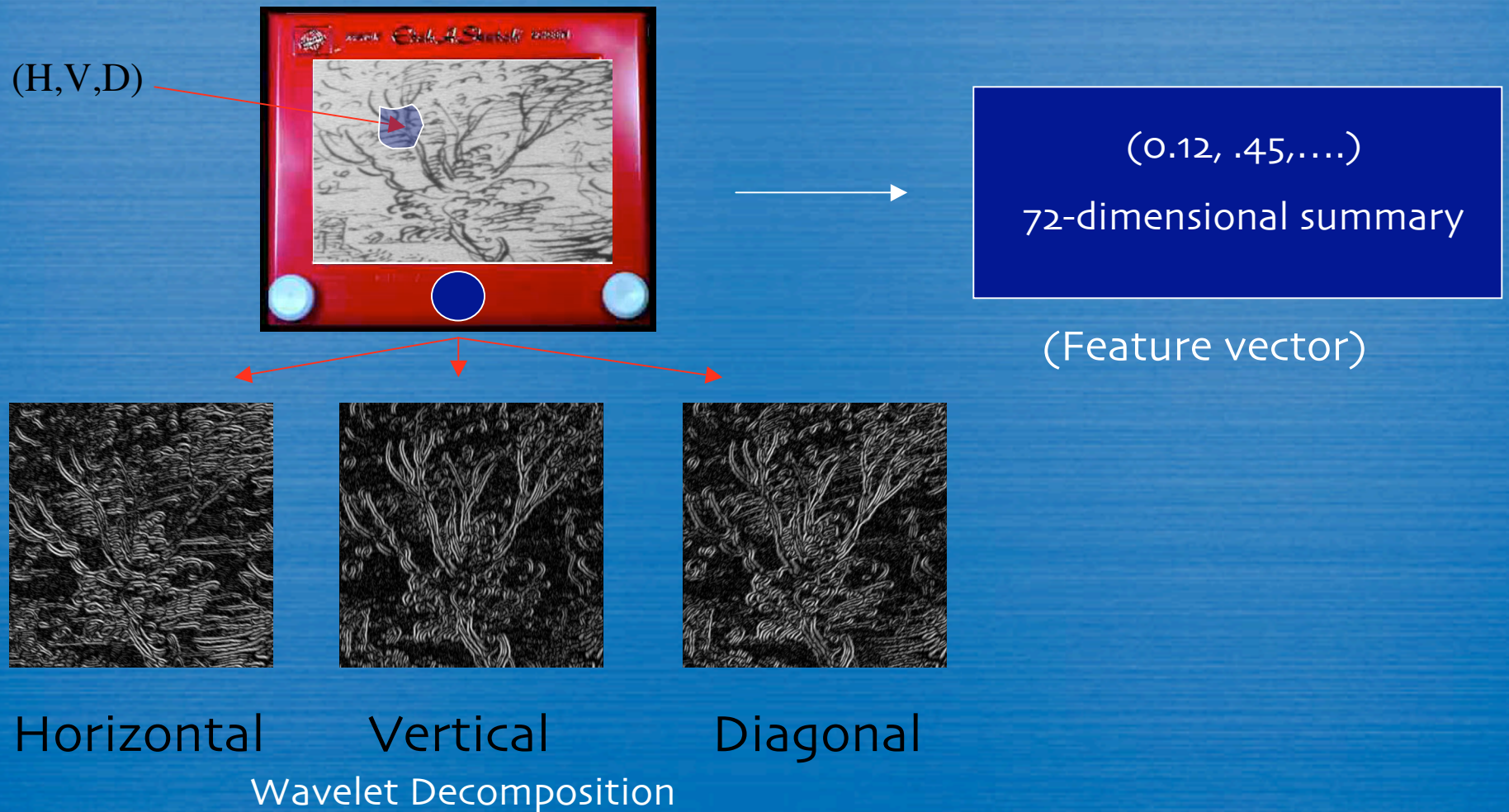
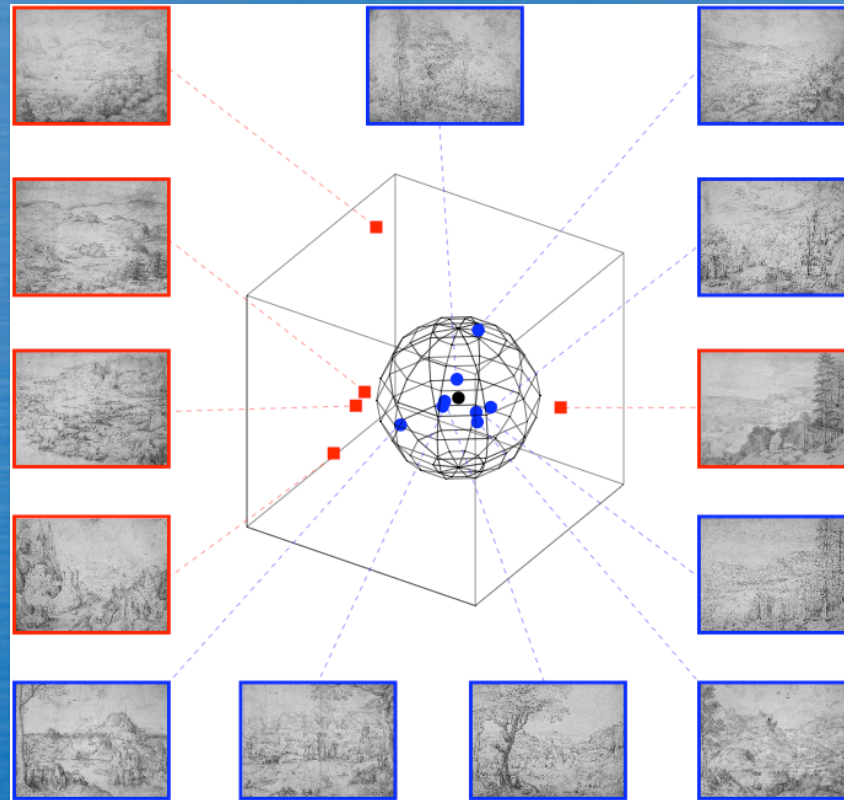


