

CS 5630/6630

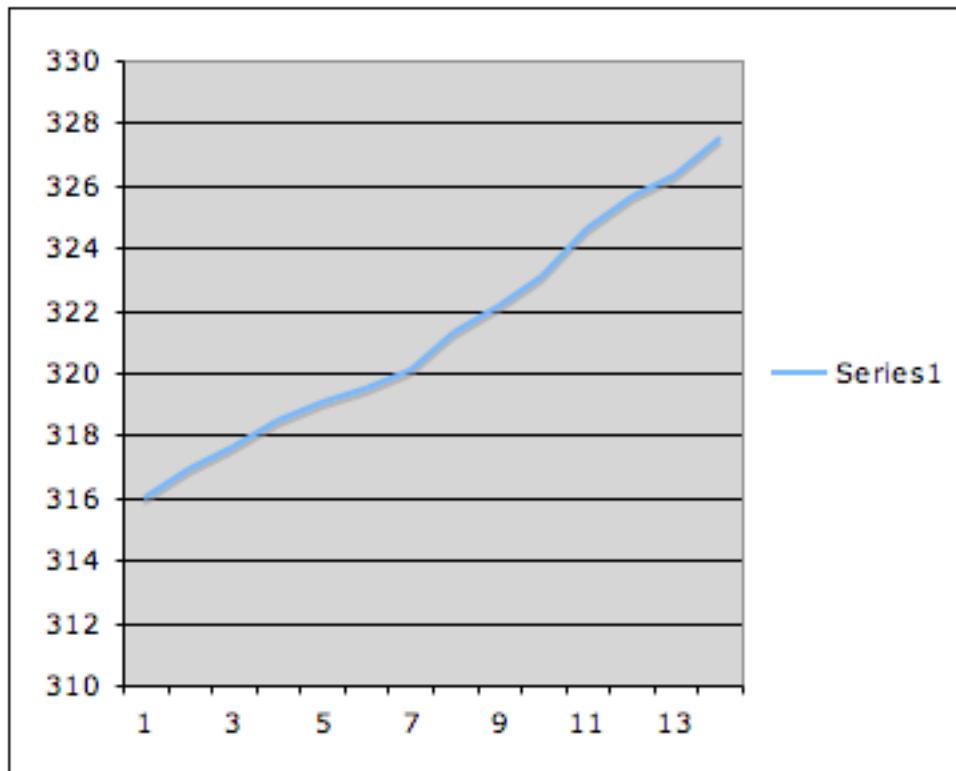
Scientific Visualization

Elementary Plotting Techniques I

Motivation

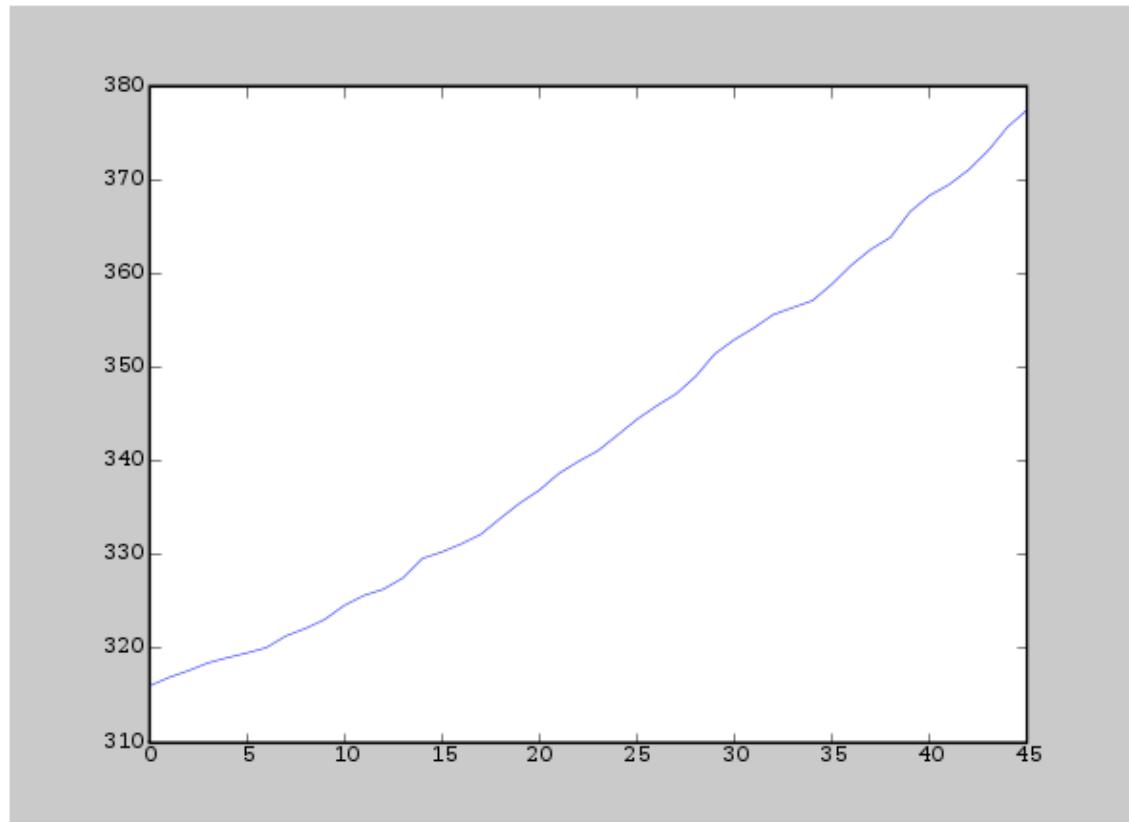
- Everyone uses plotting
- It is easy to lie or to deceive people with bad plots
- Default plotting tools are terrible
- Most people ignore or are unaware of simple principles

Motivation



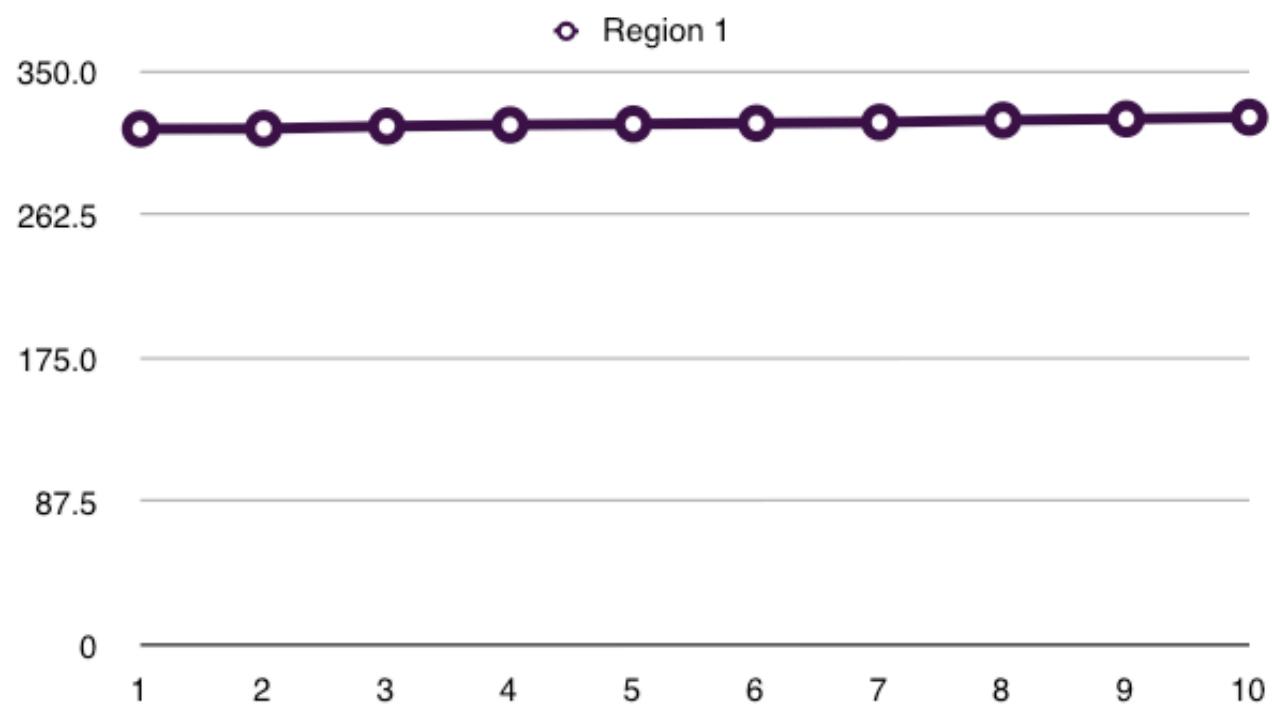
Default Excel Plot

Motivation



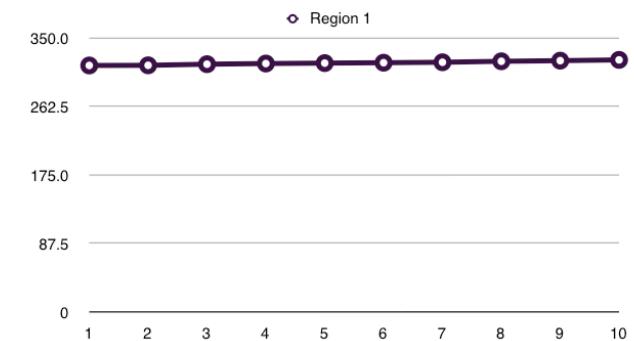
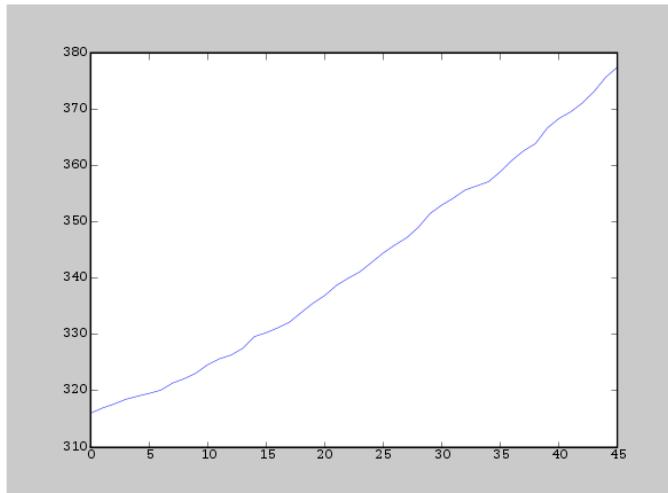
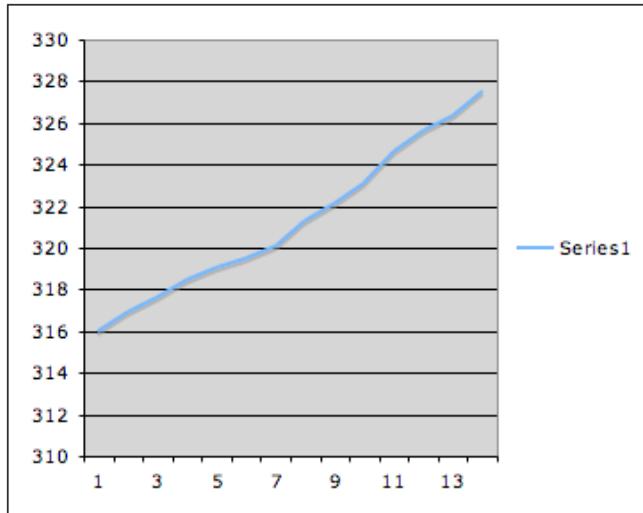
Default Matplotlib/Matlab Plot

Motivation



Default Pages Plot

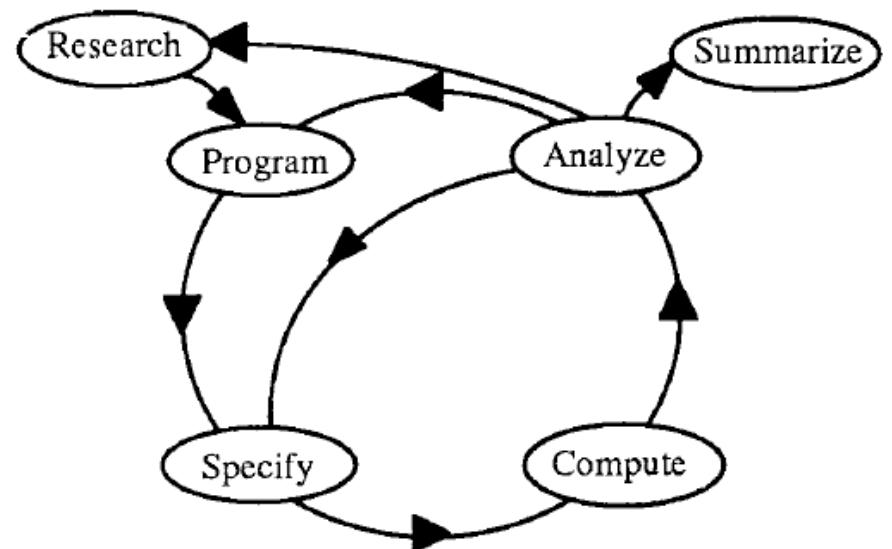
Motivation



- Why are they all different?
- What is good/bad about each?

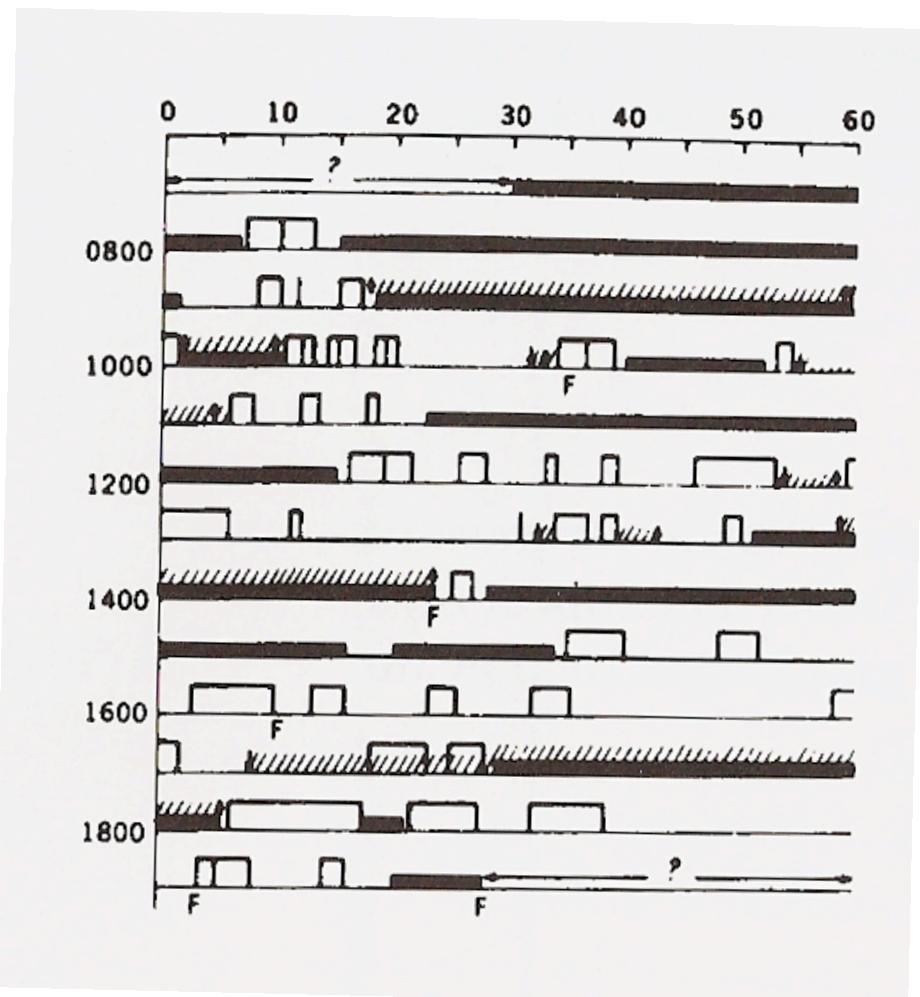
Fundamentals of plotting

- Analysis vs. Communication
- Presenting data vs. Presenting correlation
- Vision vs. Understanding



Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluidity, clutter, or chartjunk.



