Chapter 11

Can You Believe What You See?

One eye-witness weighs more than ten hearsays.
Seeing is believing all the world over.

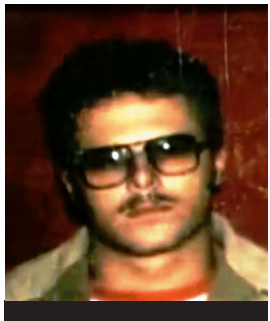
–Titus Maccius Plautus, *Truculentus*, Act 2, Sc. 2, line 6. (c. 200 B.C.)

It was 2:45 a.m., on August 9, 1984, when former Marine Kirk Bloodsworth heard a violent thumping on his front door, followed by the strident command, "Open up, it's the Baltimore County Police Department." Upon opening the door, he was confronted by police officers with guns drawn, ordering him to "step outside," while serving notice that he was under arrest for the first-degree murder of 9-year-old Dawn Hamilton.

Just two weeks earlier, the pre-pubescent girl had been looking for her friends in a game of hide-and-seek, and had sought help from two boys, ages 7 and 10 who were playing with a turtle in a nearby pond. The boys were not interested in participating, but later reported that a tall, skinny, adult male had offered to help in her search. That was the last time she was seen alive. At 2:30 that afternoon, Dawn's body was found. Her head had been crushed with a rock and a stick had been violently inserted into her vagina.

The only evidence that police had was an eyewitness report of the two boys who had seen a stranger promising to help Dawn in her hide-and-seek search. The police compiled a composite sketch from the boys' description of the killer as 6′5″ tall, skinny, curly blonde hair, and sporting a bushy mustache. Based on this sketch, Kirk Bloodsworth's next door neighbor reported him to the police.

A few days later, Bloodsworth appeared in position #6 in a police line-up. Although originally unable to identify anyone matching the tall stranger, the boys eventually recanted, identifying the man in position #6 as the one they had seen at the pond–even though Bloodsworth, at 6′ tall and 207 lbs., was not a good match to the eyewitness description.



Kirk Bloodsworth 1960–

On March 22, 1985, almost 8 months after his arrest, the former Marine was sentenced to death. On the announcement of his conviction, the courtroom exploded into a burst of applause and the chant, "Give him the gas and kill his ass." The innate human lust for revenge had overridden rational analysis in the rush to indulge its outrage.

Bloodsworth was sent to the Maryland Penitentiary, where a prison guard had been gutted by an inmate just two weeks earlier for a perceived insult. In his YouTube video of 2011, Kirk Bloodsworth described the inhumane conditions in his tiny cell on death row, and the feeling of hopelessness as the "400-pound cell door slammed shut like the tailgate of a dump truck."[1] It was from this cage that he wrote letters day after day appealing to anyone who might help him prove his innocence. But all these letters remained unanswered; he was out of sight and out of mind as the rest of the world went on with its business.

In his attempts to prove his innocence, Kirk became a prolific reader and ultimately, the prison librarian. In his reading he came upon the book, *The Blooding*, by Joseph Wambaugh, describing the work of British geneticist Howard Jeffries who had discovered the use of DNA as a human fingerprint.[2] Wambaugh reported how DNA was used to convict a suspect and it occurred to Kirk Bloodsworth that he could use DNA to prove his innocence. However, on asking his lawyer to retrieve the DNA on the undergarments of Dawn Hamilton, he was told that the evidence (traces of semen in the victim's underwear) had been destroyed. Not to be denied, Bloodsworth continued to pursue those who might know the fate of that missing piece of evidence.

Then, in an unexpected turn of events, his unrelenting persistence paid off. His new lawyer, Bob Moore, had tracked the missing evidence to a paper bag stored in the judge's chambers 9 years earlier. A trace of semen became Bloodsworth's fragile lifeline. A blood sample taken from Bloodsworth (no pun intended) became the exonerating evidence that entered his story into the annals of American justice. On July 24, 1993, 8 years, 11 months, and 19 days after his arrest and incarceration, the ex-Marine regained his freedom and won the distinction of being the first person on death row to be exonerated by DNA evidence. However, it wasn't until 2004 that this DNA evidence led to the conviction of the real killer, Kimberly Shay Ruffner.

