

# Cognitive Miscues Call For Investigative Precautions

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**Abstract:** After a lifetime of observing the world around us and making decisions based on these observations, we gain the sense that we are skilled at seeing all the important details in our environment. The truth, however, is that a gap exists between what we are exposed to and what we notice. Another gap exists between what we notice and what we can later recall. Biases might also direct our attention or influence the weight we give to any piece of information. These limitations can cause us to miss important items and impair our ability to draw accurate conclusions. Although we may not notice these miscues in our everyday lives, they can become problematic, especially for investigators who rely on observation. This difficulty is exacerbated when there is not effective communication between investigators. We present the case of the “Pizza Bomber” as an example. This case demonstrates issues with observation, attentional limitations, memory, the distortions of bias, and failed communication. We highlight several errors that occurred, identify their probable causes, and show their consequences. While these limitations and biases are natural, we offer suggestions to mitigate their negative impact.

**Keywords:** attentional biases, cognitive biases, criminal investigation

## The General Problems We Face

Perceptual limitations and cognitive errors can negatively impact our ability to make logical decisions about future actions. Critical gaps occur between what we are exposed to, what we notice, and what we later recall. Such disparities exist across multiple levels of sensation (basic vision and hearing), perception (how we interpret sensations), and cognition (attention, memory, and decision making). We cannot see everything at once, and even if we could, our attentional abilities are too limited to allocate detailed attention to everything we see. Biases might also direct our attention or the weight we give to any piece of information. Although these errors might not significantly impact our everyday decisions, they can become problematic, especially for investigators who rely on observation to develop leads and form effective hypotheses. Before focusing on a specific case example, we should first consider some glitches we face at the level of attention.

To properly encode information about an event into long-term memory, we must first notice it. Attention refers to the way in which we allocate resources to some tasks while not allocating resources elsewhere. By definition, this means we cannot attend to everything. Without proper attention we can even fail to see what is right in front of us, an error called *inattention blindness*. Simons and Chabris had participants watch a short video in which two teams of three individuals passed basketballs back and forth. The viewer’s task was to count the number of times the ball was passed between players on a specific team. Surprisingly,

46% of viewers failed to notice an actor in a gorilla suit walk across the screen (1). Although the gorilla was in their line of sight, because they did not actively pay attention to that stimulus they were, in effect, blind to its appearance. We also see this type of error in the everyday occurrence of driving accidents. Because drivers are expecting to see other cars on the road, they can fail to notice a motorcyclist or bicyclist in the lane they are turning into. Even in a static image, we are less likely to notice the presence of a motorcycle than of a taxi (2).

We also experience memory limitations. Even if we successfully attend to an object or event, there is no guarantee that we will accurately recall it later. *Change blindness* occurs when we fail to notice an alteration in an object that we have previously observed. After watching a short film, viewers may fail to notice changes to objects in a scene, an actor’s clothing, or even the identity of the actor himself (3). Although this attentional failure is robust in everyday experience, our brains do not alert us, so we believe we will spot any changes. That is, we considerably overestimate our observational ability (4). This error is understandable given that odd situations, like a gorilla walking across a TV screen or a sudden change in a person’s attire, are rare. Our brains have developed in a world where predictable events support our belief that we can trust our attentional system.

One of the basic findings in cognitive psychology is the *speed-accuracy tradeoff*. We can be either slow and accurate or fast and error-prone. Any short-cut we take in our thinking processes or any method we use to speed up a task puts us at higher risk for making mistakes. Given the

extensive time that we would need to properly attend to all items in our environment, it makes sense that we would find other ways speed up the process. In their work, Kahneman and Tversky described two systems for making judgments. System 1 is automatic and quick, whereas System 2 is more effortful and thus slower. While engaging System 1, we employ mental shortcuts, called heuristics, for making rapid judgments (5). Although helpful, they can lead to errors. The *availability heuristic*, for example, tells us that things that easily come to mind are more common than are things that take effort to recall (6). This works well when estimating how likely it is that it will snow in Minnesota this winter, but such quick judgments can overestimate the likelihood of uncommon events (7). For example, our exaggerated fear of shark attacks and airplane crashes (when we should really worry about heart disease) might be partly due to media attention, which stimulates our memory of similar past events.

