

# 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)

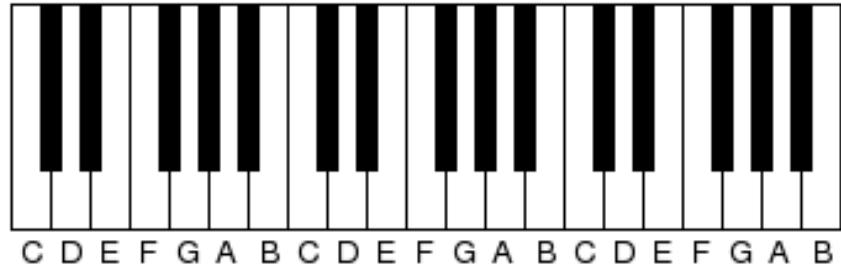


Name:	Place	Bars
Baudilio Cuama	Buenaventura	16
José Torres	Guapi	20
Francisco Torres	Guapi	24
Genaro Torres	Guapi	21
Guillermo Ríos	Guapi	17
Diosselino Rodríguez	Guapi	17
Silvino Mina	Guapi	20
Jhon Cortés	Tumaco	24
Francisco Tenorio	Tumaco	24
Juan Evangelista Sinisterra	Tumaco	18

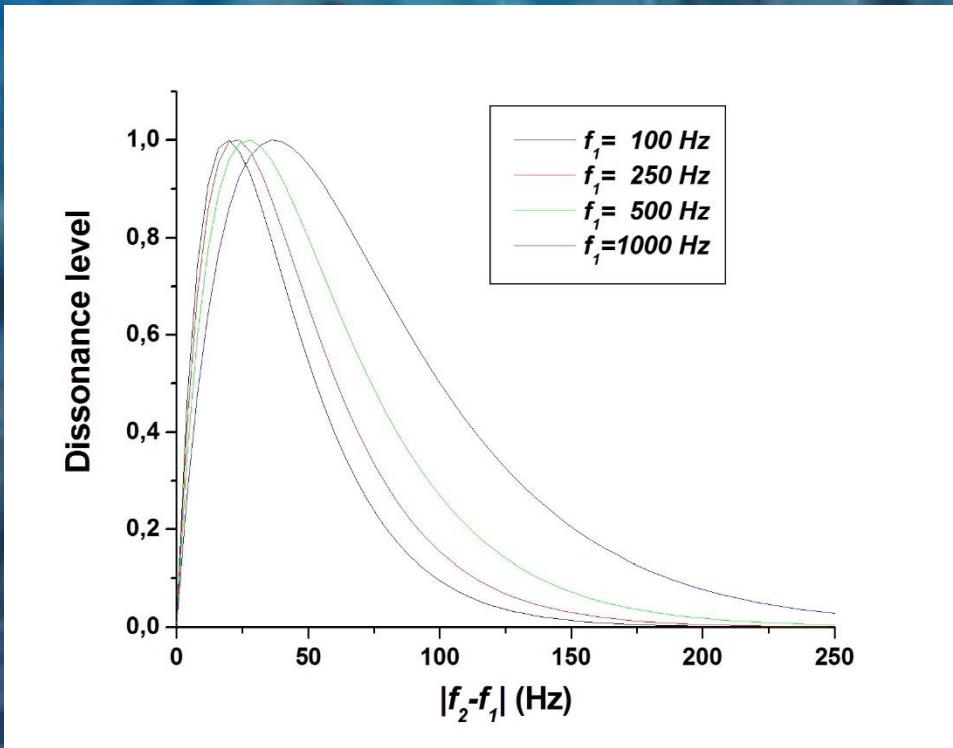


# The problem:

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

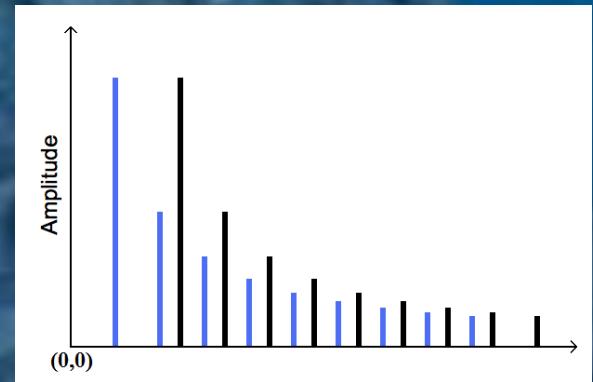
