COGNITION, EXPERT TESTIMONY, AND THEORIES OF LEGALLY RELEVANT EVENTS

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Abstract

Expert testimony in human cognition are being used increasingly in legal situations. In this article, I describe how such testimony is formulated and provided. I illustrate using three criminal cases in which expert testimony in cognition was used. For each case I describe how combining the known physical facts surrounding the event in question with known psychological facts about the workings of human cognition can assist in providing for the trier of fact a theory of how the event unfolded.

In this article I will depart from the normal practice of describing a mostly scientific experimentation, accompanied by a brief description of how the research may be applied to practical settings. Instead, I will reverse this practice: I will describe applications of research in human perception and memory to practical situations in the law with only sporadic reference to the research on which these applications are based. In this way, the scope of potential applications can be described.

I will, in particular, focus on three legal cases in which I have been involved as an expert witness in the domain of human participation and memory. I have selected these cases somewhat arbitrarily, but among them, they represent a fairly broad illustration of how principles derived from scientific work in perception and memory can be used to foster understanding and resolution of pivotal legal problems. In particular I will show how, in each case, knowledge of the scientific underpinnings of human perception and memory can be used to construct a theory of what happened during the event in question.

1. Expert witnesses in perception and memory

Although legal systems in all countries encompass a wide variety of activity, my focus here will be on criminal cases in which a person is accused of and potentially tried for some criminal act, and civil cases in which one individual brings suit against another. In such cases, some trier of fact—in the U.S., a judge or a jury, in Italy, a panel of judges—must render judgment about guilt or innocence in a criminal case or must allocate blame and restitution in a civil case.

The basis of the trier of fact's judgment is, of course, the evidence provided during the trial. Evidence can take many forms, but again for the purposes of this article, I will focus on evidence provided by *expert witnesses*. The role of an expert witness is to provide to the trier of fact with specialized information that is not part of the trier of fact's general scope of knowledge. There are thousands of kinds of expert witnesses—fingerprint experts, handwriting experts, DNA experts, economic experts, psychiatric experts, to name a few. Of interest in this article are *perception and memory experts* who, as the term suggests, provide information to the trier of fact about our understanding of human perception and memory as well as the applications of such understanding to the specific facts of the case at hand. There are two types of situations in which information about human perception and memory is particularly useful to the trier of fact: when the main event around which the case revolves involves *eyewitness testimony* and when the main event revolves around *human error*. Examples of such cases and the relevance of human perception and memory to them are described below.

1.1. The theatre of expert trial testimony

When an expert witness testifies—as when any witness testifies—the testimony is divided into a direct examination and a cross examination. During the direct examination, the expert provides—subject to the rules of evidence in the particular judicial district in which the trial takes place—the information

that he or she and the attorney wish to convey to the trier of fact. During cross examination, the opposing attorney attempts to discredit the evidence or the conclusions that have been presented during the direct examination. Sometimes the cross examination takes the form of a serious intellectual interchange, but other times it degenerates into an *ad homonym* attack on the expert him- or herself.

1.2 The sometimes misunderstood role of a perception and memory expert

An expert in perception and memory is, more often than not, associated with a psychology department. Psychologists have had a long and sometimes contentious relationship with the legal system, having traditionally been used to render judgment about mental issues. Because "dueling experts" often present opposite opinions about such issues, the scientific objectivity of such experts has been questioned. For this reason, the trier of fact—particularly if the trier of fact is a lay jury, unschooled in the different domains of psychology—often assumes by default that *any* psychologist is a clinical psychologist whose role is to opine on the mental capacity of some relevant participant in the case. For this reason, the first job of a perception and memory expert is to explain to the trier of fact that he or she is not a clinician but rather a scientist whose main job is not to evaluate patients but rather to do experiments, collect data, and develop theory in an effort to understand how normal people operate.

2. Three Cases

In the remainder of this article I have two goals. The first is to provide examples of legally-relevant situations in which either (a) quantitative measurements can be applied to the situation or (b) a reasonably precise analysis can be offered that combines, known physical facts with psychological laws. The second goal is to demonstrate how testimony by a perception-memory expert can provide a trier of fact with a well-defined choice of theories—a prosecution theory and a defense theory—about what happened in the event under consideration.

In quest of these goals, I describe three cases in which I have been involved. These cases illustrate a range of information that a perception and memory expert can provide to a trier of fact.