Wavelet Analysis for Visual Stylometry





Visualization



■ Blue = Bruegel

■ Red = non-Bruegel





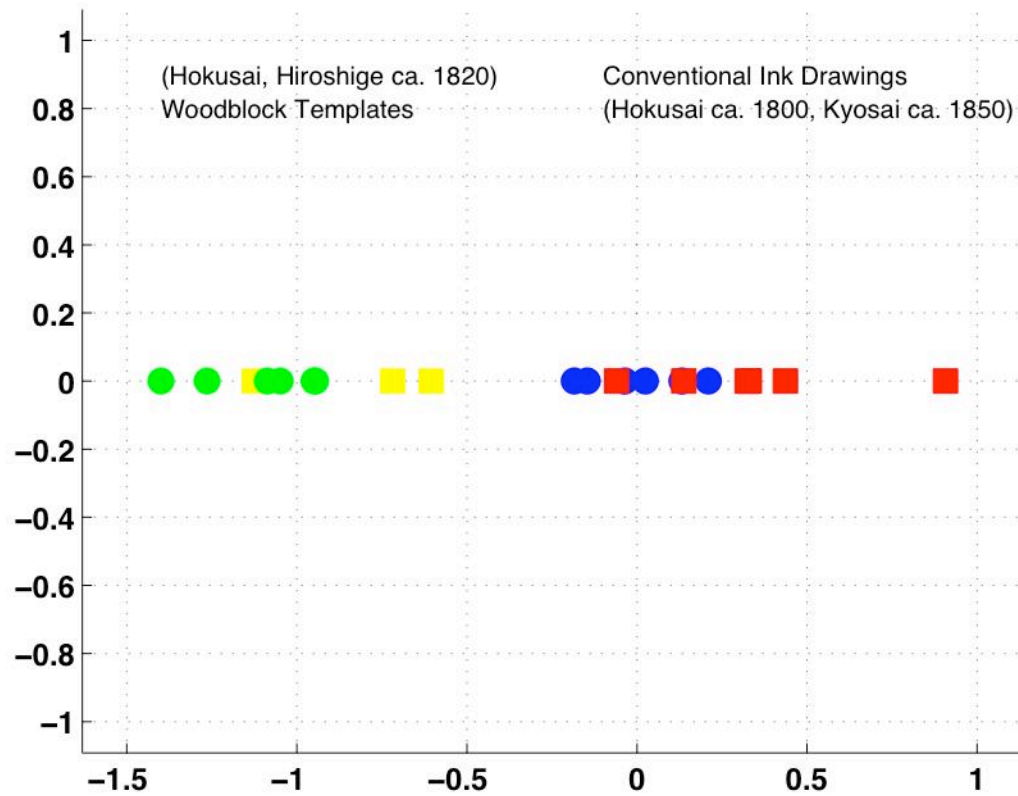
Attribution

(w./G. Leibon)

- “Secure” works
- Questioned Work
- Extract Feature Vectors
- Compare distances between secure and questioned
- Hypothesis testing to determine if the questioned is consistent with the secure
- Tests of “Robustness”



Japanese Ink Drawings (w./G. Genovese, J. Winter)





Van Gogh Project



- Organized by Rick Johnson (EE - Cornell)
- Goal - mathematical/computational characterization of Van Gogh's "technique" (brushwork, organization, etc.)
- Players - VG Museum, curators, conservators, mathematicians/computer scientists Data - 101 low res b/w images from VGM
 - 23 secure
 - 68 questionable authenticity (questionable ---> fake)



“The Contest”

- 5 secure VG
- 1 forgery (by VGM-approved restorer)
