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Influence of the bocal on the sound of the bassoon

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The bocal of a bassoon is characterized by geometrical parameters such as the bore, the outer contour and the wall-thickness as well as material parameters and the coating. Professional bassoonists select bocals extremely carefully and report influences on the playability and sound colour. In order to understand the underlying effects, several experiments were performed with bocals of the same bore bent in two different shapes and with two different materials. Images of a high-speed camera show a periodic motion of the bocal tip while the instrument is artificially blown. A modal analysis of the bocals was performed experimentally and numerically to investigate the dynamic behaviour of the structure. The first bending mode of the bocals is around 70 Hz. While the material properties shift the modal frequencies less than 2 percent, the shift due to the geometry is more than 10 percent. The experimental program included playing experiments with professional bassoonists. The setup was fixed and the players used the same reed. For each player, slight shifts in the sound spectra could be found due to the use of different bocals. The harmonic structure showed changes in the frequency bands where the bending modes differ.