



**SMU** | MEADOWS SCHOOL  
OF THE ARTS

# ACTOR @ SMU

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**SMU** | MEADOWS SCHOOL  
OF THE ARTS

- Private (secular) liberal arts university in Dallas, Texas
- Around 12,000 undergraduate/graduate students
- Meadows School of the Arts





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# MuSci Lab

# SMU MuSci Lab

**Personnel:** 6 affiliated SMU faculty; 10+ graduate and undergraduate researchers

**Active collaborators:** W. Jay Dowling (UT-Dallas), Marco Iacoboni (UCLA), Roger Kendall (UCLA), Joseph Maldjian (UT-Southwestern Medical)

## Broad research areas

- Musical affect
- Embodied music cognition
- Music and language
- Timbre
- Social psychology of music



# SMU MuSci Lab

## Facility equipped for ...

- *perceptual music studies* (MATLAB, MediaLab, DirectRT)
- *statistical/corpus analysis* (MATLAB and R)
- *neuroimaging* (UT-SW Medical)

## Areas of relevance to ACTOR

- Musical affect
- Embodied music cognition
- Music and language
- Timbre
- Social psychology of music





Research Axes	Research Sub-axes
Analysis Approaches	1. Music analysis
	2. Text analysis
	3. Audio analysis & modeling
	4. Perception analysis
	5. Performance analysis
Tool Development	6. Orchestration database
	7. Technological tools
	8. Online orchestration resource
Output Innovation	9. Pedagogy
	10. Music Theory & Musicology
	11. Composition

# Recent research

## 1. **Perception analysis:** Timbre, affect, and the brain

- Wallmark, Z., Iacoboni, M., Deblieck, C., & Kendall, R. A. (in press). Embodied listening and timbre: Perceptual, acoustic, and neural correlates. *Music Perception*.

## 2. **Text analysis:** Timbre description in orchestration

- Wallmark, Z. (submitted). A corpus analysis of timbre semantics in orchestration treatises.

