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Willingness to Use Intelligent Speed Assistance among UK Drivers: The role of personality and driving attitudes

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Highlights

- We present a new measure of willingness to avoid and to override ISA.
- Attitudes to driving violations were the strongest predictor of ISA willingness.
- Greater motor impulsivity was associated with greater willingness to override ISA.
- Low agreeableness predicted ISA avoidance, mediated by attitudes to violations.
- Findings can inform attitude-focused campaigns that promote ISA use.

Abstract

Speeding is a well-documented contributor to crash risk. Intelligent Speed Assistance (ISA) is an in-car system that helps drivers remain within the speed limit that is becoming more common in vehicles. This paper examines associations between personality, driving attitudes, and willingness to use ISA among UK drivers. A total of 176 participants (69% female; *M* age = 38.61, *SD* = 13.97), all of whom held a full UK driving licence with a mean of 20 years (*SD* = 13.5 years) of driving experience, completed an online questionnaire. Participants completed measures of attitudes to driving violations, impulsivity, sensation seeking, and the Big Five personality traits, as well as a new set of items developed for this study to measure willingness to use ISA. Principal component analysis identified two distinct and reliable components representing willingness to avoid ISA and willingness to override it. Regression modelling found that attitudes to driving violations were related to both willingness to avoid and override ISA. Mediation analysis found that agreeableness was related to willingness to avoid ISA indirectly through attitudes towards driving violations. These findings highlight a key challenge to realising the full potential safety impact of ISA. Drivers with positive attitudes toward violations, who would benefit most from ISA, are also the most likely to avoid using or override the system. Potential educational methods to address this challenge are discussed.

Introduction

Road collisions cause 1.19 million deaths per year worldwide. They are the most common cause of death for under 29 year-olds and the 12th leading cause of death for all age groups (World Health Organisation, 2023). Speed contributes both to the likelihood of collision and to the severity of a crash (Wegman et al., 2008). For example, 21% of fatalities on UK roads during 2023 involved a vehicle travelling above the speed limit (Department for Transport, 2024). Speed limits are an important component of speed management, but compliance is required for this approach to be effective. There is substantial evidence that drivers frequently violate speed limits. For example, it was estimated that 52% of cars exceeded 30 mph (50 km) speed limits in UK free-flowing driving conditions (Department for Transport, 2021).

Intelligent Speed Assistance (ISA) is an in-car safety system that aims to encourage compliance with speed limits. ISA identifies the current speed limit using cameras and/or the Global Positioning System (GPS). ISA systems may either advise or intervene. If advising, then drivers receive an audio and/or visual warning that they are speeding. If intervening, then the power to the engine is reduced to slow the vehicle's speed until it is within the speed limit. Lai et al. (2012) estimated that fitting an intervening ISA system that would not allow the driver to exceed the speed limit could reduce collisions by 33% on urban roads. This estimate reduced to 12% for a system that allowed the driver to override it. Override is, however, an important component of driver acceptability (Day et al., 2023) and required for situations where ISA recognises an incorrect speed limit.

Intervening ISA is becoming more common in vehicles (O'Carroll, 2024) and the extent to which it can reduce crashes will depend partly on whether and how drivers engage with it.

Lai and Carsten (2012) found that the drivers most likely to override ISA were those who would benefit most from speed reduction: drivers who were male, younger, and had previously indicated an intention to speed. We aim to further understand the characteristics of drivers who are more willing to avoid ISA to inform the development of promotional and educational materials designed to increase acceptance and use of ISA. We hypothesise that predictors of ISA avoidance may be similar to predictors of speeding, as the purpose of avoiding ISA is to break the speed limit.

A wide range of psychological correlates of road safety outcomes have been identified, including fitness to drive (Tinella et al., 2021) as well as speeding and driving violations in general (Sümer, 2003). Identified predictors of violations include self-regulation and normlessness (Lazuras et al., 2019) as well as anxiety and fatalism (Dotse & Rowe, 2025). In the preset study, we focus on well-established personality predictors and the related traits of impulsivity and sensation seeking.

A recent meta-analysis of relationships between the Big Five personality traits and risky and aggressive driving behaviours (Luo et al., 2023) found that lower conscientiousness and agreeableness showed the strongest correlations with risky and aggressive driving. Higher neuroticism and openness were also associated to risky driving whereas links with extraversion were non-significant. Impulsivity involves behaving with insufficient deliberation, forethought, and anticipation of consequences (Caci et al., 2003). Impulsivity has been linked to a wide range of driving violations in meta-analysis, including driving under the influence, aggressive driving, and traffic offences (Bıçaksız & Özkan, 2016). Sensation seeking is the willingness to engage in risky activities to experience new sensations (Zuckerman & Glicksohn, 2016). Zhang, et al. (2019) found associations between sensation

seeking and risky driving, aggressive driving, and speeding citations. These personality characteristics may also be associated with ISA use, as drivers who are more willing to engage in driving violations may be more likely to override or avoid a system designed to enforce compliance with speed limits.

Personality measures may help to identify drivers at elevated risk of ISA avoidance. While personality traits are not immutable (Roberts et al., 2017), they are relatively stable across adulthood (Bleidorn et al., 2022) and unlikely to provide viable targets for behaviour-change intervention in the context of road safety. However, identifying personality traits that relate to ISA avoidance may be useful to road safety, particularly in informing how intervention materials are delivered and framed (Matz et al., 2017). For example, different messaging may be effective for drivers high and low in impulsivity. Further, personality traits may be usefully viewed as distal predictors of risky driving and identifying more proximal factors that mediate the effects of personality may help to identify viable targets for road safety intervention.

