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# Expressive Timing in a Debussy Prelude: A Comparison of Student and Expert Pianists

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• ABSTRACT

The expressive timing of 10 famous pianists' performances of Debussy's prelude, *La fille aux cheveux de lin*, was measured from acoustic recordings and compared to the expressive timing of performances by 10 graduate student pianists, recorded after only a brief rehearsal on a Yamaha Disklavier in MIDI format. Despite the large differences between the two groups in preparation, experience, age, date of birth, and national origin, their *average* expressive timing profiles were extremely similar. Although individual differences tended to be more pronounced among the experts than among the students, the similarity of the average timing profiles suggests a common standard of expressive timing. Since this standard evidently can be approximated by graduate student pianists after only minimal rehearsal, it may be considered the default result of an encounter between a trained musician and a particular musical structure—the timing implied by the score.

## INTRODUCTION

The "shaping of time" is perhaps the most important aspect of expressive music performance (Epstein, 1995). Yet, relatively little is known about musicians' timing strategies. Quantitative studies of expressive timing have usually sought to elucidate underlying principles on the basis of a few selected performances (see, e.g., Seashore, 1938; Shaffer, 1981; Todd, 1985; Palmer, 1989; Epstein, 1995), whereas musicological studies of performance practice have usually relied on qualitative observations, with a few recent exceptions (Green, 1994; Bowen, 1996). Qualitative observations are particularly unreliable in the case of timing because the variations are subtle and often not heard as tempo modulations; what is usually perceived is the expressive effect rather than its physical cause.

The laboriousness of detailed timing measurements explains why only few studies have examined relatively large numbers of performances with regard to their commonalities and differences (Repp, 1990, 1992, 1995). In order to gain a better understanding of the unique artistry of great musicians, it is necessary to determine first the typical expressive patterns that may serve as an aesthetic norm for musicians and their audience. Repp (1995) conducted a comparison of performances of Robert Schumann's "Träumerei" by 24 famous pianists ("experts") and 10 graduate student pianists. The two groups differed not only in experience, generation, age, and national background, but also in degree of preparation: The expert performances came from commercial recordings, whereas the student performances were recorded after only a brief rehearsal. Nevertheless, the *average* expressive timing profiles of the two groups were remarkably similar, suggesting that pianists in both groups were guided by the same norm of global temporal shaping. However, more detailed analyses revealed that individual differences among the experts were much larger than among the students. Even for local passages in the music, the students' timing profiles could be characterized as variants of a single underlying pattern, whereas the experts typically exhibited several alternative timing strategies. Similar findings were obtained in a recent analysis of expert and student performances of the first phrase of Chopin's Etude in E major (Repp, 1997). The greater diversity among famous artists may reflect greater artistic freedom and/or multiple timing norms among earlier generations and different nationalities.

In order to arrive at conclusions of some generality, it is necessary to analyze not only many performances but also different compositions. Whereas the author's previous research focused on pieces from the Romantic piano literature, the present study compared experts' and students' timing in a French impressionist piece.

## METHODS

The music was *La fille aux cheveux de lin*, No. 8 in Debussy's first book of 12 piano preludes, composed and published in 1910. The initial measures are shown in Figure 1.

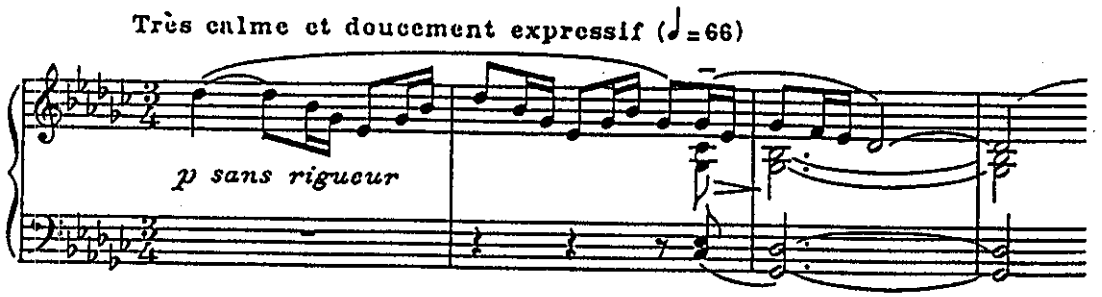


*Figure 1. The initial measures of Debussy's* La fille aux cheveux de lin *(Durand edition, 1910).*

Ten commercial recordings of the Debussy prelude were measured. The artists and the record labels are identified in Table 1. The pianists' birth dates range from 1877 (Cortot) to 1956 (Zimerman), and the recording dates span 60 years. With the exception of one American (Jacobs), the pianists are all European or European-trained (Arrau).

