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What Attracts Attention during Police Pursuit Driving?

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SUMMARY

Efficient deployment of attention is important to the safe execution of tasks with a high content of visual information, such as driving. Chasing a lead vehicle is an extremely demanding and dangerous task, though little is known of the visual skills required. A study is reported that recorded the eye movements of police drivers and two control groups (novices and age- and experienced-matched controls) while watching a series of video clips of driving. The clips included pursuits, emergency response drives, and control drives (at normal speeds) around Nottinghamshire, UK. Analysis of gaze durations within certain categories of stimuli revealed that daytime pursuit drives correspond with an increase in gaze durations on a lead car (controlled for exposure), though police drivers direct their attention to other sources of potential hazards, such as pedestrians, more so than other drivers. Copyright © 2005 John Wiley & Sons, Ltd.

INTRODUCTION

The number of police-related accidents in the UK has increased considerably over recent years (Police Complaints Authority, 2001), and has lead to a call for greater understanding of pursuit driving in regard to policies, techniques and driver skill. The expertise of the applied cognitive research community has been brought to bear upon many applied questions in the field of driving, though little research has directly investigated the particular stresses and skills that are involved in police pursuit driving. However, on the basis of previous research into general driving we know how important visual skills are in driving (Sivak, 1996), and we know that experience and training influence these skills (e.g. Chapman, Underwood, & Roberts, 2002; Crundall & Underwood, 1998; Underwood, Crundall, & Chapman, 2002). These previous findings suggest that police drivers may have developed specific search strategies for dealing with the dangerous situations that often occur in the course of their job. It is the aim of the current research to add to the understanding of how police drivers behave when faced with certain visual stimuli (such as the pursuit situation), and how training and experience contribute to the visual strategies they employ in different contexts.

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Certain contexts tend to produce eye movements that may not be conducive to safe driving. Chapman and Underwood (1998) demonstrated the focusing effect of an abrupt hazard, which reduced spread of search to a narrow area around the hazard location, and increased fixation durations upon the hazard as the driver attempted to process the novel stimulus. Furthermore, peripheral attention is reduced in the presence of a localized hazard. Crundall, Underwood, and Chapman (1999) found that the appearance of a hazard reduced the ability of participants to spot peripheral targets. Crundall, Underwood, and Chapman (2002) did note however that more experienced drivers recover more quickly after a sudden reduction in peripheral awareness than a control group of learner drivers. This *inattentional blindness* for extra-foveal stimuli (Mack & Rock, 1998) occurs when the appearance of a target goes unnoticed by participants, not because the onset of the target is masked in any way, but because attentional resources are devoted elsewhere. Such blindness to stimuli beyond the current focus of attention appears to depend however on the level of cognitive demand at the point of fixation (Lavie, 1995). This may provide the mechanism by which experience modulates extra-foveal attention, for as experience with any set of stimuli increases, there is a corresponding decrease in the amount of information one needs to extract from a stimulus in order to categorize it (e.g. Bundesen, 1990). Thus, experienced drivers should have more attention to devote to monitoring peripheral vision for any sudden threats.

Despite the benefit of experience however, all drivers have moments when attention is focused to such an extent that they may be prone to periods of inattentional blindness (Crundall et al., 1999, 2002). A striking example of the relevance of the inattentional blindness phenomena to a related applied context was observed in a study by Haines (1991). In a flight simulator study using a head-up display, two out of eight professional pilots landed their plane by flying through an unexpected aircraft that was stationary on the runway. It seems that while attending to the flight information in the head-up display, they were effectively blind to other stimuli. Even spatial proximity to the focus of attention (in this case the head-up display was overlaid on the view outside of the cockpit) is not sufficient to overcome inattentional blindness. A number of real life accidents have also been interpreted in the context of inattentional blindness (C. D. Wickens, paper presented at the 11th International Symposium on Aviation Psychology, Columbus, OH, 2001).

