http://easylink.playstream.com/affymetrix/ambsymposium/partek_08.wvx

Partek® Genomics Suite™

Differential Gene Expression & Alternative Splice Detection Using the Affymetrix Exon Array

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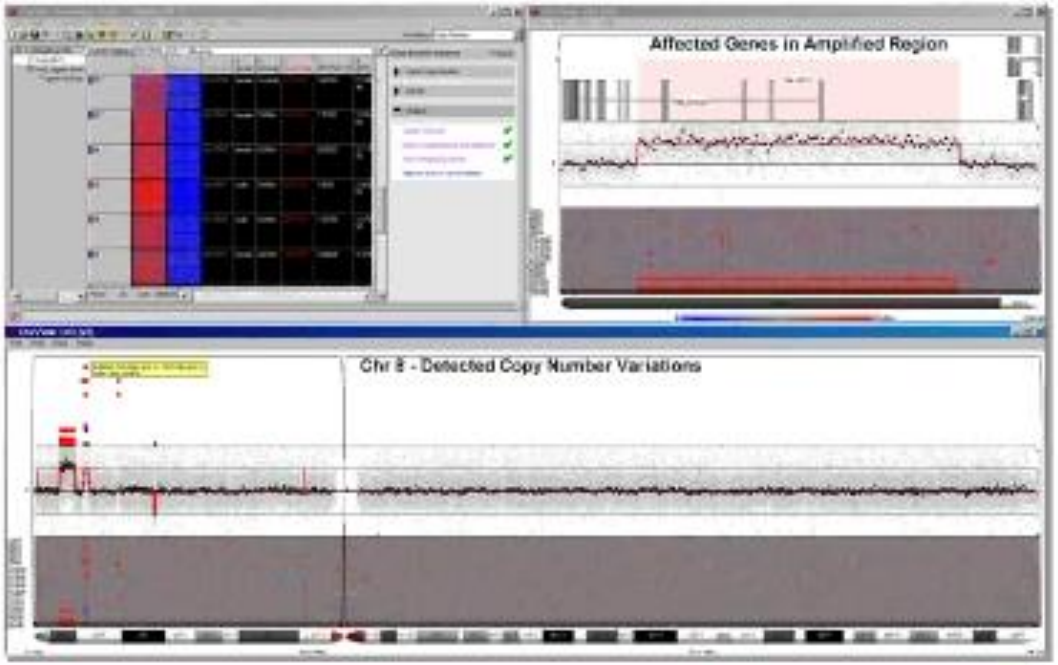

