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Anxiety and performance in the British driving test

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Abstract

Test anxiety may degrade the quality of human performance when tasks are complex and demanding. This study was concerned with the influence of test anxiety on driving performance during the British practical driving test. Thirteen candidates participated in three sessions: (a) a normal driving lesson, (b) a mock driving test, and (c) UK Department of Transport official driving test. Anxiety was measured via psychophysiology (heart rate) and subjective self-report (State-Trait Anxiety Inventory). The results indicated that state anxiety increased in accordance with the formality of evaluative scenario. Those who failed the formal driving test exhibited significantly greater increases in heart rate and state anxiety during this test than the successful candidates. These differences were not apparent during baseline conditions or the mock-driving test. The implications of the study are discussed with reference to test anxiety and consequences for driver training and testing.

Keywords: Anxiety; Driver behaviour; Driver training; Heart rate

1. Introduction

The British practical driving test is designed to assess whether candidates have learned the necessary skills to drive safely and competently when unsupervised. All UK citizens must successfully complete this test in order to obtain a full driving license. During the practical test, the candidate must complete a journey of approximately forty minutes duration under the direction of a Department of Transport Driving Examiner. This journey includes several types of roadway environment and incorporates specific manoeuvres such as reversing around a corner and emergency braking. The performance of the candidate is assessed via a standardised observation sheet (the DL25A Driving Test Report), which permits a distinction between minor and major/serious driving faults.

The form of the practical driving test was reviewed and extended in recent years (Baughan, 2000) in response to changing driving conditions and to counteract the raised accident liability of novice drivers. The DL25A currently contains forty-eight categories of error and candidates fail the practical test if they either

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make one or more serious errors or exceed sixteen minor errors. Previous research has indicated that minor errors may predict accident liability of novices (Maycock & Forsyth, 1997); in addition, candidates who incur a high number of minor faults report higher frequency of accidents during their first six months as drivers, once the effects of mileage and age have been controlled (Baughan & Sexton, 2002).

The pass rate for practical driving test was 42.8% between 2003 and 2004 (DSA, 2004). Previous research has identified a number of factors that predicted failure rate (Forsyth, 1992), these included: gender (females tended to fail more frequently), age (persons over twenty-seven years of age were less successful) and hours of practice (those with over forty hours of practice were more likely to fail). However, these factors tend to be correlated; for instance, older learners tend to spend a higher number of hours in training compared to younger drivers, e.g. an average of 33 h for teenagers compared to 51.2 h for those over thirty years of age (Groeger & Brady, 2004). The positive direction of the relationship between cumulative hours of practice and probability of failure may seem counterintuitive but there is evidence that skill acquisition tends to be rapid during the initial period of learning and negligible during the latter phase if training is prolonged (Groeger & Clegg, 2000). Aside from factors related to demographics and training, a recent survey exercise (Groeger & Brady, 2004) found that the initial competence and the rate of learning associated with a trainee was predicted by intelligence and certain personality traits, e.g. Openness and Conscientiousness (Goldberg, 1993).

A study of the test–retest reliability of the practical driving test was conducted by Baughan (2000) using over three hundred trainees. These individuals performed the test twice under double-blind conditions and were not informed of the result until after the second test. The proportion of test–retest agreements in pass/fail outcomes was 0.64, i.e. 64%. This modest value was attributed to the inconsistent performance of candidates across the tests and insufficiently developed driving skills to produce a reliable level of performance that exceeded the test-standard (Baughan, 2000). However, inconsistent performance could also reflect other factors, such as the differential levels of anxiety experienced by candidates during both tests and how candidates cope with the inherent stress of the evaluative situation.

The influence of anxiety on test performance has been the focus of considerable research (Eysenck, 1997; Zeidner, 1998). The experience of test anxiety is influenced by both trait dispositions and situational factors. Under certain conditions, test anxiety is capable of leading to a complete collapse of performance efficacy, a phenomenon known as ''choking'' (Baumeister, 1984).

According to a cognitive perspective, the experience of anxiety may depend on four categories of information: external stimuli such as task demand, internal physiological stimuli, self-monitoring of behaviour, and related cognitions (e.g. worries) (Eysenck, 2000). The likelihood of choking is governed by variables related to test anxiety such as: audience pressure, competition, rewards or punishment that are contingent on performance, and the ego-relevance of the task (Baumeister & Showers, 1986). It is obvious that anxiety may provoke sympathetic activation of the nervous system and increased self-monitoring during the practical driving test. In addition, the proximity of the examiner and the potential ego-threat associated with failure (particularly for repeated failure) increases the probability of ''choking'' for susceptible individuals during the practical test.