2.1. A murder in New Jersey

During the evening of August 23, 1995, in Newark, New Jersey, a man named Errich Thomas was shot and killed during a robbery. The killer was observed by a witness, Patricia McKinnis from the porch of her home, approximately 83 meters away. Later, following a somewhat confused police investigation, Darrell Edwards was arrested and accused of having committed the murder, following which he was identified by Ms. McKinnis from a lineup. Despite the testimony of another eyewitness, Steven Blevins, who viewed the crime from close up and swore that the killer was *not* Mr. Edwards, Mr. Edwards was convicted largely based on Ms. McKinnis's identification of him. He is now in prison serving a life sentence.

Mr. Edwards's conviction seems wrong: it seems intuitively obvious that Ms. McKinnis's distance from the killer, 83 meters, was too far for her to be able to see him clearly enough to be able to identify him. Fortunately for Mr. Edwards, his case was taken up by the New-York based Innocence Project, a New-York based organization whose purpose is to lobby for legal reconsiderations of convictions, such as that of Mr. Edwards, which seem particularly egregious.

The Innocence Project contacted me because I had recently co-authored an article describing research—with roots in a legal case similar to Mr. Edwards'—which allows one to provide a quantitatively- based analysis of how much information is lost to the visual system by virtue of seeing a person—or anything else—from any particular distance.

The details of how this is done is described in Harley & Loftus (2005). The basic idea is this. Intuitively, increasing distance diminishes one's ability to see progressively larger visual details. Somewhat less intuitively, the loss of information corresponding to a given distance is, from the visual system's perspective, equivalent to *blurring* an object, such as a face, by a suitable amount. It is quite *un*intuitive that, based on reasonable assumptions about visual information processing, amount of blur, suitably defined, is *proportional* to distance. Although a detailed explanation of this assertion is beyond the scope of this article, here, briefly, is why it is true.

Image representations and spatial filtering. A visual image can be represented either in pixel space (the usual way) or *frequency space*. In frequency space an image is considered to be a weighted sum of two-dimensional sine-wave gratings of all possible spatial frequencies and orientations that are allowable by the image's dimensions.

A *spatial filter* adjusts the distribution of weights corresponding to the various spatial frequencies that comprise the image. Of relevance to this discussion is that a *low-pass filter* disproportionately decreases the weights of higher spatial frequencies—loosely speaking, *fine detail*—which is tantamount to *blurring* the image.

The human visual system, like any optical system, acts as a low-pass filter which means, among other things, that it is incapable of seeing spatial frequencies higher than some maximum. For purposes of this discuss I refer to this maximum as F_1, which is in units of cycles per degree of visual angle. There is an analogous image parameter, f_1, which is the image's highest perceivable spatial frequency in units of cycles/image, and it is $(1/f_1)$ that is proportional to distance. Loftus and Harley (2005) measured the proportionality constant which, in turn, provides the information required to blur an image so that it mimics the information loss corresponding to a witness's seeing some object—such as a criminal's face—from any particular distance

Application to legal cases. It is thus possible to show a jury such a blurred image to assist them in

deciding whether a witness could have perceived what he or she claimed to have perceived. The Innocence Project attorneys asked me to create such an image, depicting how Mr. Edwards would have appeared to the witness, Ms. McKinnis, from a distance of 83 meters. This image, shown in Figure 1, was also posted on the Innocence Project's web site, noting that,

> "Innocence Project client Darrell Edwards was convicted of a New Jersey murder based, in part, on testimony from a witness who claimed that she saw him from a distance of [83 meters]…Scientifically it is impossible to see someone well enough from that distance and make an accurate identification."

Figure 1 here

While it is not clear that the conclusion should be quite this strong, the Innocence Project has made a legitimate point based firmly on quantitative psychological analysis. It remains to be seen whether they will be successful in achieving a legal decision that will result in a new trial for Mr. Edwards.

2.2. A truck-train accident in Alaska

Early in the morning on June 7, 1992 Lee Wheeler and Wayne Nelson were driving Nelson's truck from Fairbanks to Anchorage Alaska, a distance of approximately 500 km. Subsequent analysis of their blood-alcohol content indicated that they were both very drunk, as well as under the influence of a variety of illegal drugs.

At a railway crossing, about halfway between the two cities, their truck smashed into a freight train and exploded. Amidst the violence and chaos, Wheeler was thrown from the truck and survived; however Nelson remained in the truck and was killed.

The train engineer, Frank Kollander, was understandably horrified by the accident. Kollander stopped his train as quickly as possible and ran back to the accident scene. There, he discovered Wheeler badly injured on the highway. Ignoring the smoldering truck, and not knowing that Nelson's body was in it, Kollander tended to Wheeler on the highway for about 45 minutes while awaiting help.