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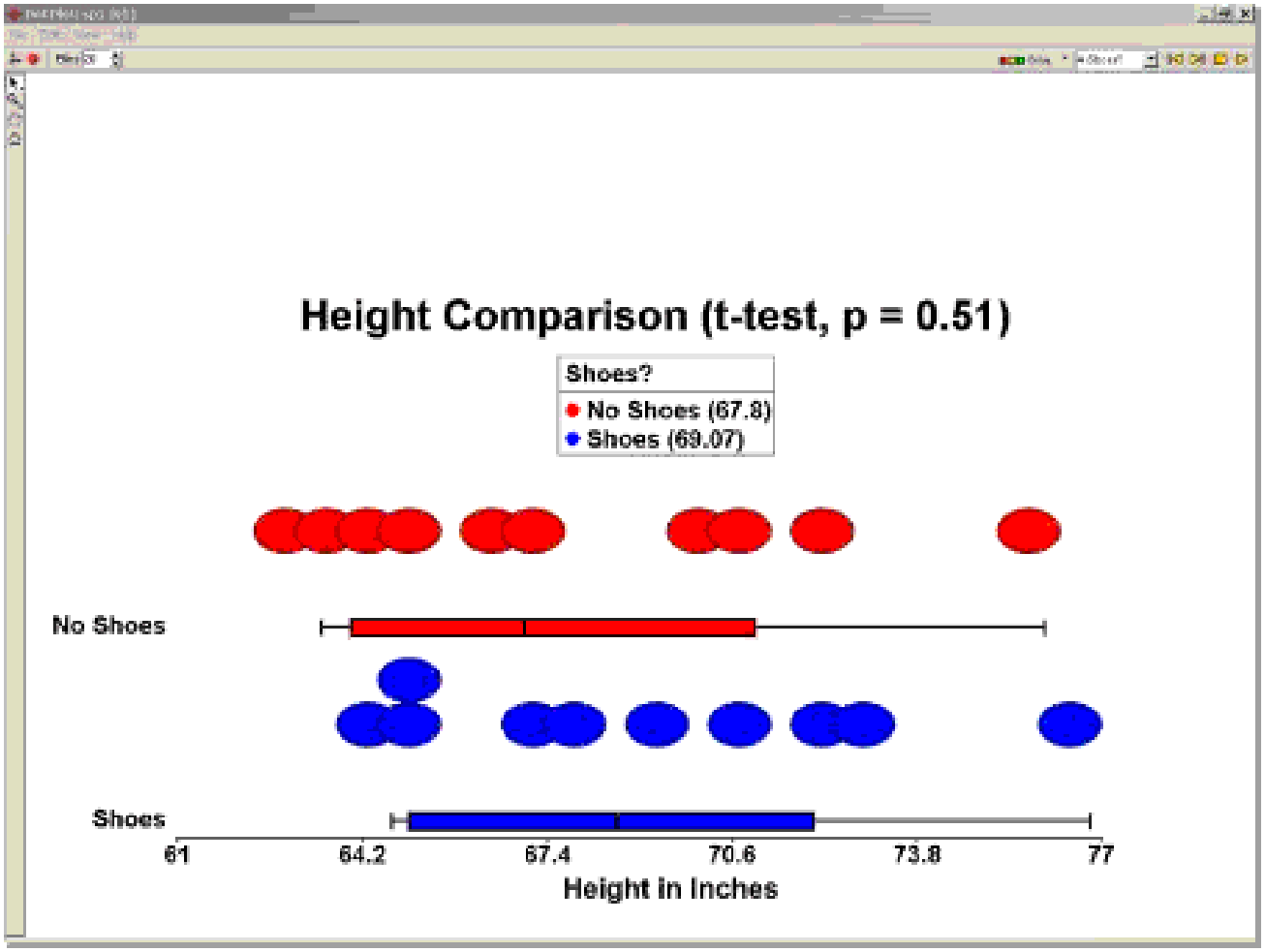
The Shoe Experiment

- Do shoes make a person taller?
  - P.I. DJ Meyer, Partek Inc.
- The measurement:
  - Measure the height 10 people with shoes and 10 people without shoes
  - Use a "two sample" t-test to see if there is a difference between the the mean of two groups
- Conclusion
  - No "statistically significant difference" in height due to wearing shoes.

