

The Basic Mathematics of Measurement



Discussion Questions:

- **What do you find most imposing about assessment?**
- **What did you think of the book chapters?**
- **What would the educational world be like without measurement?**
- **Let's assume we train a high school student to get a perfect score on the Stanford 10 achievement test. What assumptions can we make about that student's knowledge/abilities?**

Today's Topics

**Introducing Measurement &
Measurement terms**

**Understanding the basic Math of
Measurement**

- **Descriptive statistics**
- **Correlations**

Why Evaluation & Assessment is Important

- Feedback to students
- Feedback to teachers
- Information to parents
- Information for selection and certification
- Information for accountability
- Incentives to increase student effort

Bottom Line: It provides sources of information to aid in the educational process

On the purpose of testing:

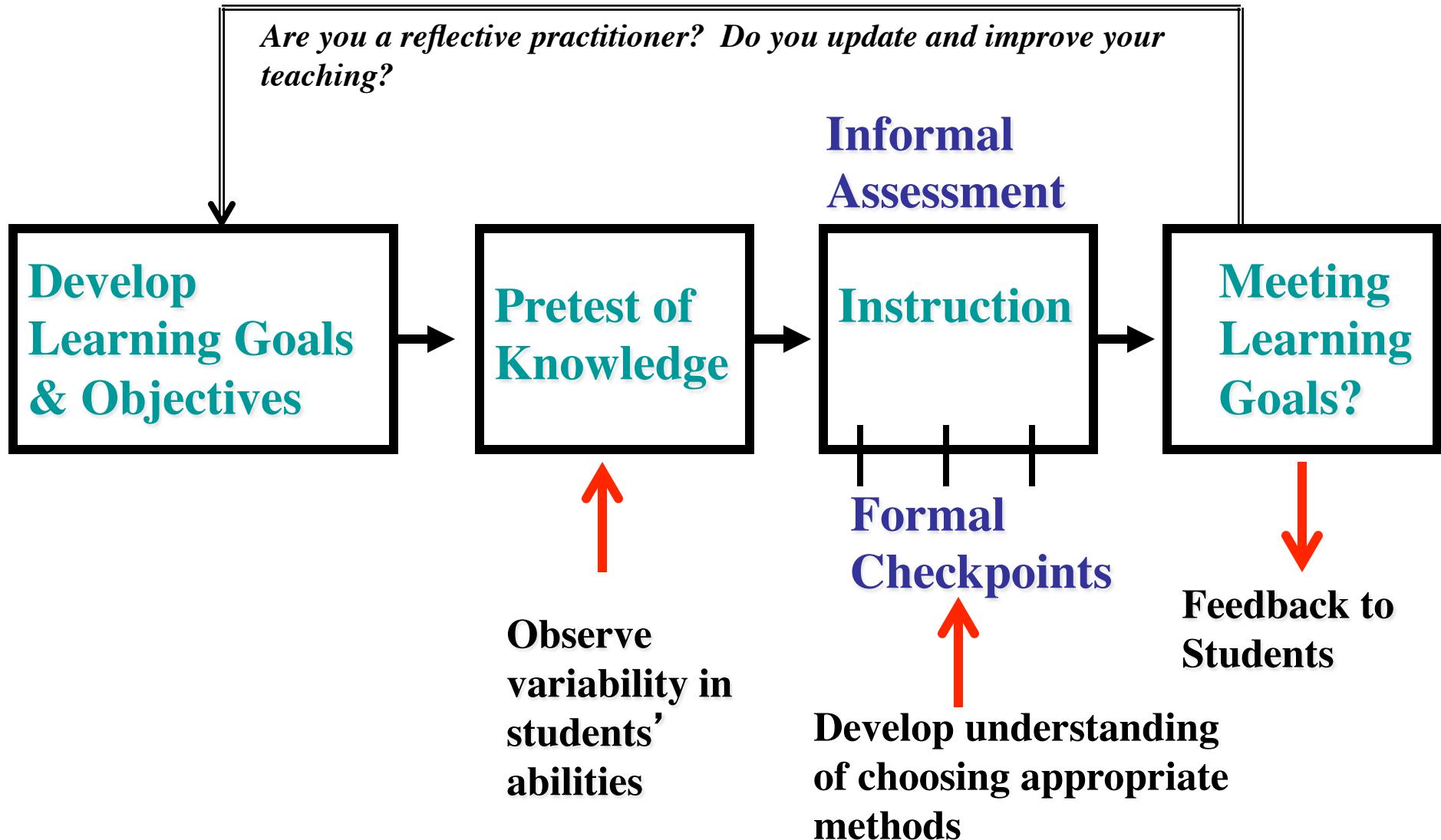
- The purpose of testing is to **SAMPLE** a test-taker's knowledge about a given topic. It is typically not intended to measure **ALL** of the test-taker's knowledge.
- The results of the test are intended to assist us in making inferences **BEYOND** that of the specific test.