## 3. **Musicology:** Timbre in popular music

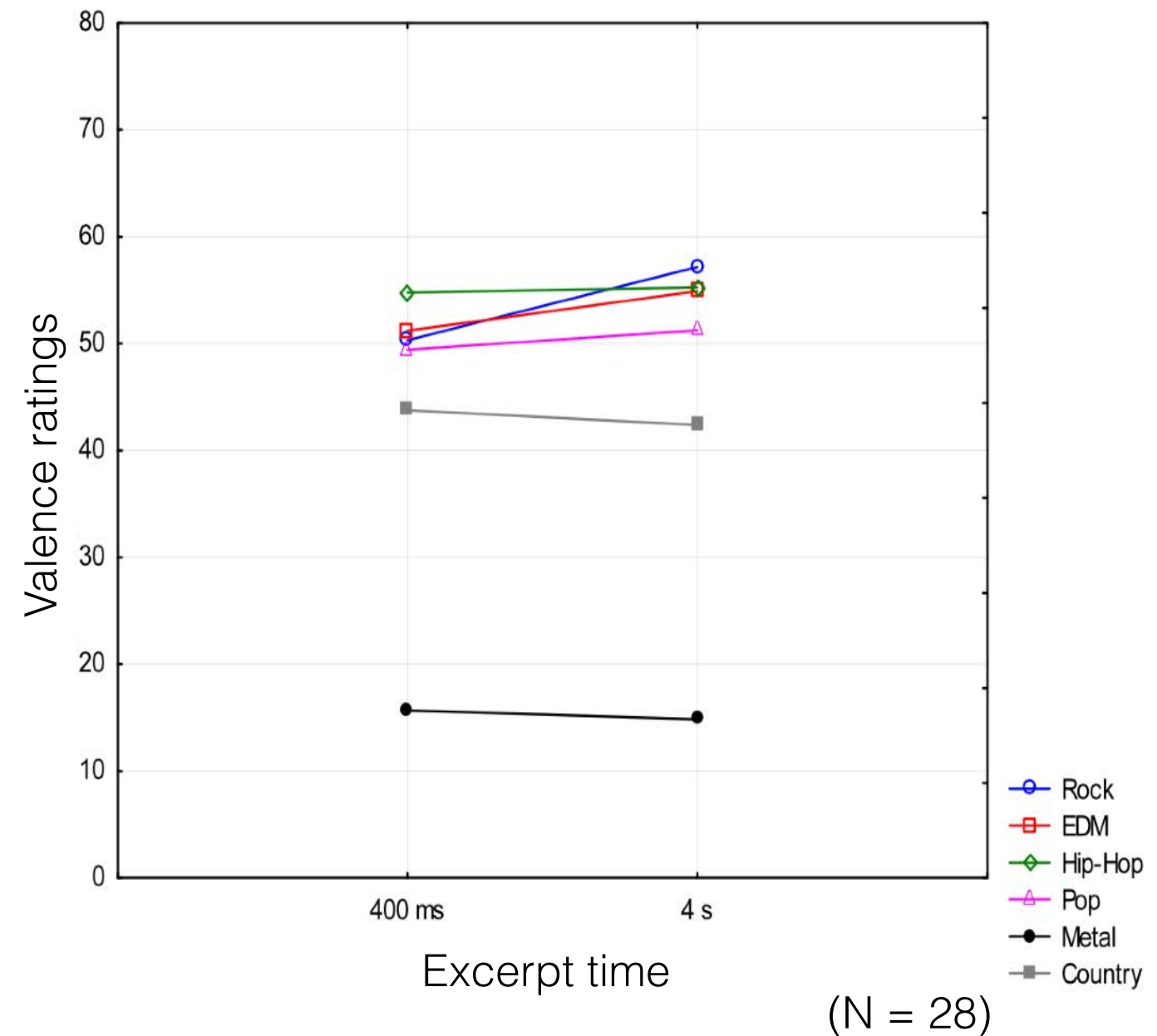
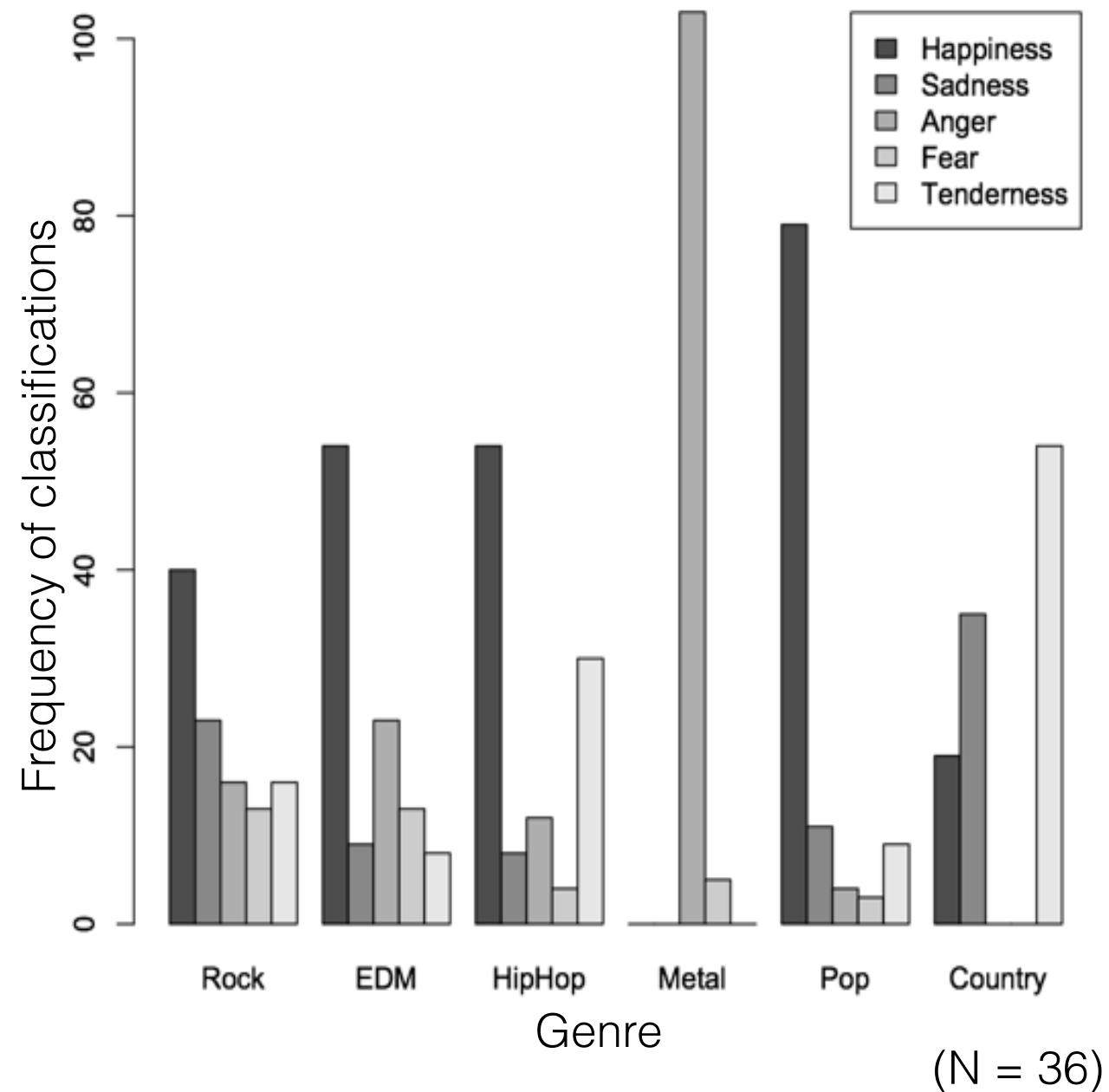
- Fink, R., Latour, M., & Wallmark, Z. (Eds.) (in press). *The relentless pursuit of tone: Timbre in popular music*. New York: Oxford UP.

# Perception analysis: Timbre, affect, and the brain

- Experiments using behavioral and fMRI techniques to explore...
  1. Affective valence of timbre, particularly in popular music contexts
  2. Neurophysiological correlates of timbre appraisal

