

Tunings and practices of the *marimba de Chonta* music of the Pacific Coast of Colombia preserve tonal consonance

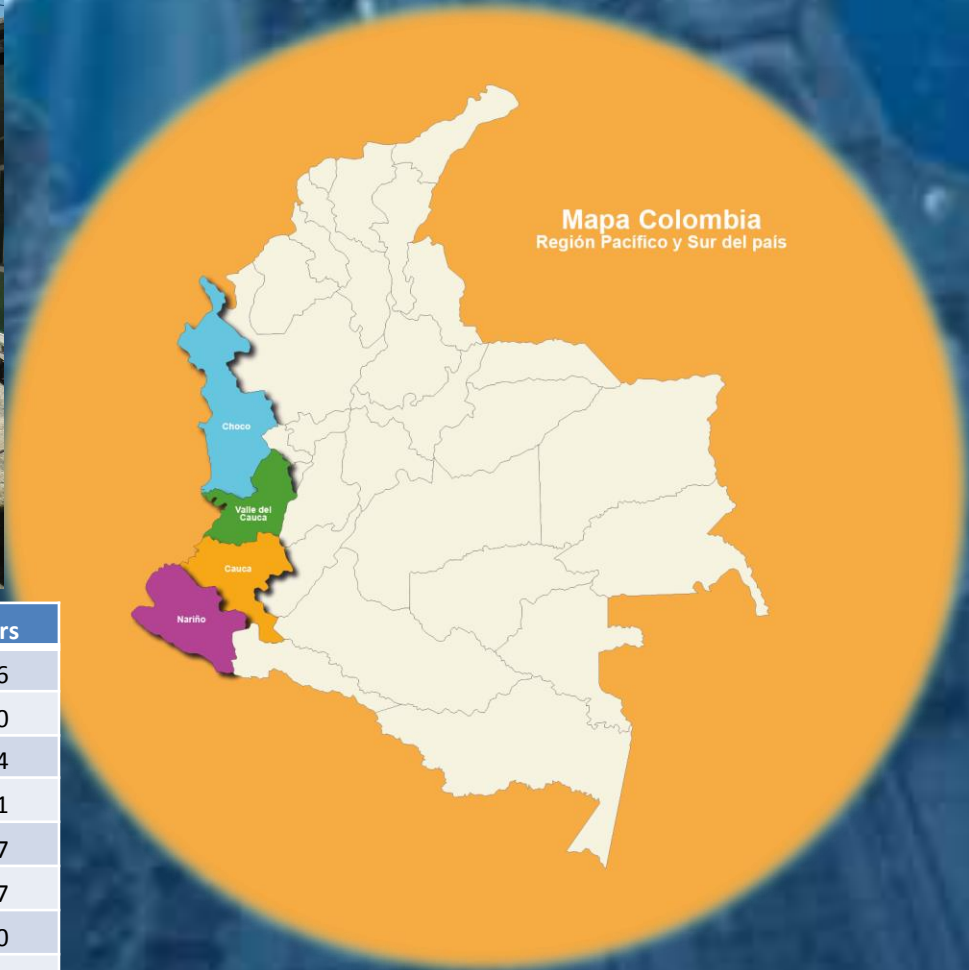
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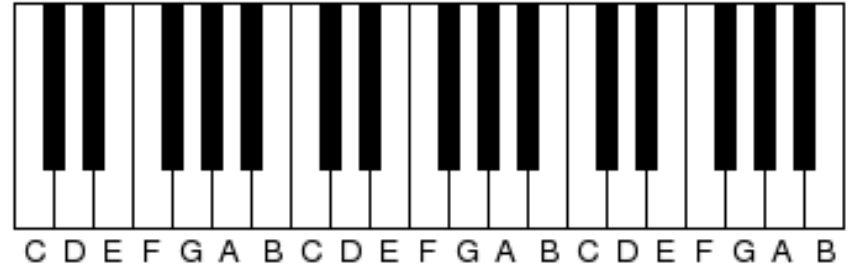
Marimba de chonta music: Intangible cultural heritage of Humanity (UNESCO)