In a happy ending to a tragic ordeal Kirk Bloodsworth, resolving to spend the rest of his life campaigning against false convictions, served as a program officer for The Justice Project and helped generate support for the Innocence Protection Act of 2001. He also played a role in promoting the legislation that came into effect on October 1, 2013, repealing the death penalty in Maryland.

This case brought to light the unreliability of eyewitness testimony. In the 30-year period between 1989 and January 2019, 362 people previously convicted of serious crimes in the United States were exonerated by DNA testing–20 of these had been on death row.[3] It is estimated that more than 4% of those sentenced to death between 1973 to 2004 were probably in-

nocent.[4] Furthermore, it was reported by the Innocence Project that since DNA testing was introduced, 73% of the 239 convictions that had been based on eyewitness testimony were overturned by DNA testing.

Why Does Eyewitness Testimony So Often Lead to False Convictions?

In a *Scientific American* article titled, *Why Science Tells Us Not to Rely on Eyewitness Accounts,* Arkowitz and Lilienfeld state:[5]

> *Surveys show that most jurors place heavy weight on eyewitness testimony when deciding whether a suspect is guilty. …* [Furthermore] *jurors tend to give more weight to the testimony of eyewitnesses who report that they are very sure about their identifications even though most studies indicate that highly confident eyewitnesses are generally only slightly more accurate—and sometimes no more so—than those who are less confident.*

Psychologists attribute the excessive trust in eyewitness reports to the juror's false assumption that memory is like a video recorder, merely replaying observed incidents during recall. On the contrary, our "fast-and-frugal" memory records only a sketch of an event as it unfolds, and during recall reconstructs the event by retrofitting these stored fragments like pieces of a puzzle.

On October 12, 1980, 30-year-old Steve Titus, while returning from his father's birthday party, was pulled over by police who were searching for a man in a similar car who had raped a female hitchhiker earlier that evening. The police took a photo of Titus and included it in a police line up that was later shown to the victim. At first, the victim was unsure that the photo of Titus was that of her assaulter. Looking at the array of photos, she pointed to the photo of Titus and said, "That one's the closest." Steve Titus was arrested and put on trial. When it came time for the victim's testimony she declared, "I'm absolutely positive that's the man."

Psychologist Elizabeth Loftus, testifying on behalf of the defendant argued that the victim's degree of certainty that Titus was the offender had increased throughout the trial on account of the *false memory* created by repeated exposure to the photo line up. In her previous research, Loftus had discovered how easily our memories can be corrupted during the reconstruction process.[6] She discovered that people revisiting childhood memories during psychiatric counselling, often emerged with memories of events that never actually happened–called *false memory*. Inadvertently, the psychiatrist through a questioning sequence had planted ideas in the head of the patient that became part of the patient's reconstructed memory. It became a mild version of the kind of brainwashing popularized in the movie *The Manchurian Candidate*.[7]

In the case of Steve Titus, however, the jury was persuaded by the certainty in the victim's eyewitness testimony and on March 4, 1981, Titus was convicted of rape in the first degree. In a desperate attempt to escape from his false conviction, he solicited help from investigative reporter Paul Henderson of the *Seattle Times*. His new attorney Jeff Jones, was able to get a new trial based on exculpatory evidence that hadn't come to light in the original trial. The charges were dismissed against Titus in June 1981 and the next month, Paul Henderson led Police to convicted rapist Edward Lee King who confessed to the crime for which Titus had been charged.

Though exonerated, the ordeal had left Titus with a gnawing bitterness toward the justice system. That ordeal, had cost him his fiancée, his job and his savings. In 1986, at the age of 35, he died of a heart attack, allegedly induced by stress. He had been victimized by a false memory. Paul Henderson, received a Pulitzer Prize the following year for his investigative reporting, and went on to become a crusader for the falsely accused.

In her Ted Talk delivered in 2013, Professor Loftus said:[8]

> *If I've learned anything from my decades working on these problems, it's this: Just because somebody tells you something and they say it with lots of confidence, detail, and emotion does not mean that it really happened. We can't reliably distinguish true memories from false memories; we need independent corroboration. Such a discovery has made me more tolerant of friends and family who misremember. Such a discovery might have saved Steve Titus. We should all keep in mind that memory, like liberty, is a fragile thing.*

Currently, most U.S. jurisdictions do not allow experts who testify in court to instruct jurors on the perils of eyewitness identification. However, false convictions, such as those described above, combined with research in psychology, that reveals the fragility of memory and the unreliability of eyewitness testimony, are gradually bringing changes into the American judicial system. In 2014, the Pennsylvania Supreme Court overturned the ban on expert testimony about the fragility of face recognition when the prosecution's case relies heavily on eyewitness identification.