Personality and related traits may shape attitudes that are more proximal and potentially modifiable predictors of behaviour. Attitudes are among the most well-established correlates of behaviour, with a meta-analysis reporting an average attitude-behaviour correlation of r = .38 across a wide range of domains (Kraus, 1995). Furthermore, a meta-analysis of 204 experimental studies found that changes in attitudes produced medium-sized changes in intentions (d = .48) and small-to-medium changes in behaviour (d = .38), providing evidence that attitudes play a causal role in behaviour change (Sheeran et al., 2016). With relevance to driving, attitudes to speeding have been found to predict observed speed (Haglund & Åberg, 2000) and speeding citations (Whissell et al., 2003). There is also evidence that attitudes

predict intentions to use and override ISA (Rowe et al., 2021; Özkan et al., 2025). These studies were conducted using the Theory of Planned Behaviour (TPB; Ajzen, 1991) as a framework. Across both studies, attitudes were stronger predictors of intentions than the other core components of the TPB model (i.e., subjective norms and perceived behavioural control). In these studies the content of the behavioural beliefs underlying attitudes included some beliefs relating specifically to ISA but also some relating to speeding more generally including shorter journey times, enjoying driving fast, and vulnerability to speeding penalties. These findings underscore the likely correlation between attitudes towards driving violations in general and attitudes towards ISA use specifically. Attitudes to driving violations have been modelled as mediators of the effect of personality-related constructs such as impulsivity and sensation-seeking on driving behaviour (Lazuras et al., 2019; Memarian et al., 2023). Therefore, this research provides some indication that attitudes to driving violations might be a potentially modifiable mediator of the link between personality and ISA usage.

Problem Statement and Research Objectives

ISA is still in the early stages of roll-out to the UK driving population (O'Carroll, 2024). In order to maximise the potential road safety benefits, drivers will need to use ISA as it becomes available and not to override it in critical situations. This can be supported by education and publicity campaigns to promote the benefits of the system to the public (Day et al., 2023). For example, Özkan et al. (2025) reported an intervention that increased intention to use ISA based on a TPB analysis of beliefs underlying ISA intentions (Özkan et al., 2024). The design of effective ISA promotion materials can be supported by understanding the personality and attitudinal characteristics of those who may seek to avoid or override the system.

The present study distributed a questionnaire to a sample of UK drivers in order to identify the extent to which the Big Five personality traits, impulsivity, sensation seeking, and attitudes to driving violations predict willingness to avoid intervening ISA (e.g., either by avoiding purchasing a car with it installed or by turning it off) or to use override options provided by ISA systems. Behavioural willingness was chosen to frame the outcome measures rather than intention as willingness captures spontaneous and situation-driven characteristics (Gerrard et al., 2008) which aligns more closely with impulsive behaviours. Willingness has been used in a range of studies exploring unsafe driving behaviours (Rowe et al., 2013; Tang et al., 2020). It was hypothesised that measures of the big five personality traits, impulsivity, sensation seeking, and attitudes to driving violations would be associated with willingness to avoid and override ISA. It was further hypothesised that attitudes to driving violations would mediate the relationship between personality traits and willingness to avoid and override ISA.

Method

Participants and Procedure

As specified in our pre-registered protocol (https://doi.org/10.17605/OSF.IO/7JU84), the study was designed to detect relationships of medium effect size (Cohen, 1992) or greater as these are likely to have real-world implications. Our pre-registered a priori power analysis, conducted using G*power (Faul et al., 2007), indicated 184 participants would provide 95% power to detect a medium effect ($f^2 = 0.15$, $\alpha = .05$) in a multiple regression model containing 12 predictors. The final sample contained 176 participants which was slightly below target. The mean age was 38.61 (*SD* = 13.97) years and 69% were female. All participants held a full UK driving licence, with a mean of 20 years (*SD* = 13.5 years) of driving experience. Their mean annual mileage was 5,817 miles (*SD* = 4,886.08). Following our pre-registered

plan, participants were recruited through an email sent to the University of xxx Staff and Student Volunteer list (no payment) and through the School of Psychology's Online Research Participation System (where they received course credit). This did not achieve the sampling target and therefore additional participants were recruited via the online recruitment platform, Prolific (www.prolific.com). These participants were paid £1.50, in accordance with Prolific's payment structure. Participants completed a single online questionnaire hosted via the survey platform, Qualtrics (www.qualtrics.com). The questionnaire structure is shown in Figure 1. Ethical approval was provided by the University Ethics Research Committee (190241409).

