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## Timbre and Form in Debussy's *Nuages*

### ABSTRACT

Timbre is doubtlessly one of the main paradigms of Debussy's music. It is thus obvious to consider timbre research as a promising tool for the analysis of Debussy's works. Within the scope of this text, this process is exemplified by an analysis of *Nuages*, the first movement of Debussy's *Nocturnes* for orchestra (1897–99). Timbre constellations are investigated by close listening and by implementation of the MIRtoolbox software (developed by Olivier Lartillot and Petri Toiviainen in 2007). By comparing four different recordings, a close relationship between bars 5–8 and 80–82 of *Nuages* is revealed. In respect to their properties of sound and harmony, these passages are ambiguous. This might tempt us to call Debussy's treatment of sound 'mysterious' or 'inscrutable'. It should always be kept in mind, however, that these ambiguities are composed out with the utmost precision. This insight leads to a reflection on questions of form. If we locate and describe specific constellations of timbre and their precisely defined properties, we are able to compare different areas of form that feature similar properties of sound. As a result, we realise that musical elements are not merely juxtaposed in Debussy's music, but interwoven in a complex fashion. By re-evaluating formal aspects in their relation to timbre, we approach a new perspective of form that is informed by current timbre research.

### 1. INTRODUCTION

#### 1.1 Preliminary Note

In this text, selected passages of four different recordings of *Nuages* are analysed, and the corresponding sonograms are reproduced. Via [www.lukashaselboeck.com/266/](http://www.lukashaselboeck.com/266/), it is possible to download the score and listen to the recordings.

#### 1.2 Debussy Analysis

In the history of analysis of the works of Debussy, not only promising perspectives, but also persistent myths emerged. New approaches presented by Debussy scholars such as Roy Howat, Richard Parks or Simon Trezise conflict with the belief that the music of the French master is largely resistant to analysis, or even 'unanalysable'. This view was already held by some of the composer's contemporaries — e.g. Jules Massenet who described Debussy's music as a 'mystery', a position that seemed compatible with the sceptical attitude towards analysis exhibited by the composer himself. Consequently, a tendency of reception was established and is partly still alive today: in the catalogue of the exhibition *Debussy: la musique et les arts*, which was realised in the honour of Debussy's 150th birthday in the Musée d'Orsay, the art historian Jean-David Jumeau-Lafond quoted Massenet's words as a motto which prefaces his text: 'Debussy, c'est l'énigme' (Jules Massenet, quoted by Jumeau-Lafond 2012, 57).

Debussy's music is irrefutably not at all simple to analyse, but it is evident that analytical obstacles can be amplified by an overemphasis of tradition; if our goal is to achieve new ana-

lytical results, it is not productive to speak repeatedly about the difficulties encountered thus far. Far more constructive is the exploration of new strategies in order to investigate the formal and structural multiperspectivity of Debussy's music.

Since 1945, the importance of this concern was realised by many scholars. Not only in France, but also in Germany there have been strong efforts to re-interpret the form and structure of Debussy's music. In matters of form, one of the main problems was the difficulty in exploring its relationship to other domains: harmony, melody, rhythm, and timbre. It subsequently seemed reasonable to focus on structure, which was the main analytical paradigm after 1945. Consequently, serial composers (see e.g. Eimert 1957; Stockhausen 1963) analysed Debussy from a statistical perspective.

Later, new approaches were presented which were not limited to structural thinking: Albert Jakobik developed a specific theory of sound constellations in Debussy's music (Jakobik 1977). Claudia Zenck-Maurer wrote about Debussy's sometimes peculiar modes of notation and other topics that had been traditionally neglected (Zenck-Maurer 1974).

Other aspects were emphasised in the USA. In Roy Howat's book (Howat 1983) Debussy's music was analysed from the perspective of proportion. In Matthew Brown's and Allen Forte's analyses, Debussy research was linked with Schenkerian analysis and set theory (Forte 1991; Brown 1993). These analytical publications provoked controversy and gradually enriched the analytical tools at our disposal.

The aim of this text is to follow this process of widening horizons, and to consider timbre research as a promising tool for Debussy analysis — an important investigation when timbre is one of the main paradigms of Debussy's music. As a second step, it will also be crucial to correlate the dimension of timbre with other domains. It may thus be possible to re-evaluate formal aspects in their relation to timbre, and to realise an approach to form which is informed by current timbre research.