Activities of a !Kung woman and her baby

Open Bar and Vertical Lines: Nursing times

Closed Bars: Sleeping

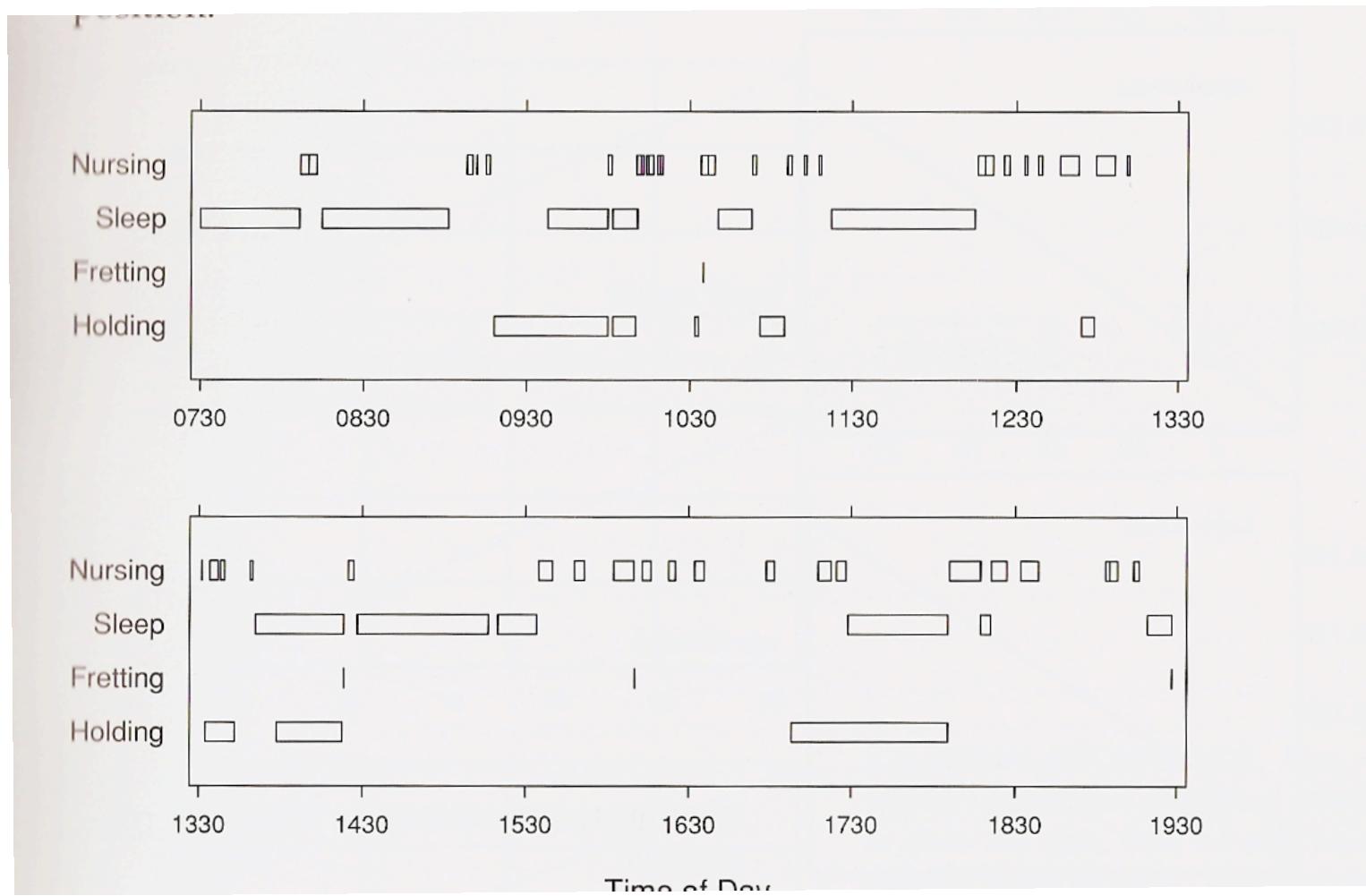
F: Fretting

Slashed Lines: Held by mother

Arrows: Picking up and setting down

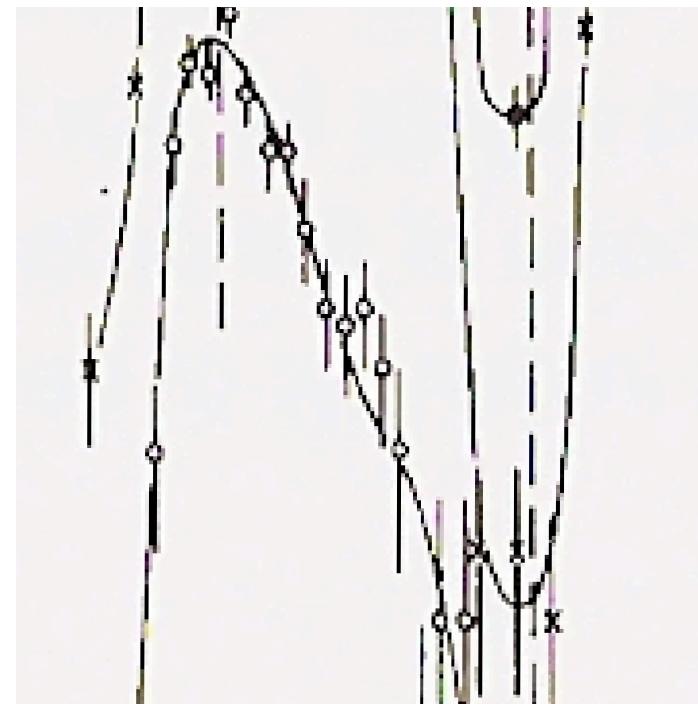
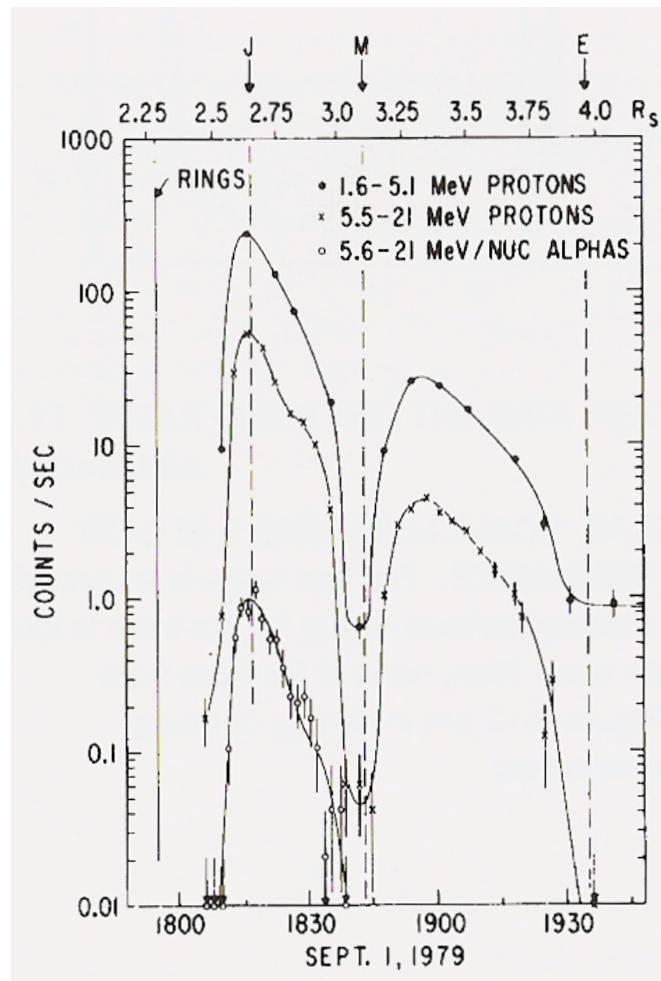
Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluity, clutter, or chartjunk.



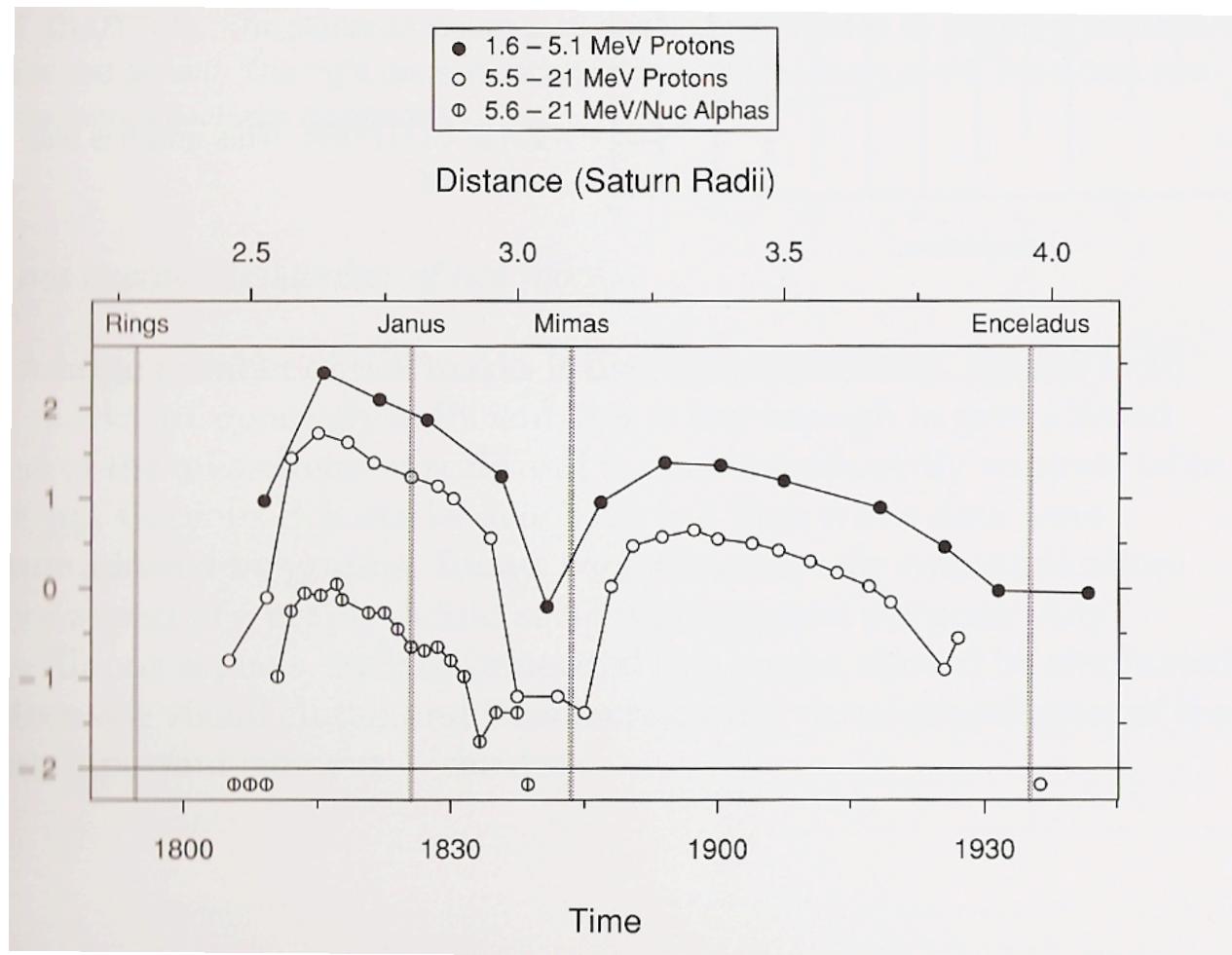
Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluency, clutter, or chartjunk.



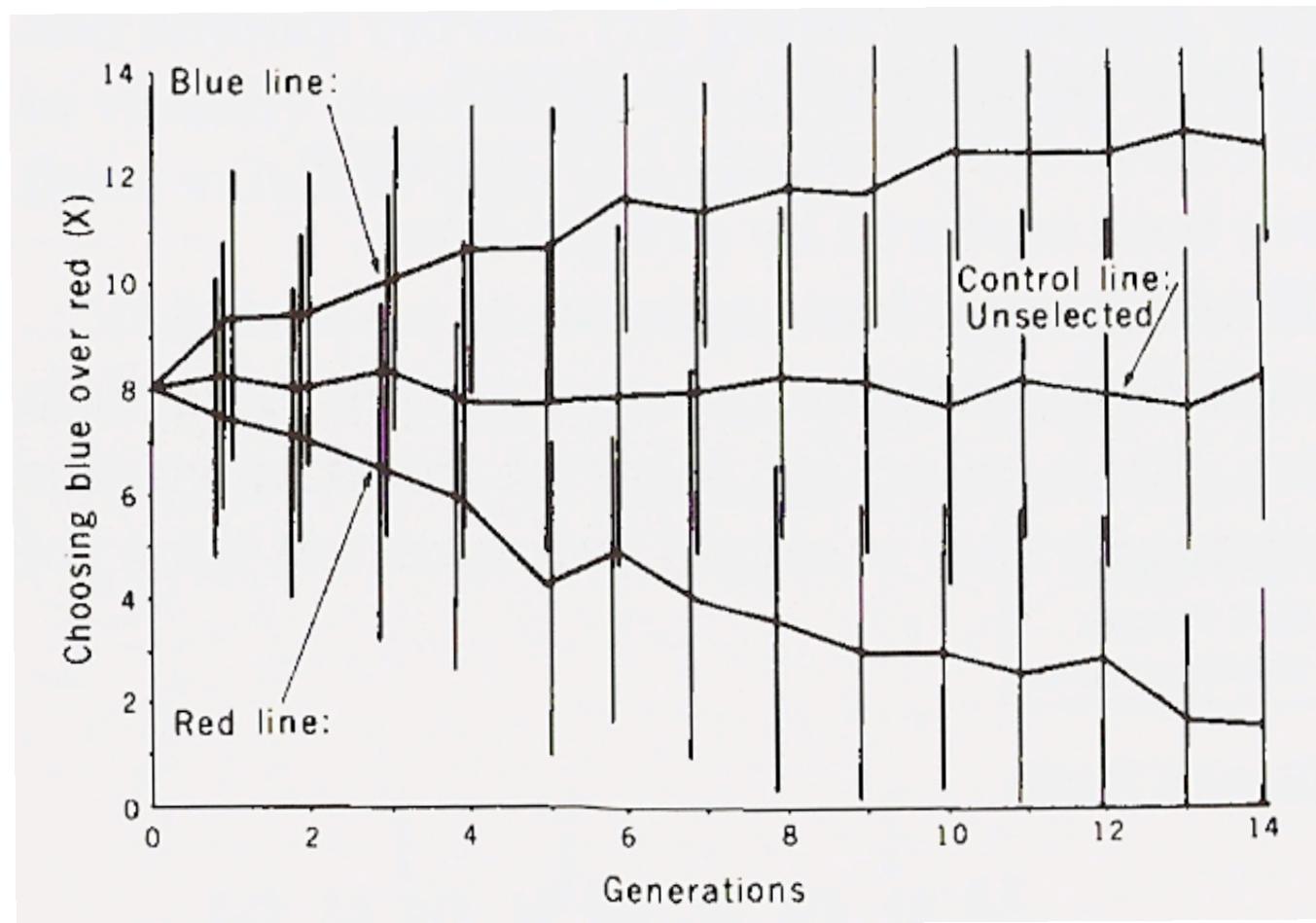
Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluity, clutter, or chartjunk.



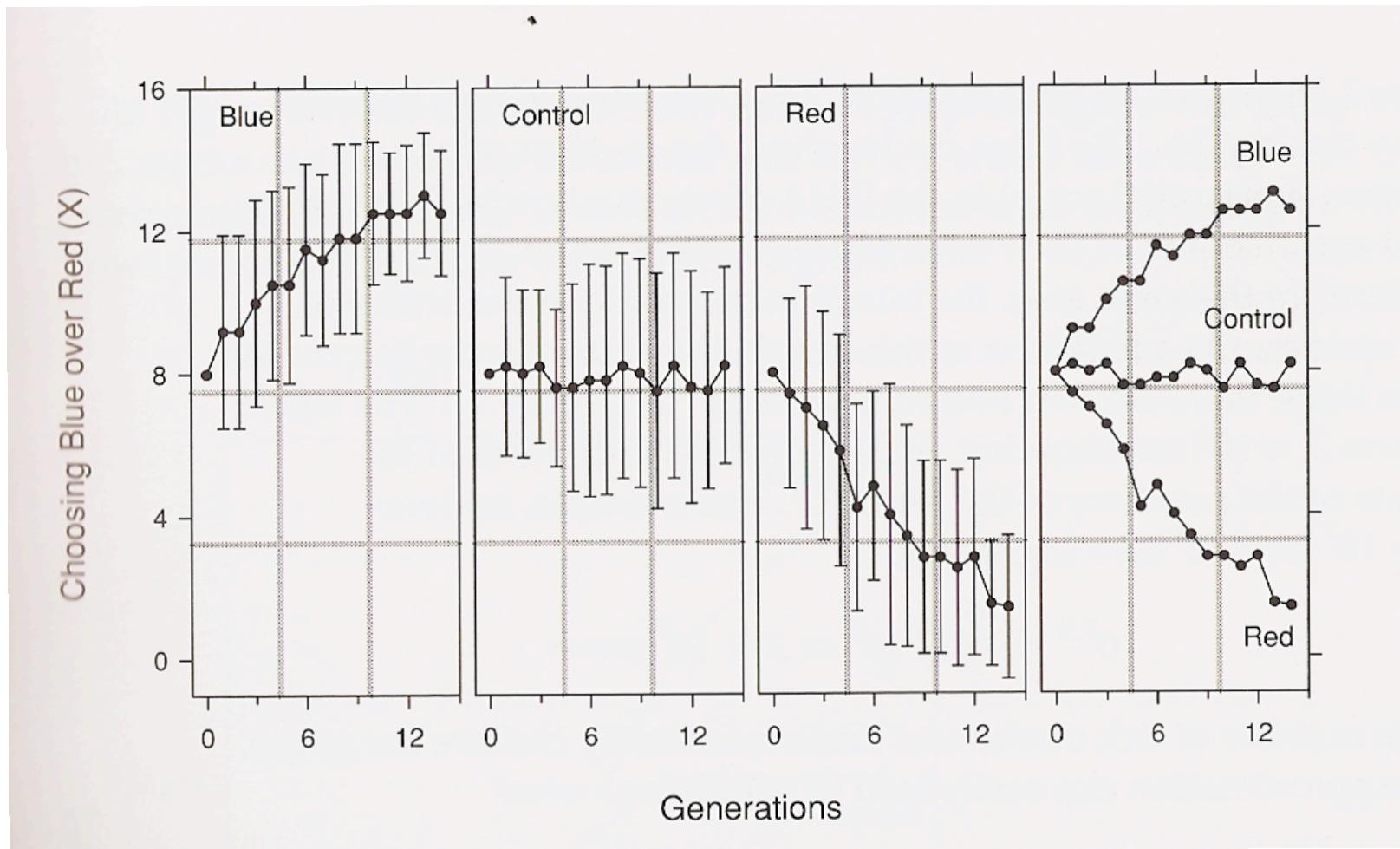
Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluidity, clutter, or chartjunk.



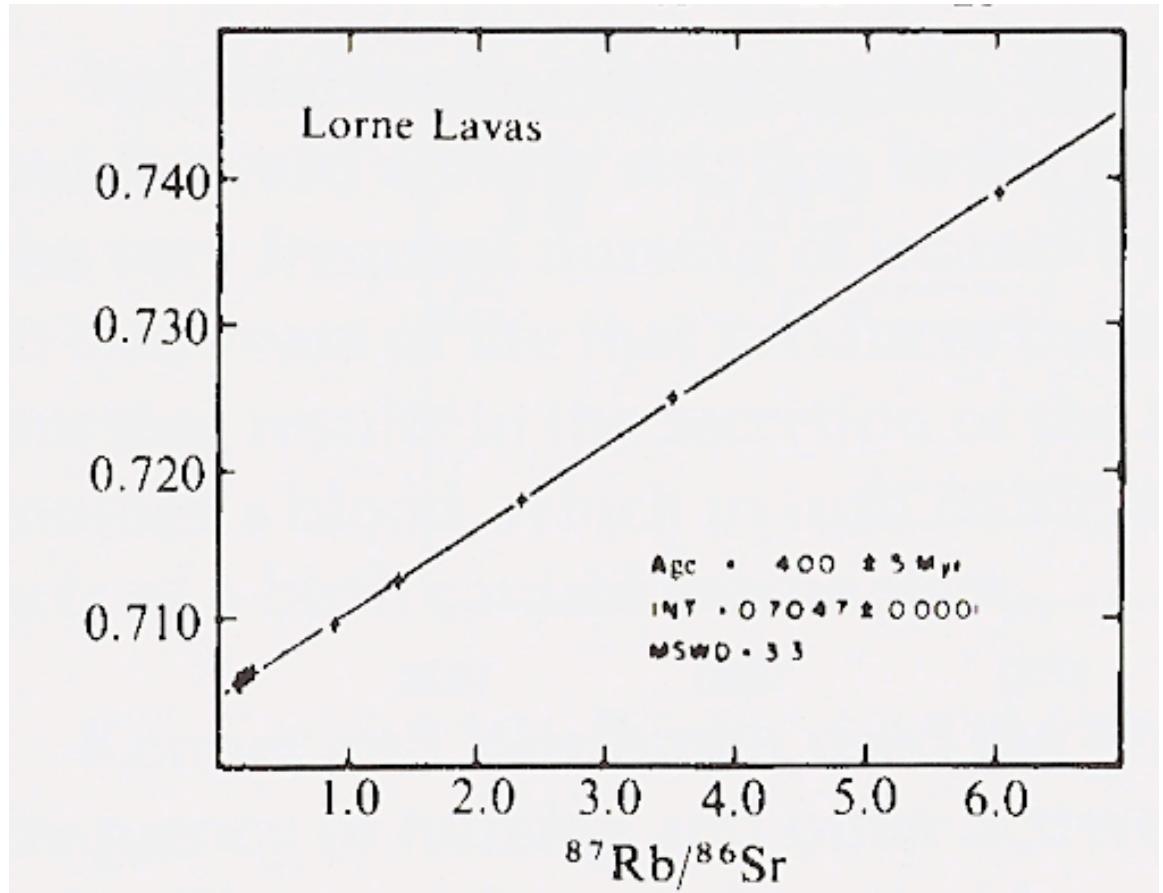
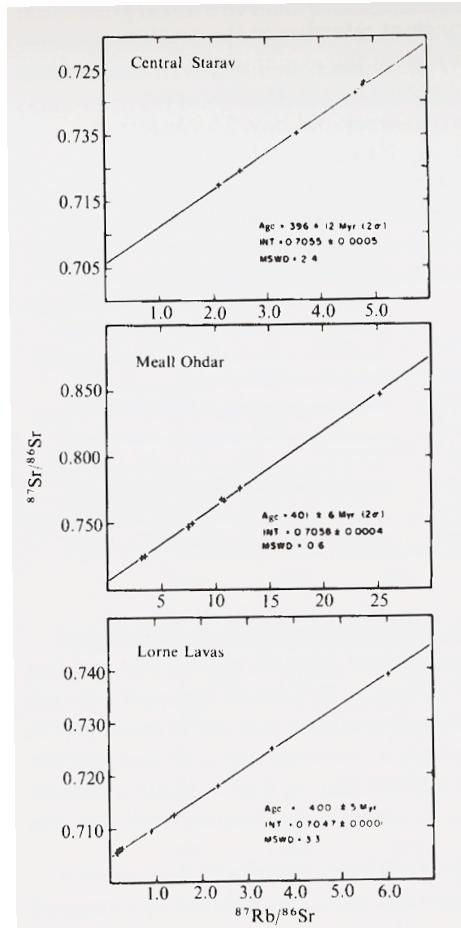
Clear Vision

- Principle 1: Make data stand out
 - Avoid superfluidity, clutter, or chartjunk.



