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Personality and accident liability: are extraversion, neuroticism and psychoticism related to traffic and occupational fatalities?

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Abstract

The aim of the present study was to investigate the relationship between extraversion, neuroticism and psychoticism, and road traffic fatalities in a data set of 34 nations. In addition to traffic fatalities per 100,000 vehicles, work-related fatalities were included in the study. Results showed that extraversion had a positive relation to the number of traffic fatalities whereas neuroticism correlated negatively with road fatalities. Occupational fatalities were strongly related to deaths on the roads but not to personality dimensions. Countries with high extraversion scores had more traffic fatalities than countries with moderate or low extraversion scores. The need for well-designed studies investigating the link between personality factors and traffic accident liability via driver behaviour was expressed. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Since the well-known slogan "a man drives as he lives" by Tillman and Hobbs (1949), it has been assumed that a driver's personality influences his/her driving style. Numerous personality factors have been included in studies as possible correlates of traffic accidents (for review, see Beirness, 1993; Elander, West & French, 1993; Lester, 1991). Among these studies, especially studies investigating the relationships between traffic accidents and extraversion, neuroticism and psychoticism as personality dimensions have been interesting.

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Although the Eysenckian three-dimensional structure of personality is well-established, research findings about the relationships between the "big three" and traffic rates have been conflicting (Beirness, 1993; Elander et al., 1993; Lester, 1991). Eysenck (1965) suggested that persons scoring high in extraversion and neuroticism are more likely to have accidents. Some studies have reported a positive relationship between extraversion and accident involvement (Craske, 1968; Fernandez Seara, 1978; Fine, 1963; Loo, 1978; Shaw & Sichel, 1971; Smith & Kirkham, 1981) whereas in other studies no relationship has been found (Perrine, 1970; Wilson & Greensmith, 1983) or the relationship has been in the opposite direction (Andersson, Nilsson & Henriksson, 1970; Pestonjee & Singh, 1980). Hence, results about relationships between extraversion and higher number of traffic accidents have been rather mixed.

Most of the studies about neurotisicm and traffic accident involvement have not found any relationship between neuroticism and accident rate. This lack of relation has been reported both in studies applying correlation techniques (Craske, 1968; Smith & Kirkham, 1981) and a criterion group design (Isherwood, Adam & Hornblow, 1982; Perrine, 1970; Pestonjee & Singh, 1980; Wilson & Greensmith, 1983). In Shaw and Sichel's (1971) study bus drivers with bad safety records had higher neuroticism scores than drivers with less accidents. In some other studies, however, the risky drivers have scored lower in neuroticism than drivers with less accidents (Andersson et al., 1970; Furnham & Saipe, 1993).

Most of the studies have been aimed at investigating the role of neuroticism and extraversion in traffic safety. Furnham and Saipe (1993) studied the differences in psychoticism scores between 20 convicted and 50 non-convicted drivers. According to their results, convicted drivers scored higher in psychoticism and lower in neuroticism. Since people scoring high in psychoticism can be described as being "tough-minded", disregarding danger and lacking feelings of guilt (Eysenck & Eysenck, 1991), it is not surprising that convicted drivers scored higher in psychoticism. These findings by Furnham and Saipe (1993) might, however, indicate that psychoticism is related to traffic convictions rather than directly to traffic accidents.

In general, the results of studies about personality correlates of traffic accident involvement are relatively mixed. One reason for these sometimes conflicting results might be the large variety of instruments used to measure extraversion or neuroticism including different Eysenckian questionnaires (MPI, EPI and EPQ), TAT (Shaw & Sichel, 1971) and MMPI (Fine, 1963). Different measures of extraversion and neuroticism might stress different aspects of the dimension concerned and, therefore, lead to different results. For example, Loo (1979) found that when extraversion scores were broken down into sub-scales of impulsiveness and sociability, impulsiveness alone carried the relationship to risky driving. Similarly, it can be supposed that some aspects of neuroticism, like moodiness and nervousness, may increase a driver's accident risk by increasing the number of driving errors whereas other aspects of neuroticism (like being a worrier) might actually strengthen a person's concern for safety. It is also possible that the negative effects of neuroticism and extraversion on driver behaviour occur only among drivers with extremely high scores (Smith & Kirkham, 1981).