#### 1.3 Timbre Research

Within the wide field of music analysis, timbre research has become an important factor, but this was not always the case. In theoretical writings of the 18th and 19th centuries, matters of timbre were widely neglected. The term timbre (in German: 'Klangfarbe') was used from circa 1822 (Muzzolini 2006, 265). Some decades later, scholars such as Hermann Helmholtz and Carl Stumpf began to explore the properties of timbre. Around 1910, composers and music theorists such as Schoenberg and Ernst Kurth began to reflect matters of timbre theoretically. All these approaches were vitally important, even though they were sporadically employed and not thoroughly interconnected. From the 1950s, the investigation of timbre intensified steadily — not only in musicology and philosophy (Theodor W. Adorno), but also in

timbre research (in German: ‘Klangforschung’) and *recherche musicale* (e.g. Pierre Schaeffer). Another important branch was the fundamental research realised by scholars including Jean-Claude Risset, John Chowning, John Grey, Fred Lerdahl,<sup>1</sup> Daniel Pressnitzer, Stephen McAdams and others (Chowning 1973; Grey 1977; Lerdahl 1987; Pressnitzer and McAdams 1999; Risset 2014). A thorough connection between these studies and analytical methods would have been desirable, but was not implemented.

Nevertheless, timbre analysis is currently an active practice in different branches of music analysis, although there are no standardised methods. Due to the complexity of this field of research, a coherent methodology has still to be developed. Moreover, timbre analysis has two major challenges with which to contend: firstly, the use of software (e.g. sonograms) and processes of close listening must be coordinated — ideally with both sides complementing each other. Secondly, the relation between timbre analysis and other methodological approaches (e.g. analysis of form) must be established.

## 2. DEBUSSY’S NUAGES

### 2.1 Introduction

*Nuages* is the first movement of *Nocturnes* for orchestra (composed 1897–99). As far as we assume, the composition of *Nocturnes* is based on two earlier studies. In 1892, Debussy wrote that he was nearly finished with *Trois scènes au crépuscule*, an orchestral triptych, which was apparently inspired by poems of Henri de Régnier (Cox 1974, 19f.). However, the piece remained unfinished and the score is lost.

The same applies for another piece written for the Belgian violinist Eugene Ysaÿe. Towards the end of 1894, the composer wrote to Ysaÿe:

I am working on three *Nocturnes* for violin and orchestra that are intended for you. The first is scored for strings; the second for three flutes, four horns, three trumpets and two harps; the third is a combination of both these groups. [...] This is, in fact, an experiment in the various arrangements that can be made with a single colour — like the study of grey in painting. (Cox 1974, 19.)

All these ideas obviously influenced the final shape of *Trois Nocturnes*, which were premiered by Camille Chevillard with the Lamoureux Orchestra on December 9, 1900 in Paris. In an introductory note to this work, Debussy wrote:

The title *Nocturnes* is to be interpreted here in a general and, more particularly, in a decorative sense. Therefore, it is not meant to designate the usual form of the nocturne, but rather all the various impressions and the special effects of light that the word suggests. *Nuages* renders the immutable aspect of the sky and the slow, solemn motion of the clouds, fading away in grey tones lightly tinged with white. (Simeone 2003, 104.)

### 2.2 Form

Debussy’s compositions unquestionably occupy a relevant position in the history of musical form. However, the composer himself not only denied any reference to traditional forms, but

<sup>1</sup> Lerdahl suggested the hierarchical analysis of the timbres of certain pieces using the paradigm of tree-like ramification (Lerdahl 1987, 154). This approach was taken on and discussed by other authors. However, in the case of Debussy it seems questionable whether this approach can be successfully implemented.

also refused to give hints concerning formal innovations in his music.<sup>2</sup> Innovations can be identified by engaging in the diversity and plurality of Debussy’s formal solutions. Sometimes his forms are clear-cut, with a precise articulation on the surface. In other cases, a fundamental ambiguity of conflicting formal strategies and discrepancies between form and other domains are established. Therefore, the question remains: how are we able to interpret form in Debussy’s music?

All this can be reflected by analysing *Nuages*: on the one hand, many listeners might perceive a tripartite form: departure, journey and return (A–B–A’). A quiet opening gradually intensifies and finally leads into the enigmatic colours of the last bars. On the other hand, there are expedient alternatives to the tripartite model. Analysis shows that the A–B–A’-design is merely a part of a complex network of formal and structural strategies. One aspect of this network was discussed by James Hepokoski: ‘the conventional ABA’ impression is present only secondarily, albeit significantly, as a telling side-effect of the more generating rotational principle’ (Hepokoski 2010, 14). This sounds plausible, but for many listeners it is the A–B–A’ form which remains in the foreground.

### 2.3 Timbre

In this situation, it helps to consider timbre as an additional factor. In doing so, we may be able to implement a critical discussion about the inner life and vivid tensions of Debussy’s musical forms.

*Nuages* is as an important step in Debussy’s preoccupation with orchestral timbre — from *Prélude à l’après-midi d’un faune* (1894) to *Nocturnes* (1897–99), *La mer* (1903–05), *Images* (1905–1908, 1912), and finally *Jeux* (1912–13). In the case of *Nuages*, the relevance of colours was confirmed by the composer himself, as quoted above in the introductory note (‘grey tones lightly tinged with white’). On another occasion, in conversation with Paul Poujaud, Debussy mentioned the experience of ‘the effects of clouds on the Seine at the Place de la Concorde’ (Herlin 1999, xiii-xiv) and its influence on *Nuages*. In a further well-known statement, Debussy said that music consists of ‘colours and rhythmicised time’ (Lesure and Nichols 1987, 184). This underlines the major importance of colour in Debussy’s music. It is obvious that *Nuages* is a study of the different nuances of colours, and — if we accept this analogue — a study of musical timbre.