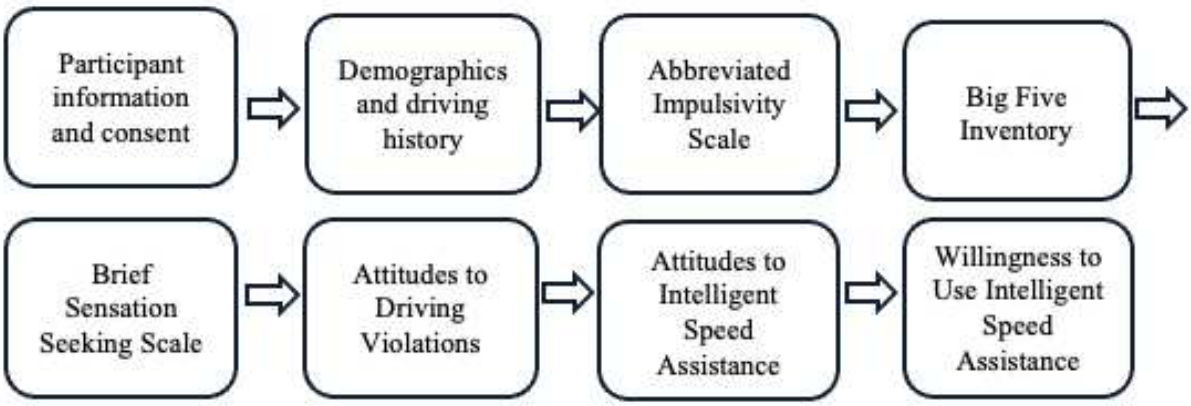

Figure 1. *Questionnaire structure*

Measures

The Big Five Personality Traits

The Big Five Inventory (BFI: Rammstedt & John, 2007) was used to measure individual differences in Openness, Conscientiousness, Extroversion, Agreeableness and Neuroticism. The scale consists of 10 items, two measuring each personality dimension. All items were scored on a 5-point scale ranging from "disagree strongly" to "agree strongly" (e.g., "I see myself as someone who is reserved"), with higher scores indicating a higher level of each trait. Rammstedt and John (2007) reported Cronbach alpha scores above .75 for all the

subscales; however, in the current study, the alpha values were Openness = .41, Conscientiousness = .51, Extroversion = .68, Agreeableness = .42 and Neuroticism = .59. These fall below the accepted level of .70.

Impulsivity

Impulsivity was measured using the Abbreviated Impulsivity Scale (ABIS; Coutlee et al., 2014). This 13-item scale distinguishes between motor (4 items), attentional (5 items) and non-planning (4 items) impulsivity. Participants indicated how frequently they engaged in these behaviours on a 4-point scale from "rarely/never" to "almost always/always" (e.g., "I am a careful thinker" (Inattention subscale), "I do things without thinking" (Motor subscale) and 'I plan tasks carefully' (Non-planning subscale). High scores indicate greater impulsivity. Coutlee et al. (2014) reported a range of alpha reliability scores based on three samples for Motor = .75 to .88, Attention = .72 to .77 and Non-planning = .70 and .75. In the present study the alpha scores were acceptable: Motor = .75, Attention = .75 and Non-planning = .68.

Sensation seeking

Sensation seeking was measured using the Brief Sensation Seeking Scale (BSSS-8; Hoyle et al., 2002). This scale contains 8 items (e.g., "I would like to explore strange places") and utilises a 5-point response scale ranging from "strongly disagree" to "strongly agree". Higher scores indicate greater sensation seeking. The measure was used as a single-factor scale to capture general sensation-seeking (Hoyle et al., 2002). The alpha coefficient in the present study was .80.

Attitudes to Driving Violations Scale

The Attitudes to Driving Violation Scale (West & Hall, 1997) is a single-factor scale comprising 7 items (e.g., "Penalties for speed should be more severe") rated on a 5-point scale from "strongly disagree" to "strongly agree". Lower scores indicate more positive attitudes to driving violations. West and Hall (1997) reported the alpha was .76. In the present study, the alpha value was .74.

ISA Willingness

We created items to measure drivers' willingness to use ISA. Initially, 25 items were developed that asked the participants how willing they were to override the system (e.g., "How willing would you be to override the ISA system by firmly pressing the accelerator in the following situations… on a clear residential road" or avoid the use of the system (e.g., "How willing would you be to delay buying a car to avoid having to buying one without an ISA system"), using a 7-point scale from "very unwilling" to "very willing". The psychometric properties of this new measure are reported in the results section.

Data Analysis

All analyses were conducted using SPSS version 31 (IBM Corp, 2025) unless otherwise stated. In line with the pre-registration, Principal Component Analysis (PCA) was used to reduce the number of variables measuring ISA willingness. The number of components to retain was determined by inspecting the scree plot and conducting Horn's parallel analysis with 1000 random data sets applying the 95th percentile criterion (Dinno, 2009) implemented in Stata (StataCorp, 2025). The reliability of emergent components was tested using Cronbach's alpha and composite scales were formed from items with loadings of .50 or greater. As detailed in the pre-registration, outliers were identified on scale scores using a 1.5

x Inter-quartile range rule. Pearson correlations were used to initially explore relationships of the personality scales and attitudes to driving violations with the ISA willingness scales. Hierarchical regression analyses were then conducted to identify independently significant personality predictors of the ISA willingness. In a deviation from the pre-registration, these regression models contained 14 predictors (age, gender, years of licensure, annual mileage, five personality factors, three impulsivity subscales, sensation-seeking, and attitudes to driving violations) rather than 12 as in our original protocol. This reflected the addition of the measure of sensation seeking, the inclusion of annual mileage and years of license as covariates, and the removal of an outcome variable that was erroneously treated as a predictor. Departing from the pre-registered plan of regressing only the significant correlates, all predictors were entered together, giving a more conservative test of independent effects. Due to occasional missing data the number of observations in our regression was 168-169 observations. This provides 91% power to detect a medium effect size. Mediation analysis using the SPSS PROCESS macro tested whether identified relationships between the personality factors and ISA willingness were mediated by attitudes to driving violations. These mediation analyses were not pre-registered and therefore should be treated as exploratory. Our pre-registration contained plans to conduct a test-retest reliability assessment of the ISA willingness measure, but this was not conducted.

Results

Forming ISA willingness scales

A PCA was conducted to explore the structure of the items assessing ISA willingness. This identified six components with eigenvalues >1 (Table 1). Inspection of the scree plot indicated an elbow after three components. This was supported by the parallel analysis: the adjusted eigenvalues of the first three components exceeded 1 (7.13, 2.87, 1.51), indicating

that they explained more variance than expected by chance, whereas the fourth fell below 1 (.70). Therefore, the PCA was rerun forcing a three-component solution.