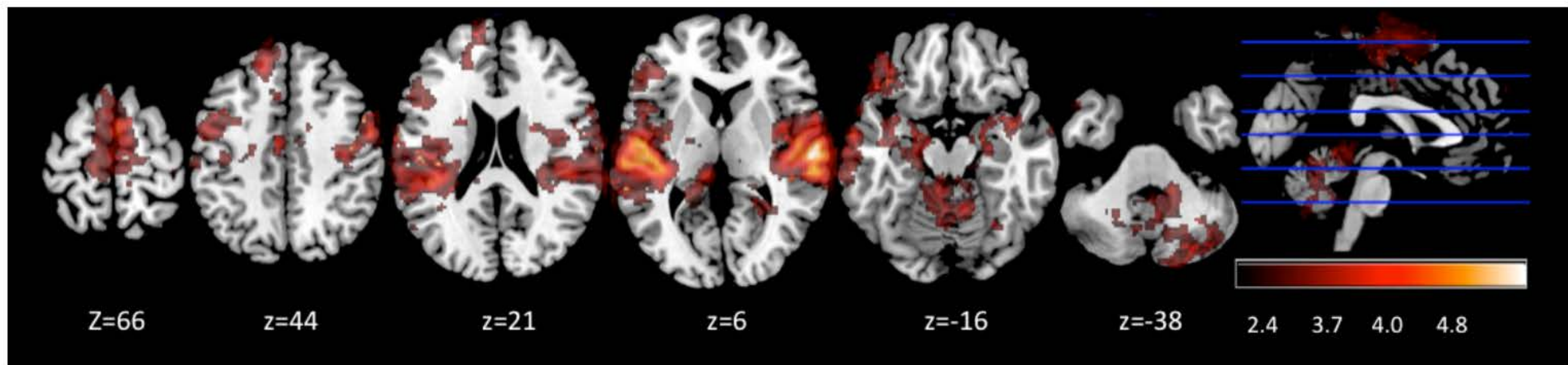


# (1) Perceived emotion of brief excerpts of popular music





## (2) Processing timbre



timbre > baseline

(N = 15)

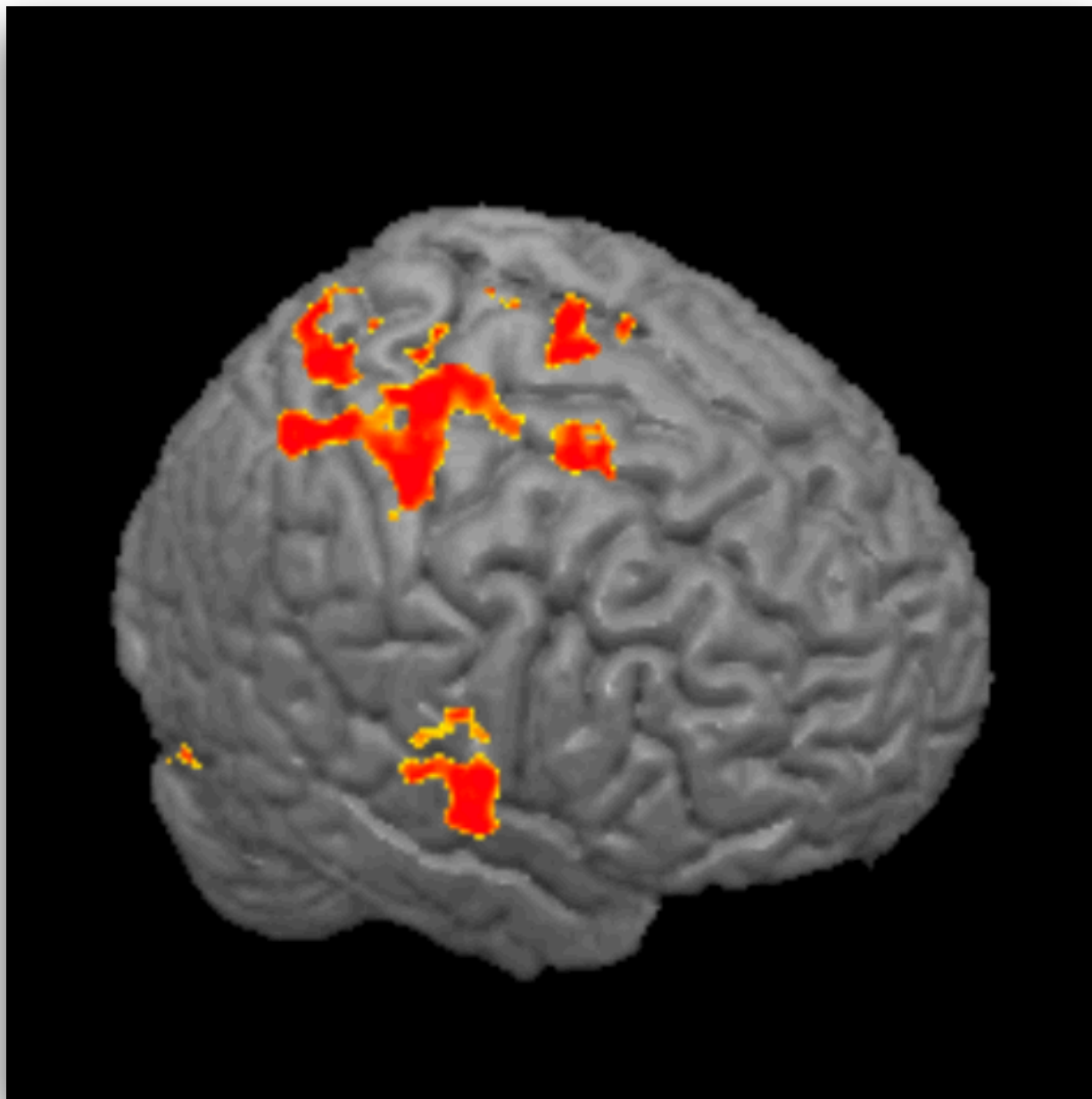


## (2) Processing *disliked* timbres

*activity in...*

- premotor cortex/SMA
- occipital visual areas
- somatosensory cortex
- insula
- amygdala

**conclusion:** timbre processing involves more sensorimotor and limbic engagement than we previously thought, especially when listening to sounds we dislike



