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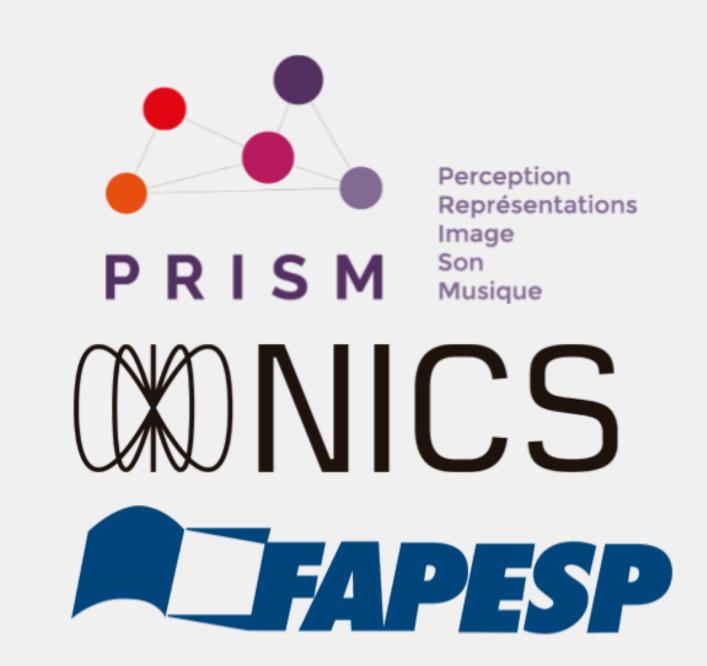
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# On the *Perceptual Fusion* in Grisey's *Partiels*: a Comparative Audio-Descriptor Analysis of Two Recordings

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#### The context

- Intermediary step of the ANTISCOPE PROJECT which aims to study the perceptual features of spectral music compositional strategies [1].
- This study focuses on *instrumental synthesis* [2] to investigate features related with *perceptual fusion* [3, 4, 5].
- The main goal is to generate audio representations [6, 7] enabling the development of a *sound* corpus to support empirical studies on orchestration.

### The research question

Far from being a fixed formula, though, each recording of Grisey's *Partiels* leads to different sensations in terms of *perceptual fusion*. That being the case, one might argue that an overlooked aspect of auditory fusion pertains to the domain of interpretation. Thus, *how could we take into account those unwritten features of the musical realization?* We propose an audio-based analysis approach [6, 7] to address this question.

### Theoretical background

- In the literature we find different elements related to perceptual fusion, such as:
- Acoustical properties linked to spectral features, like the spectral centroid; to spectrotemporal features, such as the spectral flux; and with the similarity of temporal features, like the attack time [3].
- Psychoacoustical features linked with the neurosensorial properties of hearing are involved in the process of fusion, like tonal fusion, masking, and co-modulation of pitch, among others [4].
- Analytical elements of the sound signal, as the sense of fusion is dependent on the synchronization of modulations in sound spectra, afforded by elements of musical performance such as vibrato or tremolo [5].

### Methods

The analytical procedure consisted in:

- 1. Segmentation of the audio according to Grisey's score.
- 2. Subdivision of each segment in 2 parts (trombone and bass attacks vs. ensemble textures) by using sound flux data.
- 3. Audio feature extraction according to **Table 1**
- 4. Human-conducted comparative analysis and evaluation.

Audio descriptors	Definition	Interpretation
Spectral Flux	Rate of change of the spectral content, computed by the $L_p$	Detections of onsets in
	norm of the difference of two adjacent fft window analysis [8]	the musical texture
Spectral Flatness	Computes the level of randomness in the sound signal	Noise level in the
	through entropy estimation [9]	musical texture
Spectrogram	Time-frequency representation of audio computed by	Spectrotemporal description
	the Short-time Fourier transform	of the musical texture

Table 1. Audio descriptors and analytical interpretation.

We argue these three audio representations provide clues for an exploratory approach to the sense of *perceptual fusion* in the musical texture. Thus, the stronger the level of *musical onsets*, the higher the *noise content*, and the higher the *dissimilarity between microtemporal fluctuations*, the lower the tendency of the musical texture to afford the sense of *perceptual fusion*.

