
A Fighter Pilot's Guide to surviving on the roads

🕒 3 December 2013 📁 General interest 👤 Andy Henderson

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John Sullivan is a Royal Air Force pilot with over 4,000 flight hours, and a keen cyclist. In this article he describes why collisions can occur and, in layman's terms, how some of the techniques of flying fast jets can be used to increase your chances of survival on the roads.



'What's wrong with you – are you blind?'

Who hasn't thought this at some point whilst cycling or driving?

Now, before we go on, who can say that, at some point in their own driving history, they have not been about to manoeuvre – pull out from a T-junction, etc – when a car or bike seemed to come out of nowhere? Hopefully, it was just a close shave, and no doubt quite frightening. You may have wondered how you failed to see it, and concluded that they must have been driving too fast or you would have seen them. Perhaps, on such an occasion, you were the recipient of that loud and urgent query, 'Are you blind?'

Well, here's the bad news – yes, you were. For small but significant periods of time you are completely incapable of seeing anything at all. Most of the time, as I shall explain, this is not a problem. But if it means that you fail to see a vehicle that is just about to occupy the same point in space and time as you are – then this is a big problem!

The good news is that understanding why we sometimes do not see things allows us to adopt some defensive strategies that tip the odds back in our favour. This article, then, is a fighter pilot's survival guide to avoiding collisions.

Fighter pilots have to cope with closing speeds of over 1,000 mph, and they don't always get it right! But crashes are always analysed carefully to learn the lessons that might prevent future accidents. This article reveals the hard-won techniques that fighter pilots are trained to use.

First some background. We have evolved over hundreds of thousands of years to our environment. We are highly adaptable and have eyes in the front of our heads, which gives us binocular vision for judging distance to prey, or threats.

Our eyes, and the way that our brain processes the images that they receive, are very well suited to creeping up on unsuspecting antelopes. We are even pretty good at spotting sabre-toothed tigers creeping up on us! We are, however, rubbish at spotting vehicles that hurtle towards us at high speed.

Let me explain why.

Light enters our eyes and falls upon the retina, whereupon it is converted into electrical impulses that the brain perceives as images. Clever stuff. Only a small part of the retina, in the centre and called the fovea, can generate a high-resolution image. This is why we need to look directly at something, by moving our eyes, to see detail. The rest of the retina contributes to our visual experience by adding the peripheral detail – hence peripheral vision. Peripheral vision cannot resolve detail, which prevents the brain from being overloaded with too much information, but it is very good at detecting movement. Any movement, such as the twitch of an antelope's ears or the swish of a tiger's tail, immediately alerts us to something of interest which we can then bring our high-resolution fovea to bear upon. And our eyes move fast, really fast – no doubt spurred on by the motivation of not ending up as food ourselves.

So what?

Well, first, it is an unfortunate fact that if you are converging on a given point with another vehicle at the same speed, and assuming that you are both traveling in a straight line, then there is no apparent movement noticeable by the occupant of either vehicle. That is, to the driver of each vehicle, the other will remain in exactly the same position in the windscreen up to the point of impact. There is no relative movement – so our peripheral vision is not suited to detecting it.

Remember, our peripheral vision is not good with detail – in fact, just 20° away from your sightline your visual acuity is about one tenth of what it is at the centre. Not convinced? Well, the standard eyesight requirement for driving in the UK is to read a car number plate at 20 metres. Go outside, now, and stand just 10 metres from a car and look at the number plate. Now, without moving your eyes try and read the number plate of the car on its right or left. Now try it again from 5m. Clinically, you are blind in your peripheral vision.

That's not to say that we cannot see something in our peripheral vision – of course we can. As you approach a roundabout you would be hard pressed not to see a dirty great articulated lorry bearing down upon you, even out of the corner of your eye – obviously, the bigger the object, the more likely we are to see it. But would you see a motorbike, or a cyclist?

To have a good chance of seeing an object on a collision course, we need to move our eyes and probably head, to bring the object into the centre of our vision – so that we can use our high-resolution foveal vision to resolve the detail.

Now for the really interesting part. When we move our head and eyes to scan a scene, our eyes are incapable of moving smoothly across that scene and seeing everything. This makes perfect sense: just like trying to take a picture without holding the camera still. The image would be blurred. So, our clever brain overcomes this by moving our eyes (really fast, remember) in a series of jumps (called saccades) with very short pauses (called fixations and it is only during the pauses that an image is processed. Our brains fill in the gaps with a combination of peripheral vision and an assumption that what is in the gaps must be the same as what you see during the pauses. This might sound crazy, but your brain actually blocks the image that is being received while your eyes are moving, which is why you do not see the sort of blurred image that you see when you look sideways out of a train window.