In relation to police driving, there is the obvious concern that focusing attention on a fleeing vehicle may lead to inattentional blindness for other potential hazards, such as pedestrians or other vehicles at intersections. Police drivers are aware however of the need to maintain an active visual search, and are trained to do so (Coyne, 1997). The current paper focuses upon the question of whether training and experience allow police drivers to maintain an active search of the visual scene when engaged in hazardous driving, or whether instead they suffer the same degradation that one might expect of an ordinary driver.

In order to test this hypothesis, three groups of drivers (police drivers, novice drivers, and a control group of drivers matched for age and experience with the police group) were asked to watch a series of video clips of driving and to continuously rate the level of hazard they perceived during the clips using a sliding pointer on a 11-point scale. The clips were taken from pursuit drives, emergency response drives, and control drives.

In regard to the self-reported hazard rating, all drivers rated the pursuit and emergency response clips as more hazardous on average than the control clips, though the number of discrete hazards (indicated by a sudden upward movement of the sliding pointer) was greatest for the response clips. This was expected on the basis that though pursuit clips are very hazardous, they contain a single primary hazard (i.e. the fleeing vehicle). Thus the pointer is raised initially to reflect the appearance of this hazard, and then fluctuates according to other factors such as the proximity of the lead car, and the dangerousness of the drivers' actions. Response clips however do not have a fleeing vehicle, as they represent police vehicles travelling to the scene of an accident or a crime. Though they lack a single localized hazard, the high speed of the police car, and the occasional manoeuvres that contravene normal road regulations, lead to a succession of short-duration hazards.

Upon analysis of the basic oculomotor measures, it was found that police drivers had a wider spread of search than the other groups across all clip types, but all drivers increased fixation durations and decreased their spread of search on night time pursuits and daytime response drives (indicative of increased focusing). Daytime pursuits however had the opposite effect, with a dramatic increase in the spread of horizontal search. Instead, it was the daytime response clips that showed evidence of focusing, with a diminished spread of search, despite the fact that there was no specific hazard locus as in the pursuit clips.

These two surprising results, namely that daytime pursuits do not appear to focus attention, but emergency response drives do, have been reported in more detail by Crundall, Chapman, Phelps, and Underwood (2003), where it was suggested that the drivers may adopt a compensatory strategy during the daytime pursuits, and that attention may be captured by the focus of expansion in daytime emergency responses.

There is however an alternative explanation for the unexpected daytime results. The nature of pursuit chases may change from day to night, influencing the basic oculomotor measures. For instance, as there are less cars on the road during the hours of darkness, fleeing vehicles may have a straighter escape route than during a daytime pursuit, which may follow a more circuitous route in order to avoid traffic. In this case, if the fleeing vehicle made more turns during a daytime pursuit, or weaved across lanes more often than would occur in a night time pursuit, then the daytime condition could produce a wider spread of search caused by attentional focusing on the fleeing vehicle, rather than as a compensatory strategy to avoid such focusing. The basic oculomotor measures reported in Crundall et al. (2003) cannot distinguish between these two explanations. In addition to such basic analyses, a category analysis of fixation durations is required. This is a frame-by-frame analysis of what each driver actually looked at during each video clip. The category analysis is reported in this paper.

To summarize, the initial study was undertaken to assess the potential of a fleeing vehicle to capture visual attention in pursuit drivers (compared to normal drives and emergency response drives), with obvious ramifications for police and public safety. It was predicted that all drivers would suffer some attentional capture, though police drivers should be better equipped to deal with such situations. The results of Crundall et al. (2003) demonstrated that these predictions were upheld on the basis of simple oculomotor measures, but several questions were left outstanding. First we are concerned that the increased spread of search noted in daytime pursuits was actually due to systematic variations in the stimuli (an inherent problem with realistic stimuli). Secondly, though the basic oculomotor measures suggest overall patterns of visual behaviour, they do not relate to what the drivers actually look at. It is anticipated that a category analysis will not only resolve the issue of what caused the increased search in daytime pursuits, but will also reveal further differences between police drivers and two control groups (novice and age- and experience-matched) in how they deal with the different daytime clips of pursuit, emergency response and control driving. Specifically we are interested in whether police drivers spend as much time looking at the fleeing vehicle as other drivers (i.e. is attention captured to the same extent as the drivers in the control groups?), whether they employ a different temporal strategy to other drivers (e.g. frequent, short fixations, or a few long fixations?), and whether they make better use of their spare capacity to pay attention to other safety-related aspects of the scene.

