

Music Performance in Action: Mathematical Interpretation of Liszt's Transcendental Études

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Abstract

Liszt's Transcendental Études are arduous and complex musical studies, inviting the pianists to present own interpretations and readings of the music. This paper presents a new method to analyze music interpretation in the context of performance tempo. This research looks and compares performances of all twelve études by twelve different pianists, defining maximum, minimum, and total interpretation factors.

Introduction

Franz Liszt (1811-1886), an influential figure in the history of Romanticism, known for novelties in the piano and orchestral oeuvre, stretches the limits of piano performance by diversifying his music through changes in form, structure, and harmony. A prominent artistic figure in music studies, Liszt's compositions define the history, theory, and performance practice traditions of Romanticism [10]. As a virtuoso pianist and an influential composer, he never stopped impressing the European audiences with his innovations in the expertise at the keyboard and mastery of compositional approaches [2]. A key area of study in the context of performance practice is musical interpretation – a particular thought process that a musician possesses during a performance. A pianist builds interpretation through his/her own musicianship, outlined by deviations in tempo, dynamics, articulation, and other artistic components [8].

While music in itself is an authentic and a peculiar phenomenon, a composition will always contain both subjective and objective components [7]. A particular rhythmic pattern, as published in the urtext, is an instance of an objective element, while a notion such as an interpretation, is, by all means, subjective. While there are inevitably performance trends and common traditions to present music on stage, each musician creates their language through which to produce a reading of a work. It is, however, possible to quantify interpretation and generate an objective study based on a formulaic set of ideas. This research dissects the deviations in the speed of Liszt's Transcendental Études, as based on the performances of all twelve works by select twelve pianists from different eras [4]. Tempo deviations are standard, and performers often vary the speed of their performances based on interpretations, the artistic nature of which carries subjectivity into the music, hence tempo is merely a piece of interpretative elasticity in a performance. This study will introduce a new methodology to compare interpretations from the standpoint of performance tempo. Finally, this paper will shed scholarly insight into a unique set of performance practice traditions that different pianists employ based on their artistic displays of Liszt's works. Liszt's études have been in a concert pianist's standard repertoire for ages, yet few have performed all twelve pieces in a single concert due to the arduous nature of the works [3]. The recordings in this study are by Claudio Arrau (1903-1991), Jorge Bolet (1914-1990), György Cziffra (1921-1994), Lazar Berman (1930-2005), Russell Sherman (b. 1930), Jenő Jandó (b. 1952), Boris Berezovsky (b. 1969), Bertrand Chamayou (b. 1981), Vadim Kholodenko (b. 1986), Andrey Gugnin (b. 1987), Dinara Klinton (b. 1990), and Daniil Trifonov (b. 1991), a select group of individuals who played all twelve works without a stoppage. This paper combines the studies of music and mathematics by looking at the empirical perspective of a musicological occurrence, allowing for scholarly observations and results.

The Transcendental Études

An étude is a technical study for an instrument, allowing a performer to refine a particular performative skill. The speed with which a pianist plays is merely one of the technical elements in a composition. The artistry, generated through speed, likewise complements the context of an interpretation [6]. Along with Liszt, many composers in the Romantic tradition produced piano études, including Frederick Chopin (1810-1849), Alexander Scriabin (1871-1915), and Sergei Rachmaninoff (1873-1943). The uniqueness of Liszt's works lies in musical inventiveness, the applicability of thematic transformation, and the artistic characterization of main ideas through the use of equilibrium between the melody and the accompaniment. Initially composed in 1826 and published in 1837 and 1852, the Transcendental Études are among some of the most challenging works for solo piano, as all but two of the studies contain an exclusive programmatic title, conjuring picturesque and symbolic imagery of each work through music [1]. Many factors result in a presented interpretation, such as expertise, age, technical abilities, creative output, and personal connections to the music, which is why no two performances are ever the same. Especially with the études, the technical abilities decline as a pianist ages, resulting in slower tempi as one progresses through a career. The twelve compositions combine for six works in major keys and six works in minor keys.