Not convinced? Okay, go to a mirror and look repeatedly from your right eye to your left eye. Can you see your eyes moving? You cannot. Now have a friend or partner do the same thing while you watch them. You will see their eyes moving quite markedly. The reason you couldn't see your own eyes move is because your brain shuts down the image for the instant that your eyes are moving. Experiments have shown that it is impossible to see even a flash of light if it occurs within a saccade.



Saccades - you see the red circles only and your brain fills in the rest of the detail

The saccade/fixation mechanism has always served us rather well, and means that we can creep up on antelopes without being overloaded by unnecessary detail and a lot of useless, blurred images. But it does present us with some shortcomings now that we routinely climb into metal boxes and hurtle towards each other. Our eyes and brains are just not designed for this – our world has changed far faster than our bodies can adapt.

So what?

If you get to a junction and move your head right and left to look for oncoming traffic, you need to understand that you cannot guarantee that you have seen approaching traffic. It is entirely possible for our eyes to 'jump over' an oncoming vehicle during one of the saccades. The smaller (and, specifically, the narrower) the vehicle, the greater the chance that it could fall within a saccade. You are not being inattentive; you are physically incapable of seeing anything during a saccade. Remember the 'Think Bike!' adverts, where a driver pulls out into the path of a motorcycle? I am convinced that it is the phenomenon of saccades and fixations that is most likely to lead to this sort of accident.

It gets worse. The faster you move your head, the larger the jumps, or saccades, and the shorter the pauses, or fixations. So, you are more likely to jump over an oncoming vehicle and less likely to

detect any movement in your peripheral vision (because there is even less time available for slight, relative movement to become apparent).

It gets even worse. Not only can we not see through solid objects; research has shown that we tend not to look near to the edges of a framed scene. In plain language, we tend not to look at the edges of a windscreen. So, not only do the door pillars of a car represent a physical blind spot, but our eyes tend not to fixate near to it, leading to an even bigger jump, or saccade, past a door pillar. This is called windscreen zoning.

One further point of interest, our ears usually contribute to the process of building up a picture of our surroundings, too – the snap of a twig from an unwary paw is another prompt for us to direct our vision towards something of interest. But in our metal cocoons, with the radio or MP3 device playing, this is yet another cue that we are denied.

So, you are approaching a big roundabout or junction, looking ahead of course, and the road seems to be empty. As you get closer, you look right and left as a prudent, final check. You see no other vehicles and proceed. Suddenly, there is a blast of horn and a car flashes across in front of you, missing you by inches. Sound familiar?

So what happened? On the approach, you did not see that another car was on a perfect collision course, with no relative movement for your peripheral vision to detect – possibly compounded by being behind the door pillar. Lulled into a false sense of security you looked quickly right and left, to avoid holding up the traffic behind you, and your eyes jumped cleanly over the approaching vehicle, especially as it was still close to the door pillar in the windscreen. The rest of the road was empty, and this was the scene that your brain used to fill in the gaps! Scary, huh?

You were not being inattentive – but you were being ineffective.

Just when you thought it couldn't get any worse, there is also the phenomenon of 'expectation'—your brain is less likely to recognise something that you are not expecting to see. This now enters territory that pilots prefer to leave to a scary breed of creature called the aviation psychologist, but suffice it to say that, if you think that the road is empty, you are less likely to register that a vehicle is actually present.

So, what can we do about it? Well, quite a lot actually, as forewarned is forearmed.

Drivers

Always slow down as you approach a roundabout or junction, even if only by 20 mph or so, even if the road seems empty. Changing your speed will immediately generate relative movement against a vehicle that was otherwise on a collision course – not only are you then more likely to see it, but you are no longer on a collision course!

Never just glance right and left – this leaves it entirely to chance whether you see an approaching vehicle or not – and if you glance quickly, the odds decrease markedly.

Always look right and left methodically, deliberately focusing on at least three different spots along the road to the right and three to the Left – search close, middle-distance and far. With practice, this can still be accomplished quickly, and each pause is only for a fraction of a second, but this means that you are now overriding the natural limitations of the eye and brain. Fighter pilots call this a 'lookout scan' and it is vital to their survival.

