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Technology in Statistics Education: Where Have We Been? Where Are We? Where Are We Going?

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**GEORGIA
SOUTHERN**
UNIVERSITY

Georgia's large-scale, small-feel research university

Technology in Statistics Education: Where have we been? Where are we? Where are we going?

Patricia Humphrey STEMEd 2016

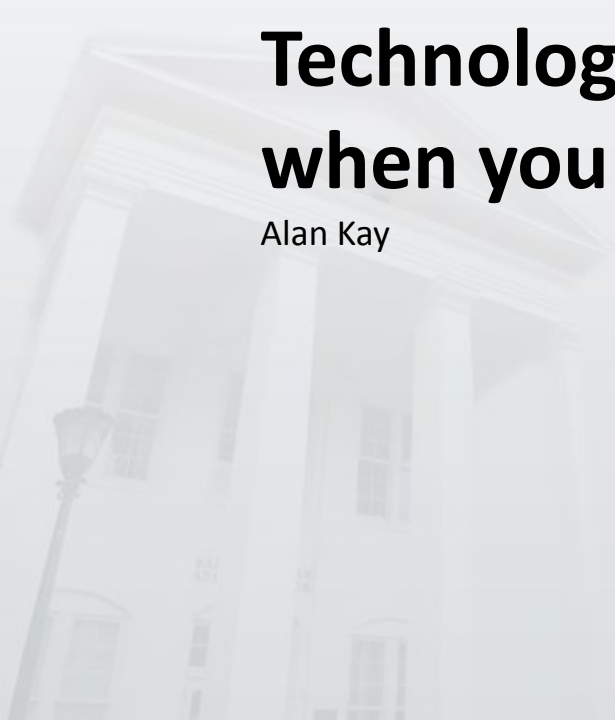
Two quotes to get us started

**If we teach today as we taught yesterday,
we rob our children of tomorrow.**

John Dewey

**Technology is anything that wasn't around
when you were born.**

Alan Kay



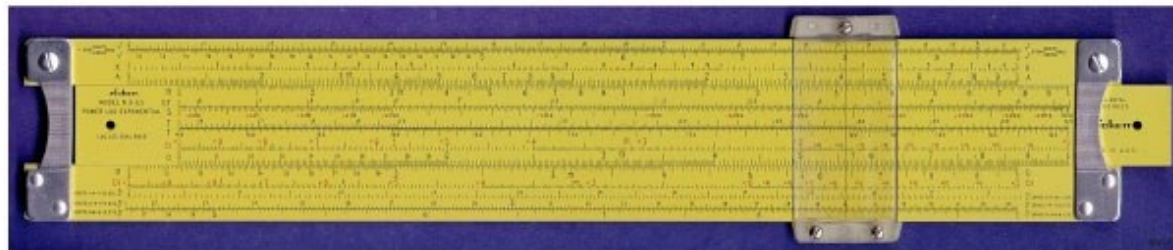
GAISE (2005)

1. Emphasize statistical literacy and develop statistical thinking
2. Use real data
3. Stress conceptual understanding, rather than mere knowledge of procedures
4. Foster active learning in the classroom
5. Use technology for developing conceptual understanding and analyzing data
6. Use assessments to improve and evaluate student learning

GAISE (2016)

1. Teach statistical thinking.
 - a) *Teach statistics as an investigative process of problem-solving and decision making.*
 - b) Give students experience with multivariable thinking.
2. Focus on conceptual understanding.
3. *Integrate real data with a context and purpose.*
4. Foster active learning.
5. *Use technology to explore concepts and analyze data.*
6. Use assessments to improve and evaluate student learning

Pre “Tech”