The attentional demands of the driving test are considerable as candidates who are relatively inexperienced are forced to respond to probabilistic events on the road. These demands are compounded by increased self-monitoring due to test anxiety. In the first instance, candidates may attend to their own behaviour and performance. There is strong experimental evidence that attending to procedural knowledge degrades the quality of skilled performance (Beilock & Carr, 2001). Secondly, candidates may be distracted by metacognitive rumination (e.g. how am I doing?). There is evidence that anxiety degrades cognitive performance via worry (Borkovec, Ray, & Stober, 1998; Wells, 1994). Worry involves a proliferation of intrusive and negative thoughts (e.g. doubts about one's ability to perform task successfully, concerns regarding the consequences of failure) that diverts attention from task performance by increasing the level of self-focus (Lewis & Linder, 1997).

A distinction has been made between the cognitive components of test anxiety such as worry and those somatic symptoms associated with physiological activity (Wang, Marchant, & Morris, 2004). Increased anxiety is often accompanied by sympathetic activation of the autonomic nervous system and corresponding changes in subjective mood. At the physiological level, anxiety provokes a characteristic pattern of increased heart rate, blood pressure, muscular tension etc. Subjectively, the individual may feel alert and tense; if anxiety reaches acute levels, unpleasant somatic symptoms may manifest themselves, such as trembling limbs, in-

creased perspiration, palpitations and shortness of breath. These physiological changes may affect performance directly; for instance, tension in the striated muscles is known to impair smooth sequences of skilled motor performance (James, Pearson, Girffith, & Newbury, 1977). Hence, anxious individuals are characterised by rigid posture and movements may be jerky and relatively uncoordinated. This effect has been demonstrated experimentally; Calvo, Alamo, and Ramos (1990) reported that anxious participants were particularly impaired on fine as opposed to gross motor tasks, and this factor may influence pedal control and gear-changing, particularly during manoeuvres.

Cognitive and somatic components of test anxiety were proposed as parallel paths of influence, but it is possible for both elements to interact. The S-REF model (Wells & Matthews, 1996) included somatic symptoms as potential sources of internal distraction. This is a potentially potent source of task interference as fear of failure/worry at the cognitive level may accelerate heart rate at the physiological level leading to a vicious spiral wherein heightened sympathetic activity begets accelerated levels of cognitive anxiety and vice versa.

The current study is concerned with the influence of anxiety on failure rates during the practical portion of the British driving test. It is proposed that test anxiety may result from several sources during the formal driving test, with candidates potentially susceptible to: (1) the high workload of the driving task itself due to their novice status, (2) the evaluative scrutiny of the Examiner, and (3) fear of failure in the eyes of family and friends.

2. Method

2.1. Design

Participants performed three journeys, a normal driving lesson, a ''mock'' driving test and the official driving test in that order. Counterbalancing of sessions was not possible as the ''mock'' driving test was effectively preparation for the official test.

2.2. Participants

Fourteen driving test candidates volunteered to participate in the study in response to a request from their driving school. An important criterion for the selection of participants was to minimise the amount of driving training with a family member or friend. This criterion severely limited the number of learner drivers who qualified for inclusion in the study, but as all participants learned with the same instructor, this restriction had the advantage of standardising the training process (Groeger & Brady, 2004). One participant was excluded from the data analysis following a disclosure that beta-blockers had been taken before the formal driving test session. The mean age of the remaining 13 participants (4 males and 9 females) was 22 years (range 17–36 years). All participants had completed between 50 and 63 h on-road practice over the 12 months period before the study (mean = 55 h). This training programme involves 50–59 h conducted with a Department of Transport Approved Driving Instructor (mean = 54 h) and the remainder was gained via the assistance of family members. All participants had never previously taken a formal driving test or a ''mock'' driving test. All participants were assessed as being of test standard by a trained Driving Instructor.

2.3. Experimental measures

Heart rate (HR) data were digitally recorded with the Polar Accurex Plus Heart Rate Monitor (Polar instruments Inc., 1999), which provided an unobtrusive and practical method of recording HR. The HR monitor was a compact unit (30 cm × 4 cm) attached to the chest of the participant across the sternum in the V5 region of the rib cage. The data recorder was a wrist device (15 cm × 3 cm), and attached to the researcher who sat on the backseat. The monitor relayed heart rate data (beats per min) in 5-s intervals to the wrist recorder for subsequent analyses.