Always look right and left at least twice. Not only does this immediately double your chance of seeing a vehicle, but, if you repeat the same scan as you did the first time (which, when it becomes a well-practiced habit, you almost certainly will), an approaching vehicle will have moved to a different part of the windscreen by the time you look the second time and is less likely to be masked by a saccade. Just note that this will not work if you charge into a junction at a constant speed because any vehicle on a collision course will stay in the same position in the windscreen – if you miss it the first time, you will probably miss it the second time too!

Make a point of looking next to the windscreen pillars. Better still, lean forward slightly as you look right and left so that you are looking around the door pillars. Be aware that the pillar nearest to you blocks more of your vision. Fighter pilots say 'Move your head – or you're dead'.

Clear your flight path! When you change lanes, especially into a slower lane, you should, of course, check your mirrors, and will undoubtedly have been watching the road ahead of you, naturally. Your last check must be to look directly at the spot into which you are going to manoeuvre, otherwise you could easily have missed a slower motorbike, cyclist or even car in that lane, one that was only in your peripheral vision as you looked ahead, and over which you 'jumped' as you looked over your shoulder or checked your wing mirror.

When the light is poor, headlights can make all the difference. Remember, lights are just as much about being seen as being able to see.



Drive with your lights on or, if this seems extreme, have daylight running lights fitted – if you don't already have them. Aviation research shows that contrast is the single most important factor in determining the likelihood of acquiring an object visually. This is why military aircraft camouflage is designed to tone down their contrast. On the ground, dark-coloured vehicles or clothing will result in reduced contrast against most usual backgrounds, and this is why high-visibility clothing (for pedestrians, cyclists and motorcyclists) and/or bright lights are so important, in the daytime as well as at night.

While it is generally understood that a low sun can make it difficult to see, it is probably not generally understood why; driving into the sun reduces contrast, especially when vehicles and pedestrians fall into the shadow of larger, up-sun objects. You must beware that even large vehicles, and especially motorbikes, cyclists and pedestrians, can become completely impossible to see under these circumstances, and you must moderate your driving accordingly. This is why fighter pilots attack from out of the sun!

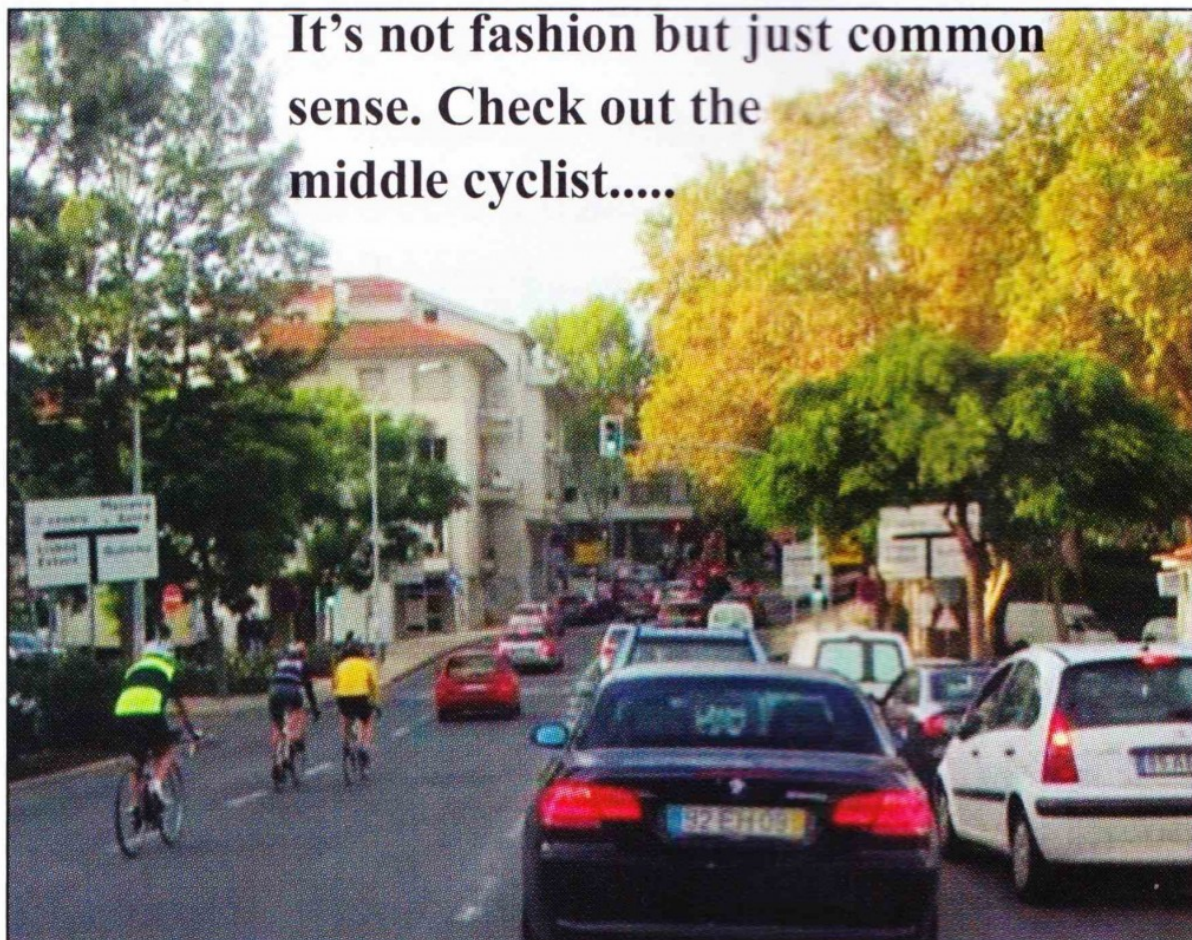
Keep your windscreen clean both inside and out! Seeing other vehicles can be difficult enough, without tipping the odds against you by having to look through a dirty windscreen. You never see a fighter jet with a dirty canopy.

