Can Accidents be Predicted? An Empirical Test of the Cognitive Failures Questionnaire

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A total of 159 young men filled out a questionnaire designed to assess the frequency of various common mental slips. Their responses were then compared with the driving records of the respondents. Those subjects reporting more mental slips were also more likely to have caused traffic accidents, but the relationship only emerged following exclusion of those subjects with remarkably bad driving records. In a second group of 152 men, questionnaire responses again differentiated those subjects who had caused accidents from those who had not.
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Can accidents be predicted? This question has been of interest to psychologists for some time. It has been argued that a better understanding of the cognitive processes involved in driving could lead to more effective accident prevention. The present study was designed to test the validity of this hypothesis.

INTRODUCTION

The phrase “accidents will happen” summarises the old fact that costly mistakes are a ubiquitous aspect of life. A somewhat more modern line of thought, however, holds that (1) catastrophic errors and (2) everyday mental slips may reflect similar breakdowns in cognitive processing.
(Reason, 1988), and that (2) such processing breakdowns are related to a
general trait, such as a propensity to cognitive failure (Broadbent, Cooper,
Fitzgerald, & Parks, 1982; Reason, 1988). Thus, individuals who often, for
example, drop things or forget appointments, may also have a greater
probability of causing vehicle collisions, industrial accidents, and the like.

If common and catastrophic errors do, indeed, jointly reflect an under-
lying dimension on which substantial individual differences exist, question-
naires designed to assess the frequency of common mental slips should
generate errors of judgement that cause accidents and, more import-
antly, provide a screening measure for occupations with high accident
rates. In this paper, we present data showing that young men with a history
of traffic accidents also reported higher rates of common mental errors
than a group of accident-free peers. We then discuss the theoretical and
practical implications of our findings.

EXPERIMENT 1

Method

The subjects in this study comprised 159 male Navy recruits, randomly
selected from groups awaiting job classification interviews at the Recruit
Training Command, San Diego, California. The subjects were part of a
larger sample involved in a study to determine the test–retest reliability
of a number of standard and experimental aptitude tests, the complete results
of which are presented in a separate paper. The mean age of the full
sample was 19.6 years, with a standard deviation of 2.6 years.

Cognitive Failures Questionnaire. The Cognitive Failures Question-
naire (CFQ) is a 25-item instrument developed by Broadbent et al. (1982)
to assess the frequency of everyday slips and errors. Each item refers to a
particular type of mistake (e.g., bumping into people, forgetting names),
and subjects are asked to indicate, on a 5-point scale, how often they
commit that particular error. The scale points are anchored by the follow-
ing descriptors: "very often", "quite often", "occasionally", "very rarely"
and "never".

The CFQ appears to provide unique information, in that, at best, it is
only weakly related to standard personality and intelligence scales (Broad-
bent et al., 1982). In order to determine the CFQ's reliability in the present
sample, the questionnaire was administered twice, with approximately 1
month in between. The CFQ was randomly administered either first or last
relative to the other tasks undertaken by the subjects.

Intelligence Tests. Intelligence scores are provided for two reasons: (1)
to verify that intelligence and propensity to cognitive failure are indepen-
dent dimensions, and (2) to determine whether general intellectual ability
might itself be a predictor of accidents. Some studies have shown a
relationship between measured intelligence and automobile accidents (e.g.,
Harrington, 1971), whereas others have not (e.g., Guilford, 1973;
McKenna, Duncan, & Brown, 1986). Smith and Kirkham (1982) and
McKenna et al. (1986) identify methodological problems with much of this
work. Regardless, it is certainly true that no consensus on the relationship
between traffic accidents and intelligence has emerged.

Two measures of general intelligence are reported in the present study:
(1) the Ravens Advanced Progressive Matrices (RPM) (Raven, 1962) and
(2) the Armed Forces Qualifying Test (AFQT). The AFQT is used to
determine the general mental ability (or trainability) of military accessions.
The RPM and AFQT were correlated 0.49 ($P < 0.001$) in the present
sample.

