



**SPSS®**

**for HR Analytics**

**Jarlath Quinn – Analytics Consultant**

[www.sv-europe.com](http://www.sv-europe.com)

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Just waiting for all attendees to join...



**SPSS<sup>®</sup>**

**for HR Analytics**

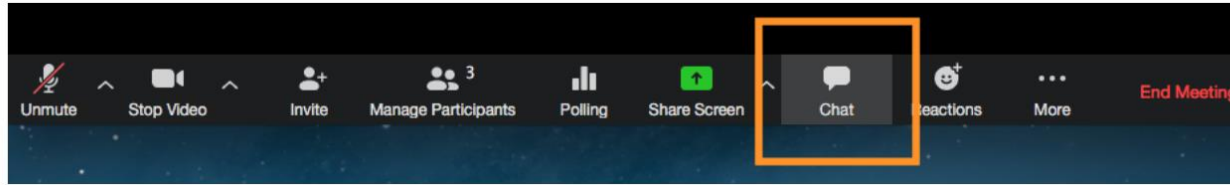
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# FAQ's

- Is this session being recorded? Yes
- Can I get a copy of the slides? Yes, we'll email links to download materials after the session has ended.
- Can we arrange a re-run for colleagues? Yes, just ask us.
- How can I ask questions? All lines are muted so please use the chat panel – if we run out of time we will follow up with you.





- Gold accredited partner to IBM, Predictive Solutions and DataRobot specialising in advanced analytics & big data technologies
- Work with open-source technologies (R, Python, Spark etc.)
- Team each has 15 to 30 years of experience working in the advanced and predictive analytics industry
- Deep experience of applied advanced analytics applications across sectors
  - Retail
  - Healthcare/Pharma
  - Finance/Insurance
  - Media/Telecoms
  - Utilities
  - FMCG
  - Charity/Housing/Government



# HR Applications in Statistics and Data Science

- Machine learning models for employee churn
- Demand forecasting for hiring needs
- Data-driven salary benchmarking
- Absenteeism pattern analysis
- Employee morale trends
- Equity and fairness audits



# Using statistics to assess equity and fairness

# Harris Trust & Savings Bank

- A statistical study from 1979 based on an equal opportunities court case
- The judge found that there was persuasive discrimination against minorities and women in the bank's pay and promotion policies.



# Los Angeles Times

## Chicago Bank Settles Bias Case for Record \$14 Million

By **WILLIAM J. EATON** and **BOB SECTER**

Jan. 11, 1989 12 AM PT



**TIMES STAFF WRITERS**

**WASHINGTON** — A Chicago bank accused of job discrimination against women and minority employees has agreed to pay a record \$14 million in back wages as restitution for past bias, the Labor Department announced Tuesday.

The settlement by the Harris Trust & Savings Bank was the largest such award ever obtained by the federal government in a sex or race discrimination case and ended a 14-year legal struggle with the company.

“It is a major civil rights victory for the federal government,” Labor Department Solicitor George R. Salem said. “. . . This settlement represents a major step forward not only for the present and former employees of the Harris Bank who will benefit