And finally, don't be a clown – if you are looking at your mobile telephone then you are incapable of seeing much else. Not only are you probably looking down into your lap, but your eyes are focused

at less than one metre and every object at distance will be out of focus. Even when you look up and out, it takes a fraction of a second for your eyes to adjust. This is time you may not have.

Motorcyclists and cyclists

Recognise that you are especially at risk – not only are you more vulnerable but the narrow profile of a motorbike or cycle makes it far more likely that you can fall into a saccade. So tip the odds in your favour – always wear high-contrast clothing and use lights. Flashing LEDs (front and rear) are especially effective for cyclists as they create contrast and the on-off flashing attracts the peripheral vision in the same manner that movement does.



The relatively slower speed of bicycles means that they will be closer to a point of collision if a vehicle begins to pull into their path. Turn this to advantage – when passing junctions, look at the head of the driver that is approaching or has stopped. The head of the driver will naturally stop and centre upon you if you have been seen. If the driver's head sweeps through you without pausing, the chances are that you are in a saccade – you must assume that you have not been seen and expect the driver to pull out!

Be aware of when the odds are really stacking up against you. If you are cycling into a low sun, have a think about how difficult it is to see the vehicles in front of you. Now imagine that you are also looking through a dirty windscreen, or one with rain beating against it! Are you content that drivers

approaching from behind have a realistic chance of seeing you? Maybe today is the day to take a different route – or time your journey to avoid the sun being straight into the eyes of drivers on that particularly busy stretch of road. Or take the bus. Having a really low heart-rate at the point at which you go under the wheels of a truck is rather pointless. This is risk management.

So is wearing a helmet – every fighter pilot wears a helmet, even though it won't make much difference if they hit the ground at 700mph! It's about reducing the chances of less dramatic incidents causing fatal cranial injuries, unnecessarily. Go figure.

3 replies to “A Fighter Pilot’s Guide to surviving on the roads”

14 December 2013 at 8:29 am

Ken
Graham

Absolutely fascinating article giving an insight into our evolution and how it impacts on current daily lives.

Should be compulsory reading for all new drivers and cyclist alike .

As a driver of nearly 50 years and a cyclist of 60 years I thought I knew most things about road craft, but I will now belt up, and saddle up in a new frame of mind !

14 December 2013 at 6:50 pm

Wilf Forrow

I agree! Worth it for the 'lookout scan' alone. Can we get permission to put it forward for other sources? I'm thinking of the national CTC magazine for a start, but it would be valuable for any magazine or website dealing with cycling or driving.

27 December 2013 at 5:11 pm

Davin

This is top stuff! By far the best advice on road safety I have ever seen. The bit about saccades is completely new to me and most relevant when driving. Watching the drivers head movements has kept me safe so far, as has watching the front wheels in the absence of an indicator signal.

Comments are closed.