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The Evidential Value of Paint. Part II: A Bayesian Approach

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ABSTRACT: Over 1000 vehicles were examined and the make, color and year recorded. In addition, the presence of foreign paint was noted and whether or not there was damage to the vehicle's paintwork that may have given rise to paint being transferred.

Using Bayes' theorem the likelihood ratios for various paint transfer scenarios are calculated. These ratios are then converted to an appropriate verbal equivalent and compared to conclusions used by forensic paint examiners for similar scenarios.

KEYWORDS: forensic science, paint, evidential value, Bayesian, survey

In a recent study (1) we surveyed forensic paint examiners to ascertain the type of conclusion used by them given certain paint transfer scenarios. That survey arose from a situation in our laboratory where different conclusions were being assigned by different scientists to the same findings.

We therefore drew up an internal survey of hypothetical scenarios and invited respondents to assign conclusions. This survey was then broadened and a total of 124 respondents completed the questionnaire.

The conclusions ranged from ''slight support'' to ''conclusive'' depending on the scenario. There was reasonably good agreement on the appropriate conclusion to use for the scenario in question.

That paper (1) also highlighted the difficulty some paint examiners have in adding any type of conclusion. Contributors to the survey also commented on the lack of statistical information on paint and the subsequent difficulty in using the term ''conclusive.''

Having surveyed paint examiners for the conclusions appropriate to a certain set of circumstances, we felt that it was worthwhile using a Bayesian approach to relate likelihood ratios to the conclusions for the various scenarios.

Many studies of the frequency of automobile paint color and layer sequence are available. Tippett (2) counted 20 000 automobiles to check the distribution of vehicle colors and models. Gothard (3) examined automobile paint flakes from the point of view of color, thickness and layer sequence.

Ryland et al. (4) examined the distribution of vehicles by topcoat color, year of manufacture and vehicle make. This study also looked at the layer distribution in the samples studied. Ryland et al. (5) looked at the frequency of occurrences of topcoat colors in the eastern United States. That study examined vehicles in transit and vehicles in parking lots. Discrimination of metallic and nonmetallic paint was possible only for the parking lot vehicles.

Two further studies by Buckle et al. (6) and Volpé et al. (7) give valuable information on the distribution of automobile paint colors in the areas studied.

We decided to conduct an automobile survey to establish a database of information for use in Ireland. Ireland is an island off Western Europe and all the vehicles are imported. Given that we do not manufacture vehicles, our population of vehicles does not resemble even that of our nearest neighbor, the United Kingdom, where there is a well established vehicle manufacturing industry.

In addition to the general information gathered in this type of survey (color, type of finish, make and year) we wished to establish what portion of the vehicle population had evidence of being involved in a collision of some sort. This involved adding a further dimension to the study—to examine each vehicle for traces of foreign paint or for the presence of damage to the surface which would give rise to paint transfer.

This aspect of the study is similar to a study by Briggs (8) where he described an examination of the clothing of people for the presence of human blood. He examined 122 suspects' clothes for blood and when found checked if the blood was the same or not as that of the owner of the clothes.

In the area of glass some studies were carried out to examine clothing for the presence of glass. Pearson et al. (9) examined 100 suits of clothes received for cleaning at a dry cleaning establishment. McQuillan et al. (10) examined 432 garments from individuals who had no suspected involvement in crime. Lambert et al. (11) examined clothing from casework. Items from 589 individuals were examined.

Our study represents an estimation of the number of vehicles of a certain color, finish, make and year on the roads in the Republic of Ireland. More significantly it gives an indication of the number of vehicles in the population that have been involved in some type of collision where paint was transferred to or from the vehicle.

We then used the results of this survey in a Bayesian statistical approach to get an estimate of the likelihood ratio for various paint transfer scenarios.

Experimental

A total of 1007 vehicles were surveyed in three different public car parks. Three observers were used in each of the locations. The layout of the survey data sheet is shown in Table 1.

Prior to the survey, the three observers undertook a sample survey to establish agreement on the distribution between the various colors, light/medium/dark, and as to what criteria were used to decide if paint was transferred to or from a vehicle. The use of the terms ''effect'' and ''solid'' was decided upon instead of ''metallic'' and ''nonmetallic.'' The terms ''effect'' and ''solid'' are those used by European Network of Forensic Science Institutes (ENFSI) paint group and it was felt that these best describe the range of finishes available such as metallic and pearlescent paint.