The *State-Trait Anxiety Inventory* (Spielberger, 1983) was used to measure subjective anxiety levels. The inventory had 40 items in total, with 20 in each of the scales. The first scale comprised items that measure State-anxiety (A-State) (e.g. 'I feel tense', 'I am worried') and the second scale measured Trait anxiety (A-Trait)

(e.g. 'I lack self-confidence', 'I am content'). Participants responded via a Likert scale ranging from 1 ('not at all') to 4 ('very much so'). The alpha coefficients for S-Anxiety and T-Anxiety have been reported as 0.92 and 0.90 respectively (Spielberger, 1983).

The DL25A *Driving Test Report* (Driving Standards Agency) was employed to assess performance on both the mock test and the formal test session. The report consisted of 22 categories; 18 to assess driving performance and four to assess manoeuvres. There were three levels of error: minor, serious and dangerous; a candidate will fail the driving test if he or she commits one serious or dangerous error. A minor driving error is less serious but an accumulation of more than 16 results in failure. The examiner/instructor graded errors in real time using the DL25A form.

2.4. Procedure

The study was conducted over a 7-month period at a driving test centre in northwest England. Each participant took part in three driving sessions (normal driving lesson, mock test and driving test) conducted over consecutive weeks. The participant did not receive any additional training between the mock test and the actual driving test. Each session lasted between 40 and 45 min and participants used their driving school car. The participants' Approved Driving Instructor conducted the normal lesson and mock test sessions, and a Department of Transport Driving Examiner conducted the driving test. A researcher was present (in the back of the car) during all three sessions to record and collect the HR data.

2.5. Normal driving lesson

A baseline measure of HR was recorded in the vehicle for a 10-min interval before the driving lesson. The participants completed the State-Trait Anxiety Inventory and were then instructed to drive as they would do normally. The route for the lesson encompassed built-up areas, dual carriageways and 'A' roads. The lesson included a series of manoeuvres such as an emergency stop, turn in the road and parking exercises. The instructor gave feedback as necessary.

2.6. Mock test session

The participants were fitted with the HR monitor and completed the State-scale (A-State) of the State-Trait Anxiety Inventory. On completion of the questionnaire, the instructor initiated a simulated driving test (mock test). The instructor acted as an examiner, scoring performance on the DL25A Report and providing participants with directions only (i.e. no feedback or assistance was given). The route was a formal driving test route, which included a series of town, country and high-speed roads. All participants performed the same route.

2.7. Driving test session

The participants were fitted with the HR monitor and completed the state-anxiety scale on arrival at the Driving Test Centre. On completion of the questionnaire, participants began a formal driving test with a Department of Transport Driving Examiner. The route consisted of a combination of town, country and high-speed roads e.g. dual carriageway. The test also incorporated a series of manoeuvres, e.g. emergency stop, a turn in the road, reverse park. The examiner assessed and recorded errors on the DL25A. The examiner informed the participants whether they had passed or failed on completion of the test and offered an oral explanation of the test outcome.

3. Results

Three categories of data were included in the study: driving performance (mock-test and formal test session only), self-reported anxiety and heart rate reactivity.

3.1. Driving performance

Six of the thirteen participants successfully passed the formal driving test. This outcome was used to divide the participants into two groups (successful/unsuccessful). The Pass group was composed of one male and five females with a mean age of 26.5 years, whereas the fail group included three males and four females who had a mean age of 24 years. There was no significant difference between the pass and the fail group with respect to age. A 2×2 ANOVA was conducted to investigate the frequency of minor and serious faults between the mock-test and the formal practical test (successful/unsuccessful $\times$ minor/serious errors). As expected, minor faults were more frequent events than serious errors ($F(1, 11) = 173.1$, $p < 0.01$) over both test sessions. A significant interaction effect revealed that those who failed the driving test made more faults overall during the formal test session but fewer faults during the mock-test session compared to successful candidates ($F(1, 11) = 30.3$, $p < 0.01$). Post-hoc tests (Bonferroni) revealed specifically that successful candidates made more faults in the minor category during the mock test session relative to unsuccessful candidates. Descriptive statistics for these data are shown in Table 1.

Those candidates who failed the practical test made an average of three serious faults during the session (Table 1). A complete listing of the type and frequency of serious faults made by the unsuccessful group are presented below in Table 2. Examples of serious faults are dominated by basic control errors (during both normal driving and the manoeuvres) and failures of observation. Descriptions of the serious faults presented in Table 2 are taken from the DL25A Driving Test Report.