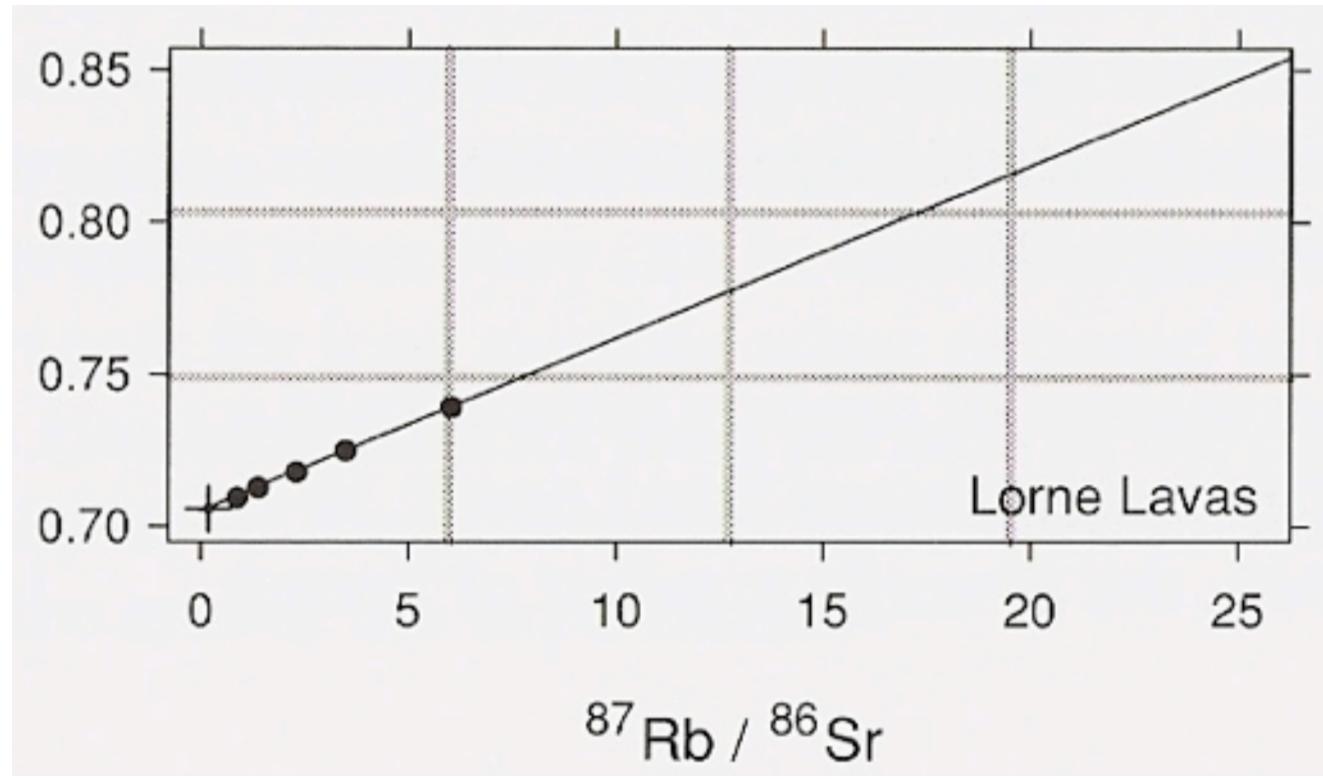
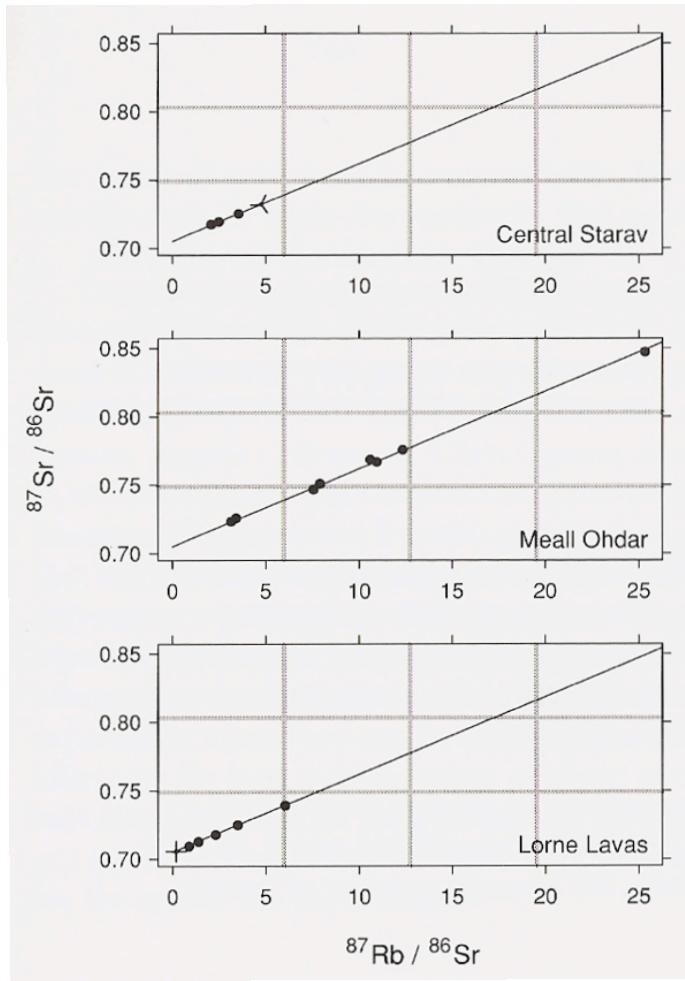
Clear Vision

- Principle 2: Visual prominence
 - Use visually prominent graphical elements to show the data.



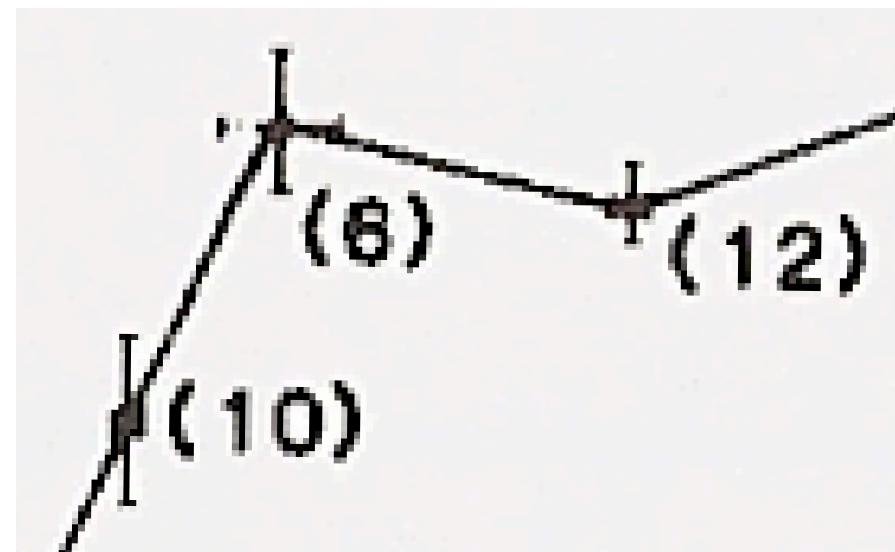
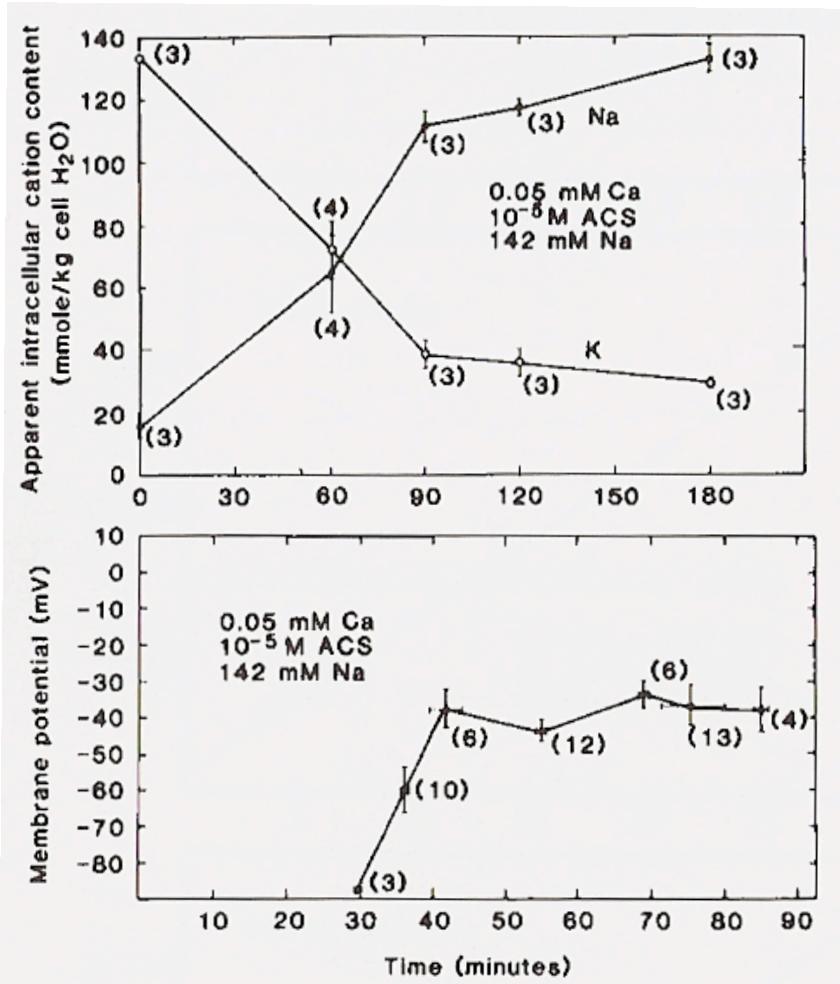
Clear Vision

- Principle 2: Visual prominence
 - Use visually prominent graphical elements to show the data.



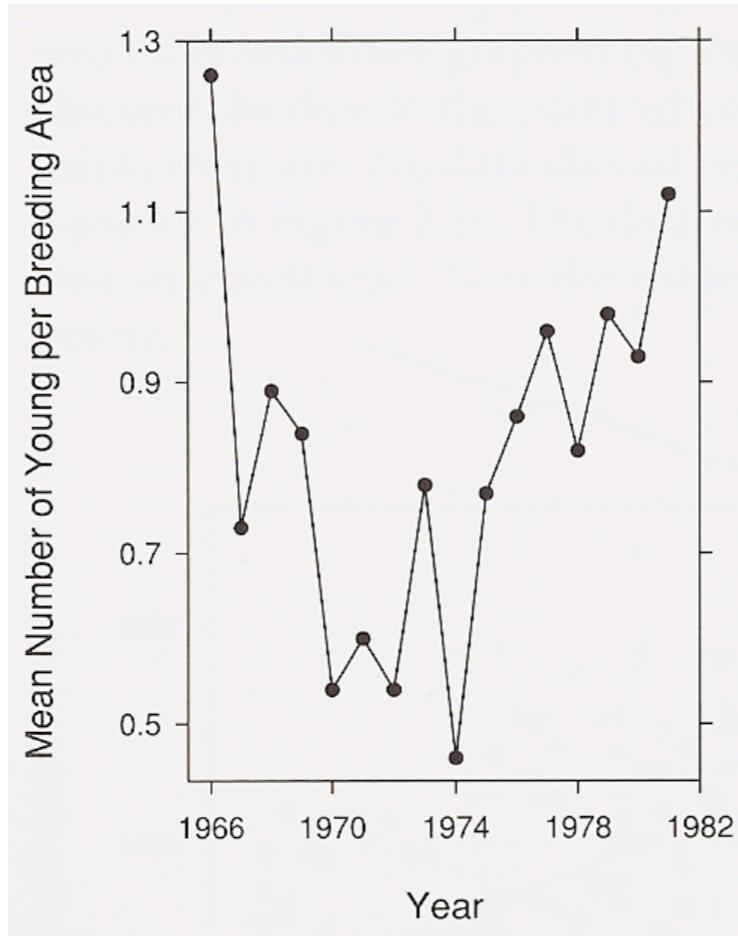
Clear Vision

- Principle 2: Visual prominence
 - Use visually prominent graphical elements to show the data.



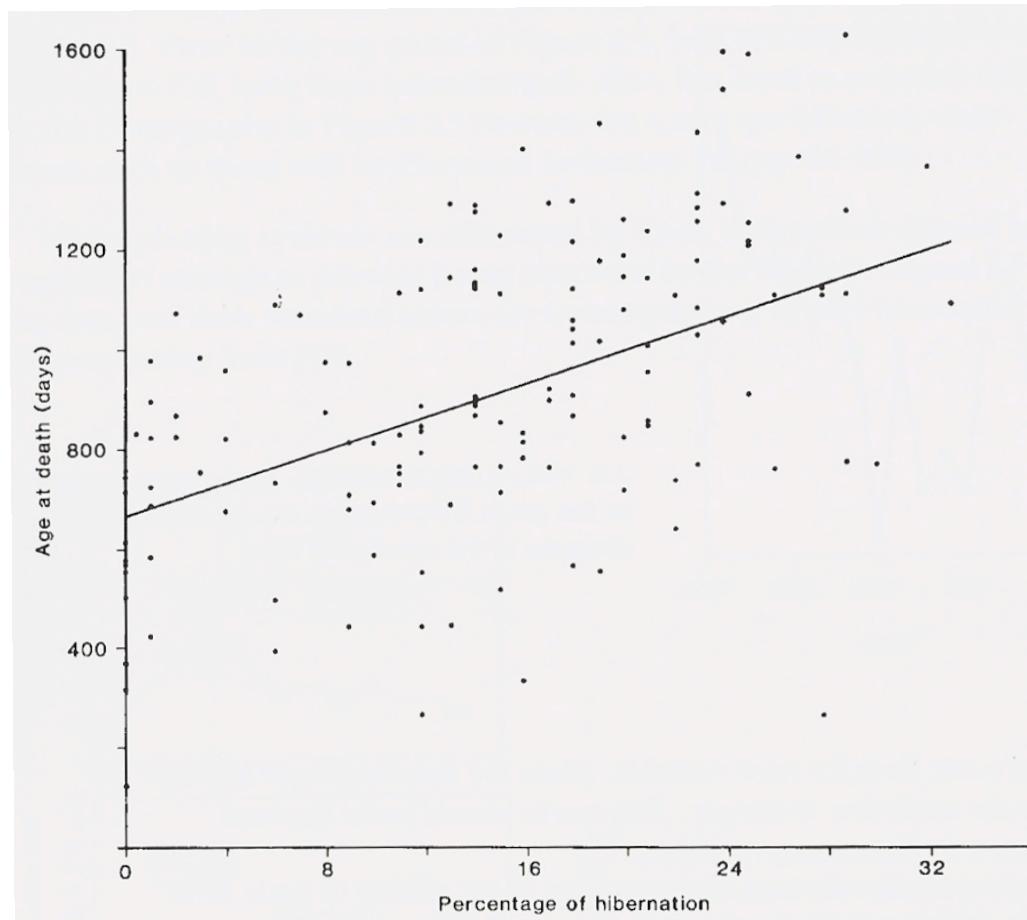
Clear Vision

- Principle 2: Visual prominence
 - Use visually prominent graphical elements to show the data.



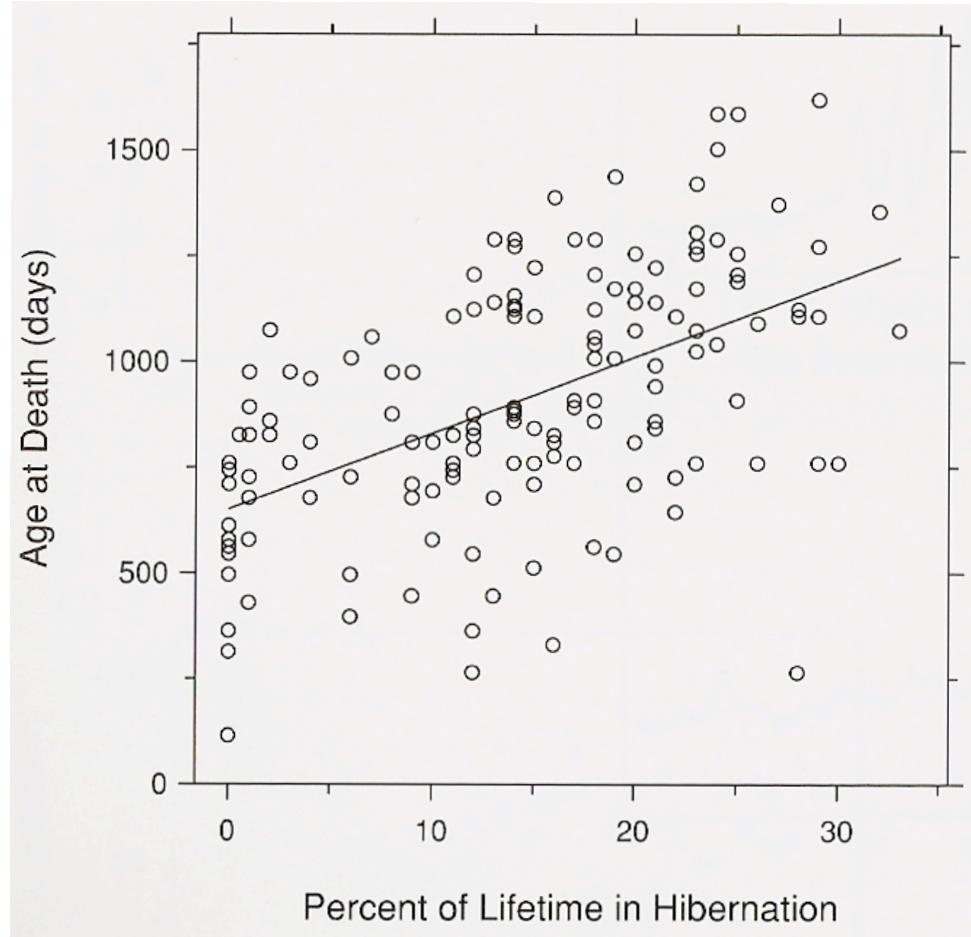
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



