

Adaptive [Visual Analytics]

A decorative graphic consisting of two wavy, overlapping lines. The top line is dark blue and the bottom line is light grey. Both lines start on the left, rise to a peak, dip to a trough, and then rise again towards the right.

Mathematical Challenges

Alan Turner April 24, 2009

FODAVA - Foundations of Data Analysis and Visual Analytics

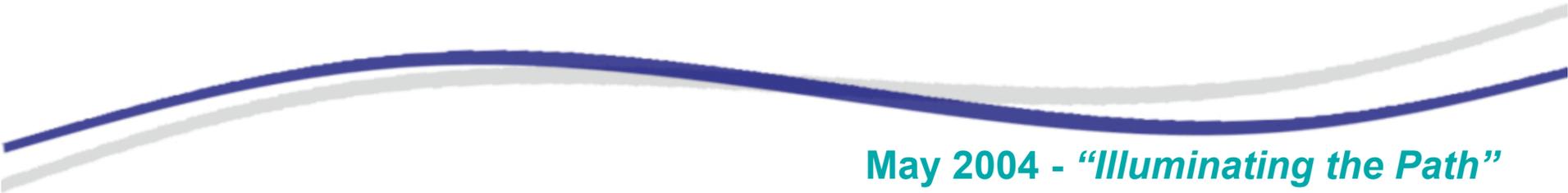
[Visual Analytics]

The Science of

Analytic Reasoning

facilitated by

Visual Interfaces



May 2004 - *“Illuminating the Path”*

[Visual Analytics]

The Science of

Deliberate (Thought)

Effective (Perception)

[Visual Analytics]

The Science of

Deliberate (Thought)

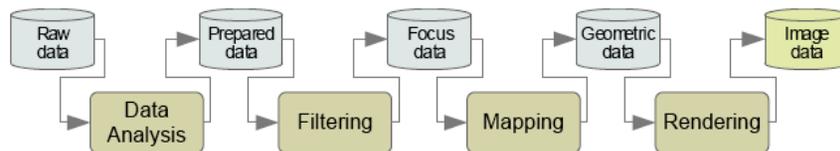
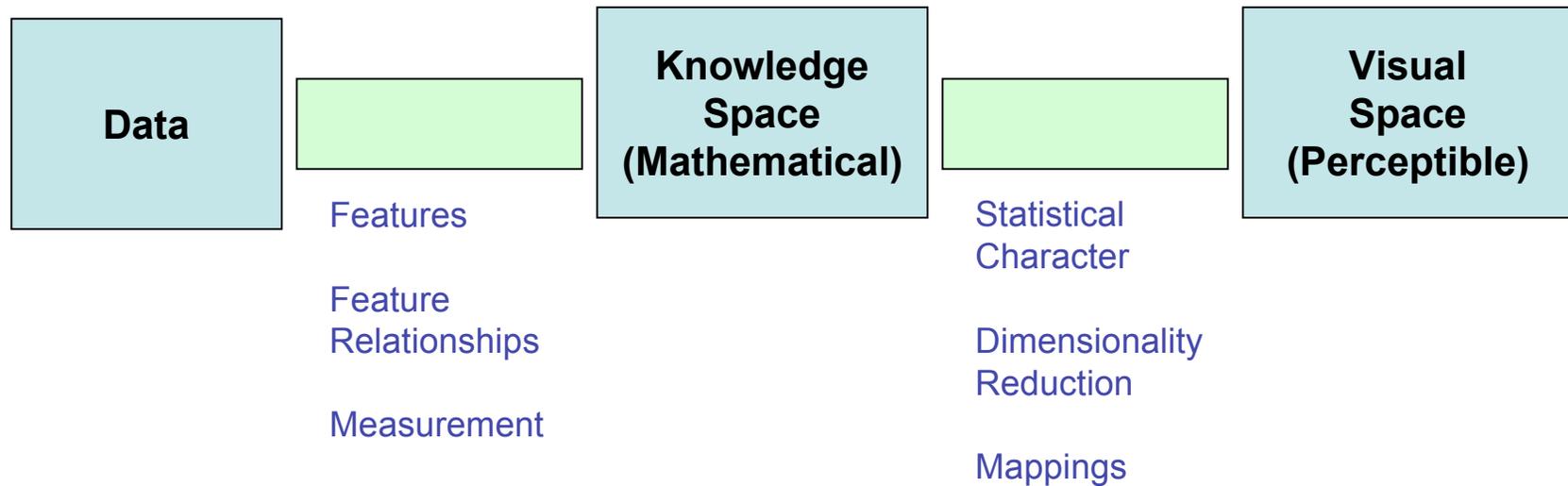
Effective (Perception)

