Interestingly, all of Gould's earlier recordings (1954, 1955, 1958, 1959) fall into the *green* **1:1** bracket. This unusual decision – as taken by Gould in 1981 – to play *Aria 2* radically slower has not been replicated until Ernst's and Lang's recent interpretations, with both performers producing an even more radical contrast than Gould. Lang's studio recording of the same year (2020b) also displays a tempo reduction in *Aria* 2 (14%), but to a lesser extent than the concert version (2020a).

35 Dammann (1986, 240) remarks that it was for financial reasons that the *Aria* was not printed twice.

36 Ibid.

37 Williams 2004, 2.

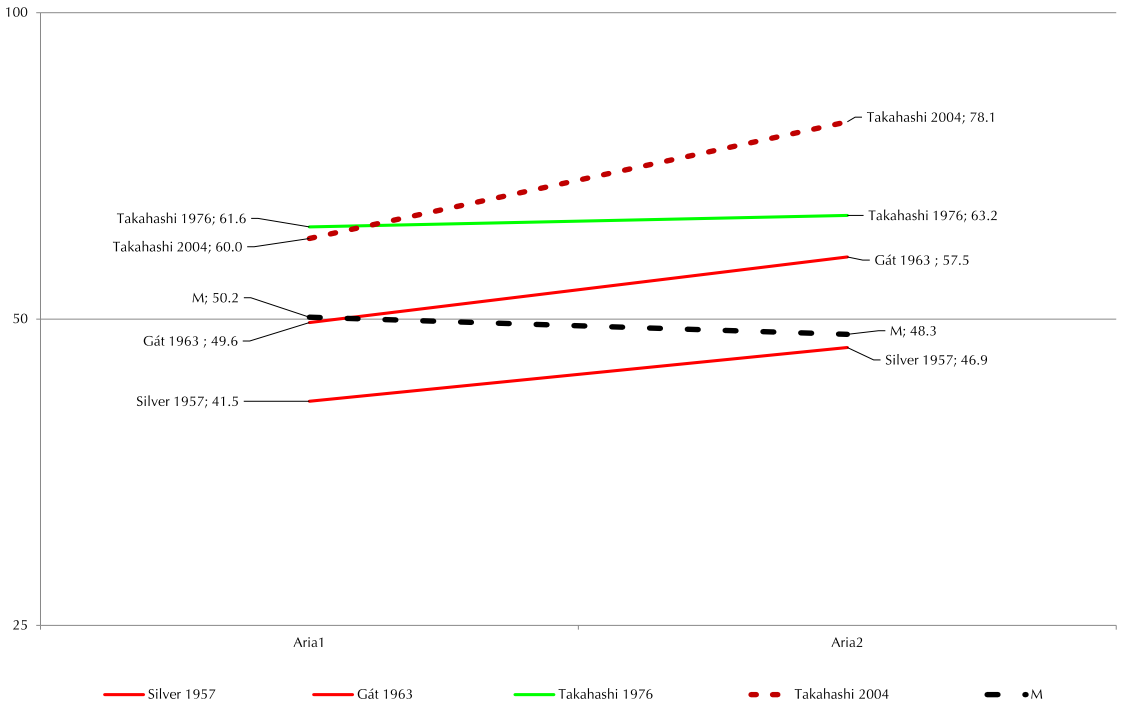


Figure 6: Tempo diagram for *Aria* 1 and *Aria* 2

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio13a_Takahashi2004.mp3

Audio Example 13a: Bach, "Goldberg Variations," Takahashi 2004, *Aria* 1 (mm. 1–4), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Yūji Takahashi, CD Avex Classics AVCL-84069, ℗&© 2014, Tracks 1, 32)

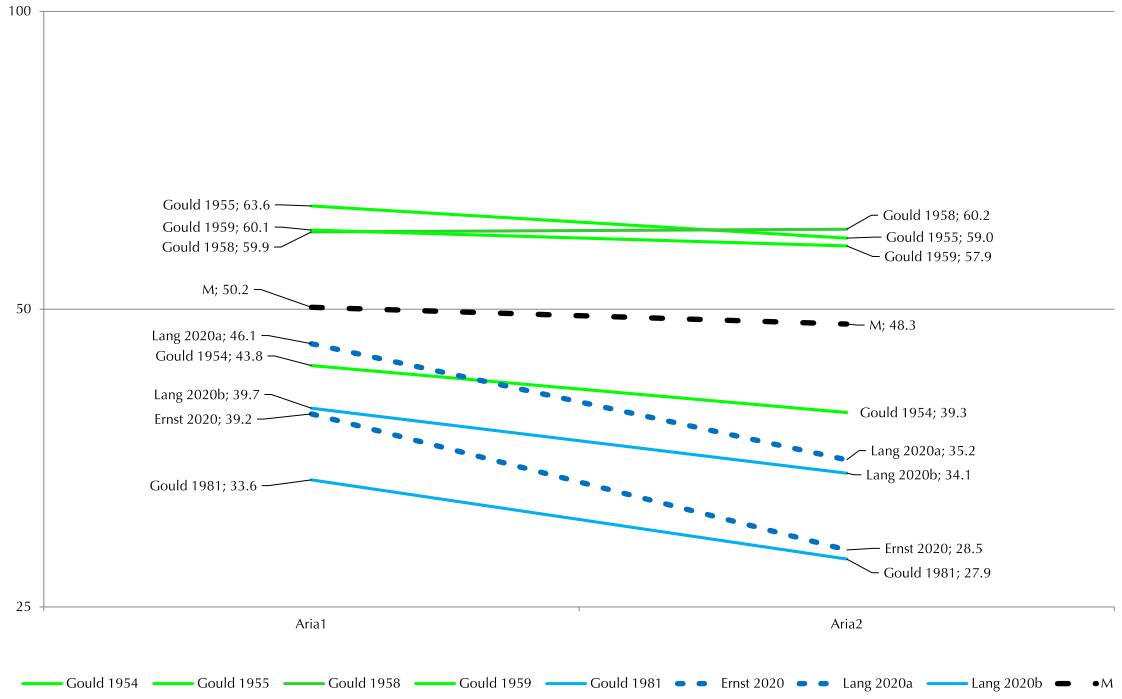


Figure 7: Tempo diagram for *Aria* 1 and *Aria* 2

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio13b_Ernst2020.mp3

Audio Example 13b: Bach, "Goldberg Variations," Ernst 2020, *Aria* 1 (mm. 1–4), *Aria* 2 (mm. 1–4) (Moritz Ernst, unpublished live recording, Stadtkirche Bayreuth, 23/07/2020, used with kind permission)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio13c_Lang2020a.mp3

Audio Example 13c: Bach, "Goldberg Variations," Lang 2020a, *Aria* 1 (mm. 1–4), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Lang Lang, CD Deutsche Grammophon B089TWSBDT, ℗&© 2020, Tracks 1, 32)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio13d_Gould1981.mp3

Audio Example 13d: Bach, "Goldberg Variations," Gould 1981, *Aria* 1 (mm. 1–4), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Glenn Gould, CD Sony Classical 52619-10, ℗ 1982 © 1993, Tracks 1, 32)

Among the recordings marked *green* in Table 5 regarding their relation between the two *Arias*, three stand out for displaying the *exact* same tempo for *Aria* 1 and *Aria* 2: Richter 1956 (52.7–52.7), Gavrilov 1993 (42.7– 42.7), and Egarr 2005 (51.3–51.3). This raises the question – as posed by Bruno Gingras during a PETAL conference[38] – whether this precise match between the two *Arias* might be a result of a technical reproduction of one track, a question which shall be explored here.

In total, there are 14 recordings which exhibit a 0–1% difference[39] between the tempi of *Aria* 1 and *Aria* 2. Several other factors beyond main tempo have to be taken into account when examining the relationship between the two *Arias* in these recordings, such as the setting (live or studio recording), the durations of each part of the *Aria* (A: mm. 1–16 and B: mm. 17–32) and whether and how repeats (A' and B') were executed, as well as further musical properties perceived through close listening (ornaments, nuances, *rubato*, etc.).[40] Table 6 offers an overview of the durations of all four sections for those 14 recordings below 1% tempo difference.[41]

Three of the interpretations included in Table 6 have been recorded live: Gould 1958, Grigory Sokolov 1982 (Audio Ex. 13e; 57.2–57.4 bpm), and Schiff 2015, which excludes them from this assumption. Their measurements show great control in replicating tempo and duration very closely on stage; this is especially the case for part B in Gould 1958 (0.6 sec difference), part A in Schiff 2015 (0.15 sec difference), and parts A, A', and B in Sokolov 1982 (0.55/0.37/0.18 sec difference).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio13e_Sokolov1982.mp3

Audio Example 13e: Bach, "Goldberg Variations," Sokolov 1982, *Aria* 1 (mm. 1–32), *Aria* 2 (mm. 1–32) (Bach, "Goldberg Variations," Grigory Sokolov, CD Melodiya/MEL-CD 10-02049, ℗ 2012, Tracks 1, 32)

The durations for Egarr 2005 show that, while the initial tempo for both arias is exactly the same, the durations of the repeated parts differ substantially, excluding the possibility that the track of *Aria* 1 has been reused for *Aria* 2. The recordings of Picht-Axenfeld 1966, Schultz 1998, Ingrid Marsoner 2009, Denk 2013, and Levit 2015 show some remarkable similarities in duration but exhibit obvious differ-

38 PETAL, Online-Conference "Goldberg Variations," 9 September 2020.

39 In this case, all mentioned percentage values depicted in Table 5 and rounded to integer numbers happened to be less than 1, i.e., none of the values rounded to 1 equal or surpass 1%.

40 A thorough sonographical study of the waveforms of the two *Arias* – in order to determine whether they are actually one and the same recording – would go beyond the scope of this article. But a quick visual comparison confirms that while the durations for Richter 1956 and Norton 1942 are exactly the same, their waveforms are indeed different (as is the sound quality in Richter). As for Gavrilov 1993, it has not been possible to detect any visual differences.

41 The durations indicated here include the time from the first note to the onset of the last note of each part, in order to avoid unclear measurements due to prolonged last notes.

ences between *Arias* 1 and 2 concerning the execution of ornaments, *rubato*, and other nuances. Except for Schultz (who plays both *Arias* without repeats), all of these recordings contain at least three audibly different versions of parts A and A' (marked blue).

