The effects of performance space on expressive piano performance
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Aims and Objectives
Musicians claim to be sensitive to the acoustics of the spaces in which they perform, and to adjust their performances to the acoustics of a given space. Nevertheless this claim has not been strongly substantiated by research. There are few studies of the relationship of auditory feedback to musical performance, and the overall results of these would seem to indicate that the presence or absence of auditory feedback makes at most a small difference to pianists' performance (Repp 1999, Finney 1997). This study attempts to investigate a yet more subtle issue: the way in which the acoustics of differing performance spaces may influence expressive performance by pianists.

Context
There is much literature on the nature of expressive musical performance (Palmer 1997). However, some areas remain unexplored. One of these is the way in which the acoustics of the performance space affect expressive performance, which highly skilled musicians consider part of the subtlety of their craft. It seems that most published studies of expressive performance deal with performances in small, acoustically controlled spaces, like recording studios, or even using instruments lacking the properties of normal concert instruments; the question then is open as to whether concert-level performance is being investigated. This study addresses directly the question of the influence of acoustic performance space on expert-level piano performance.

Methodology
The variable manipulated here was the kind of acoustic feedback given to the performer as a function of performance space. Highly trained pianists were used in this study, as these are the only kind of performers who are routinely aware of their acoustic environments and attempt to moderate their performances accordingly. All were students of at least doctoral level at Northwestern University, with an average of over 20 years of concentrated study in preparation for a professional performing career; many have in excess of 40,000 hours of deliberate practice. Two identical Yamaha MIDI Grand pianos (acoustic model C3, a 6'1" piano) with the Mark III Pro MIDI mechanism were used, calibrated so that the action and MIDI mechanisms were as similar as possible. Acoustic feedback was manipulated by the pianos' locations. One of the pianos was located in a
moderately sized recital hall, seating 400 people, with warm acoustics, used for piano recitals. The other piano was located in a vocal teacher's studio, a small, acoustically "dead" space. Pianists chose one of two well-known excerpts from late piano works of Brahms, either the final 20 bars of the E-flat major Intermezzo Op. 117 No. 1, or the final 41 bars of the A-Major Intermezzo Op. 118 No. 2. Each pianist had previously prepared the chosen excerpt for concert performance. These passages were chosen for their contrapuntal elements, their phrase structures, and variety of voicings, so that any differences in a number of significant performance parameters – balance of volume between voices, synchrony between voices, tempo rubato, and pedalling – would be apparent (cf. Palmer 1989). Pianists played the same excerpt on both pianos in three conditions: "normal," with the hammers hitting the strings in the usual manner and with the usual sound being produced; "silent," where the hammers are lifted from the strings so that the pianist has the same proprioceptive response from the piano action, but with no sound being produced, and "synthesised," in which the hammers are disconnected as in the silent condition, but with a small synthesiser producing a high-quality sampled piano sound through Sony 7506 headphones. Each condition was repeated until at least two satisfactory performances were obtained.

Results

As expected based on prior research, there were many similarities between the different conditions, including the silent and synthesised ones. This is not surprising, as the same musical structure is being communicated in all conditions. However, we did find influences of acoustic space in three primary areas: pedalling and length of key-press sustain, especially at the ends of phrases; chord asynchrony, especially at the beginnings of phrases, sections, and new thematic ideas, and tempo rubato, especially at the ends of major sections and in transitions where "pacing" was considered a critical musical issue. These differences are clearly apparent when attention is called to them but are often overlooked by listeners in their online summation of a performance. Thus, the influence of acoustic space is found in shaping expressive moments and details and not in the grand design of the performance.

An additional set of analyses, not reported here, uses a KEMAR dummy-head binaural microphone system to record the pianists' perception of their sound, by placing KEMAR at the performers' position and playing back the MIDI recordings on the pianos. We hope to understand the manipulation of "tone" or "warmth" as frequently mentioned by the pianists.
Key Contributions

Acoustic conditions make subtle but tangible differences in the ways in which expert pianists perform. Many aspects of skilled piano performance are controlled by the pianist's internal representation of the music and motor programs, resulting in limited effect of acoustic feedback. Nevertheless we do find an influence on experts' performances based on room acoustics. Only instruments as subtle as our MIDI grand pianos come close to revealing this. Only certain passages in the music were influenced by room acoustics, such as those in which the decay time of sounds was important (at the ends of phrases), and where pacing of ongoing musical materials was influenced by the acoustic interactions of instrument and performance space. These expressive details are nonetheless apparent to highly skilled listeners.

References