Eventually help arrived and many activities commenced. Wheeler was taken to the hospital, the lingering flames were extinguished, and Nelson's body was discovered and extracted from the truck. The police asked the train engineer, Kollander, what happened and Kollander reported the following,

> "...the driver was [Wheeler], that guy who was lying on the highway. Just before his truck smashed into my train, I looked directly at the his face. *He couldn't have been more than ten feet away*, and was coming straight at me, and he was looking at me. I couldn't figure out why he looked so calm and why he wasn't slowing down...I've never been so

horrified in my life...that fireball was awful; it was like out of the movies or something..." (emphasis added).

Kollander had no reason to be untruthful: in this and other statements about the accident, he seemed honest and sincere. But his observations were pivotal because eventually the case entered the province of the Alaskan judicial system, and the key question became: Who was responsible for the accident; that is, who was driving the truck? Because of the alcohol and drugs resident in both Nelson's and Wheeler's bodies, the driver, whichever man he was, was deemed to be guilty of vehicular homicide.

There was physical evidence that, contrary to Kollander's account, the dead man—Nelson—had been the truck's driver, and indeed Nelson owned the truck. But confident eyewitness testimony is very persuasive, and based on Kollander's testimony that he saw Wheeler driving just before the accident, Wheeler was put on trial for murder. The Prosecution's case against Wheeler was based primarily on Kollander's testimony that Wheeler was the driver and, from the witness stand, Kollander dramatically re-described his memory of clearly seeing Wheeler driving the truck from about 10 feet away just prior to impact.

Upon being called to testify in Wheeler's defense, I first noted that, in this case there was a great deal of valuable physical information including (1) the angle between the road and the railway tracks (b) the speed of the train, (c) the (approximate) speed of the truck, (d) Kollander's position in the front of the train and (e) the location on the train of the truck's impact. This information allowed calculation of a critical number: the minimum distance that Kollander ever was from the truck's driver was approximately 22 meters. Based on other considerations it was evident that, from this distance, Kollander could not have perceived the driver's face well enough to distinguish between the appearance of Nelson and the appearance of Wheeler.

However, the judgment of the defense attorneys was that pointing this out, indisputable though it may have been, was not sufficient to counter the very strong impression made on the trier of fact (a jury in this case) by the strong confident contrary testimony by Kollander that Wheeler was the driver. It required an explanation for why Kollander might have given such confident testimony even if he was wrong. Fortunately for Wheeler, there is a wealth of data and theory in the perception and memory literature that provides such an explanation. This explanation rests on the proposition that a person can have a strong, detailed, confidence-inducing memory when two things are true: first the original memory was poor to begin with, and second there are potential sources of *suggestive post-event information* that may have systematically supplemented the original memory such that it eventually becomes stronger and more detailed, yet false in potentially important ways).

In this case, both ingredients were present. First, Kollander's original memory of the accident was

likely poor with respect to details for of a number or reasons, including but not necessarily limited to: (1) the accident was highly stressful (e.g., Berkun, Bialek, Kern, & Yagi, 1962) (2) Kollander had a very short duration to perceive details such as who was driving the truck (e.g., Busey, Tunnicliff, Loftus & Loftus, 2000; Laughery, Alexander, & Lane (1971), and (3) his attention was likely on the task of driving his train and then stopping it as quickly as possible rather on peripheral details such as the exact appearance of the truck's driver (e.g., Levin & Simons, 1997).

Second, Kollander was potentially influenced by various types of post-event information, including, (1) while helping Wheeler, Kollander never knew there was a second person in the truck and therefore must have inferred that Wheeler was the driver (see Reinitz & Hannigan (2004) and (2) while helping Wheeler, Kollander likely reconstructed his memory of what had happened just before impact (e.g., Bartlett, 1932; Loftus, 2003; Loftus & Palmer, 1978). The end result was that Kollander developed a strong, but false memory of an event—clearly seeing Wheeler's face from 10 feet away—that he could never have actually experienced (see Wells & Bradfield, 1998 for an account of a similar phenomenon). It then was based on this memory that Kollander provided all later interview and trial testimony.

The jury evidently believed this account of Kollander's memory: after hearing the expert testimony in which this account of eyewitness memory was presented, they concluded that Kollander was honest, but that his memory was false, and found Wheeler not guilty of homicide.

