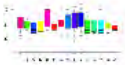
Why are they so important?

Fisher discovered ANOVA
- Tests Ho:all means equal
- vs. At least one different

Bonferroni Adjustment
- Use Conf Level
- CI = (1- alpha/I)
- I=# of comparisons



- **Blocking** – Sometimes it is more efficient to "stratify" by repeating treatments over the same subjects
- Paired experiments
- Repeated Measures

From Last Time...

- Goodness of Fit
- Test of Independence
- Test for Homogeneity

History:
- 1946-1952 Hundreds of thousands of victims, especially children
- Ethics – who to treat – who to give placebo
- Some parents refuse to have their children participate.
- What about using these relatives as control?
- Who's more at risk?
- Randomized control group avoids confounding
- 1st proposal to use given 2 consenters as treatment group
- Randomized – double blind

"Weapons" of Experimental Design

Accounting for Variabilty
- *Categorical Predictors*
- *Quantitative Predictors*

Double blind randomized control exp.

Group	Size	Rate/100,000
Treatment	200,000	28
Control	200,000	71
Nonconsent	350,000	46

An observational study observes individuals (usually from a sample) and measures variables of interest, but does not actively manipulate anything to observe the changes in the response that that might produce.

NFIP design

Grade 2	225,000	25
Grades 1,3	725,000	54
No consent	125,000	44

A **designed experiment** specifically manipulates factors to see their effects on a response. Only way to determine cause and effect convincingly.


Gear Face-Off: Aero Helmet Vs. Aero Wheels

Which is the difference?

In an experiment, certain factors are manipulated to see their effects on a response or responses.

The individuals in the experiment are the experimental units or subjects.

A treatment is an experimental condition applied to the individuals in the experiment – each treatment is formed from a combination of specific levels of the factors.

Placebo

Replication – by repeating the experimental condition, we can see the effect more clearly

- **Randomization** – To ensure fairness over factors we don't want to or can't control, we randomize

Completely randomized design

- **Control** – we control as much as we can other than the experimental factor(s) which we purposefully manipulate


YouTube


YouTube

From Last Time….