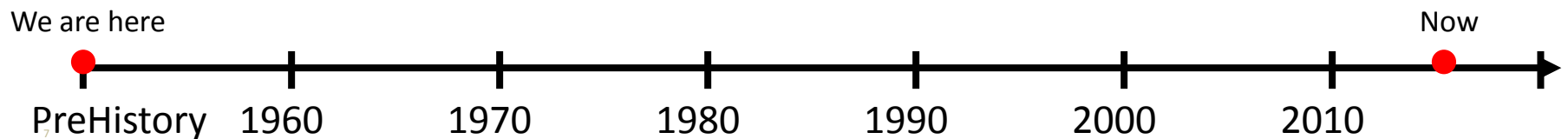
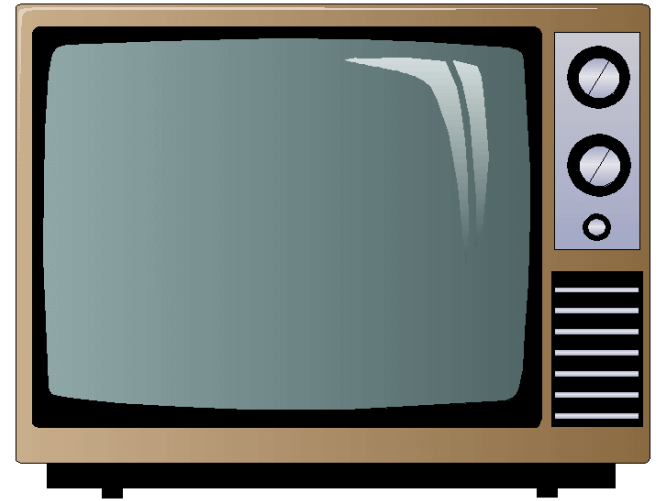
PREHISTORIC PHONES

- Buildings had phones, not people
 - Phones were black, period
 - They looked like this, period
- Pay phones were everywhere
 - And they worked



PREHISTORIC TV

- Each home had exactly 1 B&W TV in the living room
 - All TVs had exactly 3 channels:
 - ABC, CBS, and NBC
- Restaurants did NOT have TVs
 - Ever

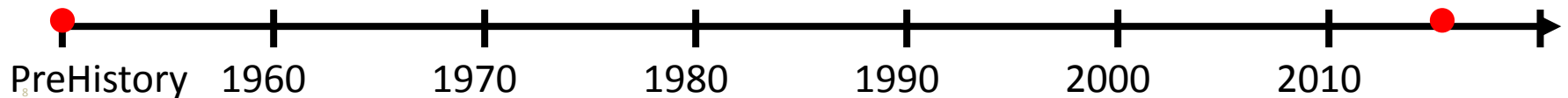


PREHISTORIC COMPUTERS

- Big, like dinosaurs!
- Governments and corporations had them, not people
- Took up an entire floor if not an entire building

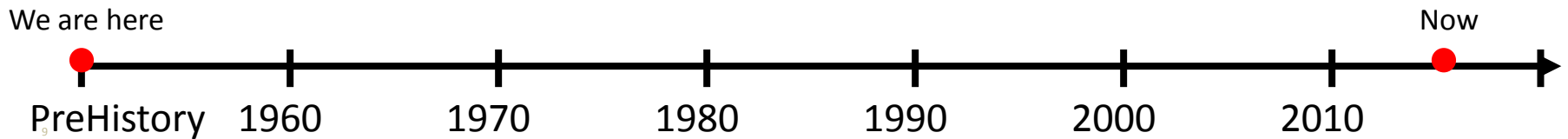


We are here



THE PREHISTORIC MATH (STAT) CLASSROOM

- **Blackboards:** Yes, one, at the front
- **Desks:** Wood and metal, arranged in rows



3. The grades obtained by 20 students in a short quiz were 9, 4, 7, 6, 10, 10, 5, 9, 7, 10, 3, 10, 9, 8, 9, 10, 6, 8, 4, 6. Find the mean of these grades.

