Experimental Study of the Plectrum Shape and the Key Velocity on the Harpsichord’s Sound

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ABSTRACT

The sound of the harpsichord originates from the acoustic radiation of a soundboard excited by a vibrating string through coupling. The string is put into motion by a complex interaction with a plectrum. This small piece of feather or plastic catches the harpsichord makers’ and players’ greatest attention: The voicing process (working of the shape, dimensions and material or the plectrum) is a crucial stage of the making and adjustment of the instrument. Different geometrical and mechanical features alter indeed the initial conditions of the vibrating string, hence presumably the sound. The study presented here aims at investigating the influence of the musician’s gesture and the plectrum shape on the sound of the instrument. Different speeds of the finger on the key (0.05 m/s to 0.3 m/s), and four different plectrum shapes (manually carved, exaggerating features found in actual plectra) are investigated. A complete set of measurements is carried out for each speed / shape configuration during the plectrum / string interaction phase: microphones for the radiated sound, optical contactless sensors for the displacement and velocity of the string vibration, displacement sensor for the key depression, a high-speed camera for the plectrum deflection obtained by image processing and a robotic finger for pressing the key with different velocities. Whereas the speed at which the finger presses the key does not seem to have a strong influence, the results indicate a clear influence of the plectrum shape on its deflection, as well as on the initial conditions of the string (deduced from the string’s motion), and on the loudness of the sound.