- Can the computer pick out the fake?

YES!
(all 3 teams)



VGP - Part II

- Kick-off meeting November 9, 2007 (MoMA)
- Next meeting: October 20-21, 2008
- New Challenges:
 - Dating
 - Attribution
 - Distinguishing Feature Extraction



Non-Example (so far!)



“Rembrandt Project” - no conclusive results...to date

Moral: Paintings are VERY complicated!

The Fractal Nature of Jackson Pollock



Blue Poles: number 11, 1952

How do we make math out of this painting - is there structure?

Richard Taylor's idea:
"Fractal" analysis



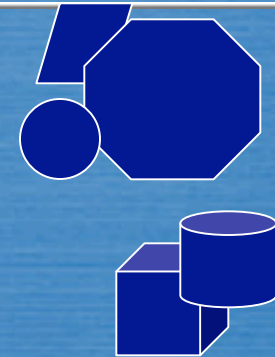
Structure lurks beneath...

There is consistent "fractal" information in Pollock's work

Fractal Geometry - the Geometry of Nature

Platonic World - perfect shapes:

Euclidean geometry



Real world (nature) - complicated "shapes"

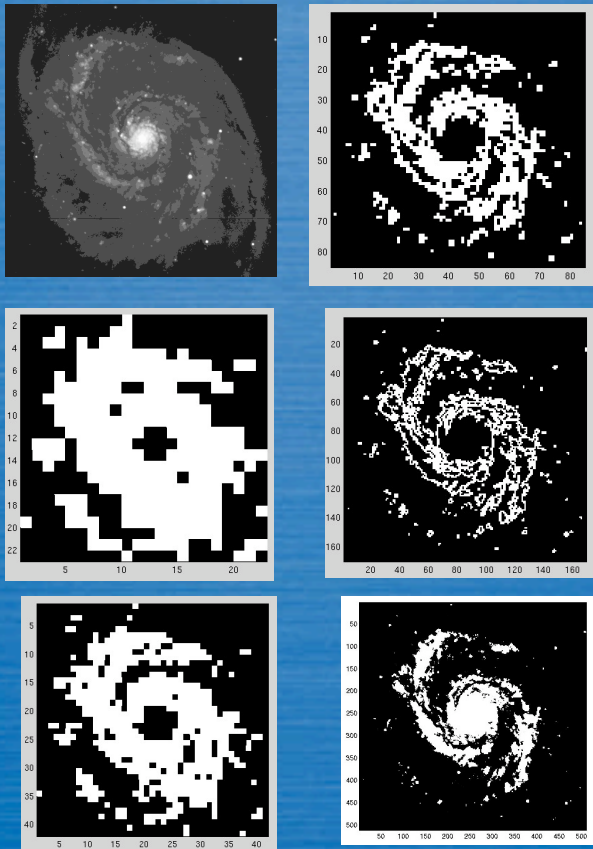
Jagged lines, swirls,... "fractals"