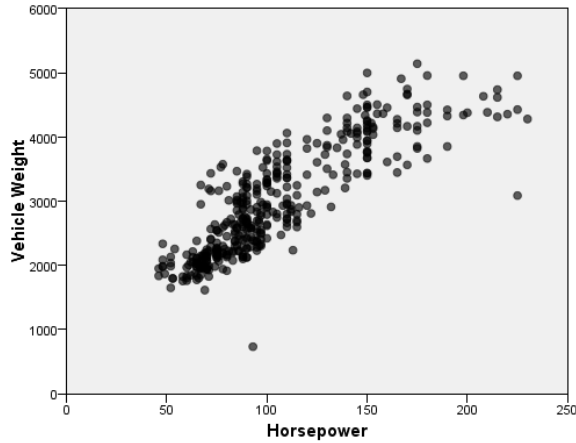


# Comparing mean starting salary for men and women

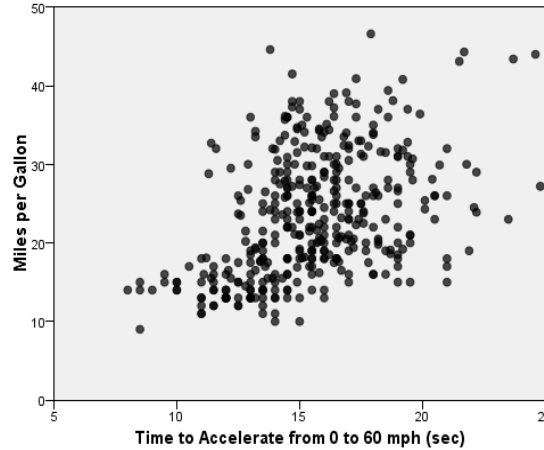


# Looking for linear correlations

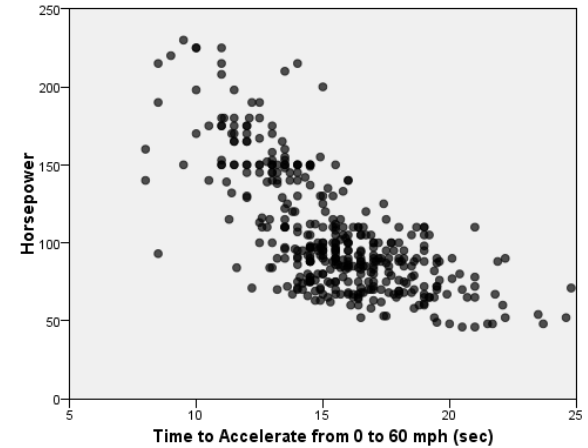
# Measuring Linear Relationships



0.859



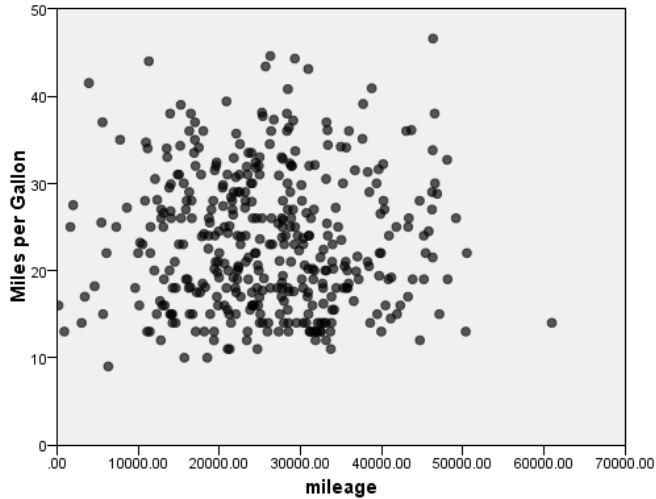
0.434



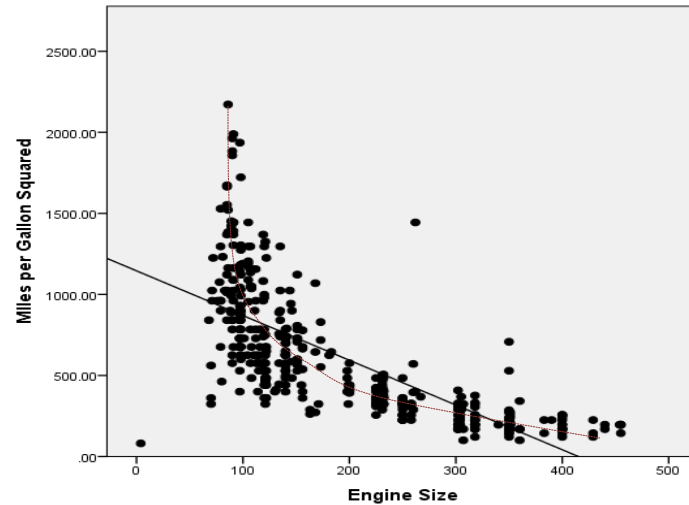
-.701

**Pearson Correlation Values**

# Non-Linear Relationships



-0.005



-.671

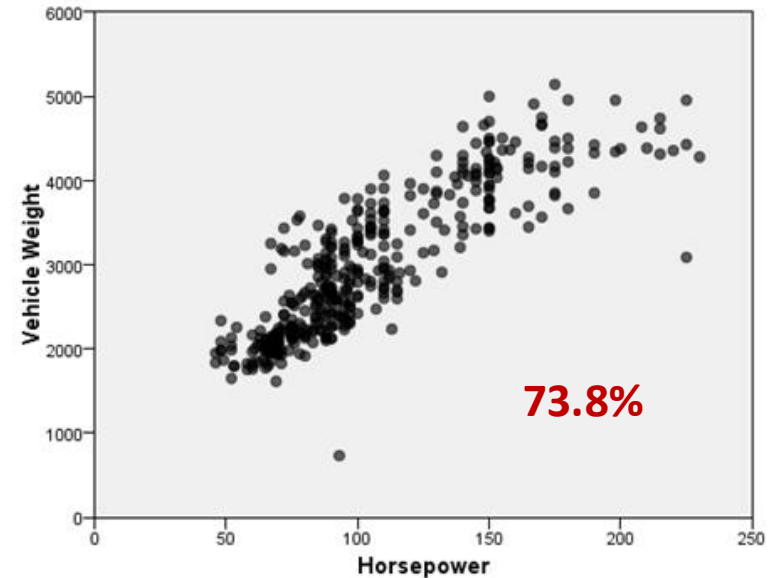
**Pearson Correlation Values**



# Performing regression

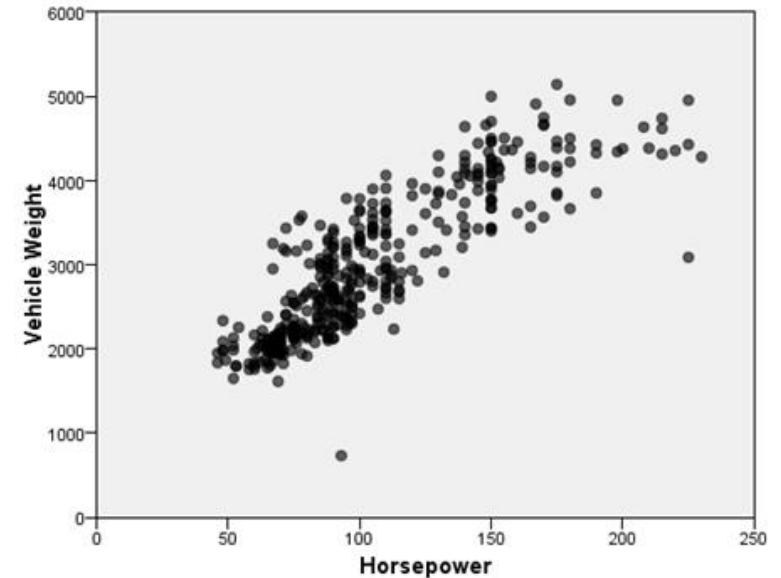
# Correlations as Percentages

- Correlation = 0.859
- $0.859 \times 0.859 = 0.738$
- $0.738 = 73.8 \%$
- Correlation Squared = 'R Square'



# From Correlation to Prediction

How can we express linear relationships as predictive models?





How long does it take to cook a chicken?



# How long does it take to cook a chicken?

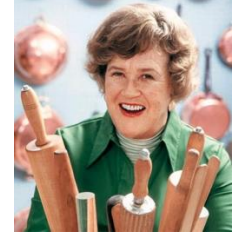
- 7 minutes per pound plus 45 minutes

$$y = mx + c$$

or

- 20 minutes per pound plus 20 minutes

$$y = a + bx$$





# Using decision trees to model employee retention

# Why use Decision Trees?

- Decision trees can be used to
  - Build profiles of staff/customers/patients/students
  - Find key behavioural segments
  - Generate predictive models
- Decision Trees are especially popular because
  - they are visual representations of models
  - relatively easy to understand

# Understanding Decision Trees

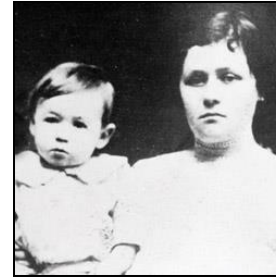
- What were the most important factors determining survival during the sinking of the RMS Titanic?

Survival on the RMS Titanic

|         |                 | Count | Percent % |
|---------|-----------------|-------|-----------|
| survive | Did not survive | 1490  | 68%       |
|         | Survived        | 711   | 32%       |
|         | Total           | 2201  | 100%      |



Gender?



Age?



Class?