Accident Data. The subjects were asked two questions related to their
driving records: (1) "How many traffic tickets for moving violations have
you received?" and (2) "How many times have you been cited for causing a
traffic accident?" Of the two traffic measures, we considered it more likely
that the CFQ would predict accidents, because tickets might often stem
from the deliberate actions of the subject (e.g., speeding so as not to be late
for work), and might therefore not reflect "mishaps" in the sense of
unintended mistakes.

Results

Descriptive statistics for the variables in the study appear in Table 1. The
information volunteered regarding driving mishaps appears generally hon-
est, as a spot comparison of subjects’ responses with actual traffic records
in military personnel files revealed an extremely high level of agreement.
As can be seen, the average subject had received one traffic ticket and had

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFQ</td>
<td>30</td>
<td>11.77</td>
</tr>
<tr>
<td>Raven</td>
<td>19</td>
<td>5.44</td>
</tr>
<tr>
<td>AFQT</td>
<td>57</td>
<td>19.67</td>
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<tr>
<td>Tickets</td>
<td>1</td>
<td>1.76</td>
</tr>
<tr>
<td>Accidents</td>
<td>0.13</td>
<td>0.43</td>
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</table>
not been cited for causing a traffic accident. What is noteworthy, however, are the extremes in this sample. Two subjects had received more than nine tickets (though nine was used as the ceiling in our records), one of whom had also had three accidents, which was the most in the sample. When grouped dichotomously, 70 of the 139 subjects (44%) had received one or more traffic tickets, while 14 subjects (~9% of the sample) had been cited for causing one or more accidents.

Preliminary analyses indicated that neither intelligence measure was correlated with accidents, or scores on the CFQ. Therefore, the analyses that follow focus on the main hypothesis of the study, i.e. that CFQ scores might predict driving mishaps. Student's t-tests were performed to determine whether the "ticket/no ticket" or "accident/no accident" groups differed on CFQ scores. The results are presented in Table 2. No significant differences emerged between those who had received tickets or caused accidents and those who had not.

<table>
<thead>
<tr>
<th></th>
<th>Tickets (n = 70)</th>
<th>No Tickets (n = 89)</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>CFQ</td>
<td>35.0</td>
<td>10.6</td>
<td>33.3</td>
</tr>
<tr>
<td>Accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 144)</td>
<td></td>
<td></td>
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</tbody>
</table>

To determine whether or not these results might be skewed by the extreme cases noted above, the subjects whose total tickets exceeded the sample mean by more than 4 standard deviations were excluded. Three subjects with eight or more tickets were thus dropped, and the analyses re-run. Again, no significant differences emerged between those who had received tickets and those who had not. As noted above, this is not entirely surprising, because tickets often stem from the deliberate or planned actions of the individual. For the accident data, however, those subjects who had been cited for causing accidents had significantly higher scores on the CFQ than did their accident-free peers (Table 3). In other words, accident-prone subjects were also more error-prone in their everyday lives.

<table>
<thead>
<tr>
<th></th>
<th>Tickets (n = 67)</th>
<th>No Tickets (n = 89)</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>CFQ</td>
<td>35.2</td>
<td>10.7</td>
<td>33.3</td>
</tr>
<tr>
<td>Accidents</td>
<td></td>
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<tr>
<td>(n = 14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 142)</td>
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</table>

Finally, we note that the CFQ had a test–retest reliability of 0.78 in the present sample.

**EXPERIMENT 2**

Because the CFQ/accident relationship only emerged following the exclusion of those subjects with remarkably bad driving records, one must wonder how much confidence should be placed in this finding. To determine whether the results could be replicated, a second experiment was conducted on an independent sample.

**Method**

The subjects in the second study comprised 152 male Navy recruits, randomly selected (as in Experiment 1) from groups awaiting job classification interviews at the Recruit Training Command, San Diego, California. The subjects filled out CFQ's identical to those used in Experiment 1, including the two questions related to driving records: (1) "How many traffic tickets for moving violations have you received?" and (2) "How many times have you been cited for causing a traffic accident?"

**Results**

Descriptive statistics for the variables in the study appear in Table 4. As can be seen, the average subject had received slightly less than two traffic tickets and had not been cited for causing a traffic accident. When grouped dichotomously, 86 of the 152 subjects (57%) had received one or more
traffic tickets, while 20 subjects (~13%) had been cited for causing one or more accidents. In general, these subjects seem to be somewhat worse drivers than the subjects in Experiment 1.