Fractal - FRACTIONAL dimension (B. Mandelbrodt, 1967)

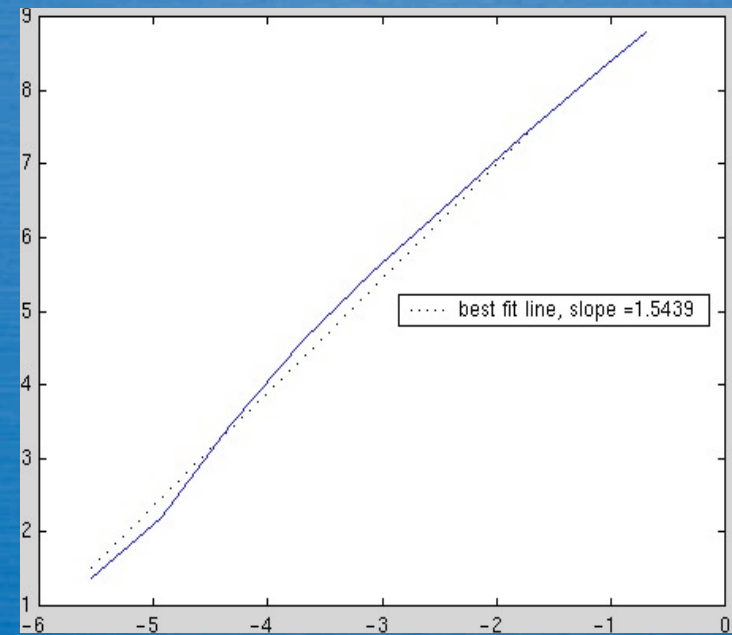
"Box Counting" for Fractal Dimension

of boxes needed to cover image depends on the length of the side - relation gives "fractal dimension"



Log(# boxes)

Thx to <http://www.ees.nmt.edu/~davew/P362/boxcnt.htm>



Log(1/(box size)) box size = # pixels

$$d = 1.5439$$

"Self-similarity:" Need r^d squares of size $1/r$ \Rightarrow d = "dimension"

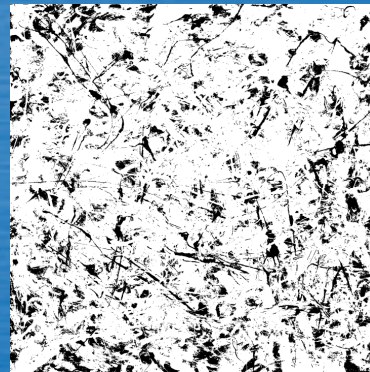


Layer extraction

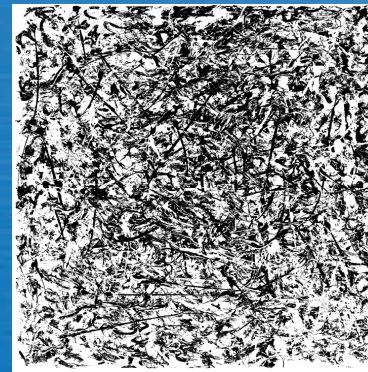
Process: choose pixel, extract all pixels of approximately that color (value)



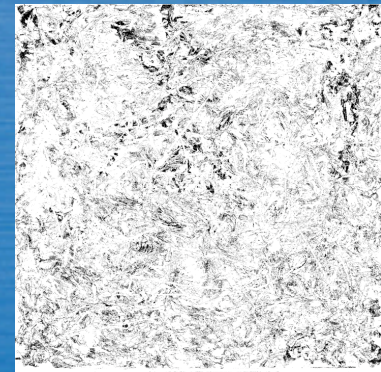
Jackson Pollock, "Full Fathom Five," 1947



