

# Sound Objects

(Schouten, 1968)

- Recognition of a sound object may depend on whether
  - the sound is periodic or noise-like;
  - the signal envelope varies (vs. being constant) and how;
  - the spectral distribution varies with time and how;
  - any sounds precede or follow.

## Studies by Plomp (1970s)

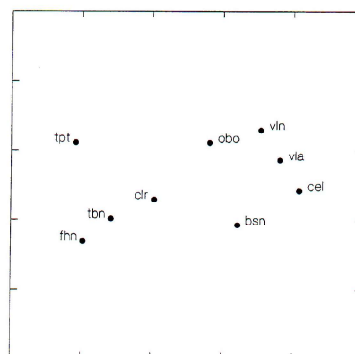
- Timbre is closely related to the differences of the average spectra in different critical bands.
- It is relative to the level produced by a sound in each critical band.

## Perceptual studies of Timbre

- Similarity ratings of sound pairs
- Exploration of the perceptual dimensions underlying the similarity ratings.

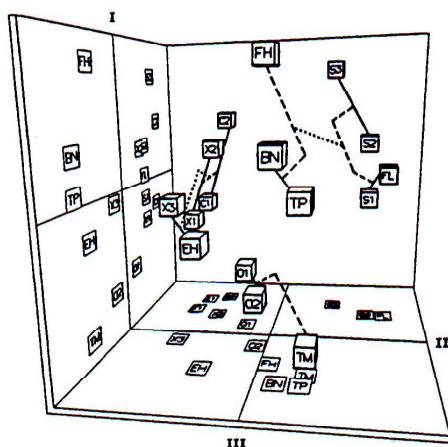
## Wessel (1973)

(Same as Plomp, 311Hz - Eb)



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

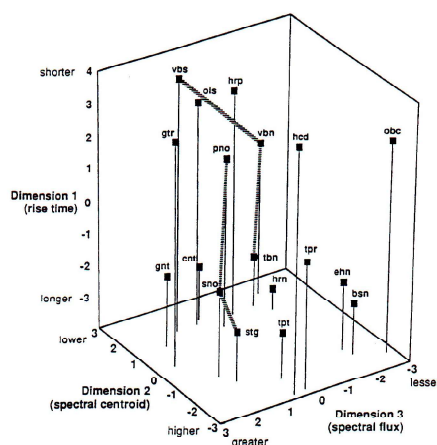
## Grey (1977)



- 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

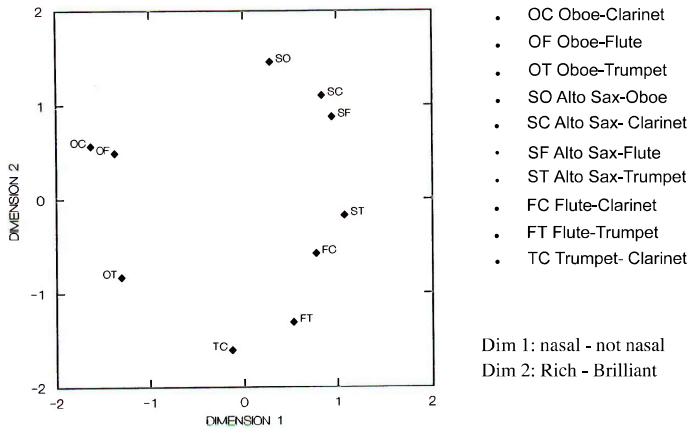
## McAdams et. Al. (1995) (FM signals)



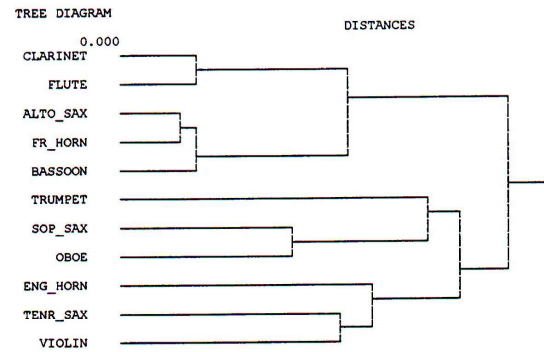
- BSN Bassoon
- EHN English Horn
- CNT Clarinet
- GTN Guitarnet (Cl + Guitar)
- OBC Obochord (Oboe + Harpsichord)
- OBO Oboe
- OLS oboleste (oboe + celeste)
- PNO Piano
- POB bowed piano
- SNO Striano (strings + piano)
- SPO Sample Piano
- STG String
- TBN Trombone
- TPR Trumpar (trumpet + Guitar)
-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

## Kendall-Carterette (1991-1994)

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



## Kendall-Carterette 1995



## Timbre, Cognition & Evolutionary Psychology

- 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
- State cues can provide information on
  - size of the sound-producing object
  - mode of excitation
  - amount of energy generated
  - materials used
  - whether the source is an inanimate object or a living agent
  - intentions and emotional states

## What is timbre for?

- Identification (*learned cues*)
  - distinguish mother from other individuals
  - truck from car / bird from tiger
- State (*innate cues*)
  - Sound implying something is being rubbed
  - Sound of something wet
  - Sound of a smiling voice or someone nervous
- 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)