Why Do Drivers Pull Out In Front Of Motorcyclists?

by Nathan Rose

In 1977, Hurt noted that "the most likely comment of an automobile driver involved in a traffic collision with a motorcycle is that he, or she, did not SEE the motorcycle…" (emphasis added). Hurt continued: "The origin of this problem seems to be related to the element of conspicuity (or conspicuousness) of the motorcycle; in other words, how easy it is to see the motorcycle. When the motorcycle and the automobile are on collision paths, or when the vehicles are in opposing traffic, the conspicuity due to motion is very low, if it exists at all. Consequently, recognition of the motorcycle by the automobile driver will depend entirely upon the conspicuity due to contrast. If the approaching motorcycle and rider blend well with the background scene, and if the automobile driver has not developed improved visual search habits which include low-threat targets…the motorcycle will not be recognized as a vehicle and a traffic hazard exists" (emphasis added).

BUT THERE IS MORE TO THE STORY THAN THAT.

Hurt's statements go too far, discount too much, and are not fully supported by later research. Though he acknowledges it elsewhere, physical obstructions from other traffic, inattention and distraction on the part of a passenger car driver, a driver conducting a visual search of inadequate duration, a lack of expectation to encounter a motorcycle, and excessive speed on the part of the motorcyclist are other factors that may account for a driver not seeing a motorcyclist. In the case of excessive speed on the part of the motorcyclist, this could also result in the driver misjudging the arrival time even if they do see the motorcycle.

SOME HAVE QUESTIONED WHETHER THE CONSPICUITY OF THE MOTORCYCLE IS REALLY THE ISSUE AT ALL.

In 1989, Olson examined the literature related to why passenger car drivers sometimes fail to detect motorcyclists. Although he noted that "considered logically, it seems reasonable that motorcycles should be less conspicuous than cars because they are smaller," Olson questions motorcycle conspicuity as the likely explanation for car drivers missing motorcycles. He observed that "the strongest support for the conspicuity hypothesis may be that the offending operator often reports a failure to detect the other vehicle." However, Olson noted that "the conspicuity hypothesis has not been seriously challenged. Almost all investigators have accepted it as fact, concentrating their efforts on means to improve conspicuity rather than on asking whether the hypothesis is correct. This is unfortunate because alternative hypotheses can be advanced. Some have research data to support them; some are speculative. All are consistent with the known facts…"

Olson noted that drivers claiming to have not seen another vehicle is not unique to motorcycle-car intersection collisions. He stated: "Violations of right of way are a common cause of collisions between automobiles, and afterward the errant driver often claims not to have seen the other vehicle. This should not be surprising. Of all the reasons that someone would deliberately move into the path of an oncoming vehicle, failure to detect it must be high on the list. But if the claimed failure to detect is not unique to motorcycle collisions, then it is not evidence for a special conspicuity problem with motorcycles." Olson discussed other explanations for why passenger car drivers sometimes miss motorcyclists, including visual obstructions and errors in the drivers' estimates of how far away a motorcycle is and how fast it is traveling.

AND OTHERS HAVE NOTED THAT THE RESEARCH RELATED TO MOTORCYCLE CONSPICUITY IS INCONCLUSIVE.

Pai published a literature review related to motorcycle right-of-way accidents [2011]. He reported that "two major causes of such a crash scenario are the lack of motorcycle conspicuity and motorist's speed/distance judgment error, respectively." This appears to be imprecise language that means that some motorists claimed not to have seen the motorcycles prior to the collision and other motorists did see the motorcycle prior to the crash but misjudged the timing of its approach. Pai continued: "A substantial number of studies have manipulated physical characteristics of motorcycles and motorcyclists to enhance conspicuity… Although various conspicuity aids have proven effective, some researchers reported that motorcyclist's or motorcycle's brightness per se may be less important as a determinant of conspicuity than brightness contrast between the motorcyclists and the surroundings…Research examining the effects of conspicuity measures on motorists' speed/distance judgments when confronting motorcycles has been rather inconclusive." In relationship to motorists' judgments of approaching vehicles, Pai noted that "larger vehicles tended to be judged to arrive sooner than motorcycles. Such a speed/distance judgment error is likely attributable to some psychological effects such that larger automobiles appear more threatening than motorcycles. Older motorists particularly have difficulties in accurately estimating the distance and the speed of an approaching motorcycle."