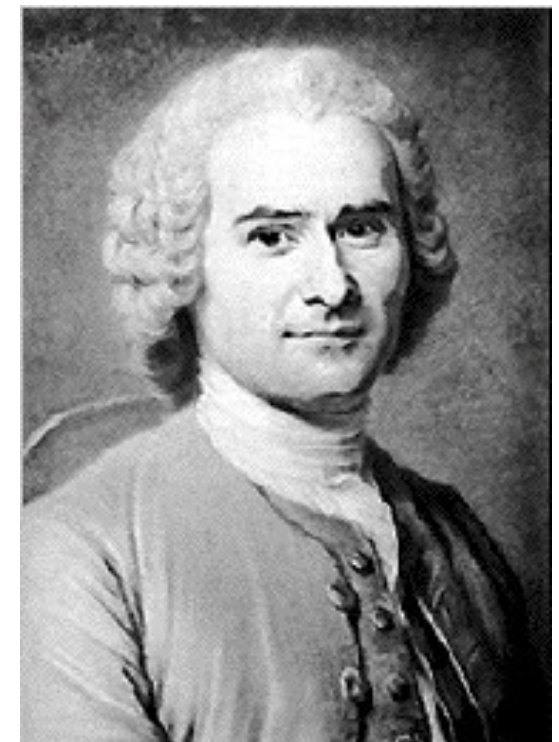


Text analysis:

Timbre description in orchestration

A sound's *timbre* describes its harshness or softness, its dullness or brightness. Soft sounds, like those of a flute, ordinarily have little harshness; bright sounds are often harsh, like those of the *vielle* or the oboe. There are even instruments, such as the harpsichord, which are both dull and harsh at the same time; this is the worst timbre. The beautiful timbre is that which combines softness with brightness of sound; the violin is an example.

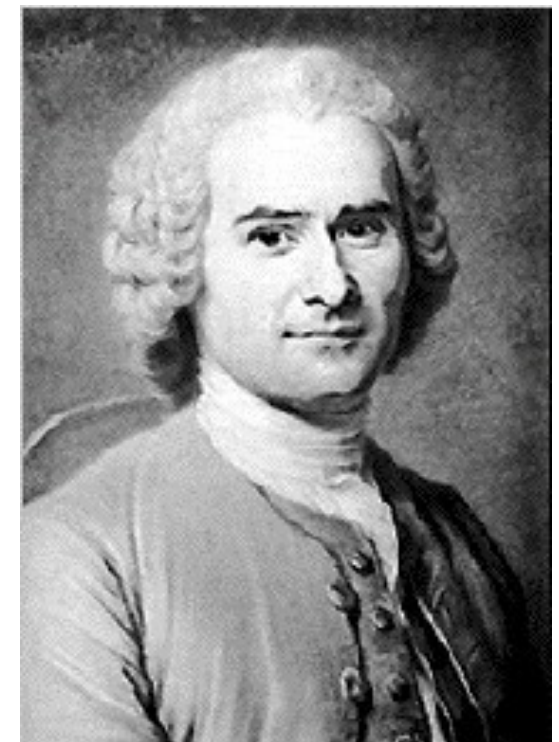
– Jean-Jacques Rousseau, in  
Diderot's *Encyclopédie* (1765)





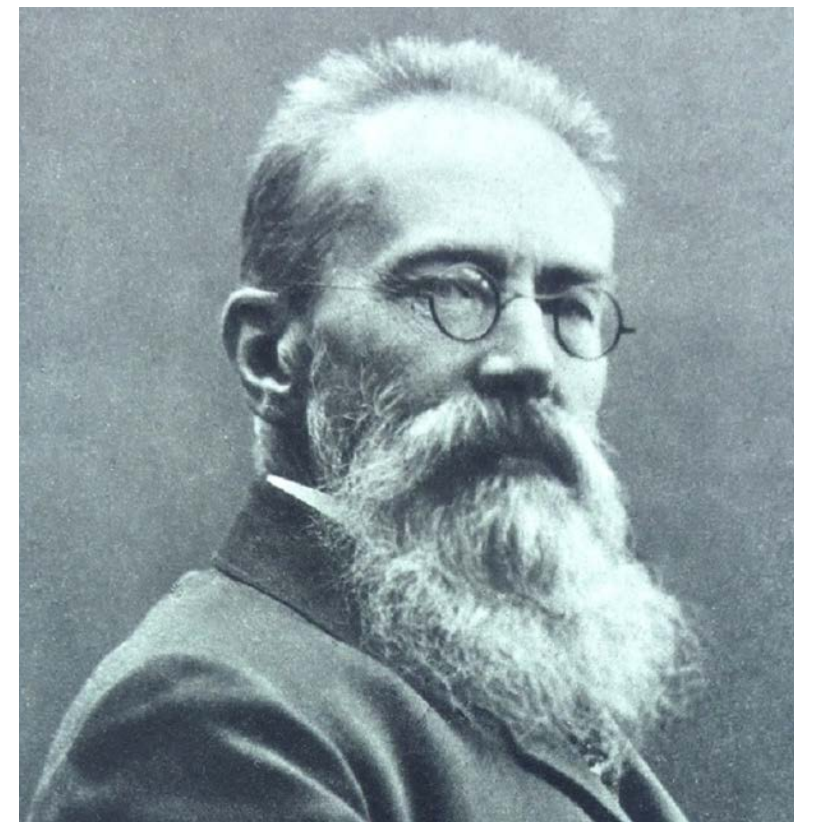
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– Jean-Jacques Rousseau, in  
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It is a difficult matter to define tone quality in words; we must encroach upon the domain of sight, feeling, and even taste [...]  
In using the terms **thick, piercing, shrill, dry**, etc., my object is to express artistic fitness into words, rather than material exactitude.