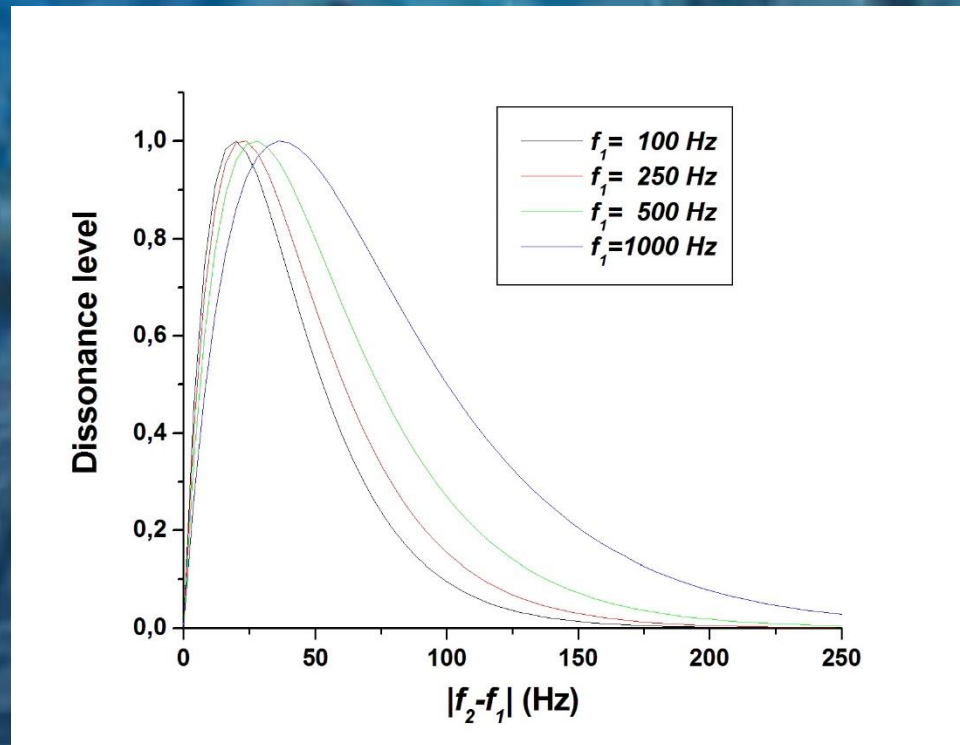
Name:	Place	Bars
Baudilio Cuama	Buenaventura	16
José Torres	Guapi	20
Francisco Torres	Guapi	24
Genaro Torres	Guapi	21
Guillermo Ríos	Guapi	17
Dioselino Rodríguez	Guapi	17
Silvino Mina	Guapi	20
Jhon Cortés	Tumaco	24
Francisco Tenorio	Tumaco	24
Juan Evangelista Sinisterra	Tumaco	18

The problem:

In the traditional marimba music of the Pacific coast of Colombia there are a set of tunings and practices that remain largely uncomprehended.



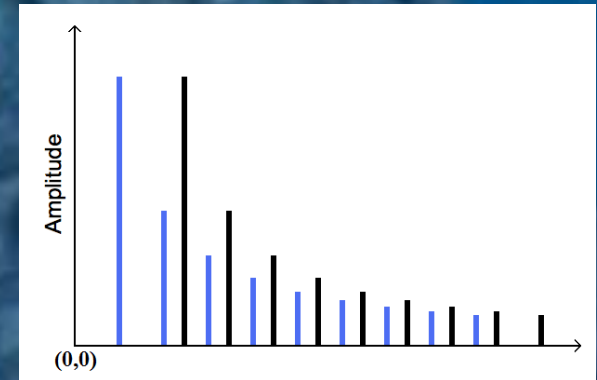
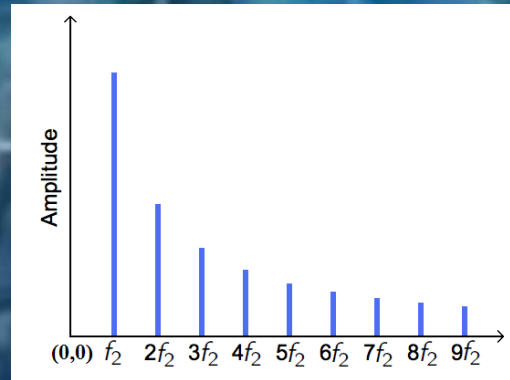
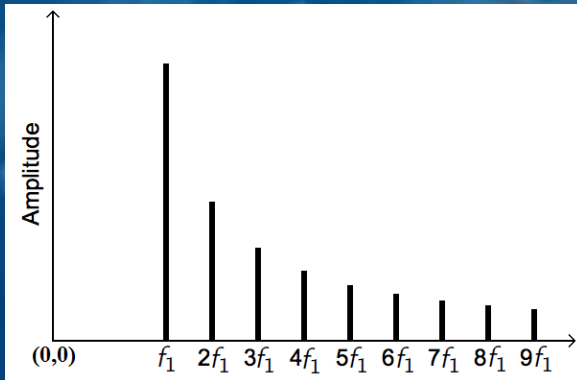
Tonal consonance for pure tones