Table 1. *Eigenvalues >1 from the Principal Components Analysis of the ISA willingness items.*

Component	Eigenvalues	% of Variance
1	7.88	31.50
2	3.52	14.07
3	2.03	8.14
4	1.14	4.54
5	1.08	4.33
6	1.03	4.10

Direct oblimin rotated component loadings are shown in Table 2. Eight items loaded strongly onto the first component at .50 or above. These items were all associated with avoiding ISA, for example, by not buying a car with ISA fitted or by turning it off before driving. This component was named the avoidance scale and the mean of the eight items was used to assess willingness to avoid ISA (α = .89). Nine items loaded above .50 on the second component. As these statements related to overriding the system to increase speed, this was named the overriding scale. The mean of the nine items was used to assess willingness to override ISA (α = .86). Four items loaded strongly on to the third component. We were unable to identify a meaningful theme for this component and therefore dropped it from subsequent analysis. Four items did not load above 0.50 on any components. As shown in Table 3, there was a significant, medium-sized (Cohen, 1992) correlation between the two ISA scales.

278 Table 2. *Direct oblimin rotated component loadings from Principal Components Analysis of*
279 *the Intelligent Speed Assistance willingness items*

280

How willing would you be to…	Component 1	2	3
...delay buying a car to avoid having to buying one with an ISA system	**.86**	.13	-.14
...have an ISA system retrospectively fitted to your vehicle as a free upgrade*	**.84**	-.12	.02
...have the ISA system permanently switched off before taking delivery of the vehicle	**.83**	.20	-.12
...have ISA fitted as a free upgrade to your existing vehicle*	**.76**	-.13	.06
...turn the ISA system off before the start of a journey	**.73**	.20	.04
...buy a car with ISA if the vehicle did not allow you to switch off the ISA system at the start of a journey*	**.71**	-.14	.22
...buy a pre-owned car without ISA rather than buy a new vehicle with the system	**.64**	.03	.01
...turn the ISA system off permanently, even if this was illegal	**.51**	.33	-.06
...buy a car with ISA if the vehicle did not allow you to drive slightly above the speed limit*	.48	-.24	.45
[1]...on a clear residential road	.06	**.81**	-.11
[1]...if you have friends of your own age in the car	.00	**.72**	.01
[1]...when travelling through a long stretch of road works on a motorway	-.02	**.72**	.05
[1]...to chase another driver that has annoyed you	.08	**.70**	-.20
[1]...when someone is trying to overtake you	.17	**.66**	-.03
[1]...if you felt pressured to go faster by a close following vehicle	-.10	**.66**	.03
[1]...to overtake a slower driver in an outer lane, using the inside lane	.04	**.58**	.13
[1]...if you were late for an appointment	.03	**.54**	.24
[1]...when you can see a faster speed limit sign ahead	.03	**.52**	.35
[1]...to push into a moving queue of traffic at the last minute	.03	.41	.21
[1]...when joining traffic on a motorway from a slip road	-.08	.04	**.86**
[1]...when overtaking	-.03	.13	**.81**

How willing would you be to…	Component 1	2	3
...buy a car with ISA if the vehicle did not allow you to override the ISA system by use of the accelerator*	.28	-.34	**.62**
[1]...if you need to reach a narrow part of the road before an oncoming vehicle	.06	.15	**.55**
[1]...on a clear motorway	.09	.38	.48
[1]...to get past a green traffic light before it changes to amber	.11	.36	.46

*NOTE: Rotated pattern matrix loadings > .50 are highlighted in bold. * denotes reverse-scored item.*

[1]*Question stem: how willing would you be to override ISA?*

Table 3. *Descriptive statistics for predictors and correlations with ISA willingness*

Items	*M*	*SD*	*r* with ISAW Avoidance	*r* with ISAW Overriding
ISAW Avoidance Scale	3.75	1.47	-	0.35***
ISAW Overriding Scale	2.36	0.95	0.35***	-
Gender[1]	0.31	0.46	0.11	0.16*
Age	38.61	13.97	-0.15	-0.12
Years held licence	20.01	13.56	-0.12	-0.11
Annual mileage	5817.34	4886.09	0.16*	0.04
Openness	3.53	0.92	-0.03	-0.02
Neuroticism	3.10	1.02	0.05	-0.03
Conscientiousness	3.71	0.81	0.01	-0.09
Agreeableness	3.44	0.85	-0.21**	-0.15*
Extraversion	2.86	1.00	-0.12	-0.05
Non-Planning Impulsivity	1.93	0.53	0.10	0.06
Motor Impulsivity	1.92	0.52	0.14	0.25**

Attentional Impulsivity	1.90	0.46	0.16*	0.18*
Brief Sensation Seeking	2.79	0.82	0.09	0.20*
Attitudes to Driving Violations	3.48	0.66	-0.42***	-0.36***

*ISAW = Intelligent Speed Assistance Willingness. [1]Female = 0, Male = 1. *p < .05. ** p < .01. *** p < .001.*

Relationships of the ISA willingness scales with the personality and attitude measures

Table 3 shows descriptive statistics and the Pearson correlations of the ISA willingness scales with demographic, personality and attitude measures. We identified six cases with outlying scores on single variables: four on the overriding willingness scale and one each on non-planning impulsivity and attitudes to driving violations. No cases had outliers on multiple variables. On inspection these cases showed coherent patterns of responding and plausible questionnaire completion times providing evidence that they are valid scores rather than resulting from poor data quality. Therefore, these data points were preserved in the analyses reported here. We ran sensitivity analyses to check the effects on the results, as described below and reported in Appendix 1. Willingness to avoid ISA was correlated with lower agreeableness and higher attentional impulsivity, riskier attitudes to driving violations and greater mileage. Willingness to override ISA was correlated with higher motor and attentional impulsivity, sensation seeking, and riskier attitudes to driving violations and gender (males had stronger willingness to override). These correlations were small according to Cohen's criteria, except for the medium-sized correlations between the ISA scales and attitudes to driving violations.