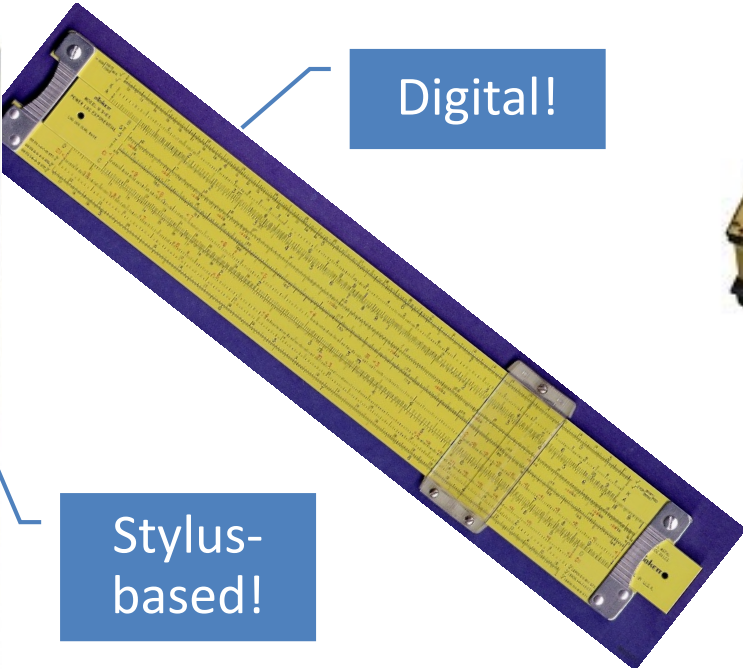
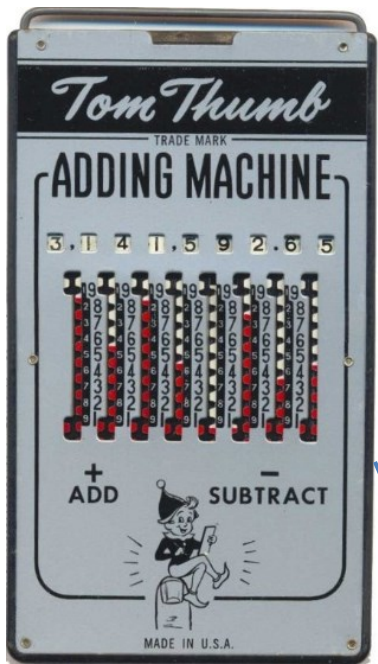
5. The weights of the 39 football players of U.C.L.A.'s 1955–56 squad were:

180	174	208	200	185	217	202	218	185	171
187	219	197	172	204	187	231	226	218	212
217	214	219	216	195	192	191	183	173	195
208	172	171	162	173	210	202	191	173	

Find the mean of these weights.

The 1960's:

In the 1960's, calculators were mechanical

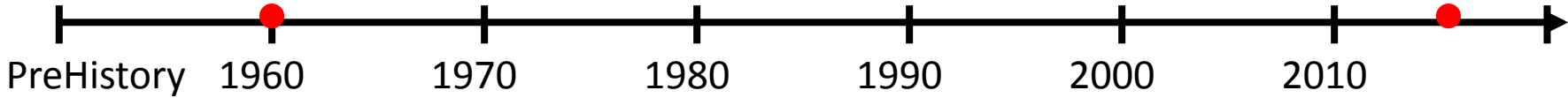


Digital!



