



Self-reported risky driver behaviour and the Big Five personality traits

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ABSTRACT

This study, similar to Arthur and Day (2009), aimed to investigate whether reported risky driving behaviours measured by driver violations, error and lapse (items of the Driver Behaviour Questionnaire (DBQ) will differ across the Big Five personality traits (openness, conscientiousness, extraversion, agreeableness and neuroticism). With a sample of 101 UK licensed drivers, a between-subjects (high or low risky driving) design was used. A Mann-Whitney U test was used to establish the difference between risky driving and the Big Five personality traits measured by the Big Five Inventory (BFI). The study found mixed results, as reported risky driving only differed across some of the Big Five traits. Drivers who reported low driver violation scored higher on conscientiousness and agreeableness. Drivers who reported high violations were more extraverted. Conscientious drivers also reported low driver error and lapse. Drivers high on driver lapse scored higher on neuroticism. There was no difference in DBQ items across openness. The study concluded that there are different elements of risky driving which differ across some of the Big Five personality traits, but the mixed findings may be due to limitations of the study, which are discussed.

KEY WORD:	DRIVER BEHAVIOUR	RISK	THE BIG FIVE	DBQ	BFI
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Introduction

According to The Royal Society for the Prevention of Accidents (RoSPA) (2010c) the annual number of road accident casualties reported to the police in Great Britain in 2009 is estimated to be 700,000. In 2009 2,222 road accidents fatalities were reported this is 12% lower than 2008 (RoSPA, 2010c). Reportedly around £15.8 billion was spent on interventions trying to prevent road accidents in 2009, this appears to be effective, because the number of fatalities has reduced by 38% (RoSPA, 2010c). However, this statistic may be an artefact, as it has not accounted for 15% increase in traffic, changing the representation of accident statistics (Hageman, 2008).

According to RoSPA (2010c) the three main contributors to fatalities were; driver error, (68%), injudicious actions, (33%), inexperience, (31%), and other factors including distractions (RoSPA, 2010c). Özkan, Lajunen, Chliaoutakis, Parker and Summala (2006) suggested that human factors were the main contributors to accidents, including driver skills (driver's performance) and driver style (behaviour, the way they choose to drive), for example risky driving. Evidence suggests that driver style is closely related to accidents occurrences, and therefore many self-report measures have been devised to measure driver style (Özkan et al, 2006).

Accident statistics are often detailed, providing foundations for research interventions. These statistics are rarely questioned, but should be treated with caution. The data is only based on estimates and may be overestimated because the data often comes from multiple sources, meaning some accidents may be reported twice (Hole, 2007). Accident statistics may also be underestimated, as some accidents such as minor accidents or those on private land may not get reported. In accident reports, the cause of accidents is often attributed to a single factor, when accidents are normally the combination of multiple factors (Arthur et al, 2001). To address the issues of accident statistics, an alternative measure should be used, Arthur et al (2001) has found self reports have better convergent validity.

In order for interventions to reduce accidents, research needs to be able to predict risky driving. To be able to predict risky driving it is important to understand what risky driving is. In the case of the present study, risky driving is defined as dangerous driver behaviour, which is likely to cause damage, injury or an accident (Lajunen, 2000). Many theories have been proposed to explain risky driving behaviour, such as Wilde's (1982), Risk Homeostasis Theory (RHT). Wilde (1982) proposes that drivers' seek to maintain a certain level of risk known as 'target risk level'. If riskiness is higher or lower than the desired 'target level of risk', individuals will act to reduce the discrepancy (Wilde, 1982). Safety measures such as Volvo's (2011) ideal 'uncrashable' car (The Telegraph, 2010), may increase risky driving if individuals feel they are lower than their 'target level of risk', to reduce accidents, interventions need to increase individuals desire to be safe to reduce the discrepancy (Wilde, 1982). Wilde's (1982) RHT is limited, as it assumes drivers habitually assess risk in the first place, and have accurate decision making skills that are not influenced by other factors (Tversky & Kahneman, 1973).

The Theory of Planned Behaviour (TPB) is applied from health psychology to explain general driving behaviour (Ajzen, 1985). The TPB suggests behaviour is determined by intention which is susceptible to change through interventions. Intention is, in turn, influenced by attitude (evaluation of performing behaviour), subjective norm (perceived social pressures), and perceived behavioural control (PBC) (perceived ease in doing task) (Ajzen, 1985). Elliot, Armitage and Baughan (2007) studied 150 participants and found that drivers' intention and PBC accounted for 67% of variance in drivers self reported speeding behaviours, but only intention was the best predictor of observed speeding. However, the TPB variables may be good predictors of the intention of risky driving, which has no practical relevance to interventions, because there is a gap between intentions to behave and actual behaviour (Conner, Smith & McMillan, 2003). Many of the theories explaining risky driving behaviour are reductionist, in that they do not account for multiple factors influencing drivers' behaviour. There appears to be no general theory of driving behaviour, perhaps due to the diverse nature of driving behaviour and its unpredictability, as driving varies in different situations, and with different people (Fuller, 2005).

Research underpinned by theories often investigates driver behaviour through quantitative methods, such as self reports. Considerably less research has been conducted using qualitative or mixed methods (Falk & Montgomery, 2007). Driver behaviour research mainly uses self-report measures, in particular the Manchester DBQ (Parker et al, 1995). The DBQ is based on a theoretical taxonomy of aberrant behaviours and the main concept in the original DBQ is the distinction between violations, errors, and lapses (Reason, 1990). Violations are more likely to lead to serious road accidents because they are conscious deviations from rules. Errors refer to those occasions when planned mental or physical activities fail to achieve the desired outcome and Lapses focus on failure to process information, including attention and memory defects (Reason, 1990). The DBQ has also been successfully implemented in a number of countries including Finland, Australia and China (Xie & Parker, 2002). Social desirable responding in the DBQ is small (Lajunen & Summala, 2003). When the DBQ is used in Middle Eastern areas, like the United Arab Emirates (UAE), it does not have the same influence, as it does in Western countries because of cultural difference (Brener et al, 2007). Despite this, the DBQ has been found to be reliable over time; Parker et al (1995) found after seven months test-retest reliabilities were 0.69 for errors, 0.81 for violations and 0.75 for lapses. This current study will use the DBQ because of its reliability, accessibility and its investigation of driver style.