Norton 1942	Aria 1 (sec)	Aria 2 (sec)	Diff. (sec)
A	47.36	47.36	0.00
A'	---	---	---
B	49.59	49.60	-0.01
B'	---	---	---
Richter 1956	**Aria 1**	**Aria 2**	**Diff.**
A	59.40	59.43	-0.03
A'	---	---	---
B	69.75	72.93	-3.18
B'	---	---	---
Gould 1958 (Live)	**Aria 1**	**Aria2**	**Diff.**
A	50.36	49.00	1.36
A'	---	---	---
B	53.55	54.15	-0.60
B'	---	---	---
Marlowe 1962	**Aria 1**	**Aria2**	**Diff.**
A	74.24	73.69	0.56
A'	---	---	---
B	86.63	82.21	4.42
B'	---	---	---
Picht-Axenfeld 1966	**Aria 1**	**Aria 2**	**Diff.**
A	58.41	58.57	-0.16
A'	57.56	---	---
B	56.70	61.69	-4.99
B'	59.58	---	---
Kempff 1969	**Aria 1**	**Aria 2**	**Diff.**
A	35.44	34.93	0.50
A'	35.84	---	---
B	39.45	40.12	-0.66
B'	---	---	---
Sokolov 1982 (Live)	**Aria 1**	**Aria 2**	**Diff.**
A	54.75	55.30	-0.55
A'	55.93	56.30	-0.37
B	56.51	56.69	-0.18
B'	61.44	65.46	-4.02

Gavrilov 1993	Aria 1 (sec)	Aria 2 (sec)	Diff. (sec)
A	70.55	70.55	0.00
A'	68.97	68.97	0.00
B	67.64	67.68	-0.04
B'	68.12	68.12	0.00
Schultz 1998	**Aria 1**	**Aria 2**	**Diff.**
A	65.41	64.35	1.06
A'	---	---	---
B	73.66	74.03	-0.37
B'	---	---	---
Egarr 2005	**Aria 1**	**Aria 2**	**Diff.**
A	57.92	59.45	-1.53
A'	60.19	62.67	-2.48
B	63.67	60.90	2.76
B'	66.72	68.88	-2.16
Marsoner 2009	**Aria 1**	**Aria 2**	**Diff.**
A	61.46	61.01	0.45
A'	61.35	---	---
B	63.52	63.78	-0.26
B'	62.50	---	---
Denk 2013	**Aria 1**	**Aria 2**	**Diff.**
A	51.86	53.86	-2.00
A'	51.00	51.66	-0.66
B	54.88	55.85	-0.97
B'	57.85	59.98	-2.13
Levit 2015	**Aria 1**	**Aria 2**	**Diff.**
A	59.39	58.53	0.86
A'	60.42	59.25	1.16
B	62.13	60.48	1.66
B'	66.70	66.05	0.64
Schiff 2015 (Live)	**Aria 1**	**Aria 2**	**Diff.**
A	51.37	51.22	0.15
A'	50.87	53.48	-2.61
B	54.55	56.99	-2.44
B'	58.80	63.05	-4.24

Table 6: Durations of *Aria* 1 and *Aria* 2 and their repeats (parts A, A', B, and B' respectively)

Neither of the remaining five recordings offers an unambiguous explanation for the durational and qualitative similarities of *Arias* 1 and 2, leaving the question of technical reproduction open to interpretation. In the cases of Richter 1956 and Marlowe 1962, there is virtually no difference in duration between parts A in *Arias* 1 and 2. Contrary to Egarr, Richter's 1956 *Arias*, played at exactly the same (initial) tempo (52.7), show a very negligible difference in duration (0.03 sec). This also applies to Marlowe, whose slightly different tempi result in a very small difference in duration (0.56 sec). Both Rich-

ter's and Marlowe's recordings, however, display a substantial durational difference for parts B; therefore, it seems safe to assume that they have indeed recorded the *Aria* twice. Whereas in Kempff 1969, the durations and musical traits are virtually identical, the fact that part A' (which constitutes the sole repeat in both *Arias* in this recording) uses distinctly different ornaments from A while producing a very similar duration could imply (but not ascertain beyond doubt) that the pianist, in theory, played a second *Aria* with identical properties.

This leaves the recordings of Norton 1942 and Gavrilov 1993, both of which exhibit an alarmingly exact durational congruence between both *Arias*, leading to the assumption that this is the outcome of a technical copying of tracks. While for Norton's recording, an explanation for this decision might potentially be sought in contemporary technical conditions, such a supposition seems meaningless in a recording made as recently as 1993. Regardless of the exact circumstances of this interpretation, it may be hypothesized that Gavrilov's intention could have been to reproduce an *exact* – technical – copy of the *Aria* to follow the variations, supposedly taking the instruction *Aria da capo* quite literally: taking the (recorded) *Aria* from the beginning and placing it at the very end. Other performers (as listed in Table 6) might have executed the same intention to a humanly possible extent (e.g. Sokolov in his live recording).

Tempo Relations *Aria* 1–Variation 1 and Variation 30–*Aria* 2

Tempo Relation 1:1 (0–10%): Aria 1 (♩) = Variation 1 (♩) (green)

The comparison between *Aria* 1 and variation 1 addresses three tempo relations (see Table 5). The single green cell corresponding to Landowska's 1933 recording (10%) indicates that a quarter note in *Aria* 1 equals a quarter note in variation 1 (Audio Ex. 14a). This is the only performance using this relation.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio14a_Landowska1933.mp3

Audio Example 14a: Bach, "Goldberg Variations," Landowska 1933, *Aria* 1 (mm. 1–4), variation 1 (mm. 1–4) (Bach, "Goldberg Variations," Wanda Landowska, CD Naxos Historical 8.110313, ℗&© 2005, Tracks 7, 8)

This interpretation features the slowest tempo for variation 1 (54.1 bpm) among all examined recordings; possibly, it is the direct result of matching it to *Aria* 1 (49.1 bpm). The second slowest tempo for variation 1 is also performed by Landowska, in her 1945 recordings (63.0 bpm); this second interpretation comes fourth in the table regarding the tempo difference between both pieces (38%), surpassing the earlier recording by reducing the tempo for *Aria* 1 (to 45.5 bpm) and increasing the tempo for variation 1 (to 63.0 bpm). After Landowska 1933, the second lowest difference between *Aria* 1 and variation 1 pertains to the recording of Blandine Verlet 1992 (17%; 75.2–88.3 bpm), the third lowest difference appears in Kempff 1969 (18%; 80.8–95.4 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio14b_Verlet1992.mp3

Audio Example 14b: Bach, "Goldberg Variations," Verlet 1992, *Aria* 1 (mm. 1–4), variation 1 (mm. 1–4) (Bach, "Goldberg Variations," Blandine Verlet, CD Astrée Auvidis E 87459, ℗&© 1993, Tracks 1, 2)

While both of Landowska's recordings of variation 1 differ considerably from the mean tempo of all examined recordings for variation 1 (54.1 and 63.0 bpm; mean value 101.3 bpm), her tempi for *Aria* 1 strongly converge to the mean tempo (49.1 and 45.5 bpm; mean value 50.2 bpm). Conversely, the tempi for variation 1 chosen by Kempff and Verlet approximate the mean tempo for variation 1 (Kempff: 95.4 bpm; Ver-

let: 88.3 bpm), and might be a result of their fast tempi for *Aria* 1 (the fastest of all examined recordings; Kempff: 80.8 bpm; Verlet: 75.2 bpm) (Fig. 8).

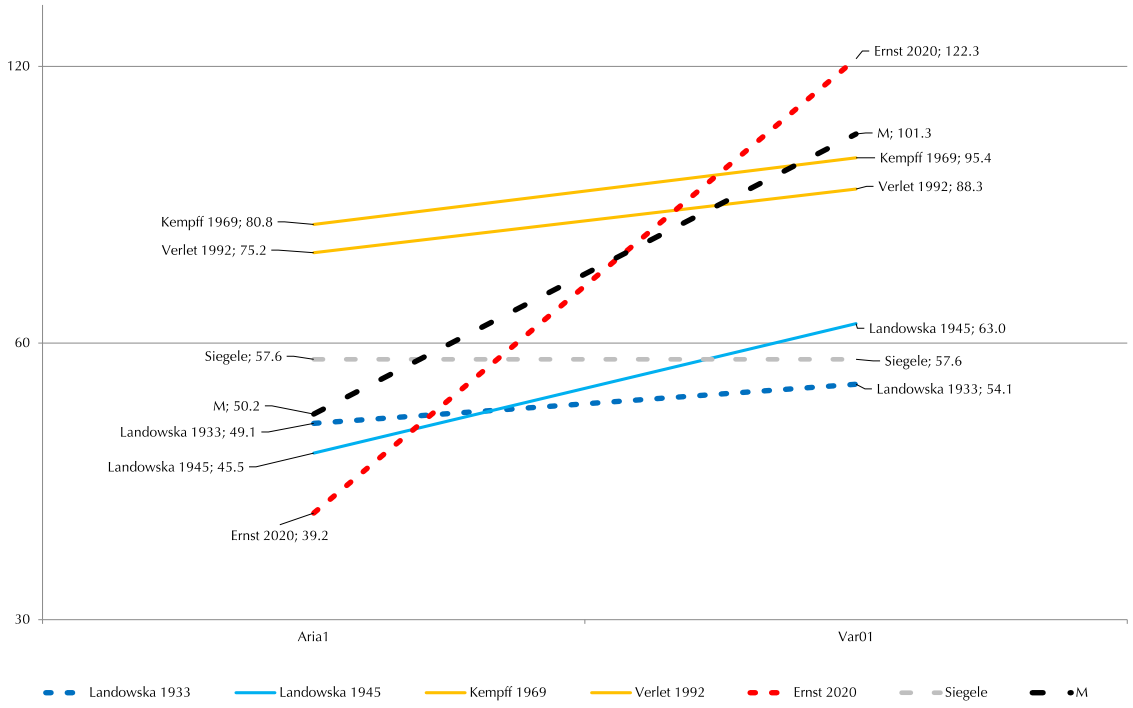


Figure 8: Tempo diagram for *Aria* 1 and variation 1

Tempo Relation 1:2 (80–120%): Aria 1 (♪) = Variation 1 (♩) (orange)

The thirty-one orange cells in Table 5 denote recordings which equate an eighth note in *Aria* 1 to a quarter note in variation 1, e.g., Christine Schornsheim 2016 (Audio Ex. 14c: 52.2–104.1 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio14c_Schornsheim2016.mp3

Audio Example 14c: Bach, "Goldberg Variations," Schornsheim 2016, *Aria* 1 (mm. 1–4), variation 1 (mm. 1–4) (Bach, "Goldberg Variations," Christine Schornsheim, CD Capriccio C-5286, ℗&© 2016, CD 1, Tracks 7, 8)

Tempo Relation 1:3 (180–220%): Aria 1 (♩) = Variation 1 (♩+♩+♩) (purple)

The single purple cell reveals that the recording of Ernst 2020 applies a **3:1** tempo relation between *Aria* 1 (39.2 bpm) and variation 1 (122.3 bpm); this implies that a quarter note in *Aria* 1 equals a whole bar of variation 1. This makes Ernst's recording the one with the largest tempo difference between *Aria* 1 and variation 1, resulting in a sudden startling impulse when the first variation begins (Audio Ex. 14d).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio14d_Ernst2020.mp3

Audio Example 14d: Bach, "Goldberg Variations," Ernst 2020, *Aria* 1 (mm. 1–4), variation 1 (mm. 1–4) (Moritz Ernst, unpublished live recording, Stadtkirche Bayreuth, 23/07/2020, used with kind permission)

The question arising at the end of the cycle is how performers correlate variation 30 with *Aria* 2, or rather, how they depart variation 30 towards the *Aria da capo*:

Tempo Relation 1:1 (0–10%): Variation 30 (𝅗𝅥) = Aria 2 (𝅗𝅥) (green)

The *green* cells indicate recordings where a quarter note in variation 30 equals a quarter note in *Aria* 2. This is only the case in Chen 1985 (61.5–57.7 bpm) and Verlet 1992 (Audio Example 15a: 64.9–66.4 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio15a_Verlet1992.mp3

Audio Example 15a: Bach, "Goldberg Variations," Verlet 1992, variation 30 (mm. 1–2), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Blandine Verlet, CD Astrée Auvidis E 87459, ℗&© 1993, Tracks 31, 32)

Tempo Relation 2:1 (45–55%): Variation 30 (𝅗𝅥) = Aria 2 (𝅘𝅥𝅮) (orange)

The fourteen *orange* cells indicate recordings where a quarter note in variation 30 equals an eighth note in *Aria* 2, e.g., in Marlowe 1962 (Audio Ex. 15b: 79.5–40.3 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio15b_Marlowe1962.mp3

Audio Example 15b: Bach, "Goldberg Variations," Marlowe 1962, variation 30 (mm. 1–2); Aria 2 (mm. 1–4) (Bach, "Goldberg Variations," Sylvia Marlowe, LP Decca DL 10056, ℗ 1962, Side B)

A comparison between variation 1 and variation 30 yields forty-five relations in total, distributed into three proportions; this variation pair has the second-highest number of tempo relations, following the obvious link between *Aria* 1 and *Aria* 2 (fifty-nine tempo relations).