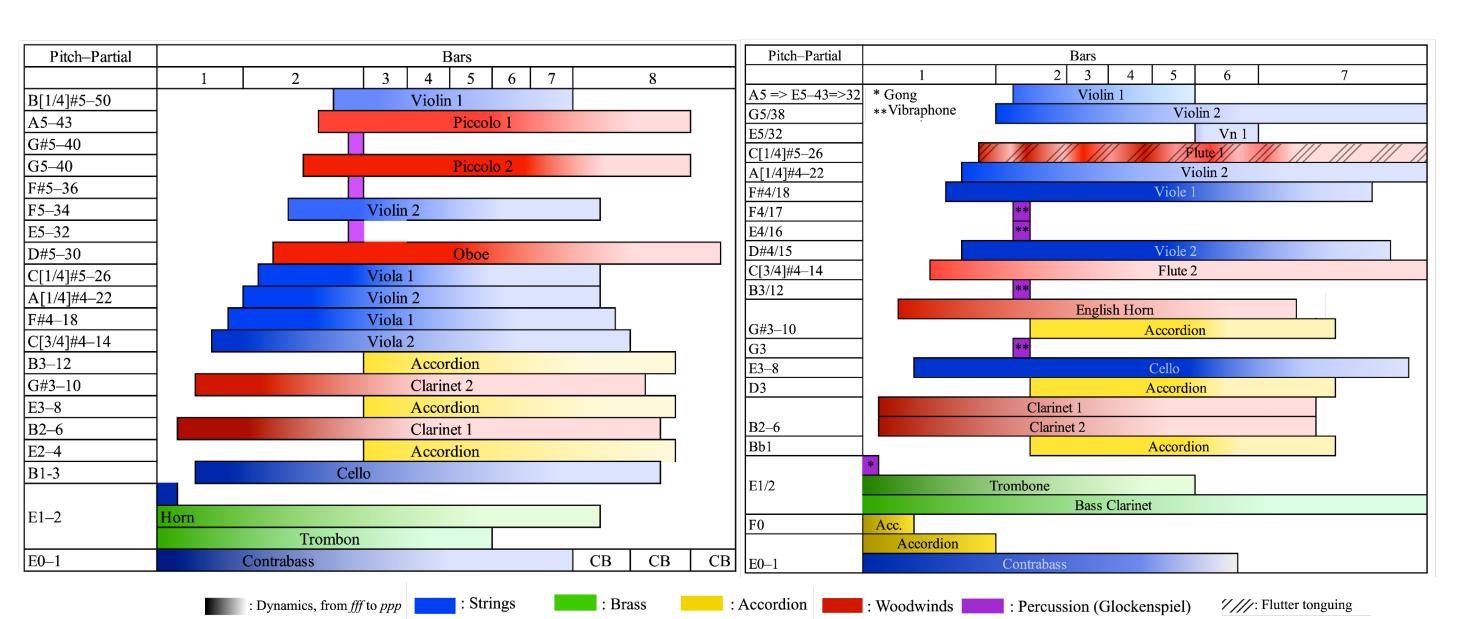
By studying the performance through the recordings, we are aware that our analysis engages with features from both the composition, performance and musical production [10]. The 2 chosen recordings are:

	Album	Ensemble	Date
Recording 1	Gérard Grisey – Les Espaces Acoustiques	Ensemble Court-Circuit	1999
Recording 2	Gérard Grisey – Les Espaces Acoustiques	Asko Ensemble	2005

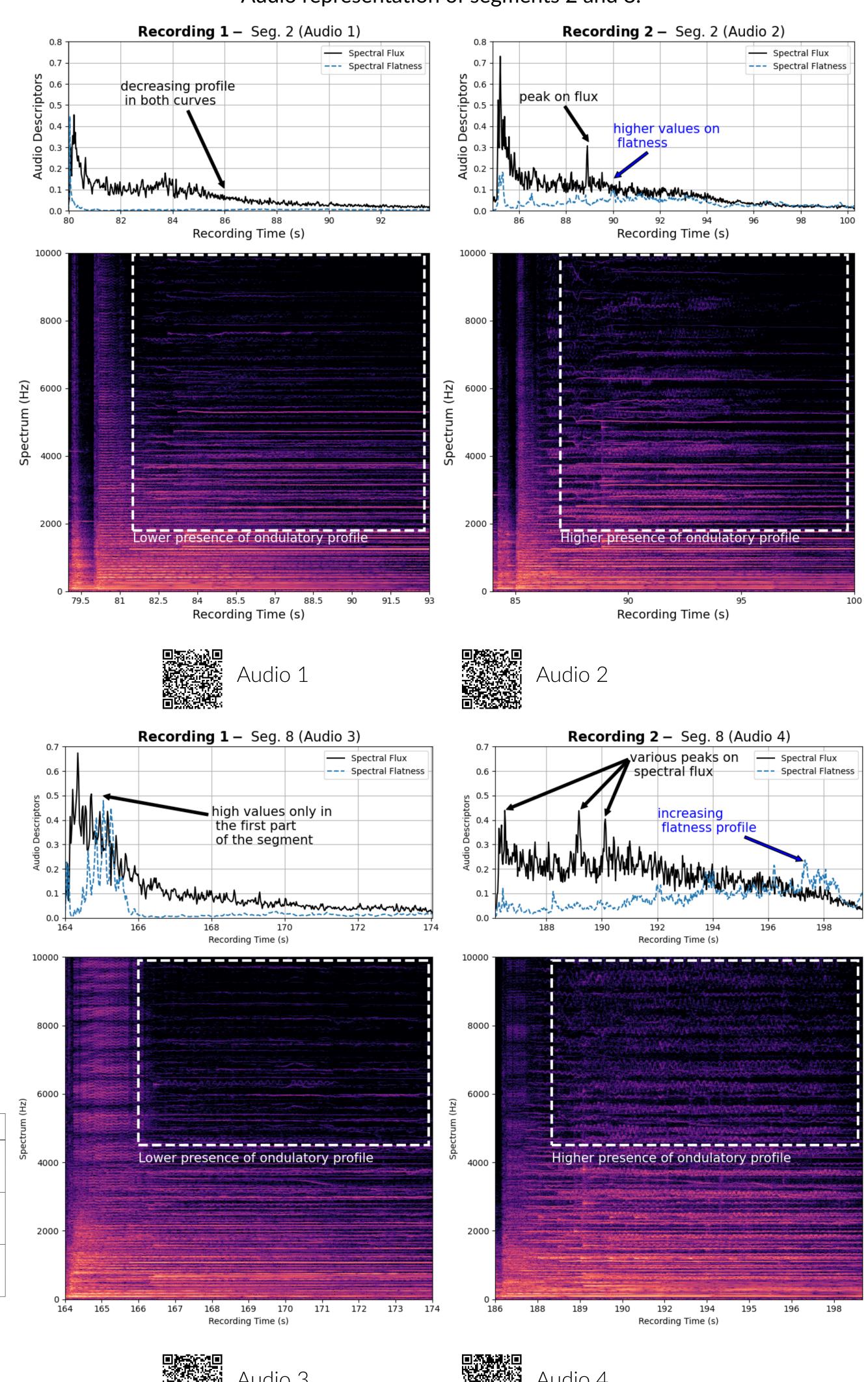
Table 2. Album, ensemble, and date of the chosen recordings.