Research investigating driver behaviour has considered the influence of individual differences, such as drivers' demographics (exposure, experience, age, and sex) to predict reported risky driving (Dobson et al, 1999). Özkan and Lajunen (2005) recruited 354 Turkish students to complete the DBQ. Riskier driving was found in younger males, compared to females and older drivers. Özkan, Lajunen and Summala (2005), found using an analysis of variance on 622 pre and post a three year gap, scores on the DBQ, as drivers got older they report less risky driving. Critically, the time gap of three years was too short for any substantial changes to occur in participants' lives. Further to this, younger drivers are over-represented in statistics compared with other age groups (Brener et al, 2007). Xie and Parker (2002) found in China respondents aged 30-35 years have higher violation scores.

However, these findings may be due to cultural and sex differences in China because middle aged males are the majority of the driving population (Goa, 1998).

Özkan et al (2006) found that male drivers reported more violations, whilst females and older drivers report more errors and lapses. This maybe because males are prone to report more risky driving because they have a more positive and assertive driving style, leading to over confident drivers (Lajunen & Summala, 2003). However sex differences may be because the DBQ has sex related items, which may be why sex differences are found cross culturally (Özkan & Lajunen, 2005). Golias and Karlaftis (2002) investigated the influence of experience on risky driving behaviour. The authors used a large survey of 20,725 observations of 19 European countries, which found drivers with more experience to be less risky. Road safety interventions like Brake (2010) focus on inexperienced drivers, because they are suggested to be more risky. There is considerably less research into the effects of driving exposure on reported risky driving behaviour. The limited amount of research on driving exposure, suggests accidents and driver violations are positively correlated (Lourens, Vissers & Jessurun, 1999).

Demographic variables have generally been consistent predictors of risky driving, which has allowed interventions such as Brake (2010) to target those at risk. Research has identified the importance of controlling for demographic variables, as they can mediate other individual differences such as personality traits, which are good predictors of various behaviours including driving (Fernandes, Hatfield & Job, 2006). Driver behaviour research appears to be reductionist, condensing predictors down into one or two predictors at a time. Rather than taking a holistic approach, like Gestalt psychology, which investigates multiple predictors to better understand driver behaviours complexity, this increasing the effectiveness of interventions (Arthur & Day, 2009).

Driver behaviour and personality

Research has suggested personality is a good predictor of risky driving. For the present research, personality will be defined as the underlying set of traits within the individual which are relatively enduring and stable, which influence individual's interaction (Larsen & Buss, 2010). Based on this definition it is expected that personality traits should be good predictors of behaviour (Larsen & Buss, 2010). There is great debate over which are the most important traits. Important traits were initially identified by definitions in the dictionary, by factor analysis, or theoretical analysis (Larsen & Buss, 2010).

Taxonomies of traits have been proposed, but one of the most justifiable ones is the five-factor model, which is also labelled the Big Five. The model is originally based on the 17,953 traits found by Allport and Odbert's (1936) in the English dictionary were then divided into four categories. Cattell (1943) reduced Allport and Odbert's (1936) first category of 4,500 stable traits to 35 trait clusters. Fiske (1949) factor analysed 22 of these clusters into a five-factor solution, but was not credited for the emergence of the Big Five. Tupes and Christal (1961) in a larger sample also identified the five-factor model. Norman (1963) established the key markers which

define the Big Five; these were conscientiousness (self disciplined and thinks before acting), extraversion (excitement-seeking), agreeableness (altruistic and cooperative), neuroticism (self conscious) and culture. There was some disagreement of the fifth factors label, but from lexical analysis across cultures, openness (imaginative) was the most common (John et al, 2008). The Big Five are the broadest traits, on a continuum. When they are investigated, neuroticism is often used because it is the other end of the continuum from emotional stability (John & Srivastava, 1999). The Big Five traits have been found to successfully predict life outcomes (Chamorro-Premuzic & Furnham, 2003). From analysis of research on driver behaviour and personality, the majority of research draws upon traits from the Big Five to predict behaviour (Dahlen & White, 2006).

There are a variety of ways to assess the Big Five; however self report questionnaires are often used because they are less time consuming. One of the most widely used ways of assessing the Big Five, is Costa and McCrae's (1989) 240 item neuroticism-extraversion-openness personality inventory, revised (NEO-PI-R). In a lot of personality research the NEO-PI-R is often too long and a shorter inventory is required. The present study will use the BFI because of its accessibility, simplicity and avoidance of ambiguity as the BFI uses short phrases based on the trait adjectives (John & Srivastava, 1999). It does not sacrifice contents or psychometric properties, as in a US sample it was established alpha reliabilities averaged above 0.80 (John & Srivastava, 1999). The BFI has an average coefficient alpha reliability of 0.83 and a three-month test re-test reliability of 0.85 (John & Srivastava, 1999). The BFI has substantial convergent validity (0.93) with NEO questionnaires and discriminate correlation of 0.20, which suggests it measures what it intends to (John & Srivastava, 1999).

There has previously been an interest in research into the predictive validity of the Big Five and driver behaviour, because of the important implications on road safety (RoSPA, 2010c). There is a lack of agreement between researchers and literature as to which traits of the Big Five are better predictors of risky driving behaviour. Despite the DBQ being the most consistent measure of driving behaviour in driver research, there appears to be a gap in the literature. When considering the Big Five and driver behaviour, research considers general risky driving, and not the DBQ items specifically (Arthur & Day, 2009). Therefore, when considering the Big Five literature, aspects referring to the DBQ, for this study were interpreted in relation to what they suggest about the DBQ items.

There are few studies focusing on openness and accident involvement. Dahlen and White (2006) found, using the Neuroticism, Extraversion and Openness Five-Factor Inventory (NEO-FFI) and the DBQ, that openness was a predictor of risky driving behaviour. Dahlen and White (2006) relied on retrospection of accident involvement, which may mean results could be misrepresentations, but could also be unethical by bringing up traumatic memories (The BPS, 2009). Arthur and Graziano (1996) used 227 students and 250 participants from an employment agency, where participants completed the NEO-FFI and the DBQ. Arthur and Graziano (1996) conducted a multiple regression, which found no relationship between openness and accident statistics.

