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A Survey of Vehicle Top Coat Colour in Malaysia

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ABSTRACT: Automotive paint is frequently encountered as trace evidence in forensic investigation. Beside microscopic and instrumental examinations, frequency of occurrence data may help the investigator to assess the value of paint evidence. This study aimed to investigate the on the road automobile paint colour distribution in selected cities in Malaysia, namely Kuala Lumpur, Petaling Jaya, Shah Alam, Johor Bahru, Nilai, Kuala Terengganu and Kota Bharu. Out of 7,553 moving vehicles randomly sampled in the seven different locations, light grey, white and black were the top three colours, making up about 52% of the total car population. When the data from two cities, i.e. Kota Bharu dan Kuala Terengganu were compared to the survey conducted in 2011, there was significant difference at 95% significant level which indicated the dynamic distribution of Malaysian automotives. Hence, the information from this survey could support forensic opinion when the assessment on evidential value is requested.

Keywords: forensic science, paint, top coat colour, frequency distribution

Introduction

Automotive paint is the decorative or protective coating applied to a vehicle [1] which can become trace evidence in forensic investigation such as hit-and-run accidents. Identification of the colour and model of a suspected vehicle and comparison of the paint flake evidence taken from an accidental scene to those collected from a suspected vehicle [2] are therefore necessary. Microscopic examinations provide morphological features of the paint flakes (*i.e.* number and order of layers, colour, thickness and reactions with solvents as well as the physical matching of questioned and known flakes) while chemical examinations further characterise a particular flake [1-3]. During the trial, explanation on the value of the questioned paint flake by an examiner following careful assessment of the probative meaning of the results is important [3,4]. Data on the frequency of occurrence or distribution of vehicles on the road is therefore valuable to a forensic scientist [5]. As such, a probative statement could provide further significance with the support of distribution frequency data of top coat colours of automotives [4]. When a questioned paint flake on a victim's clothes and a known sample taken from a suspected source were observed to have the same colour and layer sequence, both could have originated from the same painted surface. If the examiner also states that "the probability of red coloured car on the road at a certain location is one in every ten vehicle, and red is the second highest colour frequency according to a survey" [4]. This allows the court to better understand the opinion and evidential value of that paint flake.

The frequency distribution of automotive paint colour from one geographical area to another could be differed [3]. Information from the Registrar of Motor Vehicle was reported to be consistent with the results from the survey on frequency distribution of top coat colours in some countries [6-7]. Nonetheless, the official records of registered vehicle in one state may not reflect the actual on-the-road vehicles especially with good transportation connection among states. In such situation, on-the-road survey could provide more accurate information on actual vehicle colour distribution used at a particular place.

In this work, the frequency distribution of top coat colour for each car was calculated at seven cities in Malaysia. The data obtained in the survey conducted was also compared to those recorded in 2011 to study if the frequency distribution was changed or remained similar after three years period.

Methodology

Seven city areas in Malaysia, namely Kuala Lumpur (KL), Petaling Jaya (PJ), Shah Alam, Johor Bahru (JB), Nilai, Kuala Terengganu

(KT) and Kota Bharu (KB), were selected. The colours used were black, white, off-white, green blue, red, red orange, red brown, gold, gold brown, yellow green, maroon, purple and pink as well as the light, medium and dark shades of brown, blue, grey, green and yellow. An additional "misc" was added to describe the colour other than those listed.

All data was recorded at the road side at all locations while observing the top coat colour of moving vehicles. Each vehicle that passed the position of observer was observed its top coat colour. The data was counted and recorded on paper using alphabetical codes. All recorded entries were tabulated and subjected to statistical analysis. The data from two cities, namely Kota Bharu and Kuala Terengganu were also compared to the survey conducted in 2011.

Results and Discussion

Colour distribution on different towns in Malaysia

In this work, 7,553 vehicles were randomly sampled at seven different locations. The colours of vehicles were broken down into 30 categories, showing the percentage (Table 1) of each colour for each city.