The Nightmare of Jennifer Thompson

It was 3 a.m. when Jennifer Thompson, was awakened by the jarring impact of a male intruder who pounced on her bed and thrust a knife to her throat. The petrified 22-year-old struggled in vain to fight off her assailant who proceeded to rape her. Recalling those horrible minutes, Jennifer described her intent to memorize his face:[9]

I was petrified, but somehow I managed to keep my head. There was a lamp on in the hallway and a street light shining through the window, so I had a good chance to look at him. He was only inches from my face. It was horrific…I tried to stay calm because I knew if I screamed, he'd hurt me. I kept talking to him, saying that if he took the knife away, I could relax.

After the assault, Jennifer used the pretext of going into the kitchen for a drink, to escape to a neighbor's house and call the police. Shortly after, Jennifer was at the police station poring over pictures of noses and eyes from which a composite sketch was constructed. When the police compared the composite sketch with photos of convicts, they came upon a close match with 22-year-old Ron Cotton. Cotton, an African American had been released from prison six months earlier after serving time for breaking and entering.

Reliving the horror of that fateful night, Jennifer explained;

I felt sick when I saw his photo. I was sure he was the one - it was his nose, his hair…A month later, I went back to the police station for the identity parade. I was put in a room with six men. The building was being renovated so there was no glass between us, only a table. I was terrified. I picked out Ronald, convinced he was my attacker.

A few months later, based on Jennifer's testimony, Cotton was convicted and sentenced to life in prison. Jennifer described this as one of the happiest days of her life, because she would not have to fear that he might return. After her horrendous ordeal in 1984, Jennifer suffered debilitating psychological problems that would haunt her in the years that followed. In her struggle to put the experiences behind her, she began to build relationships and in 1988 she married.

Then one day in 1995, coming as a bolt out of the blue, she received a call indicating that Ron Cotton had taken a DNA test that exonerated him. The real rapist was Bobby Poole, an inmate who had been in the same cell block as Cotton. On hearing the news, Jennifer was consumed with remorse:

I can't articulate how I felt. The news shattered my world and I fell apart. Each night, after the kids went to bed, I'd sit for hours at a time and cry. I felt such a weight of shame and guilt.

After serving eleven years for a crime he didn't commit, Ron Cotton embarked upon his adjustment to a new life on the outside that made him feel "like a baby, learning to crawl again." He subsequently married and started a family. Attempting to help him in his return to a new life, Jennifer wrote a letter to the North Carolina legislature securing for him $105,000 as com-

pensation for wrongful incarceration–money that Ron subsequently used to build a house for his family.

Shortly after Cotton's release from prison, Mike Gauldin, the detective who had worked on the case, convened a meeting between Jennifer and Ron in a church in the town of Elon where Jennifer's ordeal had occurred. In an emotional accounting of their conversation Jennifer explained:

> *`I said, "If I spend the rest of my life telling you how sorry I am, it won't be enough." He looked at me with tears in his eyes and said, "I'm not mad at you. I've never been angry at you." All these years, I'd sat on the moral high ground and judged him and hated him, and here he was, willing to forgive me without question. It was my greatest lesson in life. His anger was directed at Poole who had finally confessed. We'd both been victims of the same man.*

Ron and Jennifer are now friends who communicate on a regular basis and who make public appearances to protest against the death penalty, driven by their newly-acquired understanding of the frailty of face recognition–especially when it's cross-racial.

Cross-Race Identification Bias

Jennifer Thompson is caucasian and Ron Cotton is African American. Even though Jennifer said that she had studied her assailant's face carefully, she had falsely identified Cotton. Furthermore, when she saw the face of her actual assailant, Bobby Poole, she hadn't recognized him as her attacker.