Along these same lines, Sager and his colleagues noted in 2014 that "much previous research has focused on motorcycle properties, such as size, shape, and color to explain its inconspicuousness… Much of the motorcycle safety research conducted since has focused on making motorcycles more conspicuous, generally through various lighting treatments such as headlight modulators, additional lights, and bright reflective garments…There is some debate, however, regarding the effectiveness of these measures…it has been suggested that the problem may not be one of conspicuity at all…collision statistics remain largely unchanged, suggesting that the issue may not be related solely to the motorcycle's static properties."

SOME RESEARCH HAS NOTED THAT A MOTORCYCLIST'S LANE POSITION MAY INFLUENCE IF THEY WILL BE SEEN BY A CAR DRIVER OR NOT.

Sager's research suggests that the motorcycle and rider's dynamic properties, such as lane position, also make a difference to the likelihood a motorcyclist will be detected. This was demonstrated in a 2014 study in which Sager and his colleagues used a driving simulator to examine the motorcyclist's lane position as a factor in crashes where a passenger car driver turns left and violates the right of way of the motorcycle. He described their experiment as follows: "Seventeen participants faced oncoming traffic in a high-fidelity driving simulator and indicated when gaps were safe enough for them to turn left at an intersection. We manipulated the size of the gaps and the type of oncoming vehicle over 135 trials, with gap sizes varying from 3 to 5 s, and vehicles consisting of either a car, a motorcycle in the left-of-lane position, or a motorcycle in the right-of-lane position. Our results show that drivers are more likely to turn in front of an oncoming motorcycle when it travels in the left-of-lane position than when it travels in the right-of-lane position." Sager and his colleagues had determined, based on the intersection geometry and the acceleration capabilities of the vehicle, that "a three-second gap in a stream of oncoming traffic would not allow for the safe execution of a left turn, that a four-second gap would allow for the safe execution of a left turn, but leave very little safety margin, and that a five-second or more gap in the stream of traffic would allow for the execution of a left turn and leave a reasonable safety margin."

For each of the 3 gap sizes – 3 seconds, 4 seconds, and 5 seconds – participants chose to turn more frequently when the motorcyclist was in the left-of-lane position than when the motorcycle was approaching in the right-of-lane position. Sager concludes that, "these results are consistent with our hypothesis that the right-of-lane position offers more motion cues to an oncoming driver and is therefore more likely to deter oncoming drivers from crossing in front of a motorcyclist's path as they approach an intersection. However, our findings are inconsistent with some motorcycle rider training which motorcyclists generally leave with the belief that they should always ride in the left portion of the lane. Our results suggest that the right-of-lane position may be a safer riding position when entering an intersection."

UNFORTUNATELY, MOTORCYCLISTS PROBABLY CANNOT SELECT A LANE POSITION THAT IS OPTIMAL FOR ALL CIRCUMSTANCES.

The crash scenario studied by Sager is not the only one likely to be encountered by motorcyclists. Drawing general conclusions about the optimum lane position for a motorcyclist who may be encountering multiple possible crash scenarios simultaneously seems unwarranted based on Sager's research alone. There are scenarios a motorcyclist could encounter where their choice of lane position, and how it might or might not affect visibility and conspicuity, may compete with other crash avoidance factors. Ouellet [1990], for example, examined the optimal lane positioning for motorcyclists in terms of the time they had available for collision avoidance, noting that "lane positioning as the rider approaches a potentially threatening situation is a simpler, more reliable and more effective means of reducing collision risk than reliance on emergency braking." His study revealed that "the motorcycle rider can do more to avoid a collision by moving laterally away from

a threatening vehicle, putting at least one lane-width between them, before a vehicle begins to violate his right-of-way, than he can be effective braking after the other vehicle has begun to violate his right-of-way" (emphasis in original). Depending on the intersection geometry and what other vehicles are present, these statements could dictate a left-of-lane, right-of-lane, or center-of-lane positioning.

OTHERS HAVE NOTED THAT THE EFFECTIVENESS OF CONSPICUITY AIDS (HEADLIGHTS AND BRIGHT CLOTHING, FOR INSTANCE) DEPEND ON THE CHARACTERISTICS OF THE SURROUNDING ENVIRONMENT.