Table 1: Percentage of each colour from each town of the vehicle survey

Colour	KL (n=1050)	PJ (n=1177)	Shah Alam (n=1094)	JB (n=1035)	Nilai (n=1187)	KT (n=1008)	KB (n=1002)	Total (n=7553)
Black	14.57	13.85	16.82	9.86	16.85	19.84	15.27	15.29
Light blue	3.14	3.48	4.02	5.51	7.16	2.08	4.89	4.37
Medium blue	1.62	1.10	1.10	0.87	0.59	0.20	0.50	0.86
Dark blue	3.62	4.50	5.30	4.25	3.03	4.27	5.49	4.33
Green blue	1.81	1.87	0.64	1.55	0.67	0.69	0.70	1.14
Light brown	5.05	5.78	5.48	5.70	6.66	3.47	4.89	5.34
Medium brown	1.05	1.44	1.65	1.55	2.61	0.40	0.80	1.39
Dark brown	0.76	1.44	1.37	2.03	0.76	1.49	1.00	1.26
Red brown	1.90	1.27	1.28	1.84	1.35	1.88	1.10	1.51
Red	3.05	3.99	4.30	3.48	4.21	5.85	5.29	4.29
Red orange	1.05	1.44	1.10	1.16	0.84	0.00	0.90	0.94
Gold bronze	0.10	0.93	0.09	0.00	0.00	0.00	0.00	0.17
Light grey	**18.76**	**20.31**	**17.73**	19.32	**19.97**	17.46	16.07	18.59
Medium grey	3.24	3.82	2.47	1.93	2.19	1.88	1.00	2.40
Dark grey	8.67	5.95	5.94	3.19	5.48	4.66	2.89	5.30
Light green	2.10	2.04	2.65	3.00	1.52	2.28	4.09	2.49
Medium green	0.29	0.34	0.09	0.58	0.08	0.20	0.30	0.26
Dark green	0.67	0.34	0.64	1.16	0.42	0.50	1.50	0.73
Yellow green	0.48	1.70	0.37	0.19	0.84	0.00	0.00	0.54
Light yellow	2.19	1.95	2.10	2.32	2.86	1.39	2.00	2.13
Medium yellow	0.19	0.17	0.18	0.19	0.08	0.89	0.10	0.25
Dark yellow	1.33	1.02	1.01	1.26	0.67	0.99	2.00	1.17
Maroon	1.33	1.87	1.01	1.45	1.10	0.50	1.50	1.26
Orange	0.67	1.53	1.01	1.06	0.76	1.59	1.20	1.11
Purple	1.43	1.36	2.56	2.90	1.94	1.59	1.40	1.88
Pink	0.10	0.17	0.18	0.29	0.34	0.30	0.30	0.24
White	17.71	14.44	17.37	**21.55**	13.56	**22.12**	**22.55**	18.26
Off white	3.05	1.53	1.28	1.74	3.03	2.98	2.10	2.24
Gold	0.00	0.25	0.09	0.10	0.42	0.40	0.20	0.21
Misc	0.10	0.08	0.18	0.00	0.00	0.10	0.00	0.07
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Light grey, white and black were the top three colours and made up more than 52% of the total population of the cars in this survey. Of these, light grey is the most frequently encountered colour (18.59%), preceding white (18.26%) and black (15.29%) colours. Other colours were recorded with lower proportion (< 5.34%) of the total car population.

The colour distribution ranking did not show the same order in each city. Nonetheless, light grey, white, black, light brown, dark grey, light blue, dark blue and red were always the top eight choices in almost all the towns although the ranking changed among the colours. Light grey was the most common colour in KL, PJ, Shah Alam and Nilai, but white was the colour of choice in JB, KT and KB. These two colours ranked the top two colours in five cities except Nilai and KT where black is the second most frequently encountered colour.

The percentage differences in most of the ranking orders were minor. An exception to this general description was observed in KB where dark grey was not listed in the top eight colours, and light green appeared quite often

with more than 4% of the total car population. It is also worth noting that both KT and KB have very high percentages of red cars (>5%) compared to other cities.

Comparison of data with 2011 survey

The data from two cities, KB and KT was compared to those obtained in 2011 (data not published). The colour distribution was arranged on the basis of the percentage of cars of a given colours, Table 2.

