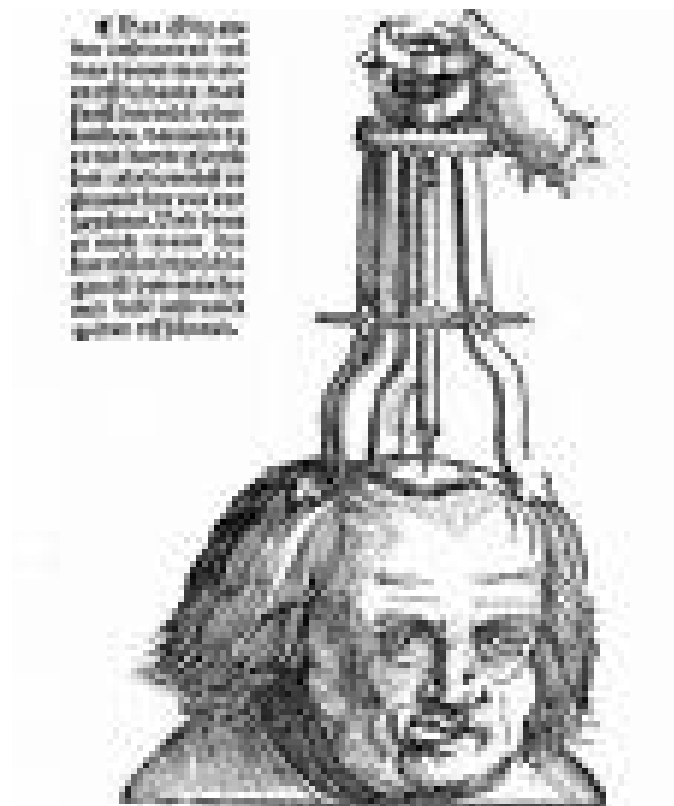


# The Ancient Art & Science of Violinmaking

## Outline

- I. Violin as the perfect invention
- II. Development in Cremona, Italy (17<sup>th</sup> C.)
  - *external toolmarks*
- III. Modern Research – Improving the Violin
- IV. Modal analysis
- V. The complications of the human brain
  - *auditory shape recognition*
  - *hearing hot vs. cold water*
  - *reassembly of tones*
- VI. Acoustic Reproduction of Violin Sound
  - *radiation field*
- VII. New Developments



Michael Darnton

Early medical tool as compared to early violin

# The Ancient Art & Science of Violinmaking

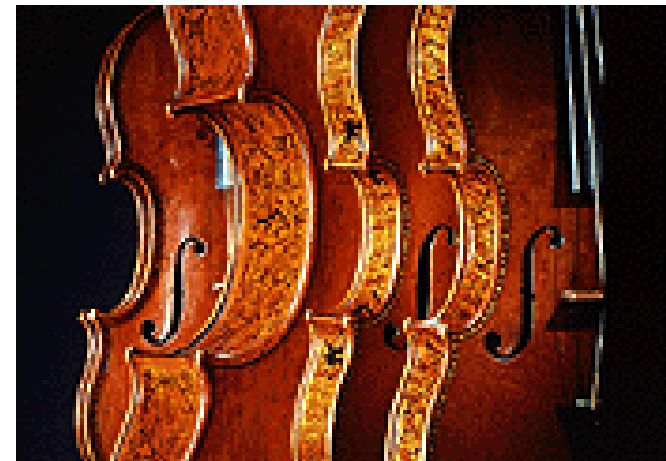
## Outline

- I. Violin as the perfect invention
- II. **Development in Cremona, Italy (17<sup>th</sup> C.)**  
**- *external toolmarks***
- III. >Modern Research – Improving the Violin
- IV. Modal analysis
- V. The complications of the human brain
  - *auditory shape recognition*
  - *hearing hot vs. cold water*
  - *reassembly of tones*
- VI. Acoustic Reproduction of Violin Sound
  - *radiation field*
- VII. New Developments

12<sup>th</sup> century



15<sup>th</sup> Century



Modern (left)  
Baroque 15<sup>th</sup>-16<sup>th</sup>  
C.(right)



The shape of the F hole is critical to sound production

## Daily Progress Slideshow

# The Ancient Art & Science of Violinmaking

## Outline

- I. Violin as the perfect invention
- II. Development in Cremona, Italy (17<sup>th</sup> C.)
  - *external toolmarks*
- III. **Modern Research – Improving the Violin**
  - **computer helps us ‘hear’**
- IV. Modal analysis
- V. The complications of the human brain
  - *auditory shape recognition*
  - *hearing hot vs. cold water*
  - *reassembly of tones*
- VI. Acoustic Reproduction of Violin Sound
  - *radiation field*
- VII. New Developments