Augmenting (Human Performance)



Computation and [Visual Analytics]

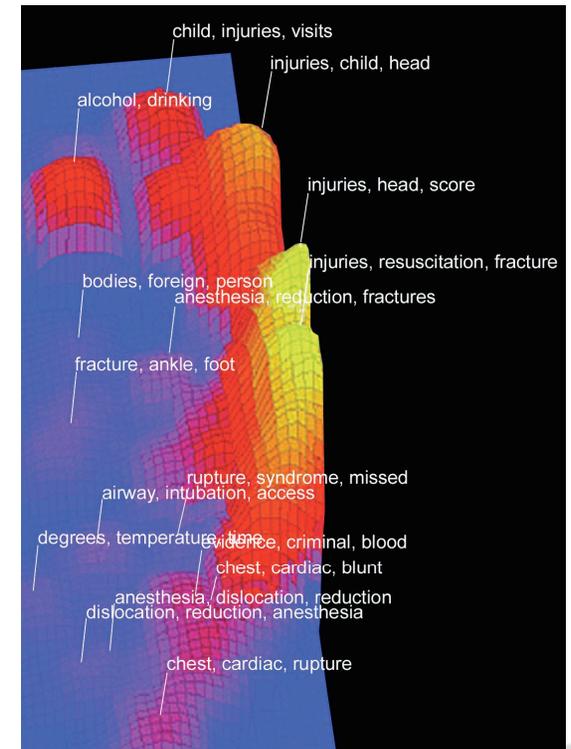
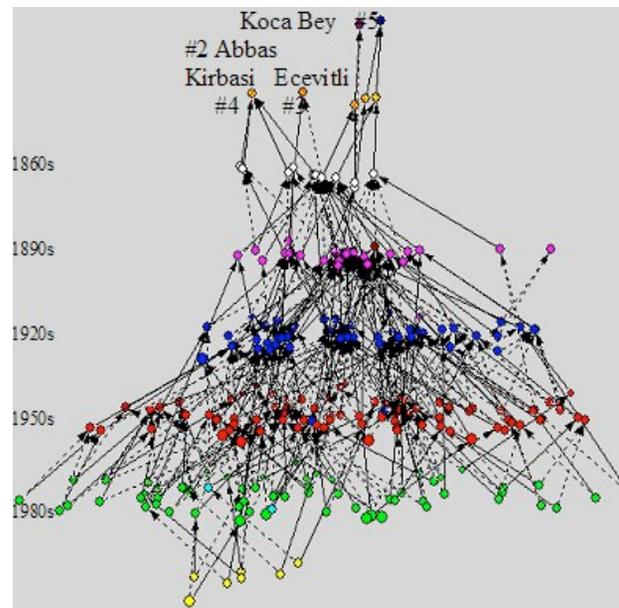
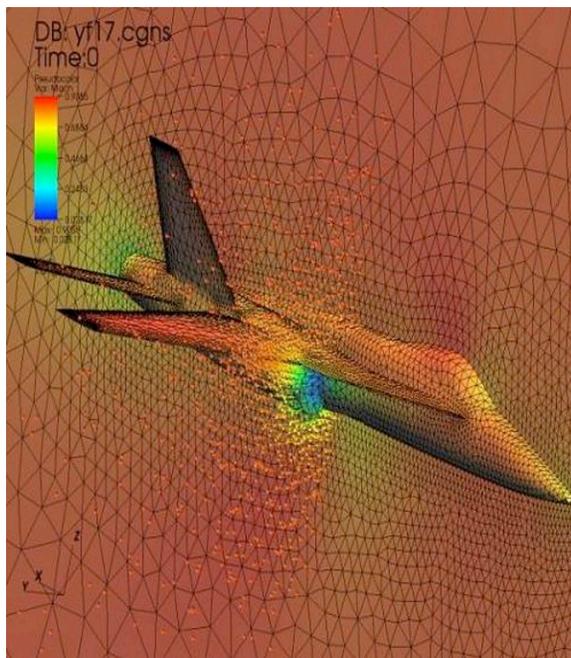
“Visualization Pipeline”



dos Santos, Brodlie. Gaining understanding of multivariate and multidimensional data through visualization. *Computers & Graphics*, 28(3):311–325. 2004.