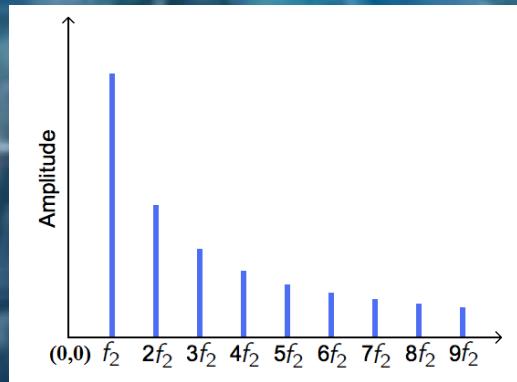
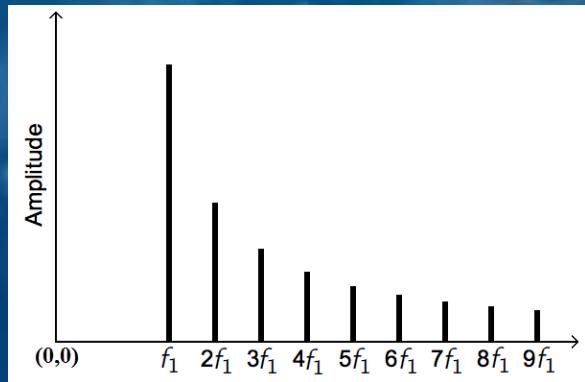


# Tonal consonance for pure tones



$$d(f_1, f_2, a_1, a_2) = (a_1)(a_2)[e^{-b_1 s(f_2 - f_1)} - e^{-b_2 s(f_2 - f_1)}]$$
$$b_1 = 3.5; b_2 = 5.75; s = \frac{0.24}{(0.021)(f_1) + 19}$$

# Tonal consonance for complex tones



Tonal consonance associated to a particular timbre ( $D_F$ ):

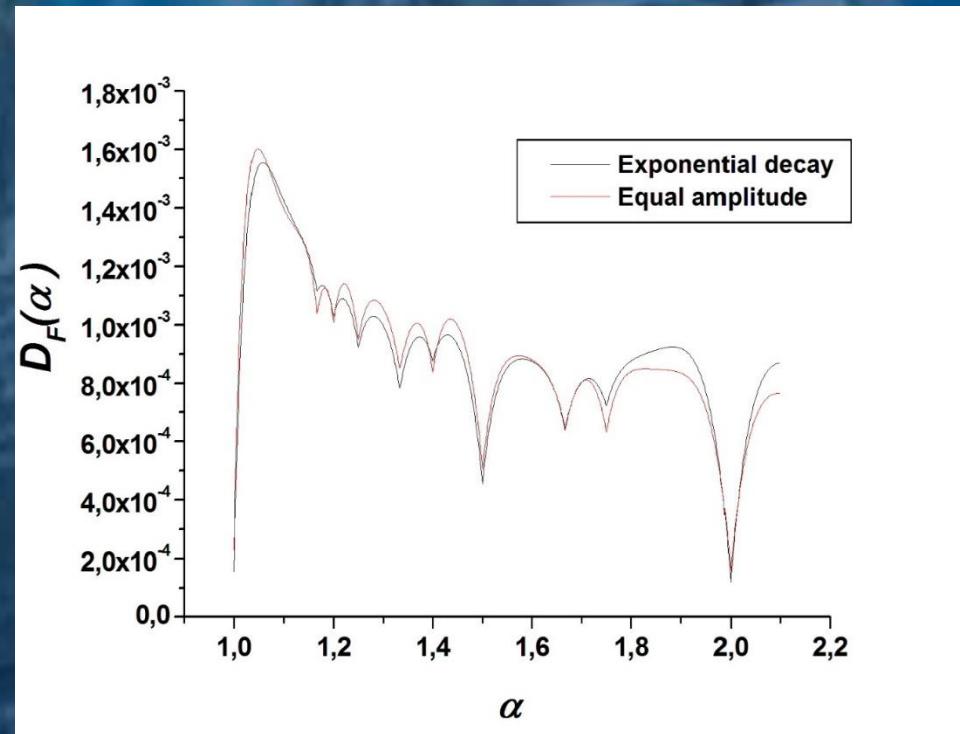
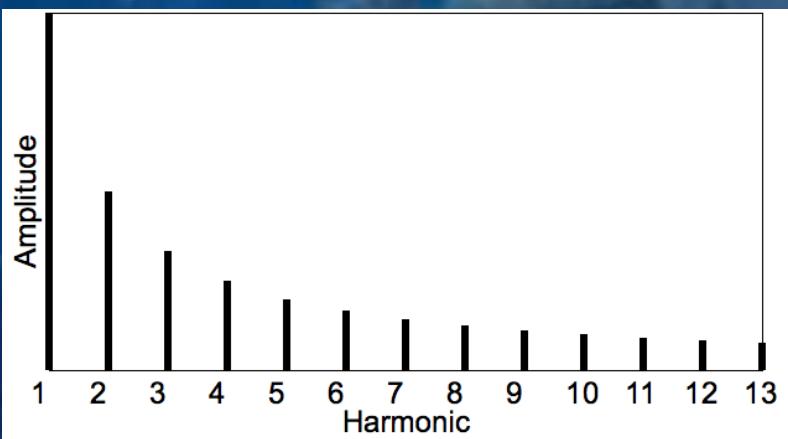
- Tonal consonance superposition principle
- Timbre strongly depends on the spectrum
- $\alpha \rightarrow$  Frequency ratio