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TABLE 1—*Sample of survey data sheet.*

Year	Make	Color (1–11)	Shade (L/M/D)	Type (S/E)	Paint Transferred from Vehicle (Y/N)	Foreign Paint on Vehicle (Y/N)

Colors: Gray = 1, Blue = 2, Green = 3, Blue/Green = 4, Red = 5, Brown = 6, Violet = 7, Orange = 8, Yellow = 9, White = 10, Black = 11.
Shade: L = light, M = medium, D = dark.
Type: S = solid, E = effect.

TABLE 2—*Accuracy (±D) of estimation (95% confidence).*

p	n = 500 ± D	n = 1000 ± D
1%	0.9%	0.6%
5%	1.9%	1.4%
10%	2.7%	1.9%
20%	3.6%	2.5%
50%	4.5%	3.2%
80%	3.6%	2.5%
90%	2.7%	1.9%

n = Sample size.
p = True proportion.
D = Accuracy (confidence interval).

Almost all damage, however slight, was included. Many situations arose where slight damage to the bumper showed the presence of white/gray material but these cases were included. In many of these cases it was felt by the observers that a slight contact with a wall was a more likely reason for the damage. The figures for the numbers of vehicles with transferred paint or giving rise to paint transfer are therefore overstated but do give a good indication of the upper limit on the number of such vehicles in the vehicle population.

We chose to survey at least 1000 vehicles in keeping with Ryland's (5) estimation of the confidence interval for this sample number. If a specified color has a true probability of occurrence p, then an approximate 95% confidence interval estimate for p is given by

$$p = \hat{p} \pm 2\,[p(1 - p)/n]^{1/2} \tag{1}$$

where $\hat{p}$ is the sample estimate of p and n is the sample size. Using Eq 1 and a confidence level of 95%, the various confidence intervals for the different p values can be calculated. These are shown in Table 2. From this, it is easy to deduce that if one wishes to estimate p to within an amount $\pm D$ with approximately 95% confidence, the required sample size is

$$n = 4\hat{p}(1 - p)/D^2 \tag{2}$$

(If an approximate confidence of 99% is desired, the numbers 2 and 4 in the above formulas should be replaced by 3 and 9, respectively.) Thus, if a color occurs 5% of the time, a sample of 475 is required if one wishes to be within ±2% of the true value with 95% confidence.

Table 2 gives the accuracy ($\pm D$) of estimation (95% confidence) using sample sizes of 500 and 1000 for various hypothetical values of p, the true proportion. It may be inferred that, especially for small values of p, a sample size of 500 would usually be statistically adequate.

Results and Discussion

The results for color distribution are shown in Table 3. This shows the largest grouping to be medium red solid at 15.1% Using Eq 1 we get the confidence interval (D) for this frequency level to be ±2.2%.

Many of the vehicles in the ''medium red solid'' category were obviously different to the naked eye. All paint examiners know the discriminating power of the microscope is high. This means that this large grouping of 152 vehicles (15.1%) could easily be further subdivided.

The Methuen color card system (12) contains more than 20 distinguishable reds that fall into the ''medium red solid'' category.

The same degree of differentiation, however, is not available in the white solid category. It was not possible to attribute light/medium/dark to this grouping. In addition the discriminating power of the microscope for white paint is low. For practical purposes, the largest single grouping is therefore white solid with 128 vehicles, i.e., 12.7% with a confidence interval of ±2.1%.

At the other end of the scale many of the color categories had very few or no occurrences, e.g., ''light orange solid'' (one vehicle, i.e., 0.1% with a confidence interval of ±0.2%).

This figure is significant in itself for paint examiners as it can be said with 95% confidence that at least 99.7% of automobiles on the road do not fall within the ''light orange solid'' category.

The results for the age of the vehicles are displayed in Table 4 and Fig. 1, together with the most recently published Department of Environment vehicle age information. It can be seen from Fig. 1 that there is a slight bias in our survey towards newer vehicles.

