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Why I study … driving

THERE is a short pragmatic explanation to this, and a rather longer one.

The short explanation is that having submitted my PhD on unconscious processing to The Queen's University of Belfast in 1984, and lectured for a year at the University of Ulster, there were very few jobs about. I noticed an advertisement for a research officer with Ivan Brown at the Applied Psychology Unit in Cambridge, working on psychological aspects of driving.

I was learning to drive at the time, and I knew nothing more about it than that; but I needed a job and applied speculatively. I don't know quite why, but the interview panel appointed me. Since then, for what is now almost 15 years, the role of cognition in skilled everyday performance has been the focus of my research effort.

The longer answer reflects not only the social importance of driving as a task, but especially the challenge for psychology of understanding how people learn and perform a complex, time-critical task.

The practical importance of driving is self-evident. A hundred years ago almost nobody drove. Now, in the UK, more than 38 million people have driving licences — that is, more than 80 per cent of those aged 16 or over.

The make-up of the driving population mirrors a number of societal changes. The changing role of women is reflected in the fact that the rate of women gaining driving licences is increasing much more rapidly than that of men, which has been largely stable over the past decade.

The average age at which men and women gain licences is now more or less the same; previously women tended to be older than men when they got their first full licence.

The impact of our rapidly ageing population is also evident. We currently have 6 million licence holders over 60 years of age, but 22 million between 30 and 59. In 30 years' time, a very substantial proportion of our driving population will be over 60.

These demographics have profound implications. Accident risk — the number of accidents per mile driven — is as high for older adults as it is for the young driver, and between four and six times that of their middle-aged counterparts. The economic cost of these accidents is estimated to be £14 billion in the UK alone; the psychological cost of the trauma that results is unquantifiable.

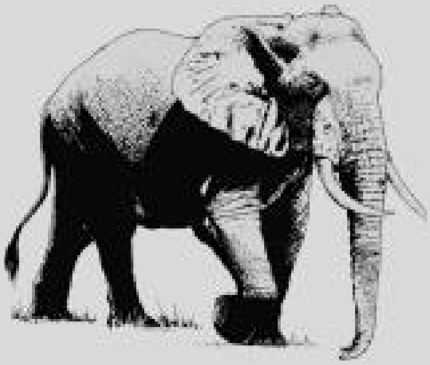
Over the years colleagues and I have tried to address a number of different aspects of driving. These range from the meta-knowledge people have about their own ability (i.e. what they think they know), through the acquisition and retention of driving skills, to more perceptual issues relating to perception of distance, speed and time, and the attentional requirements in skilled performance.

The work has involved observation of real driving, driving simulators, and still more carefully controlled laboratory studies. Where such approaches are not feasible, I use self-report surveys.

One finding from driving research that has now been very well publicised is that we all think we are better than average drivers. In part, this is because we tend to regard 'average' as a derogatory term, rather than in the more strict statistical sense.

However, there is rather more to assessments of our own abilities than this. In a study some years ago, we found that the more accident-free driving experience drivers have had, the most positively they regard their skills (Groeger & Grande, 1996). Young inexperienced drivers, too, are less positive about their ability than more experienced drivers.

In other words, how good we think we are is not a global judgement that takes insufficient account of reality. That judgement depends, crucially, on whom we compare ourselves with, what accessible negative knowledge we have about our performance, and what our causal beliefs about this are.



Concentrating on one element may obscure the whole

Furthermore, these feelings of self-efficacy, our more recent work shows, depend on how much experience of the task we have had, how we learned it, and on the feedback we received (Groeger, in press). This implies that feelings of self-efficacy are really quite task dependent, not a general property of the individual — which is not quite what we might expect from earlier work (Bandura, 1997).

Turning to perceptual issues, there are spectacular stories of how most forms of animal and human life use optical expansion cues to control the actions they take prior to collision (e.g. Lee & Reddish, 1981).

Gannets, for example, dive almost vertically when catching fish. They target fish by keeping their heads still, with bills pointing at the fish and wings extended. About a second from the water they change their wing formation into a more

WEBLINKS

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streamlined shape before hitting the water at more than 50mph. Any earlier and their ability to steer and hit the target is greatly reduced; any later and they risk catastrophic damage to their wings.

It is widely suggested that as we move around the world we use similar optical expansion information (e.g. the accelerating rate at which the apparent size of things grows as we approach them). However, our simulator-based research casts some doubt on whether drivers employ only optical expansion information.

In these and other studies drivers drive towards some obstacle which is then removed from view (the video tape stops, object disappears in simulator, driver looks away, etc.). Their task is to indicate when they would have reached the object if their speed and its position had not changed.

By using trigonometry we can work out how rapidly the rate at which the image of the object increases as the driver draws closer. This rate of optical expansion predicts quite well when drivers will signal that they have reached the object.

However, we can predict these estimates of time-to-collision equally well if we know how accurately different drivers judge static distance, and how other drivers judge similar ranges of speeds, under similar conditions (see Groeger, in press). That is, the data agree equally well with a strategy based on the retinal expansion of the obstacle image, and another that combines subjective estimates of distance and approach speed.

If the latter, more cognitively demanding strategy, was used, we might expect from the working memory literature that estimates of time to collision would be disrupted were a spatial secondary task performed during the approach (see Baddeley & Logie, 1999; Groeger, 1997). This is exactly the result obtained (Groeger & Comte, 1999).

The latter result suggests that at least one element of driving is disrupted by simultaneously performing an additional task. However, this is not necessarily what one would predict. Strangely, right across the attention literature, driving is portrayed as a highly practised skill much of which is 'automatic' (e.g. see Shiffrin & Schneider, 1977; Underwood & Everatt, 1996). Closer study of the components of the driving task seriously undermines this suggestion.

One of the most frequently performed, and perhaps most self-contained and internally consistent, elements of driving is changing gear. As such, it is a prime candidate for automation. However, if we have highly experienced drivers repeatedly make apparently identical gear changes, the time taken for each move of the gear change (between depressing the clutch, moving the gear lever from one gear to neutral, from neutral to the target gear and clutch release) are surprisingly variable and inconsistent (Groeger & Clegg, 1997). What's more, the gear changing performance of experienced drivers, shows significant decrements (although less than inexperienced drivers) if they have to perform another task at the same time (Shinar *et al.*, 1998); for example, detecting traffic signals when changing gear.

These results are inconsistent with most views of what constitute 'automaticity'. They lead us to question whether the concept is much use beyond being a colloquial way of referring to task performance that is not wholly deliberate.

This issue of whether there is such a thing as 'automaticity' is not just important in how we understand skilled performance; it also has ramifications for whether, or how, car phones, in-car navigation systems, and so on, can be safely used by drivers.

It is as much the diversity as the difficulty of the issues I have studied that have appealed to me. As I have learned something about how we might account for and predict different aspects of driving, a more fundamental realisation has become consolidated.

Cognitive psychologists have more or less satisfactory explanations for how people perform relatively simple tasks, and even some difficult tasks. However, understanding situations where multiple tasks are performed together (i.e. everyday complex behaviour) is still well outside any existing conceptual framework.

It might have been more sensible to concentrate on one element and understand it fully. But I cannot help remembering the Sufi story about blind men having radically contrasting understandings of what an elephant was. One man whose hand touched the ear thought the elephant was like a carpet, another who had felt the trunk thought it was like a hollow pipe, and so on.

Perhaps it is similar with complex task performance. It is important to appreciate what each element is, but it is in how the elements combine and constrain each other that the real understanding lies.

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