Naval Safety Center
LESSONS LEARNED
18-18

Why Don't We See Motorcycles?

Perceptual Issues and Visual Illusions

Whether it is the freedom of the open road, the adrenaline rush of the world zooming past, or just because the gas mileage is better, some folks are just drawn to riding motorcycles. That said, let's be real for a minute: Riding a motorcycle is WAY more dangerous than riding in a car.

With no seatbelts and no protective metal casing around them, any motorcycle accident does not typically end well for the motorcycle rider. Recently the federal government estimated that there are **30x more deaths on motorcycles than in cars per miles traveled**. – *Ponder that stat for a second. Mile for mile, for every 1 person killed in a car accident, 30 people die in motorcycle accidents. Wow!* How do you avoid becoming (or causing) one of the 30? Read on...

Fifty-five percent of motorcyclist deaths occur in multi-vehicle crashes (i.e. somebody hit somebody else). There are currently over 19,000 riders in the Navy, and in the last five years we had nearly 900 reported motorcycle mishaps (see Figure 1 below). **That's an average of just over four Navy motorcycle crashes per week!** We lost five Officers and Sailors to fatal motorcycle accidents just this past Veterans Day weekend 2018. While sometimes these mishaps are due to failures by the rider, just as often a rider does everything correctly, but is hurt by another vehicle that fails to yield or simply doesn't see them.

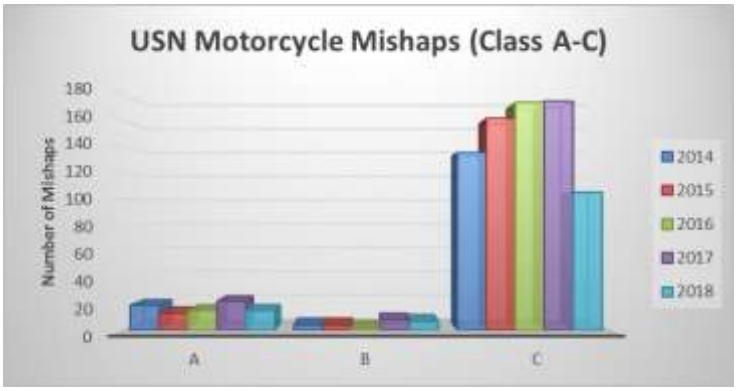

Figure 1. USN Motorcycle Mishap Data (FY14-FY18)

Some of the most common accidents are those in which drivers don't see the motorcycle and turn unexpectedly in front of a rider. In these incidents the motorcyclists aren't at fault, and the drivers of the cars or trucks aren't necessarily bad drivers — they truly **DID NOT SEE** the motorcycles approaching head-on.

Why? "Perceptual issues" (also called "**inattentional blindness**" by some researchers) can result in a driver not "seeing" a motorcycle. Think about it: a motorcycle approaching head-on occupies only a small part of a driver's vision. On a clear, sunny day, at one hundred yards, you can completely hide a motorcycle with a pencil

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held up at arm's length. At 60 miles per hour, a motorcycle will travel that football field distance in 3.2 seconds. Additionally, as the human brain tries to understand everything around it, it has shortcuts to conserve processing power. For example, commuting early in the morning you might not expect to see a motorcycle, bicycle, or pedestrian during certain portions of the commute. Therefore, **our brains may actually ignore** a motorcycle, bicycle, or pedestrian right in front of us.

Our eyes don't "see" as much as we think they do. They aren't cameras. They are biological devices with considerable limitations. There are blurry spots and blind spots, and the image gathered is actually upside down in the brain. Your eyes scan everything and constantly send pictures to the brain for analysis, but the brain can only "see" things it understands. In order to save processing power and attention, the human brain uses a "visual shorthand" so as not to overwhelm it. When things happen faster than the eye-brain system can "see", that's when we start to not perceive things. Motorcycles fall into the list of things that we may not perceive on the road. No matter how keen a driver's eyesight is, we can't avoid these inescapable lapses in the brain.