Research on conscientiousness is more consistent. Arthur and Graziano (1996) found a negative relationship between conscientiousness and risky driving behaviour. This may be because it is thought that conscientious people are more responsive to laws, such as speed limits, and are better at regulating emotions. This means they are more likely to avoid violations and self regulate, which would decrease driver error and lapses (Hogan, 1983). Arthur and Graziano's (1996) results may only be representative of volunteers and people motivated by money, as volunteers are influenced by social obligation or fear of punishment, such as not being paid, which may explain why they score higher on conscientiousness (Little, 1970). Clarke and Robertson (2005), in a meta-analysis, found low conscientiousness to be a valid predictor of accident involvement, including driver violations, because of lack of authority and abiding rules. Boggs and Roberts (2004), contrary to Arthur and Graziano (1996), and Clarke and Robertson (2005), found conscientiousness was not a useful predictor.

Extraversion research seems quite consistent. Eysenck's (1967) theory of the ascending reticular activating system, suggests that extraverts have low levels of arousal. This has lead researchers to conclude that extraverts are more prone to be involved in collisions. Extraverts seek external stimulation to increase their arousal levels, and are therefore more likely to accept higher levels of task demands and risk, thus explaining increased reports of driver violation (Eysenck, 1967). Extraverts may also be more involved in accidents because they tend to have a lower level of vigilance and decrease in performance on monotonous tasks, such as motorway driving. If this is the case, increased driver error and lapse would be expected because of defects in information processing and exploration for self-stimulation (Verwey & Zaidel, 2000). Alternatively, Dahlen and White (2006) found, in a multiple regression, that extraversion was not a useful predictor of driver behaviour. However, results of Dahlen and White (2006) may only be true of females as their sample consisted of a majority of females.

Those low in agreeableness are associated with increased driver violations, including aggressive driving, possibly due to higher emotional arousal, which, in turn, influences information processing, and increases the chance of driver errors and violations (Mesken, Lajunen & Summala, 2002). Similarly, Clarke and Robertson (2005) in a meta-analysis on the Big Five and accident statistics, found those low in agreeableness are more liable to accident involvement and violations. Clarke and Roberston's (2005) results should be interpreted with caution, as the meta-analysis, although a useful method, it only considered accident statistics, which, as mentioned previously, are commonly under or over represented. The meta-analysis only considered literature up to the year 2000, which may suggest research beyond 2000 has advanced, to consider different areas of driver behaviour (Iversen & Rundmo, 2002). Clarke and Robertson's (2005) findings may not be applicable to current driver behaviour, as it is a consistently changing behaviour since 2000. Arthur and Graziano (1996), however, found no difference.

Findings on neuroticism are mixed. Eysenck (1970) suggests that those high in neuroticism are more accident-involved, therefore possibly increasing driver error and lapses due to them having acute reactions to stressors, such as anxiety and fatigue decreasing cognitive performance such as reaction times and memory. In

contrast, Lajunen (2000) found in a multiple regression, that neuroticism was negatively related to accidents across 34 different nations, and Craske (1968) found no difference. However, Lajunen's (2000) results were only based on a relationship of national statistics, and alternative factors may be influencing the reports of neuroticism, including cultural differences (Hole, 2007).

The literature suggests a significant relationship between the Big Five and various aspects of risky driving. However, based on the discussed studies there appears to be some gaps in the literature on the Big Five and driver behaviour. When considering the relationship between risky driving and the Big Five, there is inconsistent use of different measures of risky driver behaviour or personality (Hole, 2007). This may explain the mixed findings on which trait best predicts risky driving, because of the different measures used in studies, different aspect of individuals personality are being measured, which would result in different findings (Lajunen, 2000). When the Big Five literature did use the DBQ, it only considered the outcome as general predictors of risky driving, rather than investigating each DBQ item across personality traits (Dahlen & White, 2006). From interpreting the Big Five research findings, the DBQ items would appear to have a separate interaction across personality traits. This study will add to the research investigating risky driving behaviour, by considering the differences of the DBQ items (violation, error, and lapse), rather than general risk, across personality using the BFI (Worrell & Cross, 2004).

Previous research in driver behaviour mainly used undergraduate students because of their accessibility in research, although their driving behaviour is likely to be different from the general population, because of time they often have limited driving experience (Fernandes & Job, 2003). This study intends to extend the research by using as low a number of students as possible.

Interventions such as Brake (2010) demonstrate the importance of investigating predictors of risky driving, so these predictors can be targeted and reduced in order to decrease the occurrence of risky driving. Previous research places too much emphasis on investigating the relationship between personality and driving behaviour, but for interventions to be more effective, it is important to try and identify differences, rather than factors loosely related (Özkan, et al, 2005). The purpose of the present study is to add to personality and risky driving behaviour findings, but also consider multiple factors, unlike previous research which has only investigated a few predictors at a time. The present research is taking a more holistic approach, to understand the role of the 'total' individual (Arthur & Day, 2009), which could increase the effectiveness of interventions (Arthur & Day, 2009). This issue of research over simplifying driver behaviour is evident, as literature since 2005, appears to have moved on from personality to consider current influential factors like enjoyment (Lajunen, 2011), rather than extending the research and considering the combination of previous predictors, such as personality and demographic variables as a mediator. This study will control and investigate demographic variables because of the confounding effects on personality and its current importance, but will focus on personality traits, in particular the Big Five, because of its predictive validity (Schwebel, Severson, Ball, & Rizzo, 2006).

Previous research, such as Arthur and Day (2009) have suggested there should be differences between risky driving and the Big Five. The first hypothesis will be that reported driver violation will significantly differ across the Big Five personality traits. The second hypothesis is that reported driver error will significantly differ across the Big Five personality traits. The third hypothesis predicts that reported driver lapse will significantly differ across the Big Five personality traits.

Driver Violation, error and lapse are items of the DBQ, which in this study will measure risky driving.

Method

Design

All three of the hypotheses were a between subject design because participants either scored high or low on the DBQ items. Across all three hypotheses the 50th percentile scores provided the distinction between high DBQ item scores (greater than (>) the 50th percentile) and low DBQ item scores (equal to or less than (<) the 50th percentile) (Field, 2005). The independent variables (IV) for the first hypothesis were participants reported driver violations; either high (> 12.00 (1) or low violation scores (scores equal to or < 12.00 (2). The dependent variable (DV) for the first hypothesis was participant's Big Five personality trait scores.