TABLE 3—*Color distribution of vehicles.*

Color	Light		Medium		Dark	
	No.	%	No.	%	No.	%
Gray Effect	88	8.7	42	4.2	57	5.7
Gray Solid	0	0.0	0	0.0	1	0.1
Blue Effect	27	2.7	32	3.2	34	3.4
Blue Solid	1	0.4	32	3.2	28	2.8
Blue/Green Effect	2	0.2	14	1.4	2	0.2
Green Effect	19	1.9	15	1.5	60	6.0
Green Solid	3	0.3	1	0.1	0	0.0
Red Effect	0	0.0	14	1.4	56	5.6
Red Solid	2	0.2	152	15.1	28	2.8
Brown Effect	26	2.6	19	1.9	2	0.2
Brown Solid	6	0.6	2	0.2	3	0.3
Violet Effect	0	0.0	1	0.1	7	0.7
Violet Solid	0	0.0	0	0.0	3	0.3
Orange Effect	0	0.0	0	0.0	2	0.2
Orange Solid	1	0.1	2	0.2	0	0.0
Yellow Effect	0	0.0	0	0.0	0	0.0
Yellow Solid	3	0.3	2	0.2	2	0.2
White Effect	0	0.0	0	0.0	0	0.0
White Solid	128	12.7	0	0.0	0	0.0
Black Effect	0	0.0	0	0.0	30	3.0
Black Solid	0	0.0	0	0.0	58	5.8
Total	394		328		285	

TABLE 4—*Age distribution of vehicles.*

Age (years)	F.S.L. %	D.O.E. %
<1	13.5	10.1
1	10.1	7.9
2	10.0	7.4
3	9.2	6.3
4	7.6	7.0
5	7.0	7.4
6	8.8	9.3
7	7.2	8.9
8	6.0	7.3
9	6.1	6.2
10	4.9	5.8
11	3.4	5.2
12	2.2	3.7
13	1.6	2.4
14	1.5	1.8
15	0.4	1.5
>15	0.6	1.9

F.S.L. = Results of this survey.
D.O.E. = Department of Environment figures.

Table 5 and Fig. 2 show our results for the make of vehicle encountered together with the Department of Environment's most recently published information. This shows that there is good agreement between both sets of results except for the Ford and Toyota categories.

The results of the paint transfer to or from vehicles aspect of the survey are shown in Table 6. It can be seen that a significant number of vehicles (17.1%) show evidence of having been the source of transferred paint while a smaller number of vehicles (9.4%) show evidence of having foreign paint transferred to them.

Bayesian Approach

A detailed background and explanation of Bayes' theorem and its application to forensic science and specifically to transfer evidence is available (13). However, a brief introduction is appropriate.

In the adversarial system of justice, we can visualize two competing hypotheses: C, the defendant committed the crime and $\overline{C}$, the defendant did not commit the crime (i.e., someone else committed the crime).

