



Pitch Flexibility of Brass Instruments

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To play a valved brass instrument in tune, the player must be able to bend the pitch with the lip. This study examines the influence of the structure of the instrument's impulse response on the extent to which the pitch can be bent. The impulse response of an easily playable brass instrument shows a reasonably well-defined pulse at one period of the nominal fundamental frequency of the instrument, corresponding to the propagation time from mouthpiece to bell and back. In an instrument where the frequencies of most of the strong air-column resonances are very close to integer multiples of the nominal fundamental, this reflected pulse is relatively tall in amplitude and narrow in time. In an instrument where these resonance frequencies depart more from multiples of the fundamental, the reflected pulse is somewhat lower and broader. The hypothesis tested here is that a lower, broader, reflection allows the player greater pitch flexibility than a taller, narrower reflection. This is studied in a numerical simulation combining a simple model of the lip with measured impulse responses of real instruments.