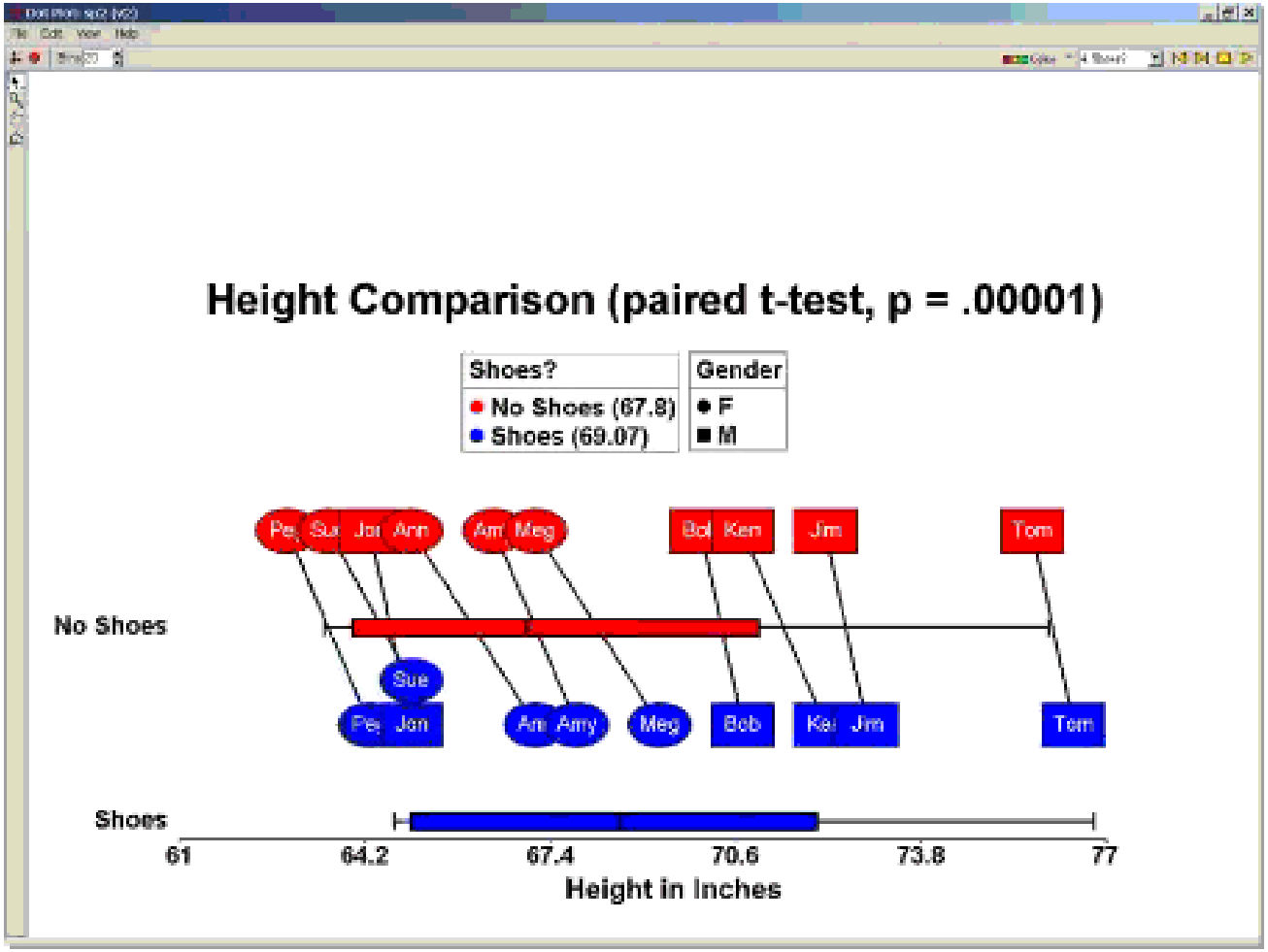
Shoe Experiment: t-Test



A simple t-test does not have the power to correctly identify this pattern without a very large sample size, because it assumes multiple samples from the same individual are independent when they are not.

(Fold-change = 1.02)

Shoe Experiment: Paired t-Test



The paired t-test provides substantially more statistical power by removing person-to-person differences from the noise.

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T-Test is simple ANOVA

$$y = \mu + S + \varepsilon$$

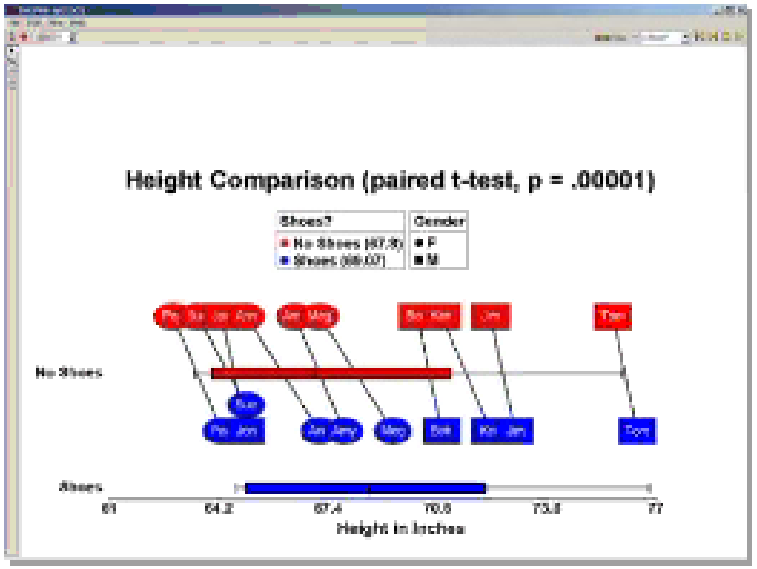
- T-test invented in 1908 by "Student" (Goss
- Here is how to write the "linear model":
  - y = Gene expression
  - μ = Mean height
  - S = Wearing Shoes? (2 levels: "shoes" vs. "no shoes")
  - ε = Error (noise)