Tempo Relation 1:1 (0–10%): Variation 1 (𝅗𝅥) = Variation 30 (𝅗𝅥) (green)

The twelve *green* cells indicate recordings where a quarter note in variation 1 equals a quarter note in variation 30, as is the case in Schiff 2015 (Audio Ex. 16a: 100.7–100.8 bpm).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio16a_Schiff2015.mp3

Audio Example 16a: Bach, "Goldberg Variations," Schiff 2015, variation 1 (1–8), variation 30 (mm. 1–8) (Bach, "Goldberg Variations," András Schiff, BBC-Proms, 22.08.2015)

Tempo Relation 2:1 (45–55%): Variation 1 (𝅗𝅥) = Variation 30 (𝅘𝅥𝅮) (orange)

The three *orange* cells indicate interpretations where a quarter note in variation 1 equals an eighth note in variation 30, e.g., Weissenberg 1981 (Audio Ex. 16b: 124.4–62.7 bpm). Landowska's 1933 recording (54.1–83.2 bpm) yields a percentage value which fits into this bracket but does not display a **2:1** relation. Analogously to Ahlgrimm's 1954 recording (as described above for the 25:24 ratio), the calculation needs to be inverted and reveals a (in this case, musically irrelevant) **2:3** tempo proportion.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio16b_Weissenberg1981.mp3

Audio Example 16b: Bach, "Goldberg Variations," Weissenberg 1981, variation 1 (mm. 1–8), variation 30 (mm. 1–8) (Bach, "Goldberg Variations," Alexis Weissenberg, EMI Classics 5 75952 2, ℗ 1982 © 2001, Tracks 2, 31)

Tempo Relation 3:2 (28–38%): Variation 1 (𝅗𝅥.) = Variation 30 (𝅗𝅥) (blue)

As indicated by the *blue* cells, thirty recordings equate a whole bar of variation 1 to a half note in variation 30; i.e., the harmonic rhythm of one variation is equated with the other as in Norton 1942 (Audio Ex. 16c: 118.9–80.9 bpm). In this case, Landowska's 1945 recording mathematically matches this pattern without displaying this relation; an inverted calculation shows that her tempo values actually match a **3:4** pattern (in this case, musically irrelevant).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio16c_Norton1942.mp3

Audio Example 16c: Bach, "Goldberg Variations," Norton 1942, variation 1 (mm. 1–8), variation 30 (mm. 1–8) (Bach, "Goldberg Variations," Eunice Norton, CD Norvard Recordings 0005-2, ℗ 2000, Tracks 2, 31)

Tempo Relations *Aria* 1–Variation 1–Variation 30–*Aria* 2

As depicted in Table 5, Ulrich Siegele's equal tempo for the four pieces postulates a **1:1:1:1** relationship (*green*). Notably, none of the performers complies with this idea, but three interpretations offer proportions for all four pairings: Tureck 1957, Marlowe 1962, and Schiff 2015. They all implement a *green/orange/green/orange* pattern (*Aria* 1 : variation 1 : variation 30 : *Aria* 2 = **1:2:2:1**), i.e., a **1:1** relation between *Aria* 1 and *Aria* 2 as well as a **1:1** relation between variation 1 and variation 30, suggesting a sort of plot based on the tempo design. Similarly, the mean values for these four pieces (50.2–101.3–76.8–48.3 bpm) create a *green/orange/[none]/[none]* pattern, only reflecting the first two relations: *Aria* 1 : variation 1 : *Aria* 2 = **1:2:1**, as realized by Kenneth Gilbert 1986, Keith Jarrett 1989, Murray Perahia 2000, Levit 2015, and Mahan Esfahani 2016. The only recording displaying an *Aria* 1 : *Aria* 2 : variation 1 = 1:1:1 pattern (*green/green/[none]/[none]*) is Landowska 1933, resulting in an exceptionally slow tempo for variation 1 as explained above. This concept of equating (!) the tempo of variation 1 to that of the arias (as suggested by Siegele) has not been realized in any other interpretation.

Tureck 1957 presents a uniquely slow tempo for *Aria* 1 (34.0 bpm; only paralleled by Gould's 33.6 bpm in 1981), breathing life into a very held-back, melodious piece played in long arcs. The ending of the first *Aria* culminates in a prolonged *penultima* before it fades away in a drawn-out *ritardando*. The subsequent variation 1 stands in stark contrast to this opening, both in dynamics and articulation, conjuring "a vision of a great archway to the experience awaiting us."[42] Similarly, variation 30 paints a lively and serene picture, then retracts twice during B' before celebrating a solemn and prolonged ending (essentially turning the fermata into a *lunga*). Mirroring the beginning, the following return of

42 Tureck 1999, 6.

the *Aria* brings back the same melodious, unobtrusive calm (Audio Ex. 17a: 34.0–74.2–66.8–35.6 bpm). Again, the *Aria* displays long and delicate arcs, this time played without repeats and progressively petering out, virtually coming to a standstill:

> The actual ending of the 30 Variations is given to the return of the Aria. This return to the beginning, following the unfolding of the Aria's potential in the experiencing of a cavalcade of multifaceted ideas and expression, completes the life cycle. This return is not a repeat; it is a return to the source. The very return to the beginning carries with it a fundamental sense of renewal and, as such, reveals yet a new meaning. The form is not circular, therefore, but cyclical, moving to a new plane of vision and perception. This return to the beginning, this end-beginning, is one of the most sublime moments in all music.[43]

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio17a_Tureck1957.mp3

Audio Example 17a: Bach, "Goldberg Variations," Tureck 1957, *Aria* 1 (mm. 1–8), variation 1 (mm. 1–8), variation 30 (mm. 1–4); *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," Rosalyn Tureck, CD EMI Classics 09647-2., ℗ 1958 © 2008, CD 1, Tracks 1, 2, CD 2, Tracks 5, 6)

In a similar way, Marlowe 1962 opens with a calm and steady *Aria* 1, using a gentle registration and slowing down only slightly at the end. Variation 1 emerges in clear distinction, vigorous and with a mellow registration. Likewise, variation 30 is well-registered and celebratory, with the first (and only) repeat offering another opportunity to relish the full color. Its ending is shaped by a strong *ritardando* which creates a ceremonious and stately finish, letting the last note linger until it fades away. This festive piece is followed by the return of the serene and steady *Aria* and its tranquil registration; a distinction from *Aria* 1 is barely to be made, save for the slight difference in tone (Audio Ex. 17b: 40.7–75.6–79.5–40.3 bpm). Marlowe's use of color and registration certainly stands out in this selection of pieces, especially in variation 30. In a 1971 interview, she criticizes the contemporary fashion of playing without the added tonal dimension of registration:

> The new wave of harpsichordists go for absolutely no registration at all, which I believe is a mistake. […] There are certain harpsichordists, very well known and very well thought of, who use no registration. They play everything on one eight foot. […] The idea of playing in a very boring way, without and change in color or tempo or anything is… well… boring. I think that any music has to come alive. I don't think one should exaggerate on one hand by making dramatic changes all the time, but I think it is necessary to use different colors. I see nothing wrong with it. Besides, the instrument has these possibilities which should be exploited.[44]

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio17b_Marlowe1962.mp3

Audio Example 17b: Bach, "Goldberg Variations," Marlowe 1962, *Aria* 1 (mm. 1–8), variation 1 (mm. 1–8), variation 30 (mm. 1–4), *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," Sylvia Marlowe, LP Decca DL 10056, ℗ 1962, Sides A, B)

Schiff's 2015 (live) recording starts out with a gently flowing, thoughtfully phrased *Aria*, played with a narrative gesture and lingering shortly on the penultimate note. In the *Aria*, as throughout the whole cycle, both repeats are religiously executed, and differentiations

43 Ibid.

44 Haney 1971, 11, 18.

are mostly made through varying ornamentation.[45] The vibrant first variation enters as if woven from the same fabric, differing in texture mainly through articulation and touch. Analogously, a very spirited and *deciso* variation 30 leads through a diverse interlacing of playful articulation and melodic phrases reminiscent of a *cantus firmus*, slowing down only somewhat at the end. With *Aria* 2, a contemplative gentle flow returns; especially in comparison to the preceding variation, it evokes a sense of calm. As in *Aria* 1, the motion hardly slows down, essentially simply *ending* with only a slight *ritardando* (Audio Ex. 17c: 55.8–100.7–100.8–55.4 bpm). There are no salient differences from its first appearance to be perceived: "After the last variation the opening *Aria* returns, unchanged. However we are hearing it with new ears because of the experiences of the past 70 minutes."[46]

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio17c_Schiff2015.mp3

Audio Example 17c: Bach, "Goldberg Variations," Schiff 2015, *Aria* 1 (mm. 1–8), variation 1 (mm. 1–8), variation 30 (mm. 1–4), *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," András Schiff, BBC-Proms, 22/08/2015; https://youtu.be/sbOwhF1hFcg)

Traces of the same proportional concept can be detected in both of Schiff's earlier "Goldberg" recordings as well. The relations presented in 2015 (55.8–100.7–100.8–55.4 bpm) are met very closely in his 1982 recording (58.1–104.5–102.0–60.2 bpm), missing the arbitrary percentage bracket for the *Aria* 2: variation 30 proportion by a neglectable 1%. The same thing can be said about the 2001 recording (61.5–104.1–107.0–60.2 bpm) which again barely misses the bracket for the *orange Aria* 2: variation 30 proportion (by 3%), falls out of the margin for the variation 1 : *Aria* 1 proportion (by 11%), but unerringly displays the two *green* (**1:1**) relations between the two *Arias* as well as the two variations. Unsurprisingly, this similarity seems to be rooted in Schiff's very consistent tempo choices which show only a minimal divergence.

Going by the pattern, the common denominator for Schiff's recordings is the *green* relation both in the first and the third column of Table 5. Such a setup (naturally also applicable to Tureck 1957 and Marlowe 1962) also makes an appearance in five other interpretations (Richter 1956, Leonhardt 1965, Richter 1970, Peter Serkin 1994, and Egarr 2005), indicating a concept which "double–frames" the cycle: connecting both the first and last, as well as the second and penultimate elements (but neither of the adjacent pieces!). This seems especially apposite for those recordings which feature no other relation beside these two (Richter 1956, Leonhardt 1965, Richter 1970, Schiff 2001, and Egarr 2005; Audio Ex. 17d: 51.3–77.1–78.9–51.3 bpm), thereby highlighting the double arc.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio17d_Egarr2005.mp3

Audio Example 17d: Bach, "Goldberg Variations," Egarr 2005, *Aria* 1 (mm. 1–8), variation 1 (mm. 1–8), variation 30 (mm. 1–4); *Aria 2* (mm. 1–8) (Bach, "Goldberg Variations," Richard Egarr, CD Harmonia Mundi USA – HMU 907425.26, ℗&© 2006, CD 1, Tracks 1, 2, CD 2, Tracks 15, 16)

45 András Schiff states in his 2015 self-interview that "[the] music is of such complexity that a second hearing is required […]."