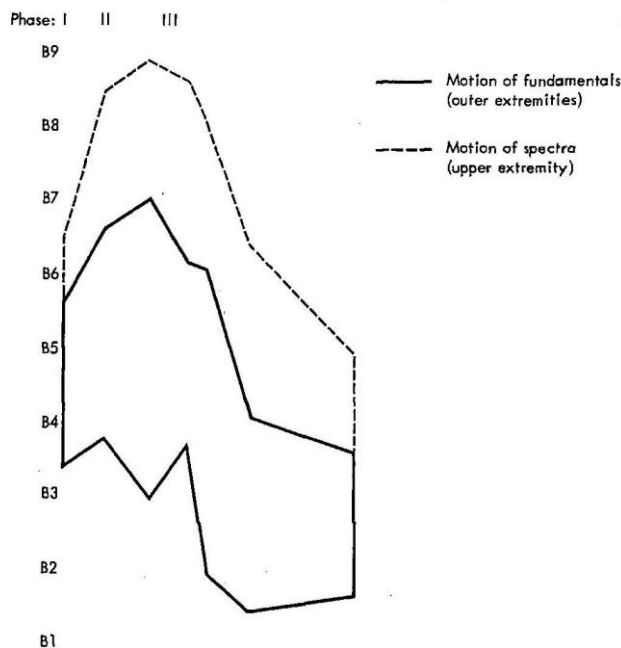
### 2.4 Robert Cogan’s Analysis of *Nuages*

In 1984, Robert Cogan presented an attempt to analyse *Nuages* from the perspective of timbre. This analysis is part of his extensive book *Sonic Design*, in which properties of timbre are considered without using software — sonograms etc.; of course, in the 80s, analytical software tools were not widely developed. Cogan prefers a mode of analysis ‘that accounts for the complete sound of music. It recognises sound’s many supranotational elements’ such as ‘spectra, attack and incidental noise, interference phenomena, and tone modulation’ (Cogan 1976, 397).

In his analysis of *Nuages*, he considers many factors that lead to a global perception of the piece from the perspective of timbre. First, he describes the process of registral

<sup>2</sup> See e.g. the quoted letter above. Instead of relating to the traditional form of the Nocturne, Debussy emphasises impressions and effects of light.

change (Cogan 1976, 390: Here, the principal motion of *Nuages* through six different registers is reproduced). On p. 393, Cogan summarises this motion graphically (Example 1).



Ex. 1. Registrational Change in *Nuages* (after R. Cogan).

In a further step, he elaborates on the acoustic properties of orchestral sound and distinguishes different phases. The piece opens with phase 1: in the beginning, a pure quality of sound is dominating which reminds us of sine wave tones (see p. 387: phase 1 is identical with stage 1). In phase 2, the intensity of the higher partials, roughness and brightness increase. Phase 2 consists of stages 2 (p. 387), 3 and 4 (p. 388) where Debussy begins to use divided writing and doublings for strings and woodwinds. In phase 2, the higher interference of partials is a result of the higher tessitura, full instrumentation, but also of the *divisi* setting. In phase 3, spectral intensity decreases again — see stage 5, p. 388, where the divided writing for strings continues, but in *pp* dynamics, and also stage 6, p. 389 (here we observe the same), and stages 7–8a and 8b where discrete pitches are clouded, leading to a high relevance of noise.

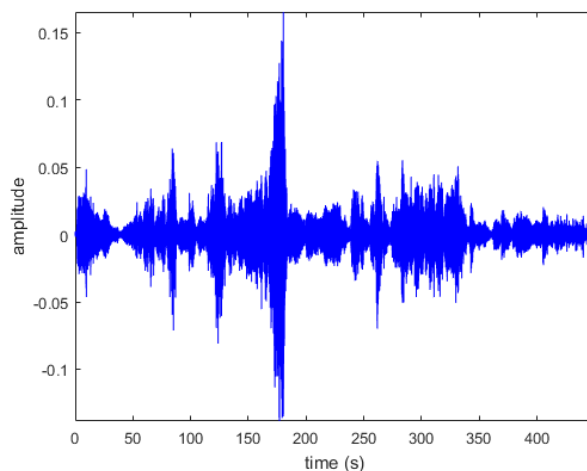
If we consider the overall curve of brightness and roughness, we see that brightness and roughness are most intense in the middle phases of the piece (see Example 2: spectral brightness, and Example 3: spectral roughness; both of these MIRtoolbox-graphs relate to the Ashkenazy recording).