Computation and [Visual Analytics]

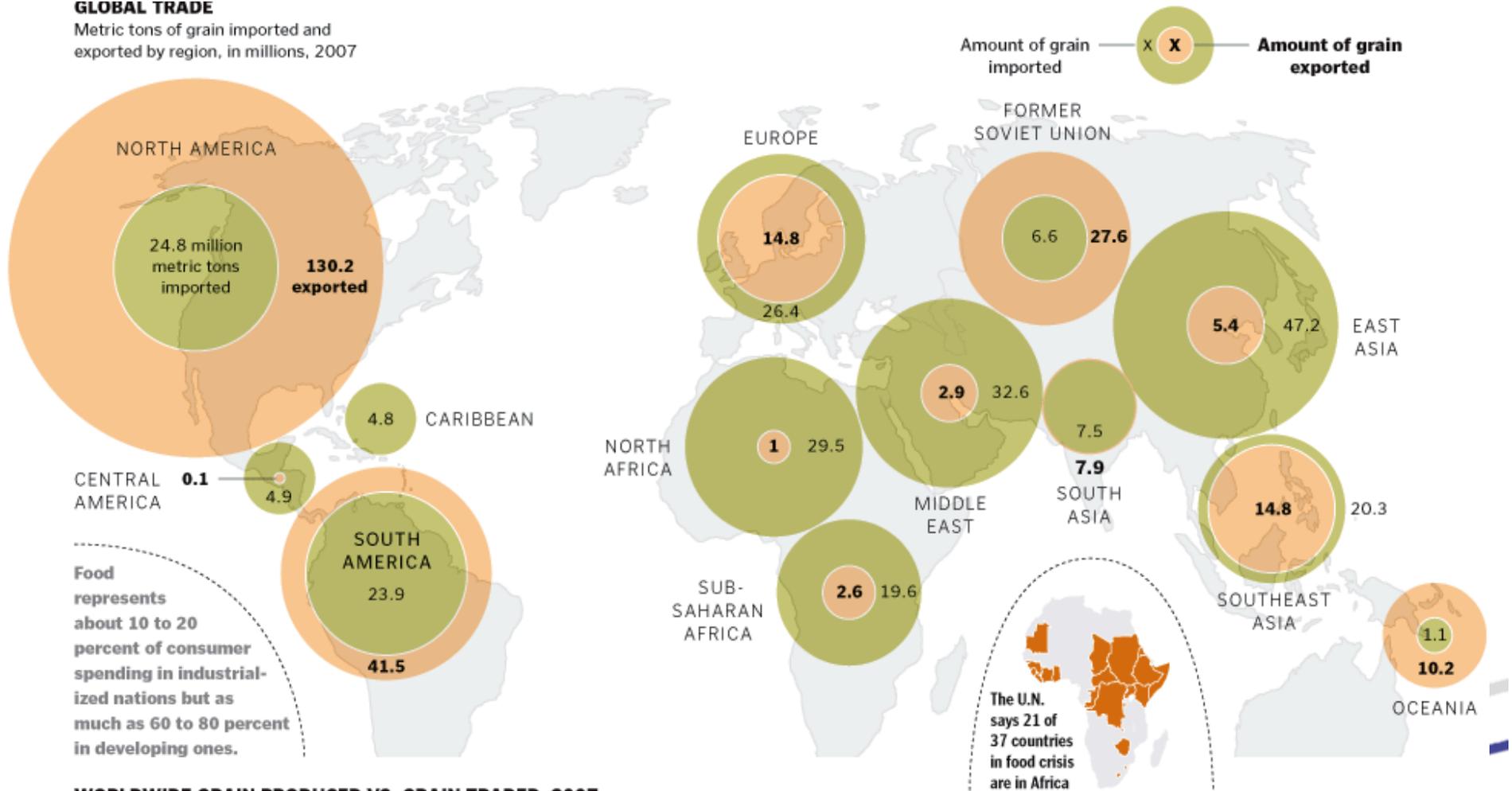
- Increasing Difficulty in Mathematical Mapping
- Salient Knowledge Features, Illuminating Relationships



Complex Problems - Global Food Crisis

GLOBAL TRADE

Metric tons of grain imported and exported by region, in millions, 2007



Food represents about 10 to 20 percent of consumer spending in industrialized nations but as much as 60 to 80 percent in developing ones.