Black Layer, "Full Fathom Five" (detail)



White Layer, "Full Fathom Five" (detail)



Silver Layer, "Full Fathom Five" (detail)

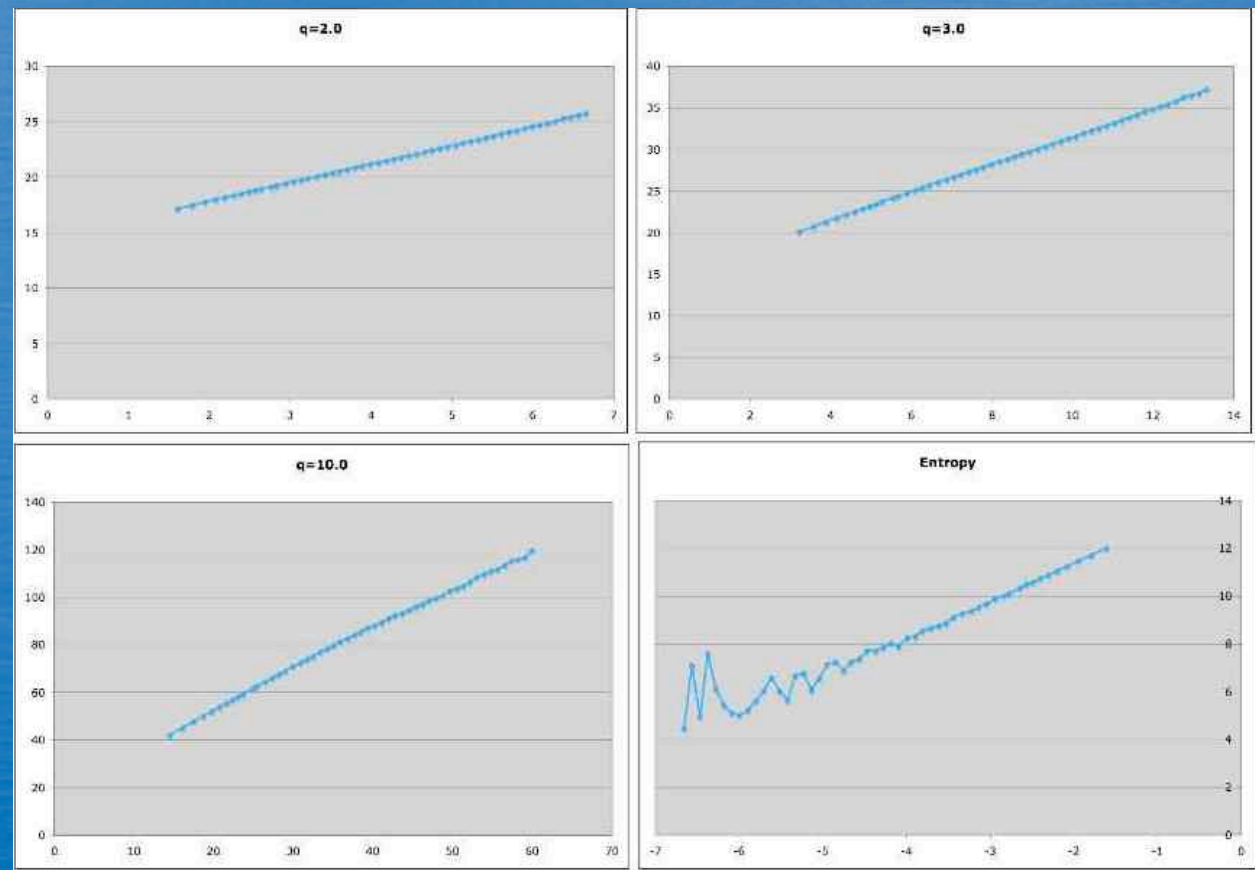


Multifractal Analysis

(w/J. Coddington, J. Elton, Y. Wang)