In the past few decades, research has revealed that people are better at recognizing faces from their own race, relative to other races. This is called the *Cross-Race Effect* (CRE). Some researchers suggest that the reason for this effect is that when we encode faces, we focus only on features that are useful for distinguishing individual members of our own race, but for members of races with whom we are less familiar, we need only encode the overt racial differences rather than feature-by-feature detail. Recent research indicates that we are also better at predicting the probability that we will recognize a face when those involved are of our race. Reporting on the case of Jennifer Thompson, researchers, Hourihan et al. opine:[10]

> *Had Ms. Thompson not been so certain of her recognition ability, perhaps the police might have spent longer investigating possible suspects prior to constructing a line-up to show the victims. In the case of suspects who are of a different race from the eyewitness, confidence at the time of encoding is even less likely to relate to subsequent recognition accuracy than for same-race faces, and police should practice more caution in their investigative search to locate potential suspects.*

The gap between what we see, what we think we see, and what we remember seeing, combined with our belief that all of these are the same, has significant implications in the courtroom. In fact, the gap between reality and visual perception pervades all aspects of our lives–a theme we will explore in greater depth in the chapters ahead.

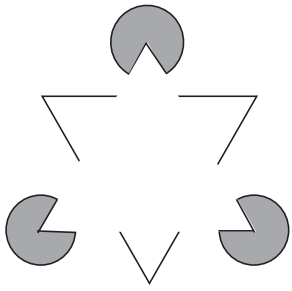
What We See is Only a Rough Approximation of Reality

In modeling the human brain, computer scientists working in the field of artificial intelligence have confronted the same issues as human evolution in the efficient storage of memory. To minimize computer memory required to store photos, these computer scientists created programs to convert large files, containing information on each pixel[11], into much smaller ones with minimal information loss. By merely sampling some pixels of a photo (a process known as *downsampling*) and estimating the shape and color of the neighboring pixels, the computer is able to "reconstruct" a close approximation of the original image. In the construction of jpeg files, the estimation is achieved using a mathematical process known as *discrete cosine transformation* that replaces an 8×8 block of pixels with the information captured in the sample and storing it in a single pixel along with a transformation matrix. The reason that such compressions work is that our eyes are less able than cameras to distinguish color and shape gradients.

These techniques are at the heart of the face recognition programs that have been emerging in recent years. Since 2020, some cars have been equipped with a camera that scans the face of a driver for signs of fatigue or emotional stress. From this scan it "draws inferences" and informs the driver that it's time to rest. Eventually the car may self-drive to the nearest rest center and force coffee down the driver's throat, or merely usurp the driving function.

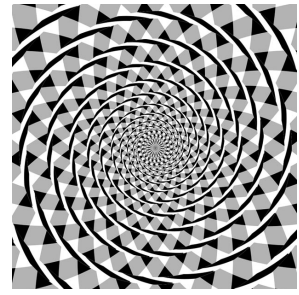
In a process resembling downsampling, human memory records only a sketch of an event as it unfolds, and during recall reconstructs that event by retrofitting these stored fragments into a coherent whole. Scientists believe that this ability to reconstruct an event from a skeletal image evolved to minimize the amount of memory needed to store events in the brain. A frequently-published example of this human capacity to compile a complete image from a skeletal outline is displayed in figure 11.1. In this configuration, we "see" a solid white triangle in the foreground, obscuring another white triangle with a black border in the background. Actually, there is no "white triangle." There are only the sectors of three circular disks and between them, three wedge-shaped figures. The white triangle (known as the *Kanizsa Triangle* after psychologist Gaetano Kanizsa) is merely "implied."

Fig. 11.1



The Kanizsa Triangle

Fig. 11.2



The Fraser False Spiral

Similarly, figure 11.2 shows the *Fraser false spiral*. It was originally called the *twisted cord effect*, because it was demonstrated by two cords of different colors twisted into a single cord and then placed on a contrasting background. Although the cord consists of concentric circles, (as we see if we trace along it) our brain "infers" a spiral and stores that impression in memory. This is what is happening when we identify a human face embedded in a mosaic of fragments; we are synthesizing into a holistic image what might appear to a computer as random pixels.