## 2.5 Timbre Analysis of *Nuages* with Support of the Software MIRtoolbox

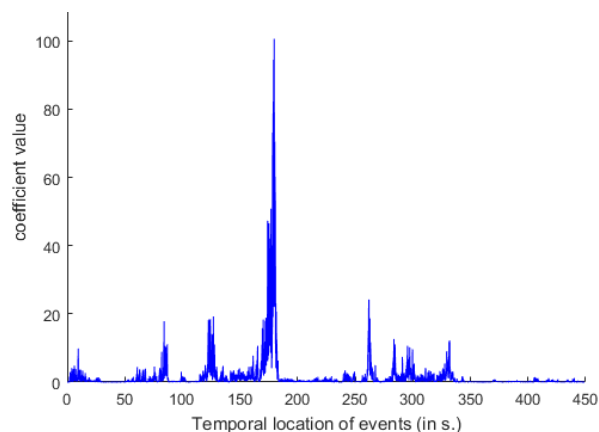
In this paper, I will complement Cogan's approach by generating timbre analyses with the software MIRtoolbox (Lartillot 2007). In order to manage the complexities of sonogram analysis and to exclude accidental misinterpretations, four recordings of *Nuages* by Vladimir Ashkenazy, Pierre Boulez, Roger Désormière and Arturo Toscanini are analysed and compared:

- Arturo Toscanini, NBC Symphony Orchestra, 1953, RCA Red Seal;

- Roger Désormière, Czech Philharmonic Orchestra, 1961, Supraphon SUM 30026;
- Pierre Boulez, Cleveland Orchestra, 1995, DG 6375943 ;
- Vladimir Ashkenazy, Cleveland Orchestra, 2000, Decca 467428.



Ex. 2. Spectral brightness in *Nuages*.



Ex. 3. Spectral roughness in *Nuages*.

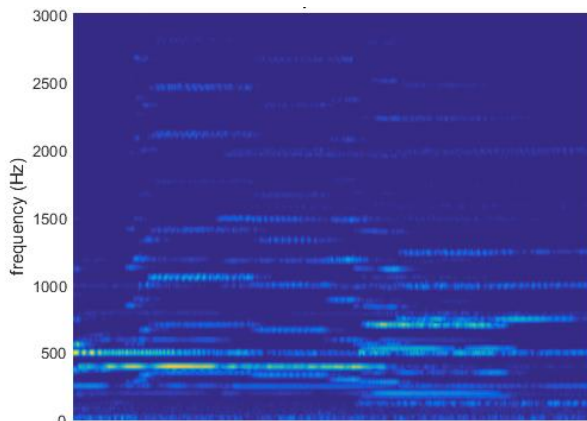
This comparative process of analysing and listening from the perspective of timbre leads to the following results: at the beginning and end of this piece an ambivalent quality of sound dominates. Two different focal areas of harmony are present which relate to the central pitches g and b, with neither of these harmonic poles being given any clear preference or stability. This ambivalence is supported by the refined use of timbres.

The piece begins with the fifth B–F $\sharp$  (bar 1). The harmony of the first two bars can be traced back to a modal scale based on B. In bar 3, a process of chromatic voice leading leads to another fifth based on G (G–D). This change of harmonic orientation is continued in bar 5, where the third G–B is reached in the clarinets and bassoons. Here, the French horn plays a signal motive, which returns several times in the course of the piece — always on the same pitches: C $\sharp$ , D, E and F ascending, and then descending again. In his analysis, Bruno Plantard pointed out the contrast between the opening (based on the fifth B/F $\sharp$ ) and the following passage (bars 5–10, based on the tritone B/F; Plantard 2004, 166). In this context, let us now discuss selected timbre analyses of the passage bars 5–8, beginning with the Ashkenazy recording (Example 4a).



The sonogram analysis of the seconds 16–32 shows that in this recording the pitch  $G_4$  at about 400 Hertz is most intense.<sup>3</sup> In bar 6, the  $G_4$  is played by the flute — the  $G_4$  of the clarinet, bar 5, is continued here. The  $G_3$  of the horn which is played one octave below, *should* actually be more intense — the partial richness of the horn is high —, but obviously the first partial of the horn combined with the flute leads to the resulting strong  $g_4$ . Another reason might be the fact that the main formant of the horn is situated at about 340 Hertz (Jordan 2007, 31), and  $G_4$  is near to this focal point ( $F_4 = 349$  Hertz;  $G_4 = 392$  Hertz). Therefore, during the first six bars the orientation turns from  $b$  to  $g$ , which is confirmed by close listening.