$$d(f_1, f_2, a_1, a_2) = (a_1)(a_2)[e^{-b_1 s(f_2 - f_1)} - e^{-b_2 s(f_2 - f_1)}]$$

$$b_1 = 3.5; b_2 = 5.75; s = \frac{0.24}{(0.021)(f_1) + 19}$$

Tonal consonance for complex tones



Tonal consonance associated to a particular timbre (D_F):

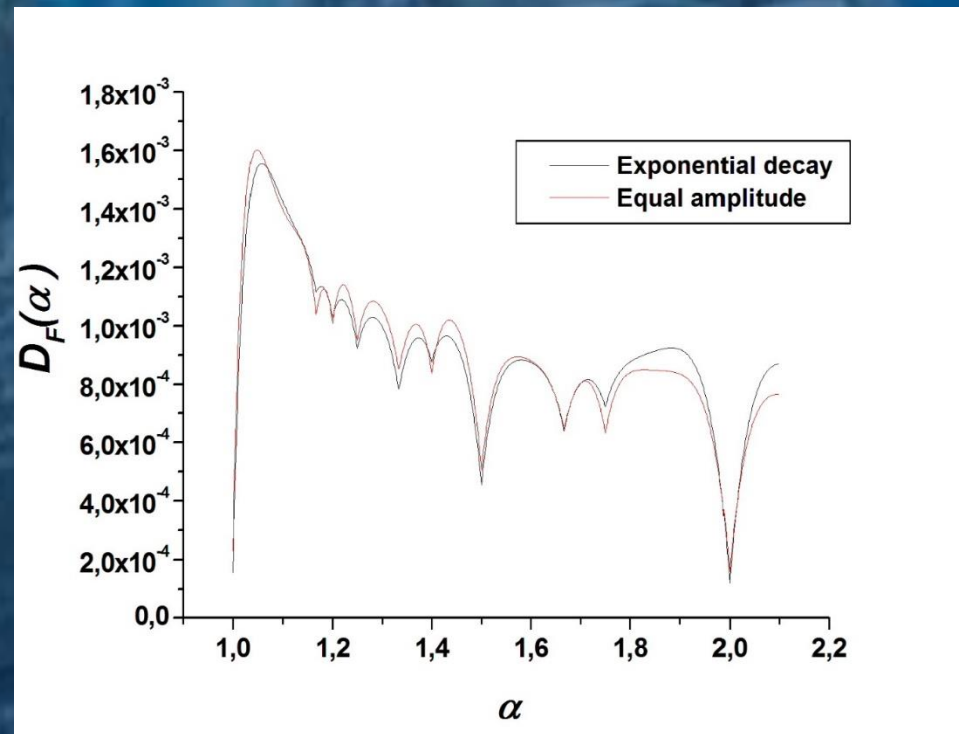
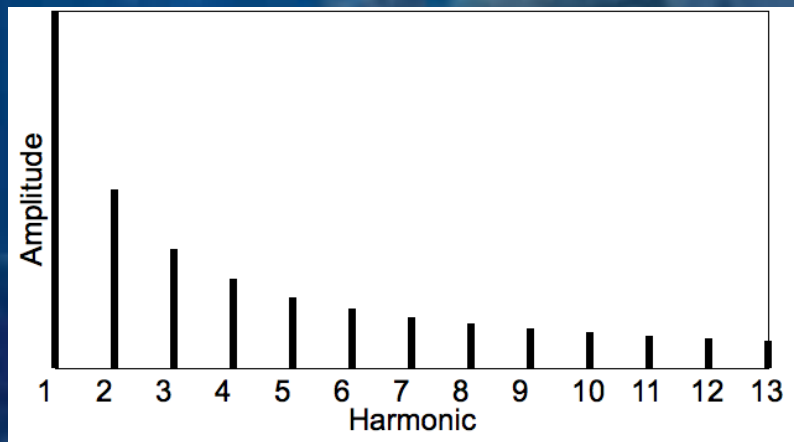
- Tonal consonance superposition principle
- Timbre strongly depends on the spectrum $\alpha \rightarrow$ Frequency ratio

$$D_F = \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n d(f_i, f_j, a_i, a_j)$$