We are here

Now

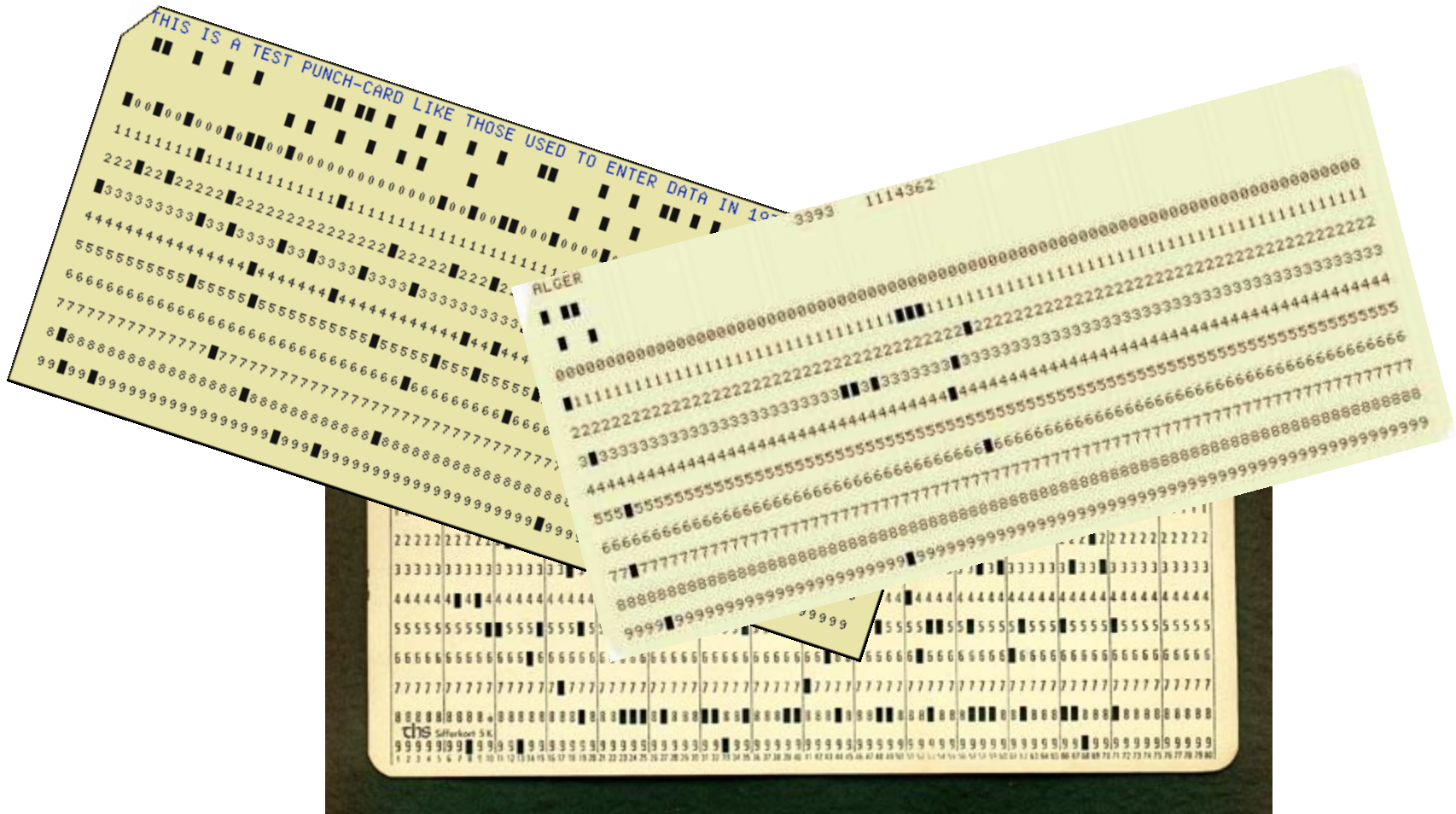


The 1970's:

Calculators and computers




“Serious” Computing



Timesharing!



LIGHTWEIGHT



HEAVYWEIGHT

\$1995/13 LBS.

The new "Silent 700" Model 745 Portable Data Terminal from Texas Instruments is the new lightweight champion. In fact, it weighs only 13 pounds... half the weight of the currently most popular portable... our own Model 735.

Since the Model 745 is really the first portable ever to achieve that "briefcase mobility" everybody's been wanting, it travels easily with you... all day.

The 745 portable puts the speed and efficiency of your computer as close as the nearest telephone and electronic outlet... anywhere.

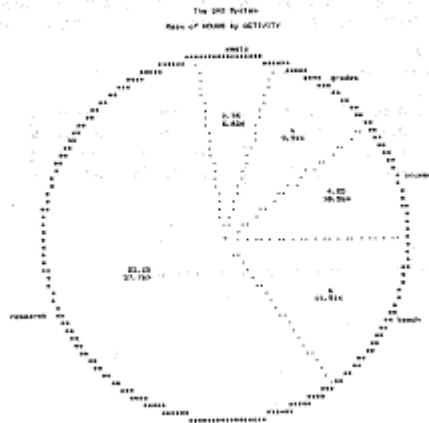
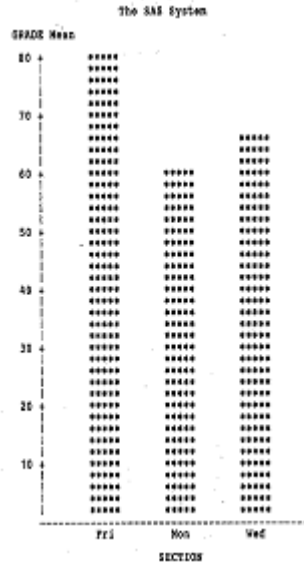
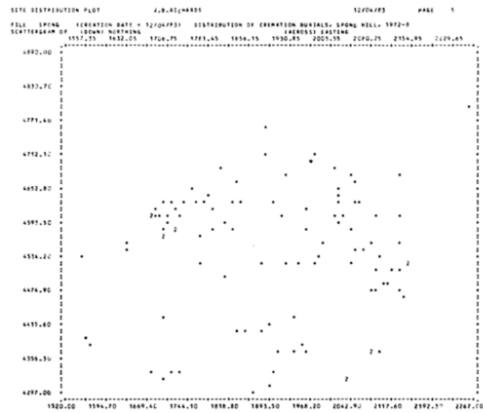
Whether it's sales order entry, inventory control, program planning or data base search and retrieval, you can have almost immediate access to current, essential data. You can have the right information on the spot... when it counts.