2.3. An automobile accident in New Jersey

In the late evening of February 26, 2006, a tragic accident occurred on a dark rural road in Cape May, New Jersey. A Dodge Caravan was traveling westbound along Tuckahoe Road at approximately 58 k/h. At the same time, another car—a Ford Crown Victoria—was traveling northbound along Stagecoach Road at 125 k/h. There were stop signs at the Tuckahoe-Stagecoach corner for the north- and southbound traffic only: that is, the Ford although not the Dodge should have stopped. But neither car stopped: the Ford hurtled into the intersection and crashed into the Dodge. The Ford's driver was briefly knocked unconscious and eventually sustained relatively minor injuries, but the occupants of the Dodge—two teenage sisters out to buy milk at a mini-mart—were killed instantly.

What made this accident unusual is that the Ford's driver was not an ordinary careless citizen. Rather the Ford itself was a New Jersey state patrol cruiser and the driver, Robert Higbee, was a highly-regarded New Jersey state trooper. Trooper Higbee was traveling fast at the time of the accident because he was pursuing a speeder at the time.

Although New Jersey state troopers, like their counterparts in all U.S. states, can legally exceed the speed limit if necessary to carry out their duties, they cannot legally go through stop signs; thus Trooper Higbee was clearly in the wrong. A civil suit against the state of New Jersey by the deceased sisters'

family resulted in a settlement of $2 million USD. However, in an unprecedented step, the Cape May county prosecutor then charged Trooper Higbee with two counts of vehicular homicide—a charge that carries a penalty of up to 40 years in prison.

This criminal case was understandably high-profile in the United States. It was followed closely by the news media and even more closely by various emergency agencies such as fire departments, police departments, and ambulance operations whose vehicles are required by their duties to drive quickly. The major question was: was Trooper Higbee reckless and deliberate in his failure to stop at the stop sign? The prosecution said that he was. Trooper Higbee said he was not because he never saw the stop sign to being with. The main question for a perception and memory expert was: given the physical environment and the known workings of human cognition, is Trooper Higbee's assertion reasonable? This requires information concerning,

- Vision: What is in a person's field of vision, and how important is central (foveal) versus peripheral vision?
- Attention: Where is a driver's attention normally, and how does focused attention in one part of the environment diminish attention in other parts of the environment?
- Reaction time: How quickly can a driver react to an unexpected stimulus?

It was about these issues that I was asked to provide expert testimony in this case on May 28, 2009. In what follows I will describe this testimony. Essentially the testimony provided a theory of what was happening in Trooper Higbee's cognitive system during the approximately six seconds that preceded the crash.

There are two critical sources of information that can be used for making decisions about cognitive events in this case. The first is the geography of the scene, which is shown schematically in Figure 2. The second source of information is data downloaded from the police car's "black box"—the event recorder, required on all New Jersey state police cars, which recorded the car's speed, along with the degree of accelerator depression (a higher value means that the accelerator was depressed more in a quest for more speed) and whether the brake was or was not being applied. These data are shown in Figure 3 and allow calculation of several quantities of interest that are described below.

Figures 2 and 3 here

2.3.1. Observable events leading up to the crash

I considered five time points of interest in the seconds leading up to the crash. Relevant data from these time points come from both the physical configuration of the scene (Figure 2) and the event-

recorder data (Figure 3).

Point 1: 6 seconds before the crash

This is the starting point of the analysis. As schematically indicated in Figure 2, Trooper Higbee was approaching a standard American "stop sign ahead" sign providing, of course, the information that there was a stop sign somewhere up ahead. For a variety of reasons, there is no standard distance by which a "stop sign ahead" sign precedes the referred-to stop sign so Trooper Higbee didn't know at that point exactly how far ahead the relevant sign was. Because it was late at night and therefore dark the difficulty in detecting it was increased. Of greater relevance was that the stop sign was, as indicated, not even in Trooper Higbee's field of vision because, from his perspective at that point, it was obscured by utility poles. Meanwhile at that moment, the Dodge van, approaching the intersection from the east was also not in Trooper Higbee's field of vision because it was obscured by buildings.

Point 2: 3.2 seconds before the crash

At 3.2 seconds prior to the crash Trooper Higbee reached the point at which, from his perspective, the stop sign physically emerged from behind the obscuring utility poles and into his of vision—although, assuming that he was looking straight ahead the sign emerged about 3.3 degrees into his visual periphery. At that point, the westbound Dodge was still not visible to Trooper Higbee because it was still obscured by the buildings.

Point 3: 2.5 seconds before the crash

As indicated in Figure 3, Trooper Higbee began to accelerate about 2.5 seconds before the crash.

Point 4: 2.2 seconds before the crash

Trooper Higbee and the Dodge van reached the locations where they became visible to each other. In particular, from Trooper Higbee's perspective, the Dodge emerged from behind the previously obscuring buildings, into his field of vision, where it represented to him an immediate danger.