METHOD

Participants

Forty-eight drivers were split into three groups: 16 novice drivers (with a mean age of 20.4 years, less than 2000 miles per annum, and 2.9 years driving experience); 16 police drivers (with a mean age of 39.2 years, 20 500 miles per annum, 21.8 years driving experience); and 16 matched controls (with a mean age of 37.1 years, 10 500 miles per annum and 18.9 years driving experience). All police drivers were trained to pursuit standard, and had previously been engaged in real life pursuits. All drivers were male.

Stimuli and apparatus

Forty-eight video clips of driving situations, recorded from the point of view of the driver, were shown to the participants. Half of these were night time clips, which were not used in the current analyses and will not be discussed further. Of the 24 daytime clips, there were eight pursuits, eight emergency responses and eight control drives. All clips lasted 60 s and were filmed in and around Nottingham, UK. Pursuits typically involved following another vehicle at high speed, with the fleeing vehicle and/or the police vehicle contravening traffic laws. Emergency response clips did not involve chasing another vehicle though they did have the police vehicle travelling at high speeds, overtaking other traffic and passing through red lights.

The stimuli were played on a video recorder, through an Epson EMP-50 digital projector onto a large white screen. The visual image subtended 60° by 38° of visual angle, with participants seated 100 cm from the screen. Participants' eye movements were monitored using a head-mounted, SMI Eyelink eye tracker, sampling at 250 Hz. Monocular measures were taken from each participant's dominant eye, and a cursor depicting the eye location was overlaid on the relevant driving clip (the output video) for later encoding by hand. Participants were given a box with a sliding scale from 0–10 to record a continuous hazard rating.

Design

A 3×3 mixed design was employed for assessing categories. The between-groups factor was driving experience (novice, police, and matched controls). The within-groups factor was clip type (pursuit, emergency response, and control drives).

The clips were randomized prior to the experiment and transferred to video tape for presentation. Participants either received the clips in the initial random order, or in a reversed order.

Eleven categories were selected for encoding (see Table 1). Gaze durations within each category were calculated on the amount of time that the eye cursor fell within the

Table 1. A list of the categories and their descriptions

Category	Description
Car ahead (CA)	A vehicle in front of the participant's vehicle travelling in the same direction
Central reservation (CR)	Central division between lanes; either bollards or a continuous barrier
Oncoming (ON)	Traffic travelling in the opposite direction
Parked vehicles (PAR)	Vehicle parked at the side of the road
Pedestrians (PED)	People on the road or pavement
Road ahead (RA)	The road between the bottom edge of the screen and the focus of expansion
Markings (MAR)	Painted road markings
Side roads (SR)	Roads that join the main carriageway
Signs (SI)	Road signs (excluding advertisements)
Traffic lights (TL)	Traffic lights at junctions and pedestrian crossings
Unprotected users (UN)	Motorbikes and cyclists

boundaries of one of the categories. The durations were coded frame-by-frame using the output video. Baseline measures of exposure were calculated for each category (e.g. how many seconds the category 'car ahead' was available in pursuit, emergency response, and control conditions) and the gaze durations within the categories were calculated as a percentage of the amount of time that the categories were available. The experimenter who categorized all the clips was unaware of which participant group each clip belonged to.

Procedure

Participants were seated 1 m from the screen and were shown some example video clips to familiarize themselves with the type of stimuli and to allow them practice using the sliding hazard scale. The pointer was always set to the centre of the scale before a clip started. The eye tracker was then calibrated, and the 48 clips were presented to participants in two blocks over a period of 45 min.