In 1996, Hole, Tyrrell, and Langham reported three experiments related to motorcycle conspicuity. These experiments involved showing the test subjects a series of images containing traffic. Less than half of the images contained motorcyclists, so that the test subjects could not assume there would be a motorcyclist in each image. Hole and his colleagues recorded the time it took the subjects to determine if a motorcyclist was present in each image. They varied if the motorcycle headlight was on or not, the type of clothing worn by the motorcyclists (plain dark, plain bright, patterned dark, and patterned bright), the distance of the motorcycles from the viewer, and the driving situation (urban or semi-rural). They also examined the influence of background clutter on the conspicuity of the motorcyclists. These researchers reported that "the effectiveness of the conspicuity aids used, especially clothing, may depend on the situation in which the motorcyclist was located: bright clothing and headlight use may not be infallible aids to conspicuity. Brightness contrast between the motorcyclist and the surroundings may be more important as a determinant of conspicuity than the motorcyclist's brightness per se. Motorcyclists' conspicuity is a more complex issue than has hitherto been acknowledged."

A sampling of specific findings by these researchers included the fact that "motorcyclists were detected more quickly the nearer they were to the viewer, and in both locations the biggest difference between the headlight-off and headlight-on conditions was at the furthest viewing distance;" "the effectiveness of the headlight as a conspicuity aid was much less clear-cut in the urban setting than in the semi-rural environment…headlight use in the urban location enhanced conspicuity only when the motorcyclist was wearing plain bright or patterned dark clothing: when patterned-bright or plain dark clothing were worn, subjects responded faster when the headlight was off than when it was on. In the urban setting, a consistent advantage for headlight use was demonstrated only when the motorcyclist was wearing patterned-dark clothing;" "in both locations, many more motorcyclists were undetected at the furthest distance from the viewer than when the motorcyclist was nearby…for the semi-rural location, at all three distances, there error-rate for the slides in which the motorcyclist's headlight was lit was half that for the slides in which the headlight was unlit…For the urban location, at all three distances, the error-rate for the slides in which the motorcyclist's headlight was lit was lower than that for the slides in which the headlight was unlit, but not markedly so;" "in both locations, there was little effect of clothing type except possibly at the furthest distance."

Helman et al. [2012] identified and reviewed 27 studies (including some of those reviewed above) that sought to improve motorcyclists' visibility or conspicuity or to improve the accuracy of judgements of motorcyclists' speed or time to contact by other road users. These authors reported that "both [bright clothing and daytime running lights] seem to be capable of improving conspicuity, when this is measured in terms of detection (under search and attention conspicuity conditions), and when measured in terms of a behavioural response (such as size of gap accepted in front of a given motorcycle). The majority of studies covered in this review support this conclusion, although there are limitations…due to the number of different visual contexts in which motorcyclists find themselves when riding. For example, coloured clothing is more effective when viewed against a contrasting background. In terms of lighting, although it appears that dedicated daytime lighting on motorcycles is effective in increasing conspicuity, this effect may be smaller when other vehicles have their lights on…When lighting is arranged in such a way as to accentuate the form of the motorcycle (and to provide greater information for judging approach speed), this aids the observer in determining the time to arrival of the approaching bike (especially at night)…Across all treatments there is evidence that colour can play a role in effectiveness; this may be especially true in settings where coloured motorcycle lights aid in the motorcycle standing out from surrounding vehicles which have white lights. Although most studies reviewed show benefits of bright clothing, dark clothing may be better if the background is also brightly coloured. In line with the underlying mechanisms proposed, higher contrast with background surroundings to enable better visibility, search conspicuity, and attention conspicuity would be beneficial. Given that environments may differ over even fairly small changes in time or location, there is not likely to be a one-size-fits-all solution, meaning that motorcyclists need to be aware of the limitations of whichever interventions they use."

THESE RESEARCHERS ALSO INTRODUCED SOME HELPFUL TERMINOLOGY.