The study of optical illusions provides insights into the neural processes involved in perception. The European Conference on Visual Perception in Spain in 2005 spawned an annual contest for "top optical illusion of the year." To view the top optical illusions in the 2019 contest, visit: https://newatlas.com/science/best-optical-illusions-2019-competition/ For a fascinating look at the Ames window illusion there is an excellent YouTube video at: https://www.youtube.com/watch?v=dBap_Lp-0oc

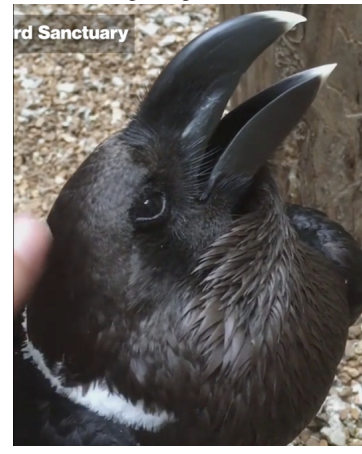
How the Brain Creates its own Reality

This ability to synthesize pixels into a complete shape is one of the most important visual acuities that we acquired through evolution. It is through this unconscious cognitive process that we are able to distinguish a predator camouflaged against a background of similar colors and textures. Detecting a venomous snake hiding in the weeds by a pond, or identifying a tiger with stripes that merge with the shadows of bamboo shoots, has often meant the difference between life and death. Though we all have the capacity to synthesize pixels into whole entities, individuals often compose different perceptions from the same image. What animal do you see in figure 11.3? Answer before you read ahead.

Can You Believe What You See?

On August 18, 2019, Dan Quintana, a scientist at Norway's University of Oslo, posted a video with the caption: "Rabbits love getting stroked on the nose." The video went viral with viewers asserting that this was not a rabbit, but rather a raven. Two years earlier, Paige Davis, a curator at the World Bird Sanctuary in Missouri had posted this video of a raven named *Mischief*, who lived up to its name. When asked how Mischief was responding to his new celebrity status, the Sanctuary reported that he's ravin' about it. Can you see the alternative perceptions?[12]

Fig. 11.3
Rabbits love getting stroked on the nose



Humans have been intrigued by optical illusions as far back as the 5th century B.C. when Epicharmus of ancient Greece attempted to explain this visual ambiguity. Such illusions reveal that things are not always as they first appear. This surprises us, because our natural tendency is to believe that what we see *is* reality.

One of the classic examples used to illustrate that different mental constructs can result from the same image was created in 1915 by W. E. Hill in his sketch titled, "My Wife and My Mother-in-Law." This features two women, one young and the other old, both merged into a single image. The old woman is looking downward to the left, while his wife is looking away from the observer who can see only her left profile. Which one do you see?

Fig. 11.4

An engaging aspect of these illusions is that once your brain has constructed a particular interpretation of the image, it is difficult to "see" a different one. The image in your brain becomes a "preconceived" notion and accessing alternative interpretations requires a special effort and focus.

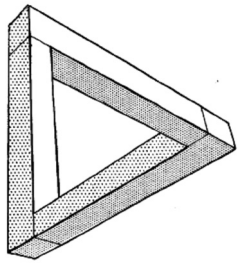
Images that Create Cognitive Dissonance

While the brain generates two alternative constructs in each of the optical illusions above, there are also images that promote the visualization of

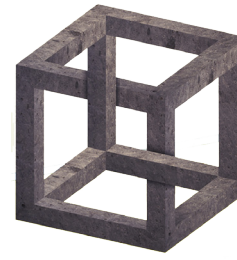
structures that violate the brain's intuitive knowledge of physical objects. In 1934, Swedish graphic artist Oscar Reutersvärd began sketching such structures with components that resemble physical entities, but when combined, represent unconstructible objects. Two such impossible objects are shown in figure 11.5.

Fig. 11.5

The Penrose Triangle



The Impossible Cube

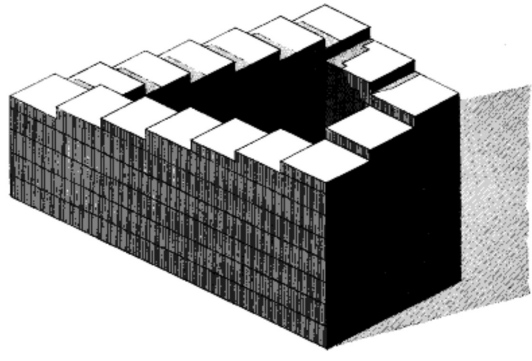


The object on the left in figure 11.5, though originally sketched by Reutersvärd was discovered independently by Lionel and Roger Penrose and named the *Penrose Triangle*. In their article *Impossible Objects: A Special Type of Visual Illusion*, published in 1958, they explain:[13]

> [In impossible object illusions] *each individual part is acceptable as a representation of an object normally situated in three-dimensional space; and yet, owing to false connexions of the parts, acceptance of the whole figure on this basis leads to the illusory effect of an impossible structure.*

Included in that article is the sketch in figure 11.6 of a flight of steps that seem to climb relentlessly upward, ultimately ending at the beginning. This illusion, reminiscent of Hogarth's 1754 engraving, *Satire on False Perspective*, was an inspiration for Escher's *Ascending and Descending*, created in 1960.