xtranormal
YouTube

- *Goodness of Fit*
- *Test of Independence*
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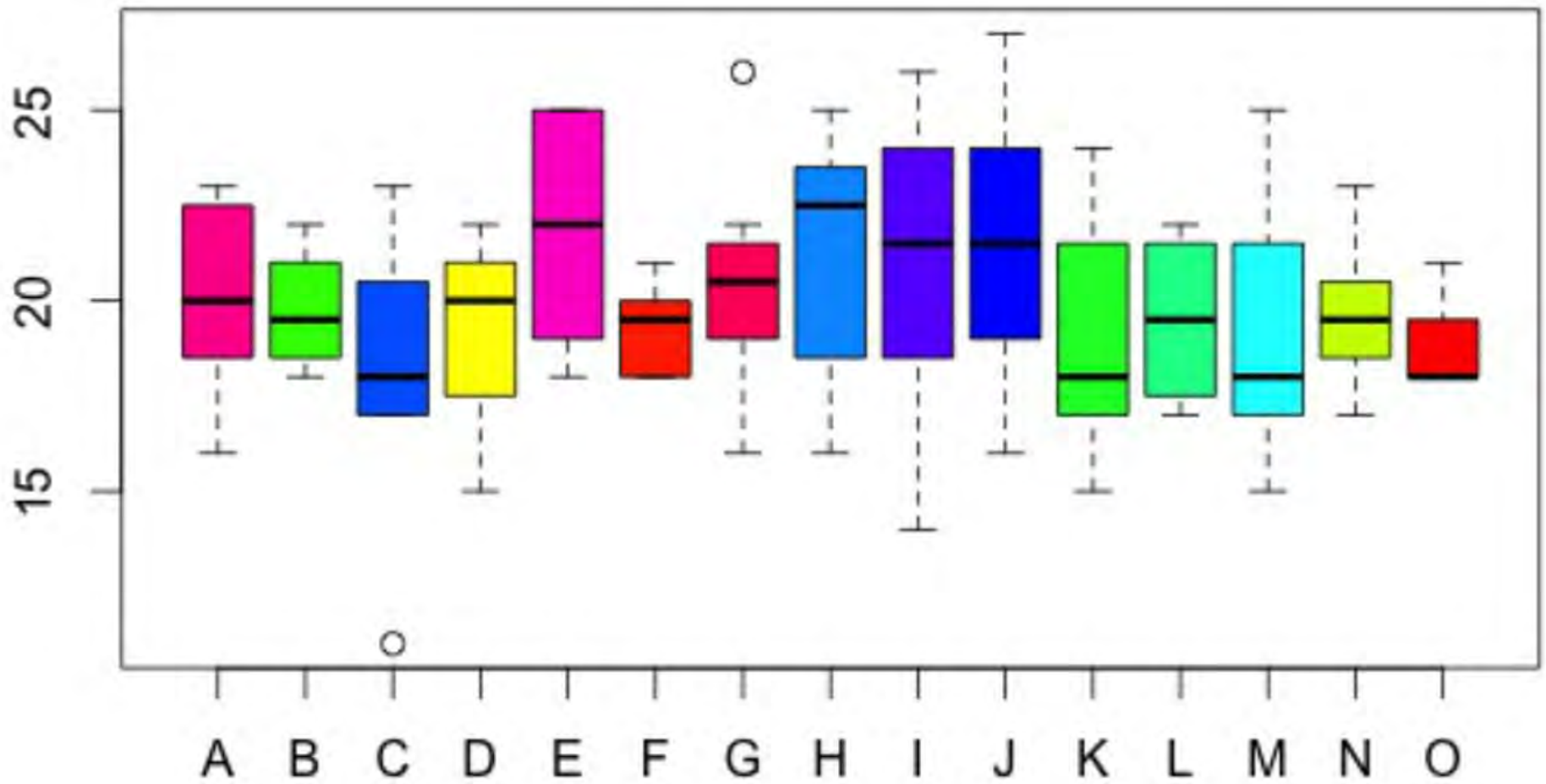
25
20
15
A
B
C
D
E
F
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H
I
J
K
L
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N
O

```
> with(teach,pairwise.t.test(Scores,Teacher,p.adjust="none"))

 Pairwise comparisons using t tests with pooled SD

data:  Scores and Teacher

  A     B     C     D     E     F     G     H     I     J     K     L     M     N
B 0.788 -     -     -     -     -     -     -     -     -     -     -     -     -
C 0.153 0.244 -     -     -     -     -     -     -     -     -     -     -     -
D 0.530 0.719 0.419 -     -     -     -     -     -     -     -     -     -     -
E 0.210 0.129 0.008 0.061 -     -     -     -     -     -     -     -     -     -
F 0.530 0.719 0.419 1.000 0.061 -     -     -     -     -     -     -     -     -
G 0.788 0.590 0.090 0.370 0.324 0.370 -     -     -     -     -     -     -     -
H 0.419 0.282 0.026 0.153 0.653 0.153 0.590 -     -     -     -     -     -     -
I 0.530 0.370 0.041 0.210 0.530 0.210 0.719 0.857 -     -     -     -     -     -
J 0.324 0.210 0.017 0.108 0.788 0.108 0.473 0.857 0.719 -     -     -     -     -
K 0.419 0.590 0.530 0.857 0.041 0.857 0.282 0.108 0.153 0.075 -     -     -     -
L 0.653 0.857 0.324 0.857 0.090 0.857 0.473 0.210 0.282 0.153 0.719 -     -     -
M 0.473 0.653 0.473 0.928 0.050 0.928 0.324 0.129 0.180 0.090 0.928 0.788 -     -
N 0.719 0.928 0.282 0.788 0.108 0.788 0.530 0.244 0.324 0.180 0.653 0.928 0.719 -
O 0.324 0.473 0.653 0.719 0.026 0.719 0.210 0.075 0.108 0.050 0.857 0.590 0.788 0.530

P value adjustment method: none
```

Bonferroni Adjustment

- Use Conf Level
- CI = (1- alpha/J)
- J=# of comparisons

```
> with(teach,pairwise.t.test(Scores,Teacher,p.adjust="bonf"))

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  A    B    C    D    E    F    G    H    I    J    K    L    M    N
B 1.00 -    -    -    -    -    -    -    -    -    -    -    -    -
C 1.00 1.00 -    -    -    -    -    -    -    -    -    -    -    -
D 1.00 1.00 1.00 -    -    -    -    -    -    -    -    -    -    -
E 1.00 1.00 0.84 1.00 -    -    -    -    -    -    -    -    -    -
F 1.00 1.00 1.00 1.00 1.00 -    -    -    -    -    -    -    -    -
G 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -    -    -    -    -    -
H 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -    -    -    -    -
I 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -    -    -    -
J 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -    -    -
K 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -    -
L 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -    -
M 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -    -
N 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 -
O 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

P value adjustment method: bonferroni
```

Fisher discovered ANOVA

- Tests Ho:all means equal
- vs. At least one different

```
> summary(aov(Scores~Teacher,teach))                Df
Sum Sq     Mean Sq     F value    Pr(>F)Teacher      14
135.12      9.6512      1.2528    0.2497Residuals   105
808.88      7.7036
```

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Placebo

Why are they so important?