– Nikolai Rimsky-Korsakov,  
*Principles of Orchestration*  
(1912)





# Questions

1. What words are most frequently used to describe qualities of instrumental timbre?
2. Are descriptive conventions reliably different from one instrument (and instrument family) to the next?
3. What does this lexicon reveal about timbre conceptualization and cognition more generally?

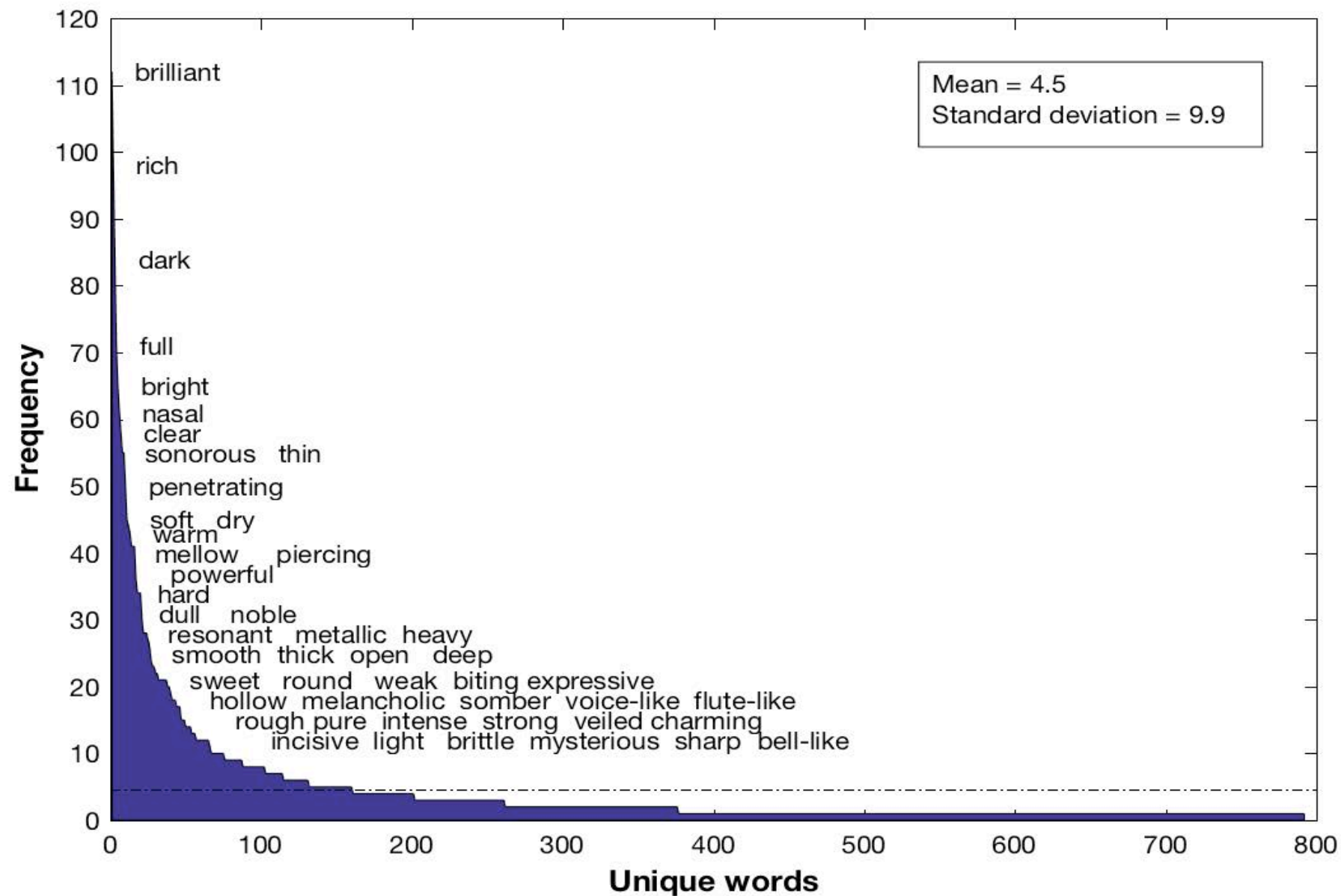
# Corpus of orchestration treatises

Author	Title	Year	Tokens	%	Types	CTTR
Adler, S.	<i>The Study of Orchestration</i>	1989	316	8.6	145	5.8
Berlioz, H.	<i>A Treatise on Modern Instrumentation and Orchestration</i>	1882	650	17.7	305	8.5
Blatter, A.	<i>Instrumentation and Orchestration</i>	1980	349	9.5	139	5.3
Brant, H.	<i>Textures and Timbres: An Orchestrator's Handbook</i>	2009	174	4.7	55	3
Forsyth, C.	<i>Orchestration</i>	1914	471	12.8	268	8.7
Jacob, G.	<i>Orchestral Technique: A Manual for Students</i>	1931	201	5.5	127	6.3
Kennan, K. & Grantham, D.	<i>The Technique of Orchestration</i>	1952	425	11.6	181	6.2
Piston, W.	<i>Orchestration</i>	1955	328	8.9	164	6.4
Rimsky-Korsakov, N.	<i>Principles of Orchestration</i>	1933	289	7.9	111	4.6
Wagner, J.	<i>Orchestration: A Practical Handbook</i>	1959	241	6.6	144	6.6
Widor, C-M.	<i>The Technique of the Modern Orchestra: A Manual of Practical Instrumentation</i>	1906	222	6.1	116	5.5
<i>M</i>			<i>333</i>	<i>9.1</i>	<i>160</i>	<i>6.1</i>
<i>SD</i>			<i>139</i>	<i>3.8</i>	<i>71</i>	<i>1.6</i>
<i>ALL</i>			<i>3666</i>	<i>100</i>	<i>879</i>	<i>10.3</i>



