

# Scientists are trying to uncover what makes Stradivarius violins special – but are they wasting their time?

December 20 2016, by Bruno Fazenda

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Stradivarius violins are renowned for their supposedly superior sound when compared to other instruments. This has resulted in numerous studies hunting for a scientific reason for why Strads sound so good. A number of these studies have focused on the chemical composition of the wood in violins made in Cremona by Antonio Stradivari in the 17th and 18th centuries. Others have considered the violins made by

Stradivari's contemporary, Joseph Guarneri del Gesu, whose violins are widely considered to be [just as good](#).

Research often looks at how the materials used in the construction of the instrument define its superior quality. For example, [one study](#) argued that a "little ice age" which affected Europe from 1645 to 1715, was responsible for the slow-growth wood used in the construction of the violins that gives them a particular quality. This type of wood would have been available to all violin makers in Europe [so other work](#) has looked at the particular varnish applied to Strads. But [the most recent study on this](#) showed that Stradivari finishes were also commonly used by other craftsmen and artists and were not particularly special.

Now a team of scientists from National Taiwan University have tried to uncover the secret of Stradivarius violins [by analysing the chemistry of the wood](#) they're made from. The researchers found that the aged and treated maple wood had very different properties from that used to make modern instruments. But is there really a secret to be found in the Stradivarius?

In the new paper the researchers found reproducible differences in chemical compositions between maples used by Stradivarius and Guarneri and those used by modern instrument makers. This alludes to a forgotten tradition unknown to modern violin makers that uses a process of transformation through aging and vibration, resulting in a "unique composite material."

The problem with studies looking at [chemical composition](#) is that they don't include measurements of how the violins actually vibrate and create the soundwaves which we hear. Stringed acoustic instruments [produce sound](#) from the vibrations of a taut string. These are passed mainly via the bridge and nut to the violin's body, where the panels resonate and create the soundwaves.

Aside from the performance of the musician, the [quality of the sound](#) can be affected by the rigidity of the connections between bridge and the panels, the shape and size of the panels and the material they are composed of. A violin whose panels are made of glass would sound different to one made of metal, due to the different vibratory properties of these materials. Even the shapes that are cut into these panels, such as the [typical f-shaped holes](#), play a part, since they break up and alter some of the resonant modes that can be sustained by the panels. The question is, are these differences in the chemical composition of the woods and other finishing materials, sufficiently different to elicit an audibly superior sound?

[Some studies](#), in the aptly named Catgut Acoustical Society Journal, have shown that there is indeed a difference in acoustic response [between Stradivarius and Guarneri violins](#). These have looked at how the body vibrates and the emitted sound pressure. Unfortunately, there seem to be no studies comparing the acoustic response between the renowned Cremonese instruments and other violins.

## **Halo effect**

[One study](#) in 2011 asked professional violinists to compare violins made by Stradivari and Guarneri with high-quality new instruments while playing blindfolded in a room with relatively dry acoustics. Contrary to all expectations, the researchers found that the most-preferred violin in the test set was a new one and the least-preferred had been made by Stradivari. They also found that most players seemed unable to tell whether their most-preferred instrument was new or old.

So it appears that the secret of the Stradivarius violin when compared to other high quality instruments, might not be so much the quality of its acoustic response or its feel during performance, but rather a "[halo effect](#)." This is a well known bias in the field of psychology where your

overall perception of something affects how you rate specific elements of it. In this case, it appears that knowing one is holding a famed instrument, seasoned by the ages and, most certainly, with a premium price tag is influencing the way it sounds to us.

No doubt the differences in material properties that are being reported in research papers will have their effect on the acoustic response, which might be measurable. The question is whether these acoustic differences are perceptible and, if so, whether they are strong enough to break any beliefs and biases we might have when told we are listening to the sound of a real Stradivarius. A systematic study on the acoustic and psychoacoustic differences between modern and prized antique violins is the only way to find the answer.

**More information:** Hwan-Ching Tai et al. Chemical distinctions between Stradivari's maple and modern tonewood, *Proceedings of the National Academy of Sciences* (2016). [DOI: 10.1073/pnas.1611253114](https://doi.org/10.1073/pnas.1611253114)

Provided by The Conversation

Citation: Scientists are trying to uncover what makes Stradivarius violins special – but are they wasting their time? (2016, December 20) retrieved 23 April 2024 from <https://phys.org/news/2016-12-scientists-uncover-stradivarius-violins-special.html>

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