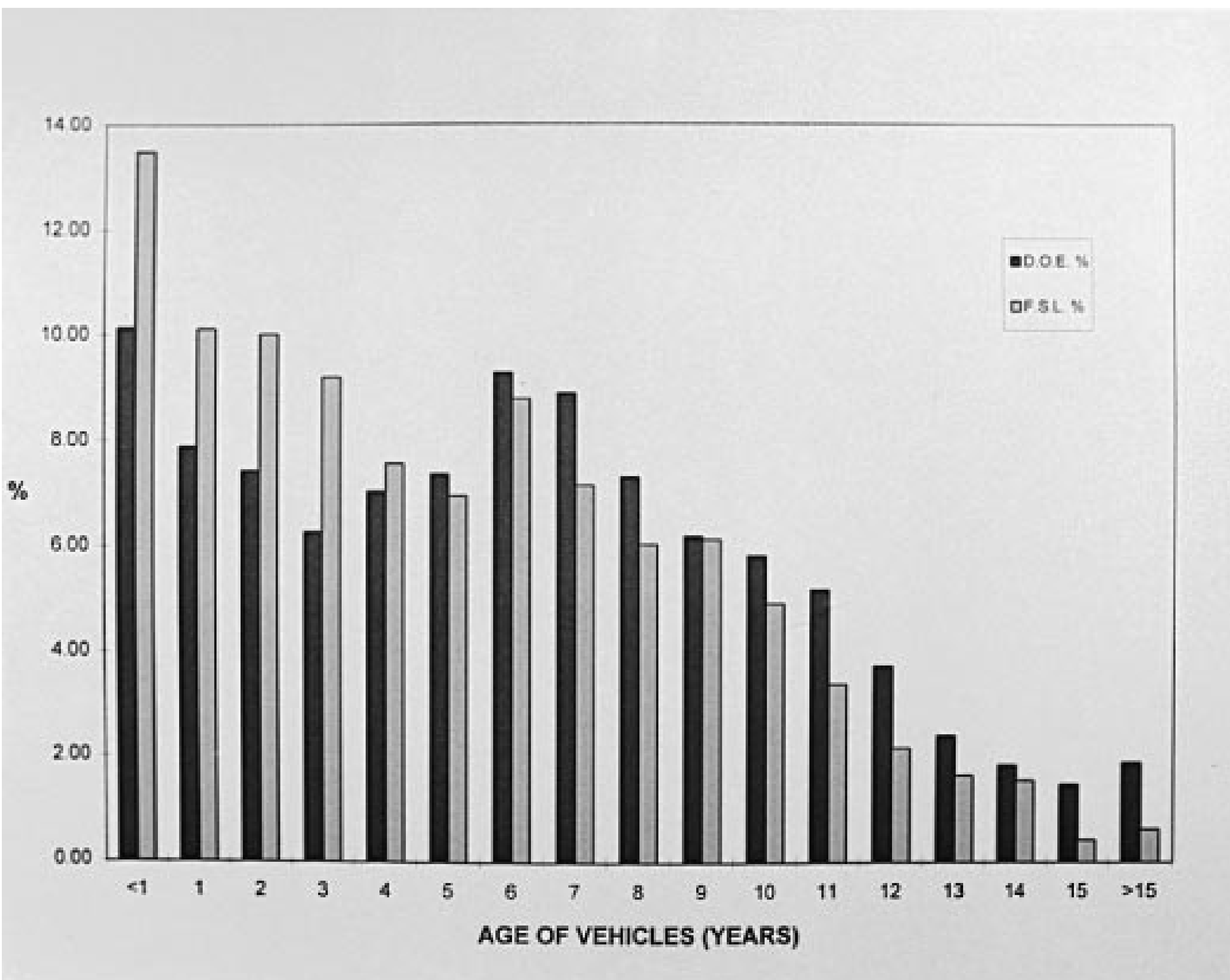

FIG. 1—*Comparison of age of vehicles in present survey (F.S.L.) with those recorded by the Department of the Environment (D.O.E.).*