46 Ibid.

It could be argued that such a construction points to a structural design which isolates the two *Arias* from the variations, juxtaposing a static arc (*Aria* 1–*Aria* 2) with a dynamic arc (spanning from variation 1 to variation 30).[47] Ostensibly, this isolation of the *Arias* from the rest of the work could imply an interpretation of *Aria* 1 and *Aria* 2 as a sort of prologue and epilogue, not fully integrated into the cycle but framing the plot – which leads from variation 1 to variation 30 – from outside.

By contrast, those recordings which only connect the two *Arias* (**1:1**) – without any evident relationship between variations 1 and 30 or those two variations with their adjacent *Arias* – might indicate a differently imagined framework: it suggests a layout which draws the same arc as above but does not explicitly isolate *Arias* from variation(s), thus integrating the *Arias* into the cycle as its actual beginning and ending (Kirkpatrick 1958, John Gibbons 1979, Schultz 1998 (Audio Ex. 17e: 44.7–105.3–63.2–44.8 bpm), Haugsand 2001, and Cédric Pescia 2004).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio17e_Schultz1998.mp3

Audio Example 17e: Bach, "Goldberg Variations," Schultz 1998, *Aria* 1 (mm. 1–8), variation 1 (mm. 1–8), variation 30 (mm. 1–4); *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," Thomas Schultz, CD Wooden Fish Recordings, ℗ 2003, CD 2, Tracks 1, 2, 31, 32)

This leads to the discussion about how the performers interpret the end of the cycle. As shown in Table 5, the relation *Aria* 2: variation 30 shows the lowest number of proportions performed, leaving these two pieces unconnected (in terms of tempo relations) in around 80% of all examined recordings. Therefore, the question arises whether the artists assign the role of "ending" to the last variation or the *Aria da capo*.

Variation 30, inscribed *Quodlibet* ("what you please"), structurally appears in lieu of a canon at the tenth; "[even] the little upbeat announces that something different is happening here – it is the first and only one."[48] The variation presents a "festive character," set in an "exorbitant" four-part *stretto*, combining two melodies (both well-known in Bach's time) in the tightest of spaces.[49] The source for the melody first appearing in the tenor is a traditional song set to the lyrics "Ich bin so lang nicht bei dir g[e]west" (I have been so long away from you),[50] which, in the seventeenth and eighteenth centuries, was commonly danced as a *Kehraus*, i.e., the last (round) dance of a dance evening or a wedding celebration, to send the party home in high spirits.[51] The second melody which follows immediately in the alto most likely stems from a song whose most commonly known version bears the following lyrics: "Kraut und Rüben haben mich vertrieben / hätt' die Mutter Fleisch gekocht, so wär' ich länger blieben"[52] (Cabbage and turnips have driven me away / if mother had cooked meat, I would have stayed longer).

Rolf Dammann reasons that the coherence between these melodies becomes evident if one proceeds on the assumption that Bach chose to include them to symbolize good-

47 See Dammann 1986, 240.

48 Williams 2004, 88.

49 See ibid. and Dammann 1986, 237, 239.

50 Dammann 1986, 235–236, and Williams 2004, 90.

51 See Schulze 1976, 70 f.

52 See Dammann 1986, 236.

bye.[53] Apparently, the impression of parting was so strong that artists used to finish their concert performances without repeating the aria; Otto Baensch reports this as a widespread "misunderstanding" in 1934, explaining that the *Quodlibet* is not meant to be a final crowning moment (and therefore not to be played in a thunderous *fortissimo*) but a good-humored transition leading back to the *Aria da capo*. In his interpretation, it is the *Aria* that speaks to the ground bass ("I have been so long away from you"), having been ousted (by "cabbage and turnips") and announcing its imminent return.[54] Aptly, Bach ends this last variation with the very melody corresponding to "wär' ich länger blieben" (would have stayed longer), additionally illustrating "blieben" with the subsequent fermata. On the other hand, Dammann argues that the finale of the cycle is not to be found in the "civil idyll" of the *Quodlibet* but in the "courtly" *Aria*. He attributes a melancholy longing and nostalgia to the last variation, characterizing it as a fading-out of the cycle, and precisely not as a blithe dance[55] (or one of the popular, playful *quodlibets* purportedly sung by Bach's family),[56] or, as Glenn Gould calls it, a "boisterous exhibition of *Deutsche Freundlichkeit*."[57]

A closer look at the recordings reveals several distinct dramaturgical decisions with regard to tempo, connecting variation 30 and *Aria* 2 in different ways (Fig. 9). The only interpretations which take a faster tempo for *Aria* 2 than variation 30 are Kempff 1969 (19% difference) and Takahashi 2004 (18%), both making astoundingly similar tempo choices. Yet, whereas Kempff replicates the fast tempo of *Aria* 1 with staggering precision (0% deviation), Takahashi's *Aria* 2 surpasses his *Aria* 1 by 30%, commencing after only a very slight *ritardando* at the end of variation 30 and thereby providing a particularly fluid transition. Hence, one might consider Kempff's *Aria da capo* a recall of his *Aria*, and Takahashi's *Aria da capo* a logical result of his *Quodlibet*.

At the other end of the spectrum, the two recordings creating the highest tempo contrast between a fast variation 30 and a slow *Aria* 2 are Gould 1981 (62% difference; Audio Ex. 18b: 73.3–27.9 bpm) and Ernst 2020 (61% difference; Audio Ex. 18c: 73.1–28.5 bpm), their tempo choices matching almost exactly.[58] Moreover, these two interpretations are simultaneously among those displaying the highest difference between *Aria* 2 and *Aria* 1 (Ernst 2020: 27%; Lang 2020a: 24%; Gould 1981: 17%). This disparity combined with the tempo-related detachment of the *Aria da capo* from the *Quodlibet* could suggest a concept which designs variation 30 as the conclusion of the variation cycle and *Aria* 2 as a mellow, reminiscing echo of *Aria* 1, orchestrating a farewell.

53 Ibid.; for the source materials see also Williams 2004, 90.

54 See Baensch 1934, 322–323: "Wenn es nun im Quodlibet bei den Mittel- und Oberstimmen heißt: 'Ich bin so lang nicht bei dir gewest' und 'Kraut und Rüben haben mich vertrieben', so sprechen sie sozusagen im Namen und als Vorauskündiger der zuletzt […] endlich doch noch zurückkommenden Themamelodie. Diese redet gleichsam den Baß an und teilt ihm mit, daß sie ihm solange ferngeblieben sei, weil die durch ihn herbeigeführte Wirrnis, seine vielen Abwandelungen und die durch sie bedingten mannigfaltigen neuen Oberstimmen […] sie 'vertrieben' habe."

55 Dammann 1986, 239–240.

56 Williams 2004, 89 (relating to Johann Nikolaus Forkel's 1802 Bach biography).

57 Gould 1956, 2.

58 In twenty-one out of thirty-three measured pieces (both halves of variation 16 measured separately), Ernst's tempi match Gould 1981 by a margin of ca. 12 bpm max.

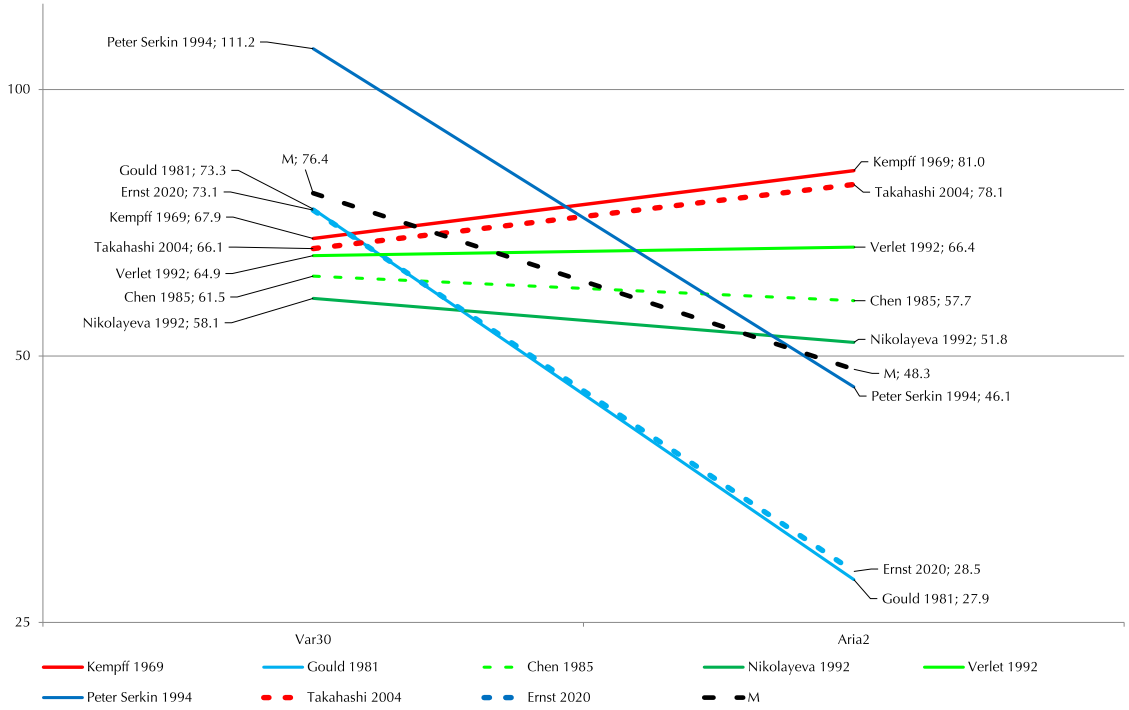


Figure 9: Tempo diagram for variation 30 and *Aria* 2

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18a_Takahashi2004.mp3

Audio Example 18a: Bach, "Goldberg Variations," Takahashi 2004, variation 30 (mm. 1–2, 15–16), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Yūji Takahashi, CD Avex Classics AVCL-84069, ℗&© 2014, Tracks 31, 32)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18b_Gould1981.mp3

Audio Example 18b: Bach, "Goldberg Variations," Gould 1981, variation 30 (mm. 1–2, 15–16); *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Glenn Gould, CD Sony Classical 52619-10, ℗ 1982 © 1993, Tracks 31, 32)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18c_Ernst2020.mp3

Audio Example 18c: Bach, "Goldberg Variations," Ernst 2020, variation 30 (mm. 1–2, 15–16); *Aria* 2 (mm. 1–4) (Moritz Ernst, unpublished live recording, Stadtkirche Bayreuth, 23/07/2020, used with kind permission)