RESULTS

The percentage gaze duration within any particular category was analysed using a series of 3×3 analyses of variance (ANOVAs) across driver (police, novices, and matched controls) and clip type (pursuit, response, and control clips). The main category of interest is the amount of time that drivers spend looking at the car ahead (as a function of the amount of time that a car ahead is present). The analyses of the other categories are included to illustrate what the drivers look at, above and beyond the main category of car ahead. As such, though the initial analysis of the category of car ahead is perfectly legitimate, the remaining categories are not strictly independent and the statistical results should therefore be viewed with this in mind. All main effects were further investigated using planned contrasts, and where relevant the F values associated with the contrasts are given in place of the omnibus Fs. Clip contrasts compared control clips to pursuit clips, and control clips to response clips. Driver contrasts compared the novices to the mean of the other two driver groups, and there was also a direct comparison between the matched

Table 2. Mean gaze durations for all categories across the three driver groups (matched control, novice and police) and three clip types (control, pursuit and response). Means are displayed as percentages of the time that each category was available

	Matched control drivers			Novice drivers			Police drivers		
	Cont	*Purs*	*Resp*	*Cont*	*Purs*	*Resp*	*Cont*	*Purs*	*Resp*
CA	45.5	69.3	35.0	37.5	57.8	28.5	37.7	58.5	27.8
CR	4.0	5.0	4.5	3.6	6.5	4.1	5.8	5.3	4.5
ON	10.9	4.5	15.7	9.6	4.3	12.8	11.7	5.7	11.9
PAR	11.7	11.9	10.6	9.5	11.9	10.0	13.2	13.7	13.1
PED	18.9	3.3	23.7	17.3	4.9	25.0	23.3	6.5	30.6
RA	27.0	15.4	43.4	24.0	16.9	40.7	26.1	18.8	43.0
MAR	0.8	0.6	1.1	1.4	1.5	2.3	0.7	0.7	0.6
SR	6.1	2.4	4.3	6.5	3.1	5.3	10.1	4.2	10.7
SI	6.0	3.1	5.0	6.8	4.6	7.1	6.4	3.9	5.9
TL	6.7	2.5	11.7	7.0	3.3	12.1	8.3	4.6	12.9
UN	15.1	23.9	52.9	15.5	20.0	28.9	15.3	31.3	44.7

control and police drivers. Mean gaze durations for all categories across clip type and driver can be viewed in Table 2.

The analysis of the category of car ahead produced a main effect of driver ($F(2,45) = 6.4$, $p < 0.01$) and a main effect of clip type ($F(2,90) = 517$, $p < 0.001$). As can be seen from Figure 1a, novice and police drivers looked at the car ahead for the same amount of time. Only the matched controls spent longer looking at the lead car. All participants however had higher gaze durations on the car ahead in the pursuit condition after controlling for exposure (Figure 1b).

These results suggest that though Crundall et al. (2003) noted an increased spread of search in the daytime pursuit clips, there is still a considerable focusing effect on the fleeing vehicle. This suggests that the increased spread of search noted by Crundall et al. was at least partially due to the greater movement of the fleeing vehicle, rather than a compensatory visual strategy.

The other interesting finding from Crundall et al. (2003) was the reduced spread of search noted in daytime emergency response drives. If visual search was focused, what were the drivers looking at? The obvious possibility is that the drivers were paying more attention to the road ahead. Analysis of gaze durations within this category revealed a main effect of clip type ($F(2,90) = 264$, $p < 0.001$). Planned contrasts revealed that response drives resulted in the greatest amount of time looking at the road ahead compared to control clips, while pursuits had the shortest gaze durations compared to the control clips ($F(1,45) > 94$, $p < 0.001$). A further analysis was conducted on those 'road ahead' gaze durations that also fell into the category of focus of expansion (the point in the road from which optic flow appears to emanate). A similar result was found with a main effect of drive type ($F(2,90) = 13.7$, $p < 0.001$). Planned contrasts revealed that response drives again produced the greatest gaze durations ($F(1,45) = 23$, $p < 0.001$), though there was no difference between the gaze durations on the focus of expansion for pursuit and control clips.