Student's t-tests were performed to determine whether the "ticket/no ticket" or "accident/no accident" groups differed on CFO scores. The results are presented in Table 5. No significant differences emerged between those who had received tickets and those who had not. However, those subjects who had been cited for causing an accident had significantly higher CFO scores than did their accident-free peers. To completely replicate Experiment 1's analyses, we excluded subjects with eight or more tickets (n = 5) and then re-ran the analyses. The results are shown in Table 6. Again, no significant differences emerged between those who had received tickets and those who had not. For the accident data, however, those subjects who had been cited for causing accidents still had significantly higher scores on the CFO than did their accident-free peers.

**DISCUSSION**

Our results indicate that, with certain qualifications, frequency of minor mental slips can be reliably measured, and related to external criteria of substantial social cost, such as traffic accidents. The main qualification is that extreme rates of driving mishaps were not predicted in Experiment 1. Given that our sample involved young men, this rare, nearly pathological driving style may instead be a function of thrill seeking, machismo or other dimensions beyond the scope of the present paper. The distinction between accidents following inattention and accidents following deliberate recklessness is theoretically important and will undoubtedly remain a concern for studies of this type. For example, if follow-up research were to use industrial accidents as a criteria, some incidents should not be predicted by the CFO if they stem from sabotage rather than absent-minded "blind mishaps".

To recognise that "true" cognitive failures are unintended also helps us fit this construct within broader theories of attention and intelligence. Theories of attention, for example, commonly distinguish between automatic and control processes. Automatic processing is a fast, parallel and effortless process that is not limited by short-term memory capacity, whereas control processing is a slow, generally serial, effortful, capacity-limited processing mode that requires substantial self-monitoring and subject regulation (Schneider, Dumais, & Shiffrin, 1984). Reason (1984) has linked mental slips to automatic processing, saying that slips occur under relatively uniform conditions: "during the execution of some automatized task in a familiar setting in which attention has been claimed by some internal preoccupation or some external distraction" (p. 574).
"Intelligence", on the other hand, is theoretically linked to intentional, resource-demanding control processes (Ackerman, 1986) and the limited information-handling capacities of short-term or working memory (Larson & Saccuzzo, 1989). It is thus not surprising that intelligence was uncorrelated with CFQ scores in Experiment 1 (see also Broadbent et al., 1982).

To reiterate, mental slips seem logically and empirically unrelated to focused attention or performance on cognitive tasks (such as intelligence tests) where concentrated effort is required (Martin & Jones, 1983). In contrast, the CFQ does appear related to performance on distributed attention tasks (Harris & Wilkins, 1982; Martin & Jones, 1983). As Reason (1988) has suggested, the CFQ may thus measure some qualitative aspect of attentional deployment, rather than attentional capacity. His review, in fact, suggests that high CFQ scores may reflect a cognitive management style of inflexible attentional focus. Such inflexibility could leave concurrent activities unmonitored and thereby susceptible to breakdowns or errors. If so, then the present finding of a link between high CFQ scores and traffic accidents can be explained as follows: The high score suggests a locked, rigid mental focus, which leaves the driver unaware of dynamic road conditions or hazards.

Though more work at the construct level is clearly needed, we wish to close by returning to the practical implications of our data. In 1985, accidents cost America US$107.3 billion, 92,500 lives and 9,000,000 disabling injuries (National Safety Council, 1986). Tragically, it has been estimated that approximately 70% of all accidents (Feggetter, 1982) and 90% of accidents in general are attributable to human error. Examples abound. The 1977 collision of two jumbo jets in Tenerife, Canary Islands, which killed 583 people, stemmed from the captain’s simple neglect to get take-off clearance. In 1979, Three Mile Island became a household word after maintenance workers, having performed routine cleaning, mistakenly left a coolant valve closed. Can the incidence of such catastrophes be reduced by more careful employee screening? In closing, we pick no quarrel with the phrase “accidents will happen”. Rather, we think it wise to add, "but to whom?"