

# 36-315: Statistical Graphics and Visualization

## Handout 12

Date: February 26, 2003

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Trend plots - Visualizing rates of change

Growth chart - Curves represent percent change from a given time.

Rate of change - Curves represent percent change from the previous time. Used for comparing trends (“which one is growing faster?”).

Instantaneous rate of change - The percent change that the series is going through at each instant.

Instantaneous slope:

$$\text{gradient}(x)_t = (x_{t+1} - x_{t-1})/2$$

Instantaneous rate = Instantaneous slope of the logarithm:

$$\text{rate}(x) = \text{gradient}(\log(x))$$

Timeline:

- 1685 Robert Plot (England) makes a ”plot” of the weather.
- 1779 J.H. Lambert depicts temperature distribution over time.
- 1786 William Playfair depicts economy with line charts.
- 1800s Scientific instruments record data as line graphs.
- 1857 Florence Nightingale makes circular plots.
- 1998 Spiral plots.

Common mistakes in time series plots:

- Connecting dots instead of a smooth prediction line
- Poor aspect ratio
- Superposition with misleading scales
- Trying to measure differences between curves (curve illusion)
- Trying to compare rate of change using raw data

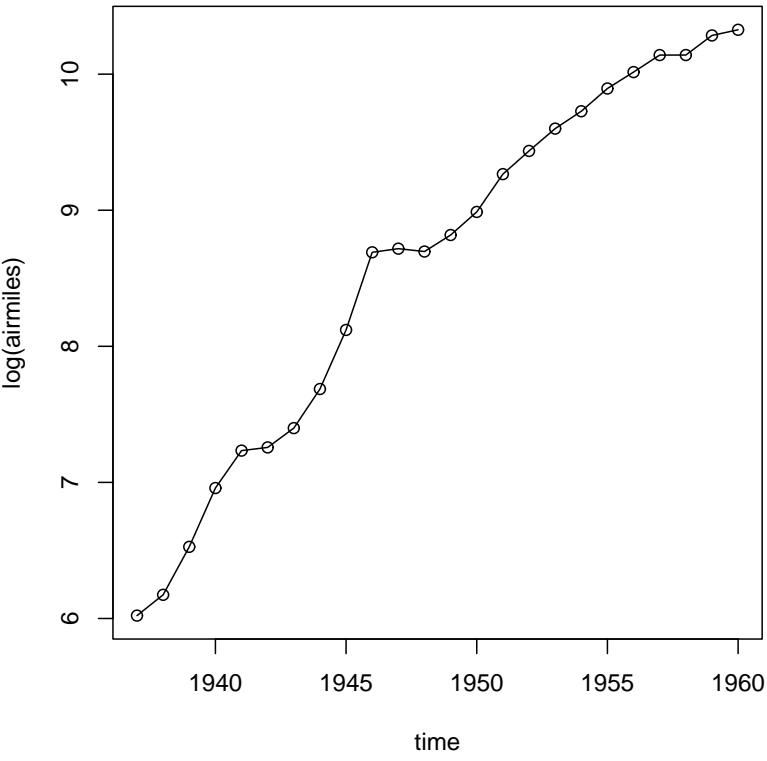
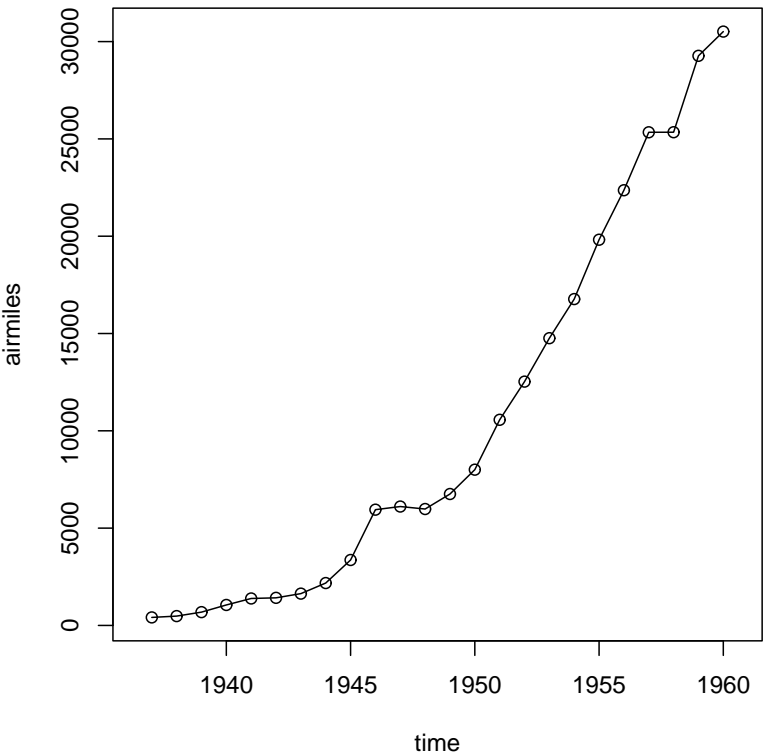
List of figures:

1. Firefighting at Mann Gulch, Montana
2. Passenger miles flown by commercial airlines, 1937–1960
3. Passenger miles rate of change
4. Four ways of comparing the number of doctorates (Cleveland, 1994)
5. Robert Plot’s (1685) “History of the Weather” (Wainer&Velleman, 2001)
6. J. H. Lambert’s (1779) table of temperature (Hankins, 1999)
7. William Playfair’s (1786) Chart of the National Debt of England (Hankins, 1999)
8. Difference of curves illusion (Cleveland, 1994)
9. Reproduction of Playfair’s imports/exports graph (Cleveland, 1994)

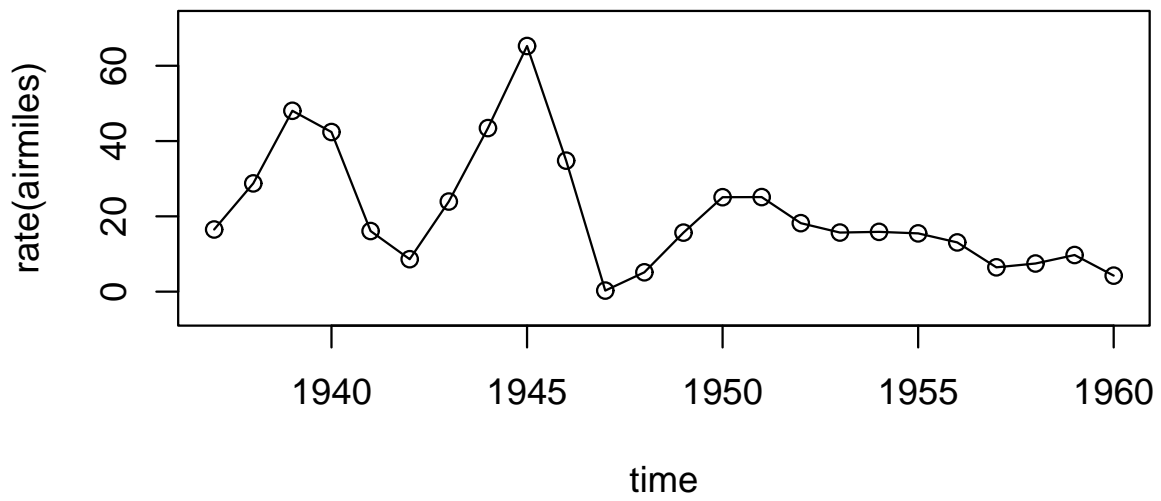
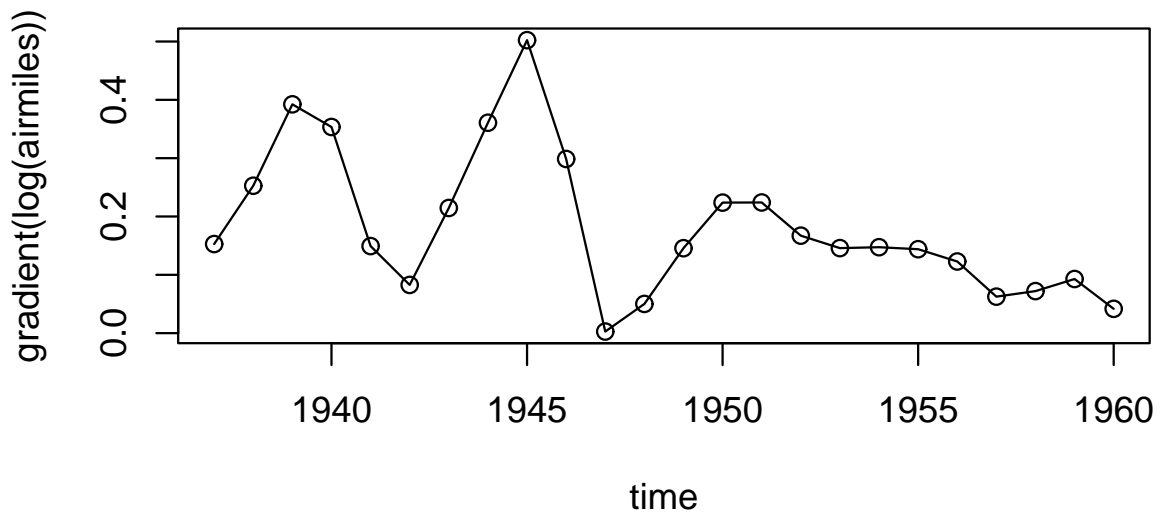
## References