Point 5: 1.1 seconds before the crash

Trooper Higbee strongly applied his brakes, leading to a rapid deceleration—but not nearly rapid enough to avoid the crash.

2.3.2. A perceptual-attentional theory of Trooper Higbee's mental state during the critical six seconds

Intuitively, it does not make sense that Trooper Higbee—an experienced police officer whose job was to drive, often in dangerous situations—would deliberately drive through a stop sign with reckless disregard to the many potential dangerous. And yet the prosecution claimed that he did. The main task of expert testimony then was to provide a plausible account—a theory—that unites known workings of

human cognition with the known facts and physical configuration of this accident. One such theory is described below and relies heavily on the data provided from the event recorder in Trooper Higbee's car, critical elements of which are reproduced in Figure 3. This theory mirrors the events occurring during the time points enumerated above.

Point 1: 6 seconds before the crash

From 6 seconds until about 4.8 seconds before the crash, Trooper Higbee was approaching and then passing the stop sign ahead sign. Beginning about .8 seconds—about 80 feet—prior to passing the stop sign ahead sign he began, as indicated in Figure 3, to lightly apply his brakes, which caused a gradual decrease in his car's speed. Why was he doing this? The theory is that he was slowing down while trying to identify the stop sign that the "stop sign ahead" sign referred to. This task was made difficult because the relevant stop sign—The Tuckahoe stop sign—was still obscured by the utility poles, and thus not yet in his field of vision. However, there was another stop sign that *was* in his field of vision. As indicated in Figure 2, the next cross street after Tuckahoe Road to the north, was Roosevelt Boulevard, which also had a stop sign that was relevant to northbound Tuckahoe Road traffic. *This* stop sign in contrast to the Tuckahoe stop sign *was* in Trooper Higbee's line of sight and what is more, it was illuminated by speeder's headlights. Thus, a reasonable conclusion for Trooper Higbee to make would be: "The 'stop sign ahead' sign refers to the Roosevelt stop sign."

One cannot, of course, make certain conclusions about how long it took Trooper Higbee to make this assessment. However, as indicated in Figure 3, he begin to accelerate again about 2.5 second prior to the crash. A standard estimate for decision-reaction time in this situation is 1.5 second, which would indicate that he likely decided—incorrectly—that the Roosevelt Boulevard stop sign was the relevant one approximately half a second after he had passed the stop sign ahead sign. At this point—critically—he no longer had to divert his attention from the speeder in search of a relevant stop sign. In other words his primary task at hand ceased to be that of finding a stop sign and returned to that of chasing the speeder. Both his attention and his focal vision was now likely directly ahead on the speeder's taillights.

Point 2: 3.2 seconds before the crash

At approximately 3.2 seconds prior to the crash—by the theory's reckoning, a few hundred ms after he had switched his focal attention to the speeder—the actually relevant stop sign i.e., the Tuckahoe Road stop sign, entered Trooper Higbee's field of vision. However, at this point, several factors weighed against the likelihood that he would shift his attention to its presence. First, the Tuckahoe stop sign was situated approximately 3.3 degree to the right of his straight-ahead line of sight, which would put it

outside of his focal vision[1]. Second, as indicated, the stop sign came into Trooper Higbee's field of vision shortly *after* he had likely switched his attention away from the search for a stop sign and back to the speeder. Third, the Tuckahoe stop sign was not particularly well illuminated.

Point 3: 2.5 seconds before the crash

At 2.5 seconds prior to the crash—and about 0.7 seconds *after* the Tuckahoe stop sign came into Trooper Higbee's line of sight—Trooper Higbee began to accelerate. Why did he do this? As indicated, he had likely not perceived or paid attention to the Tuckahoe stop sign, as he had already identified the Roosevelt stop sign as the relevant one. Having done so a second or two earlier, he had returned to his original goal of chasing and stopping the speeder. So he accelerated for the simple reason that it was the appropriate action to take in quest of this goal.

Point 4: 2.2 seconds before the crash

At 2.2 seconds prior to the crash, the Dodge van entered Trooper Higbee's field of vision. Like the Tuckahoe stop sign which had entered his field of vision a couple of seconds earlier, the Dodge entered into his visual periphery. Unlike the Tuckahoe stop sign, however, the Dodge had several features that are known to capture attention in the visual periphery: it was large, it had lights, and it was moving. It is highly likely therefore that the Dodge's entrance into Trooper Higbee's field of vision *did* capture his attention and lead to appropriate action.