To assess the independent relationships of the personality traits and attitudes to driving violations with willingness to avoid or override ISA, two hierarchical regression analyses were performed, whilst controlling for the demographic measures. The avoidance and overriding scales were the dependent variables in separate analyses (Tables 4 and 5). The predictors were entered in three blocks: (i) age, gender, years held licence, and annual mileage, (ii) the Big Five personality factors, the three impulsivity subscales, and the total sensation seeking scale, and (iii) attitudes to driving violations.

Willingness to avoid ISA

Age, gender, years held licence, and annual mileage explained 7.3% of the variance in willingness to avoid ISA ($F(4,163) = 3.20$, $p = .015$). As shown in Table 4 annual mileage made a significant independent contribution. The addition of the personality measures in block 2 explained an additional 8.2% of the variance, which was non-significant ($\Delta F(9, 154) = 1.66$, $p = .102$). There were significant independent effects of conscientiousness and agreeableness in block 2. The addition of attitudes to driving violations in block 3 explained a further 11.1% of the variance, which was significant ($\Delta F(1,153) = 23.09$, $p < .001$). Together, the variables in the final regression model explained 26.6% of the variance in willingness to avoid ISA ($F(14,153) = 3.96$, $p < .001$), with conscientiousness and attitudes to driving violations making significant independent contributions.

Table 4. *Hierarchical regression analysis predicting willingness to avoid ISA (N = 168).*

Variable	Model 1			Model 2			Model 3		
	B	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Gender	0.32	0.24	0.10	0.32	0.26	0.10	0.18	0.25	0.06
Age	-0.04	0.02	-0.38	-0.04	0.03	-0.38	-0.03	0.02	-0.32
Years held licence	0.02	0.02	0.20	0.02	0.03	0.21	0.01	0.02	0.11
Annual mileage	0.00	0.00	0.15*	0.00	0.00	0.13	0.00	0.00	0.12
Openness				0.04	0.06	0.05	0.04	0.06	0.05
Neuroticism				-0.05	0.06	-0.07	-0.01	0.06	-0.02
Conscientiousness				0.17	0.09	0.19*	0.16	0.08	0.17*
Agreeableness				-0.16	0.07	-0.19*	-0.08	0.07	-0.10
Extraversion				-0.08	0.06	-0.12	-0.06	0.06	-0.08
Attention impulsivity				0.05	0.07	0.08	0.05	0.06	0.08
Motor impulsivity				0.11	0.07	0.16	0.06	0.06	0.08
Non-planning impulsivity				0.05	0.06	0.08	0.04	0.06	0.05
Brief Sensation Seeking Scale				-0.01	0.02	-0.04	-0.01	0.02	-0.05
Attitudes to Driving Violations							-0.12	0.02	-0.36***

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Willingness to override ISA

Age, gender, years licence held, and annual mileage explained a non-significant 4.3% of the variance in willingness to override ISA ($F(4, 164) = 1.85$, $p = .12$). As shown in Table 5 the addition of the personality measures in block 2 explained an additional 10.5% of the variance which was significant ($\Delta F(9,155) = 2.13$, $p = .03$) with only motor impulsivity having a significant independent effect. The addition of attitudes to driving violations in block 3 explained a further 6.9% of the variance, which was significant ($\Delta F(1,154) = 13.67$, $p<.001$).

Motor impulsivity remained a significant predictor in the final model, with a reduced beta weight, along with attitudes to driving violations. Together, the variables in the final regression model explained 21.8% of the variance in willingness to override ISA ($F(14,154) = 3.07$, $p < .001$).

Table 5. *Hierarchical regression analysis predicting willingness to override ISA (N =169).*

	Model 1			Model 2			Model 3		
Variable	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Gender	0.33	0.16	0.16*	0.24	0.17	0.12	0.18	0.16	0.09
Age	-0.01	0.02	-0.17	-0.02	0.02	-0.22	-0.01	0.02	-0.19
Years held licence	0.00	0.00	0.04	0.01	0.02	0.20	0.01	0.02	0.13
Annual mileage	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	-0.01
Openness				0.01	0.04	0.02	0.01	0.04	0.02
Neuroticism				-0.06	0.04	-0.13	-0.04	0.04	-0.09
Conscientiousness				0.02	0.06	0.04	0.02	0.05	0.03
Agreeableness				-0.09	0.05	-0.16	-0.05	0.05	-0.09
Extraversion				-0.05	0.04	-0.12	-0.04	0.04	-0.09
Attention impulsivity				0.05	0.04	0.11	0.04	0.04	0.10
Motor impulsivity				0.12	0.04	0.25**	0.09	0.04	0.19*
Non-planning impulsivity				-0.03	0.04	-0.08	-0.04	0.04	-0.09
Brief Sensation Seeking Scale				0.01	0.01	0.07	0.01	0.01	0.08
Attitudes to Driving Violations							-0.06	0.02	-0.28***

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

The role of attitudes to driving violations in the relationship between personality and ISA willingness

The hierarchical regression analyses revealed that conscientiousness and agreeableness were significant predictors of willingness to avoid ISA, and motor impulsivity was a significant predictor of willingness to override ISA in the models containing the personality measures (Model 2). Three mediation analyses tested whether the relationship of conscientiousness and agreeableness with willingness to avoid ISA, and the relationship of motor impulsivity with willingness to override ISA, were mediated by attitudes towards driving violations. In each analysis, the respective personality factor was entered as the predictor variable, the other personality factors and the participant's age, gender, and years held licence were entered as covariates, and attitudes towards driving violations was entered as a potential mediator.