Table 1
**The pianists and their recordings of Debussy's *La fille aux cheveux de lin.***

| Pianist | Recording | Year |
|---|---|---|
| Claudio Arrau | Philips 9500 676 | 1979 |
| Arturo Benedetti-Michelangeli | DG 413450-2 | 1977 |
| Robert Casadesus | Columbia Masterworks SL-222 | ca. 1955 |
| Alfred Cortot | Seraphim 60143 | 1931 |
| Paul Crossley | Sony SK 52 583 | 1992 |
| Jörg Demus | Orpheus OR D-131 | ca. 1970 |
| Peter Frankl | Vox SVBX 5432 | 1964 |
| Walter Gieseking | EMI CDH 7610042 | 1954 |
| Paul Jacobs | Nonesuch HB-73031 | 1978 |
| Krystian Zimerman | DG 435 773-2 | 1991 |

Ten graduate students at the Yale School of Music (P1, P2, ..., P10) were paid for their participation in the study. Three were third-year (artist's diploma) students, one was in her second year, five were in their first year, and one was only about to enter the master's program. Their age range was 21 to 29. Seven were female. Three were American, two Canadian, three Chinese, one Japanese, and one Thai. All had completed their undergraduate studies in the U.S. or in Canada.

The students were recorded on an upright Yamaha MX100A Disklavier connected via a MIDI interface to a Macintosh computer. Each pianist was asked to rehearse four short pieces, including the Debussy prelude, for an hour. Subsequently, the pieces were played from the score and recorded in whichever order the pianist preferred, and then they were repeated twice in the same order.[1] In a background questionnaire, three students indicated that they had performed the Debussy prelude at some time in the past, three had played it informally, and four were familiar with it from listening only.

(1) One student (P4) was able to record only two performances.

The acoustic recordings were digitized, and a waveform editor was used to identify tone onsets, using a combination of visual and auditory cues. Onset (hammer-string contact) times were directly available in the MIDI data.[2] In chords, the highest-pitched note was taken as the reference. Interonset intervals (IOIs) were computed from the onset times and then normalized by dividing all longer IOIs into sixteenth-note fractions. The IOIs of the three performances of each student pianist were averaged to reduce unintended timing variability.

## RESULTS AND DISCUSSION

### • Basic tempo

Two measures of basic tempo were calculated. The average tempo was obtained by dividing 60,000 by four times the average sixteenth-note IOI duration (in ms).[3] This measure almost certainly underestimates the basic tempo because large ritards are included in the average. Therefore, the *modal tempo* was determined by first deriving a frequency histogram of all sixteenth-note IOIs using a bin width of 10 ms, then choosing the bin with the highest frequency, multiplying its central duration by four, and dividing 60,000 by that number. The average tempo was calculated before averaging each student's three performances, the modal tempo afterwards.

In Figure 2 the performances are arranged according to their modal tempo. The students' tempi fit well within the range of the experts, some of whom chose more extreme tempi than any student. The tempo suggested in the Durand edition (Fig. 1) is 66 beats per minute (bpm). Nearly all modal tempi were slower than that, the slowest (Zimerman) being 46 bpm. Only two pianists (Jacobs and Cortot) were faster, Cortot being fastest at 75 bpm. The tempo range thus was almost 30 bpm, and the ratio between the slowest and fastest tempi was 1.62.