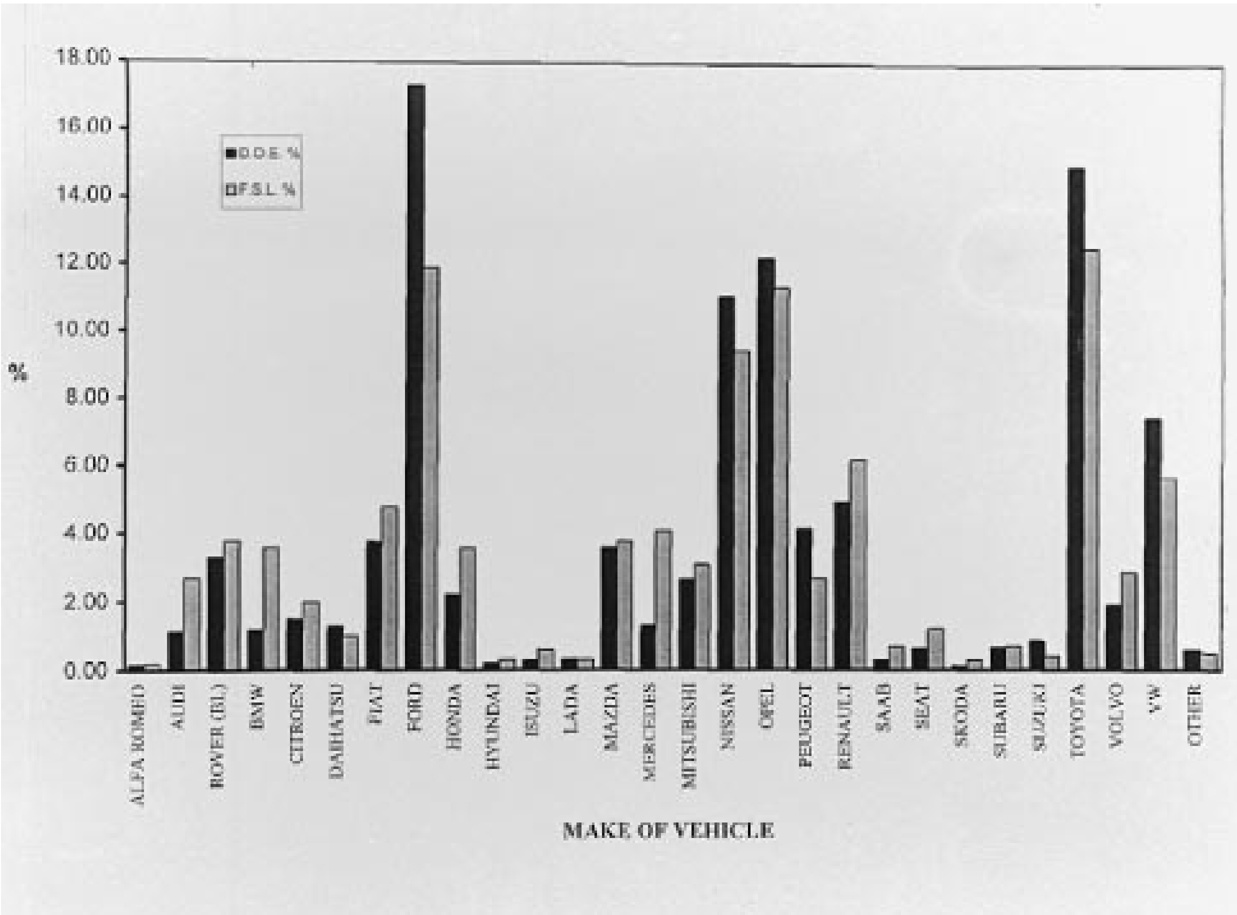

FIG. 2—*Comparison of the make of vehicles in present survey (F.S.L.) with those recorded by the Department of the Environment (D.O.E.).*

Bayes' theorem shows us the effect the scientific evidence has on the odds that C (the defendant committed the crime) is true.

Bayes' theorem states that the odds on C after the scientific evidence (posterior odds) are simply the odds before the scientific evidence (prior odds) multiplied by a factor known as the likelihood ratio (LR). This likelihood ratio LR is:

$$\frac{\text{Probability of evidence if C is true}}{\text{Probability of evidence if }\overline{\text{C}}\text{ is true}} = \frac{P(F/Ci)}{P(F/\bar{C}i)}$$

where i denotes the background information and F represents the scientific findings.

Using Bayes' theorem in the manner published by Evett (14) we can use the above information from the survey to evaluate likelihood ratios for the various scenarios outlined in a previous publication (1).

1. Single Layer of Paint Transferred from Suspect Vehicle to Injured Party's Vehicle

In this instance paint is transferred to the injured party's vehicle and a suspect vehicle is later examined and its paint supplied as a possible source for the foreign paint on the injured party's vehicle. This is analogous to the transfers to the scene in Evett's examples. For the purpose of the exercise the fact that there is damage to the paintwork of the suspect vehicle is ignored.

We are interested in establishing the likelihood ratio considering two possibilities:

C = paint on injured party's vehicle originated from suspect vehicle

$\overline{C}$ = paint on injured party's vehicle originated from random vehicle

Applying Bayes' theorem we find

$$\text{Posterior odds } (O(C/Fi)) = \text{Likelihood ratio (LR)}. \times \text{Prior odds } (O(C/i))$$
$$LR = \frac{P(F/Ci)}{P(F/\bar{C}i)} \quad (3)$$

where

P(F/Ci) = probability of scientific findings if suspect vehicle is responsible.

$P(F/\bar{C}i)$ = probability of scientific findings if another vehicle is responsible.

Note: The background i is omitted for simplicity but the evidence will always be evaluated in the light of background information.

The scientific findings in this case are simple:

F_1 = foreign paint on injured party's vehicle is white, for example.

F_2 = paint on suspect vehicle is white.

