



**Lesson3:**  
**Modeling the Web with Advanced Statistical  
Descriptive Text Models**  
**Unit2:**  
**Visually straight lines on different scales**

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Introduction to Web Science Part 2  
Emerging Web Properties



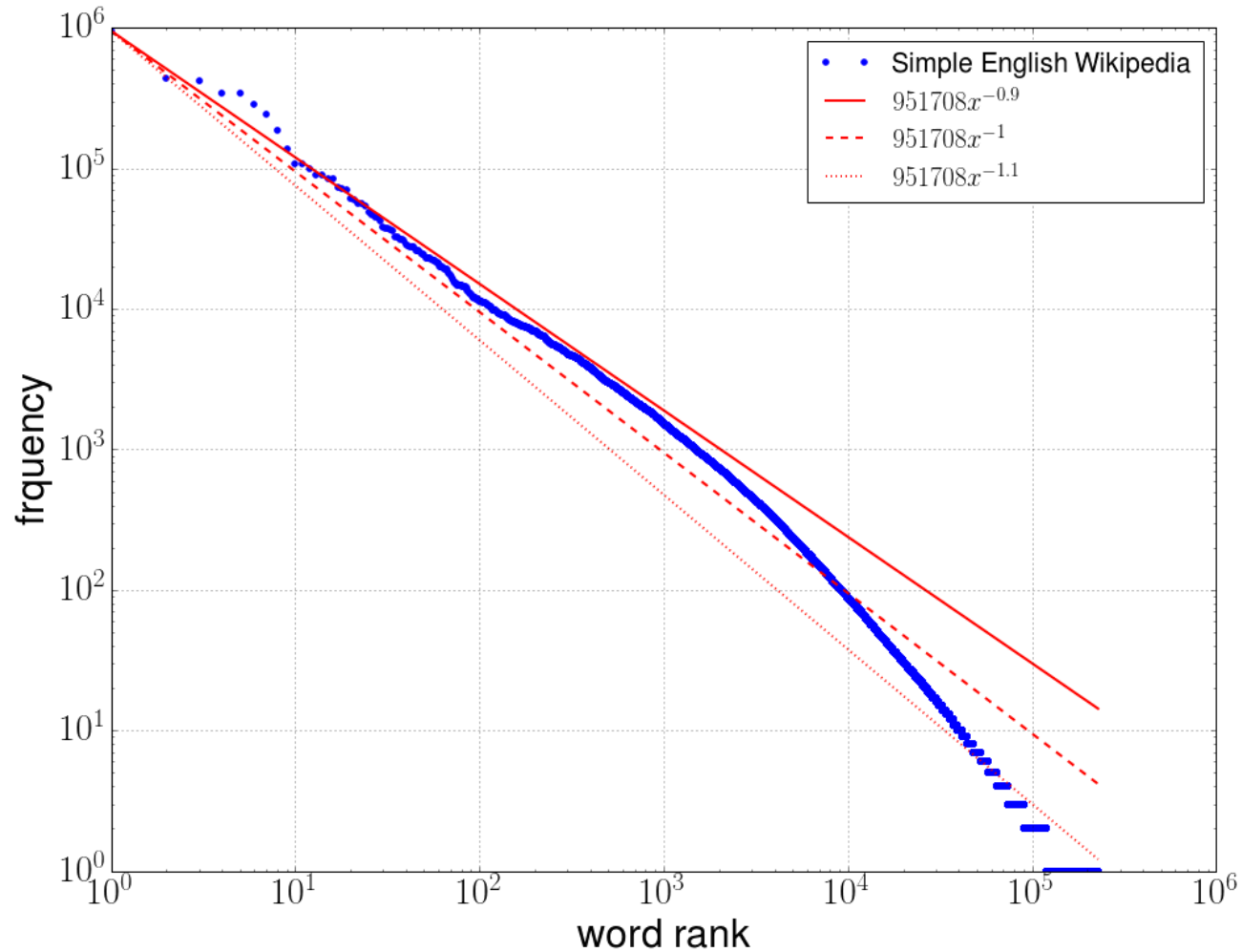


## Completing this unit you should

- Be able to do a coordinate transformation to change the scales of your plots
- Understand in which scenario power functions appear as straight lines
- Know in which scenarios exponential functions appear as straight lines
- Be even more cautious about your visual impressions