Hole, Tyrrell, and Langham noted several limitations of their study. Among these was their observation that "problems are also caused by the fact that instructing subjects to look for motorcyclists may cause them to process a traffic scene in ways that are different to those used in normal driving…Cole and Hughes (1984, 1990) distinguish between two types of conspicuity. 'Attention conspicuity' refers to the capacity of a stimulus to be noticed when the observer is not actively looking for it. 'Search conspicuity' refers to the capacity of a stimulus to be noticed when the observer is specifically looking for it. The experiments reported here have examined factors affecting motorcyclists' search conspicuity, but in real life, attention conspicuity may also be important." Helman [2012] further clarified the relationship between visibility, search conspicuity, and attention conspicuity with the following three statements:

> If the observers are directed to look at the location of the motorcycle to see if they can detect it, we are measuring visibility.

If the observers are directed to look for the motorcycle in the scene but are not told where it is, we are measuring search conspicuity.

If the observers are simply asked to report the things in the road scene that grab their attention, we are measuring attention conspicuity.

Finally, Hole, Tyrrell, and Langham observed that "the fact that there were few differences between conditions when the motorcyclist was nearby implies that motorcyclists' conspicuity at the close range within which accidents often occur might be relatively unaffected by such factors: within this range, it is possible that the psychological state of the driver may play a more important role than the physical characteristics of the motorcyclist…inappropriate expectancies may be more important in accident causation than the motorcyclist's physical properties."

SO, THE CAR DRIVER'S PSYCHOLOGICAL STATE AND EXPECTATIONS CAN BE AN IMPORTANT FACTOR.

AND, OF COURSE, LET'S NOT FORGET ABOUT THE SIZE-ARRIVAL EFFECT…

Horswill, Helman, Ardiles, and Wann [2005] noted that "drivers adopt smaller safety margins when pulling out in front of motorcycles compared with cars. This could partly account for why the most common motorcycle/car accident involves a car violating a motorcyclist's right of way. One possible explanation is the size–arrival effect in which smaller objects are perceived to arrive later than larger objects. That is, drivers may estimate the time to arrival of motorcycles to be later than cars because motorcycles are smaller." These authors conducted two experiments to test this hypothesis. In the first experiment, test subjects (28 drivers who had never ridden a motorcycle) were shown video footage of traffic approaching the viewing position of the camera. Four vehicles were used to create the video footage – a small motorcycle, a large motorcycle, a car, and a van – and these vehicles were driven towards the scene at speeds of ether 30 or 40 mph. The scene blacked out 4 seconds before the vehicle reached the camera's position. Subjects were asked to press a response button when they estimated the vehicle would have reached the viewing position of the camera. This experiment resulted in the conclusion that "time-to-arrival estimations were significantly longer for motorcycles than for the larger vehicles…" In 2003, Horswill and Helman had examined motorcyclists' behavior in comparison to that of car drivers and reported that "motorcyclists chose faster speeds than the car drivers, overtook more, and pulled into smaller gaps in traffic, though they did not travel any closer to the vehicle in front." If a motorcyclist does choose to approach an intersection at a high speed, this will exacerbate the size-arrival effect and make it harder for a left turning driver to judge the gap available for to complete their turn.

In the second experiment, Horswill et al. varied the time at which the video was blacked out (1, 2, 4, and 7 seconds prior to arrival). For these scenarios, the subject viewed the vehicle approaching for 4 seconds prior to the screen going black. From this experiment, these authors concluded that

the “motorcycles were estimated to arrive significantly later than cars, and this was significant when vehicles disappeared 1 s before they arrived (both at 30 and 40 mph). This indicated that vehicle differences were unlikely to be a result of threshold differences in detecting object expansion as all vehicles in the 1-s condition would be well above threshold before occlusion.” From both experiments, these authors concluded that “one reason that motorcyclists could be at greater risk of being hit at road junctions is because of an unfortunate optical illusion. People estimated that motorcycles reached them later than cars when time-to-arrival was actually the same…This effect is consistent with the size–arrival effect…in which participants judge, incorrectly, that approaching smaller objects will arrive later than larger objects.”

AND, EXCESSIVE SPEED ON THE PART OF THE MOTORCYCLIST CAN EXACERBATE THE SIZE-ARRIVAL EFFECT.