TABLE 5—*Vehicle make distribution.*

Vehicle Make	F.S.L. %	D.O.E. %
Alfa Romeo	0.2	0.2
Audi	2.7	1.1
BL (Austin/Rover)	3.8	3.3
BMW	3.6	1.2
Chrysler	0.1	0.0
Citroen	2.0	1.5
Daihatsu	1.0	1.3
Fiat	4.8	3.8
Ford	11.9	17.3
Honda	3.6	2.2
Hyundai	0.3	0.2
Isuzu	0.6	0.3
Lada	0.3	0.3
Mazda	3.8	3.6
Mercedes	4.1	1.3
Mitsubishi	3.1	2.7
Nissan	9.4	11.1
Opel	11.3	12.2
Peugeot	2.7	4.2
Renault	6.2	4.9
Saab	0.7	0.3
Seat	1.2	0.6
Skoda	0.3	0.1
Subaru	0.7	0.7
Suzuki	0.4	0.9
Talbot	0.1	0.1
Toyota	12.5	15.0
Volvo	2.9	1.9
VW	5.7	7.4
Others	0.3	0.5

F.S.L. = Results of this survey.
D.O.E. = Department of Environment figures.

TABLE 6—*Results of survey of damage to vehicles.*

	No.	%
Vehicles giving rise to paint transfer	172	17.1
Vehicles with foreign paint on the surface	95	9.4

The likelihood ratio now becomes:

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{P(F_2/C)}{P(F_2/\overline{C})} \cdot \frac{P(F_1/F_2C)}{P(F_1/F_2\overline{C})} \qquad (4)$$

where

$P(F_2/C)$ = probability that suspect vehicle paint is white given that suspect vehicle is responsible for transfer.

$P(F_2/\overline{C})$ = probability that suspect vehicle paint is white given that another vehicle is responsible for transfer.

$P(F_1/F_2C)$ = probability that foreign paint on injured party's vehicle is white given that suspect vehicle is white and is responsible for transfer.

$P(F_1/F_2\overline{C})$ = probability that foreign paint on injured party's vehicle is white given that suspect vehicle is white and another vehicle is responsible for transfer.

$P(F_2/C) = P(F_2/\overline{C})$ as the probability of F_2 (i.e., the paint on the suspect vehicle is white) is the same for scenarios C and $\overline{C}$. As the color of the suspect vehicle is irrelevant if it is not responsible for the transfer of the paint, then $P(F_1/F_2\overline{C})$ becomes $P(F_1/\overline{C})$. Equation 4 now simplifies to

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{P(F_1/F_2C)}{P(F_1/\overline{C})} \qquad (5)$$

The numerator

$P(F_1/F_2C)$ = 1, that is, the probability that paint on injured party's vehicle would be same as suspect vehicle if suspect vehicle left paint = 1.

In the case of the denominator we must evaluate the scientific findings in the light of the foreign paint originating from any other vehicle, i.e.

$P(F_1/\overline{C})$ = frequency of that particular color; let this frequency be denoted by fc.

Now

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{1}{fc} \qquad (6)$$

Substituting the frequency value for white solid paint value from the survey, the likelihood ratio becomes:

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{1}{0.127} = 7.9$$

This likelihood ratio obviously varies depending on color. Substituting the value for the more unusual colors from this survey we get a likelihood ratio of approximately 1000.

2. Single Layer of Paint Transferred from Injured Party to Suspect Vehicle

If we now look at the same type of transfer in the other direction the situation is more complicated.

In this example the foreign paint found on a suspect vehicle matches the injured party's vehicle. Again no inference is taken from the presence of damage to the injured party's vehicle.

The possibilities to be examined are

C = paint on suspect vehicle originated from injured party's vehicle.
$\overline{C}$ = paint on suspect vehicle originated from a random source.

The scientific findings consist of

F_1 = injured party's vehicle is white.
F_2 = foreign paint on suspect vehicle is a matching white.

So

$$\text{Likelihood ratio} = \frac{P(F/C)}{P(F/\overline{C})} = \frac{P(F_1/C)}{P(F_1/\overline{C})} \cdot \frac{P(F_2/F_1C)}{P(F_2/F_1\overline{C})} \qquad (7)$$

As in Scenario 1

$$P(F_1/C) = P(F_1/\overline{C})$$

In the $\overline{C}$ scenarios, i.e., where a source other than the injured party's vehicle gave rise to the paint on the suspect vehicle, then the foreign paint found on the suspect vehicle is independent of the injured party's vehicle, so $P(F_2/F_1\overline{C})$ becomes $P(F_2/\overline{C})$.

Equation 7 is simplified to

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{P(F_2/F_1C)}{P(F_2/\overline{C})} \quad (8)$$

We need information from the survey to evaluate the probabilities. We first consider the numerator, i.e., the C situation: Let b signify the probability that a random vehicle will have foreign paint on it; q signify the probability that the foreign paint would match that from the injured party's vehicle; and t denote the likelihood of paint transferring in the course of this accident and consisting of one top coat layer.