As reported in Table 6, the direct relationship between conscientiousness and willingness to avoid ISA was significant, whereas the indirect effect via attitudes towards driving violations was non-significant. This indicates that attitudes to driving violations does not mediate the relationship between conscientiousness and willingness to avoid ISA. In contrast, the direct relationship between agreeableness and willingness to avoid ISA was non-significant, whereas the indirect relationship was significant. This indicates that attitudes to driving violations mediated the effect of agreeableness on willingness to avoid ISA. Finally, the direct and indirect relationships between motor impulsivity and willingness to override ISA were both significant, thereby indicating the attitudes to driving violations partially mediated the relationship of motor impulsivity with willingness to override ISA.

Table 6. *Mediation analyses of the role of attitudes to driving violations in the relationship between personality measures and ISA willingness.*

Predictor Variable → Outcome Variable	Total Effect			Direct effect			Indirect effect		
	Effect	LLCI	ULCI	Effect	LLCI	ULCI	Effect	LLCI	ULCI
Conscientiousness → ISA Willingness Avoidance Scale	0.17*	0.01	0.34	0.16*	0.004	0.32	0.01	-0.04	0.08
Agreeableness → ISA Willingness Avoidance Scale	-0.17*	-0.31	-0.02	-0.09	-0.23	0.05	-0.08*	-0.16	-0.02
Motor Impulsivity → ISA Willingness to Overriding Scale	0.11*	0.03	0.20	0.09*	0.004	0.17	0.03*	0.002	0.06

Note. * $p < .05$. LLCI = Lower Level Confidence Interval. ULCI = Upper Level Confidence Interval

Sensitivity analyses

We repeated the hierarchical regression and mediation analyses, removing cases with identified outliers from relevant analyses. Two cases were dropped from models predicting avoidance and six were dropped from models predicting overriding. As shown in Appendix 1 attitudes to driving violations remained the dominant predictor of ISA willingness (Tables A1.1 and A1.2). In the mediation sensitivity analyses (Table A1.3), the indirect relationship between agreeableness and willingness to avoid ISA also remained significant. The relationship between conscientiousness and willingness to avoid ISA was essentially unchanged, remaining at the margin of significance (p =.051 in the sensitivity analysis). The total relationship between motor impulsivity and willingness to override ISA remained

significant but the direct and indirect relationships fell just below 0.05 significance in the sensitivity analysis (direct, p =.07, indirect b=.03, 95% CI: -.002, .06).

Discussion and Conclusions

The study aimed to identify the extent to which Big Five personality traits, impulsivity, sensation seeking, and attitudes to driving violations predicted drivers' willingness to use ISA. Our measure of willingness to use ISA demonstrated a coherent structure with separate components relevant to avoiding and overriding ISA with only a moderate correlation between these two subscales. While recognising that our cross-sectional data does not test causality, in line with theoretical models of behaviour, we modelled personality traits as distal predictors and attitudes as more proximal predictors of willingness to use ISA. Assuming this model, the relationship between agreeableness and willingness to avoid ISA was mediated by attitudes, whereas the relationship between conscientiousness and willingness to avoid ISA was not. There was also a relationship between motor impulsivity and willingness to override ISA as discussed below.

The positive relationship between conscientiousness and willingness to avoid ISA could be seen as counterintuitive. Previous studies have found that those who are less conscientious are more likely to speed (Hatfield et al. 2017, McDonald et al., 2023). Therefore, it might have been expected that people who scored low on this trait would be less likely to use ISA. However, lower conscientiousness was related to greater willingness to accept ISA in our multiple predictor regression model. One possible explanation is that participants who score low on conscientiousness recognised that they had difficulty in complying with speed limits and, therefore, welcomed a system that may help them to avoid speeding-related offences. However, this relationship may not be reliable; the relationship was on the margin of the

accepted significance level, falling just above 0.05 in the sensitivity analysis. The reliability of the conscientiousness scale fell below the criterion normally used to identify acceptable reliability and the bivariate correlation was non-significant and close to zero. Therefore, this result would particularly benefit from replication before treating it with confidence.

Motor impulsivity was independently related to willingness to override ISA; the mediation analysis found a significant direct relationship and an indirect relationship via attitudes to driving violations. However, both effects were modest and neither remained significant after excluding outliers in our sensitivity analysis, although the overall relationship between motor impulsivity and override willingness remained. Therefore, these results should be treated as tentative and would benefit from replication. Even if they are replicable, a cross-sectional design does not allow causality to be inferred. Any direct relationship may be mediated by variables unmeasured in this study.

However, a relationship between motor impulsivity and willingness to override ISA is consistent with existing research that shows poor motor impulse control is associated with increased levels of driving violations and risk of collisions (Bıçaksız & Özkan, 2016; Lazuras et al., 2019). This relationship highlights the possibility of targeting individuals with high impulsivity for road safety education on using ISA. Similar personality-targeted interventions have been successfully implemented in other behavioural domains. For example, Conrod et al. (2013) demonstrated that a selective intervention tailored to adolescents with high-risk personality traits, including impulsivity, significantly reduced alcohol misuse compared with controls. This suggests that tailoring road safety interventions to impulsive individuals may likewise improve engagement with and acceptance of ISA. Research in other domains has also identified that impulsivity can reduce the effectiveness of certain intervention

approaches (Churchill et al. 2011; Jacobson et al., 2015). Therefore, those delivering interventions should be mindful of whether the intervention message works well for people who are high in impulsivity, as this is a target group with great potential to benefit from road safety education.