# Statistical Tests Like Chi Square help to answer this

Survival on the RMS Titanic

|         |                 | sex    |                  |       |                  |
|---------|-----------------|--------|------------------|-------|------------------|
|         |                 | female |                  | male  |                  |
|         |                 | Count  | Column Percent % | Count | Column Percent % |
| survive | Did not survive | 126    | 26.8%            | 1364  | 78.8%            |
|         | Survived        | 344    | 73.2%            | 367   | 21.2%            |
|         | Total           | 470    | 100.0%           | 1731  | 100.0%           |

Pearson Chi-Square Tests

|         |            | sex     |
|---------|------------|---------|
| survive | Chi-square | 456.874 |
|         | df         | 1       |
|         | Sig.       | .000*   |

# Statistical Tests Like Chi Square help to answer this

Survival on the RMS Titanic

|         |                 | age   |                  |       |                  |
|---------|-----------------|-------|------------------|-------|------------------|
|         |                 | adult |                  | child |                  |
|         |                 | Count | Column Percent % | Count | Column Percent % |
| survive | Did not survive | 1438  | 68.7%            | 52    | 47.7%            |
|         | Survived        | 654   | 31.3%            | 57    | 52.3%            |
|         | Total           | 2092  | 100.0%           | 109   | 100.0%           |

Pearson Chi-Square Tests

|         |            | age    |
|---------|------------|--------|
| survive | Chi-square | 20.956 |
|         | df         | 1      |
|         | Sig.       | .000*  |

# Statistical Tests Like Chi Square help to answer this

Survival on the RMS Titanic

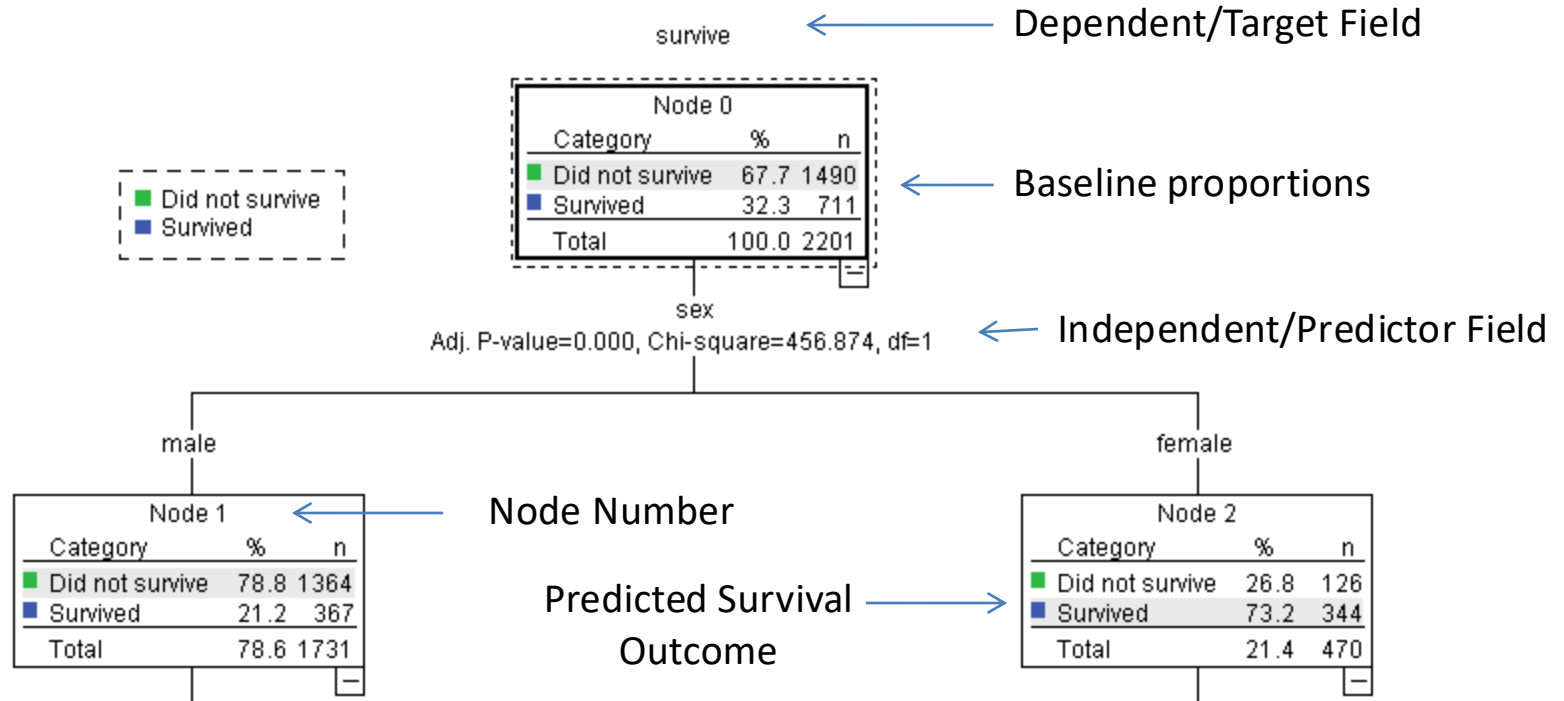
|         |                 | class |                  |       |                  |       |                  |       |                  |
|---------|-----------------|-------|------------------|-------|------------------|-------|------------------|-------|------------------|
|         |                 | 1st   |                  | 2nd   |                  | 3rd   |                  | crew  |                  |
|         |                 | Count | Column Percent % | Count | Column Percent % | Count | Column Percent % | Count | Column Percent % |
| survive | Did not survive | 122   | 37.5%            | 167   | 58.6%            | 528   | 74.8%            | 673   | 76.0%            |
|         | Survived        | 203   | 62.5%            | 118   | 41.4%            | 178   | 25.2%            | 212   | 24.0%            |
|         | Total           | 325   | 100.0%           | 285   | 100.0%           | 706   | 100.0%           | 885   | 100.0%           |