Table 2: Comparison of survey between 2014 and 2011 in KB and KT

Colour	KB		KT	
	2014 (n=1002)	**2011 (n=2500)**	**2014 (n=1008)**	**2011 (n=2499)**
Black	15.27	11.32	19.84	11.48
Light blue	4.89	3.36	2.08	4.60
Medium blue	0.50	2.48	0.20	3.44
Dark blue	5.49	3.76	4.27	4.12
Green blue	0.70	2.48	0.69	1.56
Light brown	4.89	5.08	3.47	4.64
Medium brown	0.80	2.00	0.40	2.24
Dark brown	1.00	0.60	1.49	2.00
Red brown	1.10	1.00	1.88	1.88
Red	5.29	6.52	5.85	4.92
Red orange	0.90	0.88	0.01	1.32
Gold bronze	0.01	1.24	0.01	0.44
Light grey	16.07	23.12	17.46	22.92
Medium grey	1.00	2.44	1.88	5.56
Dark grey	2.89	4.36	4.66	3.92
Light green	4.09	1.92	2.28	3.36
Medium green	0.30	1.12	0.20	0.32
Dark green	1.50	0.92	0.50	1.12
Yellow green	0.01	1.16	0.01	0.44
Light yellow	2.00	1.76	1.39	1.68
Medium yellow	0.10	0.60	0.89	0.32
Dark yellow	2.00	0.48	0.99	0.08
Maroon	1.50	1.96	0.50	1.52
Orange	1.20	2.56	1.59	1.12
Purple	1.40	1.52	1.59	1.48
Pink	0.30	0.12	0.30	0.08
White	22.55	13.04	22.12	10.28
Off white	2.10	2.16	2.98	3.12
Gold	0.20	0.00	0.40	0.01
Misc	0.01	0.04	0.10	0.04
Total	**100.00**	**100.00**	**100.00**	**100.00**

Light grey, white and black were consistently common for both surveys, remained the top three colours of choice. In 2011, light grey was the preferred colour in most of the car users in KB (23.12%) and KT (22.92%), but the white colour appeared as the more popular colour in 2014, recording more than 22% of the total car population. Black has also showed a noticeably increase in their percentage of the car population, especially in KT which reporting more than 8% increase as compared to earlier survey. However, considerably decrease in the popularity of light grey colour was observed from about 23% to 16% for both cities. The next seven colours (red, light green, light brown, dark grey, light blue, dark blue and off white) completed the top ten choices in the two cities although the ranking changed among the colours.

A G-test was used to analyse the frequencies between the present data (2014) to the 2011 survey [8]. Table 3 shows the critical value at p= 0.05 and the calculated G value from the G-test in the two selected towns. Our analysis shows the data from the two surveys in both KB and KT were significantly different at the 95% significant level.

Table 3: Critical value at p= 0.05 and the calculated G value in two selected towns

Town	Degree of freedom (df)	Critical value (p= 0.05)	Calculated G-value	Conclusion
KB	25	37.652	210.38	Calculated G > Critical value
KT	25	37.652	276.2	Calculated G > Critical value

In Malaysia, most of vehicles were dominated by the two major local manufacturers in the country, namely Proton Holdings Berhad and Perodua Auto Corporation Sdn, Bhd, their marketing, the fashion trends could greatly affect the colour distribution of Malaysian vehicle. As the top coat colour distribution is dynamic, such survey should be conducted at least once in every two years to reflect the actual on-the-road vehicle colour distribution as there was change in the distribution in the study over the three years period as evident in KB and KT. This is vital in order to update the distribution data and also the evidential value of any paint flakes collected in the future.

Conclusion

To conclude, light grey, white and black colours are the top three colours of choice by Malaysian car users, although there was slightly difference between the cities of interest. This study showed also the dynamic colour distribution on the vehicle over the time. The information from the vehicle top coat in this survey could support and strengthen forensic opinion on probative meaning of paint evidence, particularly in cases involving vehicle.