Assessment

- Comes in many forms including informal questioning in the classroom.
- It is important to choose the most appropriate method of assessment to measure the topic at hand
- Ultimately, the purpose of assessment is to assist students in attaining learning goals.

The Assessment Process:

Feedback to re-align objectives, instruction, & assessment



Important terms . . .

- **Formative vs. Summative evaluation**
 - Formative -- “How are you doing?”
 - Summative -- “How did you do?”
- **Norm-referenced assessment vs. Criterion-referenced/Mastery assessment**
 - Norms -- comparison to peer group
 - Criterion -- meeting instructional objectives

Traditional vs. Authentic Assessment

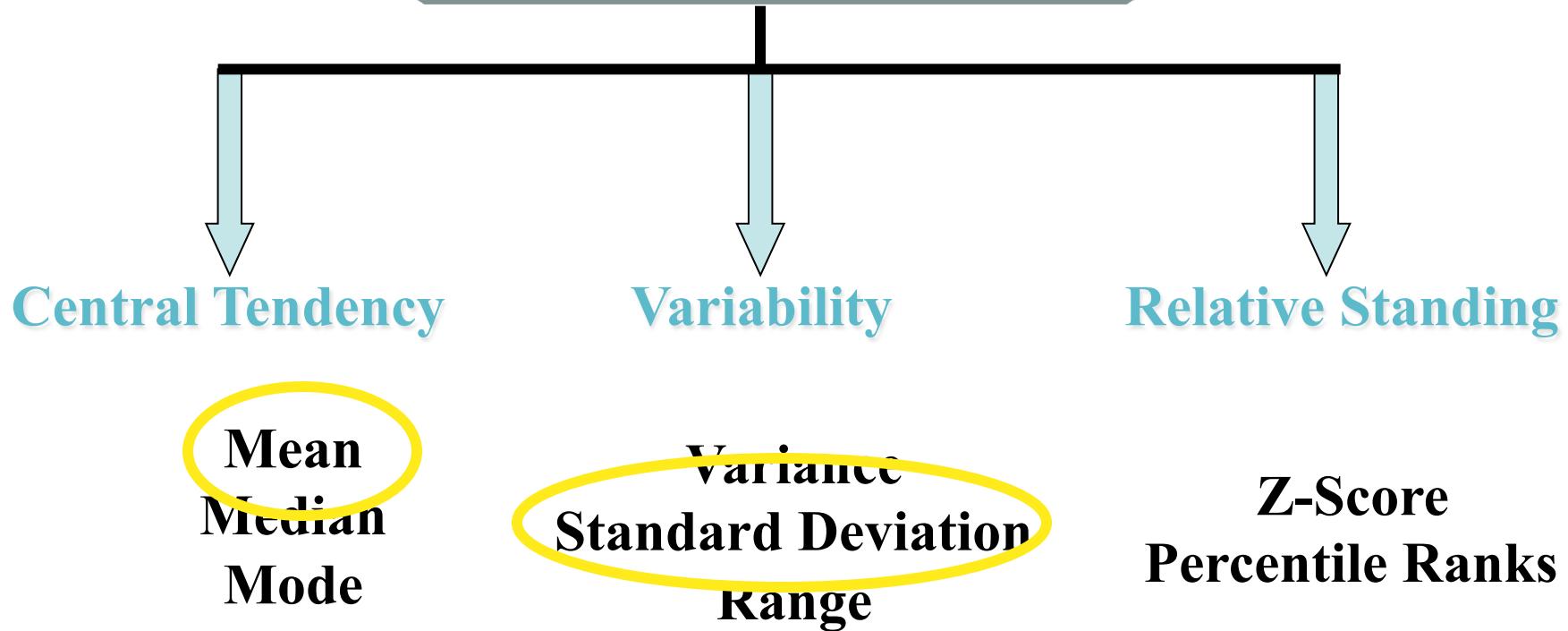
Traditional -- *measuring basic knowledge & skills*