- [1] William S. Cleveland. *The Elements of Graphing Data*. Hobart Press, NJ, 1994.
- [2] Michael Friendly. *Gallery of Data Visualization*.  
<http://www.math.yorku.ca/SCS/Gallery/>
- [3] Michael Friendly and Daniel J. Denis. *Milestones in the History of Thematic Cartography, Statistical Graphics, and Data Visualization*.  
<http://www.math.yorku.ca/SCS/Gallery/milestone/>
- [4] T.L. Hankins. “Blood, dirt, and nomograms: A particular history of graphs”, *Isis* 90:50-80, 1999.
- [5] Howard Wainer. “How to display data badly”, *Chance Workshop Lectures*, 1997.  
<http://www.dartmouth.edu/~chance/ChanceLecture/AudioVideo.html>
- [6] H. Wainer and P. F. Velleman. “Statistical graphics: Mapping the pathways of science” *Annual Review of Psychology*, 52, 305-335, 2001.

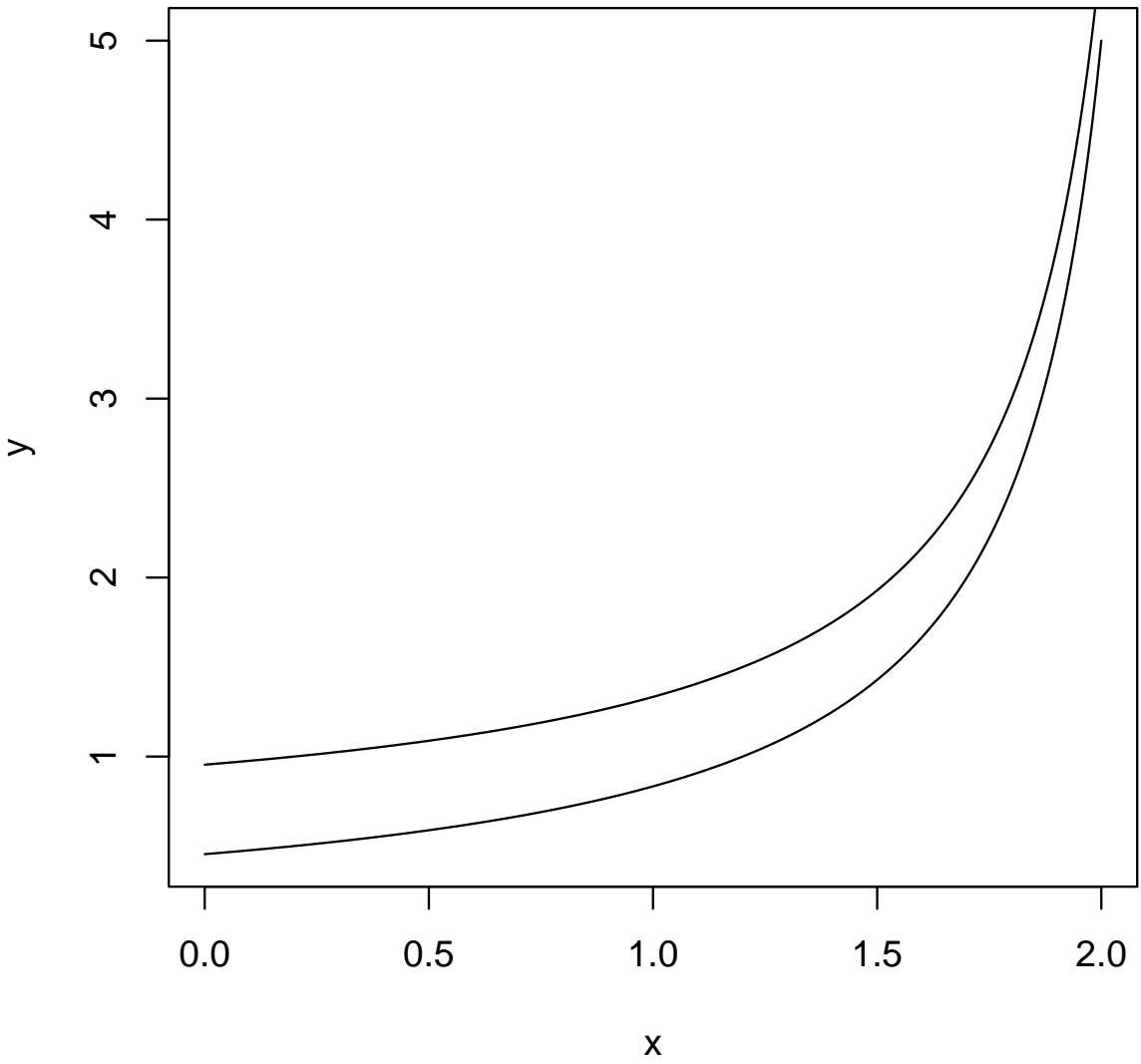
Passenger miles flown by commercial airlines:



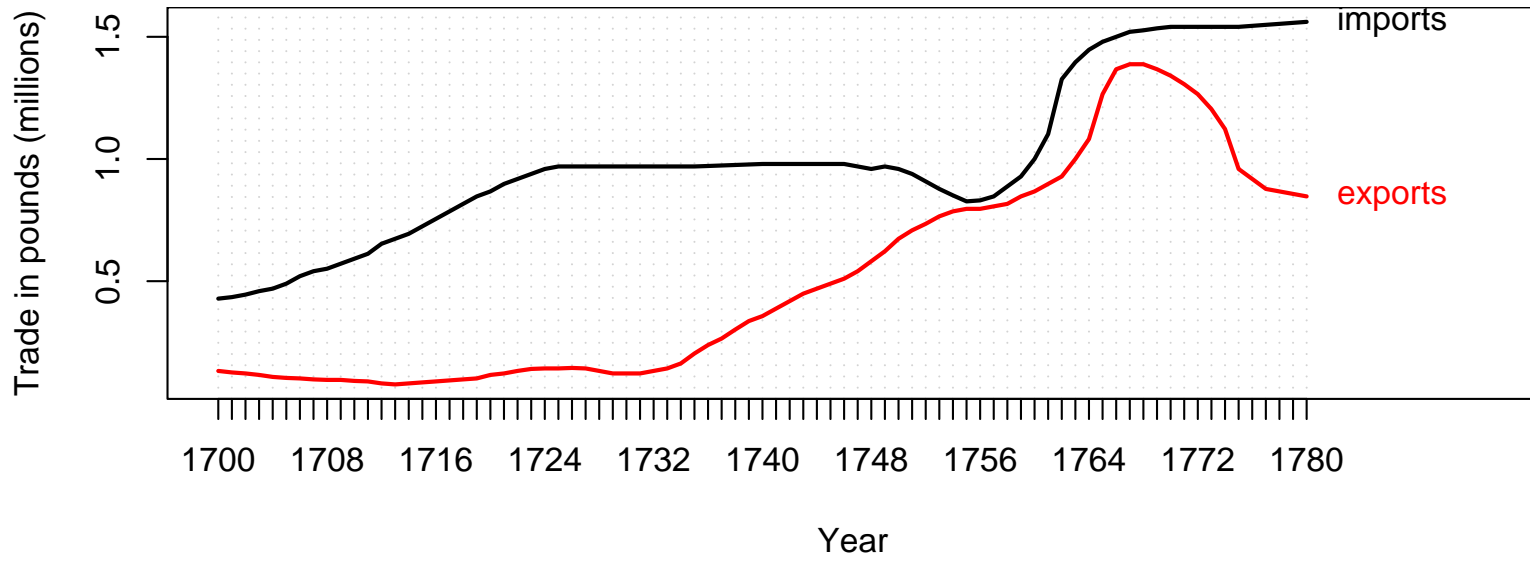
Airmiles rate of change:



Difference of curves illusion:



Example from Playfair's atlas:



9