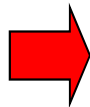
Song of a Winter Wren



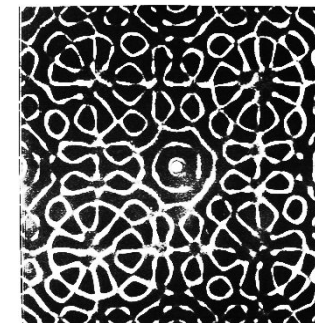
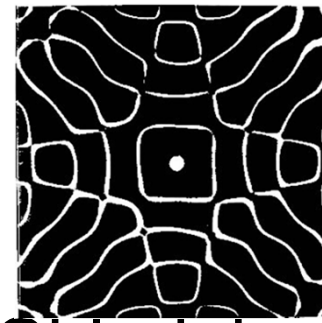
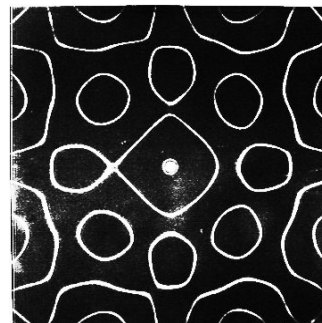
Same song at 1/5th speed

Recording from “The Singing Life of Birds” by Donald Kroodsma  
Photo: Lloyd Spitalnik <http://www.pbase.com/btblue/image/51741379>

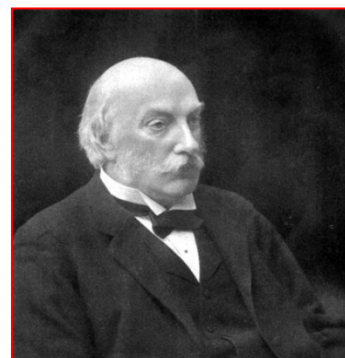




Ernst Chladni  
1756 - 1827



Chladni  
Patterns



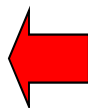
Lord Rayleigh  
1842-1919



Carleen Hutchins  
& Taptone



Computers + Modal Theory  
= Modal Analysis

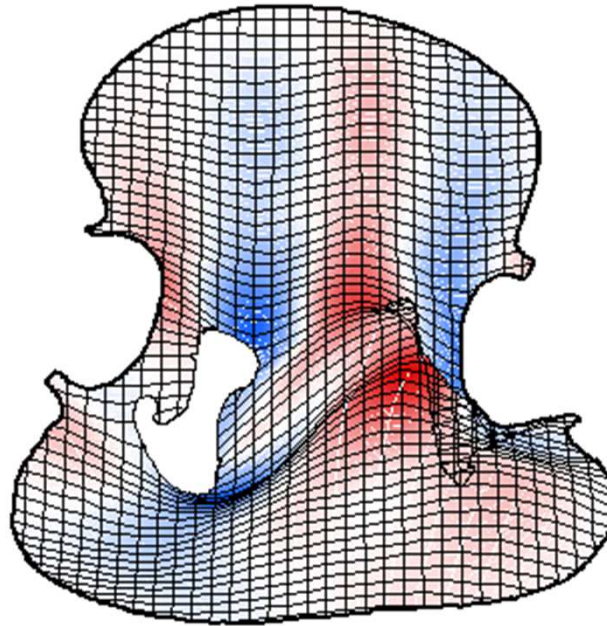


Oberlin Experts: Bissinger,  
Davis, & Stoppani



Martin Schleske

Computer helps us 'see'