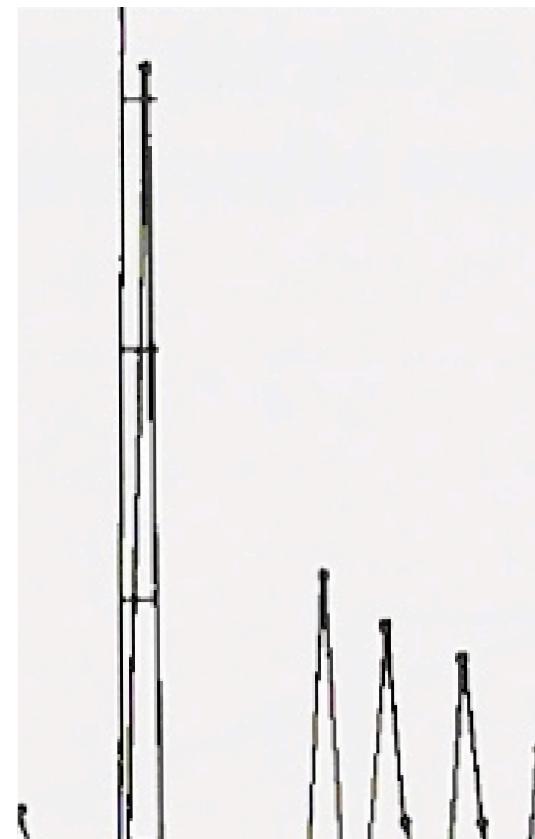
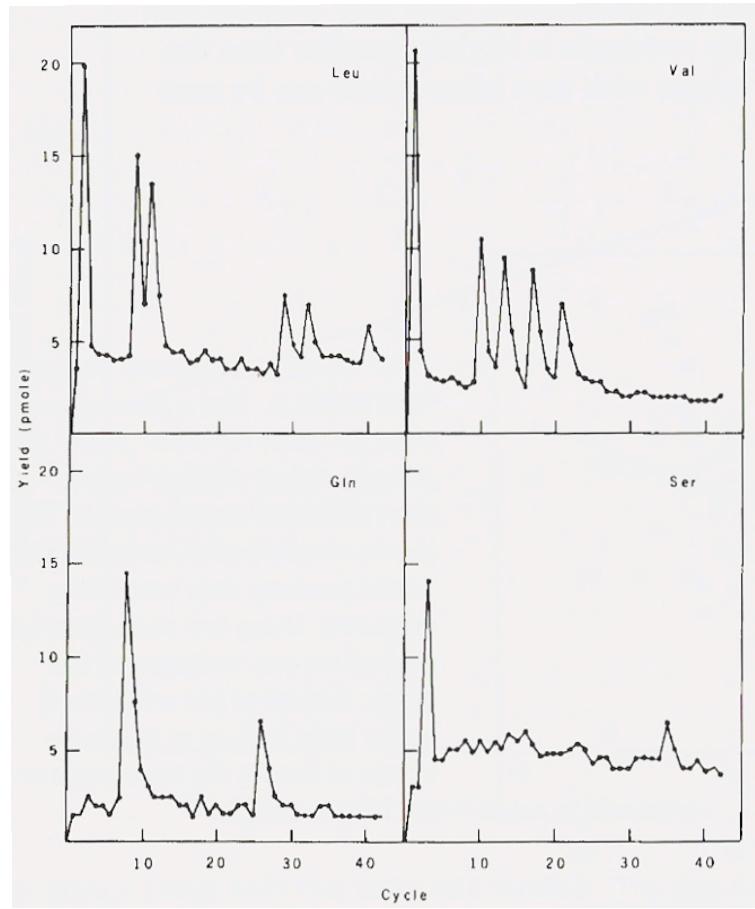
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



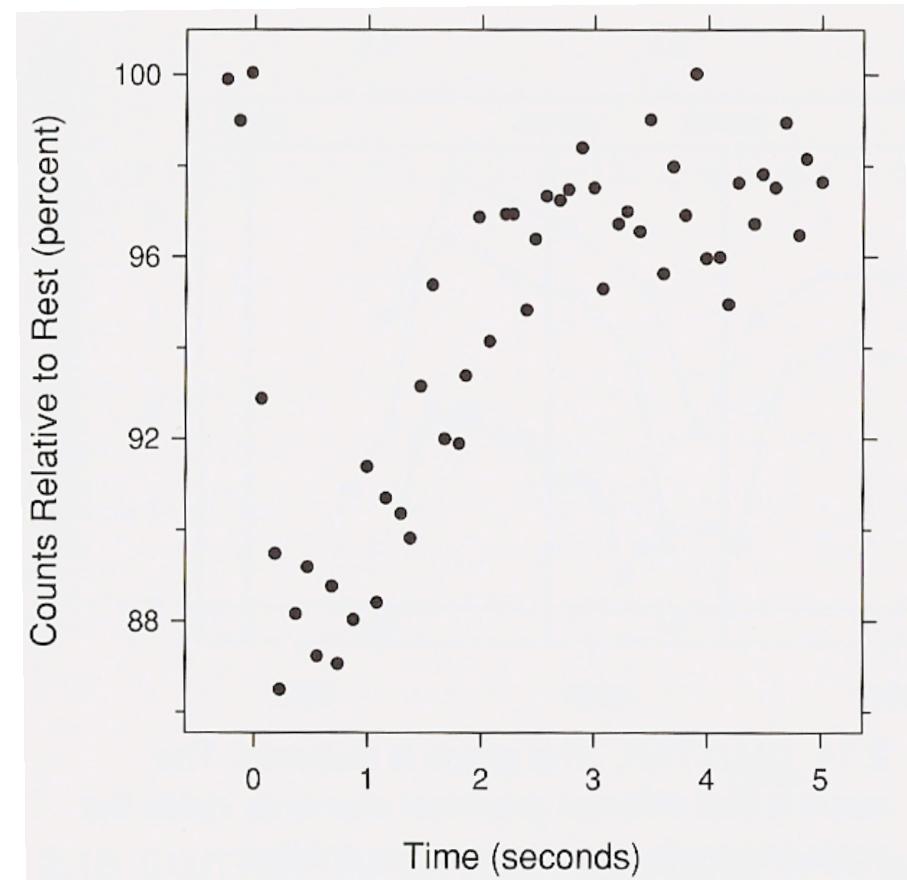
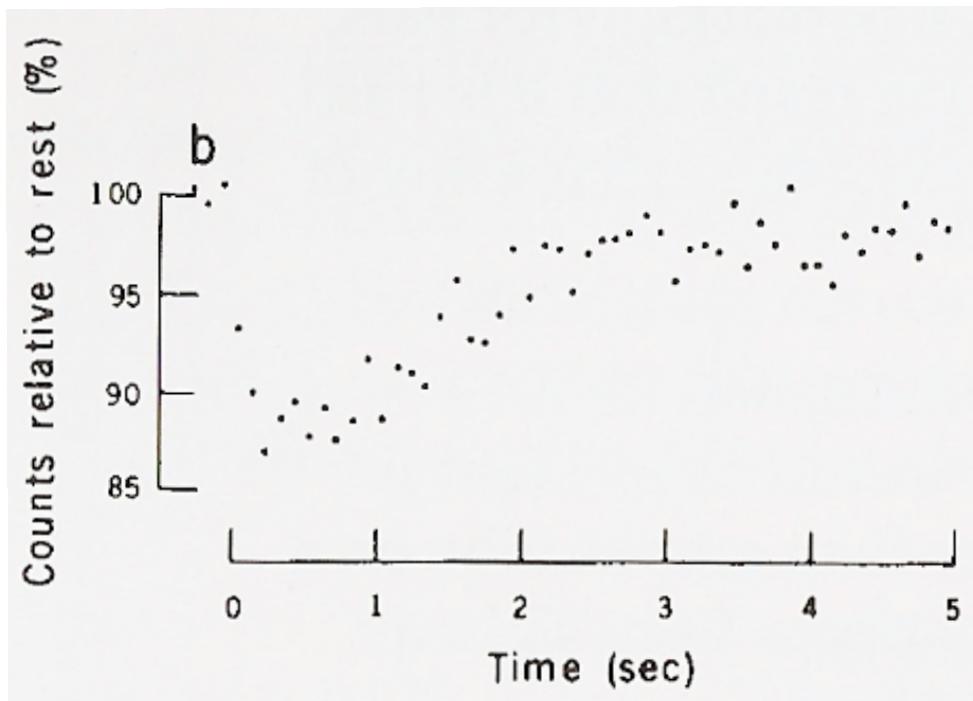
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



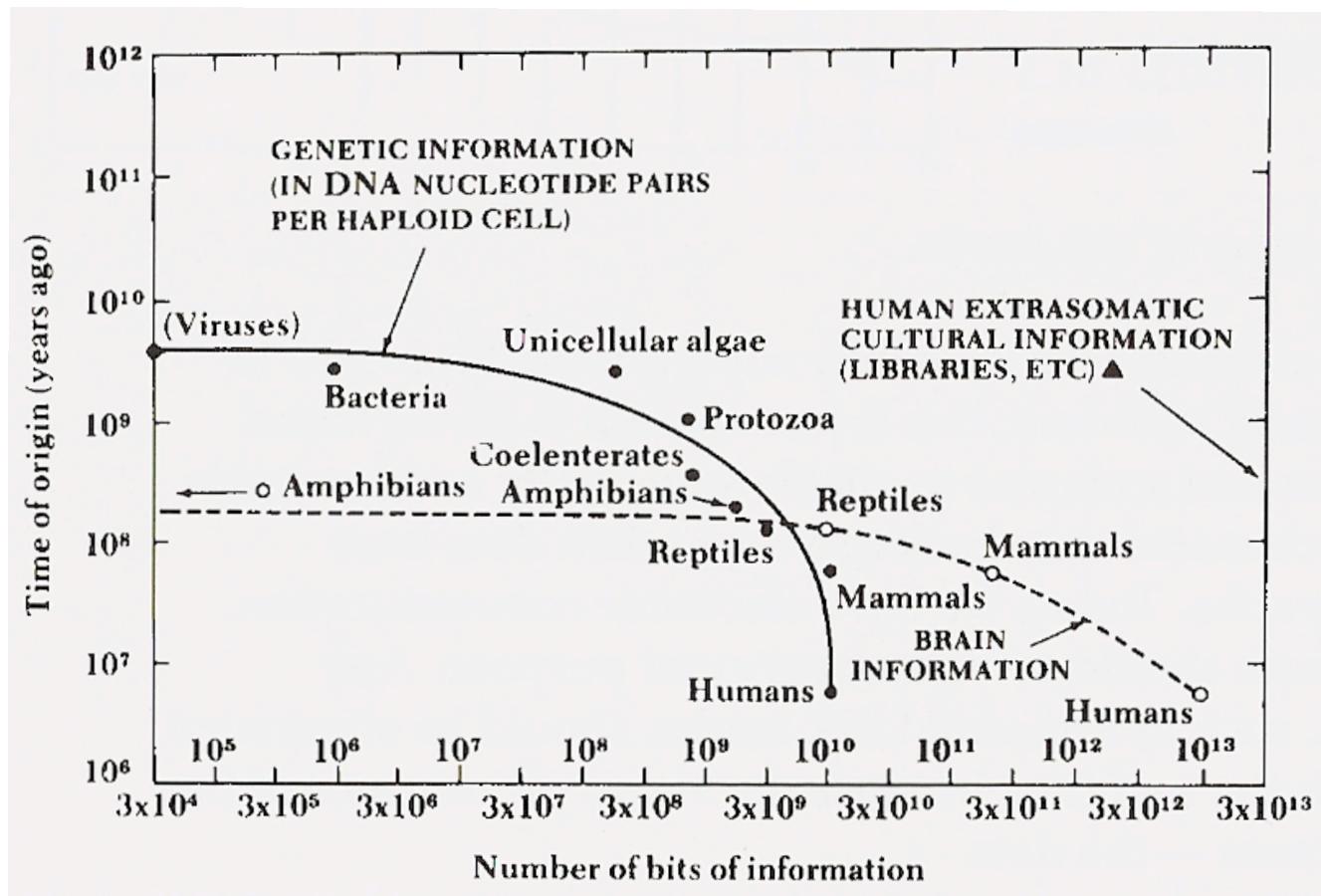
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



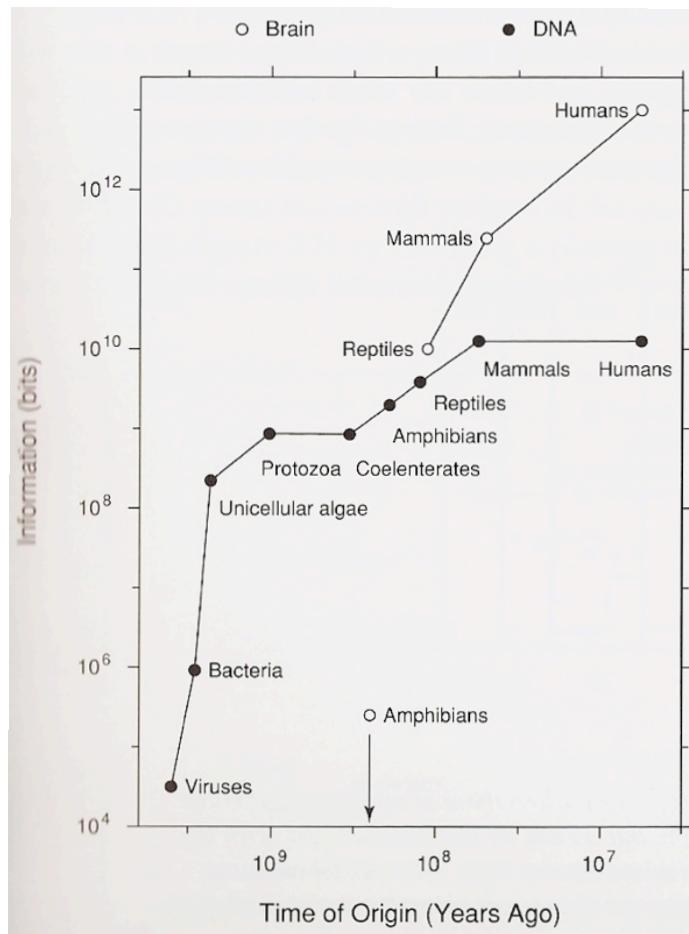
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



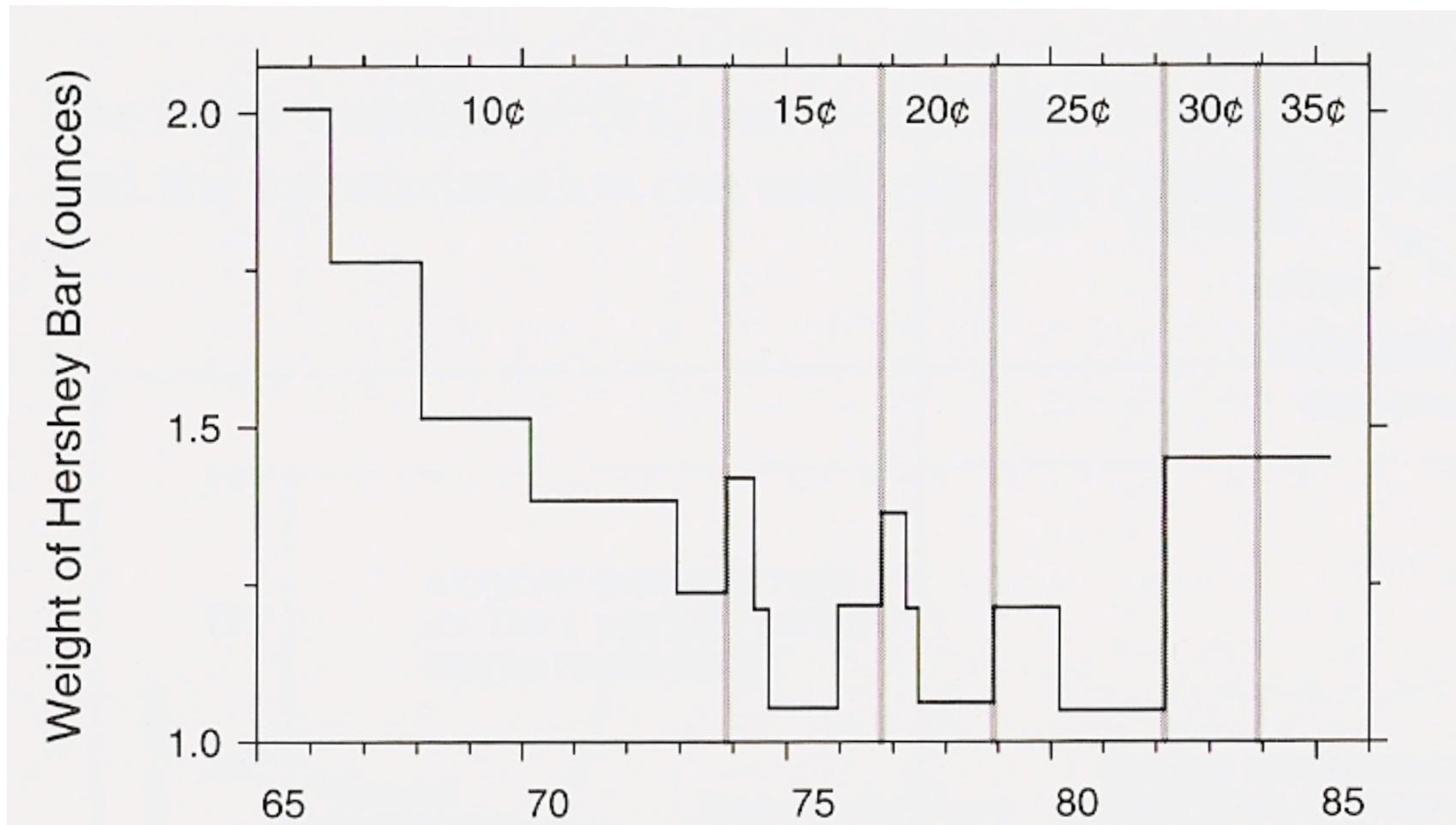
Clear Vision

- Principle 3: Scale lines and the data rectangle
 - Use two scale lines (box), add margins for data, tick-marks out, 3-10 tick marks.