A range of cognitive biases can cause erroneous interpretations and impact our actions. For example, the *confirmation bias* describes our tendency to seek out, and selectively attend to, data that supports our initial hypothesis. If we believe that small dogs are mean, we are more likely to notice when a small dog is unfriendly and a large dog is nice. If later asked to recall past experiences, we are more likely to remember events that align with our expectations. We see this error in the *forensic confirmation bias*, a problem impacting multiple levels of criminal investigation. This bias refers more generally to the ways in which “an individual’s preexisting beliefs, expectations, motives, and situational context influence the collection, perception, and interpretation of evidence during a criminal case” (8). Kassir et al. further highlight ways in which the forensic confirmation bias might negatively impact both data collection and interpretation. The very context in which physical evidence is presented to an investigator (e.g. prior knowledge of a confession) might influence the interpretation of evidence. This can lead to inaccurate narratives and false leads.

On August 28, 2003, a bizarre case with unexpected twists began to unfold. Four jurisdictions entered competing but overlapping investigations involving a bank heist, three deaths and a potential hit. From first responders to experienced detectives, investigative miscues had serious consequences and might have caused a man’s unnecessary death. Even today, these miscues hinder a definitive interpretation of the incident. This case demonstrates issues with observation, attentional limitations, memory, and the distortions of bias. Its complexity offers an opportunity to see how these issues affected the course of the investigation. While cognitive miscues are natural, some of these were avoidable, suggesting that law enforcement officers can benefit from focused training in the quirks of mental processing.

## The Case of the “Pizza Bomber”

Brian Wells worked for Mama Mia’s Pizza-Ria in Erie, Pennsylvania, as a deliveryman. His life showed no red flags for dangerous criminal behavior. Yet at the age of 46, he entered a branch of the PNC Bank at Summit Towne Center carrying a cane and wearing a white T-shirt that covered an odd bulge over his chest. He walked up to a teller and showed her a note that said, “Gather employees with access codes to vault and work fast to fill bag with \$250,000. You have only 15 minutes.” Lifting his shirt, he revealed that he was wearing a large device attached to a metal collar around his neck—a bomb. He offered a note that listed a series of strictly timed tasks to collect keys that would delay the detonation and eventually defuse it. The note also said that Wells was under surveillance and any contact with authorities would result in detonation. The teller gave Wells \$8,702 and said that no one could enter the safe at this time to retrieve more. Wells appeared to accept this. A surveillance videotape shows that he sucked on a lollipop and strolled out of the bank with the bag of money. He got into his Geo Metro and left the scene. Bank officials called the police (9).

Pennsylvania state troopers soon spotted his car in a parking lot. Wells was standing next to it, with the alleged bomb still attached. The troopers cuffed him and made him sit on the pavement while they called a bomb squad.

FBI Special Agent Jerry Clark (9, 10) arrived at the scene to talk to Wells. The bank robber said that three black men had put the bomb on him and told him to get the money. He insisted the bomb was going to explode. He seemed scared. The officers at the scene got behind their cars, just in case, while others blocked off roads to local traffic. The minutes ticked by. Wells asked for help to find a key to the collar (11).

Wells asked an officer to phone his boss. At 3:18 p.m. the device began to beep. In seconds, the bomb detonated, blowing a hole into Wells’ chest and killing him. Three minutes later, the bomb squad arrived, thwarted by the roadblocks (12).

Inside the Geo, officers found maps, handwritten instructions for Wells – the “Bomb Hostage” – and the cane he had carried, which had been fashioned into a gun. The instructions and maps were complex, like a scavenger hunt, sending Wells looking for keys and locks, with fatal consequences if he failed. The bomb was homemade but built with professional tools. The triple-band metal collar had four keyholes and a combination lock on an iron box that held two pipe bombs and a timer. Any attempt to disarm it would have set it off. Wells had been doomed from the moment the collar went on him (11). A search of Wells’ house turned up nothing to connect him to the bomb.