WORLDWIDE GRAIN PRODUCED VS. GRAIN TRADED, 2007

Dynamics in Complex Problems

- Supply
- Demand
- Trade
- Weather/Climate
- BioFuels
- Fuel Prices
- Markets
- Development Funds

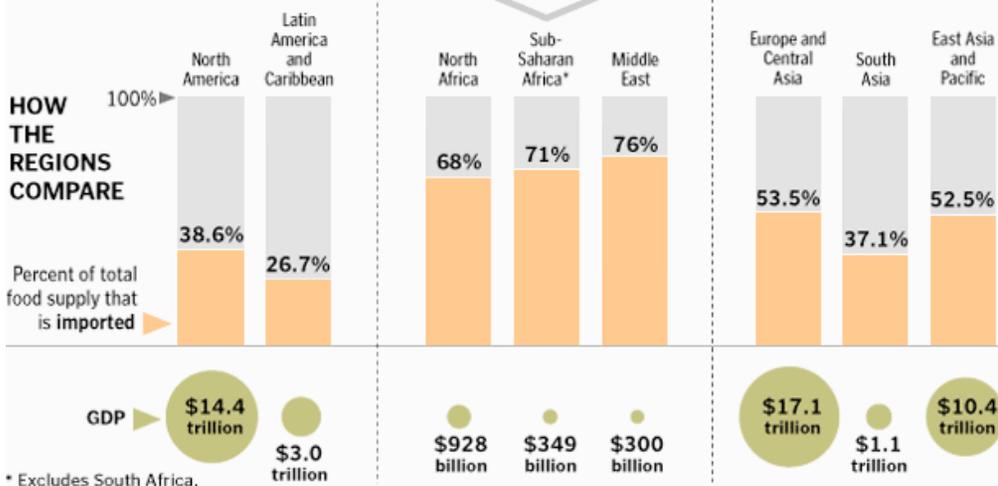
- Governance
- Humanitarian
- Disease
- Aid

THE MOST DEPENDENT ON IMPORTED FOOD

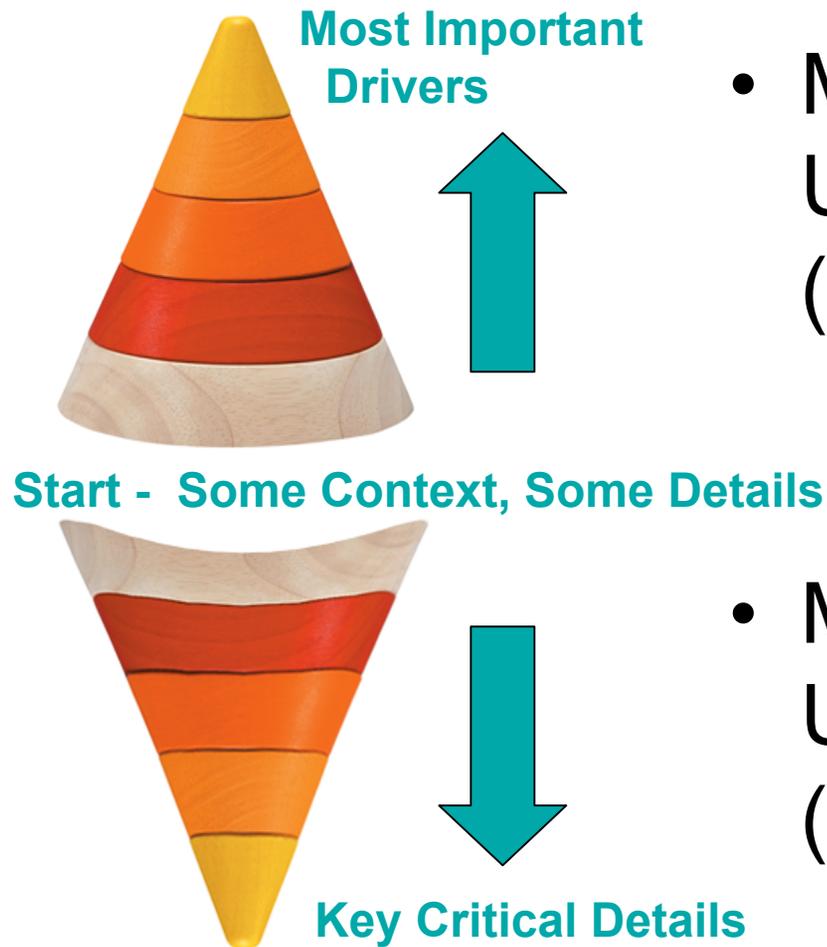
■ Countries that rely on the global market for most of their food supply



Regions most reliant on imported food are least able to afford it.