3.2. State-trait anxiety

Trait anxiety levels for the successful and unsuccessful candidates were within one standard deviation of the mean for a norm group of working adults aged 19–39 years ($n = 656$) reported by Spielberger (1983).

Table 1
Mean frequency and standard deviations of serious and minor faults (based on DL25A categorisation) for all participants during mock and formal driving tests ($N = 13$)

Session	Group (based on outcome of formal test)	Serious faults	Minor faults
Mock-test	Successful	0.5 (0.6)	11.3 (2.7)
	Unsuccessful	2.6 (5.1)	6.1 (3.7)
Formal test	Successful	0.0 (0.0)	8.2 (1.5)
	Unsuccessful	3.0 (0.8)	10.1 (2.4)

Pass/fail groups refer to the outcome of the formal driving test.

Table 2
Type and frequency [in brackets] of serious faults from the DL25A Report Form for those who candidates failed to pass the practical driving test ($N = 7$)

Type and frequency of serious fault	
Control	Gears [2]
	Clutch
	Steering
Positioning	Normal driving [2]
Mirrors	Changing direction
Use of mirrors well before	Changing speed
Use of mirrors well before	Changing direction
Junctions	Observation [2]
Judgement when	Meeting traffic
Give appropriate signals	Correctly
Response to signs/signals	Road marking
Emergency stop	Under control
Reverse park	Under control [2]
Turn in the road	Under control
Reverse to the left	Control

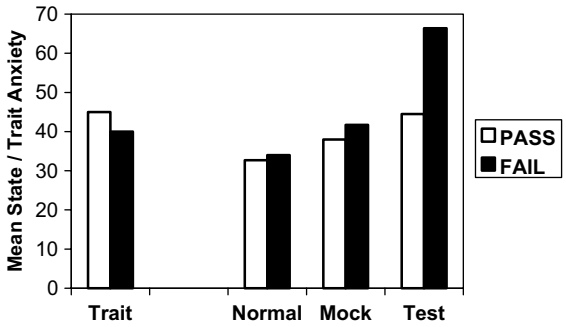

Fig. 1. Mean trait anxiety, and state anxiety across three driving sessions: (a) normal driving lesson, (b) mock driving test, and (c) formal driving test ($N = 13$). Pass/fail groups refer to the outcome of the formal driving test.

An analysis of trait anxiety found no significant difference between the successful and unsuccessful groups (see Fig. 1). A 2×3 ANCOVA (successful/unsuccessful $\times$ session) was conducted on state anxiety data using trait anxiety as a covariate. A significant main effect was found for session ($F(2,9) = 7.4$, $p < 0.01$); post-hoc tests indicated that state anxiety was higher in the formal test session relative to the other two sessions for both successful and unsuccessful candidates ($p < 0.05$). This analysis also revealed a significant interaction ($F(2,9) = 6.12$, $p < 0.05$), i.e. unsuccessful candidates, but not the successful candidates, reported a significantly higher level of state anxiety in the formal test session than in the normal driving lesson and mock test ($p < 0.05$). State anxiety levels were also within one standard deviation of the mean for the population norm group (Spielberger, 1983) except for the unsuccessful group immediately before the formal driving test. Their level of state anxiety at this time was equivalent to the 100th percentile of the norm group (Spielberger, 1983). Mean values for trait/state anxiety are illustrated in Fig. 1.

3.3. Heart rate

Heart rate data were averaged across four 10-min periods during each session and expressed as beats per minute (bpm). A $2 \times 3 \times 4$ ANCOVA (successful/unsuccessful $\times$ session $\times$ period) was performed on these data using resting heart rate as a covariate. The only significant effect from this analysis was an interaction between successful/unsuccessful and session ($F(2,9) = 4.86$, $p < 0.05$). Post-hoc tests revealed that HR was significantly higher for unsuccessful participants, but only during the formal driving test. Mean values for heart rate data are illustrated in Fig. 2.