In fact, just plug it in, place the receiver in the built-in acoustic coupler, and you're ready to send or receive up-to-the-second information.

The 745 has a new, lightweight companion... the Model 743 KSR terminal. The 743 is a compact keyboard send-receive terminal ideal for stationary computer input/output.



Graphics?



A 1970s text

Display 1.17

Data set for the sixth annual tour of the Rio Grande Valley^a

OBS	DIST ^b	TOWN ^c	SEX	AGE ^d	TIME ^e	SPEED ^f
1	100	1	M	23	4.9	20.2
2	100	0	F	22	8.3	12.0
3	100	1	M	26	8.0	12.4
4	100	0	M	36	5.7	17.6
5	100	1	M	43	6.1	16.5
6	100	1	M	40	.	.
7	100	1	M	22	.	.
8	100	1	M	17	7.9	12.6
9	100	1	M	29	9.0	11.1
10	100	1	F	46	8.1	12.3
11	100	1	M	33	4.8	21.1
12	100	1	M	25	8.0	12.5
13	100	0	M	54	8.8	11.4
14	.	1	F	27	.	.
15	100	1	F	37	12.4	8.1
16	100	1	M	22	9.3	10.8
17	100	0	M	40	6.8	14.7
18	50	1	F	39	5.6	9.0
19	100	1	M	35	9.1	11.0
20	100	1	M	15	9.8	10.2
21	100	1	F	36	10.7	9.3
22	100	1	M	24	.	.
23	100	1	M	17	.	.
24	75	1	M	9	10.4	7.2

Technology

- With handheld calculators “affordable,” many started requiring their use in Stat classes.



The standard function keys that constitute the bare essentials for statistical calculations are $+$, $-$, \times , \div , x^2 , $\sqrt{\square}$ (square root), $1/x$ (or x^{-1} , the reciprocal), and $+/-$ (change sign). Other features used in the text are parentheses (), the exponent function EXP, a memory with keys $x \rightarrow M$ (transfer display to memory), RM (recall memory), $M+$ (add display to memory). A statistical mode makes possible the convenient computation of the statistical functions \bar{x} (sample mean) and s (sample standard deviation). The El 506 also has the useful feature of displaying n (sample size), Σx (sum of entries), and Σx^2 (sum of squares of entries) in the statistical mode.

“Interesting” Statistics

Midrange

$$MR = \frac{Max + Min}{2}$$

Pseudo-standard deviation

$$PSD = \frac{IQR}{1.35}$$

“Quick” standard deviation

$$\hat{s} = \frac{Max - Min}{4}$$

1980's:

Not much changed (tech-wise).

Tech was (possibly) in the hands of the instructor, but PCs were too expensive for students.