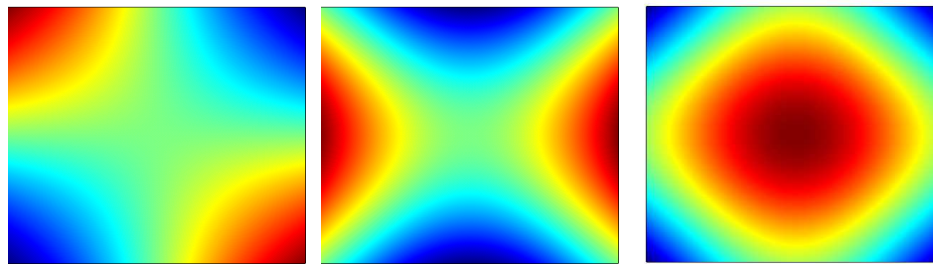
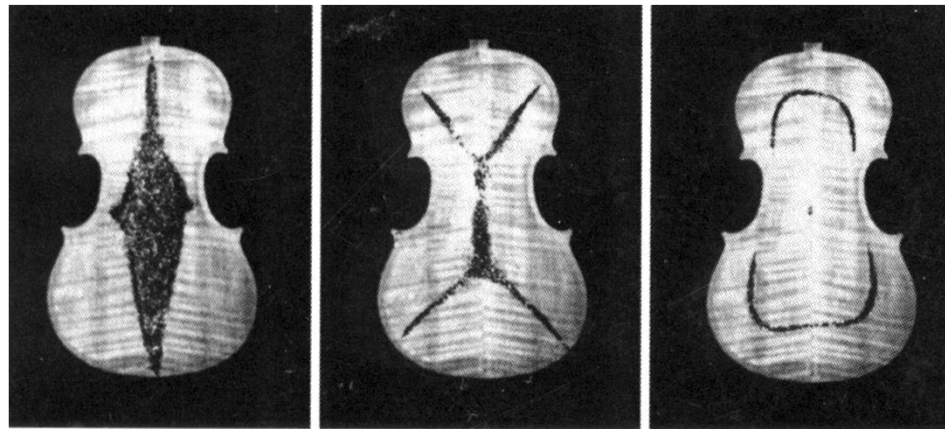
Thanks to William Sloan  
And George Stoppani

XJackson Strad F holes in motion

## Scientific plate tuning - Chladni pattern modes of a free violin plate

---

Carleen Hutchins and the "Scientific School" of violin making  
Adjust thicknesses and arching of plates to give modes  
an octave apart and symmetric mode shapes



*twisting mode*

*X-mode*

*ring mode*

*1<sup>st</sup> three modes of an isotropic, square thin plate*

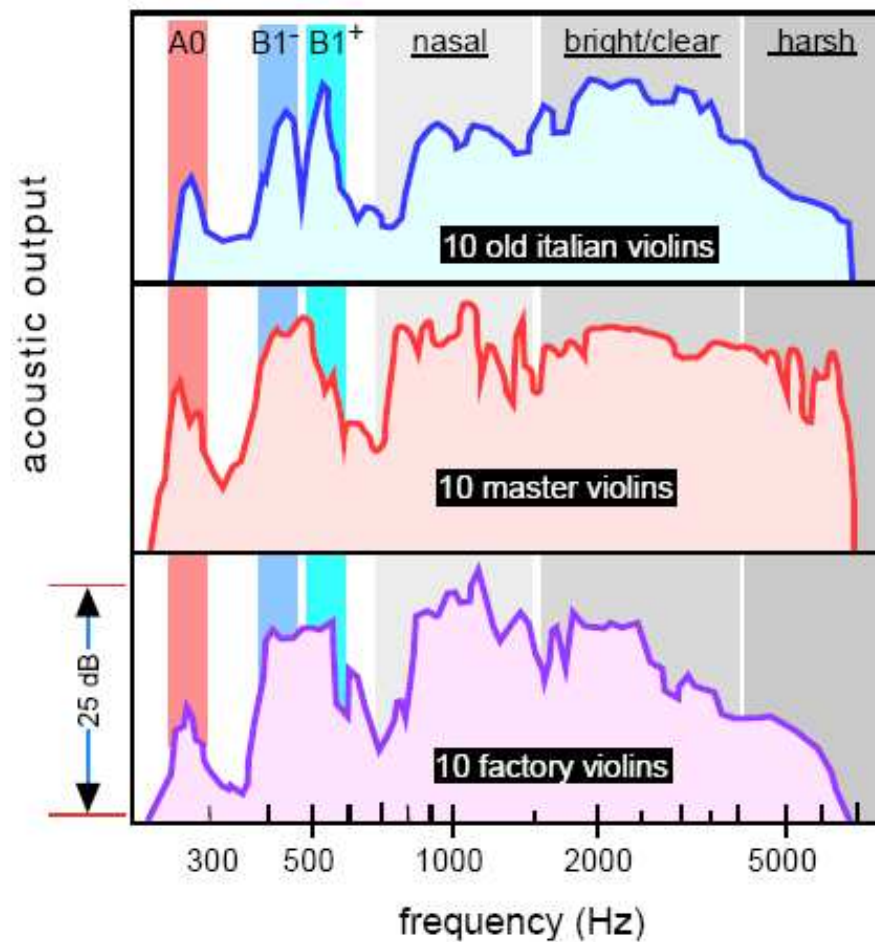


Figure 1 – Envelopes for Dünwald overlays of 10 old-Italian, 10 master, and 10 factory violins' acoustic outputs up to ~7 kHz [2]. The major radiating signature modes A0 (lowest cavity mode near 280 Hz) and the 1<sup>st</sup> corpus bending modes B1<sup>-</sup> and B1<sup>+</sup> are labeled. Note regularity of A0, B1<sup>-</sup> and B1<sup>+</sup> envelope for the old-Italian violins, but not for other classes.