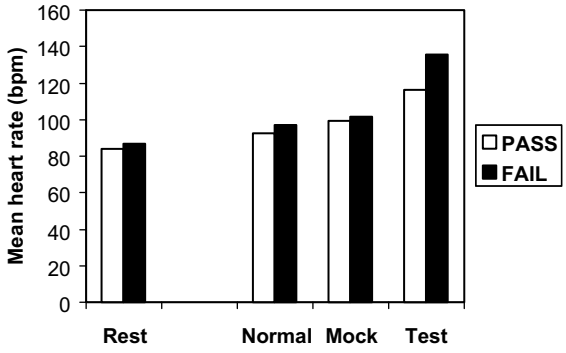

Fig. 2. Mean heart rate expressed in beats per min for all participants at rest and across three driving sessions: (a) normal driving lesson, (b) mock driving test, and (c) formal driving test ($N = 13$). Pass/fail groups refer to the outcome of the formal driving test.

4. Discussion

Those participants who failed the practical driving test were distinguished from successful candidates with respect to three categories of data: performance during the mock and formal tests (Tables 1 and 2), state anxiety (Fig. 1) and heart rate (Fig. 2). There was no significant age difference between the successful and unsuccessful candidates; however the gender ratio was 1:5 (male:female) for those who passed the test compared to a 3:4 ratio for candidates who failed. Regardless of the outcome of the formal driving test, participants accumulated an average of 55 h on-road practice prior to their first practical test; this average is similar to the average of fifty hours reported from a large survey sample (Groeger & Brady, 2004); hence our sample were typical with respect to the amount of driving experience prior to their first attempt at the practical test.

The analysis of performance data revealed the expected finding that the occurrence of serious errors distinguished between successful and unsuccessful candidates during the formal test (Table 1). Those in the successful group made more minor faults compared to unsuccessful candidates during the mock-test (Table 1). It is possible that successful candidates learned from their errors during the mock-test, but the statistical analysis did not support this conclusion however, the frequency of minor errors fell from the mock-test to the formal test for successful candidates and showed a trend in the opposite direction for those who failed (Table 1). An alternative explanation would argue that the minor fault rate was higher during the mock-test because of the relative informality of this scenario, i.e. candidates do not have the same emotional stake in a mock-test, and an instructor acts as an examiner who is familiar to the candidates. This argument was supported by the finding that state anxiety increased during the formal test relative to the mock-test (Fig. 1). In addition, the mock-test and formal test were evaluated by different people, a driving instructor and a driving examiner, therefore any differences in the occurrence of faults may be the result of inter-rater variability. The latter confound may account for increased variability with respect to the occurrence of major faults for unsuccessful candidates during the mock-test compared to the formal test (Table 1).

The frequency of serious faults was the factor that distinguished between successful and unsuccessful candidates during the formal test, i.e. there was no significant difference between successful and unsuccessful participants with respect to the occurrence of minor faults (Table 1). The listing of serious faults (Table 2) illustrates that unsuccessful candidates failed due to errors associated with control (both during normal driving and manoeuvres) and observation. These types of error could be attributed to high levels of test anxiety. A failure to check mirrors and to observe during junction negotiation is reminiscent of heightened selectivity (Hockey, 1997) wherein low priority or peripheral task activities are neglected in order to focus on higher priority activities. These types of attentional deficits are associated with test anxiety as unsuccessful candidates were diverted from the primary task by increased self-focus (Lewis & Linder, 1997). Serious faults associated with vehicle control were apparent during both normal driving and particularly when precision manoeuvres were performed such as reverse parking and the emergency stop. The latter may stem from poor motor control and co-ordination due to heightened muscular tension due to anxiety (Calvo et al., 1990). Unfortunately, considerable overlap exists between errors arising from test anxiety and those faults associated with inadequate skill development; in addition, errors associated with vehicle control and observation are common in the learner driver population (Groeger & Brady, 2004). The existence of these faults alone does not provide a convincing indication of test anxiety.

The analysis of the state—trait anxiety inventory provided evidence that: (a) failure of the practical test was associated with heightened anxiety prior to the formal test, (b) anxiety was increased by the evaluative demands of formal test compared to the mock-test, and (c) anxiety prior to the formal test was associated with that specific situation and did not represent trait differences between successful and unsuccessful candidates (Fig. 1). The increase of state anxiety from the mock-test to the formal test has already been discussed; at this point, it is sufficient to add that the ego-relevance, valence and formality of the formal test provoke increased anxiety, regardless of whether the candidate was successful or not. It is anticipated that increased state anxiety will provoke cognitive and somatic symptoms of test anxiety (Eysenck, 2000), e.g. increased self-monitoring, worry and self-focus in conjunction with increased sympathetic activation.