# Recall the plot of the reformulated Zipf law

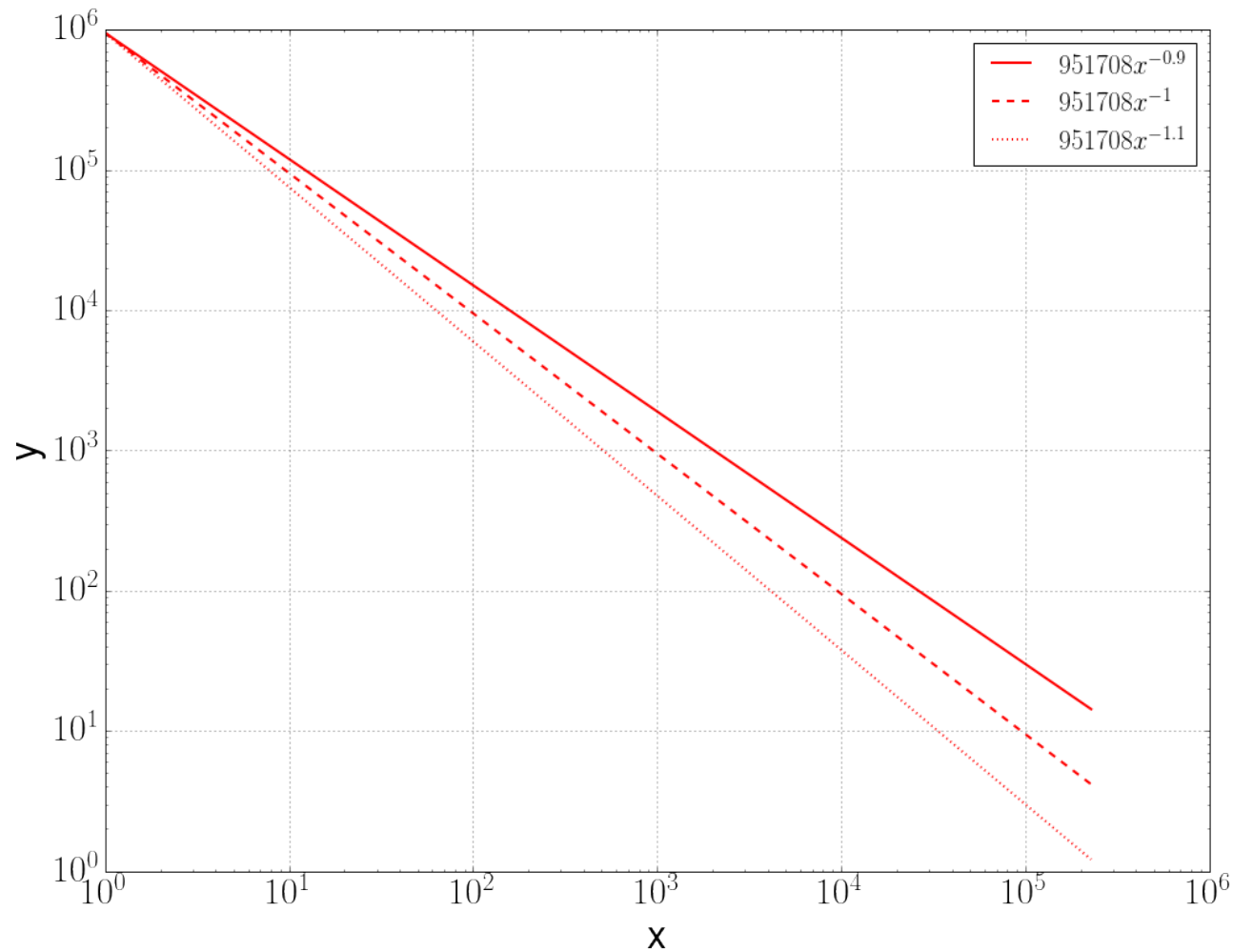
Wordrank frequency diagram on Wikipedia data sets (log-log scale)





# Power functions visually appears as a line!

Inverse power functions as straight lines?





## Lets proof: Power functions as straight lines on log log plots

- When changing to logarithmic scales we basically change coordinates
  - New y-axis:  $y' = \log(y)$
  - New x-axis:  $x' = \log(x)$
- Take a power function  $y = f(x) = cx^a$
- Express this in the new coordinates