Even more than various measures of personality, different criteria for "safe driving" or "accident involvement" may lead to different results. Most often "safe driving" has been defined as a lack of accidents in the past and a "risky driver" is, consequently, a driver with many accidents. It should be noted, however, that a driver's accident history is related to his/her annual mileage and to the type of exposure to different driving conditions (type of road, time of day, etc). There are only a few studies in which exposure and driving experience have been measured and controlled.

In addition, the way of measuring a driver's accident liability influences the possible results: self-reports can be biased because of forgetting (Maycock, Lockwood & Lester, 1991) and impression management (Lajunen, Corry, Summala & Hartley, 1997). On the other hand, accident estimates based on official records do not include minor crashes which drivers do not usually report to police or to their insurance company. Also the sample characteristics may influence the results about the role of personality factors on traffic accident causation. For example, extraversion may be a very important predictor of accident liability among young male drivers who generally tend to over-estimate their skills and take risks in traffic (Lajunen & Summala, 1995) whereas neuroticism might lead to an increased number of errors and stress especially among inexperienced drivers (Matthews, Dorn & Glendon, 1991).

Previous studies about the relationships between extraversion, neuroticism, psychoticism and traffic accidents have been based mostly on driver samples and self-reports. Lynn and Hampson (1975) studied national differences in extraversion and neuroticism by using national social indicators (e.g. suicide, alcohol consumption, divorce, crime and accident rates) for 18 industrialised nations. Based on factor analysis of these national scores, Lynn and Hampson (1975) were able to identify a two factor solution containing factors labelled as neuroticism and extraversion. In this factor structure, accidents were related both to extraversion and neuroticism. Lester (2000) recently conducted the same analyses as Lynn and Hampson (1975) for social indicators for sets of 18 and 32 nations. In factor analyses of these two samples of national social indicators, accident rate had high factor loadings (0.85 for 18 nations and 0.87 for 32 nations) on factors named as neuroticism, whereas the loadings on the factor called extraversion were much lower (0.13 and 0.20). It should be noted, however, that accidents included all types of accidents, not only traffic accidents.

The aim of the present study was to investigate the relationship between EPQ personality factors and traffic fatalities in a sample of 34 countries.

2. Method

Lynn and Martin (1995) investigated the economic and demographic correlates of extraversion, neuroticism and psychoticism in a sample of 37 nations. Later, Barrett, Petrides, Eysenck and Eysenck (1998) demonstrated the universality of the EPQ factor structure based on four factors (E, N, P and L) in a sample of 37 countries. In the present study, the same data set and method as in the study by Lynn and Martin (1995) was used to obtain national scores for extraversion, neuroticism and psychoticism. It should be noted, however, that China, Uganda and Yugoslavia were omitted from the analyses because of missing accident data. Data for the "former Czechoslovakia" was calculated by combining data from the Czech and Slovak Republics. The final data set included 34 countries.

Fatalities per 100,000 vehicles was chosen as a measure for traffic safety. This measure has several advantages compared to other measures, like the number of accidents or injuries per 100,000 vehicles. Since the compiling procedures and reporting practises of traffic accidents leading to non-fatal injuries vary considerably between countries, the traffic fatality rate is the most unambiguous measure for traffic safety. In this study, traffic fatality rates per 100,000 vehicles for each country were calculated by using fatality rates and number of vehicles taken from the World Road Statistics for 1991–1995 (IRF, 1997).

In addition to traffic fatalities, occupational fatalities were included in the analyses in order to investigate if the same relationships to personality variables apply to both traffic and work-related fatalities. The number of traffic fatalities for each country was taken from LABORSTA, the Labour Statistics Database operated by the International Labour Organization (ILO, 2000).

The number of traffic fatalities can be expected to be related to the wealth of the country, because expenditure on the roads and traffic system as well as the quality of emergency health care are related to national income. Therefore, per capita Gross National Product (GNP) was taken into account in the following analyses. Per capita GNP figures (current USD, Atlas method) for 1991–1995 were obtained from World Development Indicators (World Bank, 1997).