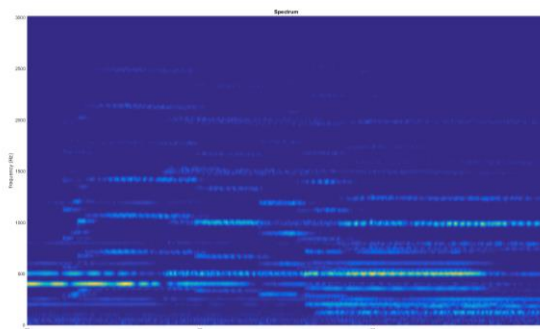
When the muted strings enter, the situation changes: the clarinets play  $G/B$  — actually not as a third, but as a tenth  $G_3$  —  $B_4$ . The  $G_4$  is played by a small number of the violins, but the instruments are muted, and therefore the sound is less intense. There is an octave doubling ( $G_3$ – $G_4$ ) with the second clarinet, but the support from below is weak because the formant region of the clarinet is much higher than  $G_4$ . As far as the intensity of partials is concerned, the interconnection of clarinet and muted string instruments is not strong, and  $G_5$ , which is also played by the muted violins, is likewise not in the foreground. The  $B_4$  is stronger because it is played by the first clarinet and reinforced by the first partial of the French horn ( $B_3$ ). Moreover, this sound is complemented by a timpani roll on  $B_2$ , and by the  $b_6$ , which is present in the upper voice of the muted violins. Consequently, at second 26 of the Ashkenazy sonogram,  $B_4$  (at about 500 Hertz) is more intense than  $G_4$  (at about 400 Hertz). Additionally,  $F_5$  (at about 700 Hertz) is important — this is the first and third partial of the bassoons, which play  $F_3$  and  $F_4$ .



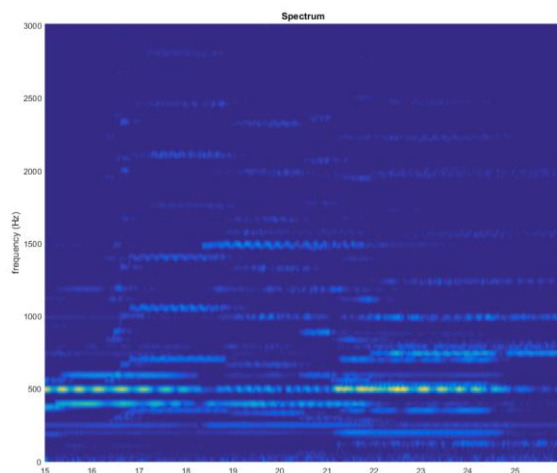
Ex. 4a. Sonogram of the Ashkenazy recording, sec. 16–32.

If we compare the four recordings, there is a similar result in the Désormière sonogram (Example 4b): during the analysed passage,  $B_4$  and also  $B_5$  become stronger than  $G_4$ . In the Boulez sonogram,  $B_4$  is intense from the beginning of the analysed passage — there is a strong third  $G_4$ – $B_4$  in bar 5–6 —, and thereafter, the intensity of  $g$  also weakens;  $B_4$  remains in the foreground (Example 4c). Due to the analogous instrumentation of  $G_4$  and  $B_4$  in bar 6 — horn and flute are combined —, no reason actually exists for a different intensity of the pitches. Differences are obviously motivated only by nuances of interpretation.

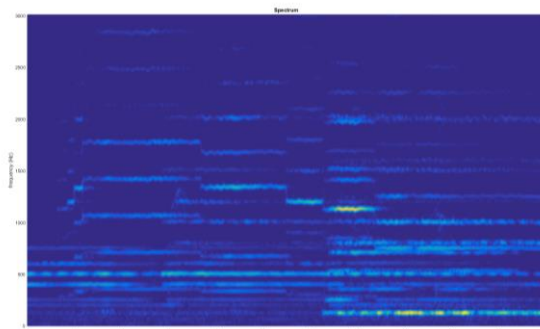
<sup>3</sup> For the discrimination of the octaves, not German notation, but scientific pitch notation is used.



Ex. 4b. Sonogram of the Désormière recording, sec. 20–35.



Ex. 4c. Sonogram of the Boulez recording, sec. 15–26.



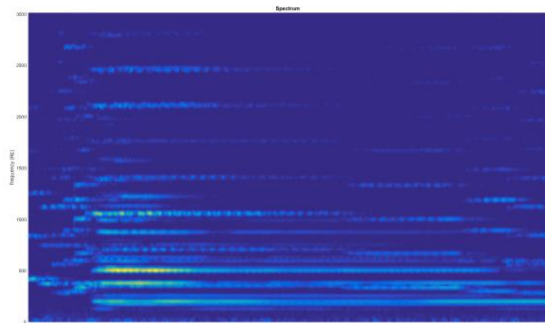
Ex. 4d. Sonogram of the Toscanini recording, sec. 15–26.

In the Toscanini sonogram, we arrive at the same result (Example 4d), as far as  $G_4$  and  $B_4$  are concerned. However, there are different accentuations of timbre in deeper and higher frequencies from bar 7 onwards — but we should remain cognisant that such differences may arise as a result of recording techniques, or of recording quality, especially when dealing with historical recordings.