Macro and Micro Understanding



- Macro Understanding (Big Patterns)

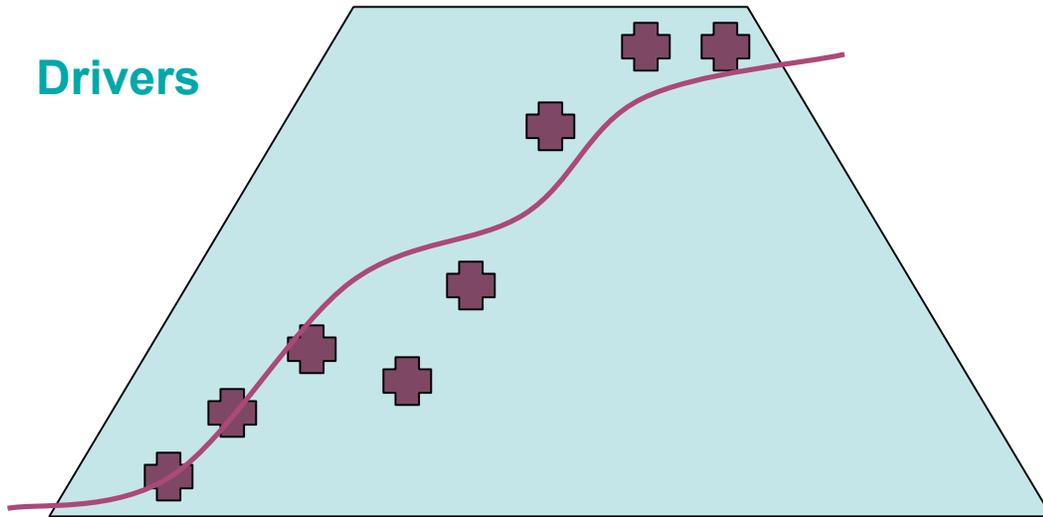
- Micro Understanding (Key Details)