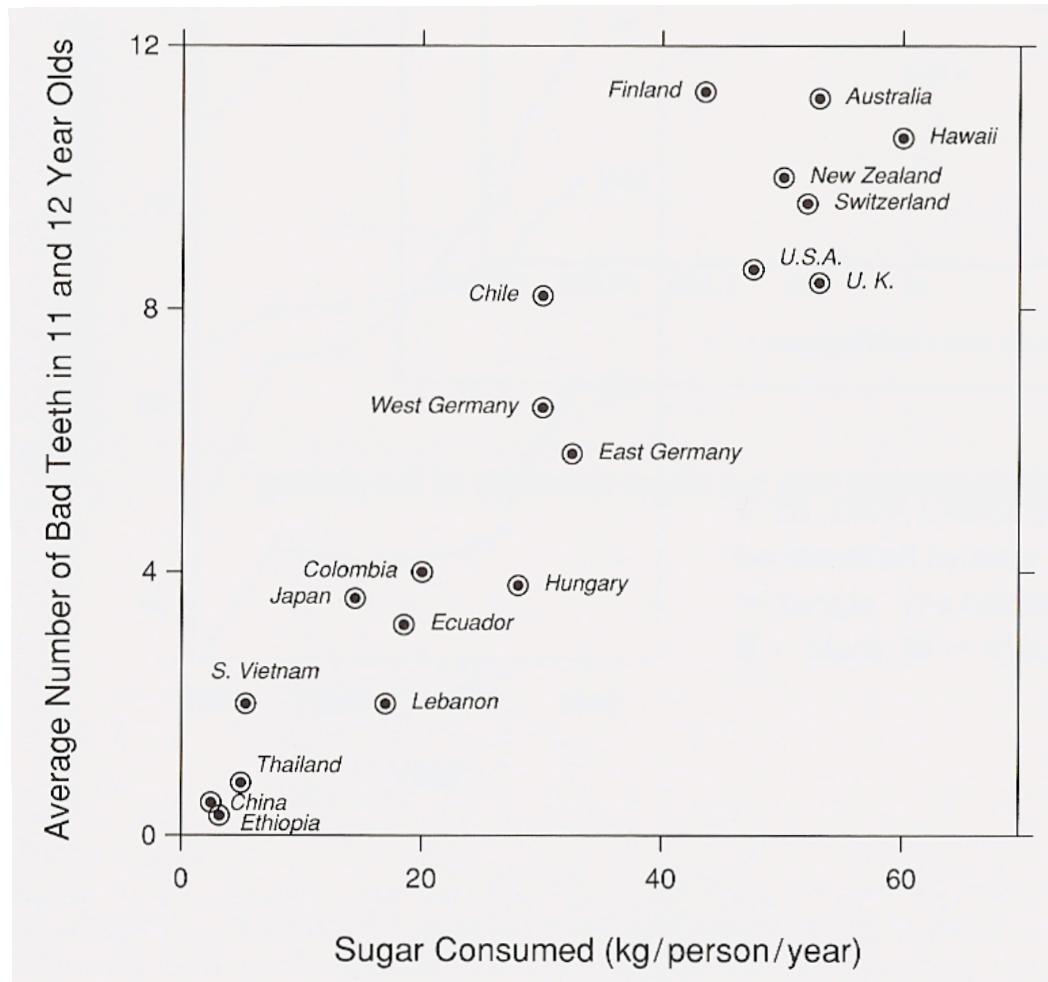
Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



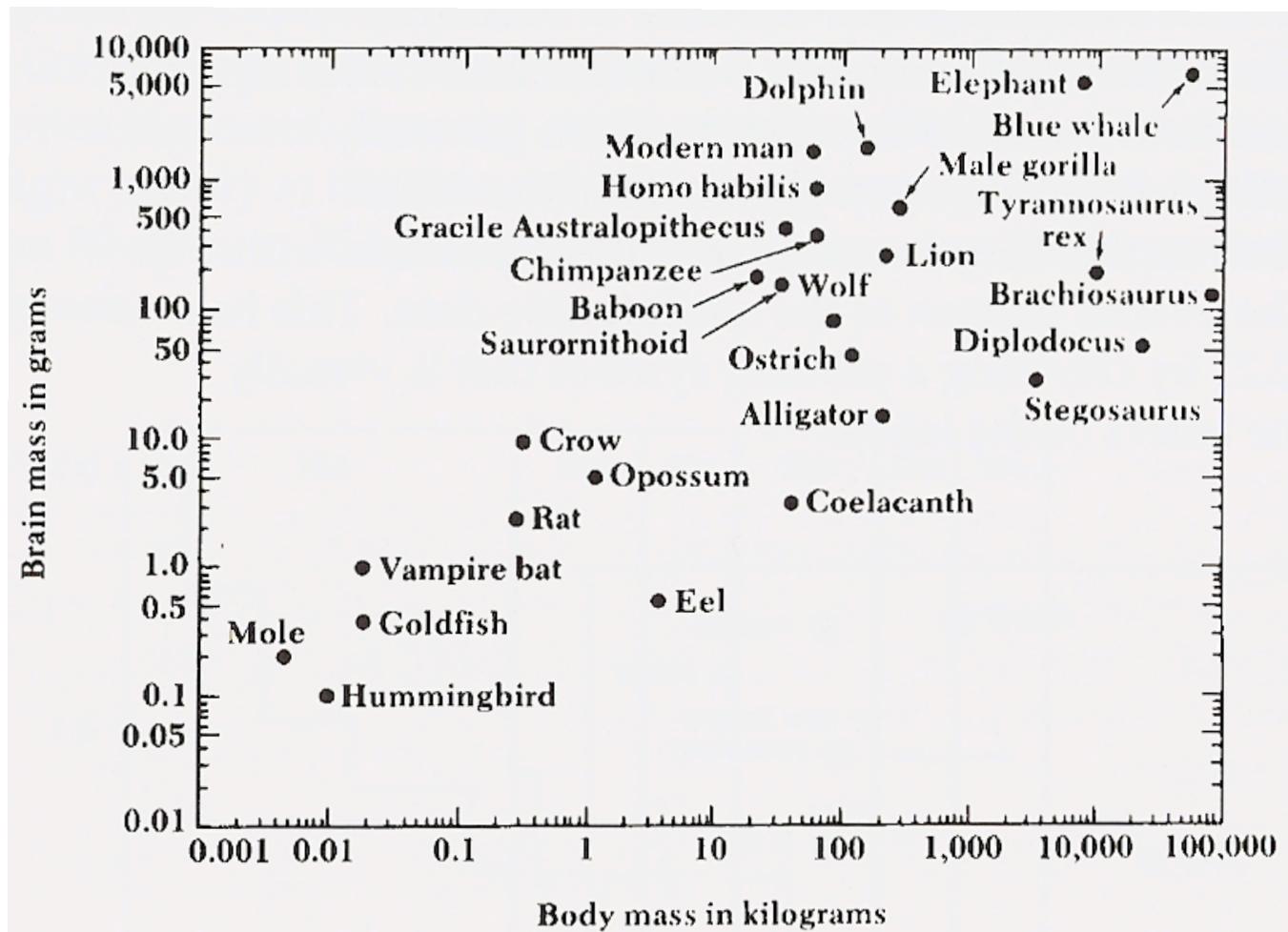
Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



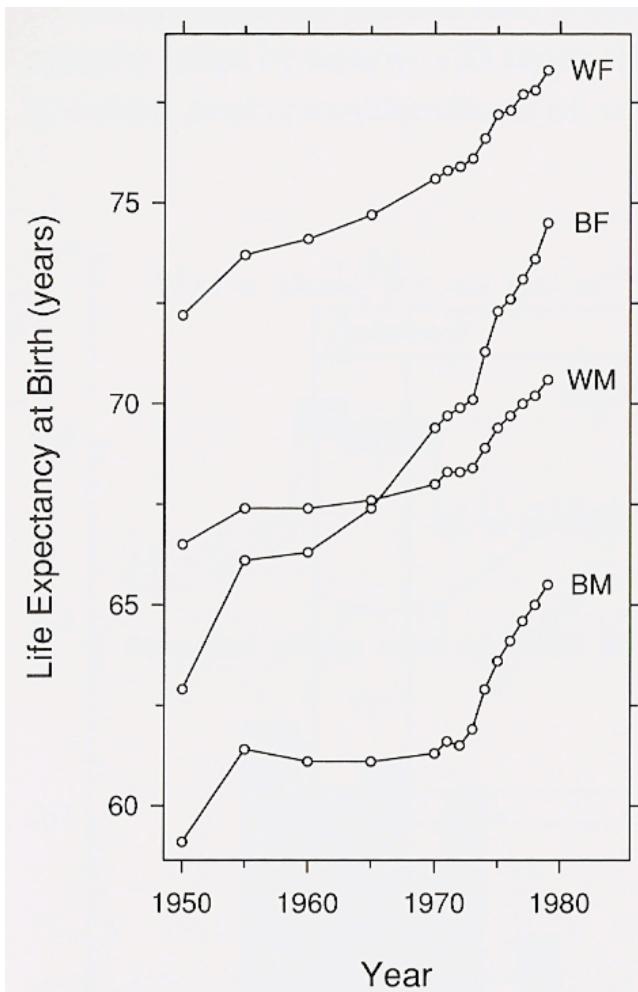
Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



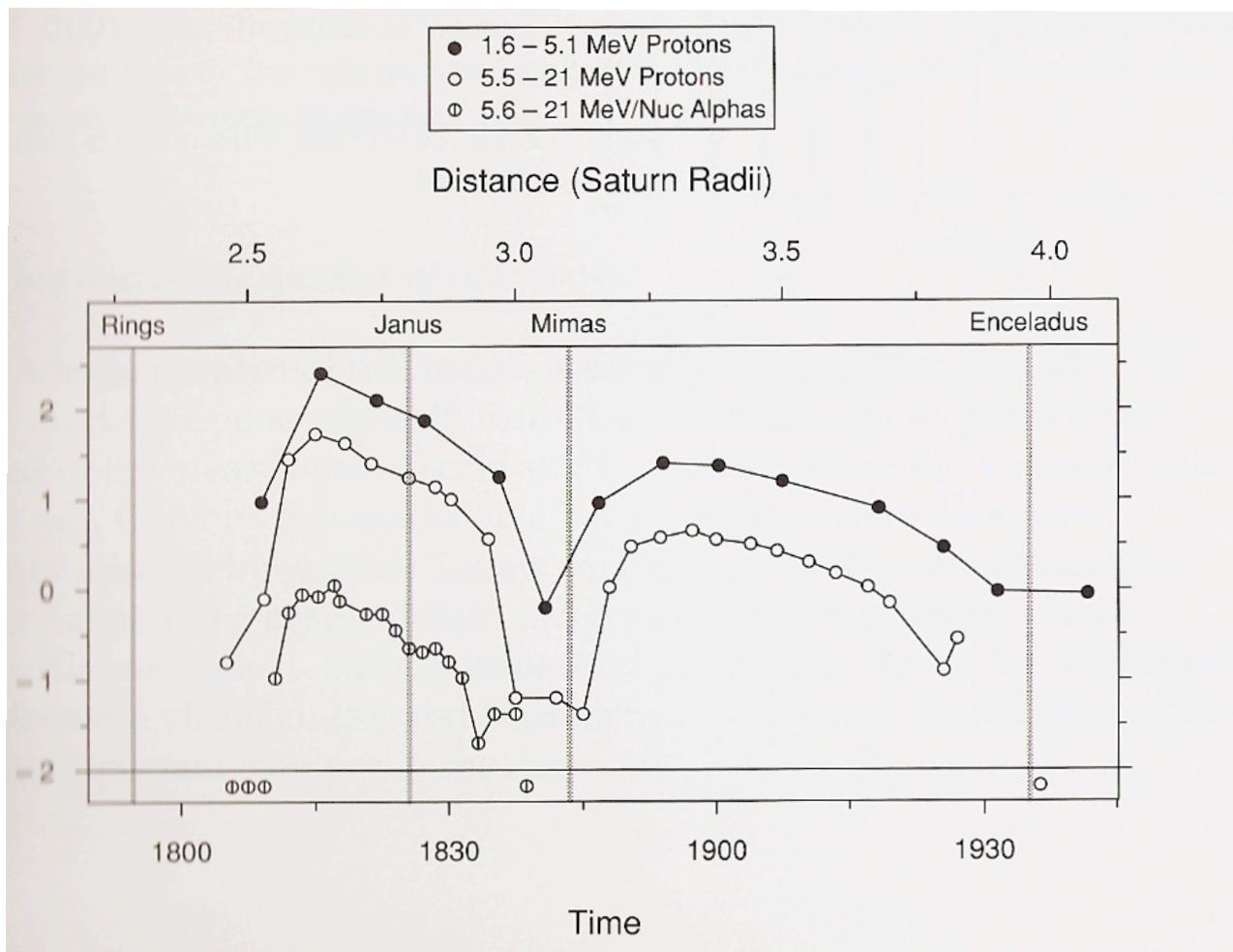
Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



Clear Vision

- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.

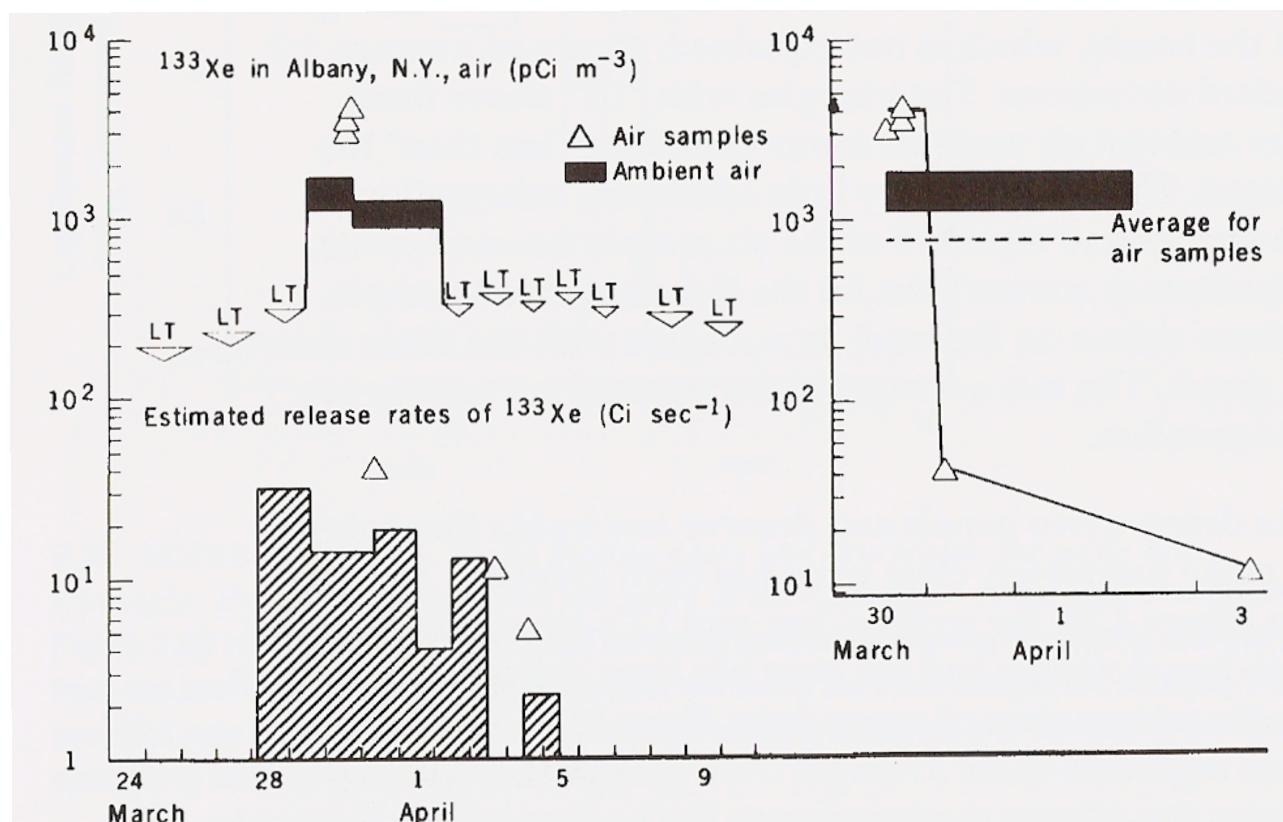
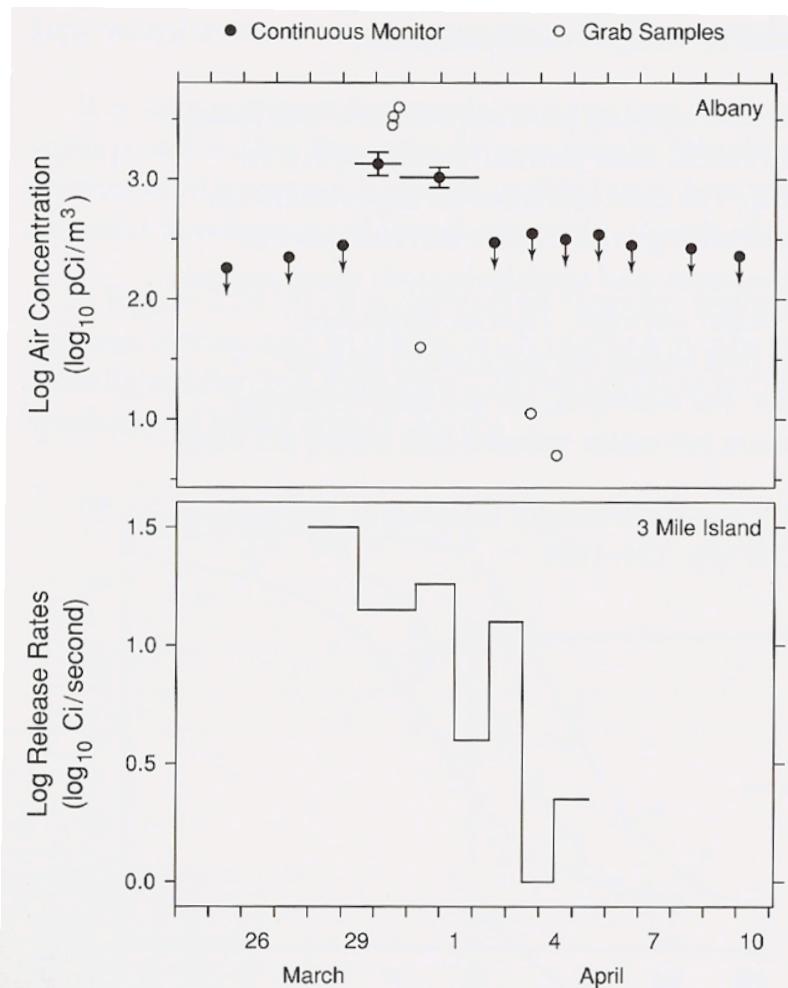


Fig. 1. Xenon-133 activity (picocuries per cubic meter of air) in Albany, New York, for the end of March and early April 1979. The lower trace shows the time-averaged estimates of releases (curies per second) from the Three Mile Island reactor (2). The inset shows detailed values for air samples (gas counting) and concurrent average values for ambient air (Ge diode). Abbreviation: LT, less than.

Clear Vision

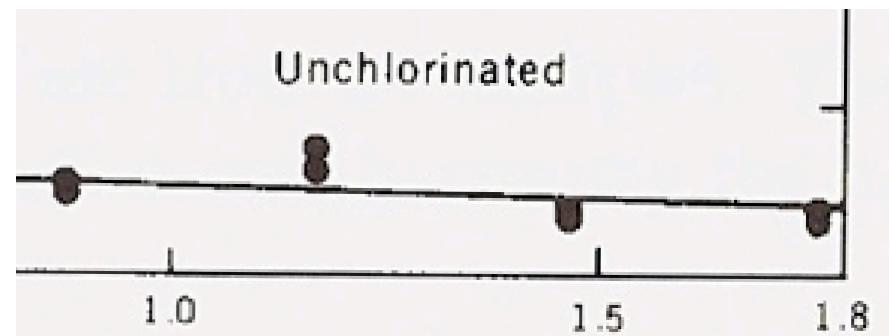
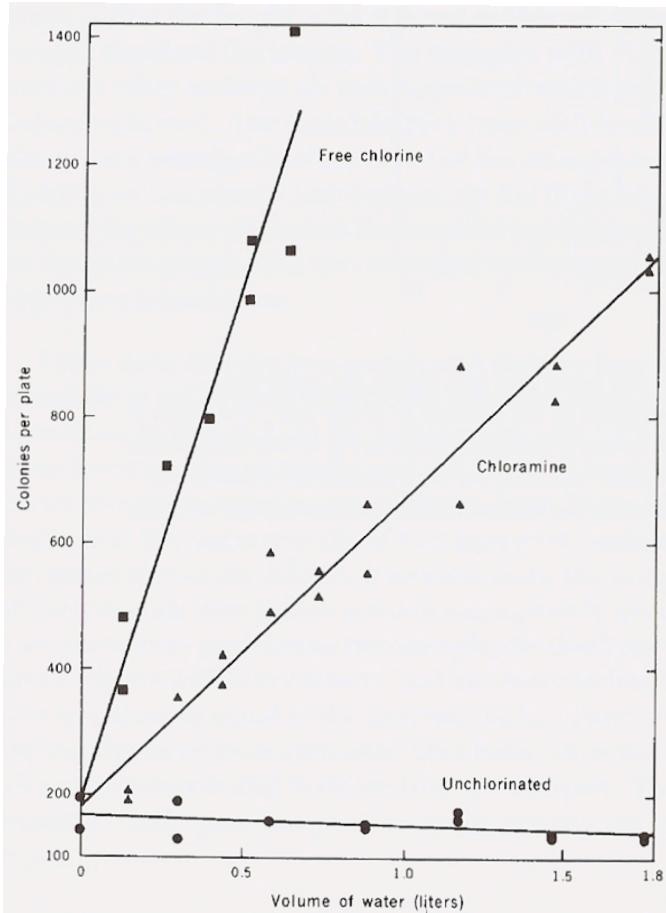
- Principle 4: Reference lines, labels, notes, and keys
 - Only use when necessary and don't let them obscure data.