The IV for the second hypothesis was participants reported driver error; either high (scores > 12.00 (1) or low error (scores equal to or < 12.00 (2). The DV was participant's Big Five personality scores.

The final hypothesis IV was participants reported driver lapse scores; either high (scores > 16.00 (1) or low lapse (scores equal to or < 16.00 (2). The DV was participant's Big Five personality scores. For all the hypotheses the IV's were measured by the DBQ and the DV's by the BFI.

Participants

One hundred and one drivers (Mean age = 42.2 years, SD = 15.8 and age range 17-78 years) with a full UK driving licence including, 51 male and 50 females were used. Participants were recruited by convenience sampling, for those participants who were available (in Worcestershire and Gloucestershire towns) at the time to participate in the study and by snowball sampling as the initial participants approached by the researcher were asked if they could get up to five of their acquaintances who hold a full UK drivers licence to participate in the study in order to get a broader variety of drivers and reduce negative effects of the researcher's presence (Webster, 1997). Participant's requesting their acquaintances participation, were advised, where possible to avoid using students, because of their often limited driving experience and over representation in driver research (Brake, 2010).

Materials

Where possible in the materials presented to the participants, constant reminders to not disclose illegal driving behaviour were presented. Participants completed a questionnaire pack to read, containing a participant information sheet about what participation requires, which they were told to keep hold of for future reference. Participants read a written brief to remind participants of what would be expected of them and consent form to sign if they agreed to participate in the study. The main questionnaires included a section on demographic information (age, sex, driving experience and exposure), the DBQ, and the BFI. Both of these were presented in the same way as constructed by the authors, one after the other. An optional section for participants was to provide their feedback on the DBQ and the BFI using some open questions. Once the questionnaires were completed, participants read a debrief explaining the full aims of the study, contact details and reminder of their rights.

The Driver Behaviour Questionnaire. The original 24 item DBQ was used in the questionnaire because of its consistency in driver behaviour literature. The DBQ requires participants to rate how often, if at all, the 24 statements have happened to them whilst driving leisurely, rating them on a six point likert scale, ranging from (0) as never to (5) nearly all the time (Parker et al, 1995). The item referring to drink driving, was removed due to ethical issues, making 23 items. Further to this, the question about disregarding the speed limit at night was changed to 'thinking' about speeding at night, to prevent disclosure of illegal driving behaviour (Parker et al, 1995). The DBQ has three subsections: violation with eight items (seven items with the removal of the alcohol question), errors with eight items, and lapses with eight items. The alpha reliability coefficients for the scales of the DBQ were highest in Great Britain: 0.79 for violations, 0.73 for errors and 0.69 for lapses (Lajunen, Parker & Summala, 2003).

The Big Five Inventory. The 44 item BFI was used because it is shortest measure of the Big Five personality traits, it has been extensively validated and is widely accessible (Costa & McCrae, 1992). The BFI requires participants to rate from, (1) disagree strongly to (5) agree strongly, on 44 characteristics that may apply to them. Scoring of the BFI is one to five for each item (John & Srivastava, 1999). Sixteen of the BFI items within the five traits were reversed to prevent participants, out of boredom, responding in a specific direction, regardless of the content. The BFI consists of 10 items for openness, nine items for conscientiousness and agreeableness. Extraversion and neuroticism had eight items (John & Srivastava, 1999).

To test the materials for the study, a pilot was carried out on 10 different participants. An optional feedback form was added just for the pilot study, where participants reported that they were happy to report their actual age, this meant participants' reported their actual age, which was later grouped. Several participants also expressed the view that depending on the purpose of their driving such as for leisure or for work, they would drive differently. The purpose of driving was then standardised to driving for leisure. For the main study a different general feedback form was used.

Procedure

As previously noted, participants were initially approached and asked if they held a full UK driving licence and would participate in a study on individual difference and driver behaviour, which would take about 15 minutes. Those who accepted took the questionnaires away to complete in their own time (to reduce hurried responses), and were asked if they could get up to five of their acquaintances who hold a full UK drivers licence to participate in the study and return them back. Those who accepted took their own questionnaire pack and five others for their acquaintances to complete. Initial participants were given all the appropriate material in order and a return location (or address) and date (usually about a week). Participants completed the questionnaire pack containing a written participant information form to read, explaining a basic reason for the study and what they would be expected to do. Participants were then asked to read and sign a consent form and the brief if they accepted to participate in the study. The questionnaire pack also consisted of some demographic information, DBQ, BFI and general feedback sheets. These were given to the participants to complete following the written instructions provided. Upon completion of the questionnaire packs, participants read a written debrief explaining the true aims of the study, reminding them of their rights, a contact email, and thanking them for their participation. Of the initial 100 questionnaires distributed 17% were not returned. In order to gather a complete set of 100 data a further 21 questionnaires were gathered using the same procedure.

Ethical consideration

This study received ethical approval from the University of Worcester ethical committee. The only potential ethical concerns the study had were the possibility that participants may report illegal driving behaviour, such as speeding. To prevent this, on the materials presented to the individuals there were clear reminder not to disclose illegal driving behaviour. "Whilst completing the questionnaire it is important that you do not report any illegal driving behaviour, for example being over the blood-alcohol limit or any driving that may have caused injury to others, as it would be my responsibility to report you. However, this does not include minor offences such as not rigorously sticking to speed limits." To prevent people ignoring these reminders, the question about disclosure about drink driving on the DBQ was removed and the question about speeding was changed (The British Psychological Society (the BPS), 2009). This prevents disclosure of illegal behaviour as they are only reporting their thoughts, not their actual behaviour (Ajzen, 1985). To prevent being able to identify participants, they remained anonymous and were only identifiable from their participant number (their consent forms were also kept separately). Minor ethical issues included slight deception, the full aims of the study were not completely explained at the beginning to prevent demand characteristics of participant's responses matching the aim (The BPS, 2009). To overcome this full aims were presented in the discussion and participants could remove their selves and results, if they were uncomfortable with this (The BPS, 2009).