The “Collar Bomber” investigation, which spanned seven years and involved a bizarre group of culprits, called on personnel from the local Erie police department, the

Pennsylvania state troopers, the FBI and the ATF. Reporters conducted their own investigation, as did documentary maker Trey Borzillieri, who carried on a correspondence with a woman who became a key suspect, Marjorie Diehl-Armstrong. The main question, once the suspects were identified, centered on the level at which Wells was involved: conspirator or unwilling victim? Holes in the story allow pointing the finger both at him, and away. How the incidents have been interpreted display numerous points of cognitive bias and errors of reasoning. We described some above, and we add others below.

As law enforcement gathered the facts, they reconstructed the incident, shifting their interpretation as new information came to light. It began with a delivery order placed at 2 p.m. for two pizzas. Wells agreed to take the pizzas to an isolated location just off Peach Street. Shortly afterward, he entered the bank, armed. Footprints and tire treads would later prove his presence at the delivery location. Reporters looking for leads spotted an area resident, a fifty-nine-year-old handyman, Bill Rothstein. Initially, he seemed peripheral (9, 10).

Police followed up the lead about the black men, but came up with nothing. They tried to interview Robert Pinetti, who worked with Wells, but he put them off. On August 31, three days after the bank robbery, Pinetti died from a fatal drug combination. He had called for help but had then refused assistance. Whether his death was an accident, suicide or homicide could not be determined, but officials considered it suspicious (12). They never found the dealer who had given him the lethal “hot shot” (10). Whatever Pinetti might have revealed died with him.

Three weeks passed. On September 20, 2003, Bill Rothstein called 9-1-1 to report that he had a body in a freezer in his home at 8645 Peach Street. In custody, he told officers that he had agreed to let his former fiancé, Marjorie Diehl-Armstrong, store the body of her boyfriend, Jim Roden, in his freezer. She had killed Roden in her home over money. Reluctantly, Rothstein said, he had helped her to clean up the scene, including dumping debris and taking the corpse to his house. However, being implicated in this criminal act had bothered him, he claimed, and he could not go through with Marjorie’s request that he grind up the body to prevent it from being found. Preparing to end his life, Rothstein had written a suicide note. Oddly, he had added, “This has nothing to do with the Wells case” (13). He would later say that he wrote this line because he did not want police to get sidetracked on an irrelevant item.

Rothstein cut a deal for a minor charge and got out on bail. No one at the time seemed to think that keeping a body on ice for a month suggested a different story (9). This would become one of the early case errors, along with perceptions of Rothstein as a compliant accomplice and concerned citizen.

Police arrested Diehl-Armstrong on September 21. She denied his accusations and said that Rothstein had

killed Roden in a jealous fit. Despite the odd mention of Wells in the suicide note, the federal Collar Bomber task force initially paid no attention to these small-town arrests over a domestic homicide. Police supervisors believed Rothstein’s story, assuming that a man with a body in a freezer would not have called for a pizza delivery so close to his house that could eventually attract police attention. Rothstein seemed too intelligent to make such a mistake. They also appreciated his willingness to show them the Roden crime scene and explain how the shooting had happened. They thought he was sincere and therefore honest (12). These assumptions would shortchange the investigation. If they believed that Rothstein was smart, they should have been alert to calculated manipulation.

Once he was cleared, Rothstein retrieved a blue van that had disappeared from his house the day after the bombing – possibly the same van seen by a witness at one of the “collar bomb” scavenger hunt sites, with Rothstein driving. ATF agent Jason Wick admitted, “We missed things” (12). Only later did investigators rethink their sense of Rothstein and compare his handwriting to writing on the ransom notes that Wells had carried. They saw similarities. On September 24, when further questioned about the Wells case, Rothstein admitted that he might have used the payphone from which the final call to Wells had come. Still, investigators thought he was tangential to the case. They lost their chance to extract more information when Rothstein died in July 2004 from cancer.