We found that people who report lower agreeableness were more willing to avoid ISA. This is consistent with the broader literature which shows a negative relationship between agreeableness and collisions, disqualification, driving offences and risky driving (Chraif et al., 2016). Agreeableness reflects cooperativeness and compliance with social norms so drivers lower in agreeableness may hold more permissive attitudes to driving violations, which in turn may underpin a greater willingness to avoid ISA. As discussed elsewhere our cross-sectional design prevents causal interpretation. Therefore, we cannot determine whether lower agreeableness shapes attitudes to driving violations or the reverse, or whether a shared disposition, such as antisocial propensity, gives rise to both. Regardless of the direction of these associations, agreeableness may help to identify drivers who would particularly benefit from technologies such as ISA and who could be targeted for educational intervention, with consideration of how ISA use can be most effectively promoted to people who are less agreeable.

As predicted, we found a robust relationship between attitudes to driving violations and willingness to avoid and override ISA. Many items in the Attitudes to Driving Violations Questionnaire (West & Hall, 1997) refer implicitly or explicitly to speeding and the purpose of ISA is to prevent speeding. This relationship may be understood in terms of general frameworks regarding technology acceptance (e.g., Davis, 1989). With reference to Advanced Driver Assistance Systems, perceived usefulness has been identified as an important predictor of usage (Stiegemeier et al., 2022). It is likely that those with more

positive attitudes towards violations perceive ISA as less useful and therefore are less willing to use it. One solution would be to implement a version of ISA that cannot be turned off or easily overridden. Such an approach would be commensurate with the hypothesis that drivers who are more likely to benefit from ISA are most likely to avoid it. However, override options are required to allay concerns regarding situations where ISA registers the wrong speed limit (Day et al., 2023) and the opportunity to override ISA is important to driver acceptability in general (Day et al., 2023). It is possible that introduction of acceptable forms of ISA may form a pathway towards the acceptability of mandatory ISA.

We modelled attitudes to driving violations as a mediator of the effect of personality on ISA willingness. This followed other work that has considered attitudes to driving violations as a mediator of the effects of personality on driving behaviour (Lazuras et al., 2019; Memarian et al., 2023). As noted above, our cross-sectional data do not support explicit tests of causal effects. It is possible that other mechanisms explain the observed correlations here. For example, it is possible that attitudes are in part shaped by behaviour as well as, or instead of, attitudes causing behaviour.

If our modelled mediation pathways are accurate then the results suggest that education and publicity campaigns targeting attitudes to driving violations could disrupt the pathways linking impulsivity and agreeableness to ISA willingness. Many studies have documented limited effectiveness in road safety interventions (Ker et al., 2003) and even unintended negative consequences of educational strategies (Glendon et al., 2014). A recent meta-analysis identified that education can have positive effects on road safety behaviour and indicated the most effective approaches to road safety psychoeducation (Tirla et al., 2024). A range of studies have shown it is possible to improve attitudes to speeding through education

(Parker, 2002, Stead et al., 2005, Steyvers et al., 2002). For example, Stead et al. (2005) found that a sustained messaging campaign based on the Theory of Planned Behaviour had a significant impact on attitudes to speeding. As such interventions aiming to increase willingness to use ISA might focus on the risks of speeding to enhance use. Other issues relevant to technology acceptance, including trust, risk perception and perceived benefits (Davis, 1989; Stiegemeier et al., 2022) are also likely to apply to ISA. As such education regarding ISA might focus on other potential benefits, including reduced driver workload and avoidance of speeding fines. Trust might be addressed through highlighting the override option, which provides drivers with a mechanism to respond if the ISA system has registered the wrong speed limit. There is already some evidence that such approach may be effective. For example, a recent study demonstrated that a leaflet and animation designed using the Theory of Planned Behaviour to convey these sorts of messages was effective in strengthening intentions to use ISA (Ozkan et al., 2025).

Limitations

The results of this study must be considered in the context of several limitations. First, as noted above, our design was cross-sectional, which precludes testing causal direction in the associations identified. Second, it should be noted that the internal reliabilities of the sub-scales contained in the BFI were under .70, which is below the desirable level to demonstrate strong psychometric properties. This is likely to weaken associations with other measures. Therefore, replication of our findings in studies using more reliable measures of personality would be beneficial. Third, the sample studied may not be representative of the UK driving population as indicated by the gender bias towards females. Our sample was recruited through a university volunteer programme and an online recruitment website. Replication in more representative samples would be desirable.

Whilst we did not ask directly, it is likely that few of the participating drivers will have had first-hand experience using an ISA system, as these systems are still relatively new. Previous work on attitudes underlying intentions to use ISA has also focused on drivers who do not have ISA currently (Rowe et al. 2021, Özkan et al. 2024). It is timely to understand the underlying characteristics of attitudes to ISA in unexposed drivers, as finding the most effective way of introducing ISA at point of purchasing a first ISA enabled vehicle may provide an opportunity to strengthen ISA adoption intentions (Grozev et al., 2026).

It would be useful for further research to test whether our measure predicts future ISA relevant behaviour, for example on a simulated drive where ISA is available. Research focusing on people who do not currently have ISA shows that attitudes are the dominant predictor of intention (Özkan et al., 2024). It is possible that the role of subjective norms and perceived behavioural control, for example, may become more important as experience with ISA is gained. However, a meta-analysis of TPB predictors of risky driving showed that subjective norms and perceived behavioural control were substantial predictors of speeding behaviour (Somoray et al., 2024). Therefore, further research would also be useful to ascertain whether the predictors of ISA (non)usage in drivers of vehicles fitted with ISA are the same as those of willingness to avoid and override ISA identified here.

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Appendix 1 sensitivity analysis removing outliers from hierarchical regression and mediation modelling.