Pearson Chi-Square Tests

|         |            | class   |
|---------|------------|---------|
| survive | Chi-square | 190.401 |
|         | df         | 3       |
|         | Sig.       | .000*   |

# Gender is most important

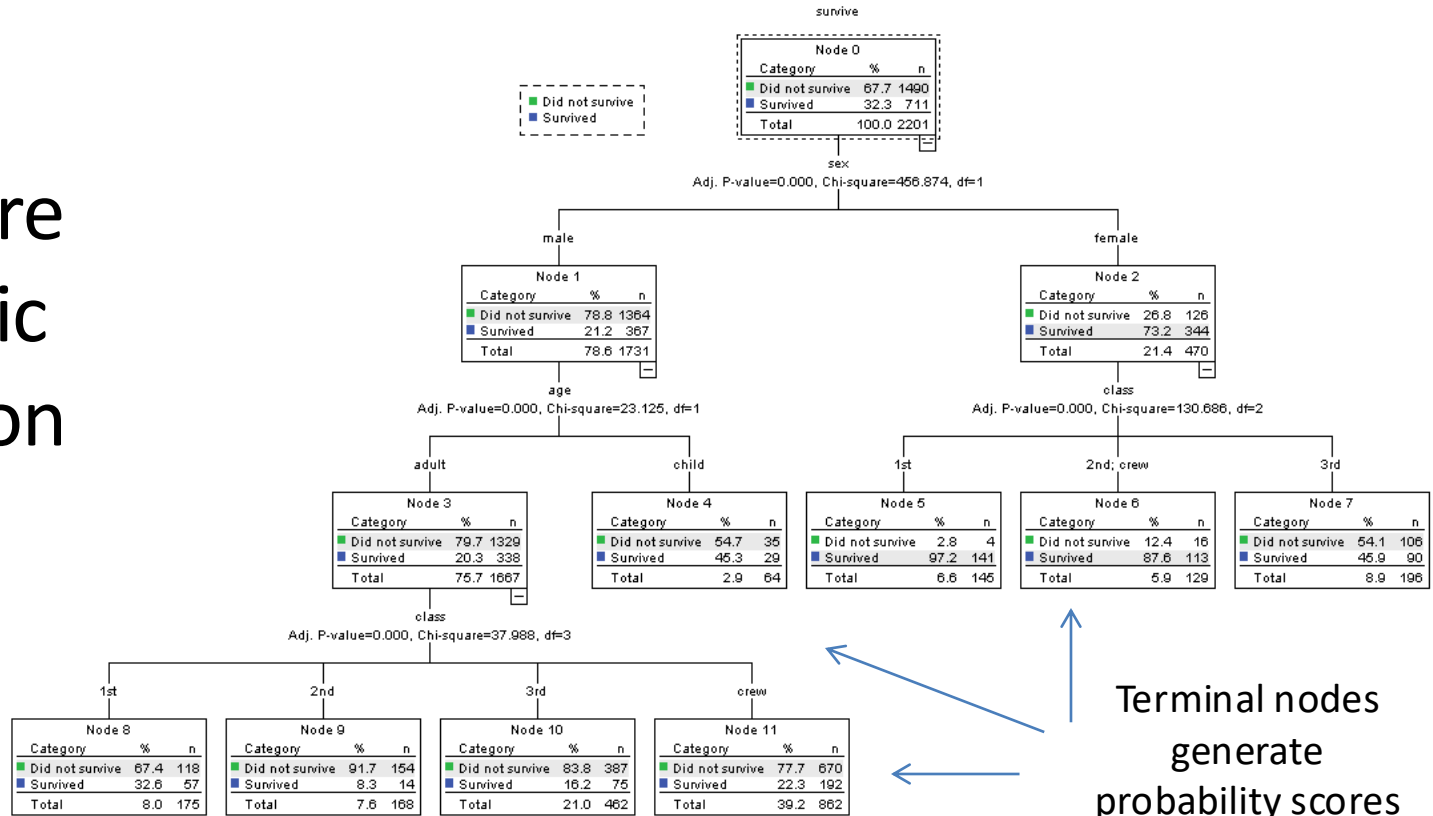
...and a CHAID Decision tree will reflect this....