Results

The first hypothesis predicts that scores on driver violation will be significantly different across the Big Five personality traits. The second hypothesis predicts that driver error scores will significantly differ across the Big Five. The third hypothesis predicts that driver lapse scores will be significantly different across the Big Five.

Preliminary analysis

The DBQ items were scored by totalling all the questions for each item. Scores for each DBQ questions ranged from 1-6. The maximum score for the violation item was 42 and the minimum score was seven. The maximum score for error and lapse items were forty eight and the minimum was eight (Parker et al, 1995). The items for each of the individual Big Five traits were totalled and to account for 16 reversed items, scores were divided by the number of items within that trait, this provided the total score for that trait which ranged from 1-5 (John & Srivastava, 1999).

Descriptive statistics.

Table 1 indicates the descriptive statistics of participants' scores on the Driver Behaviour Questionnaire items and the Big Five personality traits. The standard deviations of the Big Five traits in table 1 suggest scores are less spread from the mean than the DBQ items, and are relatively consistent except for neuroticism.

Table 1

The median, mean and standard deviation scores on the driver behaviour questionnaire items and the Big Five personality traits.

Participant scores on the DBQ and BFI			
Personality traits and DBQ items	<i>Mdn</i>	<i>M</i>	<i>SD</i>
Violation	12.00	13.90	6.11
Error	12.00	13.30	3.87
Lapse	16.00	17.00	4.90
Openness	3.50	3.51	0.62
Conscientiousness	3.80	3.88	0.66
Extraversion	3.60	3.56	0.70
Agreeableness	4.00	3.92	0.57
Neuroticism	2.60	2.51	0.71

Demographic variables were included as they provide confounding variables to personality and are an important part of individual difference. Demographic variables had a larger spread of scores and appear to violate the assumptions of normality.

Data check. An examination of the descriptive statistics identifies several different outliers across demographic, DBQ and BFI variables. However, with a small sample,

outliers are common. Mahalanobis distances of demographic variables were greater than the critical value, suggesting there are multivariate outliers. Mahalanobis distances of DBQ items were greater than the critical value, suggesting there are multivariate outliers. Mahalanobis distances of BFI items were close to the critical value, suggesting there are no multivariate outliers. Outliers were not removed because they may be representative of participants' behaviour (Field, 2005) and on inspection of the Cook's distance scores for the demographic variables, DBQ and BFI items, neither of them had a Cook's distance greater than one suggesting extreme scores are not influencing the model (Field, 2005). Demographic variable outliers were also not removed because of the lack of control for driving purpose.

An examination of univariate normality, the DBQ items (violation, error and lapse) appeared to be not normally distributed. Inspection of multivariate normality on the DBQ had also been violated. Investigation of univariate normality on the Big Five personality traits reveals openness, agreeableness and neuroticism were normally distributed. Conscientiousness and extraversion appeared non-normal with a positive skew. However, it was found that multivariate normality was not violated for the BFI items (Field, 2005). To investigate the demographic, DBQ and BFI variables, non parametric tests were required as the data was not normally distributed and the means may have been skewed from outliers and the large SD of the DBQ items. The statistical test of the study were several Mann-Whitney U tests because it is a between groups design to compare differences between participants who either scored high or low on each of the DBQ items, across the Big Five personality traits (Field, 2005).

Inferential statistics

Investigation of participants' demographic variables.

It is important to control for demographic variables because they may confound personality and are important individual differences. A Chi-square test of independence indicated some significant differences between demographic variables.

A Kruskal-Wallis test revealed younger drivers reported greater driver violations than any other age group. There were no differences between ages on driver error and lapse. A Mann-Whitney U test revealed male drivers reported greater violation, but females reported greater driver lapse than males and driver error was non significant. A Mann-Whitney U test indicated less experienced drivers reported more violations than experienced. However, driver lapse and error was non significant. A Mann-Whitney U test demonstrated no significant difference in exposure on DBQ items. A Friedman analysis of variance (ANOVA) indicated differences in participant scores across the DBQ and the BFI items.

Hypothesis one (driver violation and the Big Five) - The Mann-Whitney U test revealed small significant differences in violation scores across conscientiousness. Participants who had lower violation scores recorded greater conscientiousness than participants with higher violation. The test indicated a small significant difference in

violation scores across extraversion. Participants who had higher violation scores recorded greater extraversion than participants with lower violation.

The Mann-Whitney U test revealed small significant differences in violation scores across agreeableness. Participants who had lower violation scores recorded greater agreeableness scores than those with high violations. In addition, openness was non significant in high and low violation groups. Neuroticism was non significant in low and high violation groups.

Hypothesis two (driver error and the Big Five) - A Mann-Whitney U test revealed small significant differences in error scores across conscientiousness. Participants who had lower error scores recorded greater conscientiousness scores than participants who had high error.

Openness was non significant in low and high error groups. Extraversion was non significant in high and low error groups. Agreeableness was also non significant in low and high error groups. Neuroticism had no significant difference in high and low error groups.

Hypothesis three (driver lapse and the Big Five) - A Mann-Whitney U test indicated a small significant differences in lapse scores across conscientiousness. Participants who had lower lapse scores recorded greater conscientiousness scores than participants who had high driver lapse. The test revealed a small significant difference in lapse scores across neuroticism. Participants who had higher lapse scores displayed greater neuroticism scores than participants who had low lapse scores. In addition, openness was non significant in low and high lapse groups. Extraversion was non significant in high and low lapse groups. Agreeableness was non significant in low and high lapse groups.

There were mixed findings across the three hypotheses. In hypothesis one the only differences were those who had low violations scores higher in conscientiousness and agreeableness. Those with higher violations scores were more extraverted. There were no differences in agreeableness and neuroticism. In hypothesis two only those who scored low on error were high in conscientiousness were significant out of the Big Five traits. Hypothesis three found those low in lapse scored greater in conscientiousness and those high in lapse were more neurotic. There were no differences in driver lapse with openness, extraversion and agreeableness.