- Spelling test
- Math word problems
- Physical fitness tests

Authentic -- *measuring skills in a “real-life” context*

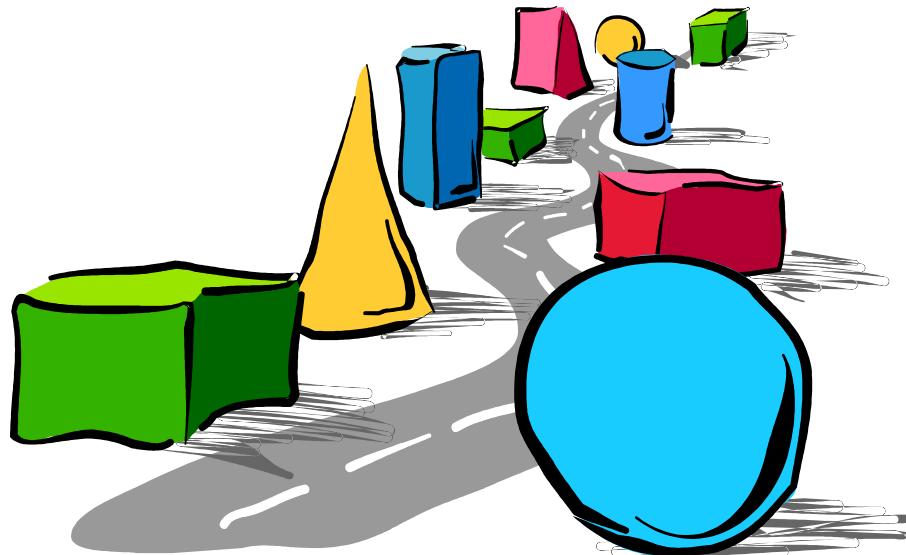
- Develop a school newspaper
- Build a model city
- Present a persuasive argument
- Portfolios

Descriptive Statistics



Standard Deviation:

- Accurate measure of dispersion-- how spread out the scores are
- Average distance of each score in a distribution is from the mean



Measure of Association

- Describes the degree of relationship that exists between two variables
- Bivariate relationships



Correlations

- A **relationship** between two variables
- **NO CAUSATION!**
- **Size:** Correlations range from -1 to +1
- **Sign:**
- Zero means no relationship
- Positive correlation--As one variable goes up (or down) the other variable goes up (or down)
- Negative correlation--As one variable goes up the other goes down

Name that Correlation!

(positive, negative, or no correlation)

Name that Correlation!

- Number of new houses built in Montana and hurricanes in Florida
- Consumption of alcoholic beverages after midnight on Sunday and performance on Monday morning exams
- Level of math self-concept and errors on an oral math exam in front of your entire hometown

Name that Correlation!