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References

1. Willis S., McCullough J., McDermott S. (2001). The interpretation of paint evidence. In: Caddy B. (ed.) *Forensic Examination of Glass and Paint*. New York: Taylor and Francis.
2. Gothard J. A. (1976). Evaluation of automobile paint flakes as evidence. *Journal of Forensic Sciences*, 21(3): 636-641.
3. Ryland S. G., Kopec R. J. (1979). The evidential value of automotive paint. *Journal of Forensic Sciences*, 24(1): 140-147.
4. Buckle J., Fung T., Ohashi K. (1987). Automotive topcoat colours: Occurrence frequencies in Canada. *Canadian Society of Forensic Science Journal*, 20(2): 45-56.
5. Ryland S. G., Kopec R. J., Somerville P. N. (1981). The evidential value of automotive paint. Part II: Frequency of occurrence of topcoat colors. *Journal of Forensic Sciences*, 26(1): 64-74.
6. Stone H. S., Murphy K. J., Rioux J. M., Stuart A. W. (1991). Vehicle topcoat colour and manufacturer: Frequency distribution and evidential significance. Part II. *Canadian Society of Forensic Science Journal*, 24(3): 175-185.
7. Volpe G. G., Stone H. S., Rioux J. M., Murphy K. J. (1988). Vehicle topcoat colour and manufacturer: Frequency distribution and evidential significance. *Canadian Society of Forensic Science Journal*, 21(1&2): 11-18.
8. Fowler J., Cohen L. (1990). *Practical statistics for field biology*. Philadelphia: Open University Press.

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The Prevalence of Borderline Personality Disorder, Antisocial Tendencies, and Aggression among Male and Female Inmates

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ABSTRACT: The objective of this study was to identify and compare the prevalence of borderline personality disorder, antisocial tendencies, and aggression between male and female inmates. A cross-sectional study involving inmates at prisons in Peninsular Malaysia was designed. Self-report psychometric instruments were used for data collection followed by descriptive analysis, independent *t*-test, and Pearson's correlation test. The findings showed that the prevalence of borderline personality disorder and antisocial tendencies behaviours are considerably high in both male and female inmates. In addition, both groups indicated high tendencies for four aggression scales. Comparison between the gender groups showed that only antisocial tendencies and physical aggression were significantly different between male and female inmates. Further tests demonstrated significant correlations between all variables, indicated that borderline personality disorder, antisocial tendencies, and aggression were associated. In conclusion, borderline personality disorder, antisocial tendencies, and aggression were highly prevalence among male and female inmates.

Keywords: borderline, personality disorder, antisocial tendencies, aggression, inmates

Introduction

Recent decades have witnessed the growing trend of prison population all over the world [1, 2]. Both male and female inmates are increasing in number although different paces. Although male inmates are still dominating, the percentage of female inmates per prison population also shows an increase. In the United State of America, more than 200% of increase was demonstrated by male inmates in between 1983 to 2004, whereas female inmates increased about 468% within the same period [2]. In England and Wales, an average of 3.7% rate of increase was recorded for the prison population since 1993 [3]. From 2002 to 2012, male prison population increased about 30% compared to 12% of the female counterpart [3]. The similar trend was observed in Australia where an increase of more than 200% among female inmates population within 10 years and the male inmate population increased more than 70% within the same period in some states [4]. Generally, most countries in the world have experienced the same trend of increasing prison population.

The conspicuous trends of the prison population warrant for certain rectification and preventive measures. The alarming situation so far has led to increasing exploration of the underlying factors for offending in both male and female. Various studies involving prison population have been conducted to acquire their contributing factors for offending [e.g. 5-7]. In addition to specific motive to achieve certain goal in committing the crime, the offending behaviours have also been related to mental and behavioural health issues. One of the most speculated factors is the presence of personality disorders, particularly the Cluster B personality disorders. The Cluster B personality disorders include antisocial, borderline, histrionic, and narcissistic personality disorders [8]. Antisocial personality disorder and borderline personality disorder have often been associated to criminal offending since the two subtypes of personality disorders are strongly associated with human aggressive behaviours [5-7].

Prison studies to explore the prevalence of criminal risk factors, the impacts, and the effective prevention strategies were conducted abroad [e.g. 5, 7]. Only little of such studies have been conducted in Malaysia [e.g. 9, 10] where empirical data relating to risk factors for criminal offending among inmates is scarce. Therefore, this study aimed to provide the necessary data related to criminal offending with the objective to identify and compare the prevalence of borderline personality disorder, antisocial tendencies, and