Method of Analysis

The initial step in the interpretational analysis is to map each performer's recording, hence generating a total of 144 values depicting time. Due to the difference in length of all études, all time values are in seconds. This research does not consider the time that each pianist takes for preparation prior to each performance; the start time of each work begins at the onset of the first played note on the piano. The following formula, $IF = 1 - (PT/APT)$, calculates for the interpretational factor (*IF*), where *PT* denotes each pianist's performance time, and *APT* represents average performance time for all the performers. We can, therefore, view the range of interpretation in each of the twelve performances for each étude through total interpretation factor (*TIF*), by adding the absolute value of both maximum and minimum interpretation factors. The percentage value defines the minimum, maximum, and total interpretation factors. Figure 1 reveals the data used for this research.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	Total
	C major	A minor	F major	D minor	B♭ major	G minor	E♭ major	C minor	A♭ major	F minor	D♭ major	B♭ minor	
Arrau	61	130	250	450	258	357	285	300	648	278	521	354	3892
Berezovsky	37	126	197	355	194	218	234	276	456	248	456	278	3075
Berman	48	109	327	427	224	326	276	279	570	244	579	303	3712
Bolet	58	173	287	532	266	378	326	386	642	326	639	360	4373
Chamayou	51	137	281	469	229	334	297	329	563	288	510	346	3834
Cziffra	45	120	312	437	236	286	298	327	538	306	608	271	3784
Gugnin	54	136	267	471	213	364	282	342	672	281	619	337	4038
Jando	50	140	264	449	232	336	311	316	562	284	497	311	3752
Kholodenko	47	139	218	418	210	276	269	306	615	237	462	284	3481
Klinton	56	140	266	457	218	315	273	322	579	288	504	316	3734
Sherman	59	178	316	529	280	349	350	369	704	309	664	333	4440
Trifonov	41	124	312	451	211	293	311	304	654	267	503	302	3773
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	
	C major	A minor	F major	D minor	B♭ major	G minor	E♭ major	C minor	A♭ major	F minor	D♭ major	B♭ minor	
Average performance time	50.58	137.67	274.75	453.75	230.92	319.33	292.67	321.33	600.25	279.67	546.83	316.25	
Fastest	37	109	197	355	194	218	234	276	456	237	456	271	
Maximum Interpretation Factor	26.85%	20.82%	28.30%	21.76%	15.99%	31.73%	20.05%	14.11%	24.03%	15.26%	16.61%	14.31%	
Slowest	61	178	327	532	280	378	350	386	704	326	664	360	
Minimum Interpretation Factor	-20.59%	-29.30%	-19.02%	-17.25%	-21.26%	-18.37%	-19.59%	-20.12%	-17.28%	-16.57%	-21.43%	-13.83%	
Total Interpretation Factor	47.45%	50.12%	47.32%	39.01%	37.24%	50.10%	39.64%	34.23%	41.32%	31.82%	38.04%	28.14%	
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	
	C major	A minor	F major	D minor	B♭ major	G minor	E♭ major	C minor	A♭ major	F minor	D♭ major	B♭ minor	

Figure 1: The interpretation-factor data for the twelve Transcendental studies by Franz Liszt.

For example, the average performance time for Étude No. 1 in C major is 51 seconds. Boris Berezovsky plays the opening work the fastest, timed at 37 seconds. Therefore, his interpretation factor is $IF = 1 - (37/50.58)$, which is approximately 26.85%. On the contrary, Claudio Arrau holds the slowest performance of this work, timed at 61 seconds. Therefore, his interpretation factor is $IF = 1 - (61/50.58)$, which is approximately -20.59%. If the performance time is precisely the same as the average time of all performances, the IF will equal to 0%, which never occurred in this experiment. It is necessary to add the absolute value of the fastest and the slowest performances to find the entire range of performative interpretations in the context of the musical tempo; in the case of the opening étude of the set, the final value is 47.45%. Musically, this is a sizeable interpretational range for a small one-minute work. Being that Étude No. 1 is one of the technically-simpler compositions in the Transcendental set, the full range of tempi that pianists take raises a variety of fascinating questions with regards to particular passages in the music where the tempi aberrations occur. The piece consists of merely twenty-three measures and two sections, yet it forms a bright contrast in speed, which pianists elect for their performances [5]. Additional calculations were then made to extract further data and to make observations by grouping the twelve études according to generalizations of music theory and performance practice.

Data Analysis

Based on the data, there are a total of five theories that can be derived grounded upon the readings of these études regarding the interpretational creativity that pianists produced.