The difference between the modal and the average tempo is a rough measure of the "expressiveness" of each performance—that is, of the tendency to indulge in ritards. By that measure, the most expressive performances by far were those by Jacobs and Frankl, whereas the least expressive ones were those by Gieseking, Casadesus, and Cortot. The last-named group includes the two Frenchmen in the group and one French-born German renowned for his affinity to French music; this is consistent with the notion of a characteristically French style of playing that aims more for clarity and sound color than for expressivity of timing. The student performances again avoided extremes, though they, too, ranged from relatively expressive

(2) The temporal resolution of the MIDI data was about 5 ms. The resolution of the waveform editor was finer, but there was inevitable human measurement error in determining acoustic tone onsets, probably of about the same average magnitude.

(3) There were 114 quarter-note beats between the onsets of the initial and final notes.

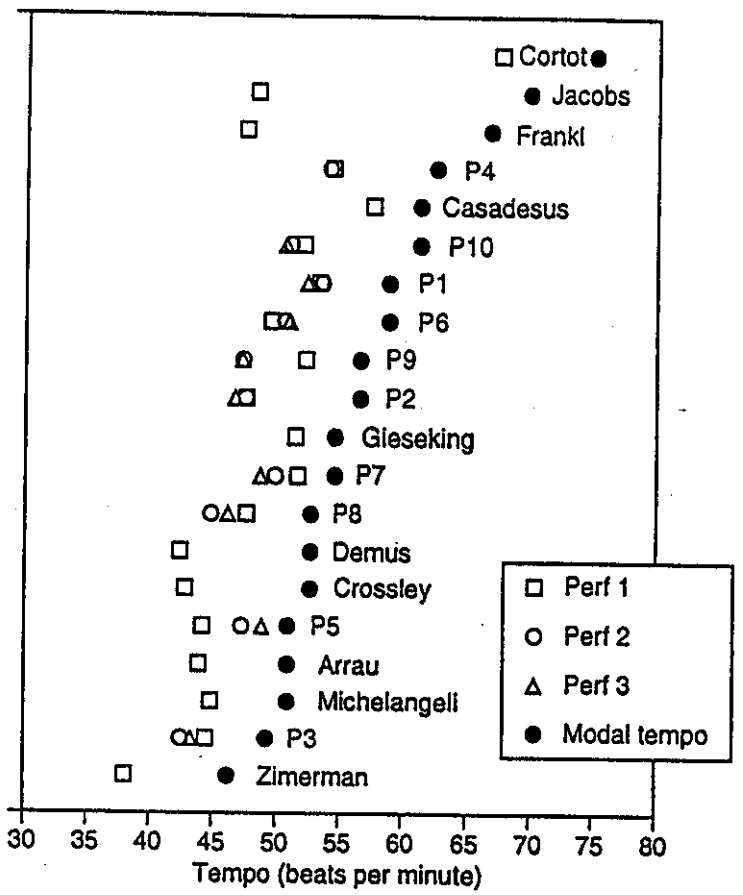


*Figure 2. Average and modal tempi of the performances.*

(P10, P2) to relatively inexpressive (P7, P5). The figure also shows the students' consistency of average tempo, which was quite high: The average within-pianist standard deviation was 1.2 bpm.

• **Average timing profiles**

An average timing profile was obtained for each group of pianists by averaging the IOIs of the 10 individual performances. These timing profiles are superimposed in Figure 3.[4] Their similarity is remarkable (r = 0.96). They agree in virtually every qualitative detail (perhaps the only exception occurs at the end of bar 13), and only small quantitative differences can be seen in some places. This suggests that both groups

(4) IOIs longer than a sixteenth note appear as plateaus in the figure. The logarithmic scale on the ordinate is used mainly to highlight differences among the shorter IOIs and to compress the graph. However, it also reflects the fact that musical duration is essentially a logarithmic dimension, both in terms of notated values and in terms of expressive timing (Repp, 1994).

of pianists were guided by essentially the same aesthetic performance standard, at least with respect to the temporal shaping of the piece.

