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Evaluating Driver Response to a Life-Threatening Emergency

Issues of Behavior, Chance and Hindsight

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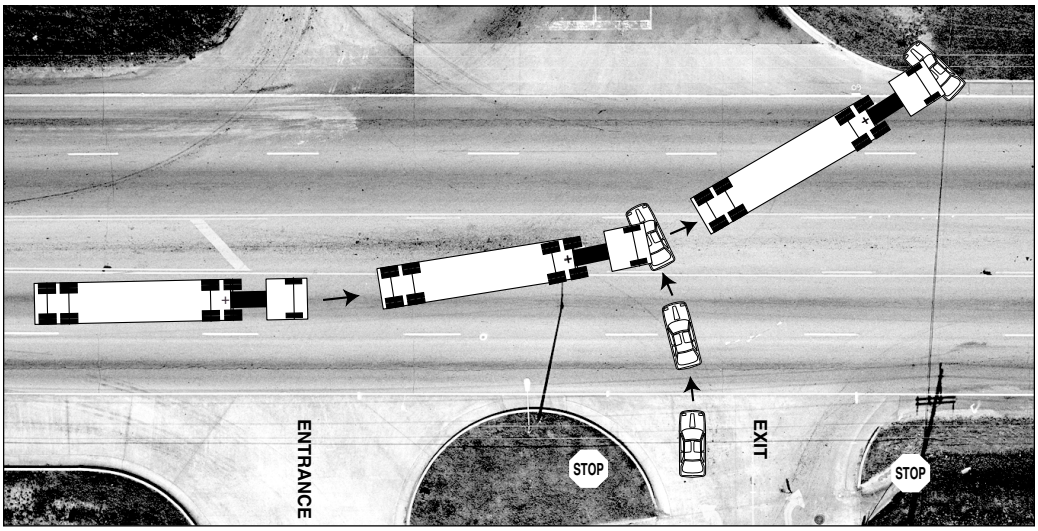

AIRMAP[3] of car exiting driveway in front of approaching truck.

INTRODUCTION

Imagine driving a truck on a major highway at 45 mph when you spot a car on your right stopped in a driveway and poised to cross the road. It doesn't move until suddenly, when you are only seconds away, it accelerates into your lane. You react aggressively by swerving to the left to get around it to avoid a collision. But it doesn't stop! It keeps accelerating and you strike it broadside in the median to the left, killing the driver and seriously injuring a passenger. After the investigators have studied the accident in detail, you are criticized for using bad judgement and over-reacting. It can be shown that if you had done nothing more than continue to go straight, the car would have just cleared your lane before you arrived.

When a driver's path is suddenly threatened by the error of another driver, an emergency situation is created which may demand extraordinary judgement, reaction and skill to avoid a collision, well outside the training and daily experience of most drivers. Yet a common accident analysis technique for determining if a driver did all he could to avoid a collision is to allow the driver time for hazard perception, decision and reaction (eg. 1.5 seconds). If braking or steering is called for then the driver is expected to utilize the performance limits of the vehicle and the pavement (eg. 0.7 g's braking deceleration for automobiles on dry roads or 0.5 g's for heavy trucks). When this type of analysis concludes that the accident "could have" been avoided, some believe this is sufficient

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[3]AIRMAP (Accident Investigation and Reconstruction Mapping with Aerial Photography) is a proprietary mapping system developed by Triodyne.

basis to criticize the driver for not being attentive or not using proper judgement.

This rather simplistic approach to evaluating the competence of a driver ignores the uncertainty and life threatening elements of a sudden emergency and their effect on a restrained, deliberate and accurate response. This approach relies on a body of research which is rich with experimental data regarding the performance limits of drivers, vehicles and roadways. However, experiments were not conducted under real, life-threatening emergency situations where a sudden and serious threat arouses an intense emotional response. While researchers in these experiments tested driver performance under numerous conditions, test subjects either knew they were in a controlled test and would not be harmed, or if they were unaware of being tested, the severity of the hazard to which they were to respond was so innocuous that it presented minimal risk of an accident. For obvious reasons they could not be tested in risky situations posing a real threat of injury.

However, researchers have identified, through study of real accidents and other means, certain psychological/behavioral reactions of humans confronted with sudden emergencies. The factors addressed in this body of research extend far beyond the standard assumptions regarding perception/reaction time and vehicle handling thresholds typically used in accident analysis. Although these factors are routinely overlooked, their relevance to a vehicle accident analysis can be significant.

Another factor which can unfairly bias the evaluation of a driver who was confronted with a sudden and life-threatening emergency is "the hindsight bias". Research has shown that once people acquire knowledge of the outcome of an event, they have a tendency to perceive that the outcome should have been predictable to others before it occurred. With knowledge of the outcome, people are able to look back in time and identify specific facts which fit the outcome, making the outcome appear predictable and inevitable. This type of thinking is known as the *hindsight bias* or the "knew-it-all-along" effect (Fischhoff, 1974).