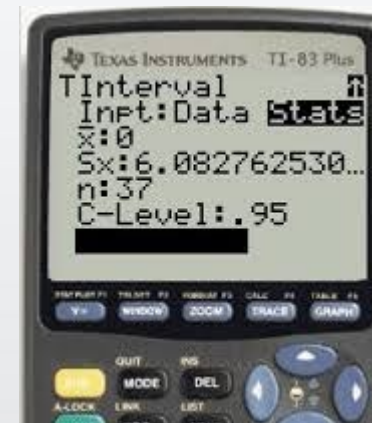
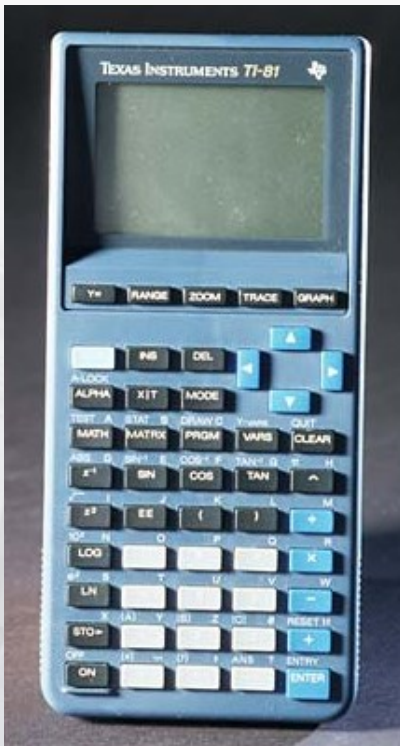
Colleges started “computer labs”
With dumb mono terminals.



1990's: Going Mobile



1990's: Graphing calculators!



1990's:

Internet really starts. Pretty much text-only.

Texts started emphasizing “concepts” – Moore & McCabe, *Introduction to the Practice of Statistics* (1990)

“Against All Odds – Inside Statistics” (1989-90)

More students started studying statistics – AP Statistics first exam in 1998

1990's: New software!

- S, S+
- Minitab release 8 (1991) had first graphical interface
- R (1993)
- Incremental Changes in texts

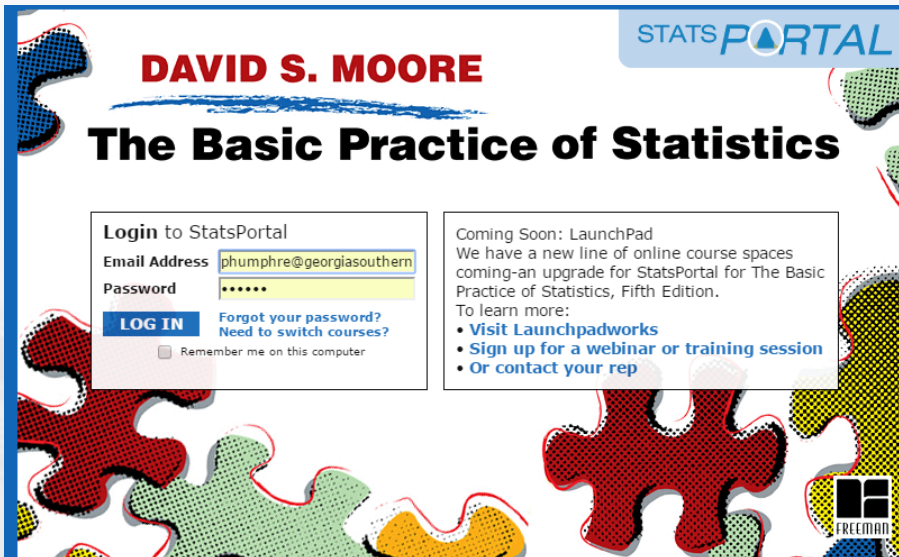
2000's: Technology explodes!



Internet!

Social media!

2000's: Technology explodes!



DAVID S. MOORE

The Basic Practice of Statistics

STATSPORTAL

Login to StatsPortal

Email Address


Password

LOG IN [Forgot your password?](#)
[Need to switch courses?](#)

Remember me on this computer

Coming Soon: LaunchPad
We have a new line of online course spaces coming-an upgrade for StatsPortal for The Basic Practice of Statistics, Fifth Edition.
To learn more:

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PEARSON

MyStatLab™

WileyPLUS

2010's: The Internet of Things



2010's:

- “Big” Data
- Randomization and Bootstrapping
- MQC (2013)
- Stat texts haven't kept up