Clear Vision

- Principle 5: Superposed data sets

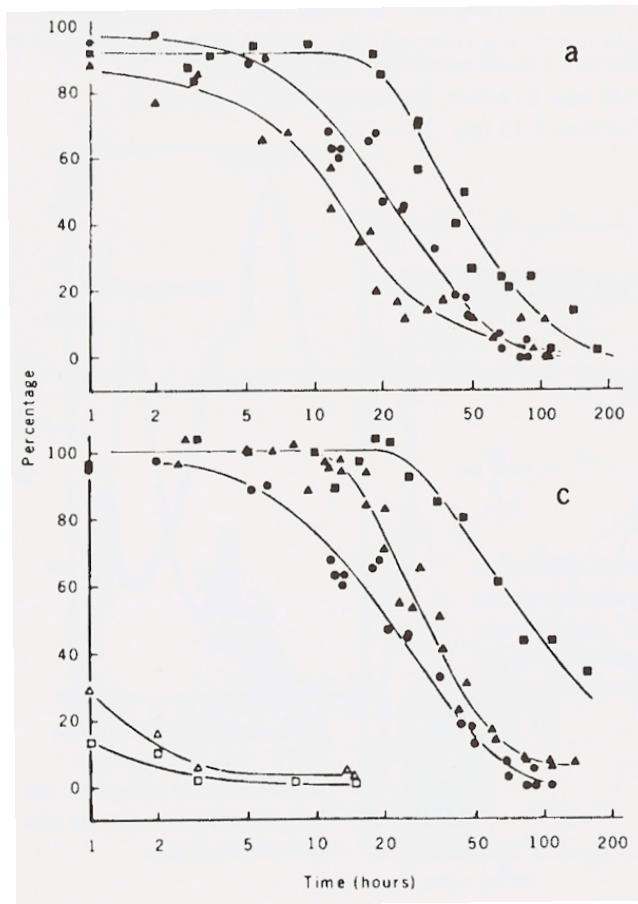
- Symbols should be separable and data sets should be easily visually assembled.



Clear Vision

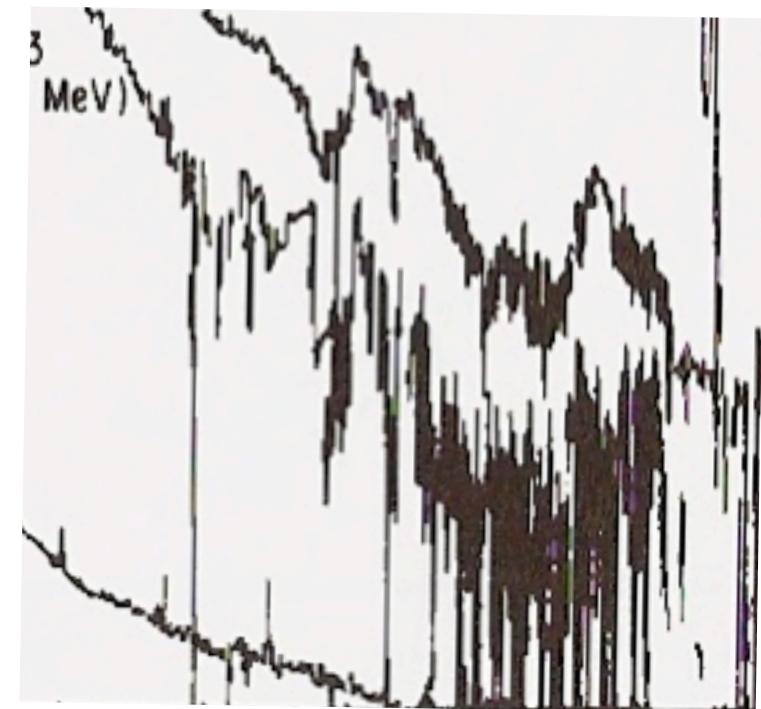
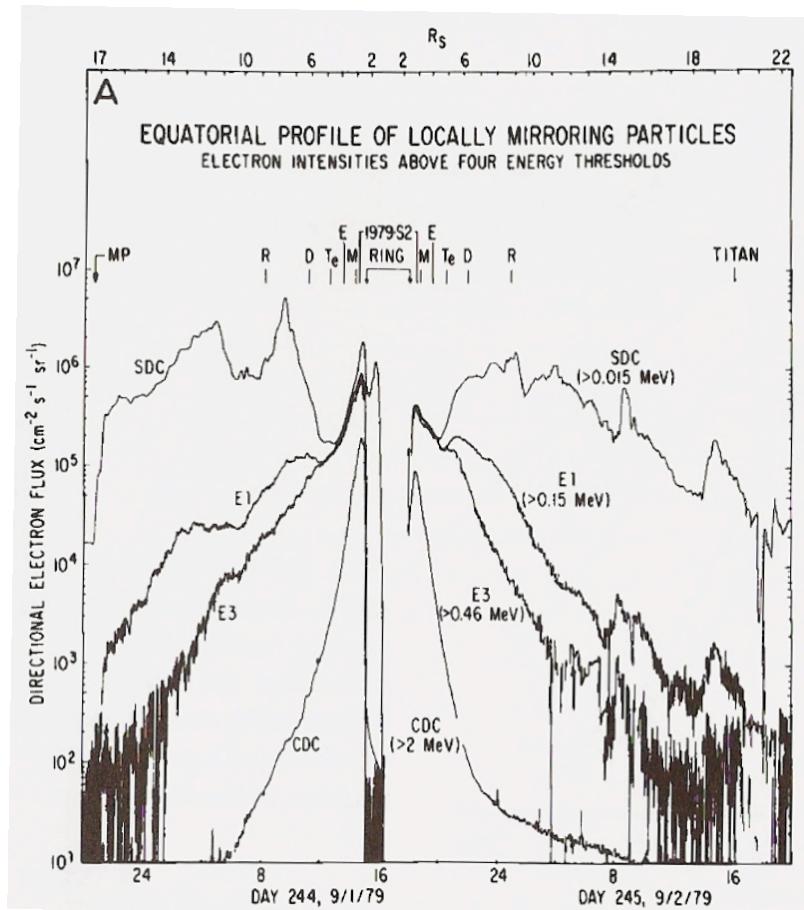
- Principle 5: Superposed data sets

- Symbols should be separable and data sets should be easily visually assembled.



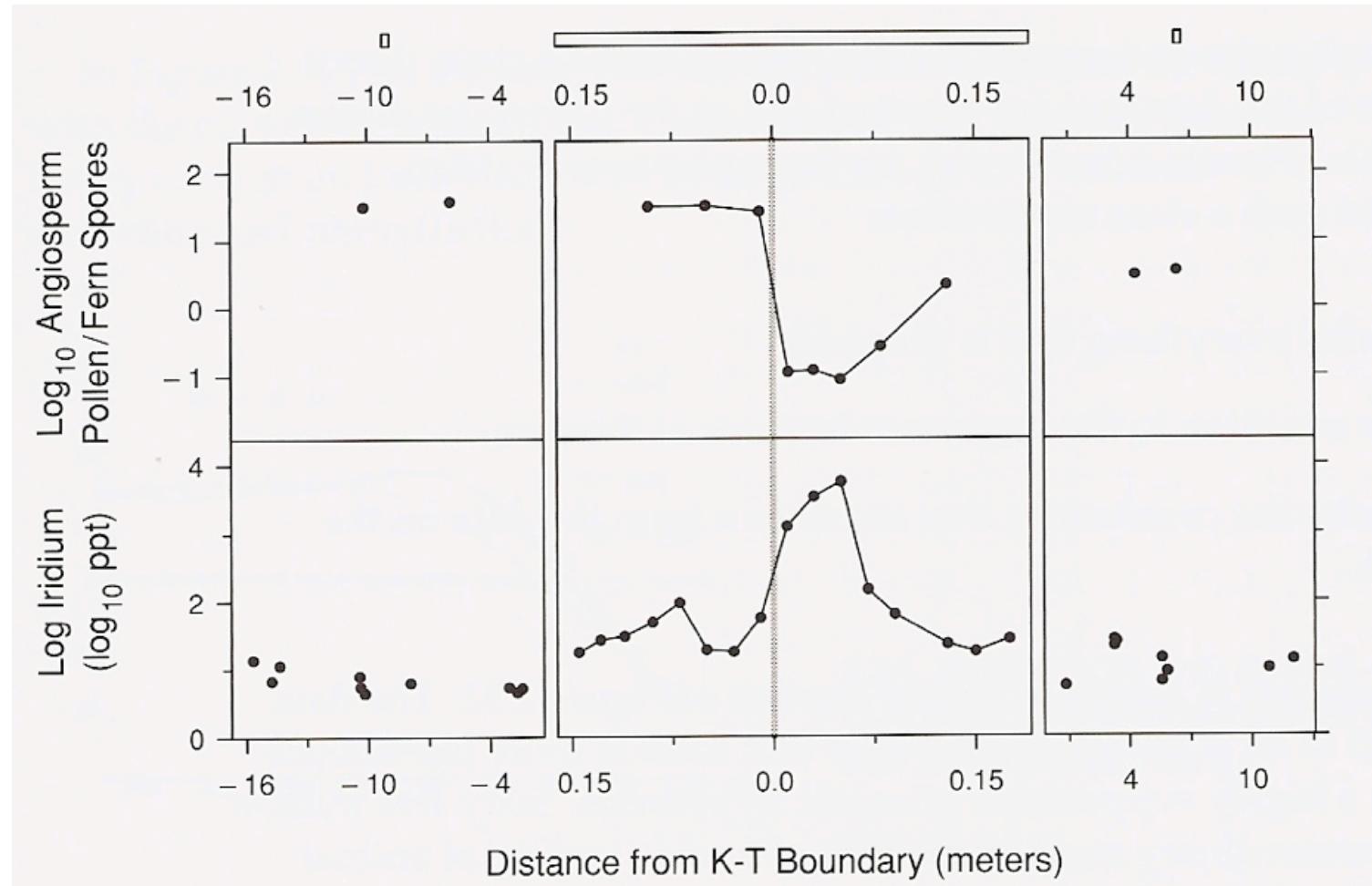
Clear Vision

- Principle 5: Superposed data sets
 - Symbols should be separable and data sets should be easily visually assembled.



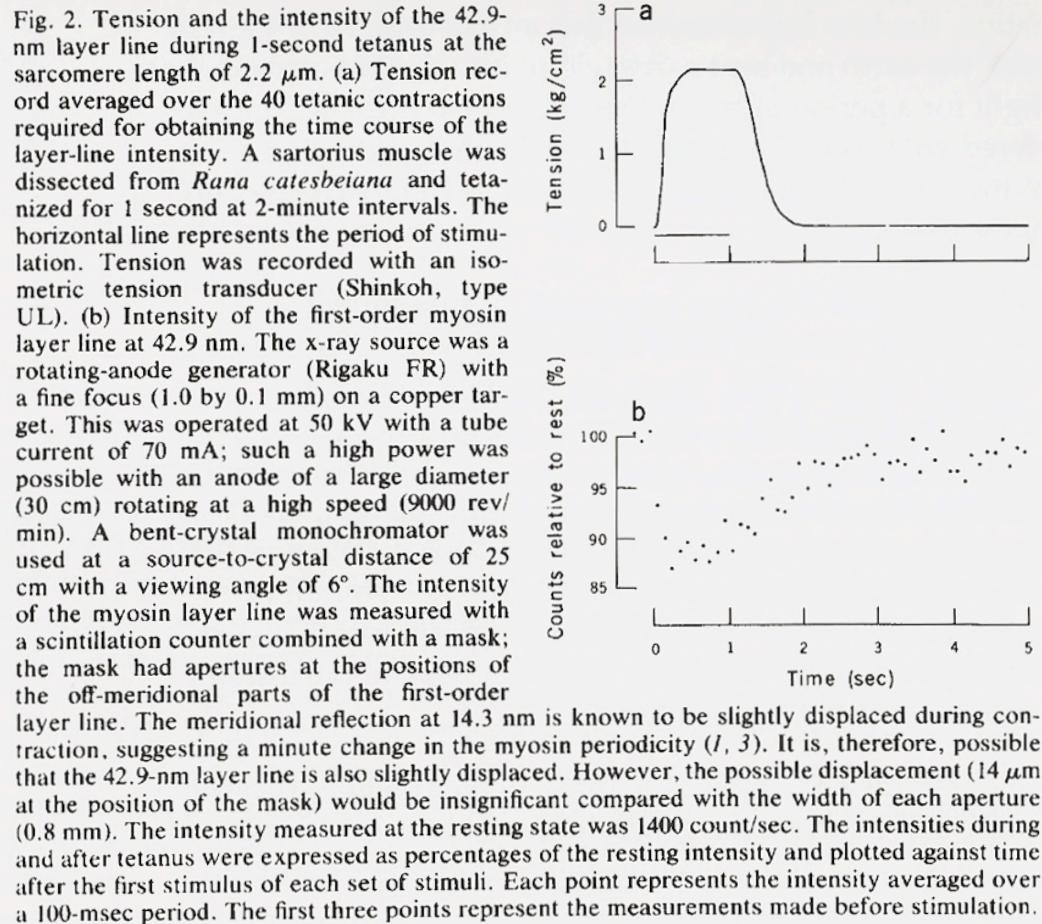
Clear Understanding

- Principle 1: Explanation and conclusions
 - Describe everything, draw attention to major features, describe conclusions



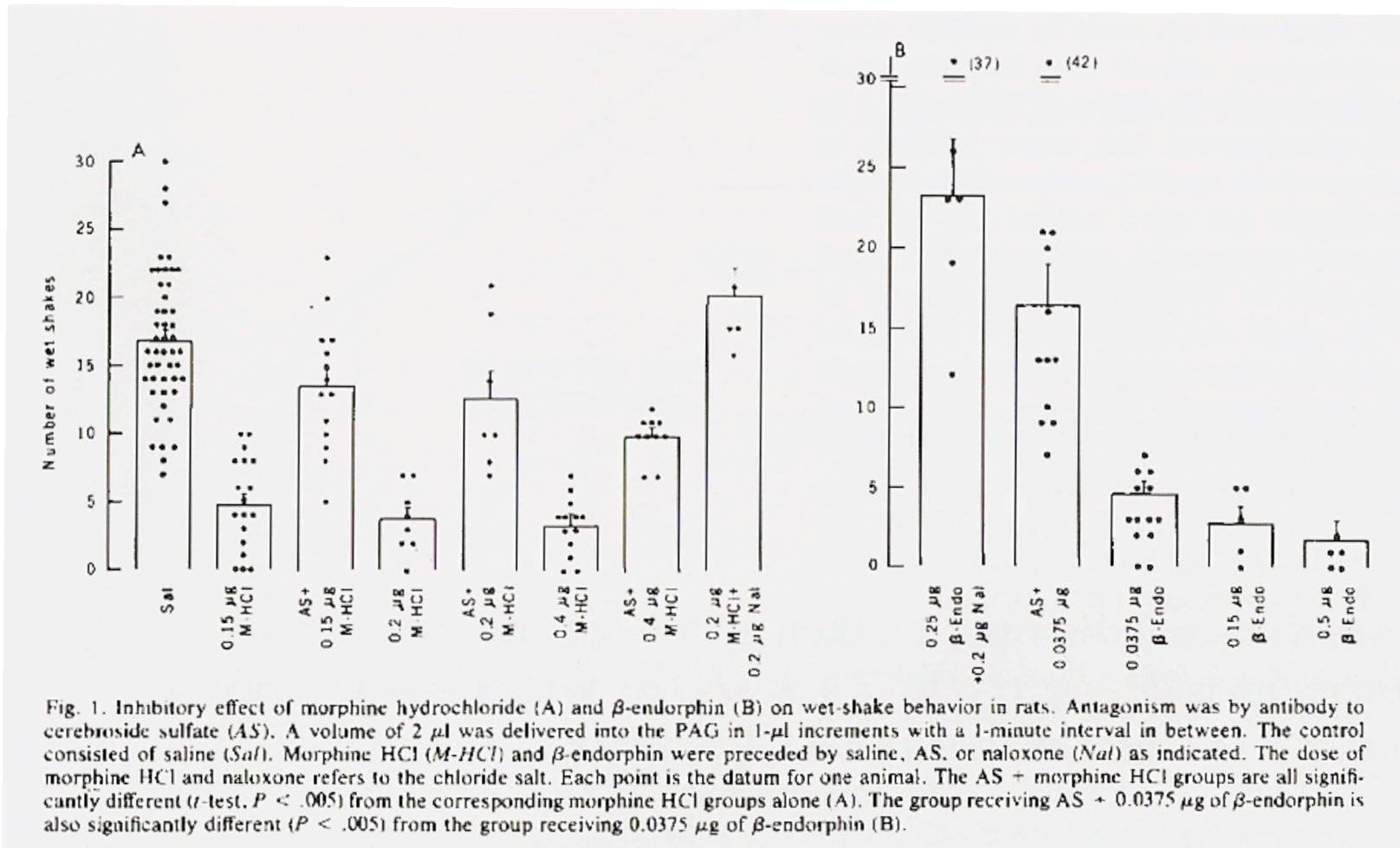
Clear Understanding

- Principle 1: Explanation and conclusions
- Describe everything, draw attention to major features, describe conclusions



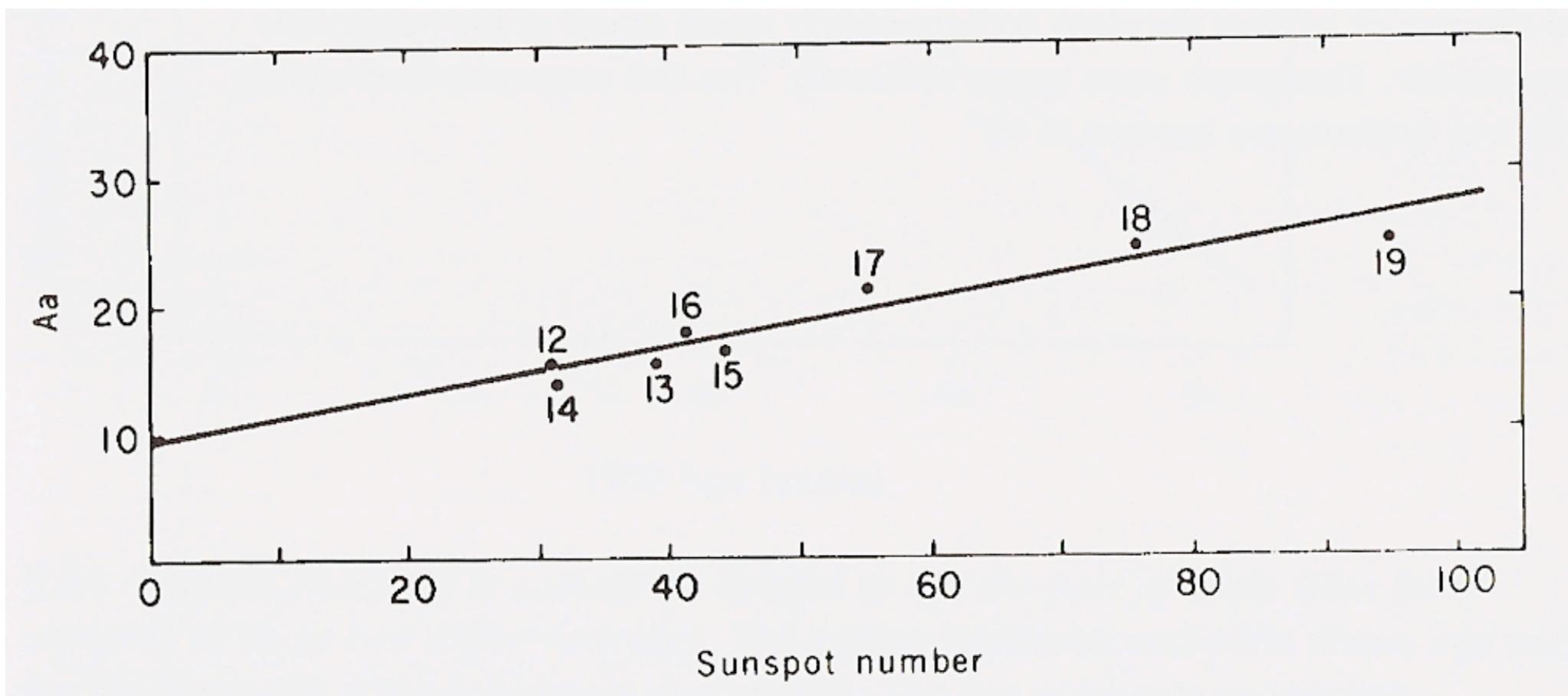
Clear Understanding

- Principle 1: Explanation and conclusions
 - Describe everything, draw attention to major features, describe conclusions