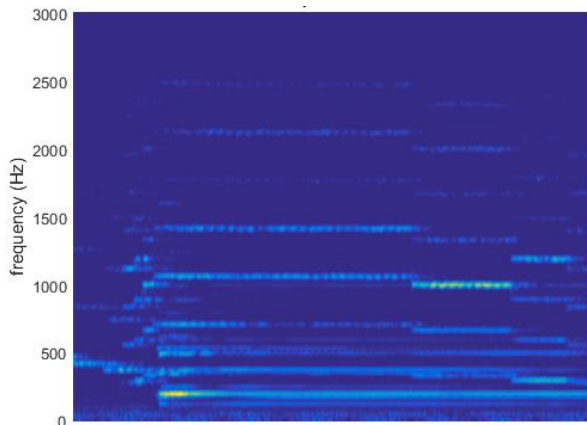
Altogether, the balance of timbre is quite diverse across the four recordings, but there are also some common properties: in bar 5, the pitch  $G_4$  is strong. With the entrance of the muted strings in bar 7, it loses its intensity. As a result, we perceive an ambivalent situation: the first two bars are based on the pitch  $B$ , and in the following bars,  $g$  comes into the foreground. This passage can be analysed by reference to an acoustic mode on  $g$ . However, sonogram analysis and close listening suggest that from bar 7 onwards the base of this mode ( $G$ ) is weakened because the pitch  $B$  is more intense. This leads us to the question of whether this passage is orientated towards the central pitch  $B$  or  $G$ . Obviously, there is no simple answer: in bars 7–8,

the ambivalence of B/G is not only prolonged, but also reinforced. This leads to the conclusion that the first eight bars tend toward an ambiguity of sound which can be listened to in different ways.

In the middle passages of the piece, Debussy prefers harmonic constellations which sound warmer than the beginning — e.g. textures based on parallel voice leading (ninth and eleventh chords over G and B minor triads). A further passage which is based on a pentatonic scale over D $\sharp$  (bar 64ff.) is crucial as a counterbalance to the colours of the beginning.



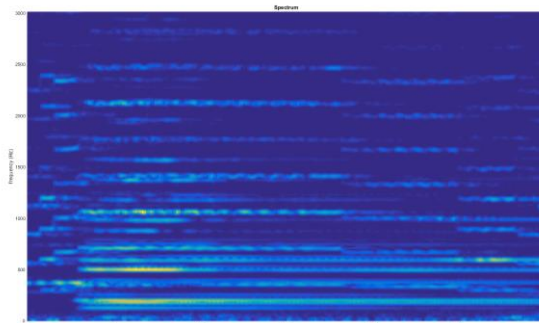
Ex. 5a. Sonogram of the Ashkenazy recording, sec. 341–52.



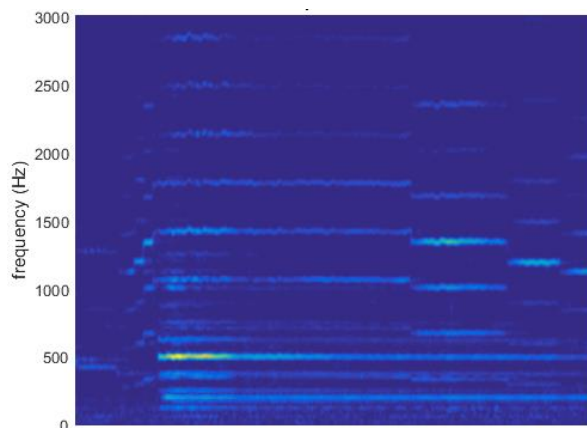
Ex. 5b. Sonogram of the Désormière recording, sec. 335–46.

The final part (bar 80ff.) can be called a ‘recapitulation’ in some respect.<sup>4</sup> Due to different aspects of harmony, melody, rhythm and timbre, the listener is reminded of bars 5–8, which have already been analysed above. However, the sonogram of the Ashkenazy recording (Example 5a) suggests that there is a decisive difference between these passages: from the beginning of bars 80–82, B<sub>4</sub> (about 500 Hertz) is stronger than G<sub>4</sub> (about 400 Hertz). This can be explained by the following: the bassoon is playing B<sub>2</sub>, and the third partial of this pitch is B<sub>4</sub>. The main formant of the bassoon is situated between G<sub>4</sub> and E<sub>5</sub> (Mertens 1975, 57) with the centre A<sub>4</sub>. Therefore, B<sub>4</sub> is near to the centre of the bassoon formant zone, and this may contribute to its high intensity.

<sup>4</sup> This formal sound design brings Wagner’s *Tristan prelude* into mind, where the beginning and the end are dominated by enigmatic woodwind sounds, in contrast to the middle passages where a powerful orchestral upsurge is dominated by the strings and brass.



Ex. 5c. Sonogram of the Boulez recording, sec. 290–96.



Ex. 5d. Sonogram of the Toscanini recording, sec. 277–86.