Continuous Flight of Steps **Fig. 11.6**



The disconnect between mental constructs and constructible objects has fascinated not only psychologists, mathematicians, and artists, but almost everyone who enjoys the challenge of cognitive dissonance. In 1982, the Swedish post office honored Oscar Reutersvärd by issuing stamps depicting his impossible figures, giving them a reality of their own.

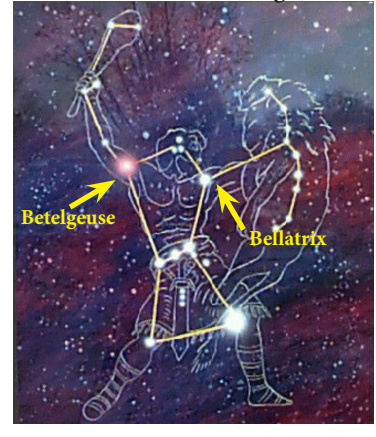
Fig. 11.7

Can Our Vision Distinguish Between the Real and Unreal?

When people in the ancient world peered into the heavens, they saw shapes that they endowed with human and animal forms. Like characters in a play, these forms were then woven into a narrative that could be used to create a celestial mythology. Figure 11.8 shows a star cluster that the ancient Greeks embedded into their myths as Orion the hunter. The constellation Orion is mentioned in Homer's *Iliad*, written in the 7th or 8th century BC.

Many of the stars that we see in this photograph have disappeared and no longer exist. Their light is reaching us now after millions of years of travel through space, so those illuminated dots are merely packages of photons sent, in some cases, before the earth was formed! As the ancients viewed the night sky, they believed they were viewing the celestial bodies in their present state. Yet, the image in the figure is not a snapshot of what the universe was at a particular time, but rather a composite of elements from different eons–many of which did not exist simultaneously–even though their light reaches us at the same time.

Orion the Hunter Fig. 11.8



Two of the brightest stars in the constellation Orion are Betelgeuse and Bellatrix. Since Betelgeuse is about 700 light years (ly) from us and Bellatrix is about 250 ly away, the image of Bellatrix that we see today, was emitted just before the American Revolution, while the image of Betelgeuse that appears in the same photo was emitted 450 years earlier. Imagine a

family photo with you standing beside your ancestors from the 16th century–some of them looking younger than you!

Before the evolution of science, humans staring at the heavens believed that they were seeing the stars in "real time"–unaware that they were viewing a composite of different slices of history spanning a range of millennia. They were seeing real images that were not part of a coherent picture–a kind of impossible construct that does not capture simultaneously existing entities. It's only through science that we can "decompose" the picture into its component parts, and recognize the false impression created by the image. This is yet another example of the gap between what we perceive and what is "true."

Epilog

Newborn humans emerge from the darkness of the womb struggling to make sense of a bright world filled with weird objects. It is believed that the first images seen by the baby register upside down on the retina. However, the brain quickly learns to flip the images, and eventually track movement and acquire depth perception. Within about 4 months, it develops the ability to distinguish facial features and identify its mother. Sometime during its first year, the baby acquires the complete range of visual acuity and merely refines these skills in the years that follow. Eventually, the infant comes to rely on vision as its most reliable source of information about the outside world, and with that will come a belief that there is little difference between perception and reality. In the chapters that follow, we will see that while the limitations of our visual physiology create a gap between perception and reality, a greater gap is created by cognitive biases that emerged as advantages during our brain's evolution.

Myth: You can trust what you see with your own eyes. You can also believe someone's description of what they have seen, if they are reporting honestly and with certainty.

Truth: What we think we see may not be an accurate or complete record of what is actually before us. Our memory of what we've seen is further distorted by our brain's attempt to give meaning to the visual images.

Our assumption that there is little or no gap between what we see and what *is*, often causes us to believe things that are untrue. Rational analysis is our only safeguard against false perceptions.