# The Ancient Art & Science of Violinmaking

## Outline

- I. Violin as the perfect invention
- II. Development in Cremona, Italy (17<sup>th</sup> C.)
  - *external toolmarks*
- III. Modern Research – Improving the Violin

### **IV. Modal analysis**

**Computer helps us ‘see vibrations’**

- III. The complications of the human brain
  - *auditory shape recognition*
  - *hearing hot vs. cold water*
  - *reassembly of tones*
- VI. Acoustic Reproduction of Violin Sound
  - *radiation field*
- VII. New Developments

-Oded Kishony, UVa Physics Colloquium, Sept 2008

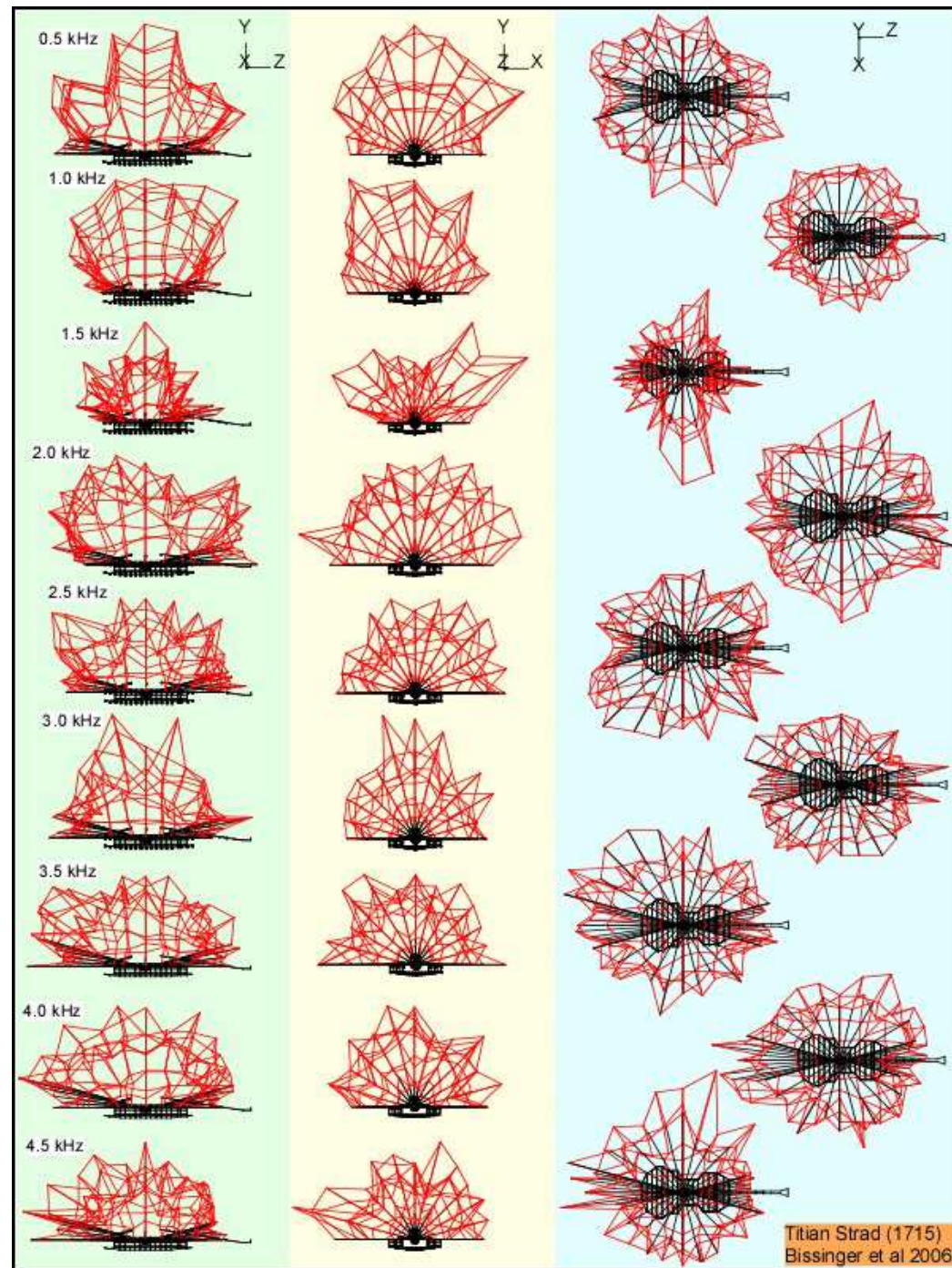
**Schleske**

**Schleske 2**

# The Ancient Art & Science of Violinmaking

## Outline

- I. Violin as the perfect invention
- II. Development in Cremona, Italy (17<sup>th</sup> C.)
  - *external toolmarks*
- III. Modern Research – Improving the Violin