Remarkably enough, Chen 1985 and Verlet 1992 apply virtually the same tempo to *Aria* 2 as to variation 30 (Chen: 6% lower than variation 30; Audio Ex. 18d: 61.5–57.7 bpm. Verlet: 2% higher than variation 30; Audio Ex. 18e: 64.9–66.4 bpm). As both interpretations only feature very slight *ritardando* at the end of the *Quodlibet*, it could be argued that the performers view these two pieces as strongly belonging together, *Aria* 2 being a sort of continuation of variation 30. This performance concept could be interpreted as conceiving the "end" of the cycle as *both* pieces together. On the other hand, both performers choose to play the *Aria da capo* slightly slower than the *Aria*, also conveying the impression of an echo of the opening piece.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18d_Chen1985.mp3

Audio Example 18d: Bach, "Goldberg Variations," Chen 1985, variation 30 (mm. 1–2, 15–16), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Pi-hsien Chen, CD Naxos 8.550078, ℗&© 1987, Tracks 31, 32)

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18e_Verlet1992.mp3

Audio Example 18e: Bach, "Goldberg Variations," Verlet 1992, variation 30 (mm. 1–2, 15–16), *Aria* 2 (mm. 1–4) (Bach, "Goldberg Variations," Blandine Verlet, CD Astrée Auvidis E 87459, ℗&© 1993, Tracks 31, 32)

The slowest interpretation of variation 30 is found in Nikolayeva's 1992 recording. As with Verlet and Chen, there is only a small tempo difference between *Quodlibet* and *Aria da capo* (11%), missing the bracket for the *green* **1:1** proportion between *Aria 2*: variation 30 by a tiny margin (1%). Taking this connection into account, all four tempo relations are present in the pattern for this recording (*green/orange/orange/[green]*, tempo proportions **1:2:1:1**), as is made obvious by the similarity in tempi (56.3–104.7–58.1–51.8 bpm). In this case, it seems possible that the calm tempo and melancholic atmosphere of the *Arias* has permeated variation 30. As with Verlet and Chen, the "end" could again be seen as a combination of both *Quodlibet* and *Aria da capo*; here, however, both *Aria* 2 *and* variation 30 project an arc back towards *Aria* 1.

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18f_Nikolayeva1992.mp3

Audio Example 18f: Bach, "Goldberg Variations," Nikolayeva 1992, variation 30 (mm. 1–4, 13–16), *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," Tatiana Nikolayeva, CD Hyperion Records Limited A66589, ℗&© 1992, Tracks 31, 32)

Conversely, Peter Serkin's 1994 tempo (111.2 bpm) for variation 30 is by far the fastest among all examined recordings, essentially making it *alla breve* (the tempo also corresponding to his choices for the *virtuoso* variations). Ipso facto, Serkin achieves a very high contrast between variation 30 and *Aria* 2 (59% slower than the *Quodlibet*). These interpretative decisions are very strongly reminiscent of Gould 1981 and Ernst 2020, matching their amount of contrast almost exactly. Consequently, he appears to apply a very similar dramaturgical concept, his festively performed *Quodlibet* achieving a *finale* atmosphere before letting the *Aria da capo* echo the beginning of the cycle (*green* **1:1** proportion between arias).

https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Audio18g_Serkin1994.mp3

Audio Example 18g: Bach, "Goldberg Variations," Serkin 1994, variation 30 (mm. 1–4, 13–16), *Aria* 2 (mm. 1–8) (Bach, "Goldberg Variations," Peter Serkin, CD RCA Victor Red Seal – BMG Classics 09026 68188 2, ℗&© 1996, Tracks 34, 35)

Summary and Implications

This study has examined the cyclic potential of the "Goldberg Variations" as implemented by performers through tempo relations between its pieces. Several difficulties inherent to the applied methodology have been observed. First, the method of examining exclusively the initial tempo does not cover possible tempo changes within the individual pieces, and the average values obtained from measuring the opening phrases may be influenced by potential rubato decisions. Second, from the quantitative data collected, it

is impossible to reliably determine the extent to which a performer actually intended to implement a certain tempo relation in performance. However, it seems safe to assume at least in a few cases that such relations were indeed a result of conscious planning, but many may equally be a "random" outcome of linear interpretation in real time, of "informed intuition,"[59] or a product of physiological conditions (as implied by Epstein).[60]

Another potential issue concerns the difficulty to relate quantitative data to the compositional properties, musical structure, or shape of a piece. These data cannot always be translated directly into a musical context. Statistical values such as the tempo range certainly depict the difference between the fastest and slowest interpretations but do not illuminate any relational pattern: for example, in spite of the exceptionally high range value for variation 25, both the fastest (Takahashi 2004) and slowest recordings (Nikolayeva 1992) of this variation show an overall pattern of three tempo relations within the cycle.

Still, various conclusions can be made from the results yielded by our quantitative examination. The collected data have shown that performers create tempo relations mostly between adjacent pieces, indicating a progression,[61] or in groups of pieces presented under the aspect of symmetry. Unsurprisingly, the examination of the beginning and end of the cycle established the **1:1** proportion between *Aria* 1 and *Aria* 2 as the most frequent relation. However, only a few recordings create a pattern of four relations connecting both *Arias* with their adjacent variations; this is especially reflected in the relatively low number of relations between variation 30 and *Aria* 2.

Tempo relations generally seem to occur less in groups selected according to nonlinear or asymmetrical criteria. While in the group of minor variations only a single performance (Norton 1942) establishes a tempo relation between all three pieces, about a third of all examined recordings establish (differing) patterns of three relations for variations 24–26. For the variations in a minor key, the most frequently established tempo relation is a **1:1** proportion between variation 21 and variation 25 (as reflected by the mean tempo values 45.1–49.2 bpm). The only exception in this case is Landowska 1945, whose historically informed interpretation is mirrored in Ulrich Siegele's theoretical tempi. Apart from this congruence, Siegele's draft of a cyclical temporal structure does not seem to be strongly reflected in the relational data gathered from the recordings (with very few exceptions).

Taking these observations as a vantage point, there is an abundance of research questions to be derived from the examinations presented here. A very rewarding topic might be a detailed analysis of performances of the *whole* cycle, i.e., of tempo relations established throughout the whole work, or even in a different selection of pieces (following different criteria). The present study has revealed that there are several performers whose interpretations feature a particularly large number of tempo relations, including András Schiff, Eunice Norton, Tatiana Nikolayeva, and Glenn Gould, suggesting that recordings by these performers warrant further investigation.

Another worthwhile research area might be an examination of the interpretational choices made by the same performer at different points in time (several recordings have

59 Rink 2002, 36.

60 Epstein 1995, 135–155.

61 This has been mentioned in ibid., 37.

been made, among others, by Glenn Gould, Angela Hewitt, Ralph Kirkpatrick, Wanda Landowska, Lang Lang, Tatiana Nikolayeva, Karl Richter, András Schiff, Yūji Takahashi, and Rosalyn Tureck), as well as an extensive comparison of "Goldberg" pieces with structurally and musically similar works. Further research aspects could include a systematic comparison of interpretations of the "Goldberg Variations" on the piano versus the harpsichord, the forming of performance traditions potentially handed down from teacher to pupil, and a historical investigation of performance trends.

APPENDIX

	artist	**year of recording**	**label**	**instrument**
1.	Serkin, Rudolf	1928	Welte piano rolls (also on Archiphon ARC-105, released 1992)	piano
2.	Landowska, Wanda	1933	Naxos Historical 8.110313	harpsichord
3.	Norton, Eunice	1942	Norvard Recordings 0005-2 (released 2000)	piano
4.	Arrau, Claudio	1942	BMG Classics – 74321 845 932 (released 1988)	piano
5.	Landowska, Wanda	1945	RCA Victor Gold Seal – BMG Classics	harpsichord
6.	Kirkpatrick, Ralph	1952	Haydn Society 3056/62, 9035	harpsichord
7.	Demus, Jörg**	1953	Westminster WL-5241	piano
8.	Ahlgrimm, Isolde	1954	Philips A 00 267-8 L	harpsichord
9.	Gould, Glenn*	1954	From CBC broadcast	piano
10.	Gould, Glenn	1955	Sony Classical 52 594	piano
11.	Richter, Karl	1956	Telefunken	harpsichord
12.	Silver, Millicent	1957	The Classics Club X-509	harpsichord
13.	Tureck, Rosalyn	1957	HMV/Capitol, CD Philips/EMI Classics 09647-2	piano
14.	Kirkpatrick, Ralph	1958	Deutsche Grammophon 439 673-2	harpsichord
15.	Gould, Glenn*	1958	West Hill Radio Archives	piano
16.	Gould, Glenn*	1959	Sony Classical 52685-2	piano
17.	Sultan, Grete	1959	Wergo WER-4043-2	piano
18.	Marlowe, Sylvia	1962	Decca DL 10056	harpsichord
19.	Gát, József	1963	Hungaroton	harpsichord
20.	Leonhardt, Gustav	1965	Teldec 8.43632	harpsichord
21.	Picht-Axenfeld, Edith	1966	Erato E1036	harpsichord
22.	Rosen, Charles	1967	Sony SBK 48173	piano
23.	Kempff, Wilhelm	1969	Deutsche Grammophon 439 978-2	piano
24.	Richter, Karl	1970	Deutsche Grammophon 445 057-2	harpsichord
25.	Newman, Anthony	1971	Columbia M 30538	harpsichord
26.	Takahashi, Yuji	1976	Denon, Columbia Music Entertainment COCQ-84162	piano
27.	Hayden, Seymour	1976	SEP International Records SEP LP 01	harpsichord
28.	Gibbons, John	1979	Titanic Ti-30/31	harpsichord
29.	Nikolayeva, Tatiana	1979	JVC Victor Japan, VICC40126/7	piano
30.	Pinnock, Trevor	1980	Archiv Produktion 415 130- 2	harpsichord
31.	Weissenberg, Alexis	1981	EMI 5 74952 2	piano
32.	Gould, Glenn	1981	Sony Classical 52619-10	piano
33.	Sokolov, Grigory*	1982	Melodiya/MEL-CD 10-02049	piano