Tonal consonance associated to the superposition of two complex tones with the same timbre:

$$D_F(\alpha) = D_F + D_{\alpha F} + \sum_{i=1}^n \sum_{j=1}^n d(f_i, \alpha f_j, a_i, a_j)$$

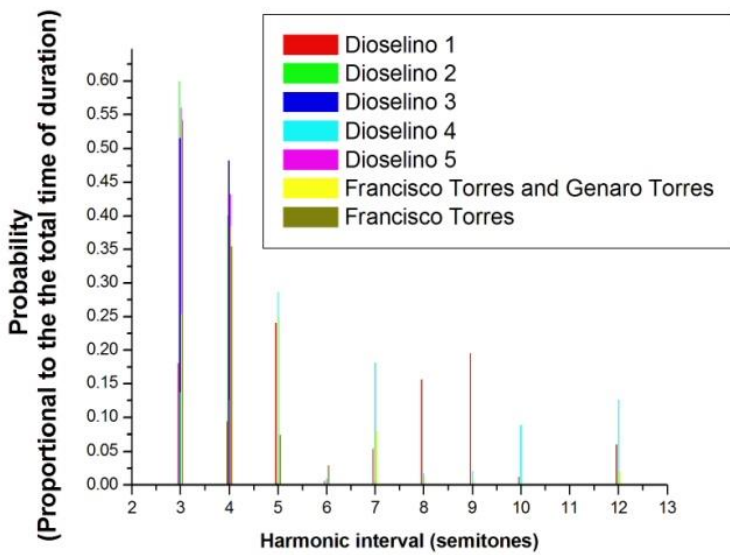
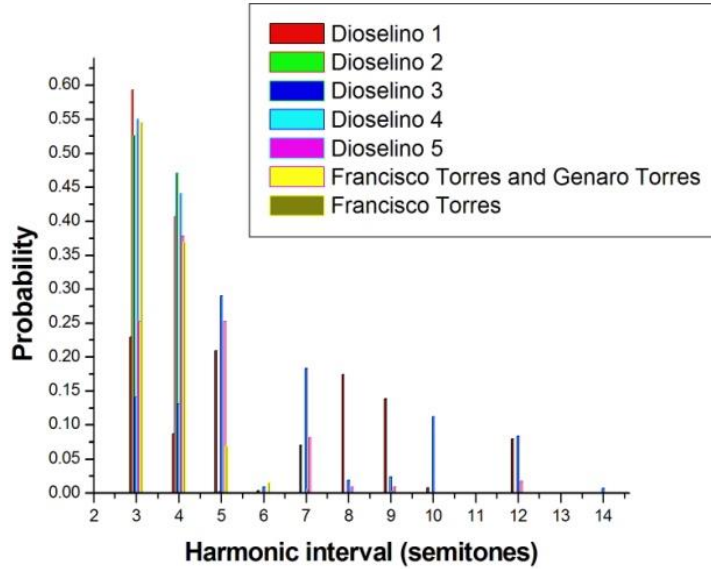
Harmonic spectrum analysis: Six harmonics