# Examples

1. “[Cello] timbre, on the upper strings, <sup>[range-high]</sup> is one of the most **expressive** in the orchestra. Nothing is more **voluptuously melancholy**, or more suited to the utterance of *tender, languishing* themes<sup>[pitch]</sup>.” (Berlioz, 1882, p. 37)
2. “The quality of the notes [on stopped French horn<sup>[technique]</sup>] varies from a **savage bark like that of a wild animal** to the **dull uncertain** sound with which a rout-seat **scrapes** over a parquet-floor.” (Forsyth, 1914, p. 113)
3. “The very *deep* notes<sup>[range-low]</sup> of the double bassoon are remarkably **thick** and **dense** in quality, very **powerful** in piano passages<sup>[dynamic]</sup>.” (Rimsky-Korsakov, 1933, p. 20)
4. “All are in sixth position [on the violin], except that the initial B is better played on the more **brilliant** E-string in third position.” (Piston, 1955, p. 50)



Top 50 words account for 49% of total; 12% of words only appear once



# By instrument

	<b>Piccolo</b>	<b>Flute</b>	<b>Oboe</b>
Tokens	92	179	159
% of WW	8	16	14
Types	58	106	88
CTTR	4.3	5.6	4.9
Top 10 descriptors	piercing, bright, weak, whistling, brilliant, shrill, breathy, clear, edgy, feeble	brilliant, clear, bright, breathy, sweet, shrill, velvety, light, penetrating, pure	nasal, thin, penetrating, pungent, coarse, reedy, thick, artless, clear, joyous

	<b>English horn</b>	<b>Clarinet (B <math>\flat</math> /A)</b>	<b>Bass clarinet</b>
Tokens	87	245	59
% of WW	8	21	5
Types	61	145	45
CTTR	4.6	6.6	4.1
Top 10 descriptors	melancholic, rich, dark, expressive, sonorous, thin, beautiful, deep, dreamy, poignant	rich, dark, brilliant, piercing, clear, warm, bright, noble, pure, shrill	rich, dark, full, goblin-esque, shadowy, sinister, windy, bright, calm, characteristic

	<b>Bassoon</b>	<b>Contrabassoon</b>	<b>Saxophone (A/T)</b>
Tokens	143	42	73
% of WW	13	4	6
Types	100	30	50
CTTR	5.9	3.3	4.1
Top 10 descriptors	thin, nasal, dark, dry, pinched, full, pale, reedy, weak, cadaverous	rough, ponderous, buzzing, deep, full, good, heavy, nasal, thick, dense	full, rich, horn-like, open, even, flute-like, heavy, penetrating, sentimental, thick