For a tangible example of our eye-brain limitations, take a look at Figure 2. Our peripheral vision is actually quite poor, and our brains try to fill in the blank information with "guesses." How many of the dots can you see at once? Hint: There are 12 of them.

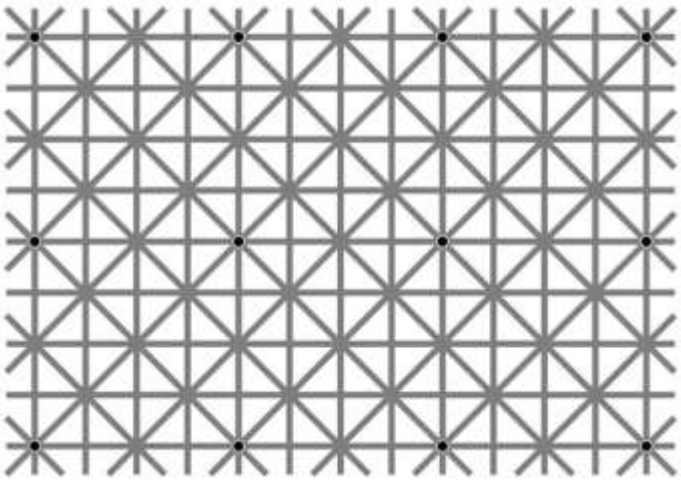

Figure 2. Can you see all 12 black dots at once in this image?

You can see any black dot by looking directly at it. The ones in the periphery, however, pop in and out, and you are physically unable to see all twelve of them. Now imagine if one of these dots was an approaching motorcycle. If it were in your peripheral vision, it is likely that your brain would not even perceive it.
— Remember that next time you are preparing to change lanes or make a left turn!

A recent Navy motorcycle mishap involving a truck turning left at an intersection is one of a thousand excellent examples to alert ALL drivers (especially motorcycle riders) to the dangers of these human "perceptual issues" on the road. A servicemember was headed home on his motorcycle in late afternoon. He wore all the required Personal Protection Equipment (PPE), including a full face DOT approved helmet, gloves, a motorcycle jacket with reflective striping, denim pants, and boots.

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The motorcyclist was driving southbound, approaching an intersection, and the traffic light was green for him to continue straight through (see Figure 3 below).

At the same time a pickup truck headed northbound approached the same intersection, intending to turn left (west). The driver of the pickup truck did not have a green arrow to make the turn, but did have a solid green light, allowing an "unprotected" left turn (yielding to oncoming traffic).

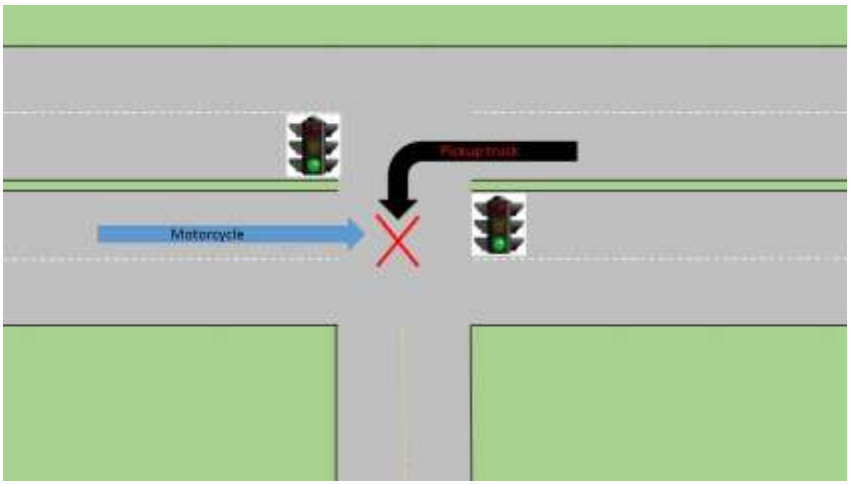

Figure 3. Example of the Mishap Intersection

Despite having a clear sight distance of the approaching south bound traffic, the driver of the pickup truck failed to see the motorcycle and attempted to make that unprotected left hand turn (see Figure 3). The motorcycle impacted the front right of the truck in the intersection, throwing the servicemember from the motorcycle. First responders found the him unconscious and severely injured despite all the PPE. The civilian driver was unhurt. The pickup truck driver was cited for failure to yield the right-of-way. The motorcycle rider did everything correctly, but the other driver was either distracted or unable to "see" him.