$\alpha \rightarrow$ Frequency ratio

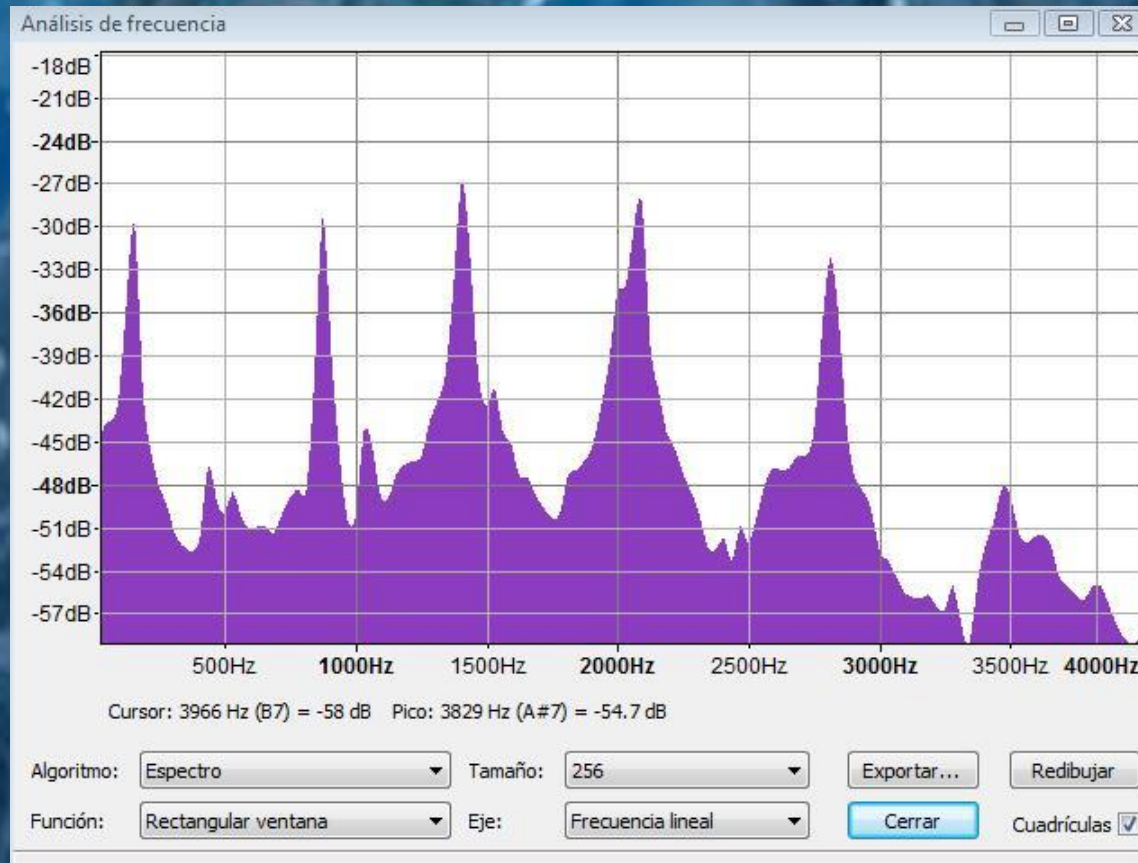
$D_F(\alpha) \rightarrow$ Total dissonance