Paired t-test is a 2-way ANOVA

$$y = \mu + S + P + \varepsilon$$

Differential "Height Expression" due to Shoe Effect

ANOVA invented by Fisher in 1923



- The linear model:
  - y = Expression
  - μ = Mean height
  - S = Shoes (2 levels)
  - P = Person (1o levels)
  - ε = Error (noise)

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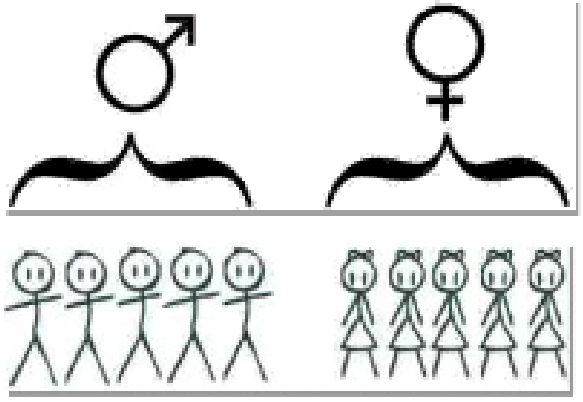
Gender Effects?

- Let's have a little fun and explore the effect of sex ;)
- 3-way ANOVA

$$y = \mu + S + G + P(G) + \varepsilon$$

- Once person is known, gender already known
  - Thus the p-value for Tissue Type remains unchanged
  - We get the estimate of gender effect for free!

