

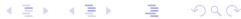
Teaching Statistics: A Bag of Tricks

Andrew Gelman

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Columbia University

3 June 2005

Examples, demos, drills, projects
Getting it to happen
Challenges and struggles



Themes

- ▶ Active learning of statistics
- ▶ Tricks for getting students involved:
examples, demos, drills, projects
- ▶ Actually doing it
- ▶ Challenges and struggles

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- ▶ Work through some examples and demos
- ▶ Discuss practical issues
- ▶ Open questions
- ▶ Collaborators:

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Active learning

- ▶ Working in groups
- ▶ Skills vs. concepts
- ▶ Motivating students to work hard and think hard
- ▶ Lots of educational research (see refs in our book)

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Some examples

- ▶ Interspersed throughout the course
- ▶ Earnings and height
- ▶ Vietnam war
- ▶ Grading on a curve

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Examples

```
. regress earn height
```

Source	SS	df	MS	Number of obs = 1379		
Model	4.8773e+10	1	4.8773e+10	F(1, 1377)	=	137.21
Residual	4.8948e+11	1377	355470204	Prob > F	=	0.0000
-----+-----				R-squared	=	0.0906
Total	5.3826e+11	1378	390606004	Adj R-squared	=	0.0900
-----+-----				Root MSE	=	18854

earn	Coef.	Std. Err.	t	P> t	[95 Conf. Interval]	
height	1563.138	133.4476	11.713	0.000	1301.355	1824.92
_cons	-84078.32	8901.098	-9.446	0.000	-101539.5	-66617.15


```
. graph earn yhat height, connect(.s) symbol(Oi) xlabel ylabel
```

- ▶ Graph the regression line and the data (consistent with the Stata output)

Earnings and height example

- ▶ Graphs on graph paper and on the blackboard
- ▶ How did it feel to make the graphs?
- ▶ How did it feel to work in pairs?
- ▶ What skills are the students learning?

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In January 1971 the Gallup poll asked: "A proposal has been made in Congress to require the U.S. government to bring home all U.S. troops before the end of this year. Would you like to have your congressman vote for or against this proposal?"

Guess the results, for respondents in each education category, and fill out this table (the two numbers in each column should add up to 100%):

	Adults with:			
	Grade school education	High school education	College education	Total adults
% for withdrawal of U.S. troops (doves)				73%
% against withdrawal of U.S. troops (hawks)				27%
Total	100%	100%	100%	100%

▶ "Back in Vietnam days, the anti-war movement spread from the intelligentsia into the rest of the population, eventually paralyzing the country's will to fight." -*The Economist* (2000)

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- ▶ How to assign grades?
- ▶ What are some possible systems? What is best?
- ▶ What are your goals?
- ▶ How could you design a study and gather evidence to decide what grading system to use?

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Examples: principles

- ▶ Relevance
 - ▶ Surveys and experiments on topics of interest (e.g., beauty and student evaluations)
 - ▶ For probability examples: boy and girl births, not tricky dice games, poker hands, etc.
- ▶ Active participation of students
- ▶ Working in pairs

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Demonstrations

- ▶ Candy
- ▶ Basketball
- ▶ United Nations

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Demonstrations: principles

- ▶ Clear instructions
- ▶ Working in pairs
- ▶ Debriefing afterward: connect to statistical topics

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Drills

- ▶ Easy questions
- ▶ Involve all the students
- ▶ Don't make it a lecture [story from our t.a.]

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Projects

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- ▶ Can they study something relevant to their own interests?
- ▶ Struggles

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Not doing it

- ▶ Teachers love these demos but don't actually use them!
- ▶ Why?

