



The Bilbao project: searching for relationships between sound and playing properties of violins with their construction parameters

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The Bilbao project aimed at relating intrinsic characteristics of the materials (wood density and stiffness) and some geometric characteristics of the violin's constituent part (thicknesses of the plates) with the tonal qualities of the complete violins. To this end, six instruments were carefully built at the Bilbao making school: three instruments with normal backs, each paired with a pliant (thin), normal or resistant (thick) top; similarly, three with normal tops, each paired with a pliant, normal or resistant back. The two examples of normal top paired with normal back serve as a control. Wood for tops and backs were closely matched in density and sound speeds – all tops and backs from the same trees. Greater control was achieved by having all plates and scrolls cut by CNC routers, using the Huberman Stradivari model. The outside surface was not changed as the graduation was performed entirely on the inside surface. In addition, another six instruments were built by six established makers, following a similar procedure but with less constraints on the choice of wood (not the same trees as for the Bilbao set though a similar density was imposed) and on the graduation of the routed plates which was left totally free (but ended in the same range of thicknesses). Finally, another violin built with a very different profile but made by one of the established maker was added to the pool as an outlier. These thirteen violins were then evaluated by twenty players during a free categorisation task and by about 70 listeners (31 violin makers, 26 bow players and 15 others) during a listening test in the Bilbao conservatory auditorium. The tests show very large differences in terms of timbre, playability and volume between the violins, and these differences will be discussed in the light of their construction parameters.