Point 5: 1.1 seconds before the crash

The appropriate action is, of course, to stop in order to avoid the crash. Normally, as indicated earlier, reaction time in this sort of situation between the onset of a signal (the Dodge's presence) and the completion of appropriate action (engaging the brakes) is about 1.5 second. In this case, Trooper Higbee completed the action within 1.1 seconds. However, there was not nearly enough time to avoid the fatal crash.

2.3.3. Outcome

The jury evidently believed this theory, as Trooper Higbee was acquitted of vehicular homicide. As of this writing, he is in the process of once again assuming his duties as a New Jersey state trooper.

3. Summary: Prosecution and Defense Theories of a Case

The American, and many other legal systems operate, essentially, on the basis of two sides of a case each presenting a competing theory of what happened. Based on the evidence that has been presented at

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[1] Unfortunately, for unknown reasons, the Tuckahoe Road stop sign had been built unusually far to the right of the edge of Stagecoach Road, which put it further from Trooper Higbee's focal vision than it otherwise would have been.

trial to the trier of fact, the trier of fact chooses between the two theories. The role of an expert can be construed as helping one side or the other construct their theory.

Table 1 summarizes the competing theories in the three cases that I have described. Because the three cases all happened to be criminal cases in which I had been testifying for the defense, the two theories are characterized as "Prosecution theory" and "Defense theory." In these three cases the prosecution theory is based on intuition and "common sense," while the defense theory is based on a combination of the known physical facts and the known workings of human cognition.

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Figures and Table

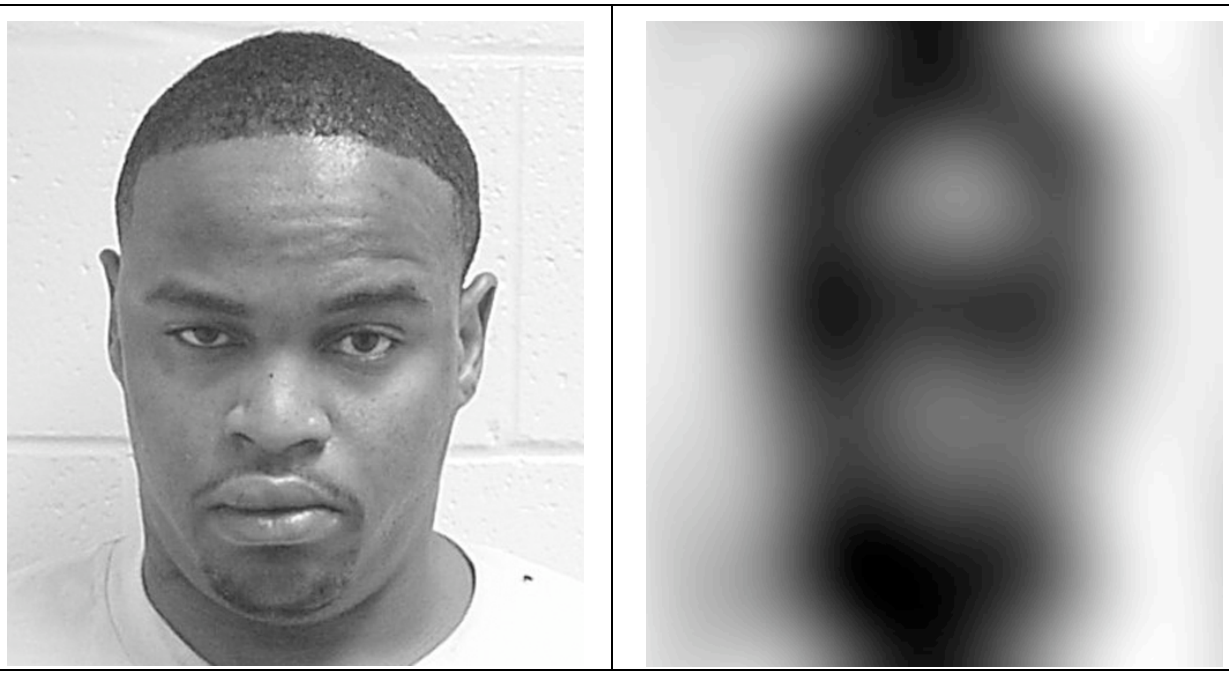


Figure 1. Convicted defendant Darrell Edwards (right) and the amount of information about his appearance that is available to the human visual system from a distance of 83 meters.