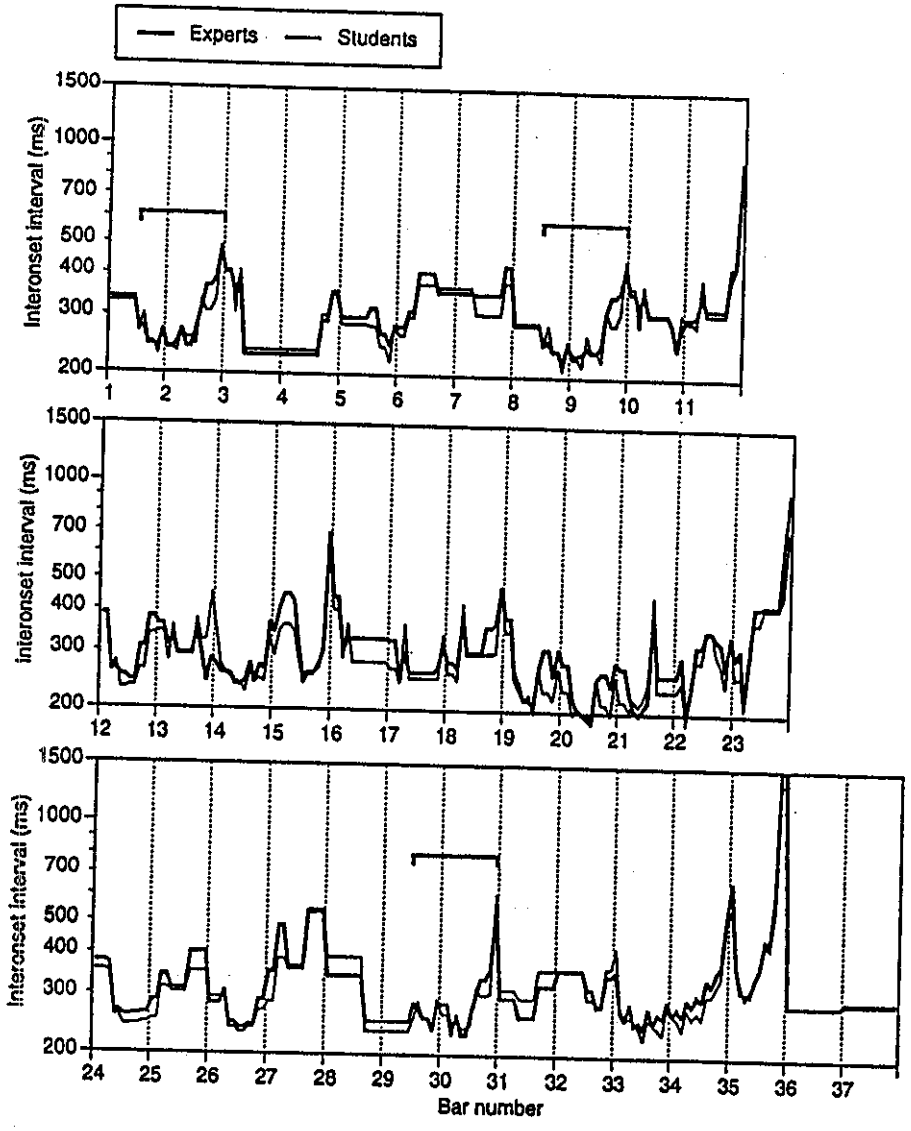


*Figure 3. Average timing profiles of expert and student pianists. Brackets indicate timing shapes analyzed in Figure 4.*

The two average timing profiles (and especially their grand average) may be regarded as estimates of a *typical timing profile* for this music (see also Repp, 1995, 1997). All individual timing profiles were similar to this typical profile: A principal components analysis on the 20 performances yielded only a single significant component (similar to the grand

average profile), which accounted for 77% of the timing variance.[5] However, students' timing tended to be more similar to this normative profile than experts' timing: Five of the six highest component loadings (0.92–0.94) were for students, whereas the two lowest loadings (i.e., correlations with the component profile) were shown by Michelangeli (0.70) and Cortot (0.71), two legendary pianists known for their strong individuality.

• A specific timing shape

Closer examination of the average profiles (which the reader may wish to undertake with the score in hand) reveals a pervasive use of conventional accelerando-ritardando shapes to mark structural units (see Todd, 1985, 1995), even in this impressionistic music. The greater diversity of the expert performances was also evident in the execution of these local patterns, as the following analysis illustrates.