Brenac, Clabaux, Perrin, and Van Elslande [2006] observe that "the hypothesis of a link between motorcycle speed and low conspicuity may indeed be advanced: for a given time to potential collision, the higher the motorcyclist's speed, the greater is the distance from the other vehicle. And therefore, for a given time to potential collision, the higher the motorcyclist's speed, the smaller is the motorcyclist's apparent size in the field of vision of the other driver." The other implication, of course, is that the slower the motorcyclist is traveling, the greater the time available for the intruding driver to clear the intersection before the motorcyclist arrives. Brenac and his colleagues conducted in-depth investigations of 22 collisions occurring in urban areas between motorcycles and other vehicles, many of which were situations where drivers pulled out into the path of an approaching motorcycle. Based on these reconstructions, Branac and his colleagues concluded that there was "a significant relation between problems of conspicuity and the motorcyclist's high level of speed in accident cases occurring in urban areas."

AND, OF COURSE, THERE’S THE LIMITED TIME THAT DRIVERS SOMETIMES DEVOTE TO SEARCHING FOR HAZARDS.

A 2006 study by Labbett and Langham examined the visual search patterns of drivers at two intersections using a hidden video camera. One of the intersections had a visibility obstruction on the corner and the other did not and allowed for an unobstructed view of several hundred meters. The intersections were on the campus of the University of Sussex and the video footage enabled these researchers to determine which vehicles had a university parking pass and which did not. This was used to determine which drivers were likely familiar with the intersections and which were not. Labbett and Langham concluded that, on average, “the drivers observed spent less than 0.5 seconds searching for hazards.” They also found that the drivers tended to only search in one direction. Labbett and Langham also did an experiment in which participants were shown video clips of approaching traffic. The found different search patterns between novice and experienced drivers. “The experienced drivers tended to fixate on only small areas of the screen whilst novice drivers tended to search many parts of the scene.”

DID I MENTION THAT THE CAR DRIVER'S PSYCHOLOGICAL STATE AND EXPECTATIONS PLAY AN IMPORTANT ROLE?

In 2010, Gershon reported two experiments related to motorcycle conspicuity. The first experiment "evaluated the influence of [the motorcycle and rider's] attention conspicuity on the ability of un-alerted viewers to detect it." The second experiment "evaluated the [motorcycle and rider's] search conspicuity to alerted viewers." Gershon and his colleagues varied the driving scenario (urban and inter-urban), the motorcycle rider's outfit (black, white, and reflective) and the distance of the motorcycle from the viewer. In the first experiment, 66 students were individually presented with a series of pictures. They viewed each picture for 0.6 seconds and then were asked to report all of the vehicle types they observed in each picture. In the second experiment, 64 participants viewed the same pictures utilized in the previous experiment. In the second experiment, though, the participants were instructed to look for motorcycles and to report whether or not each photograph showed a motorcycle.

For the first experiment, Gershon reported that the detection of the motorcycles "depended on the interaction between its distance from the viewer, the driving scenario and [the] rider's outfit…when the [motorcycle] was distant the different outfit conditions affected its' attention conspicuity. In urban roads, where the background surrounding the [motorcycle and rider] was more complex and multi-colored, the reflective and white outfits increased its attention conspicuity compared to the black outfit condition. In contrast, in inter-urban roads, where the background was solely a bright sky, the black outfit provided an advantage for the [motorcycle's] detectability."

For the second experiment, Gershon reported that the "detection rate of the alerted viewers was very high and the average reaction time to identify the presence of a [motorcycle] was the shortest in the inter-urban environment. Similar to the results of experiment 1, in urban environments the reflective and white clothing provided an advantage to the detection of the [motorcycle and rider], while in the inter-urban environment the black outfit presented an advantage. Comparing the results of the two experiments revealed that at the farthest distance, the increased awareness in the search conspicuity detection rates were three times higher than in the attention conspicuity." In other words, the rider's clothing made a difference, but the driver's awareness that there would be motorcyclists in some of the pictures (expectation) made a bigger difference. As Gershon noted, "unfortunately, detectability – especially attention conspicuity – is compromised by the perceptual characteristics of the environment that change continuously along a route. Thus, to increase detectability, [motorcycle] riders need to be aware of the perceptual aspects of their riding environment. In parallel, the results of the second experiment with alerted viewers demonstrate that other road users (e.g., car drivers) can improve their detection performance when they increase their level of expectancy and awareness concerning a possible existence of a [motorcycle] on the road (as drivers with high expectation obtained nearly 100% detection rates)."