A number of categories were favoured by a particular group of drivers. Analysis of gaze durations upon the road markings did not show any effect of clip type, but there was an effect of driver ($F(2,45) = 14.8$, $p < 0.001$). Planned contrasts revealed that the novices

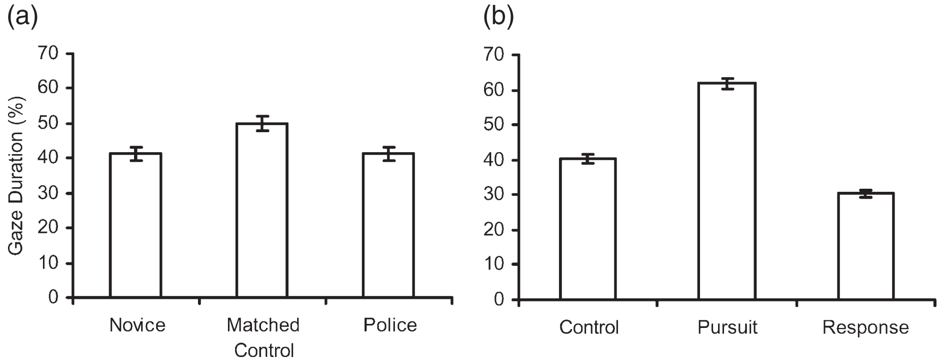

Figure 1. Gaze duration (as a percentage of category availability) on the category of car ahead, across (a) drivers, and (b) drive type (with standard error bars added)

spent the most time viewing road markings ($F(1,45) = 29.0$, $p < 0.001$). There was no difference between police and matched control drivers.

Police drivers however spent more time looking at pedestrians (at least compared to the matched control drivers, $F(1,45) = 4.86$, $p < 0.05$, though the planned contrasts did not allow a direct comparison between novices and the police). In regard to gaze duration upon the central reservation, an interaction between clip and driver was further investigated with interaction contrasts. The results suggested that the driver differences primarily lay in the contrast of pursuit clips with control clips ($F(2,45) = 7.55$, $p < 0.01$), where novices had greater gaze durations during pursuits, while the police had greater gaze durations during the control drives (see Figure 2). Police drivers also had a tendency to spend longer looking at parked vehicles. The contrast comparing

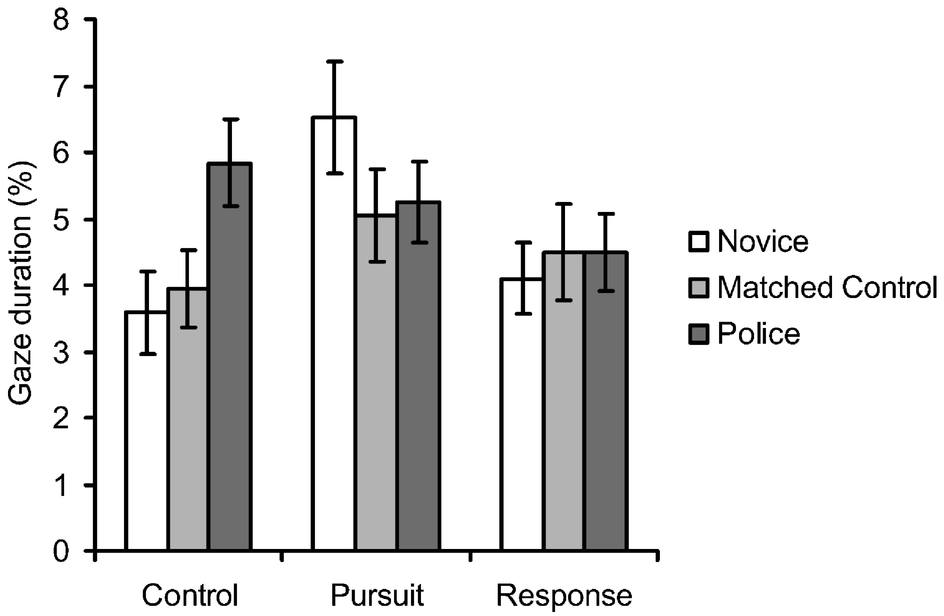

Figure 2. Gaze duration (as a percentage of category availability) upon the central reservation (with standard error bars added)

novices to the mean of the police and matched control drivers was marginal ($F(1,45) = 3.62$, $p = 0.06$) though this was mostly due to the matched controls falling in between the police and novice groups.