Discussion

The present research found mixed results for the hypotheses of the study. As hypothesised, there were some differences in driver violation across the Big Five traits (openness, conscientiousness, extraversion, agreeableness and neuroticism). Drivers reporting low violations were more conscientious and agreeable, and those who reported high violations were more extraverted. However, there were no differences in driver violation on openness and neuroticism. It was also hypothesised driver error would differ across the Big Five, but the study only found those who reported low driver error were more conscientious. There were no differences in driver error across openness, extraversion, agreeableness and neuroticism. As

hypothesised, there were some differences in reported driver lapse across the Big Five. Participants who reported low driver lapse were more conscientious, and those who reported high driver lapse scored high on neuroticism. There were no differences in driver lapse across openness, extraversion and agreeableness. Results suggest reported risky driving may differ across some of the Big Five traits.

There appears to be no consistent measure in the literature of investigating driver behaviour and personality. The present study found differences in the DBQ items across the Big Five. This study has added to the current research and it would seem possible for future research to break risky driving down into the different aspects of the DBQ to get a deeper understanding (Worrell & Cross, 2004).

Findings of the study generally support much of the research that examines the difference of the Big Five on risky driving behaviour. Openness made no difference to risky driving across all three hypotheses. Findings contradict Dahlen and White (2006), that openness was a predictor of risky driving. The present findings were supported by Arthur and Graziano (1996) that there are no differences in risky driving on the DBQ. Explanations for no difference in openness and risky driving are difficult to explain because of the lack of research investigating it. However, openness is characterised by elements of sensation-seeking and it may be that this facet is not a relevant predictor of risky driving in the present study's sample (Haque, Chin & Lim, 2010).

This study supports Arthur and Graziano (1996), and Clarke and Robertson (2005), that conscientious drivers are less risky in general, report less driver violations and accidents. Conscientious drivers in the present study consistently reported low risky driving on the DBQ items. Perhaps conscientious participants abide by all kinds of laws including driving codes. Conscientious drivers may have a good ability to regulate emotions avoiding violations, such as driving fast because of frustrations, and are therefore successful self regulators, for example, making sure they are vigilant which avoids cognitive defects such as driver error and lapse (Arthur & Graziano, 1996). Conscientious drivers, reporting less risky driving, may be because they are law abiding and conforming to instructions of the study not to disclose illegal driving behaviour for ethical reasons, rather than being safe drivers (Schwebel et al, 2006). The present findings would reject Boggs and Roberts (2004), that conscientiousness was not a useful predictor of driver behaviour.

The findings of extraversion not influencing reported driver error and lapse, is contrary to the expectations of Verwey and Zaidel (2000) and Fine (1963), because extraverts have low level of vigilance. This finding may not have been found in the present research because Verwey and Zaidel's (2000) results were based on a specific monotonous task of driving down a motorway, where as this study was standardised to general leisure driving, providing drivers with variations, which are unlikely to be monotonous. Findings do however, support Eysencks (1967) theory of ascending reticular activating system, as extraverts are characterised by seeking external stimulation through driver violations, such as speeding, to increase low levels of arousal.

The present study's findings found that agreeable drivers report less driving violations, similar to Mesken et al (2002) who found those low in agreeableness were associated with increased driver violation. Explanations for the present finding may be because agreeable drivers have lower emotional arousal, which would prevent risky driving, as they are less likely to drive aggressively (Gardner & Moore, 2008). However, no difference was found between driver lapse and error across agreeableness. This is similar to Arthur and Graziano's (1996) findings and may be because altruistic behaviours which characterise agreeableness would not be expected to be related to cognitive errors and lapses.

Findings on neuroticism support literature as neurotic drivers' cognitive performance is affected rather than seeking stimulation, which may explain why there was no difference in driver violations (Trimpop & Kirkcaldy, 1997). However, finding of the present study support Eysenck (1970) those high in neuroticism tend to be involved in more accidents and report more driver lapses, perhaps because of their oversensitivity to stressors whilst driving, and decreasing information processes such as memory. In accordance with Eysenck's (1970) explanation of neuroticism and their deficiency in cognitive processes such as attention, findings should have indicated differences in neuroticism and driver error. This may not be the case, because in examination of descriptive statistics (see Table 1); neuroticism scores had less of a spread in the sample across the Big Five. Neurotics are also characterised as emotionally unstable, but this instability will vary depending on situational factors. Neurotic results may only be representative of the time they filled in the questionnaires and influence on elements of risky driving may depend on situational factors (Eysenck, 1970). For example, if neurotic drivers are in a bad mood they are likely to drive aggressively, reporting higher driver violation. Situational factors including a persons' mood vary and so do drivers' behaviour, suggesting this is hard to measure because of its unstable nature (Murray, Allen & Trinder, 2002).

The present findings add to previous research which examines the Big Five as predictors of risky driving. This study identifies differences between specific aspects of risky driving and the Big Five. Findings may therefore be able to contribute specifically to interventions reducing risky driving, such as Brake (2010). The present study also expressed the importance of considering multiple factors of driver behaviour such as different traits, which have previously been important. Unlike previous research, driving is more complex and not influenced by a few factors (Arthur & Day, 2009). This study additionally considered demographic variables because they mediate personality traits and therefore may account for the study's main findings (Xie & Parker, 2002). Existing research fails to account for the importance of previous successful predictors of risky driving, such as demographic variables and personality when considering new predictors, as literature since 2005 has identified that key researchers are considering new predictors of risky driving and neglecting past predictors in their studies (Lajunen, 2011).

The demographic variables in the study have mixed findings. Younger drivers (17-25 years) reported more violations than older drivers (26-55 and 56-78 years), similar to Özkan and Lajunen's (2005) findings. However, driver error and lapse had no difference on demographic variables, whereas Özkan and Lajunen (2005) have

because of suggested decreasing cognitive functioning, the older group should have reported greater on driver lapse and error (Woolley, 2010). Males reported more violations, where as females reported greater lapses, supporting Özkan et al (2006) findings. There was no difference in driver error, consistent with previous research such as Golias and Karlaftis (2002) and Lajunen and Summala (1995), the present findings suggested drivers with less experience (3months-20years) reported greater driver violation than experienced drivers (21-57 years). However, no difference was found in experience across driver error and lapse. Exposure in the present study, contrary to previous research (Lourens et al, 1999) had no effect on risky driving. This may be because of the associations with age and sex. This finding may be because of the lack of control for the purpose of driving in this study and because of the lack of research it is difficult to compare findings. Demographic variables are important to consider because research under reports their influence when there are clear risks identified, this is a contemporary issue which car insurance companies moving from risk to equality and they may mediate personality findings (Simon, 2011).