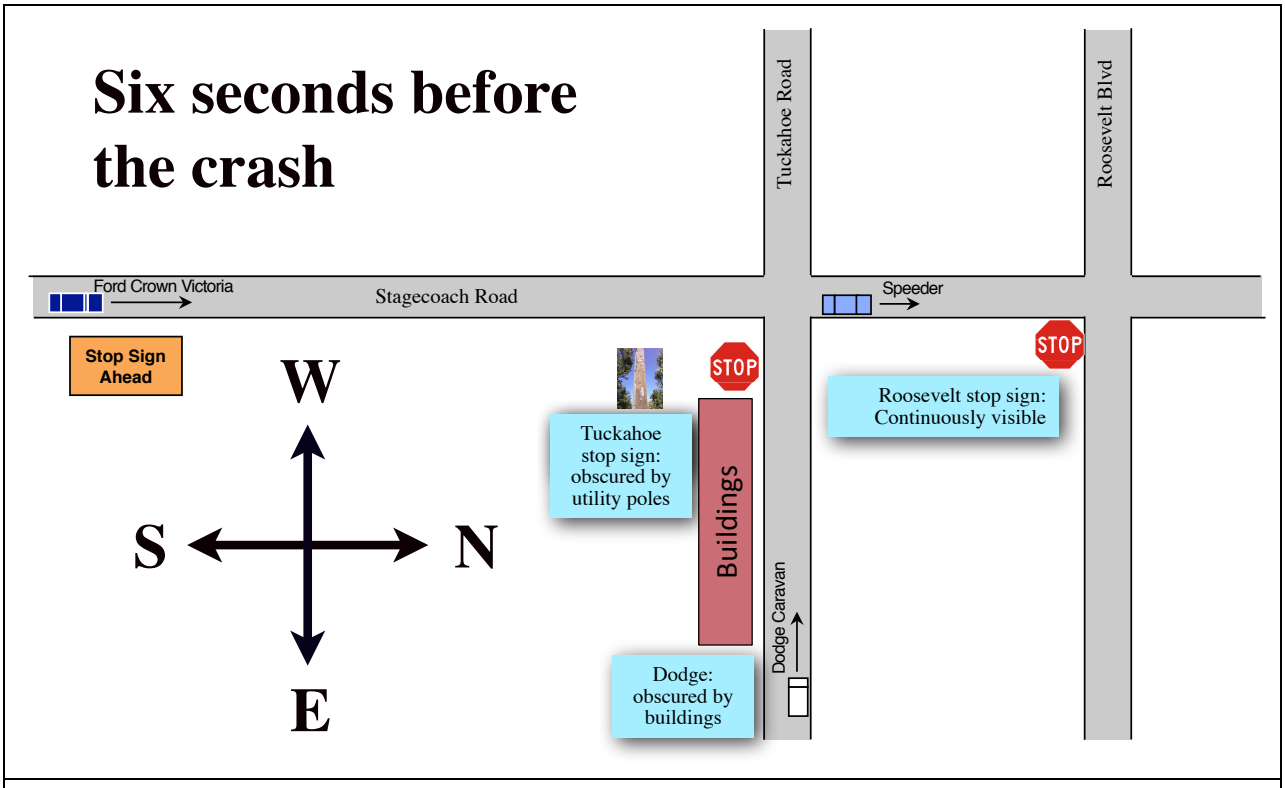


Figure 2. The general configuration of the Higbee accident scene (note that North is to the right). The northbound Ford at the left and the westbound Dodge at the bottom are about to crash. The role of the third car—the Speeder—is described in the text.