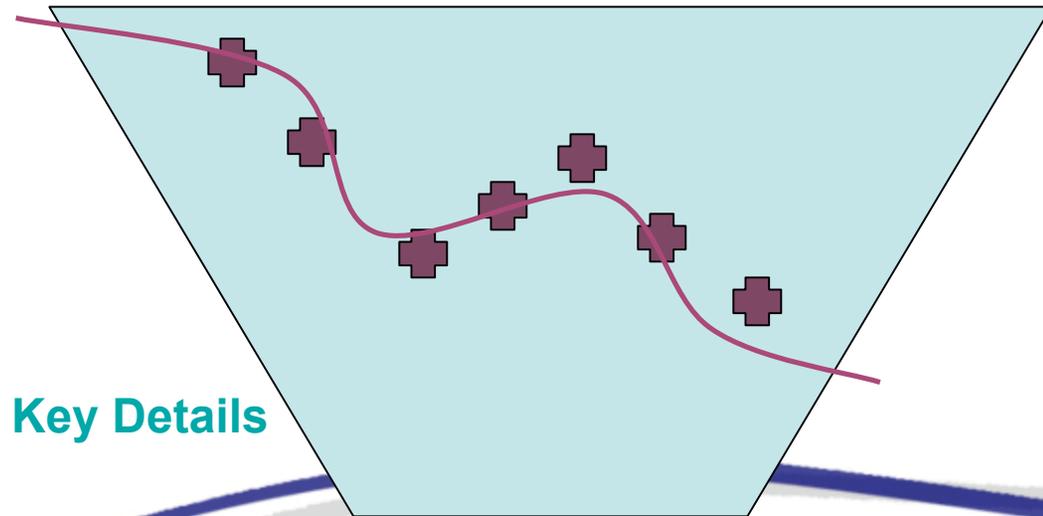
Stackable Cones, Plan Toys

Problem Solving Patterns

Drivers



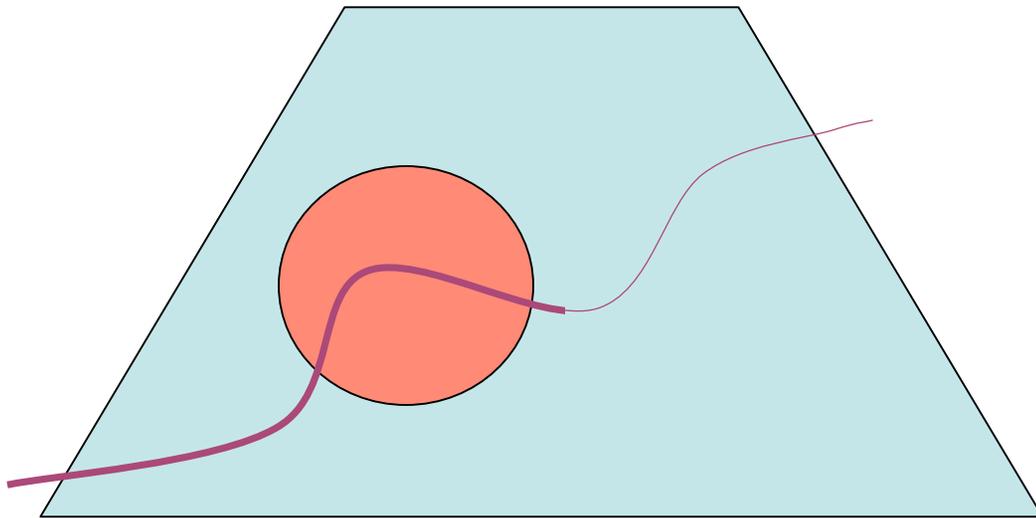
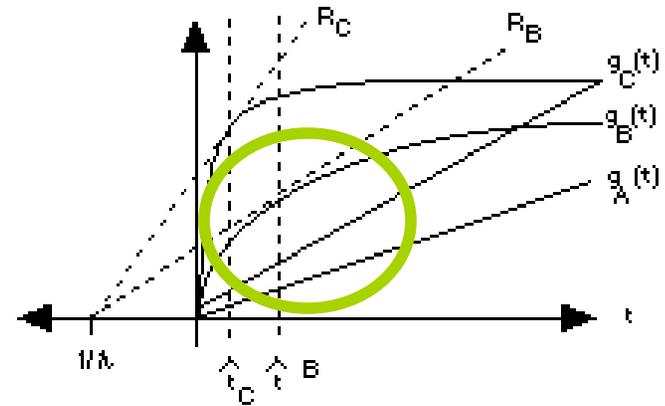
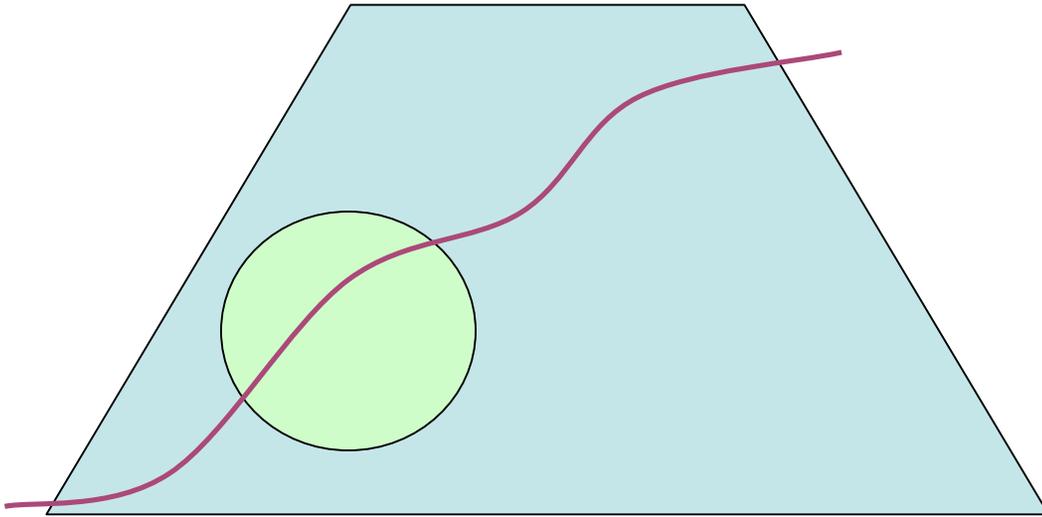
Start - Some Context, Some Details