Helman [2012] and Rogé [2012] both referred to a driver's expectation to see a motorcyclists as cognitive conspicuity. That a lack of expectancy (a lack of cognitive conspicuity) may play a significant role in car drivers failing to recognize the presence of a motorcycle is consistent with the fact that motorcycles make up a relatively small percentage of the vehicle population, and therefore, may not be encountered that frequently by passenger car drivers. For example, in 2015, motorcycles made up only 3 percent of all registered vehicles in the United States [NHTSA, 2017]. Layer on top of that the weather conditions that can limit the riding season in many states and motorcycles end up accounting for only 0.6 percent of all vehicle miles traveled in the United States. Thus, the typical passenger car driver will encounter motorcycles less frequently than they encounter other passenger cars. The lack of expectancy that this low frequency may cause is targeted by advertising campaigns in some states with slogans such as "Share the Road: Look Twice for Motorcyclists" [TxDOT, http://www.txdot.gov/inside-txdot/media-center/psas/motorcycles-bicycles/share-road.html].

AND ISN'T IT POSSIBLE THAT THE CAR DRIVER DID SEE THE MOTORCYCLIST, EVEN THOUGH THEY SAY THEY DIDN'T?

Crundall et al. [2012] observed that the statistics related to the number of look-but-fail-to-see collisions with motorcyclists may be inflated "by self-report biases. One could imagine alternative causes: a failure to look in the appropriate direction; or having looked and perceived the approaching motorcycle the car driver might fail to judge the level of risk that the conflicting motorcycle presents."

To further examine these issues, they developed a test in which subjects viewed video of an intersection on multiple screens simultaneously. The video was from the vantage point of a driver wanting to pull out at a T-junction and the screens were setup such that the subjects could turn their heads to the left and right to look for conflicting traffic. Crundall noted that "Mirror information was edited into the forward-facing video footage, providing a left-side mirror in the bottom-right of the left screen, a right-side mirror in the bottom-left of the right screen, and a rear view mirror at the top of the central screen. The three televisions were angled from each other at 120 degrees providing an immersive video, wherein participants could look to the left and right, as if looking through the side windows of their car, to check for conflicting vehicles on the main carriageway." Both novice and experienced drivers were tested, as was a group of drivers with considerable experience driving both cars and motorcycles. "Specifically we were interested in when drivers first fixate the conflicting vehicles approaching the t-junction (when they look), how long they looked for (a measure of whether they perceive) and when they press a button to pull out from the junction (which, given that the necessary – but not sufficient – preconditions of looking and perceiving are met, can be considered a measure of appraisal)."

Crundall's study included 74 test subjects – 25 novice car drivers with a mean age of 20.6 years and a mean experience level of 1.6 years; 25 experienced car drivers with a mean age of 33.4 years and a mean experience level of 14.8 years; and 24 drivers with significant experience with both cars and motorcycles (dual drivers) with a mean age of 44.9 years and a mean experience level of 25.7 years with cars and 20.0 years with a motorcycle. The videos used in the study include 10 scenarios with conflicting motorcycles, 10 with conflicting cars, and 10 with no conflicting vehicles. Conflicting vehicles could appear from either the right or the left. The clips included the approach phase to the T-junction, the stop, and then the time for the participants to make a decision about when they would pull out. Crundall also noted that "a further 42 clips (not analysed in the current paper) were randomly interspersed which required a different response; either a lane-change decision…or a hazard perception response. Participants could not predict when a hazard might appear, and thus had to remain vigilant to hazards even during the t-junction scenarios. Response times reflecting when the participants thought it was safe to pull out were recorded, along with the participants' eye movements."

Crundall reported that "the most immediate finding from the analyses was the greater caution given to conflicting motorcycles than to conflicting cars. Both the percentage of safe responses and the [reaction times] reflect a greater safety margin in responding to motorcycles… In regard to group differences, dual drivers were more cautious than the novice drivers, with the experienced group falling in between. This pattern held regardless of whether or not there was conflicting traffic. While the overall means improved with experience, the differentiation between motorcycle clips and car clips seemed greatest for the dual drivers followed by the novice drivers…dual drivers were the most sensitive to the presence of a conflicting motorcycle, while experienced drivers appeared the least sensitive."