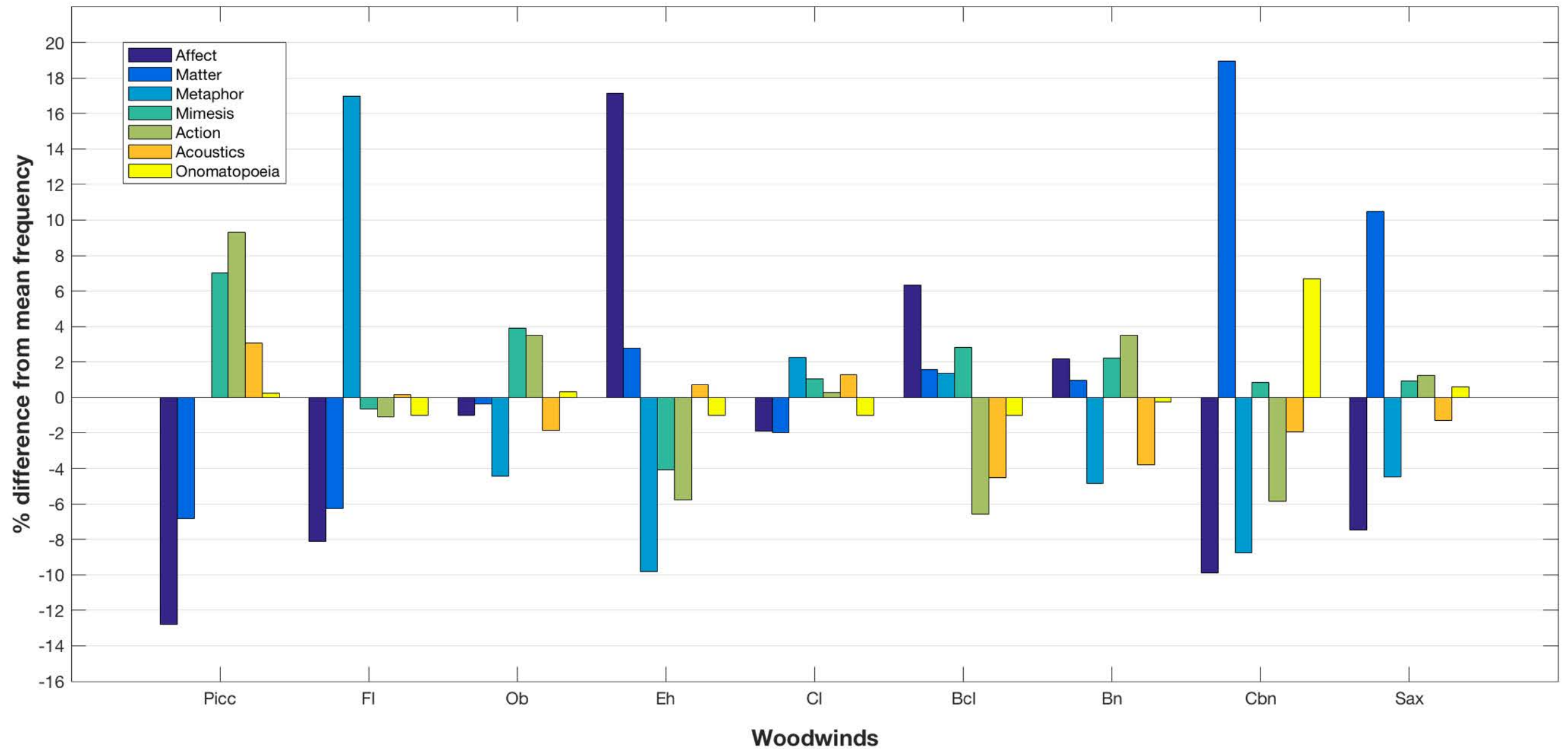
# Conceptual categories

- **Seven categories** of timbre description; typology confirmed through interrater reliability analysis

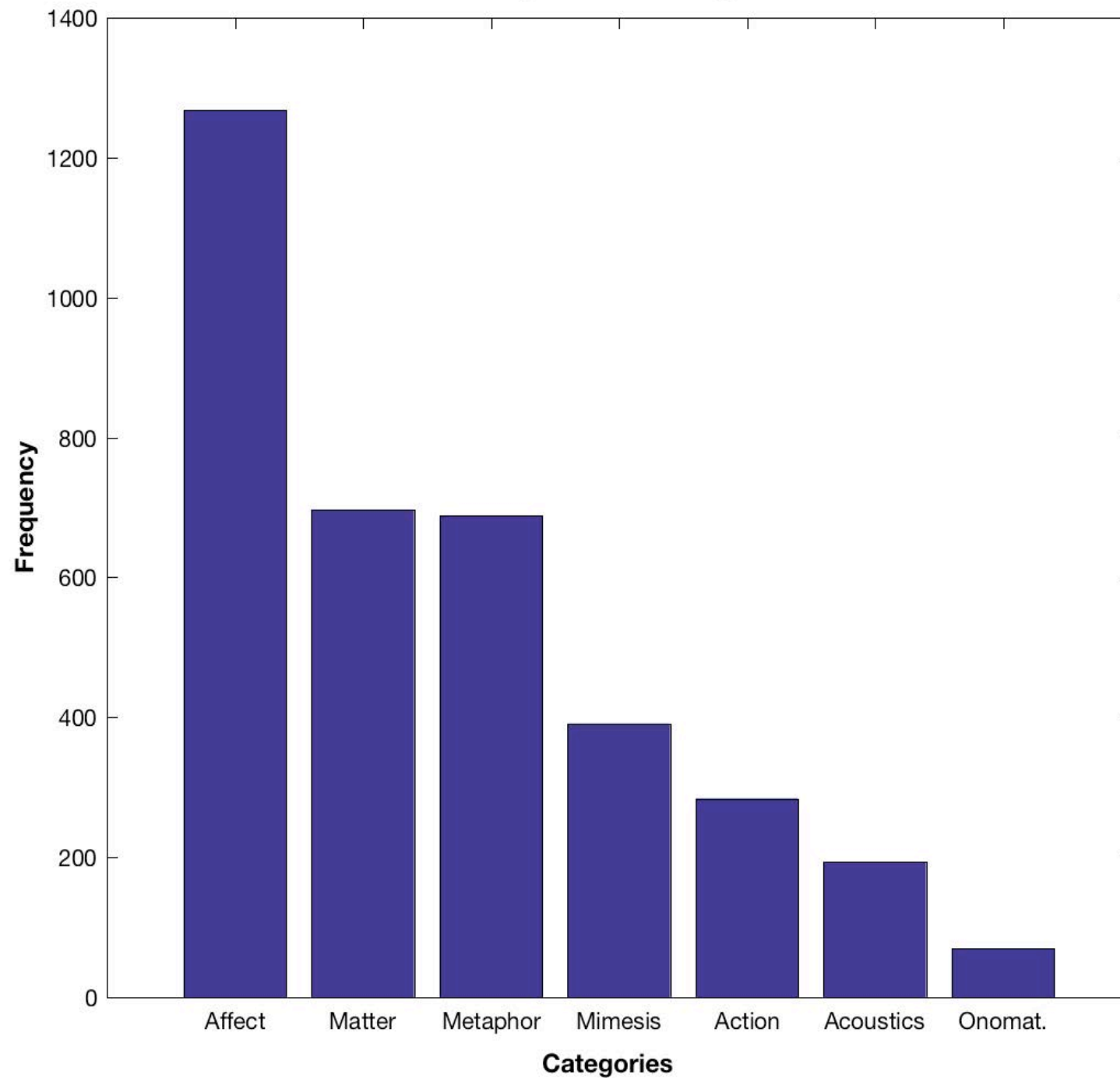
Categories	Examples
Affect	mellow, noble, grotesque, gloomy, powerful, attractive, fine
Matter	thin, round, hollow, liquid, sharp, blunt, heavy
Metaphor	bright, warm, sweet, smooth, dark, coarse, sparkling
Mimesis	Flutey (flute-like), whispering, bell-like, throaty, growling, stormy, fairy-like
Action	Piercing, biting, lamenting, strained, mocking, muffled
Acoustics	Ringling, shrill, raspy, blaring, resonant, echoing, clangorous
Onomatopoeia	Click, hiss, rattle, ping, screech, cluck, honk