Key Details

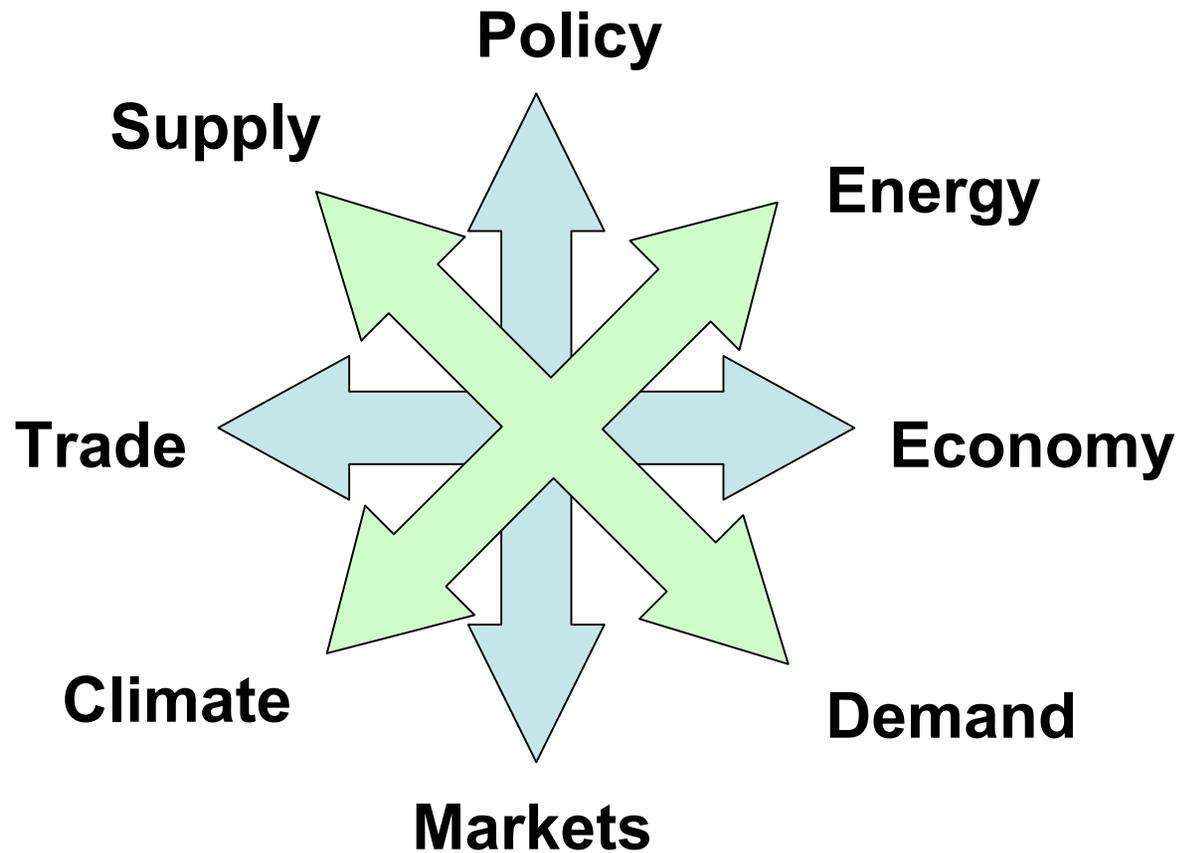
- Contextualizing
- Detecting
- Discovering
- Testing