The perception of Rothstein’s minor role changed in January 2005, after Diehl-Armstrong had pleaded guilty but mentally ill to third-degree murder in the Roden homicide. Her sentence was 7 to 20 years. Later, when Clark and Wick interviewed her in prison, she indicated that Roden’s death was linked to the collar bombing. Officials thought this statement was part of her incoherent ramblings and dismissed it. Still, they had discovered her grudge against PNC bank for letting her father empty her safety deposit box. They wanted more details, and she agreed to talk, as long as they moved her closer to Erie.

Diehl-Armstrong was a character (10, 12). A highly intelligent class valedictorian with a master’s degree and an encyclopedic memory, she was also a paranoid hoarder with bipolar disorder and a past homicide rap. In 1984, she had shot her boyfriend, Robert Thomas, in what she had claimed was self-defense. Ruled mentally incompetent several times due to her uncontrolled manic rambling, a jury had acquitted her (14). Special Agent Clark had supervised her probation for carrying a firearm. Then in 1988, her husband had died in a strange accident. No one had questioned it.

When she gave her more detailed statement about the bank heist, Diehl-Armstrong said she was not involved in the collar bombing, but she had known about it and had been within a mile of the bank when the robbery occurred. (A witness had seen her driving on August 28 the wrong way down a highway near one of the scavenger hunt sites.)

Diehl-Armstrong added that Wells had agreed to participate, although he had been forced to wear the bomb and had not known until too late that it was real. Rothstein was the mastermind, she said, and the bomb's inventor.

Independent of her, investigators had turned up information that Diehl-Armstrong had been seeking a hit man to murder her father (15). She had told at least four other people about the bomb plot, claiming *she* had killed Roden to keep his mouth shut and that she had measured Wells for the collar. In addition, although Rothstein had feigned distress over storing Roden's body, he had harbored a fugitive child molester, Floyd Stockton, for two years. Stockton had left just before the botched heist. Also, Rothstein had put his house up for sale for \$250,000 – the amount that Wells had demanded at the bank. The agents caught up with Stockton, who said that Rothstein and Diehl-Armstrong had devised the bank robbery together.

A witness dropped another name, Kenneth Barnes, an incarcerated crack dealer and a fishing buddy of Diehl-Armstrong's. When contacted in August 2005, in return for a reduced sentence, Barnes said that Diehl-Armstrong had needed cash to pay for a hit on her father. Barnes had agreed to act as a lookout. At the pre-robbery meeting, Barnes said that Wells, Pinetti, Stockton, Diehl-Armstrong and Rothstein had been present. (Later, he would inexplicably change his statement to exclude Wells.) Barnes said that on August 28, he had watched Wells through binoculars with Diehl-Armstrong.

She adamantly denied this account, but in 2006, she showed agents where she had been on the day of the incident, which further incriminated her. Witness reports placed her and Rothstein together at the phone booth associated with the heist. Other witness reports placed Rothstein driving a blue van near one of the sites on the ransom map, and one witness had nearly crashed into Wells the day before the bank heist as Wells drove out from Rothstein's property (12).

Indictments implicated Rothstein, Barnes, Wells, and Diehl-Armstrong. Stockton made a deal for immunity (15). The official report held that Wells had believed that the bomb would be fake. When he gave the cover story about black men placing the bomb on him rather than claiming he was forced, this lie added behavioral evidence to support his guilt. So did his nonchalant exit from the bank. Some thought that perhaps he knew about the planned robbery but had not agreed to wear the bomb, real or fake (and one conspirator stated this). The FBI surmised that Wells had been set up, perhaps to eliminate him after he got the money.

In 2008, Barnes pleaded guilty to conspiracy and agreed to testify against Diehl-Armstrong. However, she was once again found incompetent. As she stabilized enough to go to trial, she was diagnosed with cancer. The trial date was set for 2010 (10).

Prosecutor Marshall Piccinini called the crime participants a cast of "twisted, intellectually bright,

dysfunctional individuals who outsmarted themselves" (11). With snitch accounts, circumstantial evidence, physical evidence, and Diehl-Armstrong's self-incriminating statements, Piccinini used Barnes to paint Diehl-Armstrong as the mastermind. Wells, Barnes said, had been promised part of the money. Apparently, he was in debt to crack dealers and had a relationship with a crack-addicted prostitute, Jessica Hoopsick, so he had agreed to participate. He had thought the bomb was fake. Diehl-Armstrong had double-crossed him (16).