# Description of individual instruments



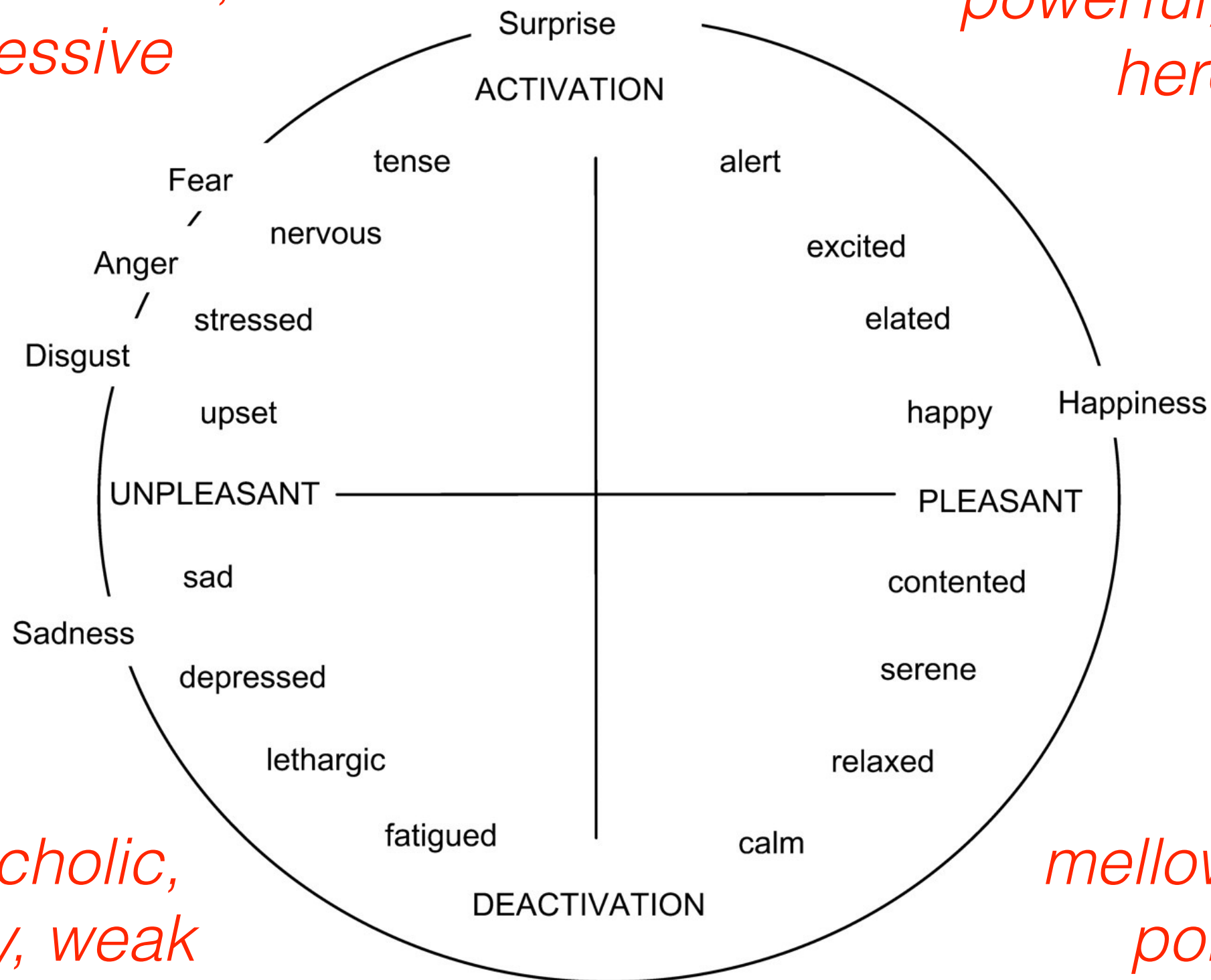
# A “sign-post for the emotions”?



Quote from Boulez, 1987

*violent, sinister,  
aggressive*

*powerful, joyous,  
heroic*



*melancholic,  
gloomy, weak*

*mellow, tender,  
poignant*



# Musicology



## **The Relentless Pursuit of Tone**

*Timbre in Popular Music*



*Edited by  
Robert Fink  
Melinda La Tour  
Zachary Wallmark*

# SMU's projected contributions to ACTOR

Research Axes	Sub-axes	
Analysis Approaches	1. Music analysis	<ul style="list-style-type: none"><li>• Timbre conceptualization</li><li>• Corpus linguistic analysis</li><li>• Affect/sentiment analysis of timbre terminology</li><li>• Development of multilingual, transdisciplinary lexicon of timbre/orchestration terms</li><li>• Affective dimensions of timbre</li><li>• Neurophysiological dimensions of timbre/orchestration perception (possibly)</li></ul>
	2. Text analysis	
	3. Audio analysis & modeling	
	4. Perception analysis	
	5. Performance analysis	
Tool Development	6. Orchestration database	
	7. Technological tools	
	8. Online orchestration resource	
Output Innovation	9. Pedagogy	<ul style="list-style-type: none"><li>• Cultural/historical musicology</li><li>• Popular music</li></ul>
	10. Music Theory & Musicology	
	11. Composition	





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