# Full CHAID Decision Tree

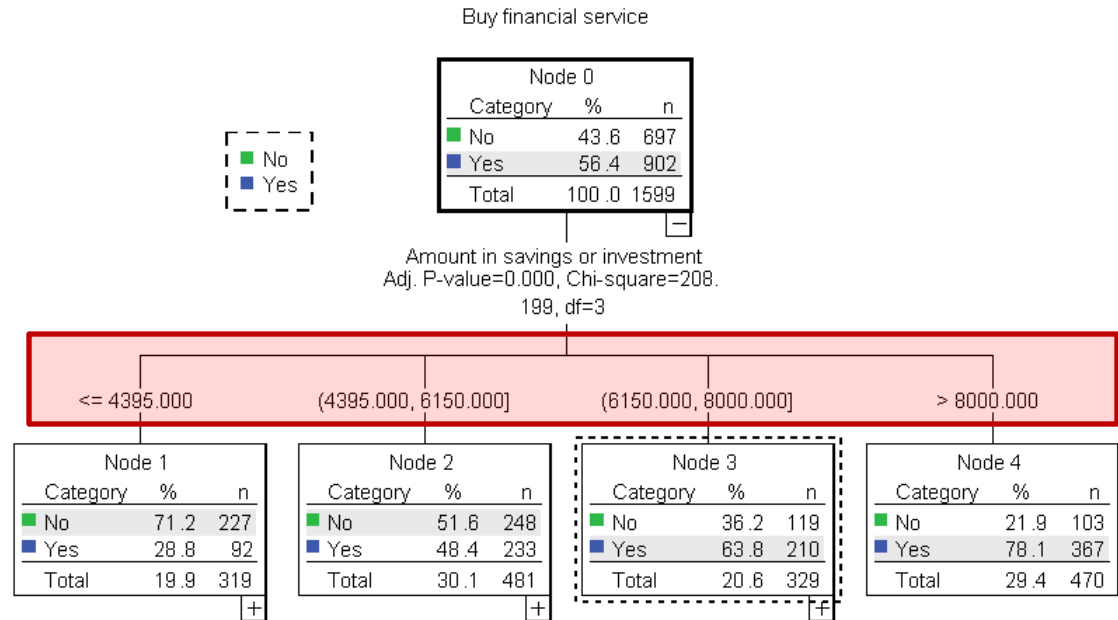
C.H.A.I.D  
Chi-Square  
Automatic  
Interaction  
Detector



# Merging/Splitting in CHAID Trees

Decision Trees can  
merge values of numeric  
*and* categorical  
predictors together

This makes the tree  
more efficient and easier  
to read





Let's take a look...



# Working with Smart Vision Europe

# Working with Smart Vision Europe

We can help with processing and analysing your data.

- Self-paced, virtual and in-person training courses in how to use SPSS products and appropriate statistical techniques
- A mix of consultancy and training whereby we do the initial work and then teach you how to replicate it

# Working with Smart Vision Europe

- **Sourcing Software**
  - You can buy your analytical software from us often with discounts
  - Assist with selection, pilot, implementation & support of analytical tools
  - <http://www.sv-europe.com/buy-spss-online/>
- **Training**
  - Formal classroom/virtual training
  - Online self-paced training resources
- **Advice and Support**
  - ‘No strings attached’ technical and business advice relating to analytics
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# Thank you