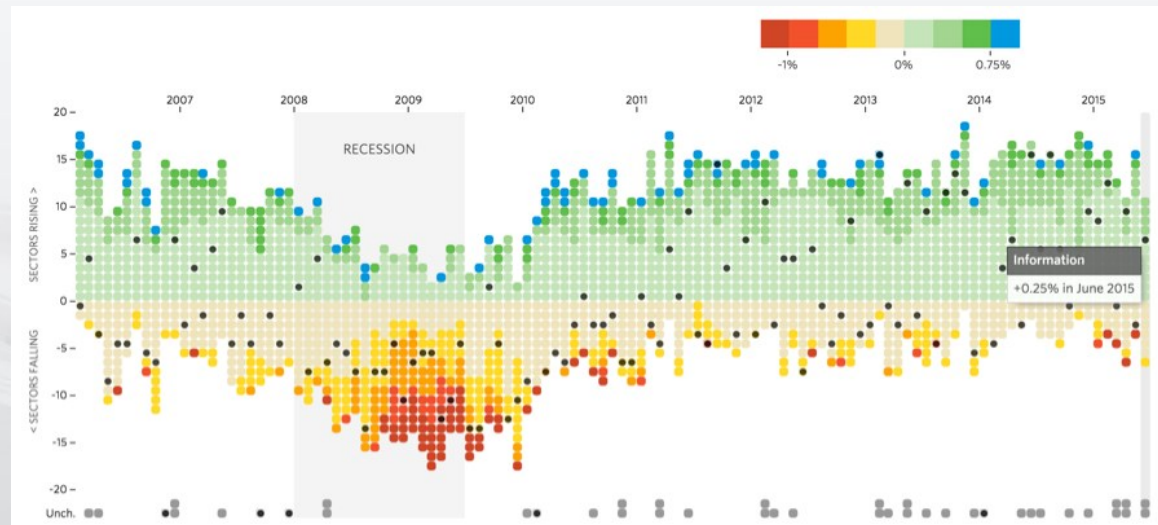


2010's: Web scraping

231	 Anguilla (UK)	13,452	May 11, 2011	0.00019%	Preliminary 2011 census result ↗
232	 Wallis and Futuna (France)	13,135	July 1, 2013	0.00018%	Annual official estimate ↗
233	 Tuvalu	11,323	July 1, 2013	0.00016%	Annual official estimate ↗
234	 Nauru	10,084	October 30, 2011	0.00014%	2011 census result ↗
235	 Saint Barthélemy (France)	8,938	January 1, 2010	0.00012%	Official estimate ↗
236	 Saint Pierre and Miquelon (France)	6,081	January 1, 2010	0.000084%	Official estimate ↗
237	 Montserrat (UK)	4,922	May 12, 2011	0.000068%	2011 census result ↗
238	 Saint Helena, Ascension and Tristan da Cunha (UK)	4,000	July 1, 2014	0.000056%	UN projection
239	 Falkland Islands (UK)	3,000	July 1, 2014	0.000042%	UN projection
240	 Svalbard and Jan Mayen (Norway)	2,655	September 1, 2012	0.000037%	Official estimate ↗
241	 Norfolk Island (Australia)	2,302	August 9, 2011	0.000032%	2011 census result ↗
242	 Christmas Island (Australia)	2,072	August 9, 2011	0.000029%	2011 census result ↗
243	 Niue (NZ)	1,613	September 10, 2011	0.000022%	Final 2011 census result ↗
244	 Tokelau (NZ)	1,411	October 18, 2011	0.000020%	Final 2011 census result ↗
245	 Vatican City	839	July 1, 2012	0.000012%	Official estimate ↗
246	 Cocos (Keeling) Islands (Australia)	550	August 9, 2011	0.0000076%	2011 census result ↗
247	 Pitcairn Islands (UK)	56	2013	0.00000078%	Official estimate

- R or Python – turn any web page with “data” into a data set for further analysis.
- Sample from large data sets.

2010's: Data visualizations



2010's: Data visualizations

Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four

BBC FOUR



lifespan

75 years

50 years

25 years

1810

income

And in 1810, it was pretty crowded down there, wasn't it?

1:14 / 4:47

YouTube

Future:

- New texts will eliminate t and z tests
- New inference methods will dominate
- Distinction between statistics literacy and “doing” statistics