In regard to oncoming traffic, though planned contrasts revealed that all drivers had shorter gaze durations during the pursuit clips compared to control clips ($F(1,45) = 171.7$, $p < 0.001$), the time spent fixating oncoming traffic during response clips was elevated compared to control clips due to the greater gaze durations of matched control drivers, as revealed in an interaction contrast ($F(2,45) = 3.77$, $p < 0.05$).

Gaze durations on side roads also produced an interaction ($F(4,90) = 3.32$, $p < 0.05$). It can be seen from Figure 3 that this occurred because although police drivers devoted a greater proportion of their gaze duration towards side roads compared to other drivers, the increased demand of the pursuit condition drastically reduced this difference.

Durations on traffic signs were not influenced by driver group, though clip type produced a main effect. Planned contrasts revealed that pursuit clips resulted in lower gaze durations on traffic signs compared to control clips ($F(1,45) = 29.1$, $p < 0.001$) though there was no difference between gaze durations during response clips and control clips.

Traffic lights also produced an effect of clip type, with response drives having longer gaze durations than control clips, and pursuit drives having shorter gaze durations than control clips as revealed in planned contrasts ($F(1,45) > 35$, $p < 0.001$).

Finally, gaze durations upon unprotected road users revealed an interaction between driver and clip type (see Figure 4). Interaction contrasts identified a difference between drivers in the comparison of response drives with control drives ($F(2,45) = 8.27$, $p < 0.01$), with novice drivers failing to increase the amount of time fixating unprotected road users on pursuits and response drives, as the police and matched-control drivers did.

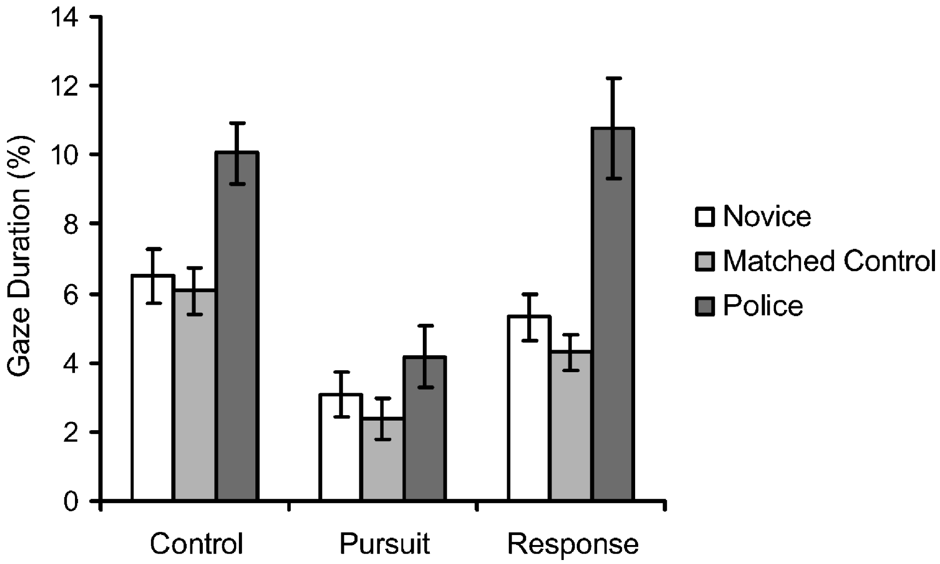

Figure 3. Gaze duration (as a percentage of category availability) upon side roads (with standard error bars added)