In this instance the white paint can be on the suspect vehicle for one of two reasons: (a) no paint was transferred and there was already white paint on the vehicle, i.e., $((1 - t)\cdot b\cdot q)$, or (b) it was transferred from the injured party's vehicle, i.e., $(t\cdot(1 - b)\cdot 1)$.

Now by adding the two probabilities at (a) and (b) we get the numerator

$$P(F_2/F_1C) = ((1 - t)\cdot b\cdot q) + (t(1 - b)\cdot 1)$$

We now consider the denominator, i.e., the $\overline{C}$ situation $= P(F_2/\overline{C}) = b\cdot q$ so the likelihood ratio becomes

$$\frac{P(F/C)}{P(F/\overline{C})} = (1 - t) + \frac{t(1 - b)}{b\cdot q} \quad (9)$$

If the likelihood ratio is considerably greater than 1, then Eq. 9 is further simplified to

$$\frac{P(F_2/F_1C)}{P(F_2/\overline{C})} = \frac{t(1 - b)}{b\cdot q} \quad (10)$$

0.8 is a value for ''t'' suggested by the authors on the basis of experience; i.e., we estimate that paint consisting of at least a top layer is transferred in 80% of collisions investigated:

$t \simeq 0.8$
$b \simeq 0.094$ from survey (Table 6)
$q \simeq fc = 0.127$ (for white solid)

so

$$\frac{P(F/C)}{P(F/\overline{C})} = 61$$

This ratio is obviously also greatly affected by the value for the frequency of color, but it can be seen to be more significant than the suspect to injured party scenario by a factor of approximately 10.

3. Exchange of Single Layer Paints

In the two-way transfer of single layers of paints the likelihood ratios of the above two scenarios are multiplied, i.e.

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{1}{fc}\cdot\frac{t(1 - b)}{b\ q} \qquad \text{that is, Eq 6} \times \text{Eq 10}$$

Again substituting values for the most commonly occurring color the likelihood ratio becomes 475—a large increase on the one-way transfer in either direction.

4. Transfer of Multilayer Manufacturer's Finish from Suspect Vehicle to Injured Party

Using the logic in Scenario 1:

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{P(F_1/F_2C)}{P(F_1/\overline{C})}$$

again

$$P(F_1/F_2C) = 1$$

but in this instance

$$P(F/\overline{C}) = (\text{frequency of color } (fc)) \times (\text{frequency of manufacturer } (fm))$$

Note: Color and manufacturer are treated as being independent because of the broad classification used under the heading ''color'' so

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{1}{fc\cdot fm} \quad (11)$$

choosing white solid color and the most common manufacturer from our survey

$$\frac{1}{fc\cdot fm} = \frac{1}{(0.127)(0.125)} = 63$$

This is approximately a tenfold increase in the likelihood ratio over the same situation when only the top layer is transferred.

It must be remembered that this figure is derived from the most commonly occurring color and the most commonly occurring manufacturers.

5. Multilayer Manufacturer's Finish Transferred from Injured Party to Suspect Vehicle

In this instance we can use Eq 10, i.e.

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{t(1 - b)}{b\cdot q}$$ and substitute the appropriate values

Let

t = likelihood of a multilayer manufacturer's paint transferring in the course of this accident. We set that figure conservatively at 0.4, i.e., 50% of cases where paint is transferred. (So t = 50% of 0.8; see Scenario 2.)
b = probability that a random vehicle will have foreign multilayer paint on it. In our survey we found foreign paint on 9.4% of vehicles. In the opinion of the surveyors none of these seems to be multilayer though it is acknowledged that this is difficult to assess in the field. We suggest 1% as a conservative value.
q = probability that the foreign paint would match the top coat of the injured party's vehicle and share the same manufacturer's layer structure, i.e. $(fc\cdot fm)$.