PSYCHOLOGICAL / BEHAVIORAL REACTIONS TO EMERGENCIES

Webster's definition of an emergency is:

> *"a sudden or unexpected occurrence or combination of occurrences demanding prompt action."*

Sudden emergency has also been addressed by the courts in many states. For example, in June of 1999, a Pennsylvania judge recognized a sudden emergency to exist when a "driver who, although driving in a prudent manner, is confronted with a sudden or unexpected event which leaves little or no time to apprehend a situation and act accordingly." (Hudock, 1999). When a potential hazard appears in the distance, an approaching driver has time to rely on his routine response and judgement to cope with the situation. However, when a hazard develops and the time-to-collision is so short that extraordinary levels of perception, reaction, skill and judgement are demanded, the situation becomes an emergency and driver behavior undergoes certain characteristic changes.

Human behavior research indicates that during an emergency, factors such as intense emotional arousal, shock, stress, fear, expectations, and conflicts between vigorous response and precise, deliberate control inhibit one's ability to reliably, predictably and successfully cope with the situation.

The following excerpts were selected from our review of the research attesting to the significance of human behavior during sudden emergencies.

> *"Man like other animals is equipped with so-called "emergency" mechanisms. When dangers, whether physical or psychological appear imminent, the 'drives' underlying behavior become stronger and behaviour undergoes certain characteristic changes. In particular, responses are more readily elicited; that is to say they are elicited by less intense and less specific stimuli. They tend to be more forceful; more extensive and more rapid. At the same time they tend to be less regular, less organized and less coordinated. The emergency mechanisms enable the subject to react rapidly and vigorously to situations which threaten him and facilitate the overcoming of obstacles of certain kinds. They are of biological value for this reason but their effects on behaviour are not always advantageous, for many of the danger situations which human adults meet require not vigorous activity but restrained, deliberate and accurate responses."* (Davis, 1959)

> *"...the serious conflict situations which demand fast and accurate responses are so infrequent that the drivers do not learn the requested behavioral models: in fact these are against their daily experience in traffic. The very problem in road safety is indeed that such severe conflicts and accordingly, accidents are so infrequent that drivers are not able to take them into account and, what more, it would not even be rational"* (Summala, 1985)

> *"Emergency situations rarely occur in a driver's experience and the braking and steering maneuvers that are then required are usually outside the routine physical behavior ranges. Immediate reactions are automatic and are therefore unlikely to include physical movements that go beyond these limits"* (Prynne and Martin, 1995)

> *"The conditions under which an engine driver, or pilot or other operator perceives a signal are usually such that he has a strong expectation of what he will perceive, this expectation being derived perhaps from a lengthy experience of similar situations and an appraisal of the current situation which is usually both confident and correct. Sometimes he is alert for departures from what he would normally expect. If he is not, he may fail to look out for or fail to perceive correctly, a signal of considerable clarity in terms of strength and duration. Thus he may totally neglect a signal which he does not expect, or misread a signal if what it indicates is contrary to what he expects. He then makes an error because his appraisal or conception of the situation and its probabilities is false."* (Davis, 1959)

> *"...one tends to perceive what one expects to perceive."* (Davis, 1959)

"The prediction of the path of a vehicle is very difficult for two reasons. First, vehicles can accelerate, brake, and change direction relatively easily, while giving little or no advance warning of these maneuvers to other drivers. Second, the behavior of each driver depends on what he thinks the other driver is going to do but neither can be sure of the other's actions in advance, so both must guess." (Ross, 1960)

"A third condition confounding predictions was deviant action, in which a driver did something that was illegitimate and improbable, and thus not expected by others. Examples are failure to turn when the turn signal is activated, or going through a red light. Even the best driver cannot always allow for the possibility of deviant action, if traffic flow is to be efficient." (Ross, 1960)

"...the result of an emergency situation is completely uncertain, and that the behavior of the obstacle to be avoided, in particular in the case of an intersection, is a determining factor. The consequences of driver actions are therefore uncertain, even if some manoeuvres have more chance of being successful than others. Collision avoidance is rather like taking a bet." (Prynne and Martin, 1995)

"Accidents are therefore a matter of chance combinations of circumstances." (Baker, 1960)

"In many types of emergency situations, however, one has not only the factor of unexpectedness to contend with, but also the additional and potentially disruptive factor of intense emotional arousal. Actual data with regard to response time to traumatic emergency events, to say nothing of the time-course of behavioral recovery following such experiences, are virtually nonexistent. Part of this is clearly due to the extreme difficulty of creating under controlled, experimental conditions the particular perceptual/cognitive events that, because of their meaning or significance to the individual, are the usual trigger for the emotional reactions associated with real-life emergencies." (Thackray and Touchstone, 1983)

"In evaluating these findings with regard to their applicability to emergency behaviors in real-life situations, it is important to recognize that unexpected and traumatic emergency situations in real life probably involve at least two phases. The first phase, which could be termed a "shock phase," constitutes the initial reaction. In this phase, the individual attempts to respond with immediate behaviors that are intended to cope with or rectify the unexpected event. It is during this phase that emotional-physiological reactions to the emergency may produce behavioral disruption or even temporary immobility." (Thackray and Touchstone, 1983)

