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How is the Production of Rhythmic Timing Variations Influenced by the Use of Mensural Symbols and Spatial Positioning in Musical Notation?

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ABSTRACT

Background

In the Western classical tradition musical literacy is commonly understood to involve proficient notation reading, with most musical opportunities relying on such a skill. The information conveyed through notation often provides one of the most important sources of reference for a performer, and the notational style can significantly affect their perception of a piece.

The notation of rhythm constitutes one of the most important musical parameters to be communicated from composer to performer. The prominent methods of representing rhythm in standard Western notation include use of mensural symbols and use of spatial layout, yet the use of space in standard Western notation is not altogether uniform. Although spaces between notes are relative (a minim being followed by a greater space than a semiquaver), this space is not generally equal to the proportional relationship of the note durations. Furthermore, a degree of irrelevant spatial information is included, such as the non-signifying distance between the barline and the downbeat. However, though there have been studies both into the visual comparison of space (Ward, 2006), and into the musical factors affecting timing variation in performance (Repp, 1992), the relationship between these two issues has not been previously considered.

Aims

To examine how notational layout and style influences the performer's realisation of the work, specifically in relation to tempo and rhythmic performance.

Method

Four notational stimuli of an original melody were created, differing by degrees from traditional Western notation:

A

B

C

D

Two versions of standard Western notation were created with proportional note spacing (A and B), (A) being significantly more spread-out than (B). A version with equidistant note spacing was also created (C), and a version relying on space alone (D, rhythm being denoted by the extension of blocks through space, as in a piano-roll and common in avant-garde notations).

Participants were asked to read a text on music analysis interspersed with musical extracts, to which they were to tap the rhythm on an electronic drum pad (connected to Logic Pro, which recorded the rhythmic taps in midi format, subsequently converted to durational information via Matlab). For each page of text participants were given two minutes to read the information, and for each section of notation were instructed to begin playing immediately. Participants were falsely told they would be tested on their memory of the article afterwards in order to conceal the main focus of the experiment.

19 participants undertook this study, with musical training level varying between 4 and 17 years of study.

Results

For overall examination, participants' spontaneous starting speeds for each condition were calculated based on their performance of the first three crotchets (no metronome was used, hence different speeds were chosen by each participant). Extract D was found to be performed slower than any of the other three notations by at least 0.2 seconds per crotchet, all other extracts' average crotchet-lengths falling within a window of 0.013 seconds. Furthermore, the speed chosen for extract D was more variable between participants than the speed of any of the other notations.

For the examination of note-to-note rhythmic variation, individual note-lengths between transcriptions were studied. This was done by converting the tapping times and derived note-lengths for each condition into percentages of total performative duration. This normalised the data and allowed both within- and between-subject comparisons to be drawn. Additionally, as most participants varied in tempo throughout each performance, their estimated timings were calculated (again as percentages) taking acceleration into account. Acceleration was regularised to be consistent across each performance which, despite smoothing some nuances of the data, allowed between-subject comparisons to be made. The timing of each note as actually performed was then compared to predicted timing, in order to find each note's variation from expectation. Data was compared across conditions.

As performance of extract D was so different to the performances of the other styles of notation, extract D was compared to the set of all three mensural notations combined (A, B, and C). Underestimates of long notes (minim or longer) were clearly evident for D, as well as greater variance from predicted length (Figure 3). Additionally, when semiquavers were considered, again a greater variance from predicted length was found for extract D, but also a tendency to *overestimate* length in performance, indicating a convergence toward the mean for both particularly sort and particularly long notes.

Comparison of extracts A, B, and C demonstrated that although spatial information alone is not enough to elicit absolutely even rhythmic performance, it nonetheless has a significant impact on performance of mensural notation. Eleven out of fifty-one notes were found to be played statistically significantly differently between the mensural notations. These differences in performance were dependent purely on notational layout, with the context of the notes and the space around them producing performative differences.

Conclusions

The layout of musical notation within a score significantly affects its realisation with respect to note duration in performance. Significant differences in performance were found depending purely on notational layout, with the context of the note symbols and the space around them producing notable performative differences. This occurred not only when a notation style providing 'appropriate' spatial information (A or B) was compared to a notational style in which spatial information did not provide additional rhythmic cues (C), but also when two notations providing different appropriate spatial cues (A and B) were compared. Several differences in rhythmic accuracy between transcriptions were found to occur at points in the score that the implied metre was disrupted; possibly indicating that notational layout has a greater effect on performance during metrically ambiguous sections, with cues relating to rhythm being relied upon more strongly than during predictable passages.

These results have significant implications for editors, composers, and performers. It is suggested that rhythmic timing accuracy depends directly on decisions made during the editing process, with different editions resulting in markedly different performances. The effect of spatial information within scores is an area requiring extensive further research, and a replication of this experiment using a smaller range of simple rhythms may tease apart the importance of space before and after note-symbols. Alternatively, the impact of non-standardised spatial information on performance could be studied, for example through bar-length changes between systems. Further research into this area as a whole could prove very relevant to the publication of notation, greatly informing editors and composers alike of the effects that their notational styles have on resulting performance.

Keywords

Music notation, performance, timing, rhythm perception, editing

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