Digital models of the piano sound have become increasingly realistic, either with deep-layered sample-based solutions or physical models of the instrument. Now, it becomes crucial for a digital piano model to provide an expressive response to performance control parameters. Those are widely carried by the MIDI communication protocol, which essentially limits performance information to timing and velocity. While it may suffice for adequately conveying broad traits of expressive piano performance, finer features like timbral nuances, achieved through subtle and largely intuitive playing variations, may be lost. Consequently, digitally reproducing performer-controlled timbral nuances may be impaired by the limitations of both the MIDI protocol and the responsiveness of piano-modeling algorithms.

This study examines this potential issue, by comparing the perception and identification of piano timbre nuances by expert listeners, between audio recordings and digital simulations of piano performances. For this aim, three pianists were asked to perform two short pieces with different timbral intentions (bright, dark, dry, round, and velvety). Audio and MIDI recordings were made. Digital simulations were created from the MIDI recordings, with the physical piano-modeling software Pianoteq, and also with the basic GarageBand sample-based model. Participants were then asked for a comparative identification of the five timbral nuances, for each type of audio stimuli (direct recordings and both digital simulations). The results indicated that expert listeners could successfully identify the timbral nuances in both the direct audio recordings and the high-quality physical-model simulations, but not so much in the coarser, sample-based simulations. Identification rates also varied between timbral nuances, with the patterns between the three types of audio stimuli correspondingly varying in range and spread. These results suggest that the limitations of the MIDI protocol may not impede the expression of piano timbre nuances, as long as digital performance simulations involve sufficiently realistic-sounding and responsive piano models.