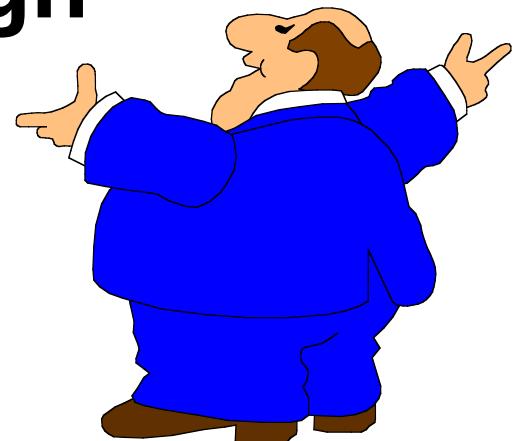
- Number of hot-wings consumed and indigestion
- Outstanding Olympic performances by the Croatian handball team and number of gold medals by Nigeria
- Hitting percentage by the NC St. volleyball team and victories
- Consumption of gelato during the summer and number of drownings

Name that Correlation!

- Hair color of dogs and their ability to jump through a hoop
- Amount of homework given by John and the chance that his students will complain
- IQ and number of driving accidents by Australian citizens

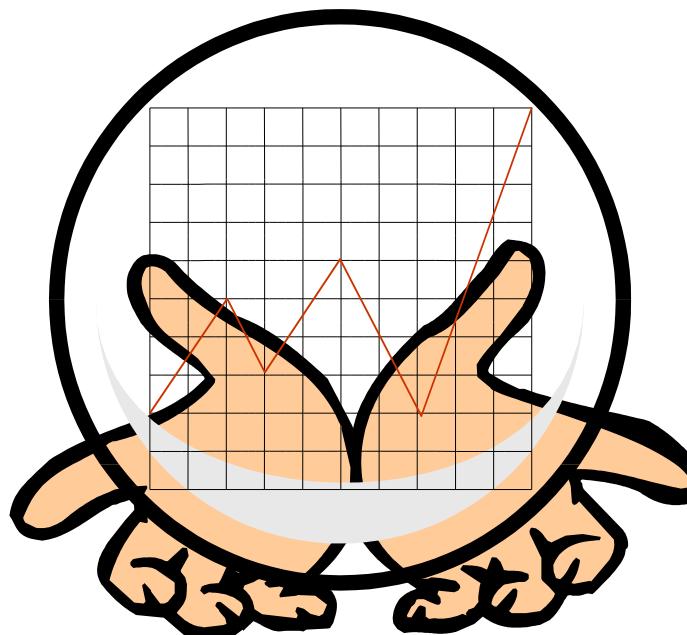
Uses of coefficient:

1. Prediction - if related systematically use one variable to predict the other
2. Validity - measures of the same construct should have high degree of relationship



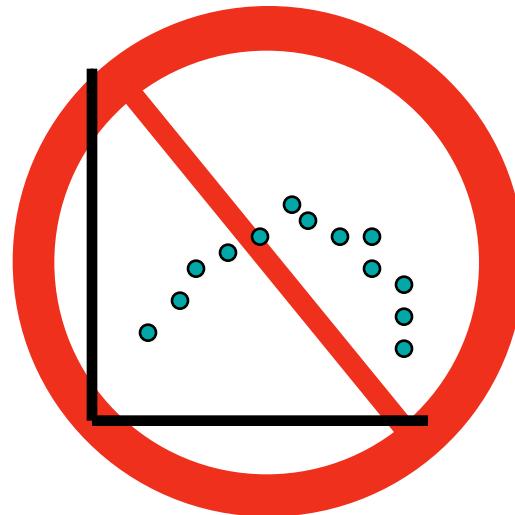
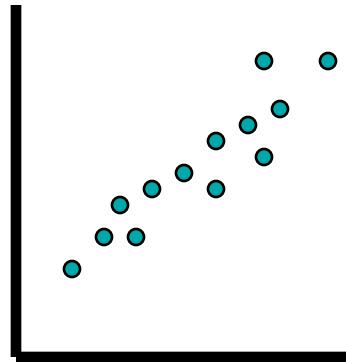
3. Theory verification - test specific predictions

4. Reliability - relationship across time or separate parts of test



Pearson's Product Moment Correlation Coefficient (1896)