34.	Schiff, András	1982	Decca 417 116-2	piano
35.	Chen, Pi-hsien	1985	Naxos 8.550078	piano
36.	Gilbert, Kenneth	1986	Harmonia Mundi HMC 1240	harpsichord
37.	Tipo, Maria	1986	EMI HMV 5 86666	piano
38.	Koopman, Ton	1987	ERATO 45326-2	harpsichord
39.	Jarrett, Keith	1989	ECM Records 839 622-2	harpsichord
40.	Asperen, Bob van	1991	EMI 7 54209	harpsichord
41.	Feltsman, Vladimir*	1991	Musical Heritage Society 513260T	piano
42.	Barenboim, Daniel	1992	Metropolitan Munich - EuroArts	piano
43.	Nikolayeva, Tatiana	1992	Hyperion Records CDA66589	piano
44.	Verlet, Blandine	1992	Astrée Auvidis E 87459	harpsichord
45.	Gavrilov, Andrei	1993	Deutsche Grammophon 435 436-2	piano
46.	Serkin, Peter	1994	RCA Victor Red Seal/BMG Classics 09026 68188 2	piano
47.	Li, Cecilia	1996	Bayer Records/Amati 9602/1	piano
48.	Vladar, Stefan	1996	Camerata Tokyo 542/EAI Classics/Preiser Records 90771	piano
49.	Tureck, Rosalyn*	1998	Deutsche Grammophon 459599	piano
50.	Schultz, Thomas	1998	Wooden Fish Recordings	piano
51.	Koroliov, Evgeni	1999	Hänssler CD 92.112	piano
52.	Schirmer, Ragna	1999	Berlin Classics 001716	piano
53.	Belder, Pieter-Jan	1999	Brilliant Classics 92284	harpsichord
54.	Hewitt, Angela	1999	Hyperion Records CDA 67305	piano
55.	Perahia, Murray	2000	Sony Classical SK/SM 89243	piano
56.	Schiff, András*	2001	ECM Records ECM 1825	piano
57.	Haugsand, Ketil	2001	Simax PSC 1192	harpsichord
58.	Takahashi, Yūji	2004	Avex Classics	piano
59.	Pescia, Cédric	2004	Claves Records	piano
60.	Dinnerstein, Simone	2005	Telarc CD-80692	piano
61.	Egarr, Richard	2005	Harmonia Mundi 907425/907426	harpsichord
62.	Zhu, Xiao-Mei	2007	Mirare MIR 048	piano
63.	Marsoner, Ingrid	2009	Gramola 98846	piano
64.	Staier, Andreas	2009	Harmonia Mundi HMU 902058	harpsichord
65.	Douglass-Ishizaka, Kimiko	2012	Open "Goldberg Variations"	piano
66.	Denk, Jeremy	2013	Nonesuch Records 535452	piano
67.	Hill, Robert*	2014	Freiburg (DE), 18.10.2014	harpsichord
68.	Hewitt, Angela	2015	Hyperion Records CDA68146	piano
69.	Levit, Igor	2015	Sony Classical 88875140142	piano
70.	Schiff, András*	2015	BBC Proms, London, 22.08.2015	piano
71.	Esfahani, Mahan	2016	Deutsche Grammophon	harpsichord
72.	Schornsheim, Christine	2016	Capriccio C-5286	harpsichord
73.	Kim, Ji-Yong (Ji)	2018	Warner Classics 0190295719371	piano
74.	Ernst, Moritz*	2020	live recording Bayreuth, Stadtkirche, 23/07/2020	piano
75.	Lang, Lang*	2020a	Deutsche Grammophon (Universal Music) – B089TWSBDT	piano
76.	Lang, Lang	2020b	Deutsche Grammophon (Universal Music) – B089TWSBDT	piano

Table 7: Discography (selection of seventy-six recordings)

