tics which uniquely identify “the guitar” are not well understood, and we have therefore undertaken comparisons of plucked sting sounds from guitars with other plucked string instruments such as the harp and banjo. By focussing on the different general characteristics of these families of instruments we aim is to understand better – from the makers point of view – what bounds represent each class and the features of the sounds to which players are most sensitive.

000246(O)
Investigating the origin of inter-individual differences in the preference for violins

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In a recent study by the authors, it was shown that violin players are self-consistent when evaluating different violins in terms of overall preference. However, a significant lack of agreement between individual violinists was observed. A new perceptual experiment was thus designed to further investigate whether there will be more between-individual agreement if violin players are asked to focus on specific features of the instrument. Skilled violinists were asked to play a set of different violins and evaluate them according to various criteria. The criteria were determined based on (a) the analysis of verbal data collected in the previous study, and (b) potential correlation with measured vibrational properties of the violin. Violins of different periods were used, varying from student to performance level. Low light conditions and dark sunglasses were used to help hide the identity of the instruments as much as possible. Considering the bow as an extension of the player, violinists were asked to carry out the task using their own bow. Preliminary results from a pilot study (small group of instruments) indicate that between-individual agreement varies considerably when rating specific instrument characteristics. Results of a more in-depth study (with more instruments, some very similar to one another) are presented in the paper.

000044(O)
On the tuning of the plates of a Viola d’Amore

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Thanks to the collaboration between the authors and the group of Ancient Instruments luthiers of the Escola Municipal de Artes e Oficios of Vigo (Spain), it is possible to follow the tuning process of top and bottom plates of a member of the Viola da gamba family. In this paper we describe the changes of the resonances of top and bottom plates, guided by the taptones of the luthier, discussing the effects of the flaming sword sound-holes and the soundbar on the initial vibration patterns. A measuring procedure is also presented and discussed with recommendations to avoid misintepretations due to the interaction with transducers and supports. The proposed procedure includes a discussion to minimize the bias due to a wrong selection of the points where the accelerometers are placed, the precision to perform a proper frequency analysis and tips to identify the frequencies of stronger resonances.

Musical Acoustics: Measurements and Simulations of Musical Wind Instrument Behaviour (S)

000542(O)
On the influence of the Q factor on the oscillating frequency of flutes and organ pipes

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The exact prediction of the oscillating frequency of flutes and organ pipes is of great interest for instrument makers. For the time being, the prediction of this frequency relies on the calculation of the passive resonance of the pipe. However, the oscillating frequency is often found to be slightly higher than the resonance frequency, in order to enhance the spectral content of the sound. The aim of the present research is to include the influence of the blowing conditions in the prediction of the oscillating frequency. Following previous descriptions, we developed a model of flute as a loop system. The mechanism of sound generation is split into different lumped parts: the jet, the aero-acoustics source and the resonator. The linear study of this model shows that the frequency is defined with respect to the phase of the loop gain: the delay due to the jet (which convects the acoustics vibration from the flue exit to the edge) is balanced by the phase shift of the resonator. This model shows the influence of the frequency dependance of the resonator phase. In other words, it shows that the Q factor, which determines the phase slope near the resonance, is fundamental in the dependance of the oscillating frequency on the jet velocity. Furthermore, the complete numerical resolution of the system leads to the oscillation thresholds. An experimental setup has been made in order to appreciate the influence of Q factor on both frequency dependance on the jet velocity and oscillation thresholds.

000043(O)
Single vs double reed conical woodwind sounds: Where does the difference lie?

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A single reed mouthpiece for an oboe has been developed [Sandra Carral, Christophe Vergez and Cornelis Nederveen. “Towards a single reed mouthpiece for the oboe”. Archives of Acoustics, to be published in May 2011]. Sound recordings show that the spectra of the radiated sound of the oboe played with this mouthpiece are of the same kind as those of the same oboe played with a standard double reed (the first few harmonics are strong, the strongest not necessarily being the fundamental). However, the sound spectra of other conical instruments such as the t\’arogat\’o are

fundamentally different from those of the oboe (the first or second harmonic being the strongest, and upper harmonics progressively weaker) although both instruments are conical. It is hypothesised that these differences are due to the detailed geometry of both mouthpiece and bore, rather than to the nature of the excitation mechanism. This paper will, on the one hand, present a thorough comparison between oboe and t\'arogat\'o sounds (steady state spectra as well as spectral centroid variation over time), and on the other, attempt to prove or disprove this hypothesis by means of impedance simulations and sound synthesis via physical modelling.

000373(O)
Effects of viscothermal losses on wavefront distortion due to nonlinear propagation in Trombones

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When a trombone is played at a high dynamic level, nonlinear sound propagation leads to a gradual distortion of the form of the acoustic pressure wave travelling from the mouthpiece towards the bell. This distortion is a significant factor in the spectral enrichment of the radiated sound which is a characteristic feature of a trombone crescendo. At a sufficiently high sound level a shock wave is formed within the tubing of the instrument, leading to a radiated spectrum which can contain significant energy well into the ultrasonic range. Viscothermal wall losses, which increase with increasing frequency, act in the opposite sense to the nonlinear spectral enrichment by preferentially damping the high frequency components of the propagating wave. To clarify the relative significance of these two effects in realistic brass instruments, experiments have been carried out on cylindrical tubes of different diameters, including tubes typical of narrow and wide bored trombones. The results of these experiments are compared with those derived through theoretical analysis.

000195(O)
Acoustical properties of bamboo in Asian free reed instruments

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The physical properties of bamboo, along with its widespread availability, have made it one of the most commonly used materials in Asian musical instruments. The Asian free reed instruments typically use bamboo pipes, and sometimes employ bamboo reeds as well, although metal reeds are now much more common. The density and elastic moduli of bamboo are both relatively low, with the Young's modulus parallel to the bamboo fibers significantly greater than the transverse modulus. A number of recent measurements have been made on the properties of the bamboo used in Asian free reed instruments. The bamboo used in some of the reeds has been studied as well as the bamboo pipe material. The elastic properties of the bamboo pipe walls, as well as the non-uniform density of the pipe wall material, are of particular interest as related to pipe wall vibrations. Investigations have been made of pipe wall vibrations in the Asian free-reed mouth organs, including both mechanically excited pipes and blown reed-pipe combinations. These include measurements of changes occurring in pipe input impedance as a result of damping the wall vibrations.

000123(IO)
Bore reconstruction from input impedance

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The determination of a pipe bore from the measured reflection function is a technique which has reached a certain maturity. However, the measurement of the reflection function in the time domain (pulse reflectometry) requires equipment rather difficult to operate. On the other hand, the techniques for measuring the input impedance have reached an unquestionable maturity with respect to measurement setup and to calibration. It is thus likely that impedance measurements might be able to give the same information. By doing simulations it is first shown that the reflection function deduced from the input impedance gives access to the bore with a precision comparable with that obtained with pulse reflectometry. Moreover a method to evaluate the error without a priori knowledge of the bore is proposed. It is then shown that the accuracy obtained with measurements is of the same order as that obtained from simulations. The technique is then used for the dimensional control of bassoon crooks for which differences on the diameter of the order of 1% can be detected. Other examples will be given.

000231(O)
Comparisons between models and measurements of the input impedance of brass instruments bells

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This work is part of a project aiming at helping craftsmen to design and characterize their musical instruments. Starting from a given wind instrument shape, our objective consists in choosing the most relevant physical model able to predict the acoustical input impedance of this musical instrument once constructed. The modeling of bells in brass