3. Results

Table 1 shows the national means for extraversion, neuroticism and psychoticism. In addition, the means for traffic fatalities, occupational fatalities, and per capita GNP for 1991–1995 are listed in Table 1. The mean values of 5 years were used in order to smooth possible annual fluctuation in accident figures and to get a more general view about the role of personality factors in traffic accidents. Table 1 shows that the traffic fatality figures were obtained for all other countries, except Puerto Rico. Unlike traffic fatalities, the national criteria for recording occupational injuries seem to vary considerably (Table 1). Some countries report the number of occupational fatalities per 1000 persons employed or per 1000 employees injured whereas other countries use the number of workers exposed to risk as a criterion. In addition, work-related fatalities can include either reported injuries or only compensated injuries. Sometimes fatalities caused by occupational diseases and/or commuting accidents are included in the figures. Hence, differences in national recording systems of occupational fatalities hamper the comparisons between nations. Therefore, results related to occupational injuries should be interpreted with special caution.

Pearson correlation and partial correlation coefficients (per capita GNP controlled) between traffic fatalities, occupational fatalities and EPQ personality factors (E, N, and P) are listed in Table 2. In general, the magnitudes of correlation coefficients remained roughly the same when per capita GNP was controlled. Table 2 shows that only extraversion correlated statistically significantly with traffic fatalities. Neuroticism correlated negatively with traffic fatalities, although the correlation was not statistically significant. When per capita GNP was controlled, the relationship between neuroticism and traffic fatalities was somewhat stronger ($r = -0.34$) than in non-partial correlations ($r = -0.28$). Since the number of observations ($n = 33$) was relatively small and P-values in statistical testing are directly related to sample size, more attention should be paid to the size of correlation coefficients and to variance explained than to significance values (American Psychological Association, 1994). Table 2 indicates that extraversion explained 34%, neuroticism 12% and psychoticism less than 1% of variance in traffic fatality figures.

The number of occupational fatalities correlated strongly with traffic fatalities, but did not have a relationship to personality variables. This lack of relationships might be related to different recording criteria of occupational accidents. Unfortunately, the size of the data set did not allow analyses limited only to those countries that used the same criteria and reporting practices. Therefore, the results of the present study concerning occupational accidents should be considered tentative.

Table 1
National means for extraversion, neuroticism, psychoticism, traffic fatalities (per 100,000 vehicles), occupational fatalities (per 100,000 persons), and per capita GNP for 1991–1995

Country	Traffic Fatalities[a]	Occup. fatalities	GNP per capita	E	P	N
Australia	20.21	6.80[b,c,d]	17 676	19.30	6.90	15.50
Bangladesh	986.49	40.20[e,f]	226	19.00	4.20	12.30
Brazil	41.99	16.46[b,c,d,g]	2960	17.60	4.00	14.80
Bulgaria	78.72	0.07[e,b,d,g]	1384	18.60	4.10	14.90
Canada	20.68	7.20[b,c,d]	19 788	18.00	4.20	12.70
Former Czechoslovakia	51.28	5.68[h,f]	2765	19.50	9.10	14.00
Egypt	283.04	12.40[b,f,g]	840	18.50	4.40	17.30
Finland	24.33	3.32[b,c]	21 114	16.20	4.70	14.60
France	30.42	6.20[b,c]	22 822	17.70	5.50	15.10
Germany	26.10	7.00[b,c,g]	25 637	18.40	6.10	13.60
Greece	67.27	4.90[h,c,g]	9518	20.20	5.40	18.30
Hong Kong	69.18	10.22[b,f,g]	18 550	16.70	7.00	14.60
Hungary	96.32	13.50[b,f]	3516	16.60	3.80	14.60
Iceland	14.98	–	24 808	19.20	3.50	13.90
India	1374.31	36.00[b,f]	324	22.70	8.10	15.20
Iran	80.66	–	2410	15.00	5.00	13.20
Israel	41.96	–	14 520	22.60	3.50	8.50
Italy	20.54	9.04[h,c,g]	19 578	18.40	4.40	16.60
Japan	17.68	–	32 698	16.50	4.80	16.70
Korea, Republic of	192.52	33.20[h,c,d,g]	7950	16.50	4.00	15.30
Lithuania	119.40	6.48[b,f,g]	2508	17.40	5.00	15.10
Mexico	48.98	10.00[h,f,d,g]	3922	20.60	4.50	14.10
Netherlands	20.10	–	21 518	17.40	2.80	11.50
Nigeria	1727.68	–	250	24.40	3.60	9.40
Norway	15.22	2.75	29 364	18.60	2.20	10.30
Portugal	75.79	–	8530	18.90	2.60	15.70
Puerto Rico	–	8.57[b,f]	6693	21.50	4.40	14.10
Romania	136.73	7.60[b,f,g]	1326	18.40	3.50	13.30
Russia	158.48	13.38[b,f]	2876	16.10	3.60	18.00
Singapore	55.28	12.86[b,f]	20 506	17.40	4.30	13.00
Spain	36.76	11.45[h,f]	13 542	17.10	3.00	16.20
Sri Lanka	342.69	–	594	18.70	4.20	12.10
United Kingdom	18.20	1.20[b,f]	17 904	18.00	3.80	14.90
United States	20.98	0.50[b,f]	25 112	21.70	3.30	15.00