- IV. Modal analysis
- V. **The complications of the human brain**
  - ***auditory shape recognition***
  - ***hearing hot vs. cold water***
  - ***reassembly of tones***
  - **Acoustic Reproduction of Violin Sound**
  - ***radiation field***
- VII. New Developments





# The Ancient Art & Science of Violinmaking

## Outline

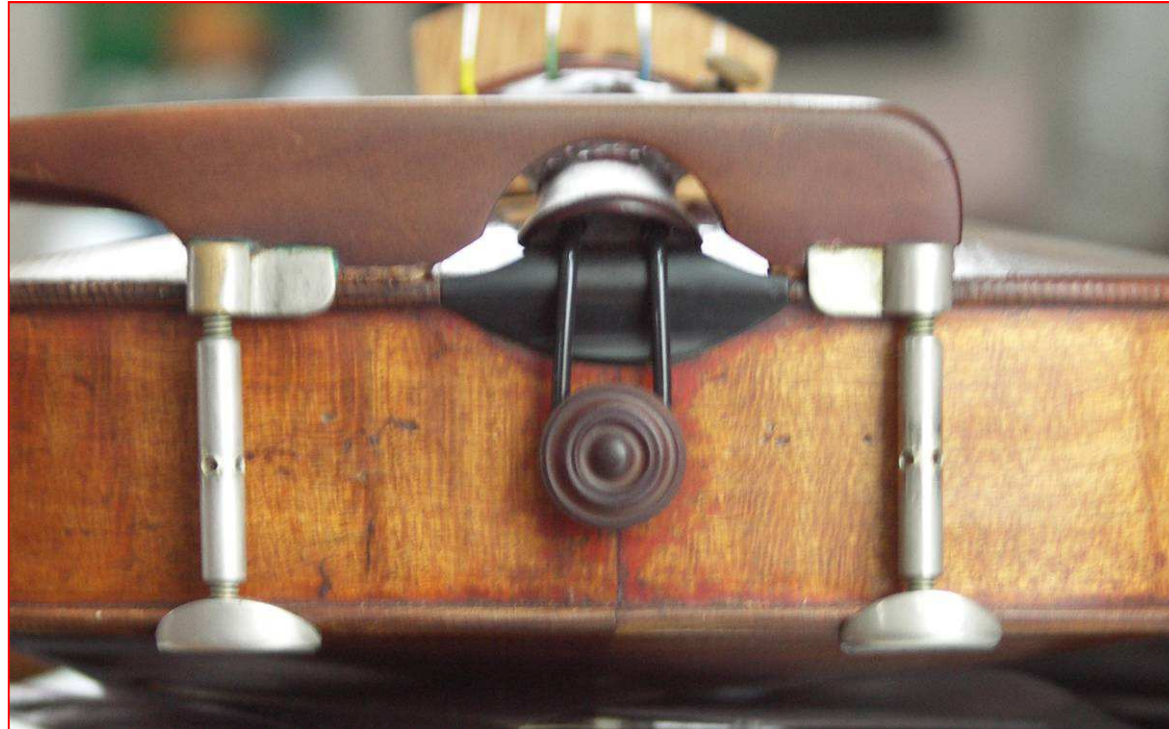
- I. Violin as the perfect invention
- II. Development in Cremona, Italy (17<sup>th</sup> C.)
  - *external toolmarks*
- III. Modern Research – Improving the Violin
- IV. Modal analysis
- V. The complications of the human brain
  - *auditory shape recognition*
  - *hearing hot vs. cold water*
  - *reassembly of tones*
  - Acoustic Reproduction of Violin Sound
  - *radiation field*
- VII. **New Developments**



Balsa violin Dough Martin 2008



David Rivinius "Pellegrina" ergonomic Viola



**The End**