Limited class time

Discomfort of trying something new, losing control

Not doing it

- ▶ Teachers love these demos but don't actually use them!
- ▶ Why?
 - ▶ Limited class time
 - ▶ Awkwardness of trying something new, losing control

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What we do

- ▶ "Covering the material"
 - ▶ Students learn by doing homeworks
 - ▶ Rely on the textbook—the students will rely on it anyway!
 - ▶ Give students tips on how to do well on exams
- ▶ Active learning in class

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 - ▶ 1 demo and 1 drill per lecture

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- ▶ Scatterplot charades
 - ▶ My example
 - ▶ Students' examples?
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Phone book sampling

KASSOMBOLA—KATZ 509

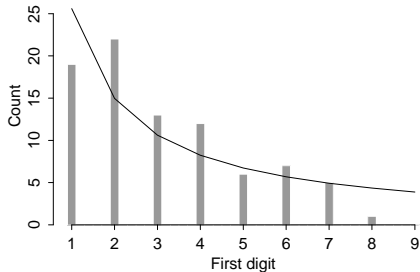
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16	KATOVITZ Michael 299 W 12.....	212 929-9511	KATUN Mosammat 316 W 95.....	212 666-4817
9	KATOWSKY Marc 215 E 95.....	212 706-2855	KATUS B 210 W 89.....	212 362-9715
3	KATRAGADDA Sireesha 31 E 31.....	212 532-6457	KATUSAK F J 176 E 77.....	212 737-8955
	KATRANCI EMI 155 E 99.....	212 722-1951	KATVAN Moshe 40 W 17.....	212 627-2169
	KATRI Edmond 160 E 48.....	212 588-0118	Moshe 40 W 17.....	212 627-4362
	KATRITSIS A.....	212 741-0174	Moshe 40 W 17.....	212 627-5035
	KATROV Marat P 747 10 Av.....	212 757-4845	Moshe & Rivka 117 W 17.....	212 627-5034
	KATS Amir 531 W 48.....	212 333-5811	KATWAROO Dianna 434 W 163.....	212 568-0636
5	Ester 15 Willett.....	212 477-2490	Errol 434 W 163.....	212 568-3629
7	Guyora 230 W 82.....	212 362-5351	KATYAL Monica 617 W 115.....	212 222-3669
8	L.....	212 588-1244	KATYANG Keo 104 W 96.....	212 749-8386
1	Inna 1277 3 Av.....	212 288-7739	KATZ A.....	212 721-3504
	Michael 345 E 93.....	212 987-2902	A.....	212 725-6758
32	Victor 75 West St.....	212 385-1686	A 268 E Bway.....	212 982-8619
54	KATSAMAKIS Basil 315 E 69.....	212 628-9512	A 737 Park Av.....	212 517-8897
47	Basil 530 E 72.....	212 628-0312	A 25 Av.....	212 533-9692
78	KATSANOS Andrew 321 E 71.....	212 717-9393	A 148 10 Av.....	212 366-6487
6	Christina 417 W 47.....	212 459-2304	A 315 E 86.....	212 831-7554
			A D 433 W 21.....	212 255-1769

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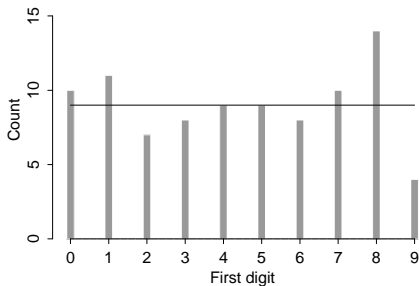
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2	519	2	116	240 W 116 St	663-1076
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4	520	2	081	511 E 20 St	533-0614
5	519	4	115	2 Horatio St	206-7914
6	519	3	124	256 ...	304-2769
7	519	2	110	350 ...	308-4620
8	520	1	107	129 ...	xxx-2xxx
9	520	5	126	315 ...	xxx-2xxx
10	520	2	040	104 ...	xxx-1xxx

Phone book sampling

First digits of addresses



First digits of telephone numbers



Struggles: demos and games

- ▶ Real and fake coin flips

```
00111000110010000100  
00100010001000000001  
00110010101100001111  
11001100010101100100  
10001000000011111001
```

```
01000101001100010100  
11101001100011110100  
01110100011000110111  
10001001011011011100  
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```

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 - ▶ The topic
 - ▶ Data collection
 - ▶ Data analysis
 - ▶ Working together

Putting it all together

- ▶ Integrating drills, hwks, exams, and lecture material
- ▶ Goal: a more teacher-friendly (and student-friendly) package
- ▶ Integrate examples, demos, drills, and supplementary material
- ▶ Just the good stuff—no “filler”

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Concluding thoughts

- ▶ Sharing teaching tips
- ▶ Where to put your teaching effort
- ▶ Connections to empirical research?

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