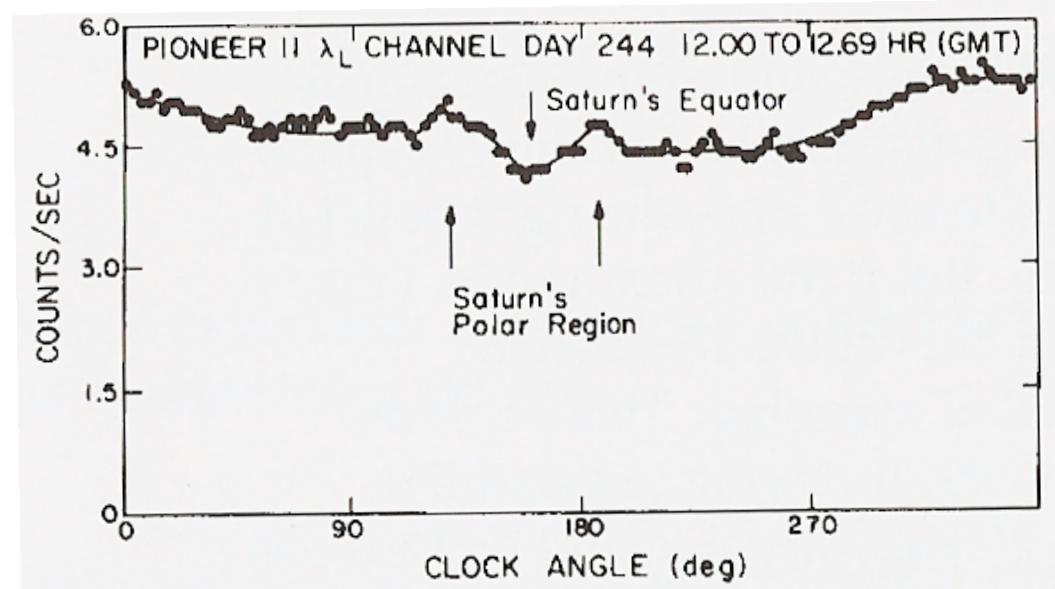
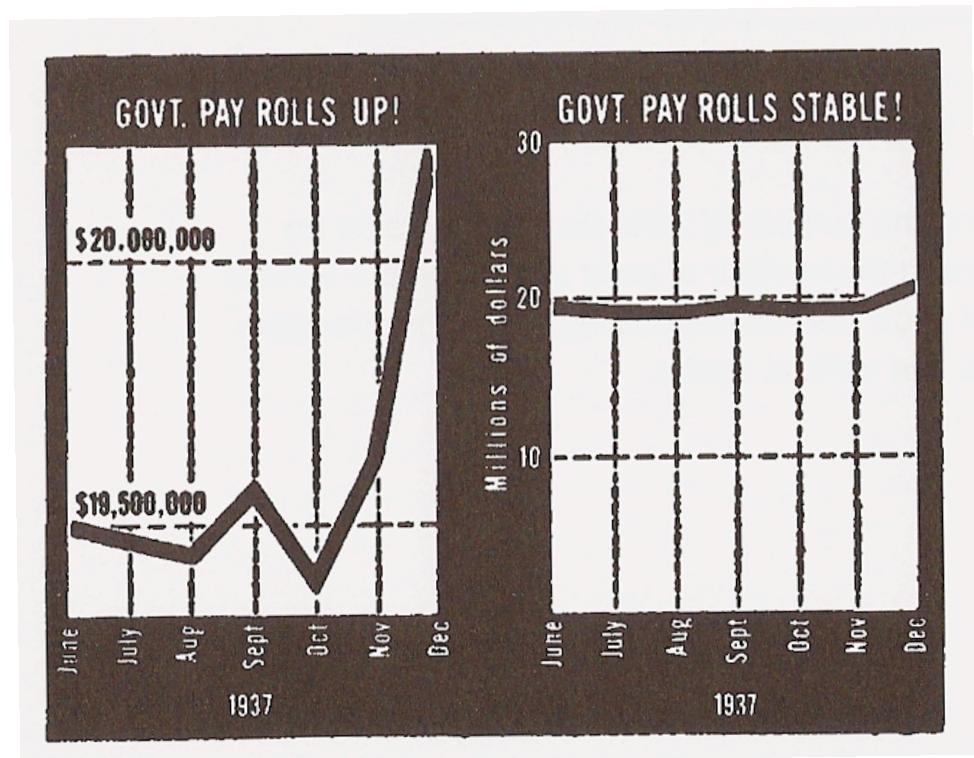
Clear Understanding

- Principle 2: Use all of the available space
 - Fill the data rectangle, only use zero if you need it



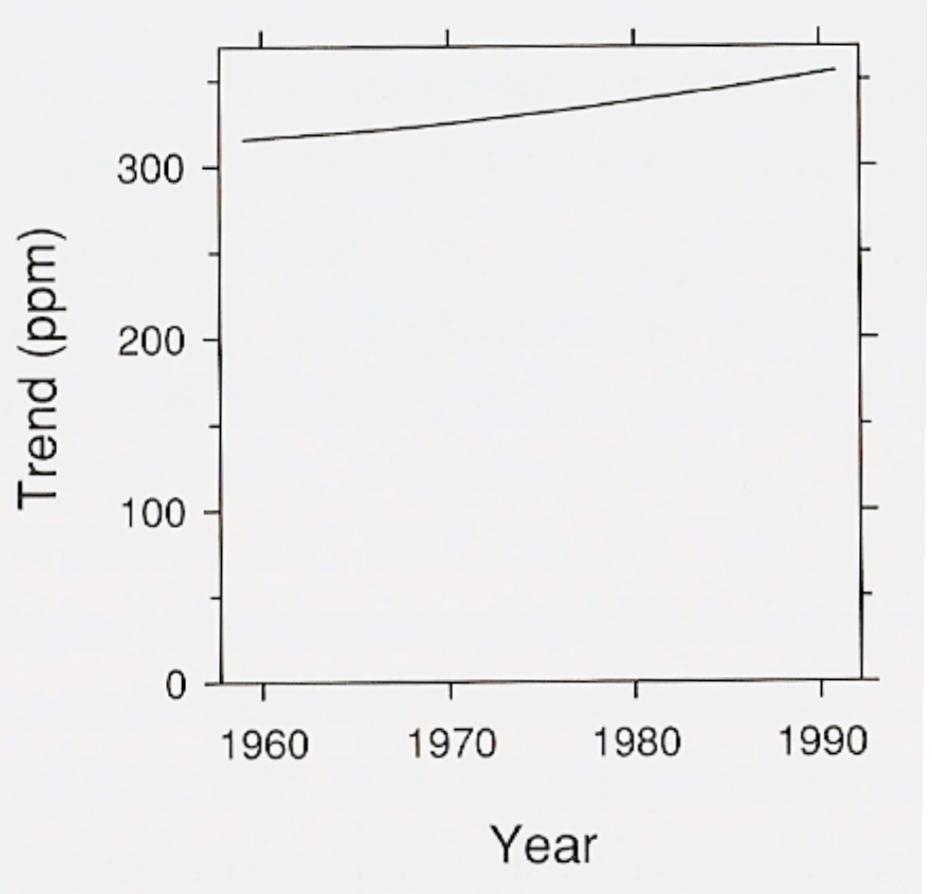
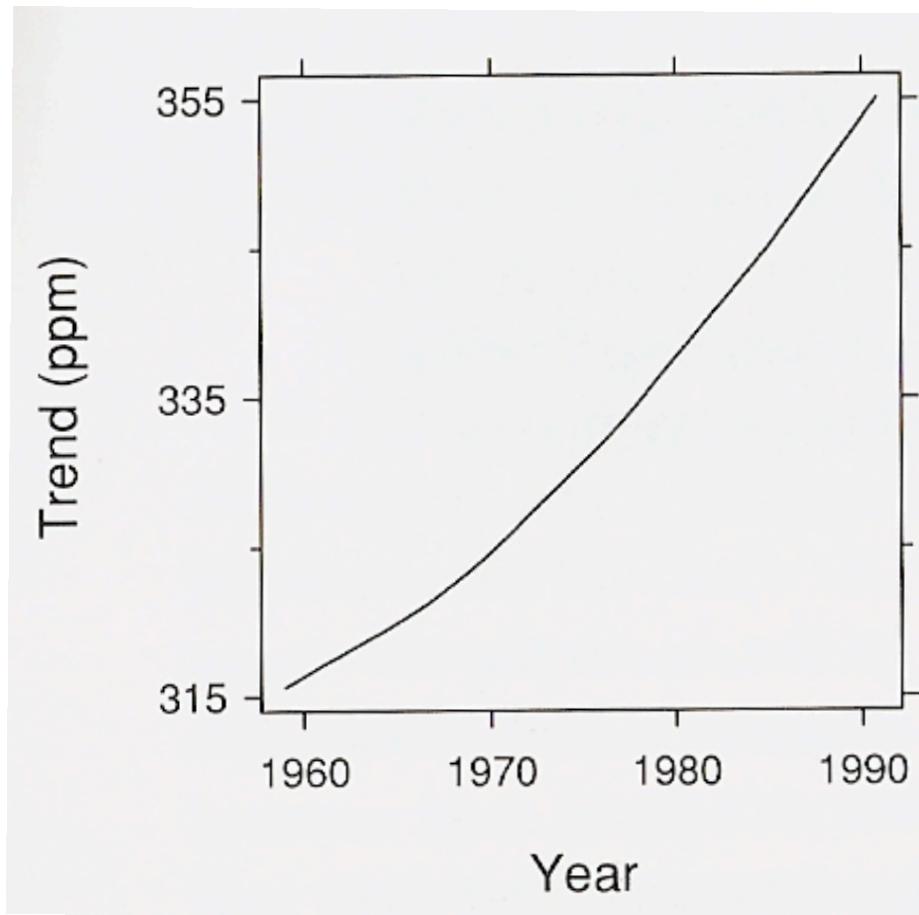
Clear Understanding

- Principle 2: Use all of the available space
 - Fill the data rectangle, only use zero if you need it



Clear Understanding

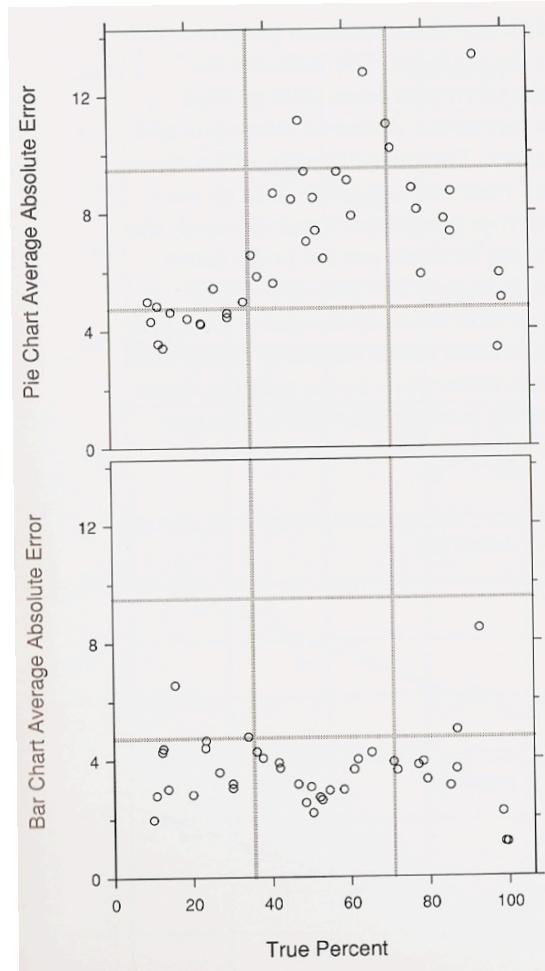
- Principle 2: Use all of the available space
 - Fill the data rectangle, only use zero if you need it



inciple 3: Juxtaposed data sets

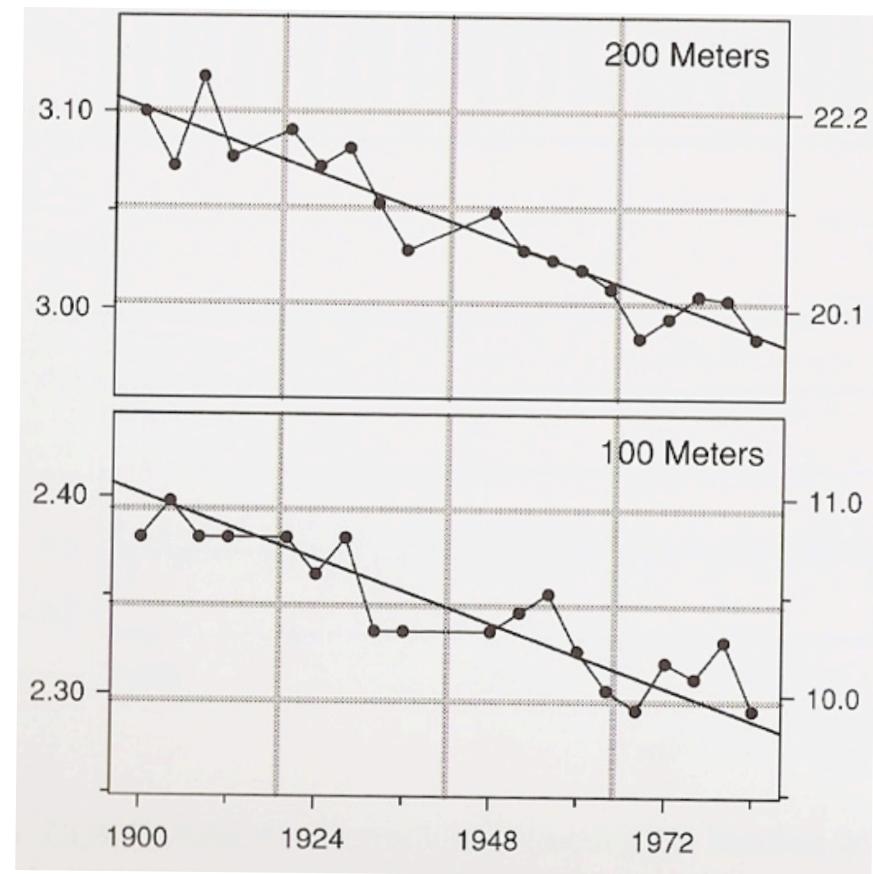
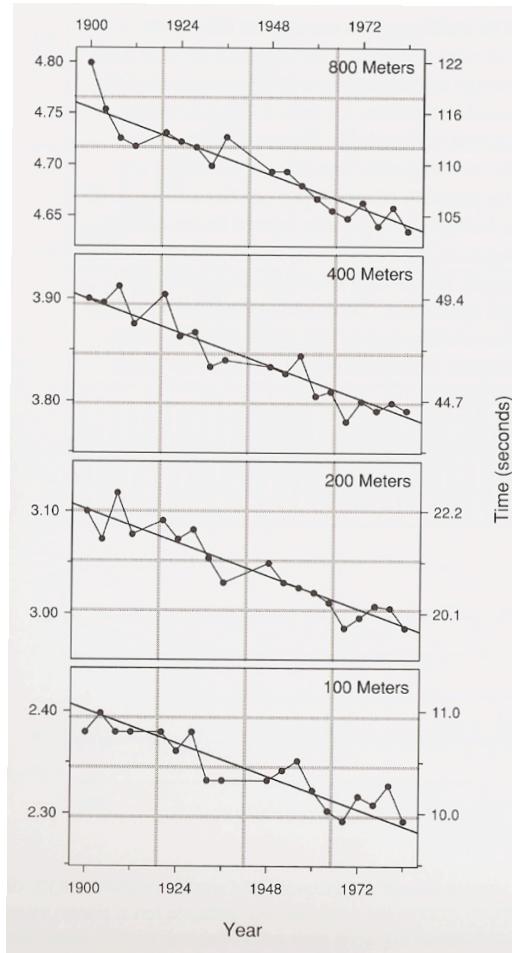
Clear Understanding