[a] Per 100 000 vehicles.
[b] Per 100 000 employed.
[c] Compensated injuries.
[d] Including occupational diseases.
[e] Per 100 000 workers exposured to risk.
[f] Reported injuries.
[g] Including commuting accidents.
[h] Per 100 000 persons insured.

Analyses based on correlation assume that the relationships between personality variables and traffic fatalities are linear. In addition, Eysenck (1965) suggested that those drivers scoring high on neuroticism and extraversion should be more liable to traffic accidents than drivers scoring low in these measures. It can be assumed, however, that the relationships would be more complex.

Table 2
Pearson correlation and partial correlation coefficients (per capita GNP controlled) between traffic fatalities, occupational fatalities and EPQ personality factors

Measures	Correlation coefficients		Partial correlation coefficients	
	1	2	1	2
1. Traffic fatalities				
2. Occupational fatalities	0.80***		0.75***	
3. Extraversion	0.58***	0.07	0.58***	0.01
4. Neuroticism	−0.28	−0.04	−0.34	−0.19
5. Psychoticism	0.14	0.13	0.09	0.08
6. Per Capita GNP	−0.47**	−0.46*	–	–

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

For example, a reasonable amount of worry might even increase a driver's concern for safety whereas both over-confidence and extreme forms of neuroticism can be expected to lead to a risky driving style. The analysis of standardized residuals showed that the relationship between extraversion and traffic fatalities was linear whereas neuroticism and traffic fatalities did not have a linear relationship. In order to visualise the relations between traffic fatalities and personality variables, the data set was divided into three groups (low, moderate, and high) according to national extraversion, neuroticism and psychoticism scores (the split was based on the 33rd and 66th percentiles).

Fig. 1 displays the number of traffic fatalities per 100,000 vehicles as a function of extraversion, neuroticism and psychoticism. Fig. 1 shows that the number of traffic fatalities was high in the countries scoring high in extraversion whereas the number of fatalities was almost at the same

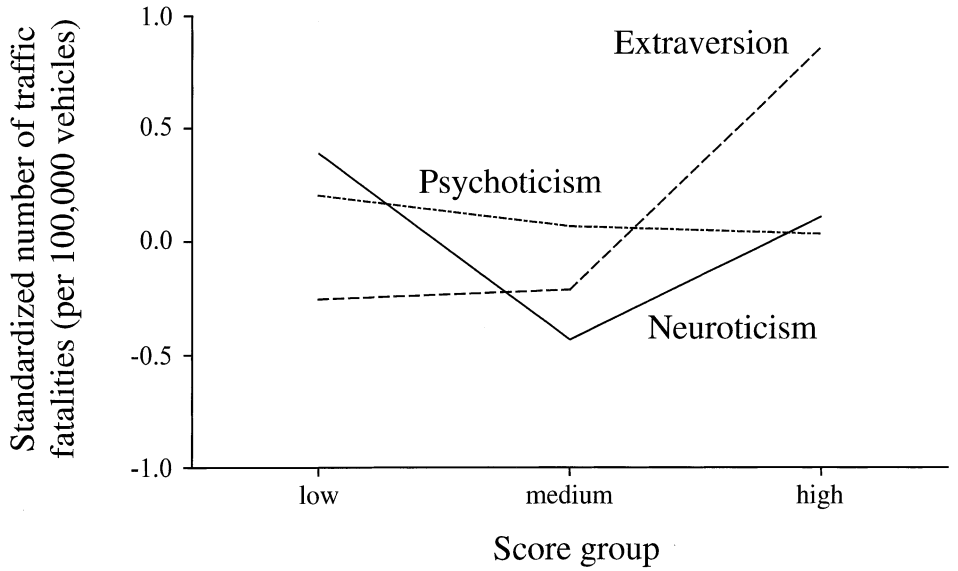

Fig. 1. The number of traffic fatalities per 100,000 vehicles as a function of extraversion, neuroticism and psychoticism.

