Predicting expressive timing and perceived tension in performances of an unmeasured prelude using the IDyOM model

Bruno Gingras[*#1], Meghan Goodchild[#2], Roger Dean[†3], Marcus Pearce[+4], Geraint Wiggins[+5], and Stephen McAdams[#6]

[*] *Department of Cognitive Biology, University of Vienna, Vienna, Austria*
[#] *CIRMMT, Schulich School of Music, McGill University, Canada*

[†] *MARCS Auditory Laboratories, University of Western Sydney, Australia*

[+]*School of Electronic Engineering and Computer Science, Queen Mary, University of London, United Kingdom*
[1]bruno.gingras@univie.ac.at, [2] meghan.goodchild@mail.mcgill.ca, [3]roger.dean@uws.edu.au,
[4]marcus.pearce@eecs.qmul.ac.uk, [5]geraint.wiggins@eecs.qmul.ac.uk, [6]smc@music.mcgill.ca

ABSTRACT

Background

Following Kendall and Carterette's model (1990), listeners' responses to a musical performance may be modeled by taking into account both the musical structure conveyed by the score and the specific features of the interpretation. Unlike most musical genres in which the performer's interpretative freedom is constrained by the metrical structure provided by the score, the unmeasured prelude is a genre which does not specify a rigid metrical and durational structure, thus providing an ideal repertoire for investigating the links between musical structure, expressive strategies in performance, and listeners' responses.

Aims

Melodic expectations, tempo variations in performance, and perceived tension can be seen as exemplifying the three vertices of a relationship involving musical structure, expressive strategies, and aesthetic responses. The present study focuses on these three parameters and aims to describe the nature of their relationship, as well as quantify its individual components and assess their directionality.

Method

Twelve professional harpsichordists recorded two interpretations of the *Prélude non mesuré No. 7* by Louis Couperin on a harpsichord equipped with a MIDI console. Subsequently, 20 nonmusicians, 20 musicians, and 10 harpsichordists listened to these performances and provided continuous ratings of the perceived tension. Melodic expectation was assessed using the information content (IC: unexpectedness) and entropy (uncertainty) of a probabilistic model (IDyOM) whose expectations have been shown to match closely those of human listeners (Pearce & Wiggins, 2006). Time series analysis techniques were used to investigate predictive relationships between IC and entropy on the one hand, and the performance and perceptual parameters on the other.

Results

Unexpected musical events tended to be preceded by a slowing down in performance timing, whereas points of high probabilistic uncertainty about the next note were associated with high variability across performers in performance timing. Tempo variation was a significant predictor of perceived tension for both musicians and nonmusicians. Because melodic expectation, as modelled by IDyOM, was predictive of expressive timing in performance, a full chain of influence between the IDyOM parameters (unexpectedness and uncertainty) and the perceived tension was outlined.

Conclusions

This study combines an analysis of expressive strategies in performance, melodic expectations (as predicted by a computational model), as well as listeners' experience of tension in an attempt to characterize the interrelationships between these elements. Results show that, in a semi-improvisatory genre such as the unmeasured prelude, predictability of expectation based on melodic structure can be linked to expressive timing strategies as well as perceived tension.

Keywords

Performance; aesthetic perception; expectations; communication; information content

REFERENCES

Kendall, R.A., & Carterette, E.C. (1990). The communication of musical expression. *Music Perception*, 8(2), 129-163.

Pearce, M. T., & Wiggins, G.A. (2006). Expectation in melody: The influence of context and learning. *Music Perception*, 23(5), 377–405.