# Results

# Score-based symbolic representation of segments 2 and 8.



#### Audio representation of segments 2 and 8.



By analyzing these audio representations, we may notice that a higher sense of perceptual fusion is afforded by Recording 1 while Recording 2 explores more variety and novelty in the musical texture.

Conclusion

- These preliminary results show that it is possible to identify some audio representations that are significant to an exploratory approach to *perceptual fusion*, offering new insights into musical analysis and interpretation studies.
- Future steps need to expand the analytical *corpus* and audio feature data to obtain perceptually relevant fusion-related representations.
- Additional analyses combined with sound synthesis and listening tests might also provide new intuitive controls of fusion between sound sources and textures, which is not only of interest for musical composition but also for sound design and other related areas.

# References

- [1] F.-X. Féron, "Gérard Grisey: première section de Partiels (1975)," *Genesis*, pp. 77–97, Oct. 2010.
- [2] G. Grisey, "À propos de la synthèse instrumentale," in *Écrits*, Paris: Éditions MF, 2e édition ed., 2019.
- [3] M. Goodchild and S. McAdams, "Perceptual Processes in Orchestration," in *The Oxford Handbook of Timbre* (E. I. Dolan and A. Rehding, eds.), pp. 496–524, Oxford University Press, 1 ed., June 2018.
- [4] D. Huron, "Tone and Voice: A Derivation of the Rules of Voice-Leading from Perceptual Principles," *Music Perception: An Interdisciplinary Journal*, vol. 19, pp. 1–64, Sept. 2001.
- [5] J. Chowning, "Perceptual Fusion and Auditory Perspective," in *Music, Cognition, and Computerized Sound: An Introduction to Psychoacoustics* (P. R. Cook, ed.), pp. 261 275, Massachusetts: The MIT Press, 1999.
- [6] M. Antunes, G. Feulo, M. Queiroz, and J. Manzolli, "A psychoacoustic-based methodology for sound mass music analysis.," in *Proceedings of*
- the 15th International Symposium on Computer Music Multidisciplinary Research, (Tokyo), pp. 135 144, 2021.
- 7] D. Rossetti, M. Antunes, and J. Manzolli, "Musical Analysis of Sound Feature Emergences Using Acoustic and Psychoacoustic Descriptors.," Revista Musica Hodie, vol. 22, 2022.
- [8] S. Dubnov, "Generalization of spectral flatness measure for non-gaussian linear processes," *IEEE Signal Processing Letters*, vol. 11, no. 8, pp. 698–701, 2004.
- [9] S. Böck and G. Widmer, "Maximum Filter Vibrato Suppression for Onset Detection," in *Proc. of the 16th Int. Conference on Digital Audio Effects* (DAFx-13), (Maynooth), pp. 1 7, 2013.
- [10] S. Zagorski-Thomas, The musicology of record production. Cambridge University Press, 2014.