"...the briefness of emergency situations lead some to consider that the driver no longer has the possibility of choosing what he does, but that he simply relies on primary reflexes, which makes all drivers equal when it comes to emergency avoidance." (Malaterre, Ferrandez, Fleury and Lechner, 1988)

"In moments of extreme stress humans tend to revert to the response they have used most often to a particular stimulus so if a new response has been learnt recently the older response will be used instead. This means that training cannot be expected to have much, if any, effect on behavior in emergencies. There is a second phenomenon which can affect some drivers under extreme stress - the inability to make any physical action at all. This paralysis can cause drivers to sit passively before a collision when they have plenty of time to react. It tends to affect cautious drivers - again because the accident situation is well outside their normal experience." (Prynne and Martin, 1995)

"Accident studies have shown that the full braking capability of vehicles is not often used in emergencies. Drivers are a fundamental part of the braking system and there is no advantage in developing more and more advances in braking systems if the driver is unable to make use of these features." (Prynne and Martin, 1995)

"Drivers rarely use the full capabilities of vehicles and tend to adjust their inputs to neutralize differences among vehicles." (Koppa and Hayes, 1976)

"The input and response parameters in the closed-loop tests usually increased as the difficulty increased (allowed maneuvering time or distance decreased) up to a point, then fell off. This indicates that the drivers tended to "give up" if the task seemed impossible." (Koppa and Hayes, 1976)

"It is, of course, the height of absurdity to apply 20/20 hindsight to a situation in which a driver must make a quick decision under life-threatening circumstances. It is generally impossible to know with great precision what that individual perceived in the brief time interval before a decision had to be made, Therefore it is generally impossible to pass judgement on their actions." (Olson, 1996)

When one considers the frailty and uncertainty of human behavior during sudden emergencies, it becomes apparent that determining whether a driver "could have" avoided a particular collision is only of peripheral interest. Certainly a more significant question regarding the culpability of a driver is **"Would all reasonable drivers under identical circumstances have avoided the collision?"** Could it be that for a population of reasonably skilled drivers, some would have avoided the collision and others would not? Is the outcome dictated more by the chance of the circumstances than by the competence of the driver?

HINDSIGHT BIAS
"the knew-it-all-along effect"

Ignoring the range of normal human response to sudden emergencies is an error when passing judgement on a driver's competence. Another error is to impose "20/20 hindsight."

The standard paradigm of hindsight research was established by Fischhoff in 1974. Fischhoff assembled several groups of test subjects and told them all the background

preceding a tragic event in history. One group was not told the outcome of the event. One group was told the true outcome and three other groups were told different false outcomes. Having knowledge of the outcome, whether true or false, doubled the perception of the test subjects that the outcome was inevitable based on the facts as compared to the group that was not told of an outcome. Even when the groups were told to try hard to ignore the outcome, their perceptions did not change. This perception of inevitability has been labeled "the hindsight bias" or the "knew-it-all-along effect."

Since 1974, *the hindsight bias* has become a well recognized and researched area of human behavior. People have been found to have considerable difficultly disregarding outcome information when they are second-guessing the past. Baron and Hershey (1988) found that outcome knowledge consistently influenced evaluations of the quality of a decision, and the competence of the decision maker. Furthermore, test subjects were largely unable to ignore outcome information even when they were carefully informed about the hindsight bias effect, when they were asked to try hard not to fall prey to this bias, or when they were promised rewards for avoiding the bias (see Stahlberg & Maass, 1998). Hawkins and Hastie (1990) defined the hindsight bias as "a projection of new knowledge (e.g. knowledge of the outcome) into the past accompanied by a denial that the outcome information has influenced judgement."

Critics of a driver's unsuccessful response to a sudden emergency are in a position to criticize because they know how things turned out and it is then rather easy to see how the accident could have been avoided but for "inappropriate driver response." They have the benefit of having considerably more knowledge about the outcome of an accident than the driver could possibly have had before it occurred. Critics focus on the actual outcome and study it following the event under no time constraint, while for the driver during the few seconds before impact, **there was no outcome.**

When the collision, its location and the approach paths of the accident vehicles are well understood, it is rather easy to show how a different maneuver would have prevented the accident. It is then compelling to blame the driver for not making the best choice (assuming there was time to make a choice). Critics will say the driver could have and should have swerved instead of braked or braked instead of swerved or perhaps done nothing at all! But, seconds before the collision when it was uncertain what the other driver would do and how things would turn out, the outcome was not as inevitable as hindsight would lead us to believe. Contrary to popular belief, hindsight does not give us 20/20 vision of the past. Rather, it gives us a backwards view, *without surprises*. "Failure to appeciate the effects of outcome knowledge can seriously prejudice the evaluation of decisions made in the past." (Fischhoff, 1974)

But, "Failure to ignore outcome knowledge is not without its benefits", Fischhoff said. "It is, indeed, quite flattering to believe, or lead others to believe, that we would have 'known all along' what we could only know with outcome knowledge, that is to say, that we possess hindsightful foresight."

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