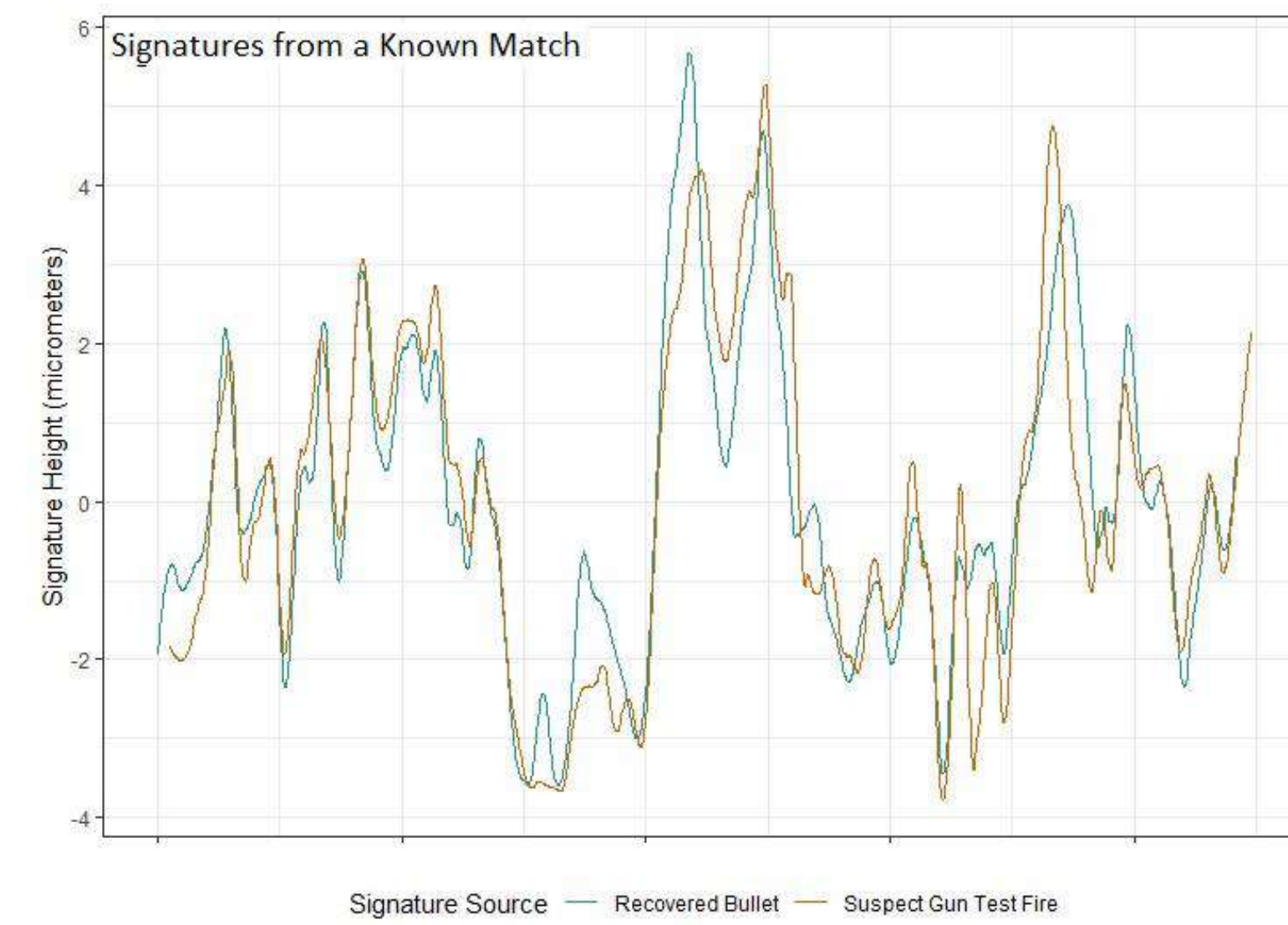