In the hierarchical regression model and mediation model predicting ISA avoidance, two cases with outliers on non-planning impulsivity and on attitudes to driving violations respectively were removed (N = 166); in the overriding models these two cases, as well as four cases with outliers on the overriding ISA scale were removed (N = 163). Model fit in these analyses was similar to the analyses in the full sample. In the analysis of willingness to avoid ISA, the demographic block explained 7.1% of the variance ($F(4, 161) = 3.07$, $p = .018$), the personality measures a further 7.8% ($\Delta F(9, 152) = 1.55$, $p = .137$), and attitudes to driving violations a further 9.9% ($\Delta F(1, 151) = 19.78$, $p < .001$); the final model explained 24.7% of the variance ($F(14, 151) = 3.54$, $p < .001$). In the analysis of willingness to override ISA, the demographic block explained 4.3% ($F(4, 158) = 1.76$, $p = .139$), the personality measures a further 8.3% ($\Delta F(9, 149) = 1.58$, $p = .126$), and attitudes to driving violations a further 10.9% ($\Delta F(1, 148) = 21.18$, $p < .001$); the final model explained 23.6% of the variance ($F(14, 148) = 3.26$, $p < .001$).

Table A1.1. Hierarchical regression predicting willingness to avoid ISA, outliers excluded (N = 166).

	Model 1			Model 2			Model 3		
Variable	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Gender	0.25	0.25	0.08	0.23	0.27	0.07	0.14	0.25	0.04
Age	-0.04	0.02	-0.36	-0.04	0.02	-0.35	-0.03	0.02	-0.31
Years held licence	0.02	0.02	0.20	0.02	0.03	0.19	0.01	0.03	0.11
Annual mileage	0.00	0.00	0.17*	0.00	0.00	0.15	0.00	0.00	0.13
Openness				0.04	0.06	0.05	0.04	0.06	0.05
Neuroticism				-0.05	0.06	-0.07	-0.01	0.06	-0.02
Conscientiousness				0.17	0.09	0.19	0.16	0.08	0.18
Agreeableness				-0.14	0.07	-0.17	-0.08	0.07	-0.09
Extraversion				-0.10	0.06	-0.13	-0.06	0.06	-0.09
Attention impulsivity				0.06	0.07	0.09	0.05	0.06	0.08

Motor impulsivity			0.10	0.07	0.14	0.05	0.06	0.07
Non-planning impulsivity			0.06	0.07	0.09	0.04	0.06	0.06
Brief Sensation Seeking			-0.01	0.02	-0.03	-0.01	0.02	-0.04
Attitudes to Driving Violations						-0.11	0.03	-0.34***

Note. * p < .05. ** p < .01. *** p < .001.

Table A1.2. Hierarchical regression predicting willingness to override ISA, outliers excluded (N = 163).

	Model 1			Model 2			Model 3		
Variable	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Gender	0.30	0.15	0.16*	0.25	0.16	0.13	0.20	0.15	0.11
Age	-0.02	0.01	-0.28	-0.02	0.02	-0.30	-0.02	0.01	-0.27
Years held licence	0.01	0.02	0.15	0.02	0.02	0.27	0.01	0.02	0.19
Annual mileage	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	-0.04
Openness				-0.01	0.04	-0.03	-0.01	0.04	-0.03
Neuroticism				-0.05	0.04	-0.12	-0.03	0.04	-0.07
Conscientiousness				0.01	0.05	0.02	0.01	0.05	0.01
Agreeableness				-0.03	0.05	-0.05	0.02	0.04	0.03
Extraversion				-0.06	0.04	-0.14	-0.05	0.04	-0.11
Attention impulsivity				0.06	0.04	0.16	0.05	0.04	0.14
Motor impulsivity				0.10	0.04	0.24*	0.07	0.04	0.17
Non-planning impulsivity				-0.06	0.04	-0.15	-0.07	0.04	-0.17
Brief Sensation Seeking				0.00	0.01	0.01	0.00	0.01	0.01
Attitudes to Driving Violations							-0.07	0.01	-0.36***

Note. * p < .05. ** p < .01. *** p < .001.

In the mediation analyses, the pattern of predictors of willingness to avoid ISA was unchanged: conscientiousness still demonstrated a significant direct relationship (b = 0.160, 95% CI [0.001, 0.319]) while the indirect relationship through attitudes to driving violations was non-significant (b = 0.012, 95% CI [−0.045, 0.075]). There was a significant indirect relationship between agreeableness willingness to avoid ISA, via attitudes (b = −0.068, 95% CI [−0.139, −0.014]) but no significant direct relationship (b = −0.085, 95% CI [−0.226, 0.056]). For willingness to override ISA, the total effect of motor impulsivity remained significant (b = 0.100, 95% CI [0.020, 0.179]). However, in contrast to the full analyses,

neither its direct relationship (b = 0.071, 95% CI [−0.005, 0.147]) nor its indirect relationship through attitudes (b = 0.028, 95% CI [−0.002, 0.063]) was significant.

Table A1.3. Mediation analyses of the role of attitudes to driving violations, outliers excluded.

	Total effect			Direct effect			Indirect effect		
Predictor → Outcome	*Effect*	*LLCI*	*ULCI*	*Effect*	*LLCI*	*ULCI*	*Effect*	*LLCI*	*ULCI*
Conscientiousness → ISA avoidance	0.171*	0.003	0.340	0.160*	0.001	0.319	0.012	-0.045	0.075
Agreeableness → ISA avoidance	-0.153*	-0.300	-0.007	-0.085	-0.226	0.056	-0.068*	-0.139	-0.014
Motor Impulsivity → ISA overriding	0.100*	0.020	0.179	0.071	-0.005	0.147	0.028	-0.002	0.063

Note. Avoidance models N = 166; overriding model N = 163. * p < .05 (total and direct effects) or 95% bootstrap confidence interval excluding zero (indirect effects). LLCI = Lower Level Confidence Interval. ULCI = Upper Level Confidence Interval.