Human Performance

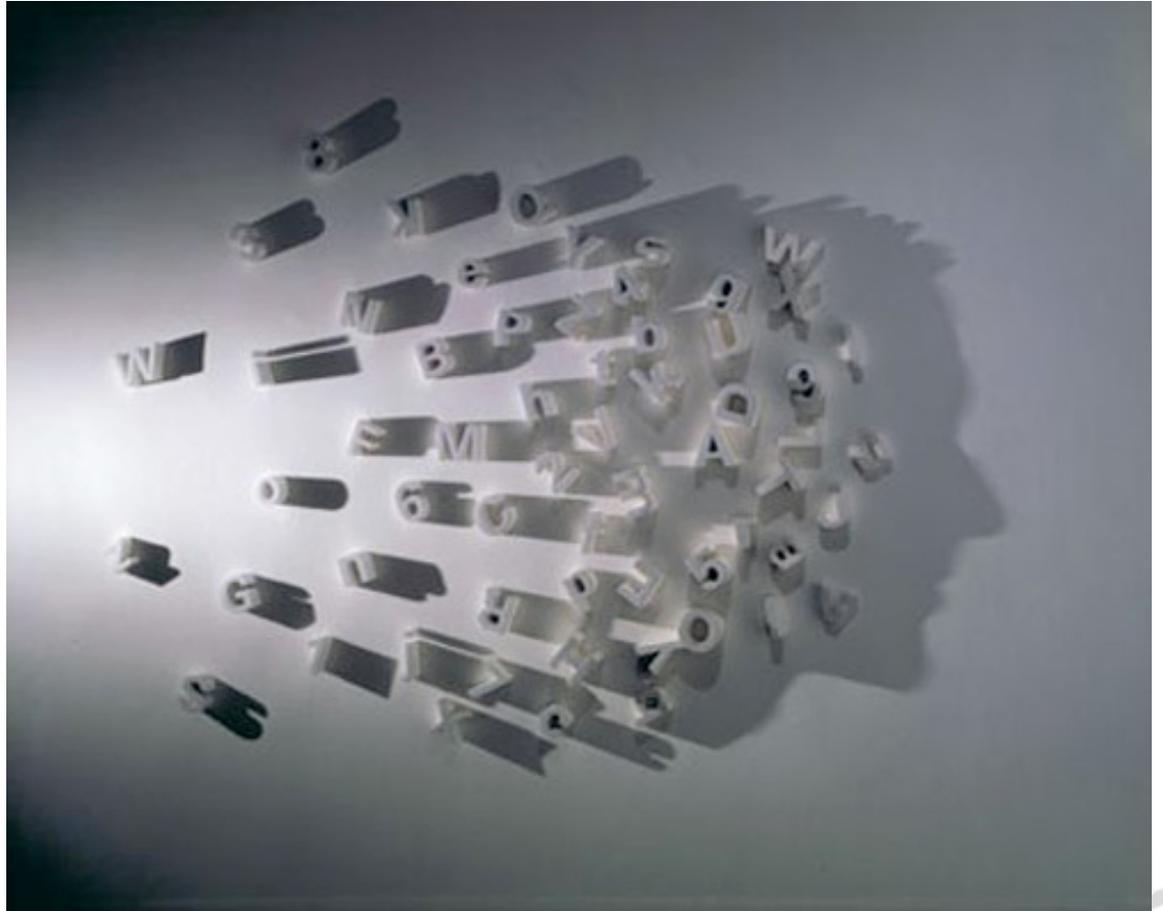


Multiple “Perspectives” -

What does the problem reveal
when considered from changing contexts?

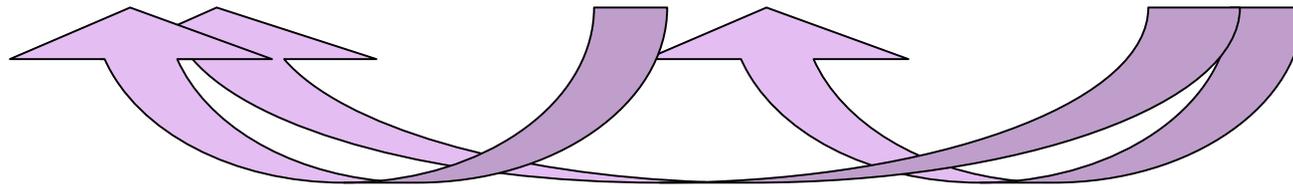
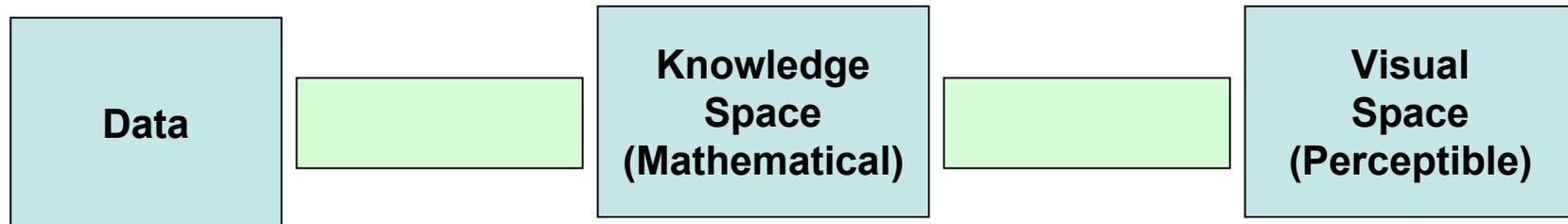


Adapting to “Perspective”



Adaptive Foundations for [Visual Analytics]

Problem Solving Evolutions Perceptual & Cognitive Viewpoints





[Visual Analytics] Mathematical at Many Scales

Critical Thinking - Accurate Perception - Human Performance