Thus, Crundall's research suggests that car drivers who also ride motorcycles are more aware of approaching motorcycles and less likely to violate their right of way. This is consistent with the findings of other researchers. Magazzù, et al., for instance, found that "having gained experience in riding any motorcycle…results in drivers being less prone to cause crashes with motorcycles with respect to drivers with no motorcycle license. It is reasonable to assume that car drivers who hold a motorcycle license have acquired more ability in riding and controlling two wheeled vehicles than drivers without a license. Therefore, it is possible to infer that some riding ability and knowledge of the risk annexed to riding, could protect drivers, maybe by helping them in the detection of oncoming motorcycles and the prediction of their manoeuvres" [2005].

THAT'S CONSISTENT WITH OTHER STUDIES – DRIVERS WHO ALSO RIDE A MOTORCYCLE ARE BETTER AT DETECTING MOTORCYCLISTS.

Rogé et al. [2012] reported a study aimed at determining "whether the low visibility of motorcycles is the result of their low cognitive conspicuity and/or their low sensory conspicuity for car drivers." These authors defined sensory conspicuity as "the extent to which an object can be distinguished

from its environment because of its physical characteristics: angular size, eccentricity in relation to the point of gaze, brightness against the background, color, and so on…in other words, sensory conspicuity reflects an object's ability to attract visual attention and to be precisely located as a result of its physical properties." Rogé relates cognitive conspicuity to driver expectations, noting that "an observer's focus of attention is strongly influenced by his or her expectations, objectives, and knowledge…in many cases, inappropriate expectations may be more important in accident causation than the motorcyclist's physical properties." These authors tested a sample of 42 car drivers in a simulator. Half of the drivers were motorcyclists and the other half were not. These subjects were subjected to three test sessions lasting 12 minutes each, with a break in between sessions. During each session, the subjects drove on roads with a speed limit of 90 kph and on a highway with a speed limit of 130 kph. They also passed through junctions and roundabouts where the speed limit was 50 and 30 kph. The traffic encountered by the test subjects in the simulator included 49 vehicles – small cars, vans, buses, tractor-trailers, and motorcycles. The authors noted that "the participants could not anticipate when and from where a motorcycle might appear because they never came back to the same section of the circuit and had to detect a motorcycle in several different situations." The authors of this study concluded that both sensory and cognitive conspicuity had an influence on drivers' detection of motorcyclists. Specifically, "a high level of color contrast between the motorcycles and the road surface enhanced the visibility of motorcycles" and car drivers who were also motorcyclists detected the motorcyclists sooner than car drivers who were not motorcyclists.

NOW LET'S SUM UP WHAT WE HAVE LEARNED FROM THESE STUDIES.

Review of these studies leads to the following observations related to collisions where a passenger car driver violates a motorcyclist's right-of-way and then states that they did not see the motorcyclists. First, for a driver to avoid an unsafe turn in front of a motorcyclist, they need to detect the motorcyclists. If they do detect the motorcyclist, they will then need to make a reasonable judgment about the time available to complete their turn before the motorcyclist arrives at the intersection. The following factors may contribute to drivers failing to detect approaching motorcyclists: a) inattention and distraction on the part of the driver; b) sight obstructions caused by the geometry of the intersection, by other traffic, by the geometry of the driver's vehicle, or by the small size of the motorcycle relative to a passenger car; c) drivers not expecting to see motorcyclists on the road; d) a lack of conspicuity of the motorcycle and rider. The influence of the motorcycle headlight and the color and characteristics of the rider's clothing on the likelihood the motorcycle will be detected depends on the specific environment in which the accident unfolds and on how far away the motorcycle is when it needed to be detected. The influence of headlights specifically will be addressed in the next section. The following factors may contribute to drivers misjudging the time it will take for a motorcyclist to arrive at the intersection after they have detected them: a) excessive speed on the part of the motorcyclist and b) the small size and narrowness of the motorcycle and rider relative to other vehicles on the roadway.

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