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

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

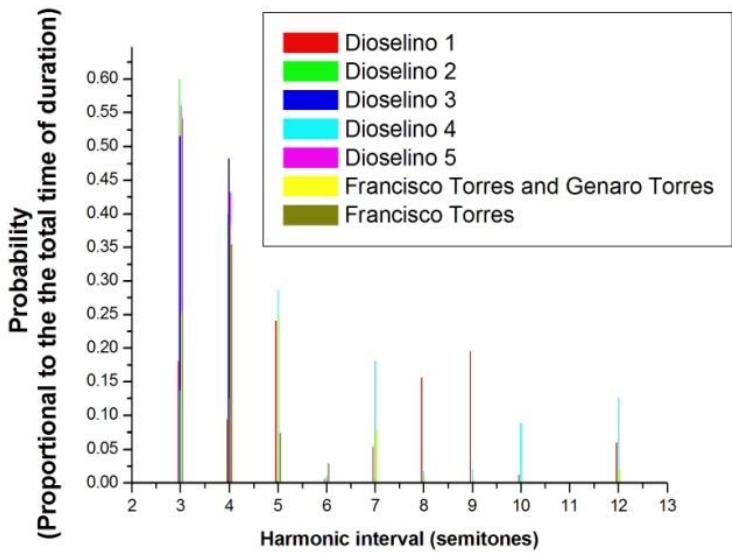
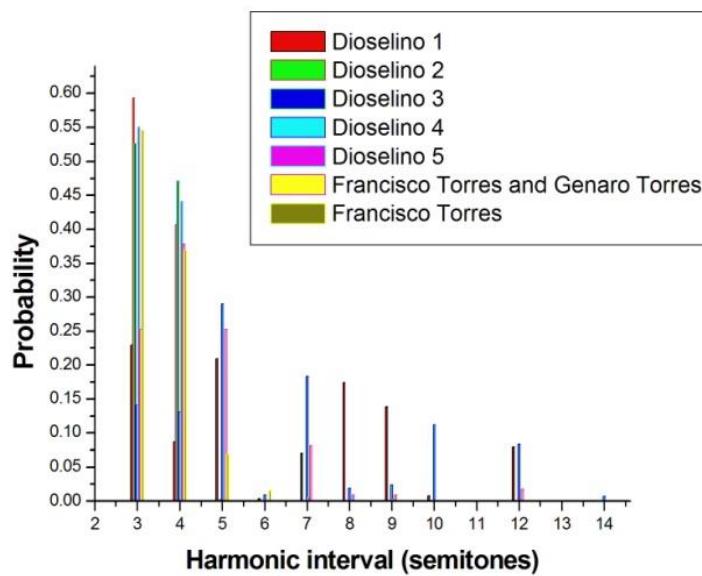
→ 
$$D_F(\alpha) = D_F + D_{\alpha F} + \sum_{i=1}^n \sum_{j=1}^n d(f_i, \alpha f_j, a_i, a_j)$$

# Harmonic spectrum analysis: Six harmonics



$\alpha \rightarrow$  Frequency ratio  
 $D_F(\alpha) \rightarrow$  Total dissonance