Driver error across demographic variables and most of the Big Five had no effect, when previous research had expected it to (RoSPA, 2010c). This finding may be because error is influenced by social desirability, despite what Lajunen & Summala (2003) suggest. Driver error in some research has been considered as a broader item including driver lapse (Özkan et al, 2006). In future, research should reconsider whether to investigate driver lapse and error as one item or include a measure of social desirability. The research of driver behaviour is beneficial to all individuals because of its practical implications to reduce accidents which are escalating with the increasing number of road users (Whatcar?, 2006).

Implications

This study has emphasised the importance of considering multiple factors at a time. Understanding risky driver behaviour and its interaction with multiple factors, such as personality, like the Big Five and demographic variables, may inform interventions and insurance companies concerned with risk (Falk & Montgomery, 2007). This research, like previous studies, has indicated personality traits are important when considering risky behaviours like driving. Assessing risk is a contemporary issue with the insurance companies' new ruling of avoiding sex discrimination of drivers (BBC, 2011), even when the present and previous research has identified risk between drivers sex and risky driving (RoSPA, 2010b). Insurance companies can still discriminate risk on the basis of driver age and experience (Stobbart, 2010). If possible, insurance companies could, in future, distinguish risk, based on a combination of factors, including personality traits susceptible to high or low risk. Rather than Insurance companies discriminating against those at high risk, in terms of behaviourism, to reduce risky driving, incentives (positive reinforcements) such as decreased insurance costs for 'safe' driving or participation in training courses could be enforced (Arthur & Day, 2009). Driver training courses could be implemented for those identified as at risk for example those who reported high on DBQ items, which may foster self awareness (Gandolfi, 2009). In the present study, participants found reflecting on their driving helpful. Incentives would also allow drivers to develop skills to improve factors influencing risk, such as extraverts learning how to increase their vigilance (RoSPA. 2010a), or extending the existing Pass-Plus (Directgov, 2009).

Recently there has been an increase in safety onboard car interventions to reduce risk, and rather than being generic, these should be tailored to individual differences of those who reported high risky driving on the DBQ. For example, Volvo (2011) intends to create an 'uncrashable' car which prevents driver violations including tailgating, it report drivers' blood-alcohol levels of drivers and surrounding hazards (The Telegraph, 2010). In this study, driver violations were greater in extraverted drivers, similar to previous research (Verwey and Zaidel, 2000). In accordance with Eysenck (1967), extraverts seek violations to increase their low arousal. Tailoring safety interventions to individual differences could reduce risky driving, and thus accidents and ineffective interventions. Volvo's (2011) 'uncrashable' car would be suited to extraverted drivers, rather than conscientious drivers, because it could not allow them to commit risky driving and would reduce their 'target level' of risk so they cannot be encouraged to take high risks, in accordance with Wilde's (1982) RHT. To be an effective intervention, insurance companies should provide incentives, such as decreased insurance fees for cars with matched safety interventions for at risk drivers to encourage drivers' to be safe (The Automobile Association, 2010). If cars, as well as safety interventions are matched to the personality traits of drivers, for example BMW are often more appealing to extraverts, by incorporating violation reducing mechanisms (or those suited) could make interventions more effective (Benson, MacRury & Marsh, 2007). This implication would require research to better understand multiple interactions of individual differences like personality and risky driving (Schwebel et al, 2006).

There are a growing number of interventions to reduce risky driving for employees within counties of the UK (Safe2travel, 2007) and encouragement for employers to check on their employees driving (Lancashire County Council, 2005). From an employment perspective, identifying the Big Five traits and various demographic variables by using psychometric tests, which may predict risky driving, could provide a means of identifying individuals who may not be suitable for jobs which require extensive driving (Gustello, 1993). For example, individuals who are highly extraverted, with the combination of monotonous driving, like motorways, may increase their risk because of their low levels of vigilance (Verwey and Zaidel, 2000). Identifying risky individuals for organisations will reduce potential costs such as medical bills, and reduce employers' lawsuits (Arthur & Day, 2009). Focus should move onto the discussion as to why there may be mixed results and alternative explanations to the findings in the present study by considering the studies limitations and future amendments.

Strengths, limitations and suggestions for future research

Despite mixed results and extending previous research, findings of this study should be interpreted with acknowledgement of its limitations. Previous research has assumed personality is a predictor of driver behaviour, but it has not been questioned as to whether exposure to risky driving affects personality. This research, similar to previous research, has not been able to address direction, but this study has extended the literature by considering differences between variables, rather than factors loosely related. In future research, the direction of influence between risky driving and personality should be investigated. Currently it is assumed personality

influences driving, but considering interactions may suggest driving influences personality. The present study has extended the research considering multiple factors, rather than a few predictors at a time, but it did not address the mediating role of personality across demographic variables, since depending on what stage of the life span a driver is at, different personality traits may slightly vary in intensity influencing driving (Lajunen, 2011). For example, extraversion is more likely to be a predictor of youth risky driving, than older drivers because of changes, such as family. This would seem like a logical next step for future research to consider, because it would involve more time to perform a cross sectional design (Field, 2005). Future study should also consider the purpose for driving, such as fleet drivers who would drive differently because of work pressures, and as mentioned in participants' feedback, would be an important factor (Davey et al, 2006). However, this was not investigated within the study, because it was concerned with driving leisurely.

Despite emphasising the complexity of driver behaviour, this study, because of limited time, may have been guilty of not taking a holistic approach to driving behaviour. The study considered specific driving behaviours measured using the DBQ, rather than general aspects which are more of a problem in the UK, such as speeding behaviours in relation to facets of the Big Five (Suhr, 1961). Despite not taking a holistic approach, this study did acknowledge multiple predictors and could inform that a more general theory of driver behaviour, including different variables is required to encourage research to consider its complexity (Fuller, 2005). Mixed findings may also be due to lack of control procedures and a small sample because of limited time, which may have skewed assumptions of the data including normality. Future studies with more time would include a larger sample; focus more on preliminary assumptions of the data, perhaps enabling the use of parametric tests to better detect differences, but the present study was more concerned with representative driving (Hole, 2007).