Harmonic intervals analysis



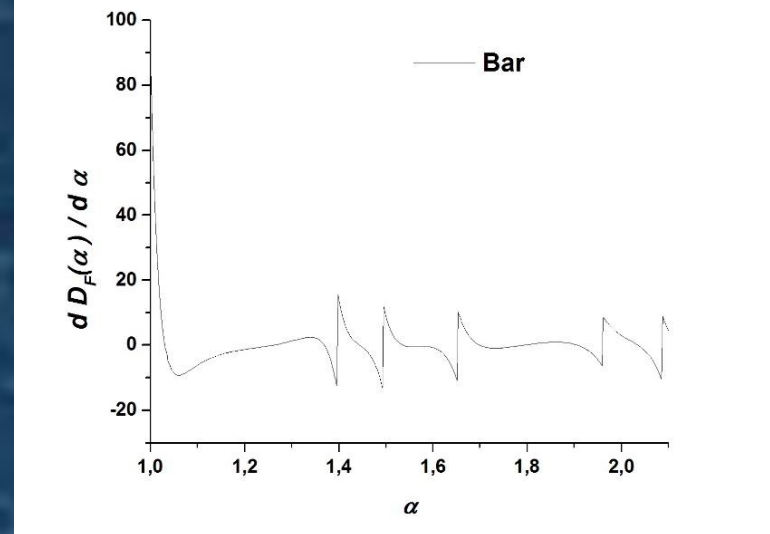
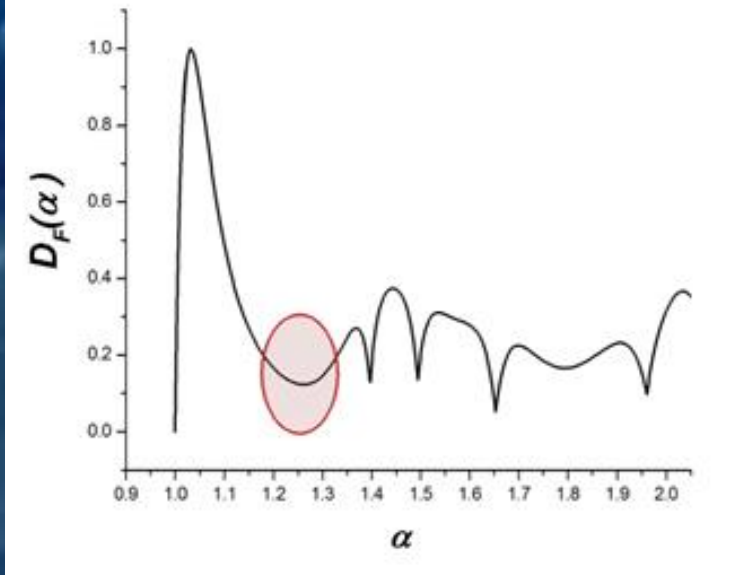
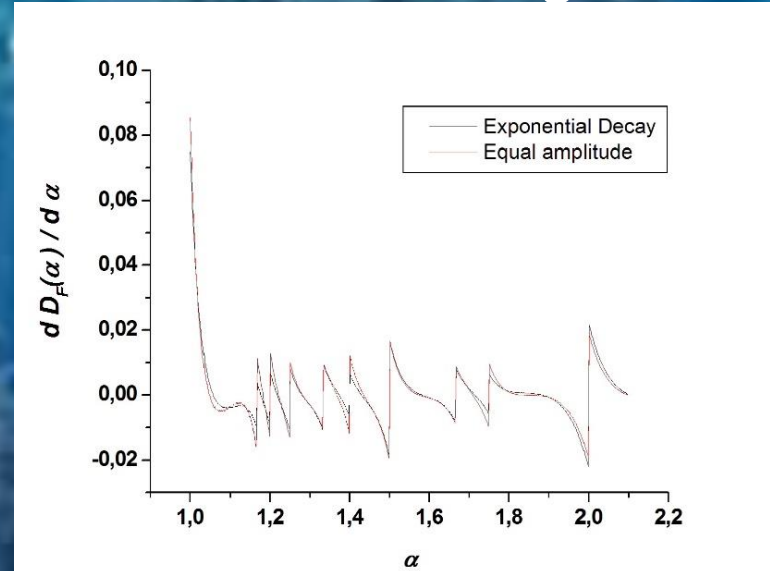
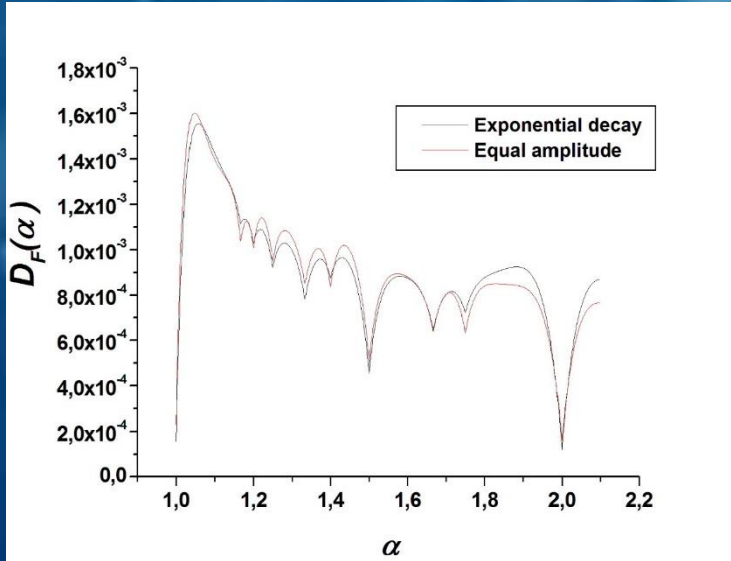
Marimba de Chouta Himno nacional