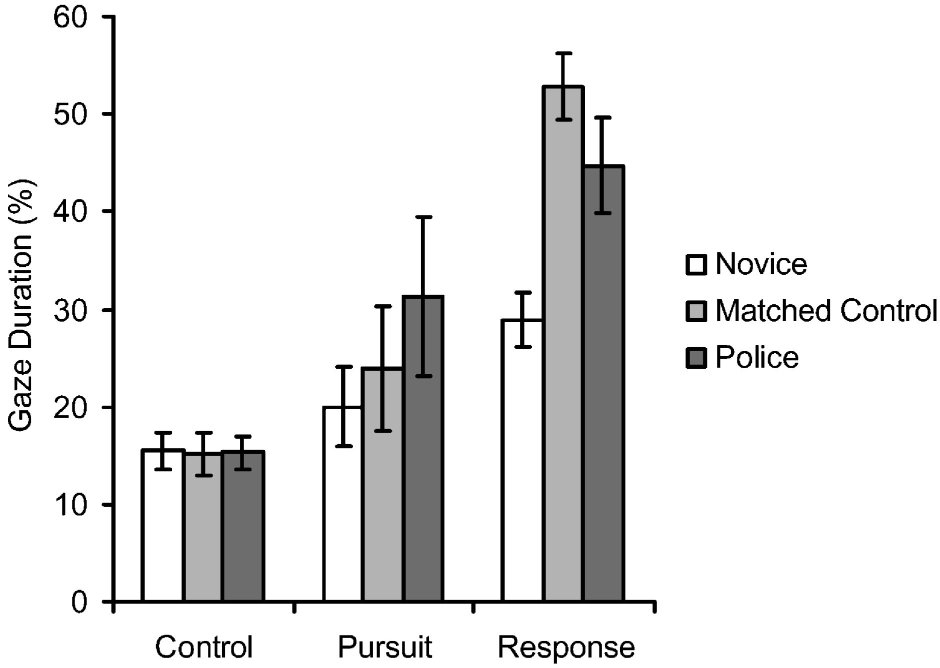

Figure 4. Gaze duration (as a percentage of category availability) on unprotected road users (with standard error bars added)

DISCUSSION

The first question raised by the results reported by Crundall et al. (2003) was whether focusing on the lead vehicle occurred in the daytime pursuits. The previous findings (an increase in visual scanning during daytime pursuits) were interpreted as a possible result of a compensatory strategy with drivers attempting to sample more of the visual scene in situations where they were aware that attention might otherwise become captured by the lead vehicle. The current results demonstrate however that attentional focusing on the lead vehicle does occur during daytime pursuits. At the same time there is a corresponding decrease in the amount of attention devoted to other categories of road stimuli such as side roads, traffic lights and road signs. The wider search strategies in daytime pursuits reported by Crundall et al. (2003) therefore appear to be partly due to increased movement of the lead vehicle during daytime drives, resulting in a wider spread of search as the driver's gaze follows the fleeing vehicle.

A second question raised by the previous research was concerned with the evidence for focusing in the daytime response drives. During these clips any increase in hazard level is considered to be dispersed rather than localized and should therefore lead to an increase in visual scanning rather than focusing attention. This prediction is supported by the continuous hazard ratings that participants produced throughout the clips (reported in Crundall et al., 2003). Whereas pursuit clips produced ratings reflecting one prolonged hazard, response clips produced ratings indicative of many shorter hazardous events, as reflected in the more variable hazard score. Despite this, Crundall et al. (2003) reported a decrease in spread of search, indicative of focusing, during daytime response drives. The current analyses support the hypothesis that this reduction in spread of search is actually due to an increase in focusing upon the road ahead, specifically at the focus of expansion. Despite the increased potential hazard of colliding with a peripheral object (such as a pedestrian) when driving at high speed during an emergency response, all drivers prioritized the focus of expansion. This is understandable in terms of the driver trying to obtain as much preview of their current course as possible, though the inevitable reduced attention to peripheral sources of hazards may be a cause for concern.

Interestingly, novice and police drivers spent the same amount of time looking at the car ahead, with the matched controls producing longer gaze durations. Does this suggest that novice drivers are as safe as police drivers? The answer depends on what these drivers spend the remainder of their time looking at, and there is evidence to suggest that police drivers spent more time looking at other potential sources of hazard such as pedestrians, parked vehicles and side roads (though gaze durations in this latter category were still reduced in pursuit clips suggesting that police drivers still redeploy some attention away from peripheral hazard monitoring). Novice drivers however appear to spend more time looking at categories that would normally serve to guide basic driving functions. For instance, novices had high gaze durations upon the central reservation and road markings, which are both typical sources of information for lane maintenance. Mourant and Rockwell (1972) also noted excessive sampling of road markings in novice drivers. This has previously been suggested to be due to a degradation of peripheral vision due to high foveal demand. It is known that lane maintenance information is gained through peripheral vision (e.g. Land & Horwood, 1995), and that inexperienced drivers have reduced peripheral awareness (e.g. Crundall et al., 2002), which taken together suggest that novice drivers may have to foveate lane markings in order to maintain lane position. The results support the hypothesis that novice drivers favour sources of lane maintenance information, even when that information is not required (as no motor interaction was necessary).