The sample of this study was small for a quantitative study due to limited time which may explain non normal distribution of results, but unlike larger studies (Özkan et al, 2006) the present study, to prevent biased results, used equal ratio of participants' sex, avoidance of the student population and a diverse age range. The sample were recruited by snowballing to get a diversity of drivers, but it relied upon participants recruiting other participants for the study, and although it was successful, participants are likely to recruit individuals who are convenient to them within the Worcestershire and Gloucestershire area where the study was initially conducted. This bias in my study might suggest results reflect regional differences of Worcestershire and Gloucestershire drivers who may use more country roads. Future research, similar to Golias and Karlaftis (2002) should consider whether there are differences in reported driving in different regions, as this would provide diversity, which this study may represent, Gloucestershire and Worcestershire regions.

This study, like much of the previous literature, used self reports because of their accessibility and ease, but they are limited because they rely on participants' accurate retrospection and memory of driving. Loftus (1993) found 14% of 590 drivers forgot they were involved in an accident, although this study only involved participants reflecting on their driving in the past week. Self reports also may be fallible, because they reflect participants' responses at that precise time, and may

vary in terms of the individual's mood and emotions to driving on that day. For example, if they are having a bad day they may rate in a more aggressive way and be more neurotic on the BFI than if questioned first thing in the morning (Lawton, Parker, Manstead, & Stradling, 1997). When investigating driver behaviour with self reports, future studies should be mindful of the unstable nature of driving and should investigate the DBQ test re-test reliability in more detail about whether driving is unstable or the DBQ items are too generic (Hole, 2007).

For ethical reasons, this study could only use self reports, which investigate drivers' intentions, but these cannot establish individuals' actual behaviours, which is a limitation of the TPB (Elliot et al, 2007). However, participants have reported in the past that they would be more honest about driving on self reports, rather than face-to-face (Sullman & Taylor, 2010). When asked, 63 of the participants in this study preferred referring to their driver behaviour on a questionnaire. Self reports are subjectively interpreted and are influenced by individuals' self presentation. For example, a driver may consider themselves as a 'safe' driver, and will fill in the DBQ reflecting this, when others perceive them as risky (Bassett, Cate & Dabbs, 2002). However, the present study was concerned with driver self reports, not significant others. Individuals' representation of what is 'safe' or unlawful on the DBQ differs between individuals, and reflects individuals' response. This ambiguity of phrases was also found in the feedback forms about the DBQ. Participants may create an identity which they may want to express, for example males may report more risky driving because it is what is reinforced in the media (Tragos, 2009). Future studies could attempt to bridge the gap between intentions and behaviours by objectively investigating driver behaviour, and by using mixed methods of self reports (intention) as a predictor of actual behaviour, investigated with observation, similar to Elliot et al (2007), to add to interventions.

The mixed findings may be explained by the drawbacks of the DBQ and BFI, despite their initial good reliability. When researched in this study, even with appropriate scoring, their internal consistency reliability was low. The DBQ internal consistency was .683 which is acceptable, however the BFI reliability was poor .050. These lower than expected values, may suggest these measures are influenced by social desirability, despite what Sullman and Taylor (2010) have suggested. When using the DBQ or the BFI in future, a social desirability scale may be recommended. However, by using the DBQ it allowed to break risky driving down to violation, error and lapses, rather than a generic risk common in research. The mixed findings may also be explained because of the inconsistent measures of the Big Five used in research, as different measures may find contrasting results (Cellar, Nelson & Yorke, 2000). Some participants reported in the feedback sheets that on the BFI it was difficult to put a number to their personality based on statements, as it varied depending on situational factors, such as what mood the person was in. The BFI was chosen because it prevents participants' frustration as it is short. Despite the DBQ being a measure of risky driving, even if the alcohol question was included (which for ethical reasons it was excluded from this study), the DBQ neglects other contemporary risky driving behaviours, including mobile phone use, satellite navigation systems, motorway driving, slowing down for horses and cyclists which are just a few examples mentioned by participants feedback (Road Safety Scotland, 2006). These neglected behaviours in 1995 when the DBQ was developed may not

have been an issue (Hole, 2007). This supports the present study's emphasis of drivers' behaviour complexity and instability. Risky driving is influenced by multiple factors, which are often unstable, such as the situations drivers are in, whereas the Big Five are more stable traits, which change more slowly and it is questionable as to whether both of these should be considered alongside each other, as in this study and previous research (Clarke & Robertson, 2005).

This study has added to previous research considering the complexity of driver behaviour considering multiple personality traits and demographic variables at a time. Future research should extend this study by taking a more holistic perspective, using a larger sample, and controlling for multiple variables, even including aspects such as drivers' enjoyment (Lajunen, 2011). Interactions between multiple variables and driver behaviour are extremely complex, and even this study has had to simplify its nature to consider only five traits and four demographic variables, due to limited time, but it is more than previous literature. This study was also reductionist considering the differences of single traits on risky driving, rather than accounting for the interactions between traits on driver behaviour (Schwebel et al, 2006). For example, not all extraverted drivers will be risky, as their behaviour may be mediated by other traits like conscientiousness. On the other hand, this study with limited time was only able to provide the beginning of expanding the research and in future a larger study should investigate the interactions between multiple variables and driver behaviour (Lajunen, 2011). This study also has practical relevance because it could help inform basics of future interventions to road safety and it controlled for ethical concerns (BPS, 2009).

Overall, the present study has added to literature into a relatively new and unstable area of research. This study even added to previous research by including a small thematic analysis which provided some useful feedback. Perhaps because of the nature of driver behaviour, feedback was sparse which may suggest why research into a consistently changing behaviour has been limited to quantitative research (Giacomini, 2001).

Conclusion

To conclude, in spite of the limitations noted previously, the mixed findings of the study add to the research that there are some differences in risky driving across the Big Five traits. This study, similar to that of Arthur and Day (2009) also emphasised the importance of taking a holistic perspective of the individual in driver behaviour, to appreciate its complexity, by investigating multiple factors and their interactions depending on situational factors. This study has also added to previous research by suggesting that risky driving can be broken down into lapses and violations, but future research should decide whether to include errors as an item or a social desirability scale. Research in future should control for previous important factors addressing risky driving, even when considering new areas of research, and begin to emphasise the complexity of risky driving. Research should investigate differences, to inform intervention to reduce risky driving and accidents (RoSPA, 2010c).

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