# Harmonic intervals analysis

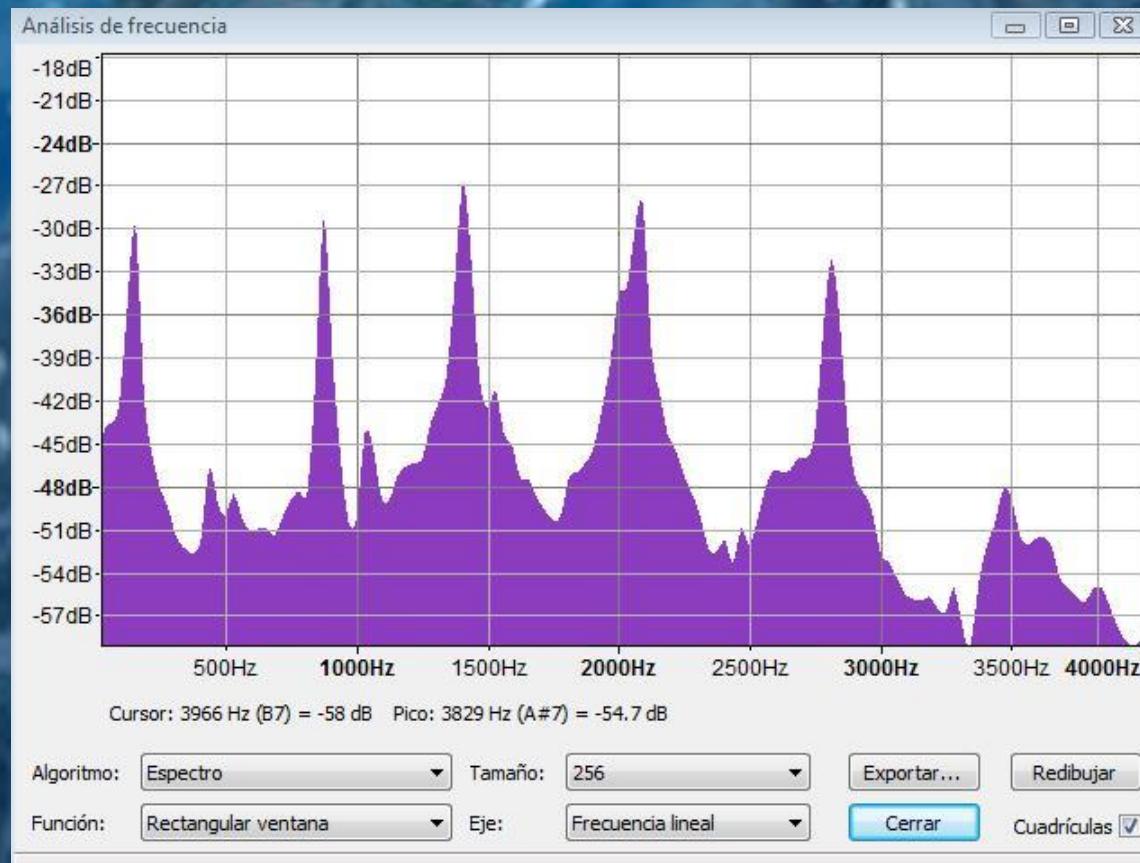


Marimba de Chonta

Himno nacional

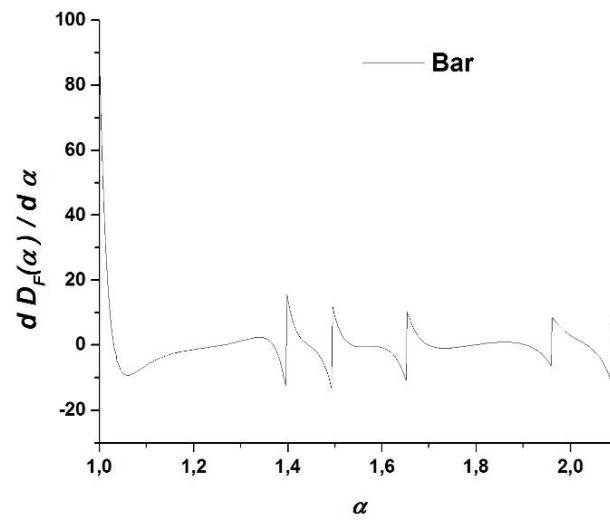
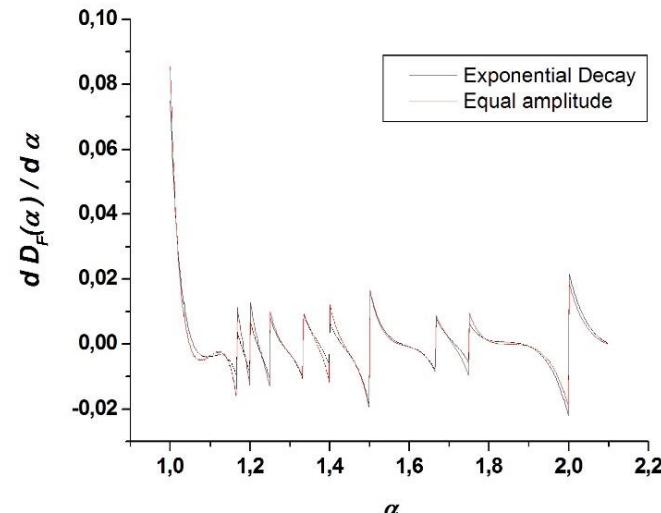
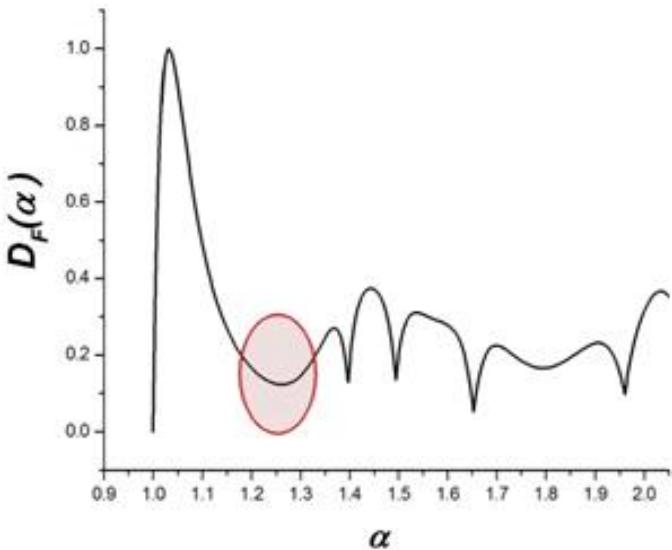
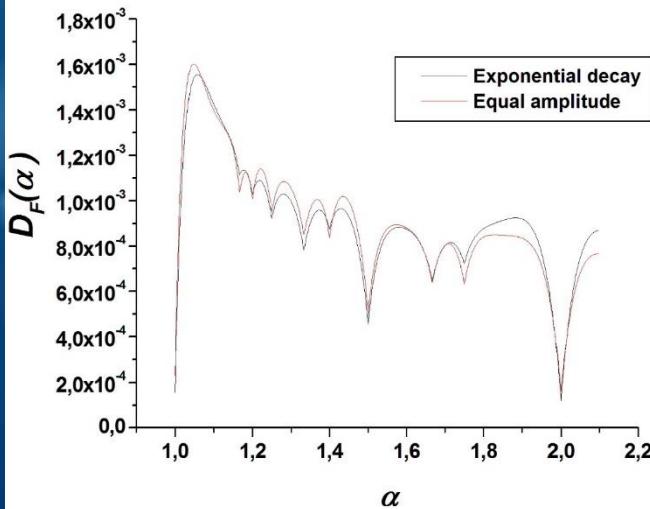
The musical score consists of eight staves of music for marimba. The title "Himno nacional" is at the top right. The first staff starts with a treble clef, a common time signature, and a key signature of one sharp. Measures 1 through 16 are shown. Measure 16 ends with a repeat sign and a first ending bracket. Measures 17 through 25 show the second ending. Measures 25 through 34 follow. Measures 34 through 40 show a variation. Measures 40 through 46 complete the piece. The notation includes various note values (eighth, sixteenth, thirty-second) and rests.