When Diehl-Armstrong took the stand on October 26, 2010, she claimed that she had never met Wells. Her insult-laced, two-day diatribe was unconvincing. The jury convicted her of armed bank robbery, conspiracy and using a destructive device in a violent crime. She received life sentences (17). In 2017, Diehl-Armstrong died.

Hoopsick, who initially had refused to talk about Wells, told Borzillieri that she had set Wells up for a fee and he had not known about his designated part in the robbery. She claimed that he was innocent. However, her timeline contradicted established facts and other witness statements. She seemed to want to clear Wells because he was likely the father of her child.

There are holes in the story and some investigators did not believe that an erratic, garrulous, mentally ill woman as Diehl-Armstrong could have planned such an elaborate scheme. Perhaps she launched it so she could pay a hit-man, but a convincing case has been made that Rothstein was the mastermind (11). Maybe he wanted to please Diehl-Armstrong, a woman he once had loved, or maybe he hoped to raise his status before he died from a nobody to a somebody by devising a puzzle that would keep cops guessing for years. Even after the conclusion of this case, many questions remain unanswered.

### **Where Things Went Wrong**

We see several examples of investigative errors in the Pizza Bomber case. The first of these is the lack of attention to the blue minivan. While doing a drive-through of the scavenger hunt, PA State Trooper Lamont King described seeing a blue minivan driving towards the second drop-off point. After pausing, the van backed up and drove away. King surmised that the driver was responsible for dropping off the notes, clearly an important clue. Yet, the team turned its attention elsewhere. According to King, "We did our preliminary investigation and just referred it right back to the FBI, but the van was never mentioned again" (12). Years later, when shown a video of a blue Astrovan parked at Rothstein's house, King identified it as the van he had seen at the drop-off point.

It is unclear why this lead was not prioritized. Perhaps this is an example of a large-scale case of inattentive blindness. Although the existence of the minivan was figuratively "in their line of sight," the investigators failed to focus on it, losing the lead. Everyone was busy

allocating attentional resources elsewhere. It is also possible that the wealth of bizarre facts, such as a body in a freezer and a deadly scavenger hunt, eclipsed attention to the more mundane minivan. Because the brain's attentional resources are limited, inevitable attention to the fantastic elements would decrease attention to the minivan.

Even if the minivan had been properly attended to, there is no guarantee it would remain in memory as a salient detail. This initial attentional loss might have been compounded by the fact that bizarre material is better remembered than more ordinary information, a memory bias known as the *bizarreness effect*. For example, we are more successful at recalling nouns presented in a bizarre sentence than those presented in a common sentence (18). Because the information does not make sense we must allocate more effort to understand it. This additional effort requires a greater depth of processing, which is itself associated with better recall memory (19). This bizarreness effect, however, emerges only when we attempt to recall *both* bizarre and common information at the same time (20), such as considering both a minivan and a collar bomb. Looking back for leads, the unusual features of the case (e.g. collar bomb) might have directed attention away from the mundane (e.g.. minivan) and reduced recall memory of the minivan.

There is, however, an alternative explanation for this lack of follow up. One problem was that there is some debate about the original eyewitness testimony. In fact, it has been argued that the van was originally reported as being white, not blue (21). Let's assume for now that the van color was actually be blue, but the witness said it was white. In that case, this would be an example of the kind of eyewitness testimony error that Elizabeth Loftus has studied, and provided expert testimony about, for over four decades (22). Obviously any initial misinformation coming to the police will be detrimental to their further investigation.

