

Who Does Control the Attack Transients of the Recorder, the Musician or the Instrument Maker?

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ABSTRACT

Physical models of the recorder allow predicting their quasi-stationary behaviors. The evolution of sound qualities is predictable and well understood when control parameters, such as mouth pressure, evolve slowly compared to the response time of the instrument. However, the musician continuously varies his control to articulate the music. For example, during the attack transients, an abrupt increase of the supply pressure induces the progressive development of acoustic oscillations. The musician varies the characteristics of attack transients as a function of the musical context. The control of these attacks is therefore an essential aspect of learning to play the recorder and of making this instrument. There are few studies on recorder attack and they are generally only qualitative and/or focus on one specific aspect observed on few data. The first aim of this study is to identify and quantify the characteristics of the attack transients of recorder-like instruments in musical context in the temporal and spectral domains. The second one is to understand how the musicians and the instrument makers can control these characteristics.

Attack transients produced by one novice and two experienced players on four hand-made recorders (bass, alto, soprano and sopranino) are compared. This analysis leads to dividing recorder attack transients in two phases: the onset of the acoustic oscillation and its growth. The duration and the spectral content of the onset varies from one musician to another. A model is proposed to interpret the origin of the input of energy necessary to initiate the oscillation of the instrument. During its formation, the jet can be interpreted as a flow source coupled with the resonator inducing acoustic oscillations. This model enhances the relative importance of control parameters and instrument design on the onset characteristics. The growth duration, similar for the three players, is imposed by the instrument properties which are themselves controlled by the instrument makers. The growth is also characterized by the simultaneous evolution of different spectral components. A specific empirical study allows identifying the stability conditions for each component. This characterization allows interpreting the spectral evolutions observed during experimental attack transients with energetic considerations. These stability conditions being imposed by the manufacture, the musician can or not encourage the development of high components by controlling the temporal evolution of the mouth pressure.