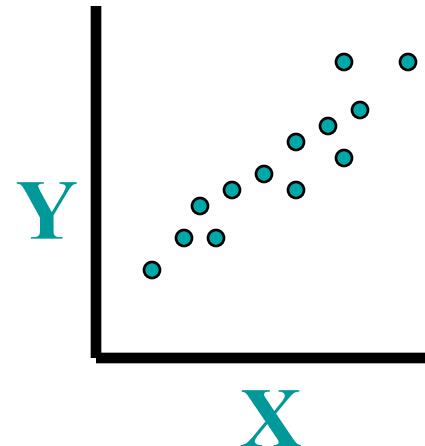
r_{xy} = correlation between x and y



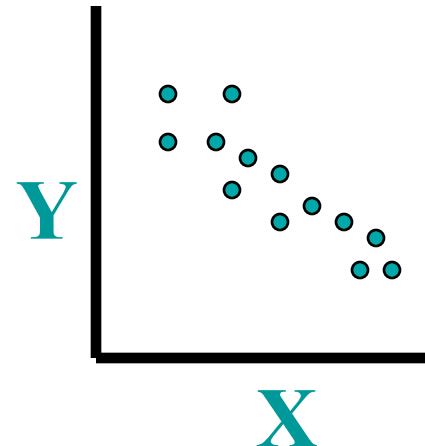
Represent relationship graphically

Direction of Relationship

- Positive

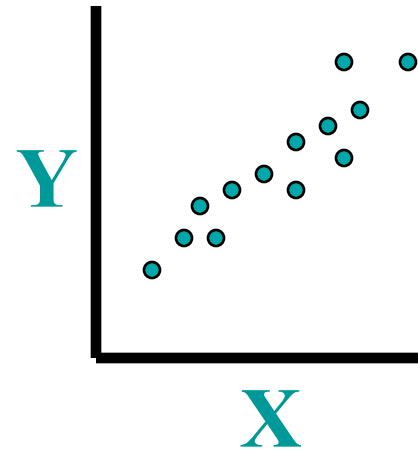


- Negative

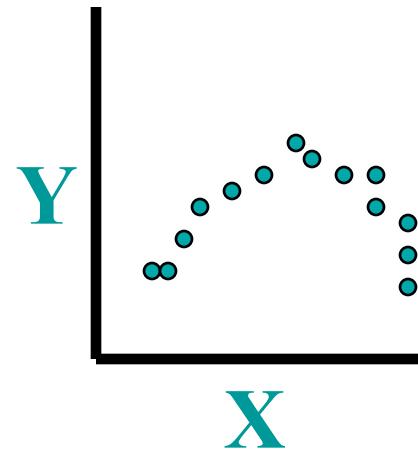


Form of Relationship

- Linear

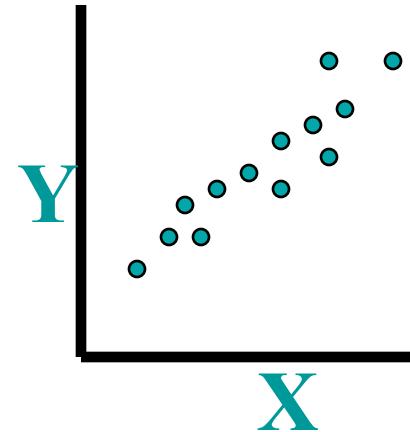


- Curvilinear

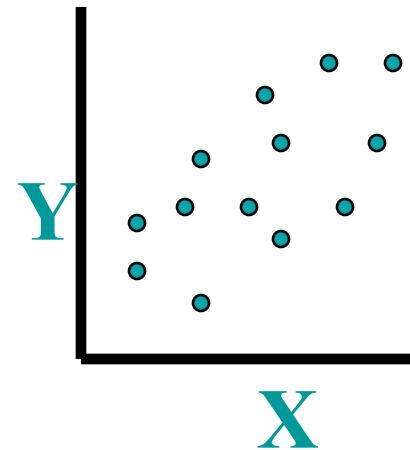


Degree of Relationship

- Strong



- Weak



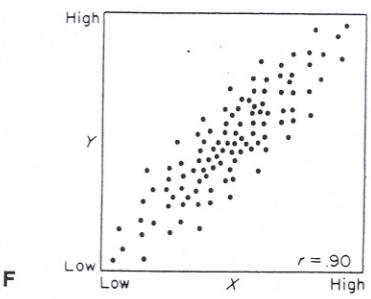
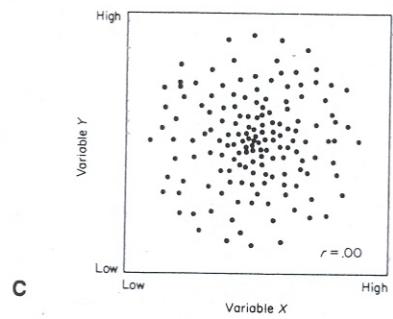
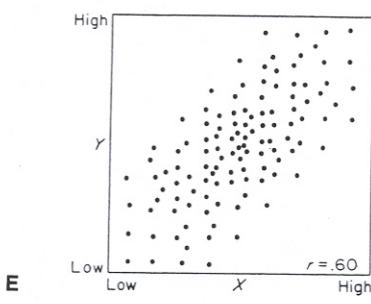
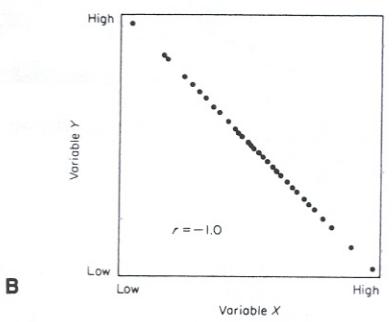
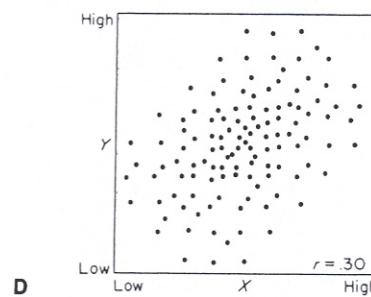
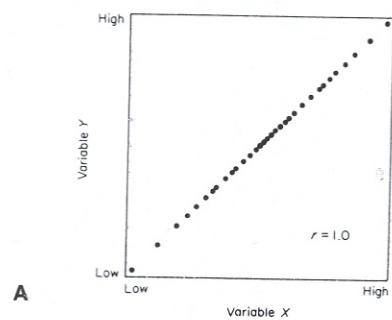
Strength of a Correlation

General Rule of Thumb (but definitely situationally dependent!)

Strong coefficients = .70 — .90

Moderate coefficients = .40 — .50

Weak coefficients = .15 — .25



LINCOLN Journal Star

50¢

LINCOLN, NEB.

MONDAY

MARCH 11, 1996



Coffee may help lower risk of suicide, study suggests

BY HILLARY CHURA
Associated Press

CHICAGO — Women who drink coffee are less likely to commit suicide than those who do not, suggests a study being published today.

The author cautions, however, that the results may not be significant because doctors might have told depressed patients not to drink coffee, a factor that wasn't studied.

The study of 86,626 female nurses from 1980 to 1990 found 11 suicides among those who drank two to three cups of caffeinated

coffee per day, compared with 21 cases among colleagues who said they almost never drank coffee.

"Coffee drinkers seem to do everything that seems to put them at risk for depression and suicide, but they are highly protected," said the study author, Dr. Ichiro Kawachi of Harvard Medical School and Brigham and Women's Hospital in Boston.

He noted that many coffee drinkers lead stressful lives and smoke and drink alcohol heavily.

Kawachi's study did not examine whether respondents were told not to drink coffee, nor did it question the effect of caffeine on

people who attempt suicide. Kawachi said the issues merit further study.

A 1990 study found that as little as 100 milligrams of caffeine per day could produce increased feelings of well-being, energy and motivation to work. A 5-ounce cup of coffee contains 40 to 180 milligrams of caffeine, according to the Food and Drug Administration.