Bars 1–3, 8–10, and 29–31 contain very similar melodic material. In bars 1–3 (see Fig. 1), an undulating melody is stated without accompaniment, except for two chords accompanying the final cadence. Bars 8–10 restate the melody over a chordal accompaniment. In bars 29–31, the melody is one octave higher and only sparsely accompanied. An accelerando-ritardando shape typically extended from the second beat in the first bar to the end of the second bar in each case, as indicated by the brackets in Figure 3. In all individual performances, these shapes could be approximated quite well by cubic functions, proposed by Epstein (1995; Feldman, Epstein, & Richards, 1992) for the modelling of tempo changes.[6] Small superimposed "spikes" (see Fig. 3) reflected a relative lengthening of the second sixteenth note in each anapestic (short-short-long) motive, which seems to be a common finding (Gabrielsson, 1974; Drake & Palmer, 1993). A systematic difference between experts and students may be noted towards the end of each shape in Figure 3. It seems that the experts paid more attention to the slurs in the score (see Fig. 1) and lengthened the IOI between slurs.

In terms of the cubic curve fits, there was no indication that the experts' timing patterns were more well-shaped or precise than the students'. On the contrary, it was among the experts that some rather unusual timing patterns were found (Michelangeli, Zimerman, Demus). Figure 4 shows the cubic curves for all pianists. Clearly, there was more diversity among the experts than among the students, even though all seemed to follow the same basic timing shape.

(5) Since this analysis was based on correlations among timing profiles, it was insensitive to differences in basic tempo.

(6) Quadratic functions, which proved sufficient in some earlier studies of timing shapes (Todd, 1985; Repp, 1992), did not fit well at all here.