First, there are no direct correlations between the études in major and minor keys, meaning that, on average, the choice of a key does not affect a set of interpretations, as shown in this study. The major-key études, Nos. 1, 3, 5, 7, 9, and 11, have an average performance time of 332.67 seconds. For these works, the average maximum interpretation factor and minimum interpretation factor are 21.97% and -19.86%, respectively, with the total interpretation factor of 41.83%. The minor-key études, Nos. 2, 4, 6, 8, 10, and 12, have an average performance time of approximately 304.67 seconds. For these works, the average maximum interpretation factor is 19.67%, the minimum interpretation factor is -19.24%, and the total interpretation factor is 38.91%. Therefore, while the études in major keys have a slightly higher interpretation factor, the tonalities and the key choices of the études do not directly influence the interpretative decisions that performers make at the keyboard. Compositionally speaking, there is an existing pattern to key structure in the creation of these works by which Liszt abides. This, however, is not translated into the interpretational view of the performance practice.

Second, a particular emphasis was made on the comparison of études with an average performance time of under and over five minutes. Based on the data, no significant correlations exist in the context of a work's length. There are six études with an average performance time of below 300 seconds, including Nos. 1, 2, 3, 5, 7, and 10, averaging a performance time of 211.04 seconds. With an average maximum interpretation factor of 21.21% and the average minimum interpretation factor of -21.05%, the total interpretation factor is 42.26%. The remaining études, Nos. 4, 6, 8, 9, 11, and 12, have an average performance time of 426.29 seconds. With an average maximum interpretation factor of 20.43% and the average minimum interpretation factor of -18.05%, the total interpretation factor is 38.47%. Therefore, while the études with an average performance time of under five minutes have a slightly higher interpretation factor, the speed and the performance time allocated for each work do not directly influence the interpretative decisions of the pianists.

Third, the most interpretative études are Nos. 1, 2, 3, and 6, all of which have a total interpretation factor of >45%, shown through tempo deviations that the pianists make at their performances. The two highest interpretative études, Nos. 2 and 6, hold a total interpretation factor of >50%. The fourth highest interpretative étude, No. 3, with its total interpretation factor of 47.32%, generates a gap of 6% when compared to the fifth highest interpretative étude – No. 9.

Fourth, the most technically challenging works of the set, Nos. 4, 5, and 12, are not the most interpretative pieces. This is an interesting observation, since a technique and abilities at the keyboard can

either permit or limit performers in their choice of tempo. The difficulties of the *Mazeppa* (No. 4) include large leaps in both hands, as well as having to play a continuous succession of thirds alternating between the hands. The difficulties of *Feux Follets* (No. 5) include melodic emphasis and the necessity to play double notes in the right hand in the context of a sustained chromaticism [9]. The difficulties of *Chasse Neige* (No. 12) include continual leaps and the need to play relentless tremolos in both hands. Nevertheless, with all the complexities that Liszt presents, these three études are not the highest interpretative pieces from the perspective of the performance speed. In fact, Étude No. 12 has the lowest total interpretation factor at 28.14%.

Fifth, while this data allows one to analyze the performative culture of each pianist's artistic world in the context of Liszt's Transcendental Études, some observations can likewise be made when comparing performances of each pianist individually. For instance, Bolet has the slowest interpretations of five of the six minor-key études, including Nos. 4, 6, 8, 10, and 12. On the contrary, Sherman has the slowest interpretation of four of the six major-key études, including Nos. 5, 7, 9, and 11. Furthermore, Berezovsky has the fastest performance of nine of the twelve études.

Conclusion

Tempo variability depends on the composer, the genre, the performer, and the style. Internal factors of a performance likewise play a role in the speed that the performer takes, since the composer's choice for dynamics and articulation may alter the interpretation of a performance. There is no direct correlation in tempo variability when comparing works in Baroque, Classical, Romantic, and post-Romantic repertoire. However, there are correlations in tempo variability when comparing the same set of works by multiple pianists. Music interpretation is an essential part of artistic research that integrates the composer's suggestions with each pianist's understanding of a work. Their unique interpretations are the reasons for audience members attending live concerts and recitals. Empirical research dissecting interpretative tempo choices allows for a closer understanding of Liszt, his études, and the performance traditions of the 20th and 21st centuries. An analytical examination of each pianist and his/her recordings allows one to plot and compare a variety of performances.

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