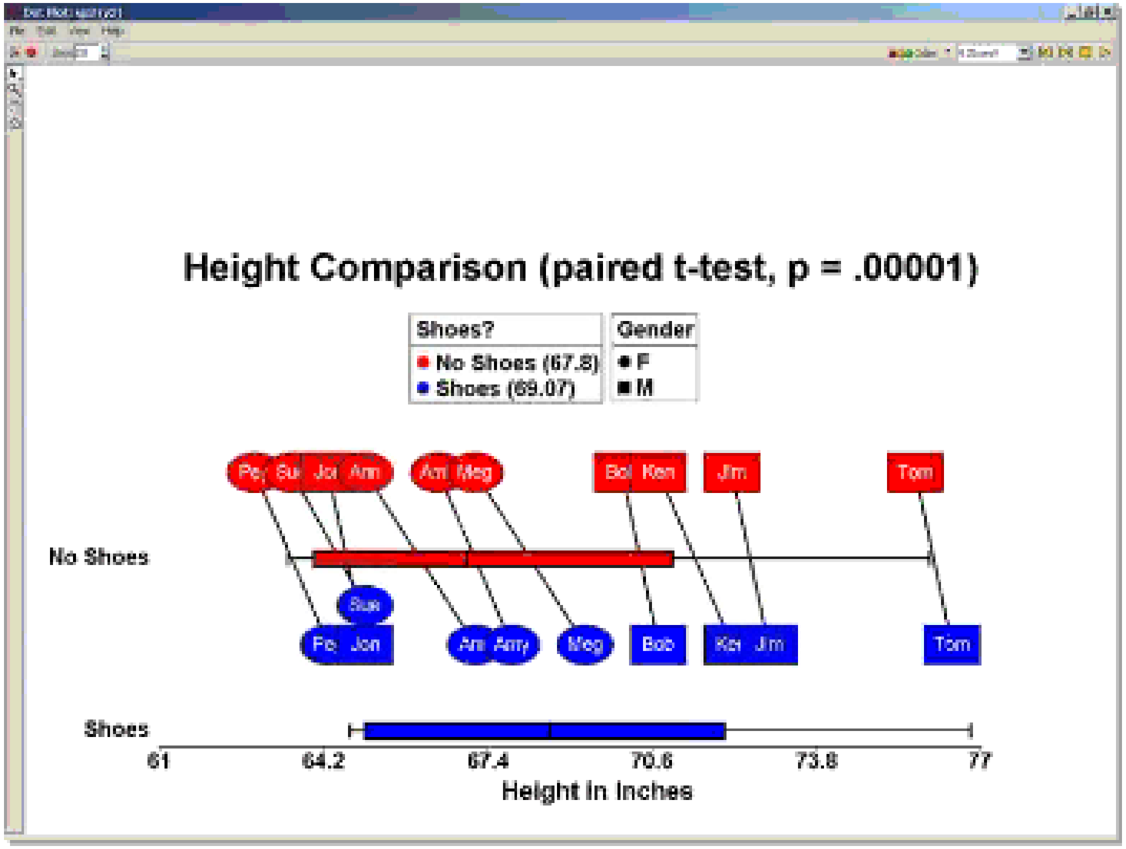


Add Gender (3-way ANOVA)

$$y = \mu + S + G + P(G) + \varepsilon$$

- *p*(Shoes)=1e-5
- *p*(Gender)=.04
- *p*(Person)=2e-9

- *It appears (p=.o4) that men (at Partek) are significantly taller than women*

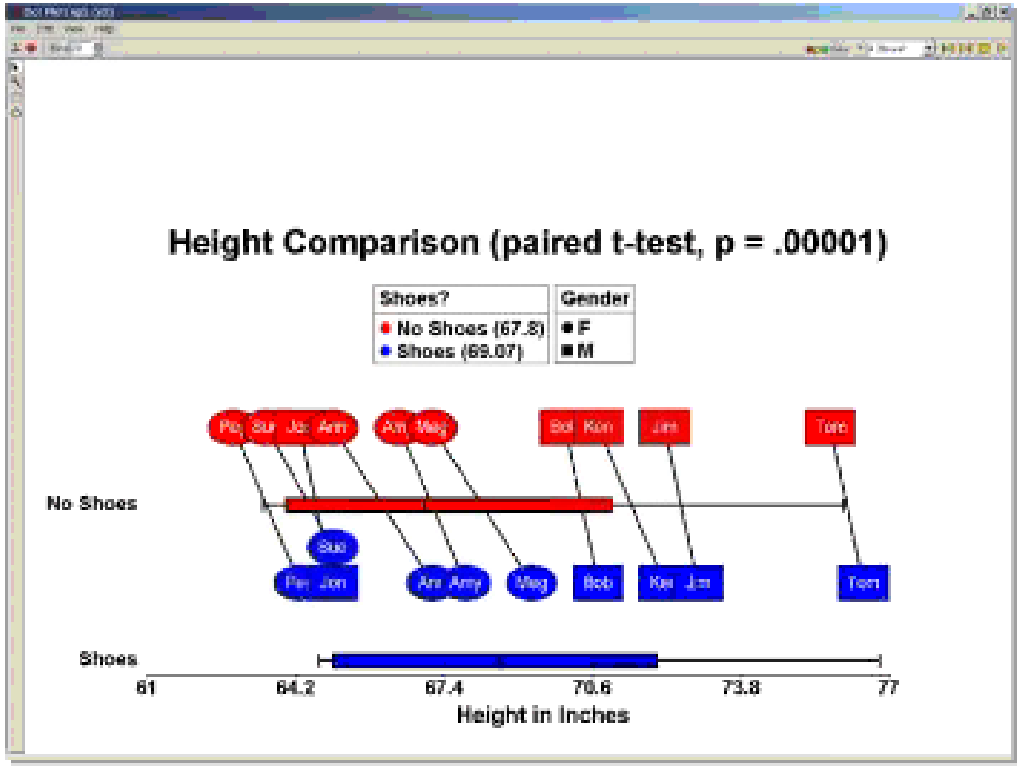


Explore Gender/Shoe Interaction…

- *Do shoes have the same effect on men & women*

$$y = \mu + S + G + S*G + P(G) + \varepsilon$$

- *p*(Shoes)=1e-8
- *p*(Gender)=.04
- *p*(Person)=2e-12
- *p*(Shoe*Gender) =7e-5



- *Wow! Shoes affect women's height more than men's!*
- *Also note that p-values for shoe effect are even smaller because we explained more "noise"*

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