TABLE 7—*Comparison of conclusions (for various scenarios) from a previous survey with conclusions suggested based on likelihood ratios.*

Scenarios	Likelihood Ratio Values from This Study	Suggested Verbal Descriptions for These Values (14)	Verbal Descriptions Preferred by the Majority of Participants in Previous Survey (1)
1	8	weak/slight support	slight support
2	61	support	slight support
3	475	strong support	support
4	63	support	support
5	2494	very strong support	support
6	157 122	very strong support	strong support

Substituting the values for white solid Toyotas from the survey

$$\frac{P(F/C)}{P(F/\overline{C})} = \frac{(0.4)(0.99)}{(0.127)(0.125)(0.01)} = 2494$$

6. Exchange of Multilayer Manufacturer's Finish

As in Scenario 3 above

$$\text{Likelihood ratio} = \frac{P(F/C)}{P(F/\overline{C})} = \frac{1}{fc \cdot fm} \cdot \frac{t(1 - b)}{b\ q} = 157\ 122$$

Using this logic we realize that exchange of nonmanufacturer's finish must be even higher in likelihood ratio value.

The above arguments show that transfers *from* the injured party's vehicle are more significant than transfers *to* the injured party. In the case of transfer of single layers the likelihood ratio is approximately ten times greater for transfer from the injured party while in the case of transfer of multilayer manufacturer's finish the ratio is approximately 40 times greater.

Similar scenarios were circulated previously and the results of this questionnaire form the basis of a previous paper (see Table 7). In that exercise the difference between paints transferred to and from the injured party was not highlighted.

Conclusion

A Bayesian approach to paint evidence can give useful information to assist forensic paint examiners evaluate the significance of their findings.

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ERRATA/CORRECTIONS

We have identified a number of instances in which the authors of work published in the Journal of Forensic Sciences have miscited papers originally published in the Journal of the Forensic Science Society as having been published in the Journal of Forensic Sciences.

The known instances of this error for volume 44 of the Journal of Forensic Sciences are detailed/corrected below. We have not checked other volumes for similar errors. The Journal of Forensic Sciences regrets these errors.

Since 1995 (Volume 35), the Journal of the Forensic Science Society has been published under the title "Science and Justice."

The editors of both journals take this opportunity to remind authors of the necessity for ensuring the accuracy of the references they cite in manuscripts submitted for publication. The Instructions for Authors of both journals make it clear that accuracy of reference citation is the responsibility of authors, and good scholarship demands attention to this matter.

A. R. W. Forrest	R. E. Gaensslen
Editor, Science and Justice	Editor, Journal of Forensic Sciences

The journal citation in reference 7 in Foreman LA, Smith AFM, Evett IW. Bayesian validation of a quadriplex STR profiling system for identification purposes. should read: J Forensic Sci Soc 1992;32:5–14.

The journal citation in reference 5 in Bourel B, Hedouin V, Martin-Bouyer L, Becart A, Tournel G, Deveaux M, Gosset D. Effects of morphine in decomposing bodies on the development of Lucila sericata (Diptera: Calliphoridae). should read: J Forensic Sci Soc 1991;31:469–72.

The journal citation in reference 8 in Hedouin V, Bourel B, Martin-Bouyer L, Becart A, Tournel G, Deveaux M, Gosset D. Determination of drug levels in larvae of Lucila sericata (Diptera: Calliphoridae) reared on rabbit carcasses containing morphine. should read: J Forensic Sci Soc 1994;34:95–7.

The journal citation in reference 15 in Hedouin V, Bourel B, Martin-Bouyer L, Becart A, Tournel G, Deveaux M, Gosset D. Morphine perfused rabbits: A tool for experiments in forensic entomotoxicology. should read: J Forensic Sci Soc 1991;31:469–72.

The journal citation in reference 10 in McDermott SD, Willis SM, McCullough JP. The evidential value of paint. Part II. A Bayesian approach. should read: J Forensic Sci Soc 1992;32:333–48.

The journal citations in references 4 and 5 in Infante F, Dominguez E, Trujillo D, Luna A. Metal contamination in illicit samples of heroin. should read for 4: J Forensic Sci Soc 1979;19:203–9. and for 5: J Forensic Sci Soc 1980;20:177–81. [in reference 5 only the volume number is miscited]. And in both references, the lead author's name is "Joyce JR."

The journal citation in reference 1 in Savolainen P, Lundeberg J. Forensic evidence based on mtDNA from dog and wolf hairs. should read: J Forensic Sci Soc 1988;28:335–9.

The journal citation in reference 1 in Kupfer DM, Chaturvedi AK, Canfield DV, Roe BA. PCR-based identification of postmortem microbial contaminants—A preliminary study. should read: J Forensic Sci Soc 1968;8:73–6.

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