The analysis of heart rate produced similar findings to the subjective self-report data: (a) candidates who were unsuccessful during the practical test had higher heart rates compared to those who passed, and (b) these differences were unrelated to baseline levels of heart rate. Increased test anxiety, operationalised via subjective

self-report and psychophysiology, was the variable that distinguished between success and failure during the practical test. It is argued that candidates in the unsuccessful group experienced additional anxiety during the practical test due to increased self-focus and heightened sympathetic activation; furthermore, the presence of anxiety may have interfered with driving performance via distraction due to increased self-monitoring (Beilock & Carr, 2001). Alternatively, increased sympathetic activation and associated somatic symptoms may have functioned as a source of internal distraction from the driving task. This hypothesis was proposed by Wells and Matthews (1996) in their S-REF model; that physiological signal have a negative influence on performance, particularly when (a) internal symptoms are severe and persistent, and (b) the task is highly demanding and therefore, prone to interference effects.

It is difficult to ascertain the direction of causality with respect to how test anxiety interferes with performance based on the current data. The picture presented in the previous paragraph describes how various components of test anxiety (Eysenck, 2000) degrade performance and lead to failure. However, when test anxiety is high, levels of self-monitoring also increase (this effect may be augmented by the close proximity of examiner and candidate during the practical test) and the obvious occurrence of an error may lead to a perception of poor performance or failure, which causes an increase of test anxiety. In addition, it has been argued that candidates high in test anxiety have a tendency to detect a mismatch between actual and expected performance (Eysenck, 1997), i.e. to perceive performance to be less than optimal. In the current study, state anxiety on arrival at the Driving Centre was significantly higher for those candidates who failed the practical test. These data suggest that anxiety may have predisposed those individuals to failure before the test was even initiated. It is difficult to identify the source of this anxiety, which must reflect self-efficacy (Bandura, 1997) (i.e. the expectation of success/failure) and whether candidates felt prepared to take the practical test. However, it is impossible to establish causality with respect to the psychophysiological data which provided to only source of continuous measurement, i.e. whether increased heart rate increased the likelihood of serious faults or whether the commission of serious faults caused increased heart rate.

There were several weaknesses with the current study; most strikingly, the reliability of this finding was jeopardised by the small sample size. The study was planned to control as many aspects of the training process as possible, hence, only candidates who spent the overwhelming majority of their time with a professional driving instructor were included. A replication of the study using a higher number of candidates is required to substantiate our findings. A larger pool of participants would also enable other trait variables to be explored; for instance, to study whether personality variables such as defensiveness and anxiety influence successful/unsuccessful rates during the formal driving test (Derakshan & Eysenck, 2001). It would also be useful to extend the period of data collection to investigate how patterns of anxiety are modulated during future driving tests for failed candidates. In addition, the current study relied on mean heart rate as the sole physiological index of emotionality. It is recommended that the range of physiological variables is extended during any future research, specifically pre- and post-test samples of neuroendocrinological activity may be collected to explore the relationship between catecholamine and corticosteroid secretion during the formal test (Kirschbaum et al., 1995).

5. Conclusions

The study provided evidence that elevated anxiety was associated with failure of the formal driving test. The direction of causality was difficult to ascertain and further research is required to both corroborate our findings. However, test anxiety may contribute to the relatively low test–retest validity values associated with the practical test (Baughan, 2000) and its relative contribution merits further investigation.

The study indicated that participants who failed the formal test experienced increased levels of subjective anxiety prior to testing and exhibited elevated heart rate during the formal test compared to successful candidates. These differences between individuals were not apparent from trait anxiety scores or from driving performance during a mock-test. The rise of state anxiety prior to testing may indicate that unsuccessful candidates anticipated failure or experienced an exaggerated response to the ego-threat associated with the formal test. Increased heart rate during the formal test may indicate high mental workload due to lack of confidence or insufficient preparation. However, our data are inconclusive with respect to identifying an unambiguous source of anxiety during the formal test.

If further research supports our finding, there are several implications for how the formal driving test is conducted and how drivers are trained in the UK. The driving test could incorporate an initial "settling-in" period where candidates are provided with an opportunity to acclimatise to the evaluative situation without formal assessment. Professional bodies such as driving schools may wish to consider the incorporation of relaxation techniques into their training programme, particularly for candidates who are susceptible to anxiety or those who persistently fail the formal test.

This study provided interim results to support the view that test anxiety contributes to successful/unsuccessful rates for the driving test in the UK. The data also indicated that heightened somatic feedback during anxiety might be detrimental for complex, perceptual-motor performance. Further research is necessary to substantiate our hypotheses and justify any amendment to current practice in driving testing/training.

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