If we compare the sonograms of the Ashkenazy, Boulez, Désormière and Toscanini recordings, we retrieve similar results: in the Toscanini sonogram (Example 5d), B<sub>4</sub> is also more intense than G<sub>4</sub>. In the Boulez sonogram (Example 5c), not only B<sub>4</sub>, but also B<sub>2</sub> is emphasised. And finally, in the Désormière sonogram (Example 5b), B<sub>2</sub> dominates. The pitch B<sub>4</sub> is dominant in three of the four sonograms (5a, 5c and 5d), even if it sounds only ‘virtually’ — as the third partial of the B<sub>2</sub> of the bassoon —, in contrast to bar 6, where the B<sub>2</sub> is played by the flute, but does not have significant effects on the timbral hierarchy. This confirms the previously outlined view that at the beginning and end of *Nuages*, there exists a fragile balance between different focal areas of timbre (mainly B and G) which depends on changing overtone relations.

Another interesting fact lies in bar 80, where the French horn plays F<sub>4</sub>. In the Ashkenazy sonogram we observe a high intensity of C<sub>6</sub>, the second partial of F<sub>4</sub>, at about 1050 Hertz. This partial is situated in the formant region of the French horn — which extends from G<sub>5</sub> to E<sub>6</sub> with the centre B<sub>5</sub> (Mertens 1975, 49). Therefore, not only B<sub>4</sub> is intense, but there is an additional conflict between B<sub>4</sub> (500 Hertz) and C<sub>6</sub> (1050 Hertz) which may contribute to the dissonant effect of this sound constellation. The close relationship between the bars 5–8 and 80–82 could therefore also be explained by this ‘timbral dissonance’ which forms a link between the two passages (B<sub>4</sub>/F<sub>5</sub> and B<sub>4</sub>/C<sub>6</sub>).

In the following bars, the mentioned harmonic constellations remain, albeit with modifications: in bar 84, b<sub>2</sub> is omitted, and the French horn motif (C $\sharp$ <sub>4</sub>, D<sub>4</sub>, E<sub>4</sub>, F<sub>4</sub>) plus the F<sub>3</sub>/G<sub>3</sub> of the clarinets remain. In bar 88, the B<sub>2</sub> (tremolo of the celli and timpani) and B<sub>3</sub> (French horn) change their harmonic function again — now the b is situated over D<sub>2</sub>/E<sub>2</sub> of the celli and double basses. Tremolo and timpani sound increasingly dominates.

Bars 94 (g1 in the double basses) and 98 (flute motif) remind us of the idyllic middle section (bars 64ff.). However, the piece ends with the B played by the strings and timpani. Thus, the ambivalence of B/G is continued into the final passage.

### 3. CONCLUSION

The sonogram analyses presented here demonstrate that the beginning and end of *Nuages* are characterised by timbre constellations which fluctuate between the central pitches B and G. In respect to harmony and sound, these passages are ambivalent.

Given these findings, it is crucial to draw the right conclusions. Certainly, this exemplified ambivalence might tempt us to simply call this treatment of sound ‘mysterious’ or ‘inscrutable’: ‘Debussy, c’est l’énigme’. However, it should be considered that these ambiguities are composed out with utmost precision, or, as Vladimir Jankélévitch has formulated it:

While every secret is obscured by complication and shadowy depths, with Debussy everything is open because his mysteries are clear. *Debussy is mysterious, but he is clear.*<sup>5</sup> (Jankélévitch 1976, 17.)

This insight, which is confirmed by sonogram analysis in this text, might also lead to a new reflection of the question of form. If we locate and describe sound constellations and their precisely defined properties, we should also be able to compare different formal sections that feature similar properties of sound. By doing that, we realise that Debussy’s forms consist of elements which are not merely juxtaposed, but complexly connected and interwoven.

In the case of *Nuages*, it may make sense to re-evaluate the A–B–A’-form by connecting its conventional formal design to the inner properties of timbre. By realizing that bars 5–8 and 80–82 are characterised by a specific ambiguity of sound, we recognise that sound qualities and their relationship to form and listening are at the core of Debussy’s music.

There are conclusions that ultimately reach even further. Timbre analysis allows for re-evaluation of the term ‘impressionism’ and its misinterpretation as vague pointillism.<sup>6</sup> This implies the implementation of a perspective which does not rely on our intuition exclusively, but which is informed by current timbre research.

### KEYWORDS

Form, Musical Perception, Timbre.