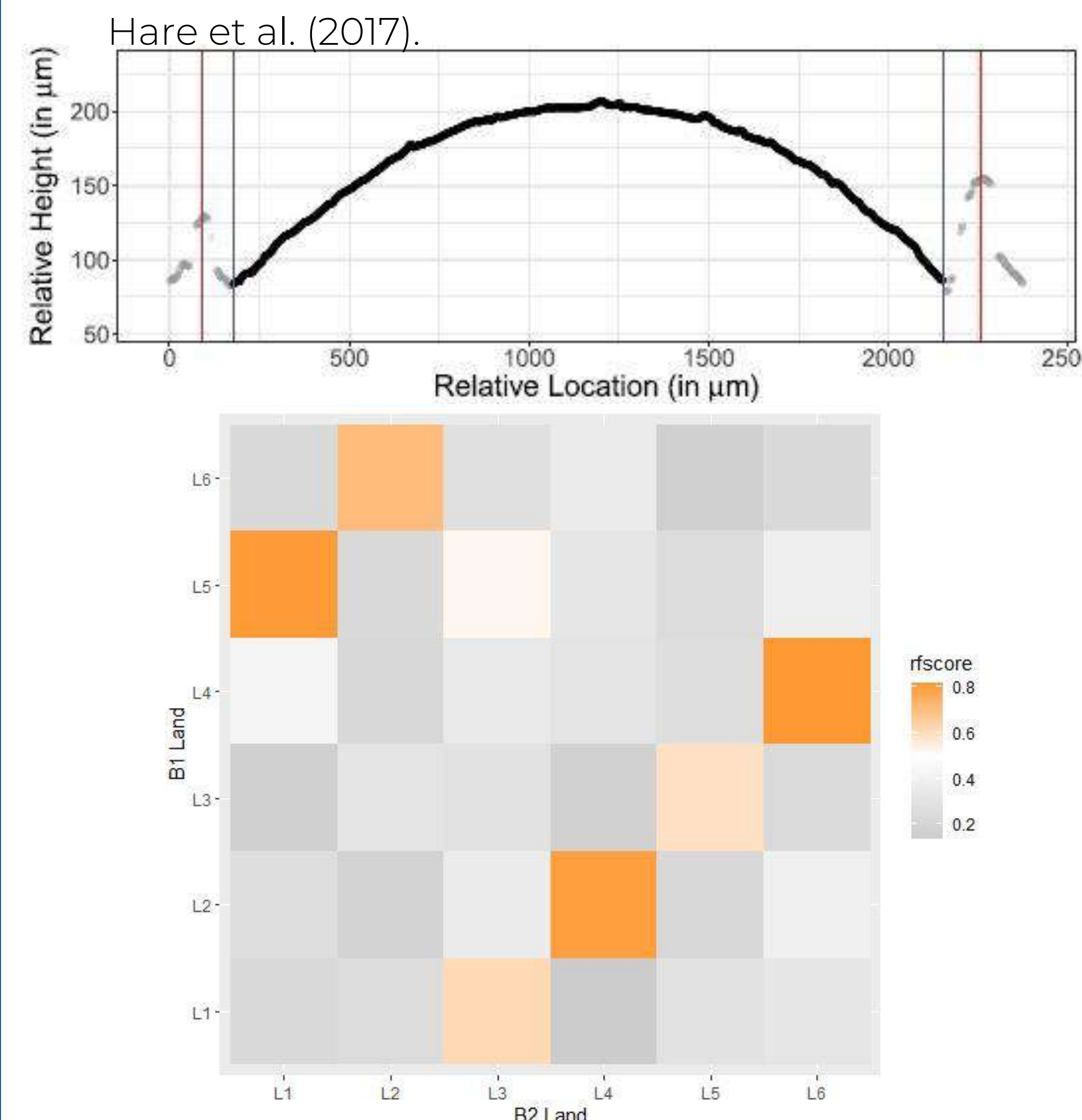