Similar to the possible inattentive blindness in the case of the van, investigators appeared to have experienced an *inattentive deafness* to Diehl-Armstrong's claim that "Rothstein should be charged with the murder of Brian Wells" (12). Even coming from a witness of questionable credibility, this is a noteworthy statement. However, Jason Wick from the ATF stated that "Erie PD was doing their thing with Jim Roden, we were doing our thing in a direction other than Mr. Rothstein. And we didn't pay much attention to it really; we knew it was going on, but we were focusing on other avenues at that time" (12). This attentional failure might have arisen from *tunnel vision*. As illustrated by Wick's statement, the ATF was already focused on another line of investigation and, as such, these agents were invested in information that aligned with their hypotheses. Findley explains that once investigators are set on a particular conclusion their tunnel vision might cause them to "focus on a particular conclusion and then filter all

evidence in a case through the lens provided by that conclusion" (23).

This error often arises from a confirmation bias. Rothstein had been cleared as a suspect early in the case, despite a profile from the FBI's Behavioral Analysis Unit that matched him more than Diehl-Armstrong. The profilers believed that the caper had been not a bank robbery but a highly choreographed game, observed by the perpetrator, who took pleasure in the commotion he had launched. He enjoyed making others do what he wanted them to do. He would be "comfortable around a wide variety of power tools and shop machines." He was "a frugal person who saves scraps of sundry materials in order to reuse them in various projects." And he was "the type of person who takes pride in building a variety of things." (24). Yet, the investigators were focused elsewhere. Similarly, because Diehl-Armstrong's claim did not align with their investigative hypothesis, they were likely to undervalue or entirely discount her statement in favor of data that supported their opinions.

In addition, the power of story made its mark. As strange as his claims were, Rothstein controlled the story narrative. When he reported Roden's murder, he completed the plan on his own terms. He made the call to police and added the line about Wells in his alleged suicide note, to focus police on the Collar Bomber case in a context of his creation. If he played it right, Rothstein would seem like a victim, too, not a perpetrator – even to the point of minimizing the fact that Roden's body had been in his freezer for a month. By going to the police first, he set up the story. He did pass a polygraph, but the fact that he nearly fell asleep should have alerted agents to the possibility of drugs or self-hypnosis techniques. Their bias in his favor, due to his supposed cooperation, enabled their inattentive blindness.

These events are critical because the order and organization of a narrative structure influences both memory for details (25) and how plausible a story will sound (26). Diehl-Armstrong was under arrest for the murder of her boyfriend (the second time this has happened) and she offered a one-liner. Rothstein, however, spun a complex, detailed story about Roden's death. Our tendency to more easily believe and remember stories than simple facts – the *story bias* – could have undermined Diehl-Armstrong's claims.

This tendency to believe Rothstein's narrative, and then look for details to corroborate it, is another example of how a confirmation bias can derail an investigation. However, the investigators were not the only ones to fall into this cognitive trap. Documentary maker Trey Borzillieri did something similar. He had been seeking a crime like that of the West Memphis Three, who were featured on HBO documentaries as victims of a system gone wrong. Borzillieri had come across the Wells case and thought it looked similarly twisted: law enforcement had made a hasty, unfair judgment about Wells. Borzillieri

builds a case to show that Wells was innocent, saying he merely went to make a pizza delivery and was forced into the scheme. Yet Borzillieri participates in the same error. He says they accepted Rothstein's story at face value, so they made mistakes. Similarly, he accepts Jessica Hoopsick's narrative at face value and aligns his documentary to the theory that supports her. He also states that Diehl-Armstrong had a vested interest in saying Wells was a co-conspirator, because by law it meant she could not get the death penalty. Therefore, he thinks Hoopsick's story about Wells' innocence had more credibility. However, Borzillieri fails to acknowledge Hoopsick's vested interest: she wanted the father of her child (Wells) to be innocent. Since she gave Borzillieri an exclusive interview, he might have felt beholden to her. Thus, he has several layers of bias that potentially distort his view.

