Testing Lerdahl’s Tonal Space Theory – Evidence from music recordings
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Introduction

This paper evaluates the potential of Lerdahl’s (2001) theory of musical tension developed in Tonal Pitch Space (TPS) as an explanatory instrument for the production of expressive timing and dynamics in the performance of tonal music. In addition, the results are compared with Smith and Cuddy’s (2003) perceptual study focusing on the same piece (Waldstein Sonata, 2nd movement), in order to ascertain whether the same conceptual framework underlies both the listener’s expectations and performance decisions.

The study of performed expressive timing and dynamics (e.g., Repp 1992a; 1992b, Clarke 1988, Gabrielson 1987, and Palmer 1992), as well as models of expressive performance (e.g., Todd 1985; 1992, and Widmer 1995) often relate expressive deviations to musical structure, as formalized in Lerdahl and Jackendoff’s (1983) A Generative Theory of Tonal Music. Lerdahl’s (2001) more recently published TPS constitutes a refinement of the former and the theoretical concepts offered proved to be powerful tools for empirical research, as indicated by preliminary investigation on the perception of musical tension.

Smith and Cuddy (2003), for example, conducted a perceptual analysis of an excerpt of Beethoven’s Waldstein piano sonata and compared it with the musical tension predicted by Lerdahl’s (2001) theory. They show that the expectations and perceived tension correspond to the profiles generated by the theory (Smith and Cuddy 2003:7). These results are confirmed by Vega (2003), who also shows a significant correlation between theoretical predictions and the perceived tension and melodic attraction of Mozart's Piano Sonata, K282 (measures 1-8) (see Vega 2003:35).

The ongoing research which is the basis for the current paper examines the timing and dynamics profiles of 25 recordings of Beethoven’s Waldstein Sonata (second movement) by world-class pianists, analysing them in terms of the musical tension predicted by Lerdahl’s (2001) theory. Final results, to be announced at the ESCOM meeting, offer a perspective on the effectiveness of TPS as an instrument for investigating the criteria underlying performed expressive deviations.
Methodology

The same musical material used by Smith and Cuddy (2003) was adopted – the initial eight measures of Beethoven's piano sonata Op. 53 (Waldstein). The musical text was segmented into thirteen events ranging from three to seven crotchets, according to Lerdahl and Jackendoff’s grouping structure.

Twenty commercially available digital recordings of this text by world-class pianists were analysed. Timing and dynamic data were obtained with recourse to standard sound editing software and compared to Lerdahl’s theoretical model of tension and attraction developed in Tonal Pitch Space. For every one recording, timing and dynamic data were averaged for each of the thirteen events and compared to Lerdahl’s predicted values of attraction and local and global tension using standard statistical tools (Pearson’s correlation coefficient).

Results and discussion

Overall, preliminary results show significant relations between timing and dynamic data, on the one hand, and, on the other hand, between these data and predicted values of tension (local and global) and attraction. As a matter of fact, a strong negative correlation between timing and dynamics was verified as well as a positive strong correlation between attraction and dynamic data. For individual performances, dynamic data often exhibits strong positive correlation to attraction and global tension whereas timing often shows week negative correlation to local tension.

These results agree with Smith and Cuddy (203) who tested Lerdahl’s theory from a perceptual perspective and can therefore be taken to confirm (as earlier established by Repp 1990, for example) that the same cognitive mechanism underlies both the production and the perception of expressive deviations.

In addition, Lerdahl’s refinement of generative theory (Lerdahl and Jackendoff 1983) developed in Tonal Pitch Space is shown to be of remarkable explanatory power regarding performer criteria used in the production of expressive timing and dynamics in tonal music.

References


