

Wood density explains sound quality of great master violins

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The advantage of using medical equipment to study classical musical instruments has been proven by a Dutch researcher from the Leiden University Medical Center (LUMC). In collaboration with a renowned luthier, Dr. Berend Stoel put classical violins, including several made by Stradivarius, in a CT scanner. The results are published in the July 2 issue of the online, open-access journal *PLoS ONE*. The homogeneity in the densities of the wood from which the classical violins are made, in marked contrast to the modern violins studied, may very well explain their superior sound production.

Experts are fascinated by the fact that classical Cremonese violins from the famous masters such as Stradivari (1644 – 1737) and Guarneri del Gesu (1698 – 1744) are still unparalleled in their abilities of tonal expressiveness and projection.

300 years of technological advancement has not provided substantial improvements towards paralleling the achievements of the classical Cremonese violin makers. It is obvious to look for clues in the material properties of the wood from which these violins are made, however until now it was impossible to study this without risk of damage to these instruments, each valued at several million dollars.

A unique collaboration between the Leiden University Medical Center (LUMC) in the Netherlands and Terry Borman, luthier in the United States, led to new insights. Previously, at the Division of Image Processing, Department of Radiology, Dr. Stoel developed a computer program, in collaboration with pulmonologist Dr. Jan Stolk, that calculates lung densities in emphysema patients from Computed Tomographic (CT) scans, in order to demonstrate the efficacy of certain medical treatments.

Based on his knowledge of measuring lung densities non-invasively, Dr. Stoel designed a new

computer program to study wood densities from CT scans. Subsequently, he and Terry Borman scanned in New York five Cremonese and seven contemporary violins at Mount Sinai Hospital, and analyzed the wood densities.

The average wood density of the classical and modern violins did not differ significantly. However, the differences in wood density between early and late growth were significantly lower in the ancient violins.

Since differentials in wood density impact vibrational efficacy and thereby the production of sound, it is possible that this discovery may explain the superiority of these violins. This insight offers new possibilities into replicating the tonal qualities of these ancient instruments, as the researchers conclude in *PLoS ONE*.

Citation: Stoel BC, Borman TM (2008) A Comparison of Wood Density between Classical Cremonese and Modern Violins. *PLoS ONE* 3(7): e2554. doi:10.1371/journal.pone.0002554

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