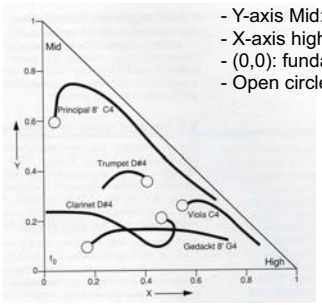
Schouten (1968)

- Recognition of a sound object may depend on several factors:
  - Whether the sound is periodic, or it has a noise-like character.
  - Whether the waveform envelope is constant or varies with time, and what those fluctuations are like.
  - Whether any other aspect of the sound, for example its spectra, is varying with time.
  - What are the preceding and following sounds.

Timbral Mapping - Low vs. High Harmonics



- Y-axis Mid: 2,3,4th harmonics
- X-axis high: 5th and above
- (0,0): fundamental
- Open circles depict steady states

Tristimulus diagram by Pollard and Jansson (1982)

Steady State

TABLE 7.1 Listener judgments of recorded wind-instrument tones presented with first and last half seconds removed (Berger 1963)

	Response										
Stimulus	Flute	Oboe	Clarinet	Tenor saxophone	Alto saxophone	Trumpet	Cornet	French horn	Baritone	Trombone	No answer
Flute	1	2		1	6	5	4			4	7
Oboe		28									2
Clarinet	1	1	20	4	3						1
Tenor saxophone			25	2	1						2
Alto saxophone				3	4		1	11	5	5	1
Trumpet	8				6	2	3	4	1	3	3
Cornet		1				12	15				2
French horn	1			2	3			5	6	6	7
Baritone			1	1	2	3	2	4	7	3	7
Trombone	2	1		5	3			1	5	9	4

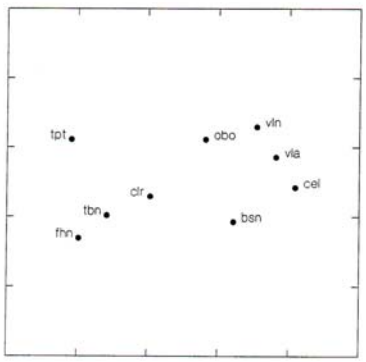
2. Perceptual studies of Timbre

- Similarity ratings of pair of sounds
- Tried to discover the dimensions from which subjects were abstracting their similarity ratings.

Plomp studies

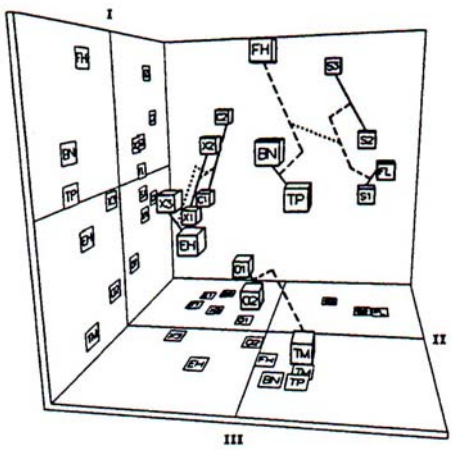
- Timbre is closely related to the differences of the average spectra in different critical bands.
- It is relative to the level produced by a sound in each critical band.

Wessel (1973) (Same as Plomp, 311Hz - Eb)



- Dimension 1: Onset characteristics of low and high frequency components
- Dimension 2: Brightness (spectral centroid)

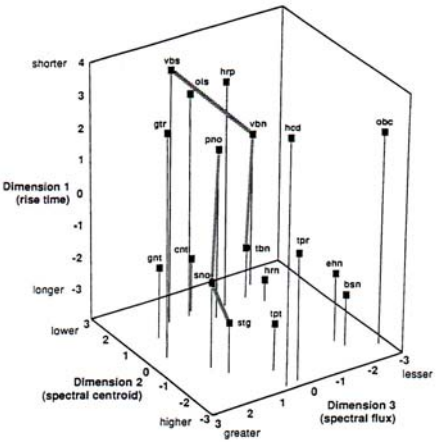
Grey (1977)



- O1, O2 Oboes
- C1 =Eb Clarinet
- C2 Bass Cl
- X1 Alto Sax (mf)
- X2 Alto Sax (p)
- X3 Sop Sax
- EH English horn
- FH French Horn
- S1 Cello (sul ponticello)
- S2 Cello (normal bowing)
- S3 Cello (sul tasto)
- Tp Trumpet
- Tm Muted Trombone
- FL Flute
- BN Bassoon