Marimba de chonta Timbre

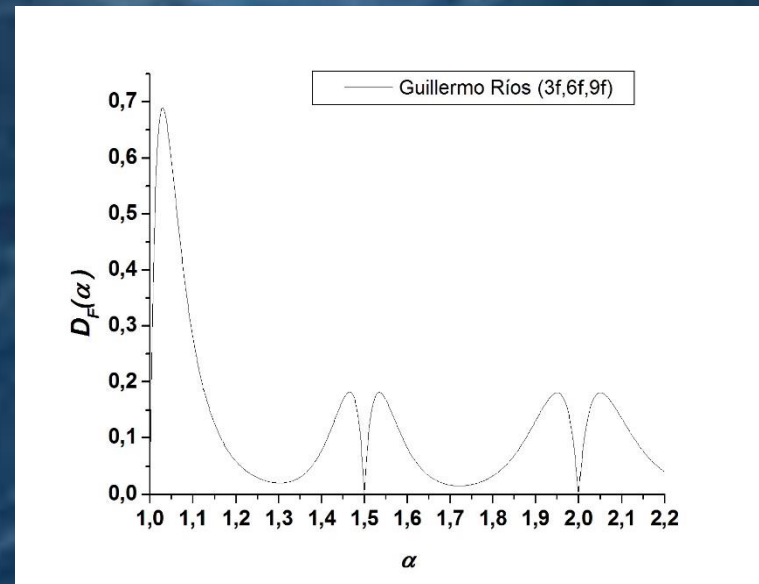
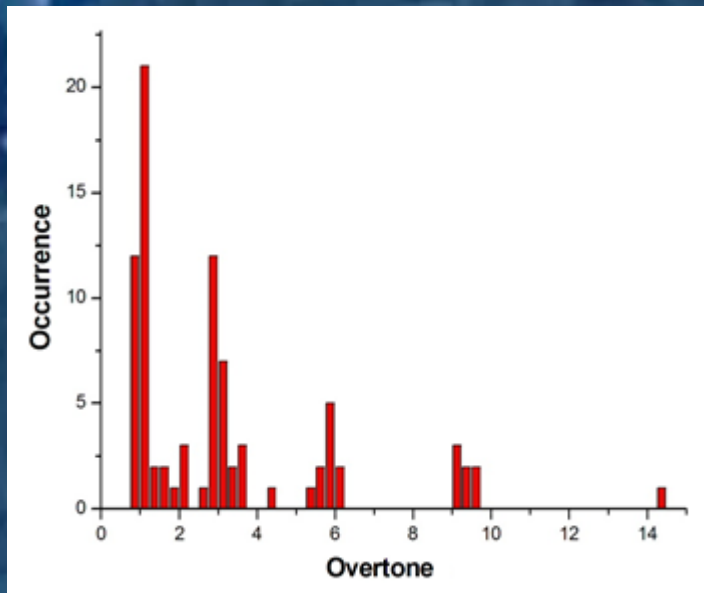
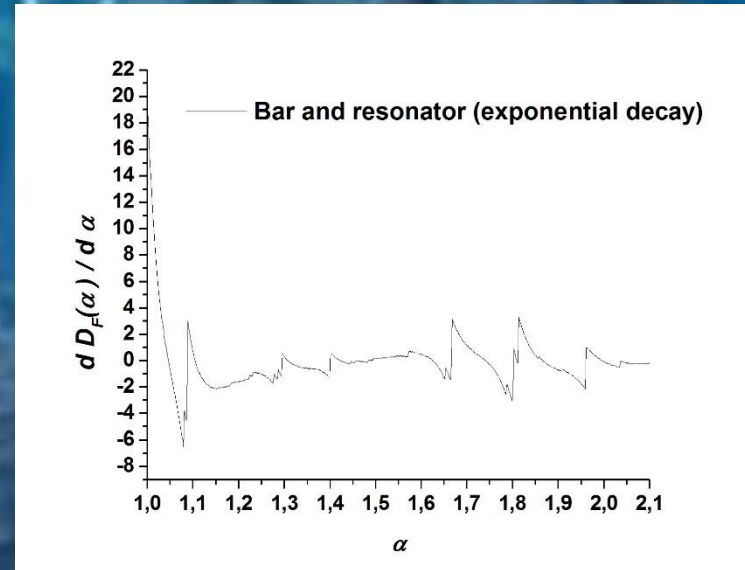
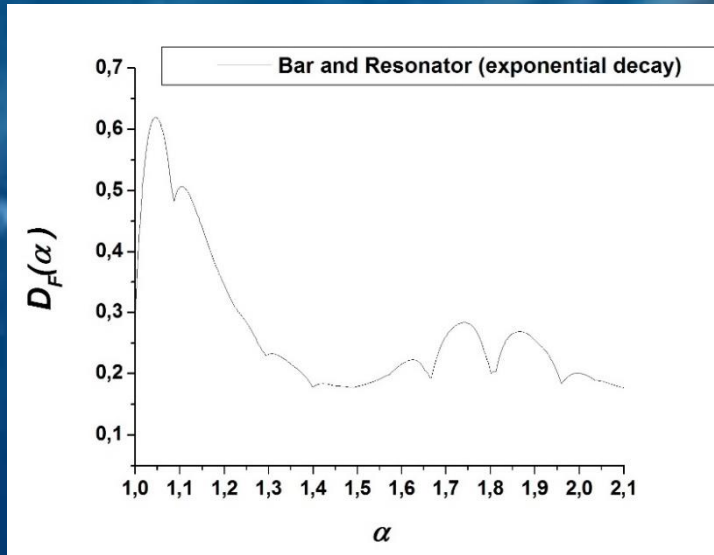