	Aria 1	Variation 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16a	16b	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Aria 2	
Pulse	♩	♩	♩	♩.	♩.	♩	♩.	♩.	♩	♩	𝅗𝅥	♩.	♩	♩	♩	♩	𝅗𝅥	♩.	♩	𝅗𝅥	♪	♩	♩	𝅗𝅥	♩	♩.	♪	♩	♩.	♩	♩	♩	♩	
Rudolf Serkin 1928	70.4	127.9	104.4	58.9	90.9	178.3	----	----	----	74.5	113.6	202.2	84.4	57.4	127.0	38.5	44.8	93.5	137.8	117.3	213.5	131.3	56.9	138.8	129.1	54.0	50.6	108.4	92.7	103.4	111.4	91.7	61.4	Rudolf Serkin 1928
Landowska 1933	49.1	54.1	72.5	64.1	62.9	133.4	42.1	73.1	112.3	58.3	83.0	118.9	83.9	34.6	89.3	27.9	33.5	76.6	131.6	100.5	123.0	104.3	31.6	82.2	91.0	88.5	51.3	91.6	79.0	78.9	80.6	83.2	47.9	Landowska 1933
Norton 1942	61.3	118.9	73.6	59.2	62.7	175.0	43.9	75.7	130.7	69.3	83.0	184.6	72.9	38.6	85.1	26.8	32.5	47.6	125.6	76.7	150.4	130.5	52.2	108.3	121.5	81.5	52.9	115.5	62.1	94.6	99.0	80.9	61.2	Norton 1942
Arrau 1942	47.7	113.0	89.0	69.3	60.9	124.1	43.8	83.5	110.7	64.4	96.0	151.0	56.8	38.6	97.1	32.5	33.3	71.1	103.0	111.0	187.2	103.0	45.4	105.9	103.1	63.2	47.4	95.2	69.9	84.0	94.5	78.8	49.1	Arrau 1942
Landowska 1945	45.5	63.0	72.6	59.5	60.3	125.5	40.4	70.9	102.0	55.1	82.2	112.3	78.2	34.7	92.3	27.7	32.0	75.6	117.4	99.1	111.1	89.8	27.2	84.8	87.0	76.4	49.5	85.6	71.8	72.0	79.1	81.0	44.2	Landowska 1945
Kirkpatrick 1952	53.8	99.3	51.8	35.7	63.4	143.6	53.6	----	90.2	60.0	68.9	156.8	75.1	39.3	86.0	30.3	28.2	63.6	121.4	67.5	140.2	96.1	56.6	61.1	105.9	55.5	48.4	89.3	77.5	88.0	98.7	71.1	52.0	Kirkpatrick 1952
Demus 1953	41.3	98.0	61.3	49.8	56.6	124.3	31.1	63.6	105.2	50.1	70.6	135.5	56.7	39.4	87.0	22.8	27.2	75.3	99.1	90.8	100.4	100.5	38.2	94.7	93.3	55.8	55.6	91.5	74.9	71.1	85.7	76.5	39.9	Demus 1953
Ahlgrimm 1954	57.4	109.4	63.5	47.4	58.2	151.0	43.4	57.0	96.8	59.7	84.9	145.6	59.2	32.9	80.2	33.7	31.1	69.6	105.5	84.2	138.8	95.9	45.1	86.9	94.1	52.7	65.0	91.9	64.9	80.1	105.2	76.5	58.3	Ahlgrimm 1954
Gould 1954	43.8	110.0	92.4	54.5	61.0	158.3	48.1	53.0	128.7	77.5	83.6	157.0	82.5	39.4	102.0	27.6	28.1	72.4	115.1	112.2	169.8	115.9	57.3	99.4	112.3	96.0	46.6	111.2	87.1	96.4	108.6	67.8	39.3	Gould 1954
Gould 1955	63.6	137.4	110.5	73.1	68.5	174.0	68.3	64.0	141.1	102.9	98.7	155.2	112.9	50.0	108.5	31.0	36.8	92.7	118.7	93.2	146.2	141.8	42.6	101.4	110.3	107.5	33.0	114.0	84.7	90.1	102.8	91.2	59.0	Gould 1955
Richter 1956	52.7	77.5	67.7	53.0	56.6	98.5	43.7	64.8	76.4	69.1	83.4	109.7	65.2	56.4	80.5	27.8	37.5	51.6	79.4	80.8	115.3	86.1	46.5	90.6	78.3	59.1	49.7	70.5	66.2	71.8	84.1	72.1	52.7	Richter 1956
Silver 1957	41.5	81.2	55.6	66.8	58.6	124.6	34.4	70.2	104.7	52.7	63.7	141.6	49.2	30.6	92.6	27.3	30.0	73.1	110.4	103.8	154.1	99.2	46.2	98.2	96.3	74.5	57.7	90.3	76.4	76.1	88.5	68.5	46.9	Silver 1957
Tureck 1957	34.0	74.2	48.3	52.9	40.6	100.2	31.0	59.7	98.0	50.4	61.0	112.2	44.7	53.6	86.7	25.5	31.1	59.8	99.0	73.8	128.4	92.8	36.4	67.4	82.8	51.6	45.3	81.3	54.0	71.7	86.0	66.8	35.6	Tureck 1957
Gould 1958	59.9	126.1	100.7	66.6	62.1	177.0	81.5	62.0	119.1	90.5	90.1	150.7	109.0	59.4	103.4	29.9	38.7	85.4	113.2	90.2	134.3	118.9	57.7	93.0	109.4	103.4	46.1	110.6	78.9	95.0	107.9	88.5	60.2	Gould 1958
Kirkpatrick 1958	55.6	98.2	56.7	35.5	63.2	137.1	46.1	55.3	91.0	62.2	81.0	156.5	77.9	40.8	86.4	31.3	30.8	61.4	126.7	74.9	159.0	101.9	66.2	79.2	103.8	62.0	49.4	91.3	74.9	89.9	96.0	79.0	52.8	Kirkpatrick 1958
Gould 1959	60.1	122.2	81.5	59.1	61.9	152.0	73.4	56.4	123.0	94.6	97.1	133.1	105.4	54.1	100.0	28.7	38.0	83.3	111.9	97.7	130.9	118.3	49.7	94.9	104.6	101.4	48.1	109.6	76.1	97.2	102.0	79.6	57.9	Gould 1959
Sultan 1959	50.0	108.9	68.9	56.2	67.1	132.6	42.0	63.2	113.9	57.2	73.0	146.2	62.8	53.0	101.7	29.4	31.2	71.7	111.7	75.4	143.1	110.3	49.1	105.6	99.0	75.0	46.3	93.7	70.9	76.3	89.1	83.4	46.0	Sultan 1959
Marlowe 1962	40.7	75.6	73.5	49.7	52.4	118.4	41.3	51.7	96.4	45.2	73.2	120.0	70.5	30.7	81.8	23.0	28.8	64.5	104.0	87.0	100.0	83.2	31.2	81.7	83.1	61.3	37.3	83.3	63.4	78.9	79.8	79.5	40.3	Marlowe 1962
Gát 1963	49.6	113.8	64.5	44.3	44.7	140.9	60.9	67.0	119.2	64.8	86.6	164.3	67.5	38.2	90.4	37.9	28.2	69.7	113.7	107.0	162.3	102.2	44.7	96.3	94.1	65.4	65.0	106.8	75.4	92.5	101.8	83.6	57.5	Gát 1963
Leonhardt 1965	45.7	66.3	71.4	63.4	60.1	99.7	39.8	66.0	73.7	63.0	77.3	97.3	56.3	37.5	75.8	26.2	31.2	65.8	95.2	91.1	113.9	88.1	32.1	91.2	75.1	58.3	45.0	88.9	62.8	66.6	79.7	65.4	43.0	Leonhardt 1965
Picht-Axenfeld 1966	47.5	91.1	72.2	46.0	49.3	104.4	37.5	65.9	93.2	63.1	79.6	123.0	64.2	39.3	83.9	31.6	31.9	65.0	90.5	80.5	140.9	87.0	49.4	81.1	83.6	65.3	49.0	75.8	58.4	76.0	79.1	68.3	47.1	Picht-Axenfeld 1966
Rosen 1967	51.1	106.9	85.2	45.6	53.1	133.8	54.4	65.8	97.3	61.4	81.2	163.1	59.9	48.9	94.4	34.6	27.7	67.5	115.8	85.7	175.1	104.9	54.3	92.9	98.3	57.5	52.5	115.6	71.4	101.4	97.0	75.7	46.3	Rosen 1967
Kempff 1969	80.8	95.4	93.4	57.0	66.0	117.5	59.3	55.9	92.2	71.0	85.9	138.7	50.4	54.7	87.2	29.8	32.3	65.6	84.5	99.2	161.6	81.3	42.4	98.8	86.7	61.9	62.5	83.1	77.3	80.9	81.8	67.9	81.0	Kempff 1969
Richter 1970	57.2	85.3	76.3	56.8	56.8	106.3	48.8	65.0	86.0	69.1	85.8	120.8	71.4	63.1	86.5	30.5	35.2	59.7	88.1	78.2	130.1	98.0	53.1	87.9	84.5	67.9	58.4	78.0	70.5	78.3	88.1	82.0	59.2	Richter 1970
Newman 1971	56.5	135.2	103.5	70.4	77.6	169.3	52.0	81.4	121.4	70.1	102.7	141.6	93.7	50.5	97.1	32.1	39.7	82.7	118.3	85.1	155.8	115.6	48.3	108.1	93.4	91.7	63.3	96.2	92.5	91.3	105.8	95.3	58.8	Newman 1971
Hayden 1976	46.7	80.9	62.1	59.7	59.6	127.2	33.7	69.7	94.9	51.7	80.0	143.1	86.3	26.4	106.1	22.2	37.6	64.1	99.0	118.9	92.3	100.9	34.7	113.7	89.7	68.4	36.4	100.5	64.7	79.3	104.0	85.6	39.2	Hayden 1976
Takahashi 1976	61.6	120.7	73.5	68.1	60.9	121.3	43.2	37.1	119.0	88.0	88.2	156.7	73.2	39.5	99.5	30.3	40.3	67.4	93.1	95.5	207.4	121.1	47.5	107.3	108.5	101.6	63.7	100.4	69.3	86.4	94.2	81.9	63.2	Takahashi 1976
Gibbons 1979	58.7	100.9	91.7	60.2	60.7	126.1	46.3	81.3	99.7	70.5	82.9	121.8	76.0	39.1	85.4	33.2	40.7	71.2	96.7	87.8	168.9	89.8	40.0	102.8	88.3	88.2	50.4	86.2	72.7	71.6	88.1	75.8	56.4	Gibbons 1979
Nikolayeva 1979	51.1	105.9	93.3	59.1	57.7	138.5	48.5	54.0	96.3	76.7	79.8	105.2	84.0	42.3	85.6	26.0	31.9	71.9	101.2	98.5	101.8	111.3	30.6	77.0	78.7	86.0	30.6	88.6	65.0	70.1	73.7	66.0	55.4	Nikolayeva 1979
Pinnock 1980	43.6	94.2	84.9	72.6	61.1	119.9	44.5	81.9	109.2	46.9	83.2	133.1	43.4	43.4	100.4	28.4	40.5	66.2	110.2	89.9	143.3	106.5	30.2	92.5	91.6	67.8	46.2	89.2	75.6	91.5	85.1	59.8	42.8	Pinnock 1980
Weissenberg 1981	45.5	124.4	74.6	73.0	75.1	144.4	47.3	94.6	126.3	58.7	88.3	120.2	75.7	29.6	96.1	28.9	29.4	69.5	129.2	104.9	109.3	104.2	43.0	106.4	109.1	77.1	52.5	94.4	76.2	97.9	82.3	62.7	42.5	Weissenberg 1981
Gould 1981	33.6	82.2	79.7	63.4	57.7	165.1	74.4	55.5	110.9	97.4	94.0	146.8	92.5	41.7	93.9	21.4	28.6	69.2	108.9	94.7	90.2	119.8	46.8	94.4	103.7	92.0	34.5	111.8	73.1	90.3	93.0	73.3	27.9	Gould 1981
Schiff 1982	58.1	104.5	98.4	69.0	64.5	138.2	56.2	82.5	124.8	100.8	93.5	141.7	105.1	57.1	106.3	41.3	38.1	77.7	106.5	101.2	156.6	119.4	64.4	90.0	94.9	96.3	65.9	93.9	78.0	79.2	98.4	102.0	60.2	Schiff 1982
Sokolov 1982	57.2	118.6	67.2	42.0	61.3	148.8	41.6	51.1	118.5	69.8	66.8	80.6	88.2	48.0	99.1	42.6	34.1	43.9	115.5	67.4	105.1	123.2	30.3	68.0	104.4	59.5	35.6	95.5	65.8	89.7	83.0	72.8	57.4	Sokolov 1982
Chen 1985	66.0	117.2	73.5	74.3	43.4	129.8	43.1	86.2	110.8	63.0	77.2	108.7	100.3	43.4	93.5	28.2	31.2	77.8	93.0	81.3	173.2	105.4	50.9	95.0	84.2	73.7	46.1	96.3	70.2	77.4	79.4	61.5	57.7	Chen 1985
Gilbert 1986	49.3	88.6	77.4	64.2	61.8	112.3	38.7	72.6	102.8	62.7	83.7	111.9	54.7	30.8	88.1	34.3	40.8	65.0	94.0	95.0	140.8	89.4	50.3	91.1	84.8	70.8	52.5	83.5	62.8	78.7	80.5	74.3	46.5	Gilbert 1986
Tipo 1986	55.5	102.5	72.3	64.1	54.9	145.5	57.6	54.7	111.7	57.0	85.0	109.4	101.5	34.6	100.5	31.9	29.9	77.4	126.7	75.6	122.4	118.0	54.7	80.9	105.4	64.8	45.0	100.5	74.8	81.7	69.2	66.3	51.7	Tipo 1986
Koopman 1987	42.6	103.5	88.5	63.8	58.7	113.1	47.2	79.3	85.4	71.5	73.0	121.6	60.3	43.7	89.4	33.3	33.9	69.4	83.0	96.4	138.1	84.4	51.0	91.3	79.0	76.0	54.2	76.1	64.6	72.5	81.6	68.7	41.2	Koopman 1987
Jarrett 1989	40.7	80.4	59.9	50.1	52.3	95.8	40.0	59.6	86.3	58.4	64.6	102.9	58.8	36.1	77.5	31.8	37.0	52.9	86.2	78.4	131.2	86.5	45.4	84.5	87.0	61.2	54.5	78.7	50.4	75.9	80.8	66.3	42.9	Jarrett 1989
Asperen 1991	39.9	95.2	70.6	64.2	56.0	111.8	33.6	75.3	97.5	44.1	79.2	122.3	40.5	47.5	79.4	25.0	37.5	69.5	91.2	75.1	171.2	79.3	37.4	81.3	60.6	52.4	51.9	73.9	50.3	64.5	90.3	62.1	37.3	Asperen 1991
Feltsman 1991	41.6	109.2	99.0	66.6	64.3	146.9	52.6	67.7	109.3	79.1	80.3	165.4	98.7	41.8	103.6	25.7	29.6	71.8	83.1	91.2	196.3	95.8	38.4	85.4	95.6	88.0	44.0	93.6	77.1	94.3	88.2	71.9	40.9	Feltsman 1991
Barenboim 1992	49.5	101.4	66.6	49.0	56.2	139.4	46.9	73.5	90.0	76.2	62.1	125.8	93.9	56.5	73.0	28.1	27.6	68.4	110.2	100.7	120.4	94.1	50.7	97.3	79.4	104.4	44.2	109.5	85.1	89.7	81.1	79.4	44.1	Barenboim 1992
Nikolayeva 1992	56.3	104.7	91.8	59.9	55.6	129.7	47.9	56.1	92.6	73.9	72.8	97.6	80.4	41.0	78.8	24.8	29.3	73.1	99.2	74.2	104.4	103.6	31.6	73.0	76.9	88.1	25.6	79.6	60.0	65.6	65.3	58.1	51.8	Nikolayeva 1992