Jury Perception of Bullet Matching Algorithms and Demonstrative Evidence

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Algorithm and Demonstrative Evidence



- Described by Hare et. al. (2017)
- Identify bullet lands
- Apply smoothing function twice to extract signature
- Compare land signatures using random forest
- Calculate bullet-to-bullet match score

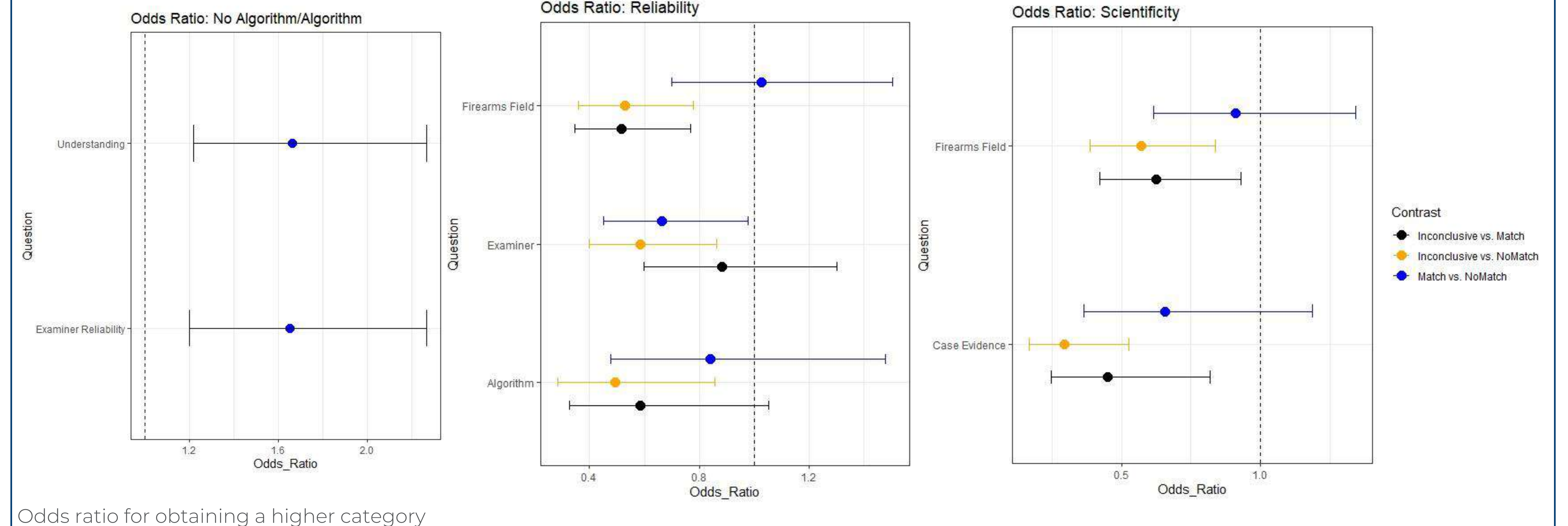
Study Design

- Richard Cole has been accused of a crime – the only evidence linking him to the crime scene? A bullet. (Garrett et al. 2020)
 - This bullet is compared to Richard Cole's firearm, discovered in a routine traffic stop
 - Potential jurors are asked to read testimony pertaining to the case, and make judgements regarding the strength of evidence – and the guilt of the defendant
- 2x2x3 Factorial Design
 - Demonstrative Evidence (Images vs. No Images)
 - Algorithm
 - Forensic Expert Testimony
 - Forensic Expert Testimony + Algorithm Expert Testimony
 - Expert Conclusion (Match vs. Inconclusive vs. Exclusion)
- Prolific representative sample feature
 - 588 participants used in analysis

Limitations

- Typos in survey for approximately half of the participants
- Testimony is written
- Potential jurors unable to deliberate
- Sample is from an online survey-taking website
- Firearm evidence is only evidence presented

Results



*indicates unequal slopes in stepwise ordered logistic regression model

Question	Algorithm	Conclusion	Picture	Algorithm* Conclusion	Algorithm* Picture	Picture* Conclusion	Algorithm*Picture* Conclusion
Gun Crime Probability	0.5687	<0.0001	0.4357	0.5262	0.6291	0.8836	0.6166
Cole Crime Probability	0.7916	<0.0001	0.9539	0.658	0.4996	0.4697	0.9976
Firearm Examiner Credibility	0.9554	0.3727	0.1668	0.9024	0.9989	0.7918	0.5937
Algorithm Expert Credibility	--	0.5437	0.7351	--	--	0.7479	--
Firearm Examiner Reliability	0.0020	0.0177	0.9736	0.2619	0.3499	0.7370	0.7983
Algorithm Expert Reliability	--	0.0360	0.5963	--	--	0.8545	--
Case Evidence Reliability	--	<0.0001*	0.2003	--	--	0.8302	--
Firearms Field Reliability	0.2528	0.0010	0.9297	0.3194	0.5156	0.9426	0.3903
Firearm Examiner Scientificity	0.2972	0.2374	0.8831	0.1332	0.4099	0.5559	0.5693
Algorithm Expert Scientificity	--	0.1352	0.6359	--	--	0.8313	--
Case Evidence Scientificity	--	0.0002	0.9017	--	--	0.1642	--
Firearms Field Scientificity	0.1016	0.0101	0.8404	0.3237	0.9462	0.9507	0.6020
Firearm Examiner Understanding	0.0014	0.6177	0.4429	0.6272	0.7541	0.4305	0.5068
Algorithm Understanding	--	0.4313	0.4318	--	--	0.5688	--
Firearm Uniqueness	0.9735	0.9988	0.9654	0.912	0.9716	0.998	0.8608
Cole Evidence Strength	0.4209	<0.0001*	0.0201	0.0139	0.4335	0.771	0.5396
Gun Evidence Strength	0.1139	<0.0001*	0.6134	0.6004	0.6984	0.3406	0.2071

References

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