Make sure scales match and graphs are aligned



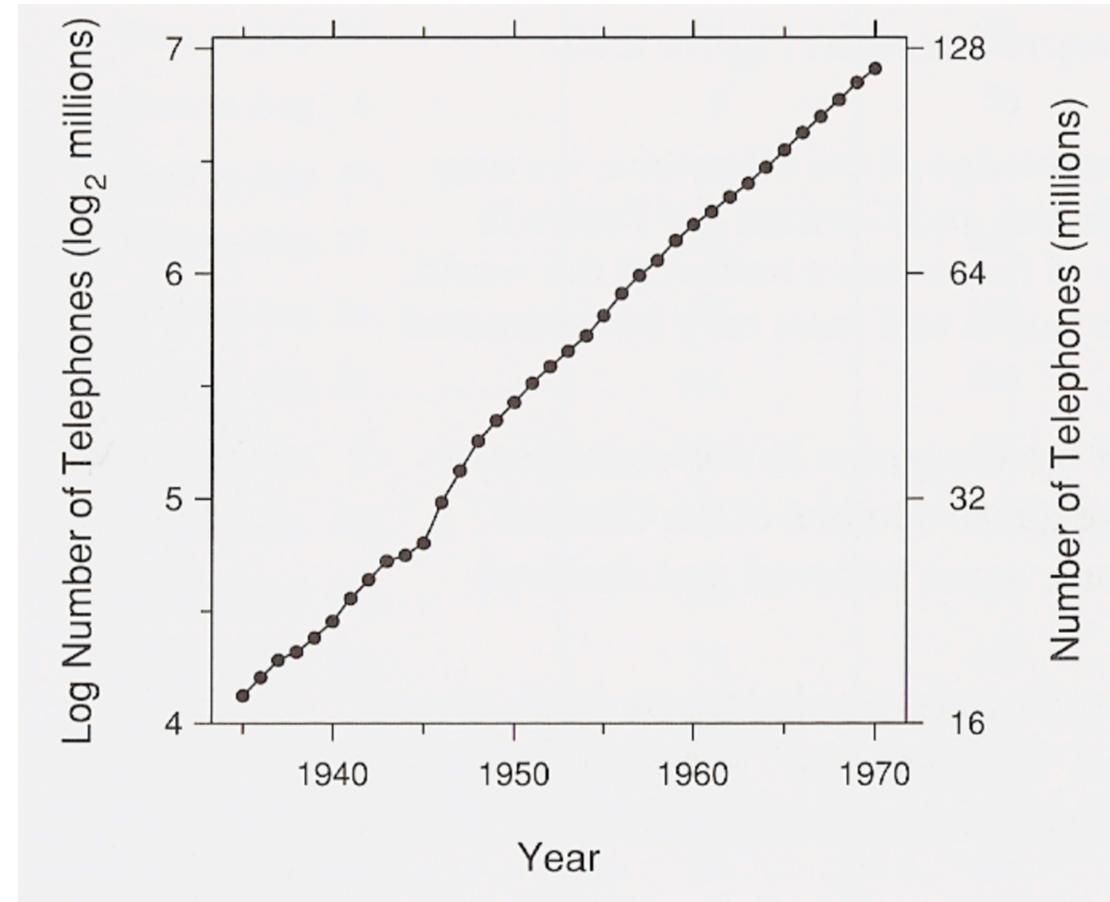
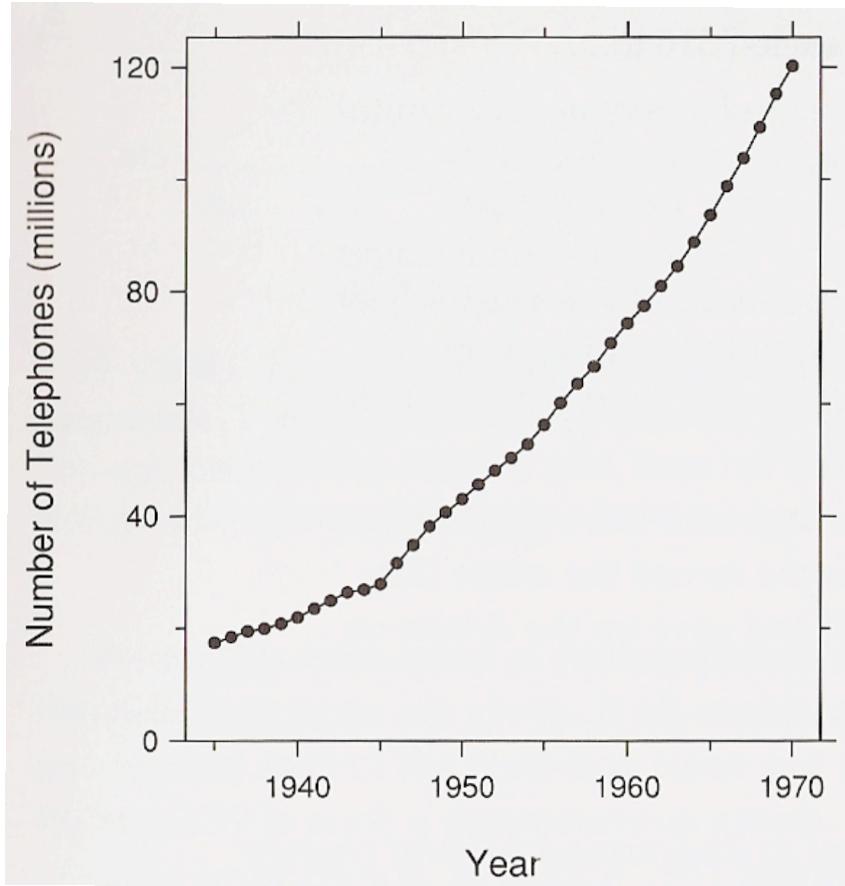
Clear Understanding

- Principle 3: Juxtaposed data sets
 - Make sure scales match and graphs are aligned



Clear Understanding

- Principle 4: Log scales
 - Used to show percentage change, multiplicative factors and skewness



Clear Understanding

- Principle 4: Banking to 45°
 - Aspect ratio is important for judging rate of change

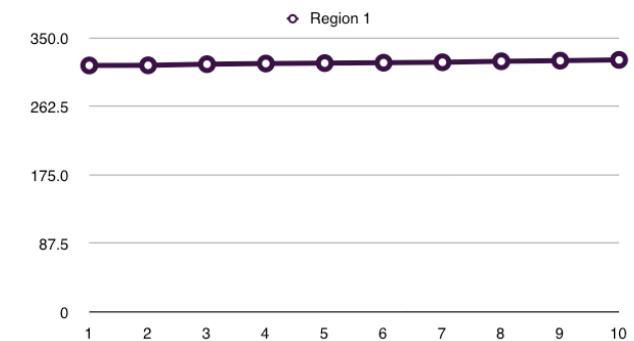
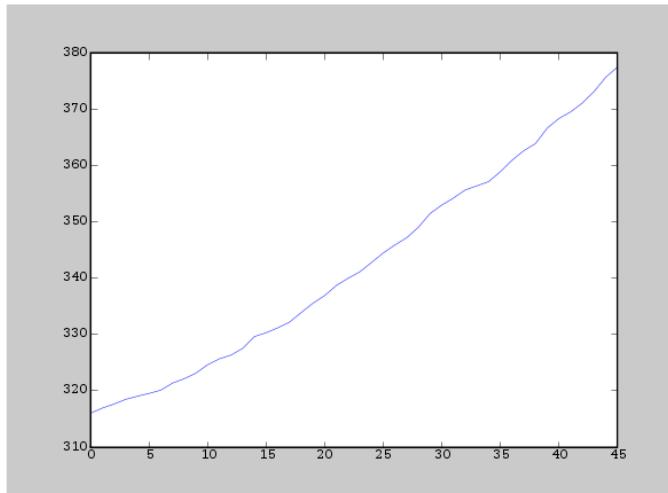
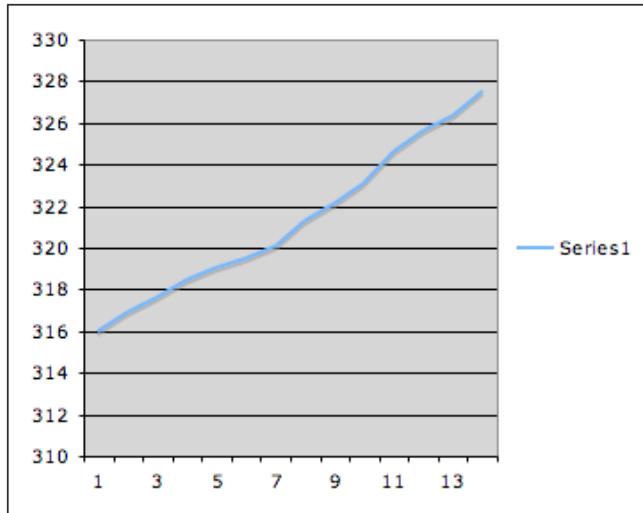
CO2 VisTrails Demo

Summary of Principles

- Clear Vision
 - 1. Make data stand out
 - 2. Visual prominence
 - 3. Scale lines and data rectangle
 - 4. Superposed data sets

- Clear Understanding
 - 1. Explanations and conclusions
 - 2. Use all available space
 - 3. Juxtaposed data sets
 - 4. Log scaling
 - 5. Banking to 45°

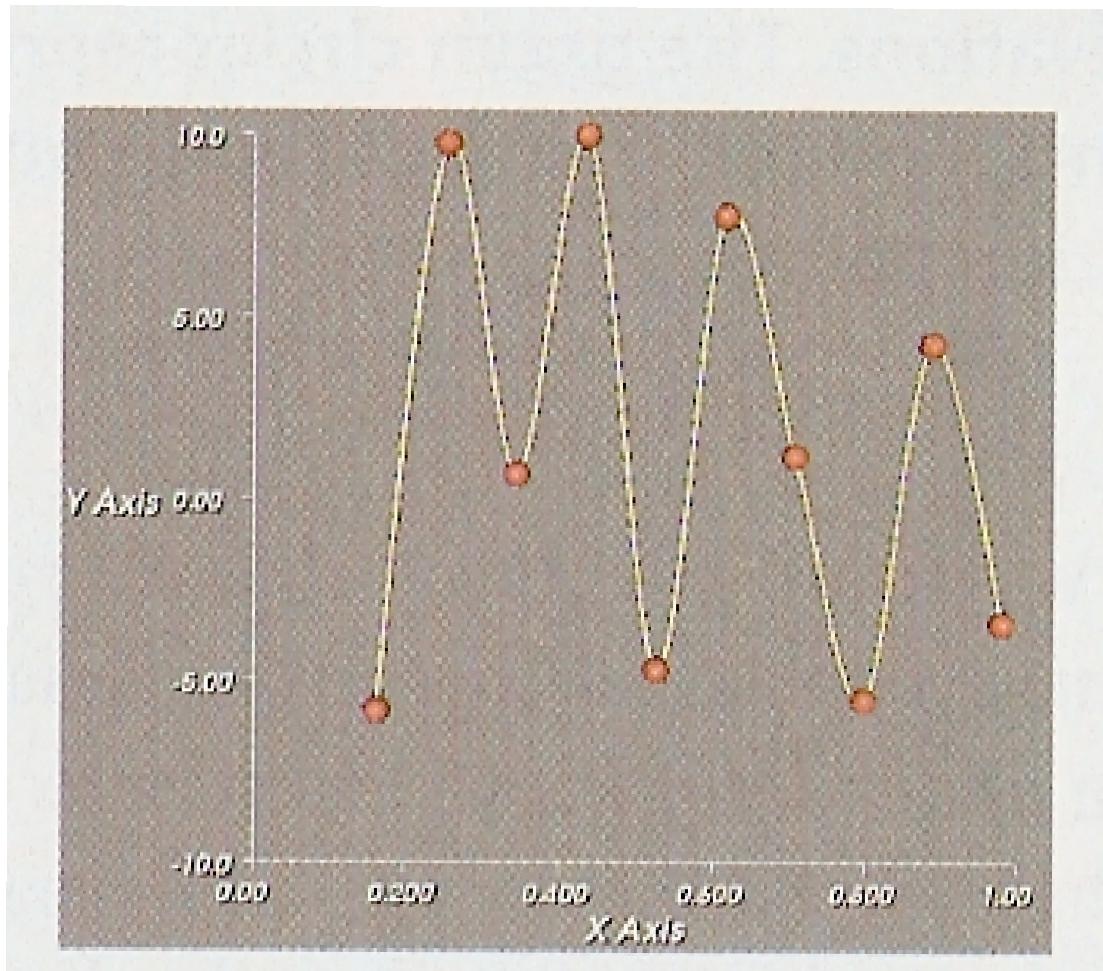
Summary of Principles



- Why are they all different?
- What is good/bad about each?

Quiz on Principles

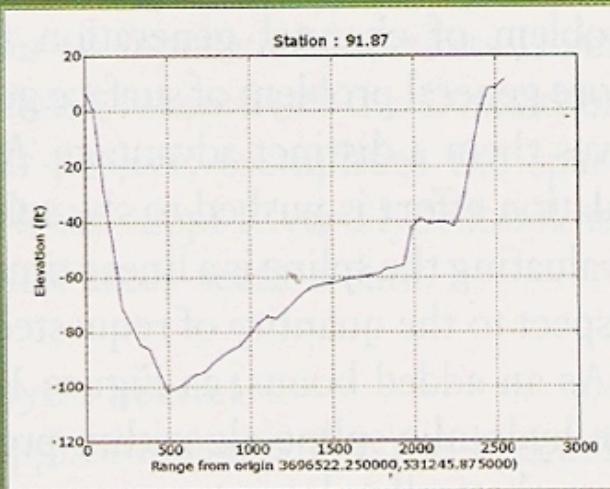
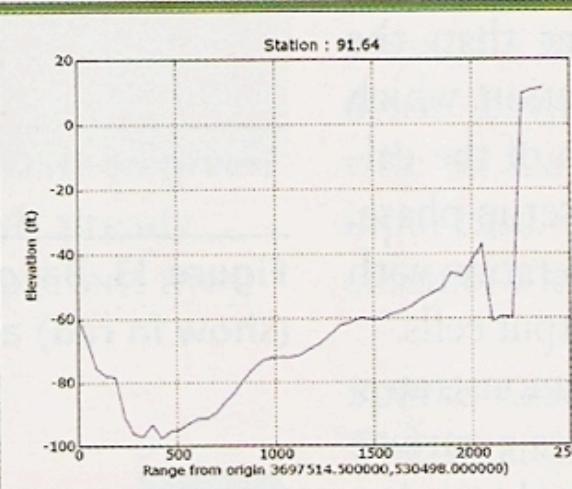
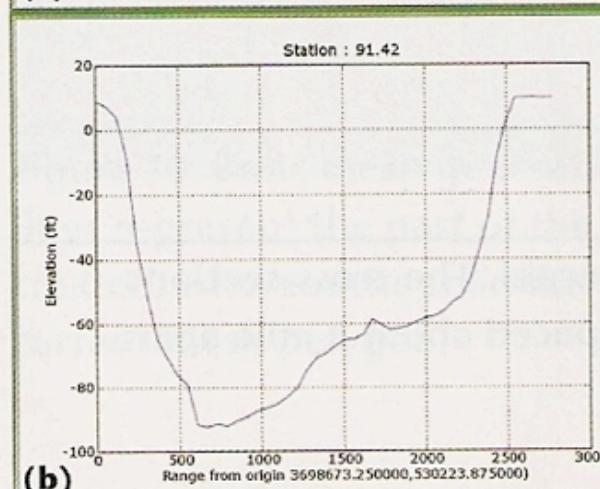
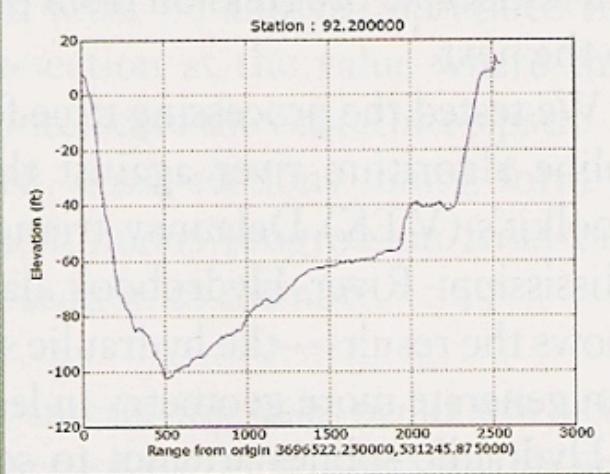
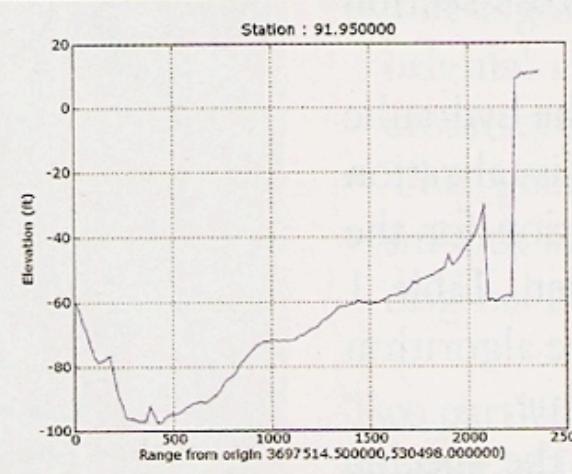
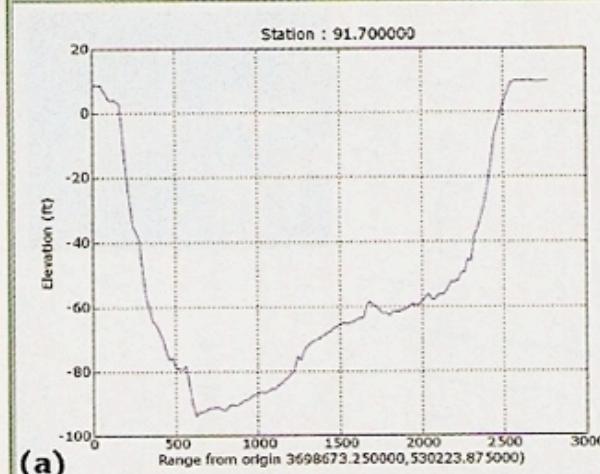
- What is wrong with this plot?



Computing in Science & Engineering
Sep/Oct 2007
page 8

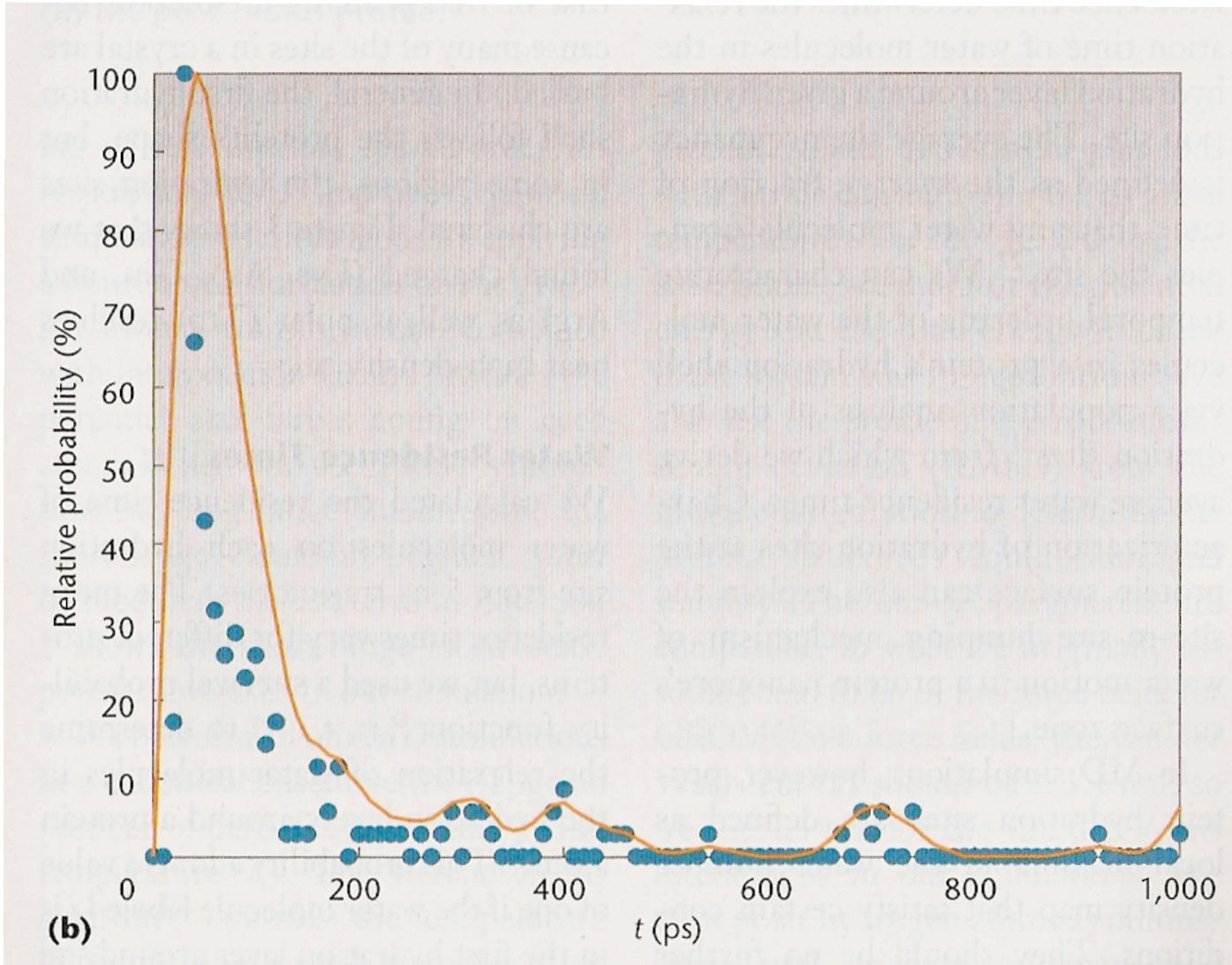
Quiz on Principles

- What is wrong with this plot?



Quiz on Principles

- What is wrong with this plot?



Computing in Science &
Engineering
Sep/Oct 2007
page 94