Jackson Pollock, "One" 1948

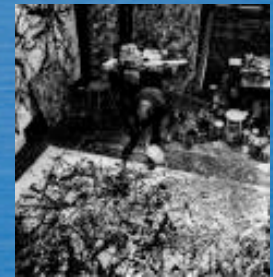
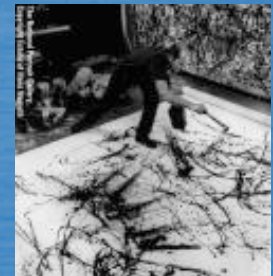
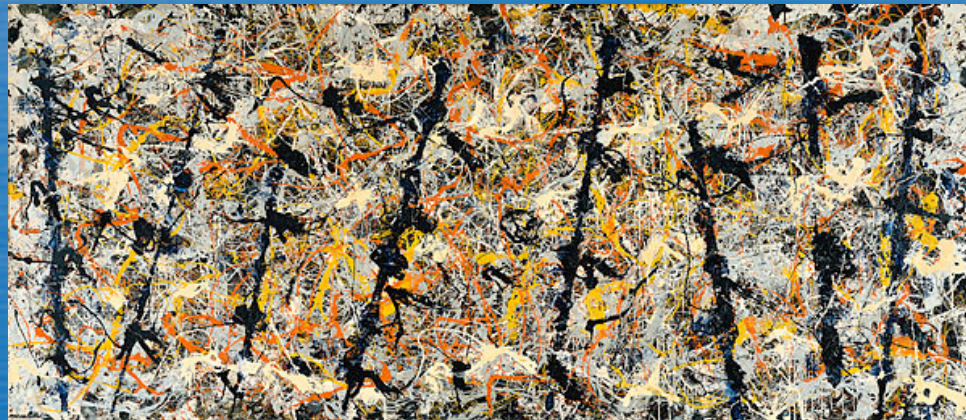
- Well-defined multifractal dimension (Mureika, et al.)
- Entropy pattern





Some conclusions (R. Taylor)

- Generally two fractal dimensions attached to images - reflecting two steps in prep.
- Different periods corr. different dimensions - increasing in time (1.3 - 1.9)

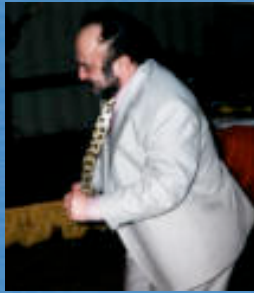


Blue Poles, 1952, $D = 1.72, 1.98$



Music Stylometry

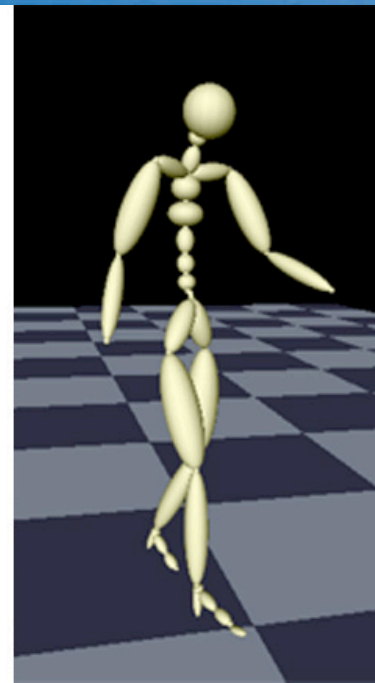
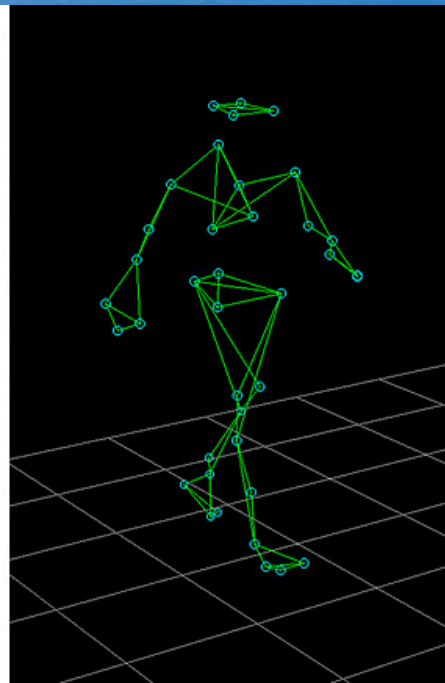
- Composition-based: Manaris, et al. - using MIDI files (128 pitches, temporal information, etc.)
 - Using Zipf-related stats
 - Artificial Neural Net classifier on 20-30 features
- Spectrum-based: (Pampalk, others) Use “spectral information” - frequency-based (based on the actual sound file)



It's the way you walk...