Theoretical analysis I

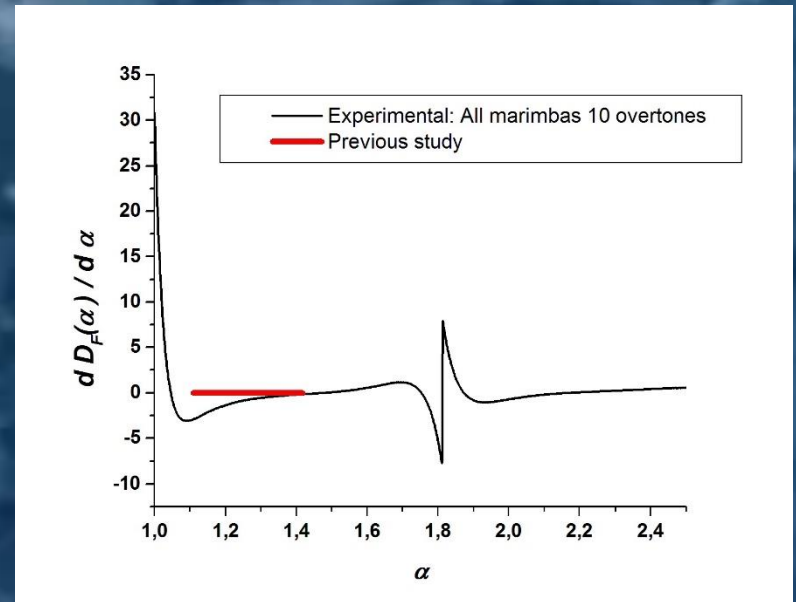
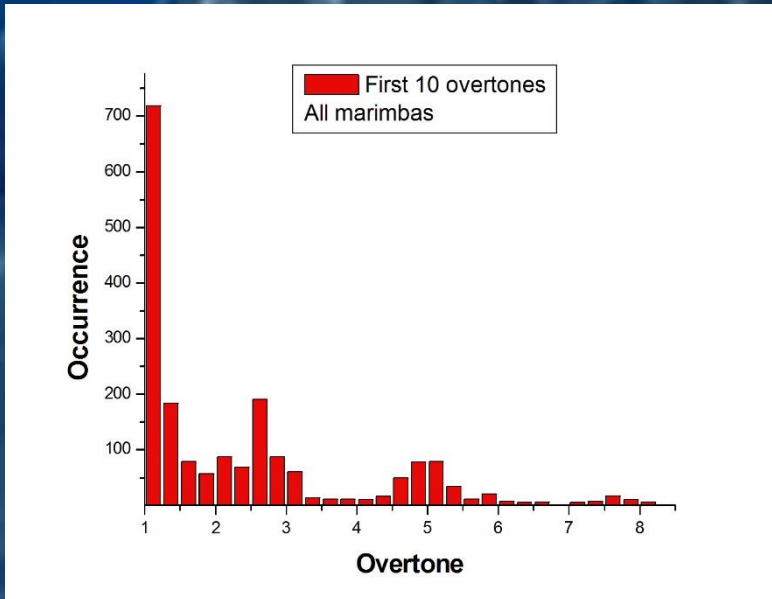
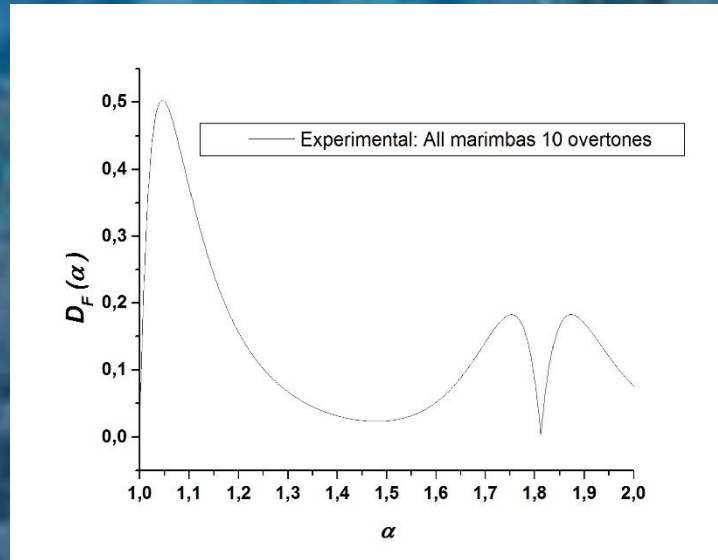
Closed pipes, strings without stiffness and rectangular bars



Theoretical & Experimental



All marimbas: Experimental





Thank you!