JAMA®
The Journal of the American Medical Association

Symposium on Peptic Ulcer

Interim Report on Results of Gastric Freezing for Peptic Ulcer

Present Indications, Limitations, and Clinical Achievement

Eugene F. Bernstein, MD; Robert L. Goodale Jr., MD; Arthur S. McFee, MD; Arthur J. Madsen, MD; John P. Delaney, MD; Owen H. Wangensteen, MD

[+] Author Affiliations

Since this article does not have an abstract, we have provided the first 150 words of the full text.

EXCERPT

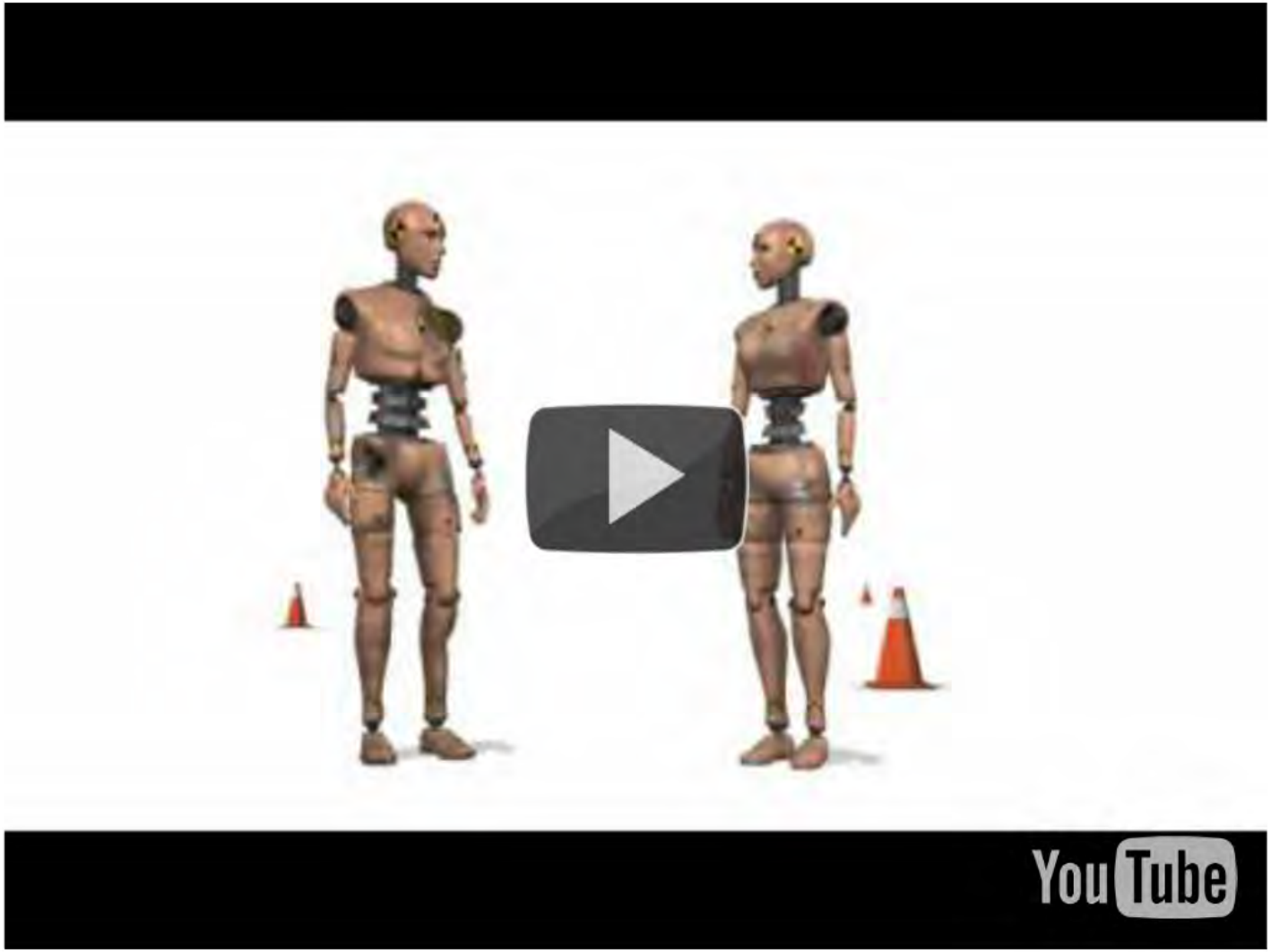
GASTRIC FREEZING is under evaluation as a " definitive treatment of various manifestations of the peptic ulcer diathesis, including duodenal, gastric, and stomal ulcer, and stenosing esophagitis. The vast majority of the 365 patients treated by us to date have been candidates for elective surgery for duodenal ulcer (Table 1). Following a freeze of 45, 50, or 60 minutes, with gastric inflow temperatures of about —17 C (0.8 F), dramatic and immediate relief of ulcer pain and rapid healing of ulcer craters has been observed quite regularly.