All participants, however, had a reduction in attention to certain categories during pursuits, including on-coming traffic, traffic signs and traffic lights. Though the police drivers do seem to maximize their time searching for other potential hazards, it appears that all drivers must redeploy some attention to the fleeing vehicle. The matched-control drivers, however, seem to be especially attracted to the fleeing vehicle. This suggests that two separate mechanisms may be at work. First, age may partly determine one's ability to disengage from the lead vehicle (as seen in the comparison of novices and the matched control drivers), though training and specific experience allow the police to overcome any age-related degradation. It has previously been reported that the ability to disengage from stimuli can be affected by both age and experience. Where children may find it easy to disengage from stimuli, adults may have to develop the ability with context-specific practice (Fischer & Weber, 1993). This explanation does not however distinguish between top-down and bottom-up reasons for disengaging. Do novice drivers disengage sooner than the matched controls because their lack of context experience prevents them from realizing how pertinent the lead car is as a source of information? Or do the matched-control participants linger on the lead car because it takes them longer to process the same amount of information? While the results cannot yet explain the processes behind attentional capture and disengagement, they do demonstrate that important patterns exist.

One might also posit a second process that differentiates between the police and other drivers, perhaps arising from a schema-based understanding of what other categories of stimuli should be attended to, above and beyond the lead vehicle. Contextual experience of situations consisting of recurrently co varying objects allows drivers to build up schemas that they use to direct visual search in specific situations. For instance, Shinoda, Hayhoe, and Shrivastava (2001) found that drivers were more likely to search for and spot a stop sign at an intersection, than while driving along a straight road in a simulator. In regard to the current results, the police drivers' greater familiarity with the stimuli suggests that they should have developed schemas for directing visual search during pursuit and response conditions. This indeed seems to be the case, with police drivers consistently favouring those areas of the visual scene from which secondary hazards may appear.

It must be noted that one limitation of the findings arises from the difficulties in obtaining adequate control groups. Ideally, the design would have included a group matched with the novices for experience and matched with the police for age ('older novices'), and perhaps even a group matched with the police for experience and the novices for age ('young experienced drivers'). Unfortunately both of these control groups are difficult to recruit. The latter group is perhaps the rarest as youth tends to preclude experience, while the older novices represent a very small percentage of the overall driving community. Even if older novices can be recruited, they still represent the tail end of a distribution and may therefore produce driving behaviours that should be more properly considered as outliers rather than representative of a separate population.

To conclude it appears that police drivers do have their attention captured by a fleeing vehicle during daytime pursuits, however their specific experiences and training allow them to disengage more easily from the car ahead (compared to the matched-control drivers). The novices however spent an equal amount of time fixating the car ahead as the police drivers, yet their remaining capacity is not as efficiently deployed as that of the police drivers. The results suggest that specific police driving experience and training does influence the visual search of pursuit officers, mitigating the probability of attentional capture by a fleeing vehicle, though there is still a question of whether the extent of focusing that occurs with police drivers is too great. Though police drivers did fixate potential sources of hazards more so than other drivers, they also reduced gaze on other vital road stimuli such as traffic lights and road signs. This may however represent a greater reliance on other cues for information (e.g. road geometry may provide the same information as certain road signs), or the greater use of peripheral vision (e.g. highly salient traffic lights may be perceived extrafoveally).

A potentially worrying effect is the extent of focusing in response drives, as this could also reduce awareness of the peripheral road situation, and may be applicable to a wider range of drivers from all emergency services. Though the current results cannot yet link these focusing effects to accident liability, it is hoped that these data will help to form a foundation from which we can begin to understand the visual skills that are required for safe police driving.

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