Kawachi's study was criticized by Dr. John Greden, an expert in depression at the University of Michigan.

He said researchers should have examined the effect of antidepressants and blood pressure medication, which tends to be

a depressant. He said they also should have looked at how many suicide victims tried to stop smoking, which can trigger depression.

"The findings could have nothing to do with caffeine," Greden said.

Kawachi's study appears in today's issue of the American Medical Association's Archives of Internal Medicine. It is consistent with a 1993 Kaiser Permanente Medical Care Program study of 128,934 men and women, which also found a lower risk of suicide among people who drink more caffeine.

Kawachi's study was funded by the National Institutes of Health.



Weird News

By Chuck Shepherd

UNIVERSAL PRESS SYNDICATE

McDonald's opened restaurants in its 100th country, Belarus, amid about 4,000 eager customers and 500 protestors, and a few days later, in its 101st, Tahiti. According to "New York Times" columnist Thomas Friedman, no two countries with McDonald's restaurants have ever gone to war against each other — because, as Friedman theorizes, countries prosperous enough to support a McDonald's are surely stable enough to resist most provocations.

University of Florida Study Finds Tall People Earn More

The Palm Beach Post, Fla. - October 21, 2003

Oct. 21--It doesn't matter if you're a man or woman, old or young. If you're tall, you'll make more money than your shorter co-workers, according to a University of Florida study.

Researchers at UF analyzed three studies that followed thousands of participants from childhood to adulthood, taking gender, weight and age into consideration. The results showed inches translated into thousands of dollars over a lifetime of work.

On average, taller people make \$789 a year more per inch than their shorter co-workers, said the study, which was released last week. So, a 6-foot-tall employee would earn \$5,523 more a year than his 5-foot-5 cubicle neighbor, the study said.

With the average American man standing 5-feet-9 and the average woman 5-feet-4, researchers speculate that tall people have more self-confidence, translating into more success and respect.



RICH ADDICKS / Staff

Despite allergies in this Stone Mountain family, the Jordans adore their 1-year-old cat, Baxter. The dad, Melvin (second from right), isn't sure about a study that supports exposing young kids to cats and dogs.

Study: Pets help kids avoid allergies

By CHARLOTTE MOORE
cmoore@ajc.com

Children exposed to pets within the first year of life are much less likely to develop allergies, according to a new federal study that challenges what many doctors have believed about allergies.

According to the study, led by a Medical College of Georgia researcher and published in today's Journal of the American Medical Association, exposure to at least two dogs or cats early in life may reduce by 50 percent or more a child's risk of developing allergies in later childhood.

Incidences of allergy-related illness and asthma have increased

significantly over the past 20 years.

The new study challenges the findings of previous research that led allergists to discourage exposure to animals in a child's first year of life. But Dennis Ownby, the study's lead investigator, said the new research does not support past studies and should prompt scientists to "isolate and refine" effective new ways to prevent allergies.

"There were two problems with those studies," said Ownby, chief of the allergy and immunology department of MCG in Augusta. "The studies often involved relatively small numbers of children . . . and the studies were retrospective. They examined children at around the age of 14 and

asked, 'Did you have a dog in the house in early life?'"

Ownby's Detroit-based study tracked 474 children born between 1987 and 1989 for seven years to see if those with pets were more likely to develop allergies. Sixteen percent of the children with no pets in the home developed a cat allergy compared with only 8 percent of kids with two or more pets. At the same time, 9 percent of kids with no pets became allergic to dogs, compared with only 3 percent of kids with two or more pets.