The quantification of the style of motion: Motion Capture





Retargeting

Animal -> Animation



Cartoon -> Cartoon:

C. Bregler, L. Loeb, E. Chuang, H. Deshpande



Personal Style

- Eharmony® - “29 dimensions of Compatibility”
 - Core Traits
 - Emotional Temperament, Social Style,...
 - Vital Attributes
 - Relationship skills, values and beliefs,...



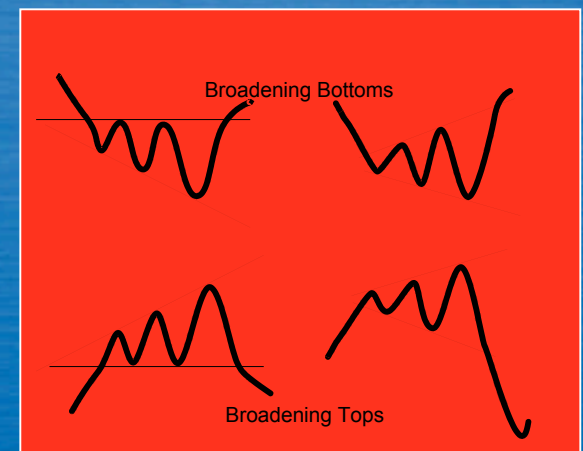
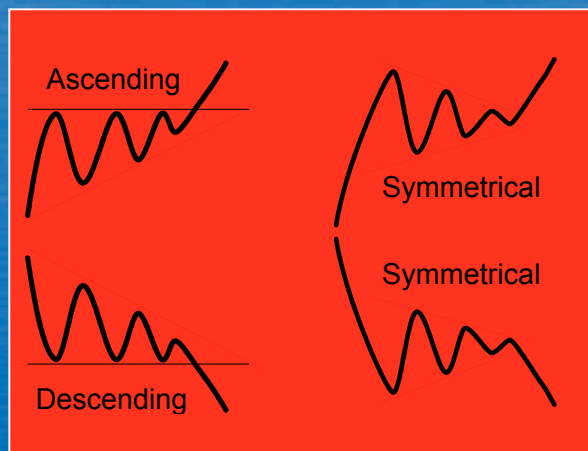
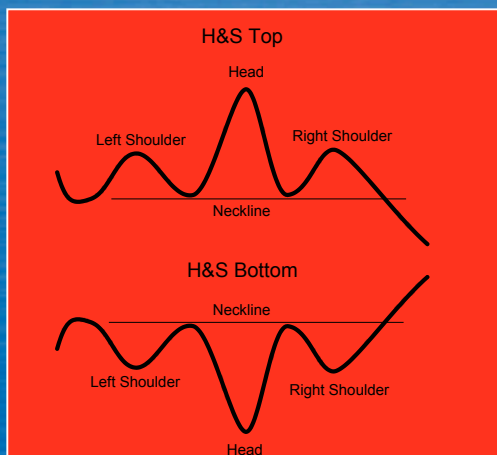


Shopping Style

- Purchasing: Collaborative filtering
 - Amazon.com -
 - “Why is this recommended for you?”
 - Buyers close in “ratings space” will be likely to buy similar things
- Fraud detection
 - Your purchases do have a characteristic style
 - Look for purchases “far from normal”

Market Styles

- Market timing - reading the “style” of the price of a security/commodity - market indicators as proxy for psychology of the market:
- Features -
 - Head and Shoulders
 - Triangles
 - Broadenings





We are (in part) our Numbers

- In a digital world, style is mathematical and statistical
- Only at the beginning...