### REFERENCES

- Brown, Matthew, 1993. ‘Tonality and Form in Debussy’s *Prélude à L’après-midi d’un faune*’, *Music Theory Spectrum* 15/2: 127–43.
- Chowning, John, 1973. ‘The Synthesis of Complex Audio Spectra by Means of Frequency Modulation’, *Journal of the Audio Engineering Society* 21: 526–34.
- Clevenger, John R., 2001. ‘Debussy’s Rome Cantatas’, in Jane F. Fulcher (ed.), *Debussy and His World*. Princeton (NJ): Princeton University Press, 9–98.
- Cogan, Robert, and Escot, Pozzi, 1976. *Sonic Design: The Nature and Sound of Music*. Englewood Cliffs (NJ): Prentice-Hall.
- Cox, David V., 1974. *Debussy Orchestral Music*. London: BBC Publications.
- Eimert, Herbert, 1957. ‘Debussys *Jeux*’, *Die Reihe* 5: 5–22.
- Forte, Allen, 1991. ‘Debussy and the Octatonic’, *Music Analysis* 10: 125–69.
- Grey, John M., 1977. ‘Multidimensional Perceptual Scaling of Musical Timbres’, *JASA* 61/5: 1270–77.
- Hepokoski, James, 2010. ‘Clouds and Circles: Rotational Form in Debussy’s *Nuages*’, *Dutch Journal of Music Theory* 15/1: 1–17.
- Herlin, Denis, 1999. ‘Avant-propos’ in *Œuvres complètes de Claude Debussy*, vol. 3 (*Série V*). Paris: Durand.
- Howat, Roy, 1983. *Debussy in Proportion: A Musical Analysis*, Cambridge: Cambridge University Press.
- Jakobik, Albert, 1977. *Claude Debussy oder Die lautlose Revolution in der Musik*. Würzburg: Konrad Tritsch Verlag.
- Jankélévitch, Vladimir, 1976. *Debussy et le mystère de l’instant*. Paris: Plon.
- Jumeau-Lafond, Jean-David, 2012. ‘Du côté de l’ombre: Debussy symboliste’, in *Debussy: la musique et les arts*. Paris: Musée de l’Orangerie/Musée d’Orsay/Skira Flammarion, 56–69.
- Jordan, Andreas, 2007. *Akustische Instrumentenerkennung unter Berücksichtigung des Einschwingvorgangs, der Tonlage und der Dynamik*. PhD diss. Wien: University of Music and Performing Arts.
- Lartillot, Olivier, and Toivainen, Petri, 2007. ‘A Matlab Toolbox for Musical Feature Extraction from Audio’, *Proceedings of The 10th International Conference on Digital Audio Effects – DAFX-07*. (<[https://dafx.labri.fr/main/dafx07\\_proceedings.html](https://dafx.labri.fr/main/dafx07_proceedings.html)>, accessed 27/04/2023.)
- Lerdahl, Fred, 1987. ‘Timbral Hierarchies’, *Contemporary Music Review* 2: 135–60.
- Lesure, François, and Nichols, Roger, 1987. *Debussy Letters*. Cambridge (MA): Harvard University Press.
- Mertens, Paul-Heinrich, 1975. *Die Schumannschen Klangfarbengesetze und ihre Bedeutung für die Übertragung von Sprache und Musik*. Frankfurt am Main: Erwin Bochinsky.
- Muzzulini, Daniel, 2006. *Genealogie der Klangfarbe*. Bern: Peter Lang.
- Parks, Richard, 1989. *The Music of Claude Debussy*. New Haven (CT): Yale University Press.
- Plantard, Bruno, 2004. ‘Deux études du mouvement: *Nuages* et *Fêtes*’, in Maxime Joos (ed.), *Claude Debussy: jeux de formes*. Paris: Éditions Rue d’Ulm, 159–88.
- Pressnitzer, Daniel, and McAdams, Stephen, 1999. ‘Two Phase Effects in Roughness Perception’, *JASA* 105/5: 2773–82.
- Risset, Jean-Claude, 2014. *Écrits*, vol. 1 (*Composer le son: repères d’une exploration du monde sonore numérique*). Paris: Hermann.
- Simeone, Nigel, 2003. ‘Debussy and expression’, in Simon Trezise (ed.), *The Cambridge Companion to Debussy*. Cambridge: Cambridge University Press, 101–16.

<sup>5</sup> ‘Au lieu que tout secret est secret en complication et en ténébreuse profondeur, Debussy est patent parce que ses mystères sont clairs. *Debussy est mystérieux, mais il est clair*’. (Trans. Anne Ewing.)

<sup>6</sup> This misinterpretation has a long history. As far as we know, the first application of the term ‘impressionism’ to Debussy’s music can be found in Henri Delaborde’s report on *Nocturnes* (quoted after Clevenger 2001, 71): ‘One recognizes in his [Debussy’s] case a feeling for musical color, the exaggeration of which makes him too easily forget the importance of precision of design and form. It is strongly desired that he guard against this vague ‘impressionism’ that is one of the most dangerous enemies of truth in works of art. The first movement of the symphonic piece of M. Debussy is a sort of adagio prelude, of a reverie and affectation that lead to confusion’.

- Stockhausen, Karlheinz, 1963. 'Von Webern zu Debussy: Bemerkungen zur statistischen Form', in *Texte zur elektronischen und instrumentalen Musik*, vol. 1. Köln: Dumont, 75–85.
- Trezise, Simon, 1994. *Debussy: La mer*. Cambridge: Cambridge University Press.
- Zenck-Maurer, Claudia, 1974. *Versuch über die wahre Art, Debussy zu analysieren*. Munich/Salzburg: Verlag Katzbichler.