level in countries with low and medium scores in extraversion. One-way analysis of variance (ANOVA) showed that the effect of extraversion on traffic fatalities was marginally significant ($F2,\ 30 = 3.10,\ P = 0.060,\ \eta = 0.17$). The shape of the neuroticism curve in Fig. 1 shows that a moderate amount of neuroticism seemed to benefit traffic safety, whereas low and high scores on the neuroticism scale might increase the number of fatal traffic accidents. In one-way ANOVA, however, the effect of neuroticism was not statistically significant ($F2,\ 30 = 1.07,\ P = 0.356,\ \eta = 0.07$). As already seen in Table 2, psychotisism did not seem to have any relationship to traffic fatalities ($F2,\ 30 = 0.14,\ P = 0.986,\ \eta = 0.03$).

4. Discussion

The last decades in personality research show that neuroticism and extraversion are two main personality factors present in many cultures (Barrett et al., 1998). Supposedly, these personality dimensions have relations to driver behaviour and might partly explain why the number of traffic accidents (per 100,000 vehicles) varies to such a great extent even within Europe. For example, in 1995, 61 drivers per 100,000 vehicles died in Portuguese road traffic whereas the corresponding figure for Norway was 15 (IRF, 1997). Since 90% of traffic accidents have been estimated to be caused by human factors (Lewin, 1982), the role of personality in traffic safety is critical.

Earlier studies about the effects of extraversion, neuroticism and psychoticism on traffic safety have mainly been based on small samples. A great variety of criteria for safe driving have been used (Lester, 1991). In many studies, driving experience and exposure have not been controlled at all (Elander et al., 1993). Therefore, it is not surprising that results concerning the effects of personality factors on traffic accident involvement have been mixed. In the present study, the relationship between EPQ personality dimensions and traffic fatalities was studied in a sample of 34 countries.

Results showed that extraversion correlated positively with traffic accidents, neuroticism had a negative (although statistically non-significant) relationship to accidents and psychoticism had no relationship to traffic fatalities. Further analyses showed that countries having high scores on extraversion had higher traffic fatality figures than countries with low or medium scores. This result might indicate that there is a ''threshold value'' of extraversion after which the negative effects of extraversion on traffic behaviour occur. The relationship between neuroticism and road fatalities was somewhat different: countries scoring low and high in neuroticism seemed to have more traffic fatalities than countries with medium scores. This result might indicate that a certain amount of concern for personal safety and social norms is needed for safe driving, but instability and moodiness may have a negative effect on driving. Similarly, lack of concern and over-trust expressed as low scores in neuroticism might lead to risk-taking in traffic.

This study addressed the relationship between personality factors and occupational fatalities as well. Correlation coefficients between personality dimensions and occupational fatalities were all statistically non-significant and small. It should be noted, however, that national practices in recording occupational injuries vary and, therefore, the comparisons become very difficult. Results concerning occupational injuries should, therefore, be interpreted with caution. On the other hand, the number of occupational fatalities was strongly related to traffic fatalities also when the national income level (GNP) was controlled. This finding might indicate that a ''safety culture'' might be prevailing in some countries whereas in some other countries safety issues are perceived as less important.

Studies using national accident data have several advantages compared to studies based on driver samples. National figures for traffic fatalities are presumably more reliable than self-reports, because the definition of a traffic death is more unambiguous than that of "traffic accident". In addition, forgetting and social desirability (Lajunen et al., 1997; Maycock et al., 1991) do not bias the national figures as in the case of self-reports.

Despite clear advantages, the macro analyses using cross-cultural personality data and traffic safety figures have some limitations. Although macro analysis is very useful in investigating the relationship between personality factors and traffic accidents, it cannot describe the full path from personality factors to accident involvement via driving behaviour (driving style) adequately. This is because international indicators for driving style are not available to the same extent as personality and accident data. It can be supposed that neuroticism and extraversion have distinct pathways to influence traffic safety: neuroticism can be expected to be mostly related to driver stress (Matthews et al., 1991) and driver errors whereas extraversion is more likely related to violations and deliberate risk-taking. In future, studies measuring the main personality factors, driving behaviour and outcome variables (accidents) are needed to describe the relationship between personality factors and traffic safety.

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