Understanding Jury Verdicts using Logistic Regression Modeling

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Project Rationale & Goals

There are several requirements of a juror to ensure an unbiased verdict. The verdict is determined impartially to give the defendant the fairest trial possible. Jurors base their decisions on many different factors. In this study we will determine which factors contribute the most towards the verdict of mock jurors.

Data Collection

A mock trial survey was completed by 600 individuals recruited through Amazon Mechanical Turk[5]. The mock jurors answered the questions after they were presented a case where the suspect was portrayed as not guilty.

- Initial verdict-based on a description of the crime with conclusive forensic evidence.
- Secondary verdict-based on additional forensic evidence descriptions, information on cross- examination, and points to consider
- Changed verdict-based on measurements of chance to the suspect's involvement after reviewing the points to consider and the odds of real-world events happening.

Methods and Materials

We used R[1], a statistical computing program, to fit different logistic regression models using the logistic regression equation: $logit(pi)=\alpha+\beta \cdot Xi$.
The survey included several variables, the most significant variables were used to compute the best models.

Variables

(bolded variables are on a -3 to 3 integer scale):
Age-age in years
UnderstoodEvidence-high values for jurors reporting they understood the evidence well
Maxmath-highest math class (none, high school, calc, above calc)
NativeEnglish-1 if English is native language, 0 otherwise
SupportDP-1 if support death penalty, 0 otherwise
KnowSciMeth-high values for jurors reporting they know the scientific method well
KnowForSci-same as above for forensic science knowledge
PoliticalSpectrum-Identified as very liberal (-3) to very conservative (3)
EvidenceType-shoe print, fiber, fingerprint, or DNA
EvidenceStrength-very or moderately strong evidence
ErrorEstimate-Juror's estimate of chance of lab error
RMPEstimate-Juror's estimate of chance of evidence matching the defendant by random chance
Greater50Kelly-Does evidence support the statement that there is >50% chance the defendant is guilty?
Kelly More Likely-Is it much more likely the evidence came from the defendant than from anyone else?
Implicates-Does the evidence implicate the defendant?

Results & Discussion

Table 1- variables that affected the jurors' initial verdict

Variables	P value	Odds ratio
Intercept	0.05267 .	29.4653
Age	0.06016 .	0.9436
UnderstandEvidence	0.02122 *	0.5603
KnowSciMeth	0.00866 **	0.4774
KnowForSci	6.14e-06 ***	3.5323
PoliticalSpectrum	0.07306 .	1.3348
SupportDP	0.03745 *	0.3341
NativeEnglish	0.03656 *	0.0607

p-value is significant at the level of: <0.001(***), 0.001(**), 0.01(*), or 0.05 (.)

Figure 1- scatter plot of jurors' age, knowledge of forensic science, and political stance

The likelihood of a juror saying that the suspect is guilty initially is expressed in odds ratio column in Table 1. For example, every additional year of the juror's age, the juror is 0.9436 times as likely to say that the suspect is guilty for their initial verdict in this mock trial.
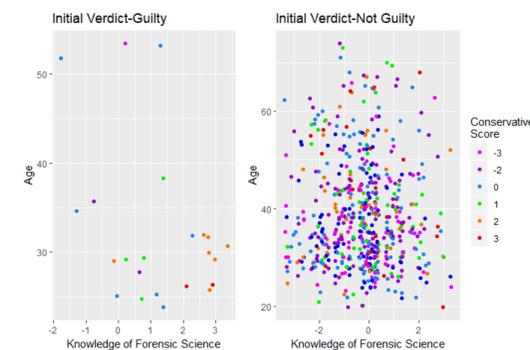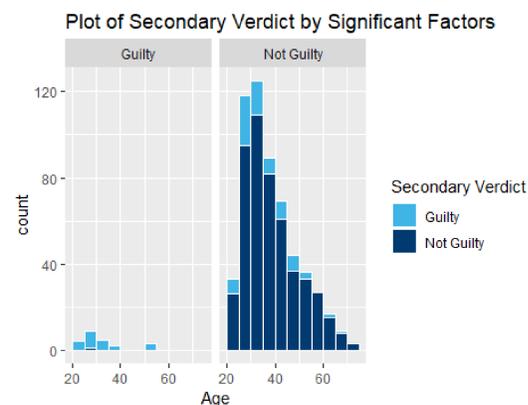
Figure 2- Histogram of jurors' age and their secondary verdict

If a juror chose guilty for their initial verdict, they are 231 times more likely to choose guilty for their secondary verdict.

Table 2- variables that affected the jurors' secondary verdict

Variables	P-Value	Odds ratio
Intercept	0.1198	0.2848
InitialVerdict	4.15e-17***	230.9967
EvidenceType		
-Fiber:	0.5041	0.6599
-Finger:	0.8289	0.8825
-Shoe:	0.1647	0.3822
Strength Strong	0.5328	1.4070
-Fiber:Strong	0.1968	0.3441
-Finger:Strong	0.5385	0.6480
-Shoe:Strong	0.4598	0.5110
Maxmath		
-college calc	0.0187*	0.3347
-hs only	0.0143*	0.3722
-none	0.0015**	0.1380
ErrorEstimate	0.0377*	0.8276
Age	0.0027**	0.9575
RMPEstimate	0.0007***	0.7037

Table 3- variables that affected the jurors' change in verdict

Variable	P - value	Odds ratio
Age	0.007884**	2.6117
RMP Estimate	0.103554	2.2933
Greater 50 Kelly	0.017124*	1.8776
Implicates	0.003065**	1.2712
Kelly More Likely	0.002344**	1.1853
Error Estimate	0.000741***	2.0339
EvidenceType		
-Fiber:	0.320337	0.51689
-Finger	0.59879	0.65589
-Shoe	0.084619 .	0.28378
Strength Strong	0.868737	1.10791
-Fiber:Strong	0.129701	0.26094
-Finger:Strong	0.657330	0.71153
-Shoe:Strong	0.81090	0.43208

Figure 3- scatter plot of jurors' RMPEstimate, implicates value, and their change in verdict

More jurors returned guilty verdicts if they believed the evidence implicated the suspect in the crime.

Results & Discussion

Odds ratio (OR): a measurement of the increase (if >1) or decrease (if <1) in the probability a juror will return a guilty verdict

Example: (see Table 1), the OR of KnowSciMeth is 0.4774. So, a juror is about half as likely to return guilty verdict for every step up in the scale of knowledge of the scientific method, with all other factors being the same.

Conclusions

Initial verdict was most affected by age, UnderstoodEvidence, KnowSciMeth, and KnowForSci, PoliticalSpectrum, SupportDP, and NativeEnglish. **Secondary verdict**, accounting for the experimental condition, is most affected by initial verdict and math courses: the more experience in math a juror has, the more likely they are to return a guilty verdict. Finally, of the 73 people who **changed** their verdict, the most important factors were ErrorEstimate and Implicates.

Limitations: Results are not completely realistic. Other factors and circumstances influence juror decision making during a trial, such as time spent on decision-making, amount of publicity around a trial, and influence jurors have on each other. Also, the survey-takers tended to be younger, more educated, and more likely to be male than the population of jury-eligible people in the US.

References

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Acknowledgements