Besides the brain processing limits we've already discussed, other visual illusions can affect a driver's ability to see motorcycles. One illusion happens because motorcycles are the minority on the road, and the brain doesn't "expect" to see them. When looking left and right at an intersection, the brain perceives the things that are most common and easy to spot (like cars or trucks). The brain can ignore things, however, that don't match these criteria, such as a motorcycle, bicycle, pedestrian, or animal. The unexpected image that the brain receives of a motorcycle is simply not added to the mental image the brain creates.
*— It is important for all motorists to **consciously** scan for all hazards, not just the "expected" hazards.*

A second visual illusion that affects a driver's ability to see motorcycles is called "saccadic masking." This is a process in which the brain replaces the blank spaces in a quick scan of the roadway with recent memories or images from previous experiences. This masking can result in a motorcycle being "lost" in the blank spaces between the images that the brain rapidly processes when a driver quickly scans the road. Because no motorcycle is perceived, it isn't added to the mental image, and the driver's brain never "sees" it.
— It is important to not just to casually scan the road for hazards, but to do so with a conscious purpose and intent.

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A third visual illusion that may impede perception has to do with the how the size of an object correlates to distance. Drivers' brains tend to perceive a larger object to be closer than it really is. On the flip-side, if an object is smaller, drivers tend to perceive the object as being farther away. Because motorcycles are small in comparison to automobiles, even if the brain overcomes all of the issues we've already described and actually adds the motorcycle to the mental image, it erroneously interprets as being farther away than it really is. When drivers act on this wrong perception, they set up accidents like the one above.
— It is imperative for every driver to remember that "objects may be closer than they actually appear."

These visual limitations and illusions don't just happen to the drivers of four-wheeled vehicles. They happen to everyone – including motorcycle riders. The limits and illusions don't harm us as often when we are just walking around on two legs as humans were originally designed to do. The problems arise when we motorize ourselves and move so much faster through the world, while our eyes and brains still see and process at walking/running speed.

What does this all mean to me? We ALL must be alert and look with intent for all objects such as motorcycles, pedestrians, bikes, animals, etc., and not just cars and trucks. This is even more important if you are changing lanes or turning left across the opposing traffic. You don't see what you don't perceive. We must thoroughly scan the roadway for hazards, because quick, casual scans can leave unknown gaps in our brains' visual model.

Lessons Learned and Best Practices

A. For Motorcycle Riders:

1. They can't see you, and they don't even know it.

-Not every driver on the road is looking for you, *and VERY FEW even KNOW about these visual illusions.*

2. Take action to be seen and heard.

-Wear bright colors that help draw attention. You also may be able to grab drivers' attention through sound, like your horn or loud engine noise. Auditory cues are processed differently by the brain than visual cues.

3. Don't trust that they see you – always be guarded and look for an escape route.

-You must expect drivers who just truly don't "see" you! You must always be scanning for an "out" should an unsafe situation develop.

4. Ride like you are part of the problem.

-Riders are human too, and your brain is subject to the same illusions.

In short – riders should ride like everyone is a hazard to you…because they are.

B. For All of Us:

1. Scan for the unexpected, including motorcycles and cyclists.

-"Look twice," is a good saying, but often only re-confirms the wrong sight picture.

Recommendations

1. Brief this to all Sailors and Marines.
2. Once you read this, share it with someone you know, including your family. It might save them from an accident.

And remember, "Let's be careful out there"