# *Marimba de chonta Timbre*

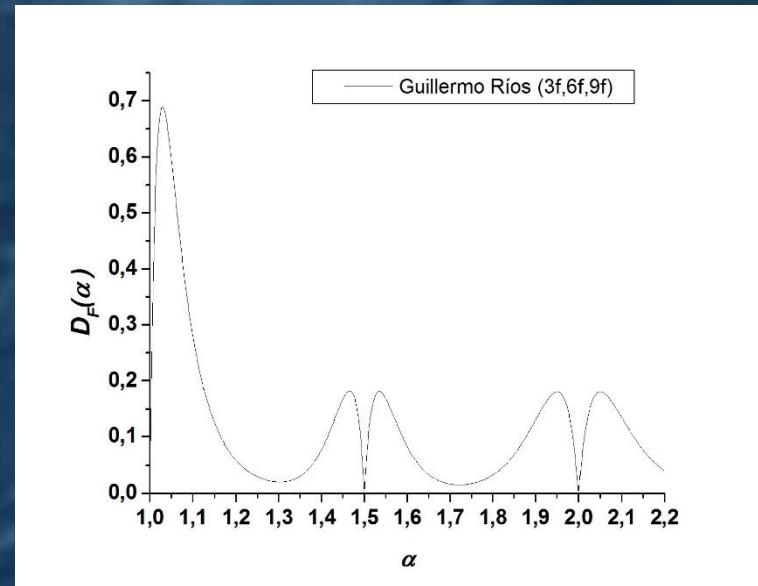
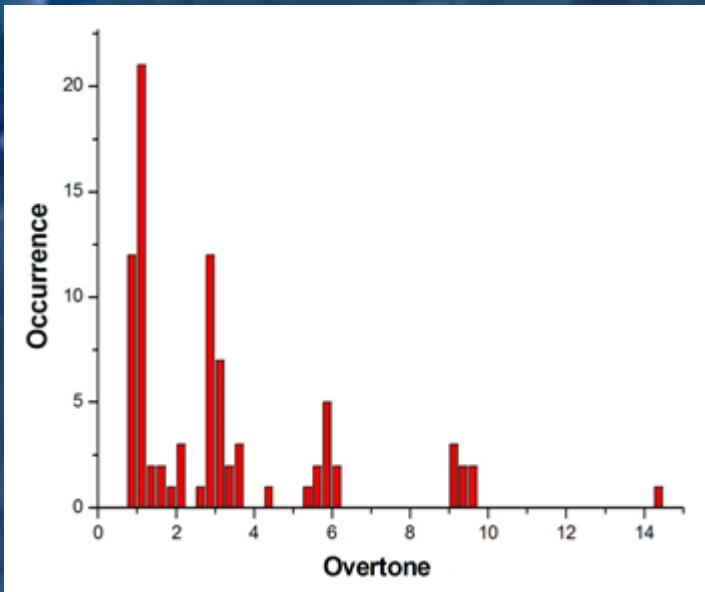
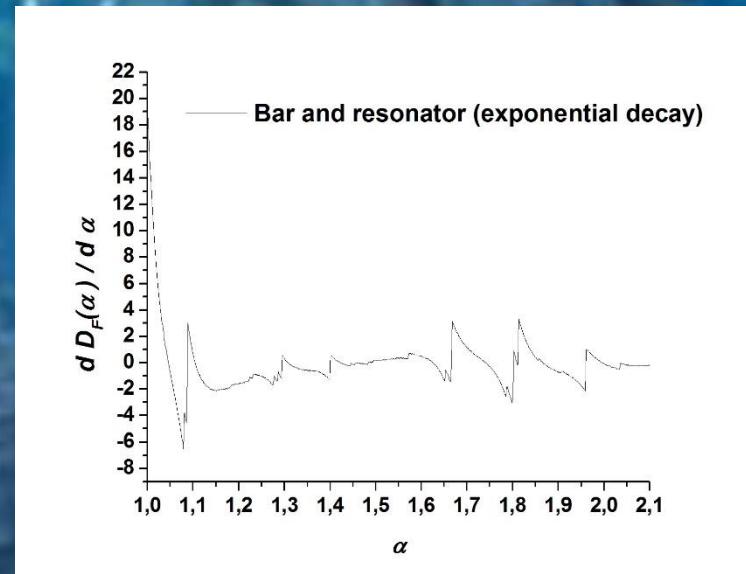
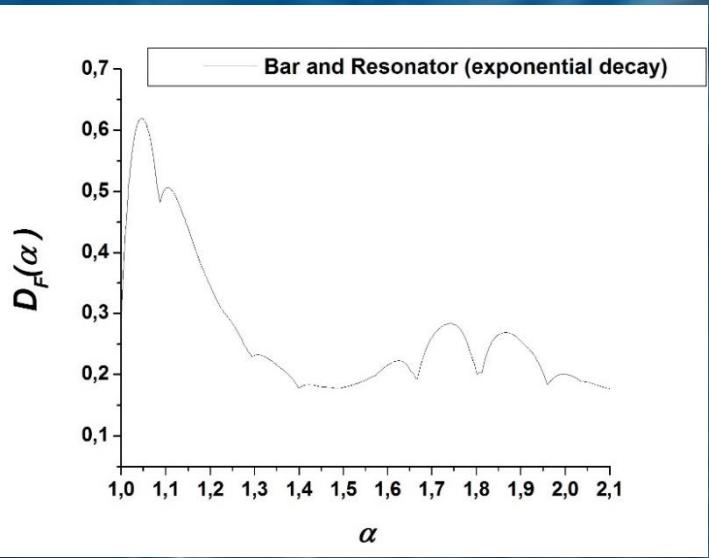