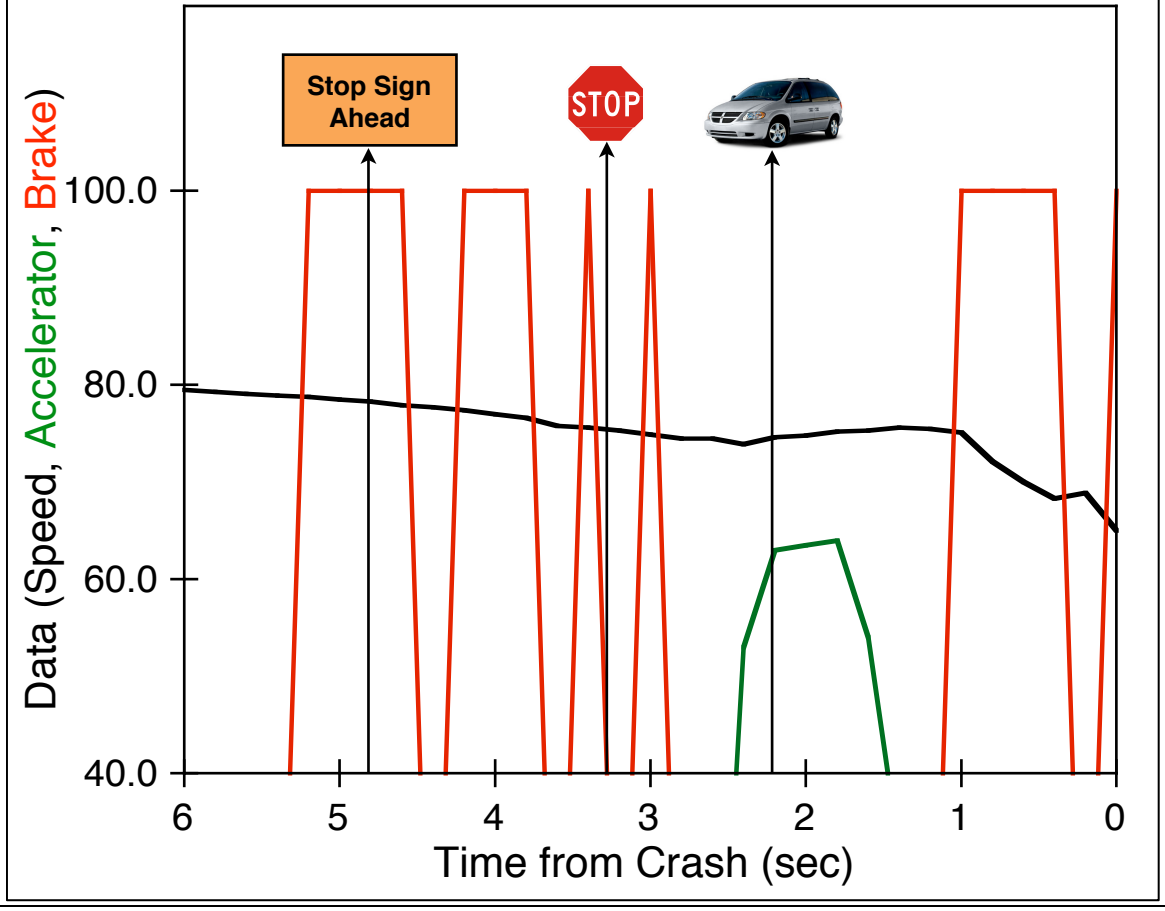
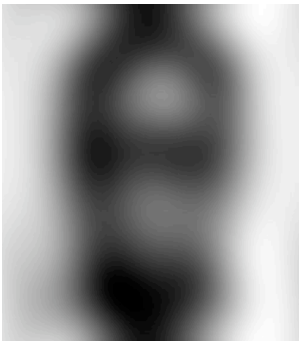


Figure 3. Information downloaded from the Ford's event recorder as functions of time prior to the crash. The solid, generally decreasing line represents the Ford's speed in mph. The series of pulses beginning at approximately 5 seconds and ending at time zero represent brake applications. The pulse centered around 2 seconds represents degree of accelerator application.

Table 1. Summaries of defense and prosecution theories about each of the three events described above. In each case, an expert in human cognition as primarily responsible for construction of the defense theory.

Prosecution theory: Edwards	Defense theory: Edwards
• The witness was able to accurately perceive the killer's appearance from a distance of 271 feet. • Therefore the witness's identification of Mr. Edwards was reliable and Mr. Edwards is the person who committed the crime.	• This is what the human visual system is capable of perceiving at this distance, assuming everything else is perfect. • It is therefore unlikely that the witness would have accurately encoded the killer's appearance 
Prosecution theory: Wheeler	**Defense theory: Wheeler**

• Ignore: Physical evidence that Wheeler was not the driver.
• Ignore: Physical/mathematical evidence that Kollander was never more than 70 feet from the truck's driver.
• Conclude: Kollander's confidently-expressed memory of seeing Wheeler driving was based on his perception of the accident (after all, this is just common sense).
	• Believe: Physical evidence that Wheeler was not the driver.
	• Indicate: Physical/mathematical evidence that Kollander was never more than 70 feet from the truck's driver.
	• Conclude: Kollander's confidently-expressed memory of seeing Wheeler driving was based on
	  • poor original perception, combined with…
	  • well-understood reconstructive processes leading to Kollander's memory that Wheeler was the driver.

Prosecution theory: Higbee	**Defense theory: Higbee**

• Ignore: Trooper Higbee has a long history of being a safe and conscientious cop.
• Believe: Trooper Higbee recklessly ignored the stop sign and somehow intended to cause the crash.
	• Consider: Trooper Higbee has a long history of being a safe and conscientious cop.
	• Consider: Trooper Higbee did not perceive the Tuckahoe stop sign because of,
	  • normal human limitations in the visual and perceptual systems
	  • normal human limitations in attentional ability
	  • normal human limitations in reaction time