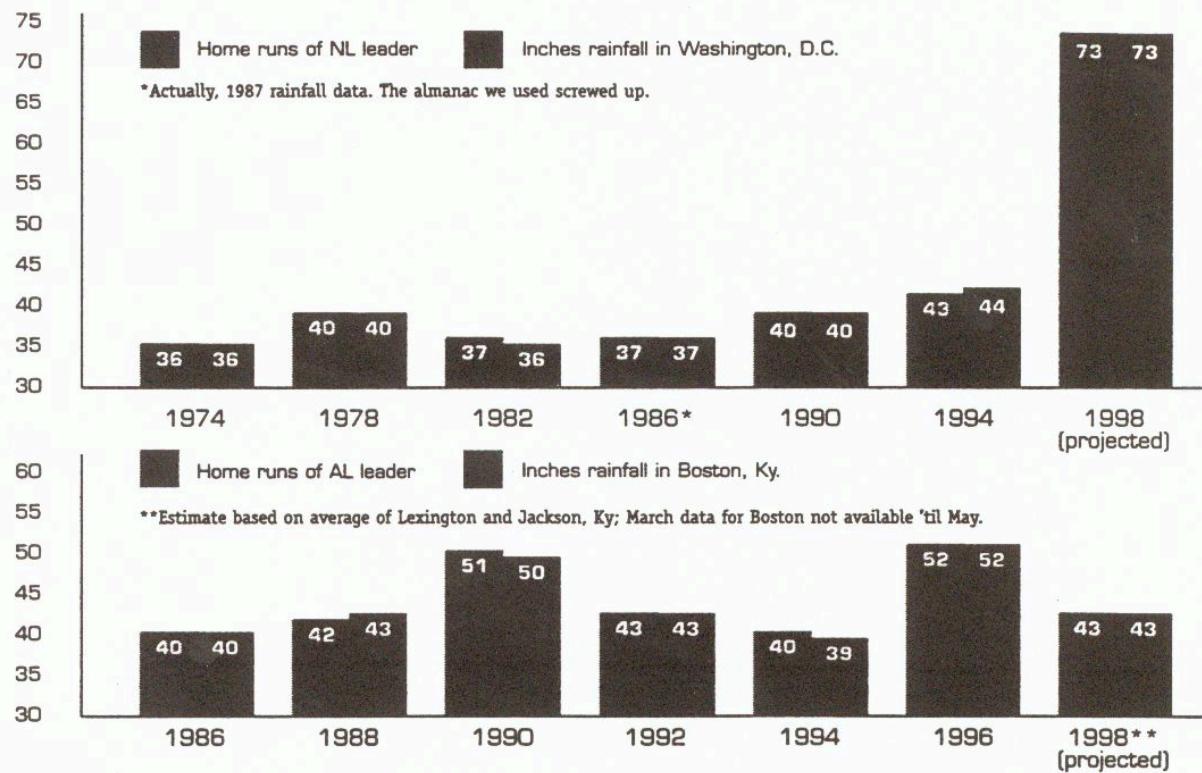
Researchers suggested early exposure to pets may change how a child's immune system responds to animals "in a way that helps protect against allergies."

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Researchers suggested early expo-

COINCIDENCE...OR CONSPIRACY?

It may once have been the Babe's record, but this year it belongs to El Niño. While Mark McGwire and Junior aim for the elusive 62-homer mark, and others debate whether such a feat is even possible, we know the answer is there already: in the clouds. Every four years since 1974, the National League's leading homer hitter has equaled or come within one of the total inches of rainfall in—appropriately enough—our nation's capital, Washington, D.C. And the American League? Look to less prestigious, but clearly no less influential, Boston, Ky. Every two years since the mid-'80s, the number of inches there has just as accurately predicted the total of the AL leader.



The Bluegrass State's mild winter is bad news for Junior. But a particularly wet East Coast winter (189% of normal rainfall) has Big Mac on pace to belt a no-doubt-about-it 73. Okay, okay, "at this pace" predictions bug you and El Niño's wrath won't continue. Fine. Normal rainfall for the rest of the year means 47 dingers for Mark. So let's split the difference (60)—and hope for a one-game playoff.

To be Statistically Significant (the probability of chance)

- ***The difference is due to systematic influence and not due to chance.***
- ***Significance level:***
 - Alpha = 0.1, 0.05, 0.01, 0.001
 - *Normally, alpha = 0.05*
- ***Probability < 0.05***
 - *1 chance in 20 (difference found not due to treatment or intervention)*