Verlet 1992	75.2	88.3	72.0	48.0	50.0	107.3	32.6	62.8	91.3	65.3	79.1	130.4	70.8	47.3	96.0	35.5	36.9	62.6	94.5	73.7	141.7	85.6	47.9	71.5	79.7	62.2	72.7	83.2	57.7	80.9	72.9	64.9	66.4	Verlet 1992
Gavrilov 1993	42.7	115.2	80.7	74.2	62.8	167.1	79.9	77.1	122.2	77.8	89.6	178.0	93.5	75.0	108.9	23.0	34.4	69.8	117.1	104.1	216.1	135.6	36.4	99.2	104.4	99.8	34.7	114.2	82.4	121.2	124.4	80.9	42.7	Gavrilov 1993
Peter Serkin 1994	51.0	107.1	89.4	37.9	64.0	121.6	41.3	77.5	102.9	64.0	84.6	136.5	69.9	33.1	101.1	28.7	38.2	72.9	109.9	78.3	165.6	111.6	33.1	104.4	101.7	65.9	36.3	108.8	69.4	85.4	93.7	111.2	46.1	Peter Serkin 1994
Li 1996	39.0	103.0	88.3	66.4	62.5	134.6	73.0	59.0	115.8	83.1	87.6	143.9	101.0	40.8	106.0	22.7	29.7	68.8	107.1	82.1	83.6	150.3	46.6	78.3	100.4	80.9	38.3	101.3	69.8	83.4	85.9	77.6	40.2	Li 1996
Vladar 1996	49.2	108.6	91.0	67.8	64.2	145.5	50.0	83.4	120.4	78.4	97.9	135.5	87.8	40.2	96.3	31.5	36.5	78.8	100.9	108.0	146.2	114.4	59.8	91.8	97.4	78.3	55.4	94.8	76.1	86.1	87.2	92.6	41.1	Vladar 1996
Schultz 1998	44.7	105.3	81.9	66.3	62.8	139.5	34.7	66.6	102.0	43.8	80.2	126.8	45.7	36.4	75.6	30.5	28.8	65.6	88.0	58.6	114.3	92.1	28.8	92.0	74.6	53.9	48.5	87.6	69.7	67.0	83.2	63.2	44.8	Schultz 1998
Tureck 1998	46.0	71.3	59.2	49.9	42.9	91.6	31.9	63.0	77.1	54.3	57.4	92.7	49.1	56.7	77.6	27.8	33.0	49.7	66.8	71.3	125.7	84.2	45.3	57.0	71.6	55.8	56.3	78.4	47.9	67.2	89.7	67.2	39.1	Tureck 1998
Belder 1999	38.2	94.6	84.1	65.7	53.7	115.2	33.0	70.1	93.8	51.4	83.4	128.7	51.7	50.0	84.0	26.7	31.8	68.7	97.0	79.8	154.2	92.3	41.8	93.4	84.8	56.4	54.7	80.4	62.3	71.0	87.0	59.5	41.6	Belder 1999
Hewitt 1999	51.1	113.5	79.2	57.5	61.7	129.9	38.1	65.0	103.8	72.2	86.1	123.3	77.0	45.4	93.0	31.5	29.3	71.5	90.0	94.3	122.3	110.1	49.9	94.5	94.6	67.2	46.2	97.7	68.6	85.8	72.0	70.5	48.4	Hewitt 1999
Koroliov 1999	44.6	105.3	82.1	65.2	63.8	162.1	42.0	71.4	108.1	67.1	86.8	147.0	90.6	38.0	94.6	24.9	33.0	70.8	110.3	65.5	86.8	116.7	43.4	67.1	95.6	78.3	35.0	76.5	74.8	94.2	80.3	86.4	41.3	Koroliov 1999
Schirmer 1999	38.6	89.5	76.4	54.4	55.6	144.7	41.1	54.2	100.9	65.5	81.3	120.9	86.2	36.1	89.2	27.2	28.7	62.1	81.4	70.9	93.9	98.7	43.7	73.2	86.4	71.7	39.8	98.6	69.8	81.5	89.0	73.3	34.8	Schirmer 1999
Perahia 2000	52.8	104.4	81.6	68.7	58.8	144.7	47.3	76.1	108.7	59.8	86.2	154.1	89.3	41.0	94.1	32.0	37.8	75.2	120.4	97.1	131.6	107.4	51.7	85.1	105.2	81.4	48.9	99.7	77.9	92.6	83.6	82.5	48.9	Perahia 2000
Schiff 2001	61.5	104.1	95.3	66.3	62.2	131.0	50.0	85.1	119.4	88.3	90.8	134.5	103.2	50.8	101.6	38.5	40.1	70.9	90.4	103.7	142.2	117.0	72.1	84.1	92.2	90.1	60.5	86.6	81.4	65.8	100.1	107.0	60.2	Schiff 2001
Haugsand 2001	49.9	86.0	90.3	70.3	67.2	108.9	46.7	71.7	85.2	62.9	86.5	101.4	58.6	43.4	87.6	29.2	38.7	70.1	107.6	101.2	155.6	89.9	47.0	93.0	88.6	62.5	53.6	94.2	66.1	75.2	84.8	74.5	45.8	Haugsand 2001
Pescia 2004	46.9	109.9	76.1	69.2	65.4	156.9	43.9	74.3	120.7	65.6	94.3	145.1	99.2	41.0	99.8	25.6	37.0	74.9	120.1	97.4	113.4	110.8	52.9	101.2	104.2	72.8	36.8	95.8	77.4	94.7	103.4	97.4	42.2	Pescia 2004
Takahashi 2004	60.0	85.5	77.8	58.0	53.6	106.0	41.5	71.8	87.1	81.2	74.5	131.0	67.8	49.3	85.7	36.4	29.3	57.1	71.6	74.6	157.1	105.7	48.9	94.1	76.4	81.6	77.4	78.5	51.2	68.8	71.5	66.1	78.1	Takahashi 2004
Dinnerstein 2005	40.3	110.9	52.3	38.6	57.3	146.7	51.8	53.3	107.2	73.2	88.1	140.8	70.0	43.3	102.8	25.4	32.5	70.2	128.2	84.8	113.4	116.6	31.9	58.0	103.8	98.5	45.6	119.2	64.8	57.9	79.2	72.2	34.8	Dinnerstein 2005
Egarr 2005	51.3	77.1	69.6	48.2	53.6	83.0	33.0	70.1	77.1	51.4	71.4	105.5	75.0	36.6	80.2	34.3	39.6	58.2	79.3	77.7	135.6	73.1	49.4	76.3	74.4	61.6	49.4	73.9	61.5	65.2	73.8	78.9	51.3	Egarr 2005
Zhu 2007	46.6	109.1	79.3	77.2	58.9	158.8	43.5	62.6	115.5	71.3	82.9	146.9	99.5	40.8	105.0	28.1	30.0	78.9	117.9	79.4	122.3	127.5	43.8	73.8	109.4	87.5	46.5	98.8	82.8	77.2	89.6	80.8	44.6	Zhu 2007
Staier 2009	49.1	101.8	78.7	52.8	68.9	134.2	62.4	74.2	88.4	52.7	86.9	123.2	83.7	47.7	82.1	30.3	38.5	77.5	120.3	91.6	168.6	80.7	46.9	90.2	91.9	82.1	51.1	99.1	80.8	90.1	81.6	65.1	43.5	Staier 2009
Marsoner 2009	47.5	123.4	108.2	73.3	70.1	157.2	44.6	73.1	123.1	66.9	94.2	143.5	102.2	41.8	100.2	29.0	38.2	84.6	111.8	102.4	190.4	108.9	45.6	96.1	106.8	72.2	53.4	99.0	80.7	80.8	97.6	85.3	47.6	Marsoner 2009
Ishizaka 2012	42.2	103.7	62.9	69.2	57.3	129.8	40.4	60.7	105.4	63.4	77.7	124.5	91.9	48.8	90.0	29.1	33.3	60.1	121.4	74.6	140.4	96.8	34.1	88.6	87.7	75.3	41.3	99.5	69.5	80.2	87.1	68.3	38.4	Ishizaka 2012
Denk 2013	56.0	110.3	96.5	60.9	56.2	153.7	54.3	78.5	122.7	72.2	92.2	148.7	85.5	39.4	111.0	33.6	34.2	74.8	108.9	92.3	216.0	98.0	46.5	79.7	96.3	92.7	58.5	111.1	70.4	91.3	104.9	78.9	56.1	Denk 2013
Hill 2014	54.4	94.6	90.5	69.3	58.0	116.2	47.6	70.4	88.6	81.0	83.6	110.7	59.0	42.7	91.6	30.5	33.7	73.0	98.9	80.5	166.3	89.5	43.6	104.6	86.7	67.8	54.7	94.9	74.6	81.3	89.1	68.2	51.3	Hill 2014
Hewitt 2015	47.9	117.0	78.2	56.1	56.9	133.6	35.6	67.3	107.2	67.7	85.5	126.9	77.9	41.4	94.5	29.5	34.6	72.3	88.2	91.2	118.2	106.9	43.9	89.6	92.9	62.0	45.2	99.7	70.6	88.1	67.9	72.3	42.6	Hewitt 2015
Levit 2015	49.4	104.8	72.9	69.1	61.4	148.9	50.0	71.7	107.4	60.7	84.2	152.7	100.2	35.5	98.9	32.3	32.5	83.1	115.7	97.6	141.7	111.0	52.0	87.9	101.5	85.2	49.0	96.2	86.4	90.1	97.6	84.2	49.8	Levit 2015
Schiff 2015	55.8	100.7	88.9	63.2	60.2	134.1	48.4	84.3	114.4	84.4	87.5	131.3	97.7	46.8	101.1	35.0	39.6	66.3	92.6	93.9	139.3	115.8	66.0	76.0	90.7	84.8	57.8	84.1	74.7	63.2	96.3	100.8	55.4	Schiff 2015
Esfahani 2016	52.2	97.9	97.5	50.7	63.4	133.1	62.1	73.4	99.6	56.2	87.3	136.9	86.1	45.3	98.0	33.7	34.3	71.0	105.6	88.1	183.5	109.5	50.6	94.2	88.0	58.3	59.4	102.8	75.6	85.8	91.5	79.5	50.3	Esfahani 2016
Schornsheim 2016	52.2	104.1	72.1	54.8	64.8	125.9	55.9	71.1	86.4	63.8	76.6	135.6	70.1	50.3	87.7	31.0	37.0	71.8	90.8	81.5	195.5	84.6	49.0	104.4	75.0	71.5	55.2	90.9	73.0	73.3	67.2	76.5	50.9	Schornsheim 2016
Kim 2018	41.0	108.5	85.7	67.3	65.3	164.4	35.5	63.4	121.9	72.8	84.3	148.1	98.0	35.3	102.3	26.5	30.4	62.4	109.6	91.1	144.4	103.3	35.2	74.3	98.3	71.0	36.9	112.7	74.9	78.3	84.7	83.1	37.6	Kim 2018
Ernst 2020	39.2	122.3	83.2	65.1	65.7	170.7	41.1	80.1	120.2	40.3	108.5	144.4	88.7	31.4	108.8	24.9	36.9	84.1	101.8	103.3	146.4	109.2	41.4	113.2	100.4	56.8	46.9	112.2	68.5	98.8	104.7	73.1	28.5	Ernst 2020
Lang 2020a	46.1	102.1	86.3	46.5	71.1	148.1	63.2	65.0	102.6	60.9	84.5	120.2	98.0	33.0	88.6	19.9	34.8	76.1	100.6	73.3	159.0	106.8	28.1	93.3	99.6	63.4	39.1	119.5	76.7	96.2	90.4	59.4	35.2	Lang 2020a
Lang 2020b	39.7	96.8	84.1	45.1	67.0	148.2	56.6	61.5	100.7	60.4	84.6	107.7	98.5	32.4	88.1	21.4	37.1	80.5	102.4	82.4	159.9	95.5	29.8	94.1	91.3	73.5	40.5	118.8	87.8	92.9	86.8	60.1	34.1	Lang 2020b
M	50.2	101.3	79.3	59.4	60.3	134.8	47.4	68.0	104.8	66.9	83.3	133.3	78.3	43.1	93.2	29.6	33.9	70.1	104.4	88.6	142.8	104.0	45.1	90.0	93.4	74.0	49.2	95.1	71.7	82.5	88.8	76.4	48.3	M
Max.	80.8	137.4	110.5	77.2	90.9	178.3	81.5	94.6	141.1	102.9	113.6	202.2	112.9	75.0	127.0	42.6	44.8	93.5	137.8	118.9	216.1	150.3	72.1	138.8	129.1	107.5	77.4	119.5	92.7	121.2	124.4	111.2	81.0	Max.
Min.	33.6	54.1	48.3	35.5	40.6	83.0	31.0	37.1	73.7	40.3	57.4	80.6	40.5	26.4	73.0	19.9	27.2	43.9	66.8	58.6	83.6	73.1	27.2	57.0	60.6	51.6	25.6	70.5	47.9	57.9	65.3	58.1	27.9	Min.
SD [%]	17.8	16.2	17.2	17.0	12.4	16.2	24.0	15.2	13.9	19.8	12.0	16.3	23.4	20.5	10.8	15.4	12.2	13.1	14.2	14.6	21.8	14.7	21.5	15.3	13.1	20.1	19.7	13.1	13.1	13.8	12.9	14.9	20.7	SD [%]
M (Piano)	50.4	107.5	82.0	60.9	61.0	143.0	49.3	67.3	110.8	70.8	84.8	139.8	84.6	44.1	96.3	29.2	33.4	71.5	105.7	88.6	142.0	110.7	45.5	90.0	97.4	77.9	46.9	99.8	73.3	84.8	90.1	79.6	48.0	M (Piano)
M (Harpsichord)	49.9	90.6	74.7	56.7	59.1	120.8	44.3	69.3	94.6	60.1	80.5	126.3	67.4	41.4	87.7	30.2	34.9	67.5	102.0	88.7	144.0	92.5	44.4	89.8	86.4	67.3	53.1	87.4	68.8	78.5	86.6	73.8	48.9	M (Harpsichord)
Range (%)	140.3	153.8	128.7	117.4	123.6	114.7	162.8	154.9	91.6	155.6	97.9	150.8	179.1	184.5	74.0	114.1	64.7	113.0	106.2	102.8	158.5	105.6	165.4	143.4	113.2	108.5	202.2	69.4	93.4	109.6	90.4	91.5	189.7	Range (%)
SD [%] from Max.	60.8	35.6	39.3	30.0	50.7	32.2	71.9	39.1	34.7	53.9	36.4	51.7	44.3	74.0	36.3	44.1	31.9	33.4	32.1	34.2	51.4	44.5	59.9	54.3	38.3	45.2	57.5	25.6	29.4	47.0	40.1	45.6	67.6	SD [%] from Max.
SD [%] from Min.	-33.1	-46.6	-39.1	-40.2	-32.6	-38.4	-34.6	-45.4	-29.7	-39.8	-31.0	-39.5	-48.3	-38.8	-21.7	-32.7	-19.9	-37.4	-36.0	-33.8	-41.4	-29.7	-39.7	-36.6	-35.1	-30.4	-47.9	-25.9	-33.1	-29.9	-26.5	-24.0	-42.1	SD [%] from Min.
	Aria 1	Variation 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16a	16b	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Aria 2	

Table 8: Tempo chart for all seventy-six recordings; this table can be downloaded as a separate PDF-file: https://storage.gmth.de/zgmth/media/1119/Motavasseli_Bach_Tab08.pdf

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