Dim 1: Centroid
Dim 2: Relative Synchronicity in the transient portions of the upper harmonics
Dim 3: Presence of low-amplitude, high frequency energy near the onset of the signal

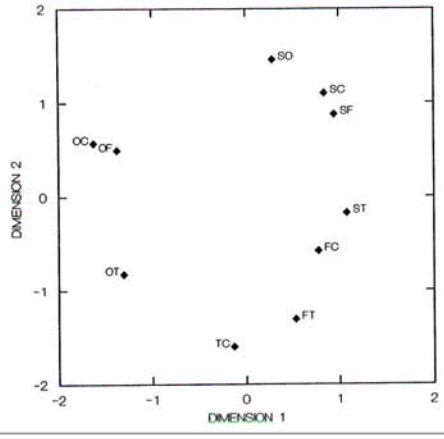
McAdams et. Al. (1995)FM signals



- BSN Bassoon
- EHN English Horn
- CNT Clarinet
- GTN Guitarnet (Cl + Guitar)
- OBC Obochord (Oboe + Harpsichord)
- OBO Oboe
- OLS oboleste (oboe + celeste)
- PNO Piano
- POB bowed piano
- SNO Striano (strings + piano)
- SPO Sample Piano
- STG String
- TBN Trombone
- TPR Trumpar (trumpet + Guitar)
- TPT Trumpet
- VBN Vibrone (vibraphone + trombone)

Kendall-Carterette (1991-1994)

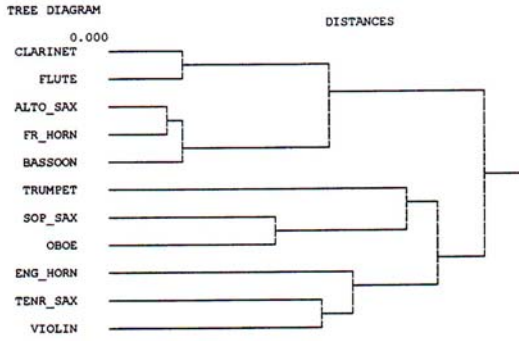
Compared dyads of woodwinds in unison (Bb 466Hz), minor thirds, major thirds, and melodies)



- OC Oboe-Clarinet
- OF Oboe-Flute
- OT Oboe-Trumpet
- SO Alto Sax-Oboe
- SC Alto Sax-Clarinet
- SF Alto Sax-Flute
- ST Alto Sax-Trumpet
- FC Flute-Clarinet
- FT Flute-Trumpet
- TC Trumpet-Clarinet

Dim 1: nasal - not nasal
Dim 2: Rich - Brilliant

Kendall-Carterette 1995



3. A different approach to studying timbre: Cognition and the Evolutionary Psychological approach

- Based on the premise that sensory systems evolved to provide biological useful information about the world
  - Following discussion based primarily on David Huron's theories on evolutionary psychoacoustics.

- Considers the properties that sounds have in helping humans solve basic evolutionary problems
  - seeking food and shelter
  - avoiding danger
  - establishing friendships and alliances
  - pursuing sexual relationships
  - raising offspring

What is timbre for?

- Identification
  - Distinguish mother from other individuals
  - Truck from car
  - Bird from tiger
- State cues
  - Sound implying something is being rubbed
  - Sound of something wet
  - Sound of a smiling voice
  - Sound of someone nervous

- State cues can tell us something important about the sound
  - size of sound-producing object
  - mode of excitation
  - amount of energy generated
  - materials used
  - innanimate object vs. living agent
  - intentions and emotional states

- Aggression associated with low pitch (Ohala, 1984; Morton, 1984)
- Low tones tend to evoke perceptions of something big
- Transposed unintelligible speech up in pitch is perceived as less aggressive (Ohala, 1980; 1982)
-

- For D. Huron, identity/discrimination issues are learned and state cues are innate.

Some possible dimensions/ features of timbre

- According to D. Huron (2005)
  - Gender (masculine, feminine)
  - Aggressiveness/submissiveness
  - Cuteness
  - Coziness
  - Fear
  - Pleasure
  - Sexiness