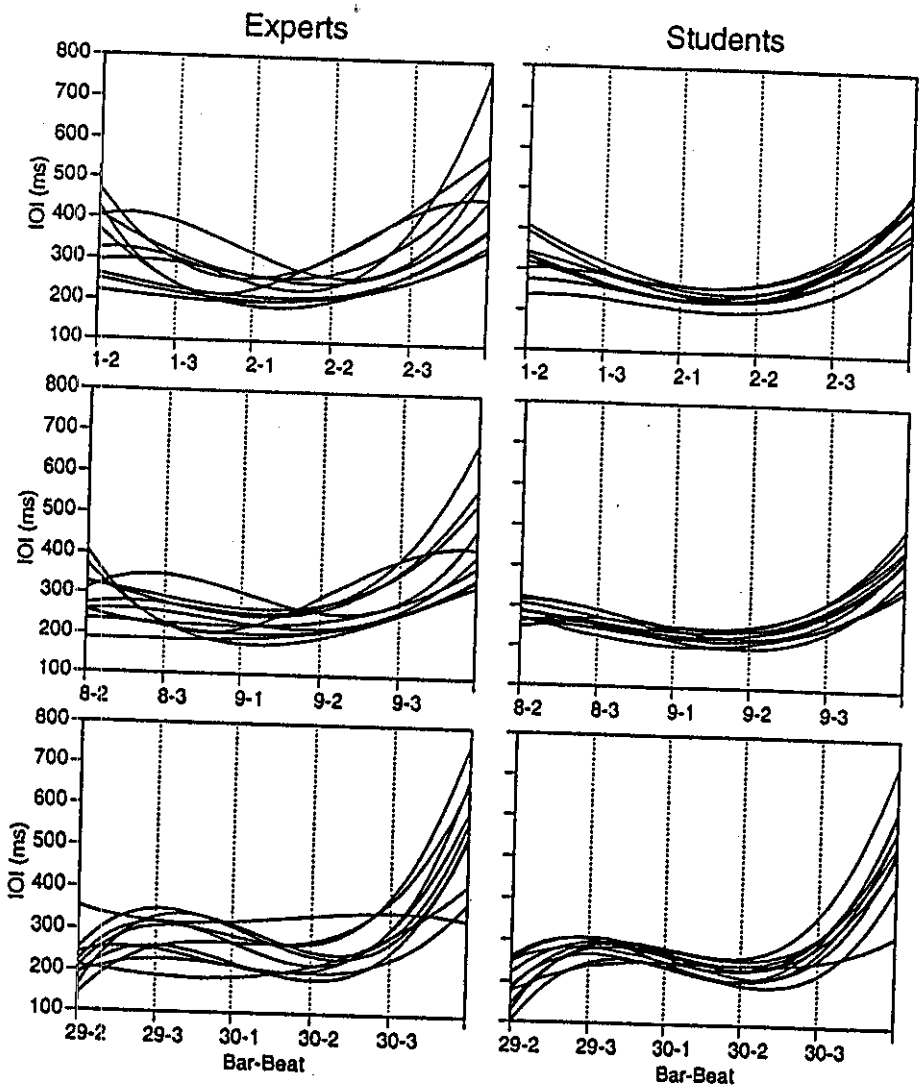


*Figure 4. Cubic functions fitted to individual experts' and students' timing shapes in three analogous musical passages.*

## GENERAL DISCUSSION

The present results are in close agreement with those of two earlier comparisons between experts' and students' expressive timing (Repp, 1995, 1997). In each case, the average timing profiles of experts and students were highly similar, but the experts exhibited greater diversity than the students.

The similarity of the average timing profiles indicates that both groups followed essentially the same norm or aesthetic standard with regard to expressive timing. This is remarkable in view of the differences in experience, age, year of birth, and national origin. Moreover, the students exhibited the normative timing profile after only minimal preparation. This indicates that their tacit musical knowledge and technical skill were sufficient

to generate an appropriate timing pattern almost spontaneously. Although the Debussy piece was not unfamiliar to them, it seems extremely implausible that they were merely reproducing the timing pattern of some previously heard performance. Such a complex timing pattern could be remembered (if at all) only if it makes sense to the listener, and this requires that the tacit knowledge underlying its generation has already been acquired.

There could be various reasons for the greater diversity of experts compared to students. Degree of preparation could play a role, as could age, generation, experience, national origin, time of recording, and personality.[7] It stands to reason that many concert and recording artists have achieved success because of their individuality and originality. To hold an audience's attention or make people buy one's recordings, it is necessary to distinguish oneself from competitors, and most experts have accomplished that in one way or another. The student pianists, on the other hand, have yet had little incentive to develop individual voices as artists, trying mainly to please their teachers and competition juries. Nevertheless, they do exhibit consistent individual differences in expressive timing (see also Repp, 1995), which may serve as the basis for the future development of stronger individualities.

It remains unclear to what extent the greater diversity of the expert performances may reflect the existence of multiple or changing norms of expressive timing. An investigation of this issue would require hundreds of historic recordings of the same work, which are simply not available. The author's working hypothesis is that the norms of expressive timing have not changed in recent history, if ever, and that they result mainly from a fundamental connection between timing and cognitive grouping that probably transcends music (Repp, in press). What has changed is the compositional structure of music, the willingness of artists to deviate from the norms, and the acceptable magnitude of expressive tempo modulations. If so, then the typical timing profile derived from a number of performances represents the expressive timing implicit in the score —the timing "called for" by the music and produced by a performer who "lets the music speak for itself". Needless to say, it may not constitute the most interesting performance (Taruskin, 1995; Repp, 1997). However, typical expressive timing should be seen as an integral part of the music, not as a "deviation" from the mechanical timing suggested by the score (Seashore, 1938; Cook, 1990). Rather, it is the timing of individual performances (including mechanical computer performances) that should be regarded in terms of its deviations from the normative timing. [8]

(7) As to degree of preparation , the author has heard all the participating student pianists in formal recitals and does not believe that their playing was much more individual after careful preparation.