## Lets proof: Power functions as straight lines on log log plots

- Express  $y = f(x) = cx^a$  with  $y' = \log(y)$

$$y' = \log(cx^a)$$

$$\Leftrightarrow y' = \log(c) + \log(x^a)$$

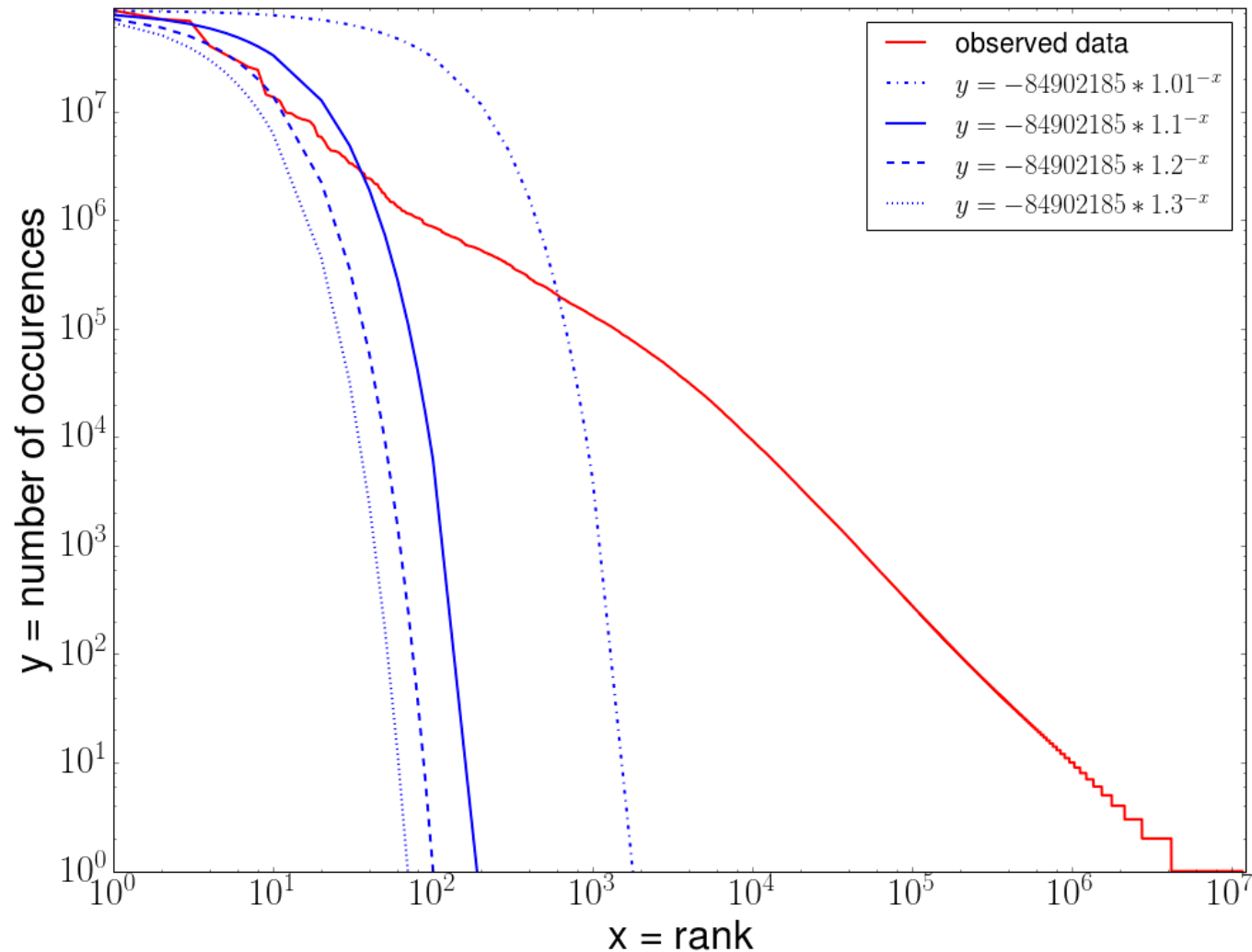
$$\Leftrightarrow y' = \log(c) + a * \log(x)$$

with  $x' = \log(x)$  we get  $y' = \log(c) + ax'$

which is the equation of a straight line with slope  $a$  and offset  $\log(c)$  in our new coordinates.

# Exponential functions are also curved

Word frequencies depending on word rank on English wikipedia





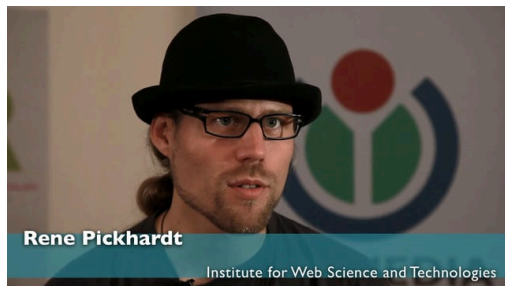
## Conclusion

- Don't get fooled by visual impressions!
  - Our brain thinks in linear scales
  - Sometimes we see more on a log or on a log log scale
- Power functions appear as straight lines on log log plots
- Exponentials appear as straight lines on log plots
  - Can you do the proof?
- Linear functions appear as straight lines on standard linear scales





# Thank you for your attention!



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