# Theoretical analysis I

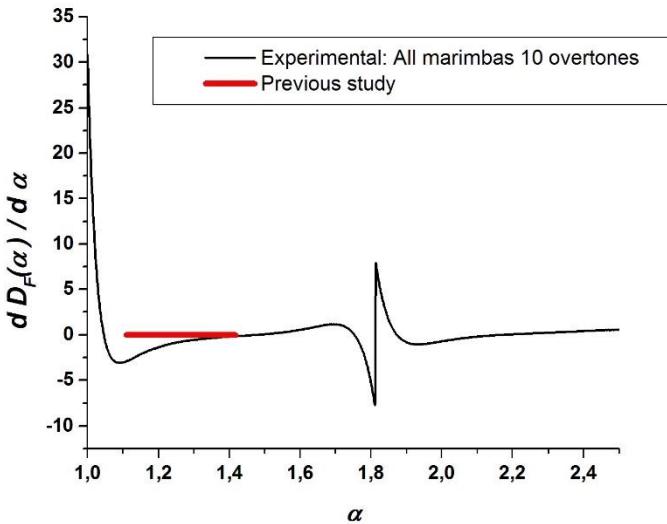
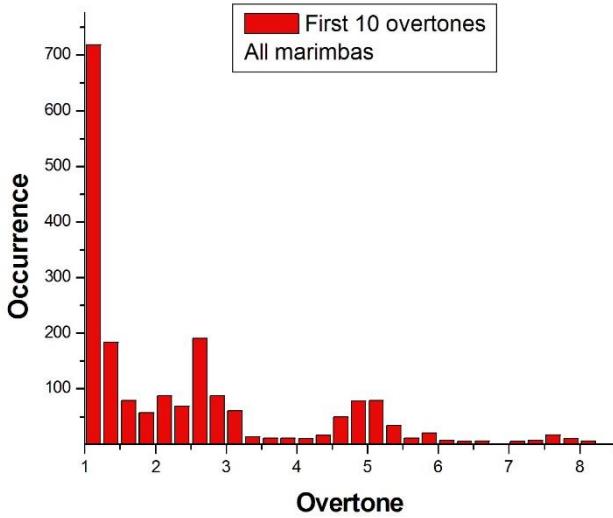
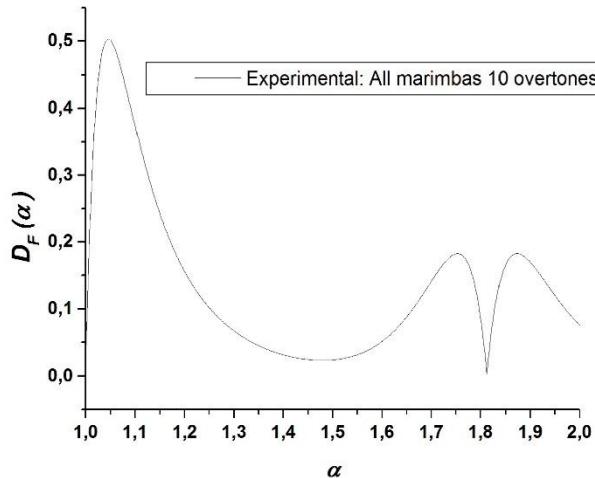
## Closed pipes, strings without stiffness and rectangular bars



# Theoretical & Experimental



# All marimbas: Experimental





*Thank you!*