At least twice, valuable information was provided to local police but not passed to the FBI. In the first instance, inmate Kelly Makela shared written notes about conversations with Diehl-Armstrong. During a discussion about Roden's death, an officer mentioned that Makela's notes included information that was possibly relevant to the Pizza Bomber case. No one told the FBI. Second, Barnes' claims were not passed along about Diehl-Armstrong attempting to hire him to kill her father. Inter-group cooperation issues might have influenced these oversights. As Wick said, "I mean there's always that feud between the federal government and state and local at time. It's unfortunate, but it does happen" (12). These errors might also be pinned on tunnel vision. In both cases, interviewers focused on a different question, so information relevant to the Pizza Bomber case received no attention. Alternatively, the oversights could have resulted from *linkage blindness*. At the same time that the FBI viewed the heist as being more than a bank robbery, they failed to see how a small-town murder case might be related. Because each agency had its own jurisdiction and responsibilities, the investigators tended to think only within their own boundaries.

### Overcoming Our Biases

If the miscues from heuristics and biases cause us to make errors, why do we keep making these mistakes? Perhaps we are hardwired to follow short-cuts whenever possible. Our brains do prefer the path of least resistance, and some cognitive biases might have evolved to help us better navigate our world. One examples of these is *negative outgroup stereotypes*. In general, we tend to form positive opinions about our own group, yet we distrust others (the outgroup). This bias might have developed because the risk of assuming outgroup members will *not* harm you outweighs the effort you put into protecting yourself against attack (27). Our tendency to see connections that don't really exist (a problem in several

heuristics) follows from how our brain is designed, at a neural level, to look for patterns and associations (28).

So, where do we go from here? There is great interest in the fields of psychology, forensic science, and even business in trying to "debias" or help us overcome our tendency to slant information to support a belief. In fact, Lilienfeld and colleagues suggest that "a plausible case can be made that debiasing people against errors in thinking could be among psychology's most enduring legacies to the promotion of human welfare" (29).

A common assumption is that expertise in one's field can help overcome these errors. Unfortunately, this is not the case. One study used an ambiguous mock crime scene to examine the success of experienced crime scene investigators and student novices at finding crime-related traces (30). Prior information provided to participants suggested that this was a murder or a suicide, or no context was given. Although novices were more confident overall in their initial impressions of the crime type, the context influenced both experts and novices. Because of the assumption that a crime had occurred, both groups found more traces in the murder context. Surprisingly, the novices were more likely than the experts to find two important crime-related traces. This suggests that expertise alone is insufficient to overcome context biases at a crime scene.

In the business world, debiasing is often described in two broad ways. The first approach has to do with changing the thinking process of the decision-maker, and the second seeks ways to change the environment in which the decision is made (31). To change the decision-maker involves bias awareness through training about the range of biases (as this article has just provided). Although knowledge alone will not prevent errors, until we acknowledge our biases we cannot address them. One problem, however, is that many forensic science experts show a *blind spot bias*. Kukucka et al.'s survey of forensic science examiners found that even if experts acknowledge the problem of bias, they tend to see it in other domains or examiners, not in themselves. This was a more significant problem for examiners without bias training, which indicates that training provides some benefit (32).

For more concrete action, we should "*consider the opposite*". By carefully asking ourselves how our initial interpretation or judgment could be in error, our attention is naturally drawn to evidence not previously considered (33). This could be particularly helpful in cases of tunnel vision, which arises from a *threshold diagnosis* (quick judgment before gathering the facts) or confirmation bias. A strategy that causes an individual to specifically look for disconfirming evidence might help to curb the tendency to adhere to expectations. Several studies have also demonstrated that training can implement a more analytic than heuristic approach to dealing with probability-based problems. The degree to which this applies to new

situations, however, may depend on such factors as time delay (34) and the training method (35).

To take up the second challenge—change the environment—an important step would be to include an effective process for inter-group cooperation. A less territorial approach to information gathering, and a willingness to view the whole picture could lessen the occurrence of linkage blindness. Also, add a blind review of the facts. Keeping opinions about what a piece of evidence *should* demonstrate from the person reviewing the evidence can reduce confirmation bias.

To be fair, the Pizza Bomber case was unique. Obviously, no one can prepare for every eventuality, but a more educated awareness of biases, more practice dealing with surprising (and distracting) clues, and more effective procedures for inter-group cooperation might help to avoid miscues that can undermine investigations.

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