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## •La expresión rítmica en un preludio de Debussy: estudio comparativo entre estudiantes y pianistas profesionales

Tras haber medido la expresión rítmica de la interpretación de diez pianistas célebres del preludio *La fille aux cheveux de lin* de Debussy, a partir de grabaciones acústicas de sus versiones, la hemos comparado con la de diez pianistas estudiantes del conservatorio, registradas, tras un breve ensayo, en formato MIDI en un Disklavier Yamaha. A pesar de las inmensas diferencias de preparación, experiencia, edad, fecha de nacimiento y nacionalidad entre ambos grupos, la media de su expresión rítmica fue extremadamente similar. Aunque las diferencias individuales tendían a pronunciarse entre los expertos, la similitud en la media de ambos grupos hace suponer que la expresión rítmica se funda en un criterio general común. Ya que este modelo común puede ser conseguido por cualquier estudiante tras mínimos esfuerzos, podemos considerarlo el resultado por defecto de un encuentro entre un músico experimentado y una determinada estructura musical, el ritmo subyacente en la propia partitura.

## • L'espressività ritmica in un preludio di Debussy: uno studio comparativo tra pianisti studenti e professionisti.

L'espressività ritmica di 10 esecuzioni del preludio di Debussy, La Fille aux cheveux de lin, eseguito da 10 famosi pianisti, fu misurata e quindi confrontata con l'espressività ritmica di 10 esecuzioni dello stesso brano effettuate da 10 studenti di pianoforte, registrate, dopo una breve prova, sul Disklavier MIDI Yamaha. Malgrado la notevole differenza fra i due gruppi dal punto di vista della preparazione, dell'esperienza, dell'età, della data di nascita e della nazionalità d'origine, la media dei profili dell'espressività ritmica fu sorprendentemente simile. Benché le differenze personali siano più pronunciate tra gli esperti, questa somiglianza lascia supporre che l'espressività ritmica si basi su un modello comune. Poiché questi livelli possono essere raggiunti da pianisti studenti anche solo dopo una prova, possiamo dedurre che il non raggiungimento di questi risultati dipenderebbe dalla presenza di una particolare struttura musicale relativa al ritmo implicato nel pezzo.

## • L'expression rythmique dans un prélude de Debussy : étude comparative entre des pianistes étudiants et experts

Après avoir mesuré l'expression rythmique de dix pianistes célèbres, à partir d'enregistrements acoustiques de leur interprétation du prélude *La fille aux cheveux de lin* de Debussy, on la compare à celle de dix pianistes étudiants de conservatoire, enregistrée après une brève répétition sur Disklavier MIDI Yamaha. En dépit des énormes différences de préparation, d'expérience, d'âge, de date de naissance, et d'origine nationale entre les deux groupes, la moyenne des profils de l'expression rythmique est étonnamment semblable. Bien que les différences personnelles

soient plus prononcées parmi les experts, cette similitude laisse supposer que l'expression rythmique se fonde sur un critérium général. Puisqu'un minimum de répétition permet à des étudiants de s'en approcher de très près, on est en droit de penser que leur carence résulte de la mise en présence d'un musicien formé et d'une structure musicale particulière — le rythme sous-jacent à ladite pièce.

## • Expressive Zeitgestaltung in einem Prelude von Debussy: ein Vergleich zwischen Klavierschülern und Experten.

Die expressive Zeitgestaltung beim Vortrag des Preludes *La fille aux cheveux de lin* von C. Debussy durch zehn berühmte Pianisten wurde auf der Basis von Schallaufnahmen untersucht und mit der von zehn fortgeschrittenen Klavierschülern, aufgenommen nach nur kurzer Probe auf einem Yamaha Disklavier, verglichen. Trotz der großen Unterschiede zwischen den Angehörigen der beiden Gruppen hinsichtlich Vorbereitung, Erfahrung, Alter und Nationalität waren die durchschnittlichen Zeitgestaltungsprofile außerordentlich ähnlich. Obwohl individuelle Unterschiede bei den Experten stärker ausgeprägt waren als bei den Schülern, lassen diese Ergebnisse auf einen gemeinsamen Standard der expressiven Zeitgestaltung schließen. Da dieser Standard von fortgeschrittenen Klavierschülern nach nur kurzer Probe näherungsweise erreicht wird, kann er als natürliches Produkt des Zusammentreffens zwischen einem geschulten Musiker und einer speziellen musikalischen Struktur betrachtet werden — als die von der Partitur implizierte Zeitgestaltung.