The distinction between gastric cooling and gastric freezing needs re-emphasis. Gastric cooling, involving inflow temperatures of 5 to 10 C (41-50 F), has been employed in the emergency treatment of massive upper gastrointestinal hemorrhage since its development in 1958.[1,2] Its efficacy has been confirmed in a number of independent observations and it appears to have found favorable acceptance by the medical profession.

Gastric

FOOTNOTES

Presented as part of the Symposium on Newer Knowledge and Therapy of Peptic Ulcer at the 112th Annual Meeting of the American Medical Association, Atlantic City, NJ, June 17, 1963.


YouTube

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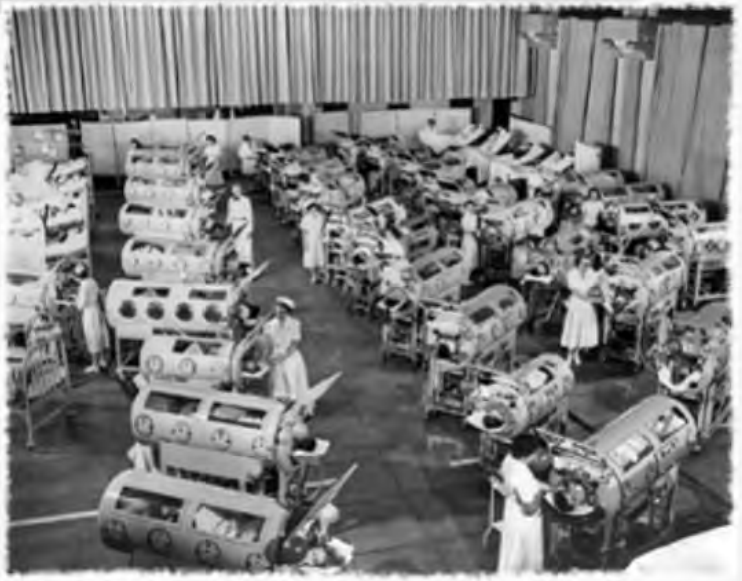

History

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- Ethics -- who to treat -- who to get placebo?
- Some parents refuse to have their children participate.
- What about using those refused as control?
- Who's more at risk?
- Randomized control group avoids confounding
- 1st proposal to use grade 2 consenters as treatment group
- Randomized -- double blind


Jonas Salk
Medical Scientist
USA
63
2006


Albert Sabin
Virologist
USA
87
2006

Double blind randomized control exp.

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P value adjustment method: none
```

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Gear Face-Off: Aero Helmet Vs. Aero Wheels

Michelle Valenti/Active.com

By Sean Madsen, Boulder Center for Sports Medicine

VeloNews

Dear VeloNews Training Center,

I have a big time trial coming in a few months. I don't have a huge budget for new equipment, but I'm considering investing in either an aero helmet or aero wheels. Which will help me the most? -Todd

Time trial equipment is certainly expensive, but can afford the rider a quantifiable improvement in race performance. Prioritizing equipment can be a daunting task, especially given the marketing hype surrounding aerodynamics. To help in the decision making, let's look at the scientific studies that have been performed in wind tunnels and real world settings.

Many studies have illustrated the primary resistance that a cyclist must overcome, especially at high speeds, is wind resistance. (Grappe et al., 1997; Kyle and Burke, 1984) Moreover, these same studies have pointed out that the body accounts for the majority of the aerodynamic drag, usually about 70 percent. If the body is the primary source of aerodynamic drag, then making changes to the body position can cause substantial changes in drag (Broker, 2003; Garcia-Lopez et al. 2008; Juekendrup and Martin, 2001).

These same studies have also pointed out that optimizing aerodynamic drag does not necessarily result in optimized metabolic cost and respiratory capacity. So there is a balance between aerodynamics and power generation. All of this leads to the conclusion that the most important use of your money is actually getting positioned properly on your bike.

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