

From:

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Part II

THE EVOLUTION OF INCONSISTENT CRITICAL THINKING

The purpose of part II is to introduce the reader to an evolutionary-based framework that hypothesizes why all of us, even those trained to think critically, are inconsistent with our critical thinking performance in some situations. In order to accomplish this goal, chapter 5 will address the trade-off that can occur via the process of natural selection. Simply put, our evolutionary heritage results in abilities that are an overall benefit for survival and reproduction, but in certain circumstances these abilities can have unwanted influences.

The specific theory that will be elaborated upon in chapters 6 and 7 hypothesizes that our pattern-seeking tendencies as humans are complemented by a cognitive system (i.e., they are interconnected) that is biased toward strengthening and maintaining our current beliefs, both true and false. While the advantage of these biases from an evolutionary perspective will be elaborated upon, the unwanted influence for us as critical thinkers is that the biases can interfere with our ability to apply critical thinking and objectively evaluate claims in some circumstances. The most pertinent biases that interfere with our individual ability to evaluate claims will be reviewed from the large literature within cognitive psychology.

In chapter 8, although not the focus of this book, I will discuss the

role of emotions and how emotionally based beliefs can interfere with our ability to skeptically evaluate evidence. Sir Arthur Conan Doyle and the Piltdown Man hoax will be used to illustrate the influence of emotionally based beliefs on objectively analyzing evidence.

Finally, in chapter 9, two case examples will be used to illustrate inconsistent critical thinking. After using as an example my own personal embarrassing abandonment of critical thinking in regard to the Scopes Monkey Trial, a second example involves a person with a brilliant mind and a reputation as an outstanding skeptic. These examples are reflective of the cognitive biases that we all possess, especially when our highly cherished personal beliefs are challenged.

Chapter 5

THE PROS AND CONS OF OUR EVOLUTIONARY HERITAGE

Can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favorable individual differences and variation, and the destruction of those which are injurious, I have called Natural Selection, or the Survival of the Fittest.

—Charles Darwin, *The Origin of Species* (1859/2003, p. 89)

In contrast with other species, humans are not the largest animals on the planet. We are not the fastest runners, we do not have the most stamina or strength, and we have a variety of limitations compared with other species. This is not unusual, as the process of natural selection has resulted in every species having individual characteristics that are beneficial for survival and reproduction. Specifically, those traits that are beneficial to us as a species (i.e., humans) are more likely to be passed down to successive generations.

It is important to be aware that while natural selection results in the establishment of useful abilities for a particular species, often

there is a trade-off, in other words, there can be unwanted influences mixed in with the overall beneficial trait that increases the likelihood of survival and reproduction. Let's take for example the cheetah, an animal with an obvious beneficial ability. The process of natural selection has resulted in the cheetah developing and ultimately possessing great speed, which has the benefit of allowing the cheetah to run faster than its prey. This individual characteristic of great bursts of speed, however, comes at a price. Specifically, the trade-off for the cheetah in obtaining this great speed is reduced stamina and strength. (Compare a cheetah with a lion or leopard; of course, the lion and leopard do not possess blazing speed, which is a trade-off for them.) So, if the cheetah does not catch its prey with the initial burst of energy, it is unlikely to have a successful hunt, as it does not possess the stamina to continue the chase. Simply put, perfection does not happen via the process of natural selection; rather, species possess specific useful modifications that more often than not increase the probability of successful survival and reproduction in response to unforeseeable circumstances.

Let's take an example of the trade-off that has resulted from the evolution of the human visual system as a graphic illustration of both very favorable and in isolated circumstances unfavorable outcomes. Note that the human visual system is a wonder of the evolutionary process. In today's society, this system allows people to track and (in some instances) hit a baseball, drive a car, have a sense of depth, and identify landmarks, among a wide variety of other acts. In most circumstances, the visual system provides us with the appropriate needed information and performs just fine. From an evolutionary perspective, the visual system has aided in our survival and reproduction in a wide variety of ways (e.g., to chase and kill prey, to spot a potential predator from a distance, to help identify a potential mate).

However, it is important to consider not only the benefits of the human visual system but the limitations that have also evolved. The process of natural selection does not produce perfection but has resulted in modifications that increase the chances of survival and reproduction. Specifically, one of the trade-offs for the human visual

system is that in some circumstances we are prone to visual illusions (i.e., we see what does not exist in the physical world). As a personal example, when living in Colorado in the San Luis Valley as a new assistant professor in my first academic job, my wife and I used to have to drive over a mountain range to travel to the nearest big city. Every now and again, when no traffic was around, I used to stop the car and place it in neutral with my foot on the brake. The game was, are we going uphill or downhill? As a social scientist, I was well aware that perceptual cues can sometimes be very misleading, and the backdrop provided a variety of perceptual cues. Sometimes we guessed correctly, but sometimes when we guessed downhill, the car would roll backward and vice versa. Simply put, in certain circumstances our visual system provides misleading information, which demonstrates the imperfections of the system. However, in everyday life, we are typically not even aware that we may be taking in and interpreting visual information that does not accurately reflect reality. Thus, we can be wholly unaware, in certain contexts, of how our evolutionary heritage can influence us. In this instance, something as simple as evaluating "up" or "down" is

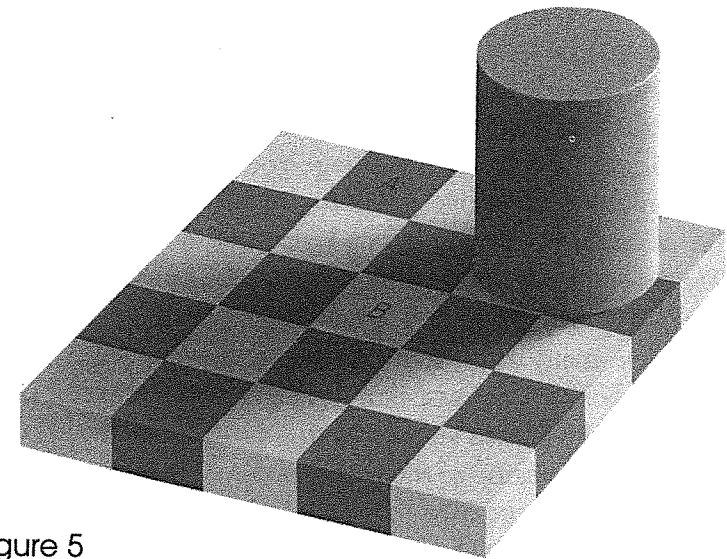


Figure 5

sometimes sabotaged by the evolutionary heritage of our visual system, which in most instances serves us well.

To give the reader a concrete example of how the visual system is imperfect and can mislead us without our knowledge, let's take a look at my favorite visual illusion (fig. 5). Please keep in mind that in a normal setting, you would not be aware that you were seeing an illusion, which changes the experience, but this illusion is so powerful that revealing this fact will not spoil its effect. With that disclaimer, look at the squares that are labeled A and B in the figure. Believe it or not, both squares are the same color (i.e., both are the identical shade of gray). Not convinced? Please check Dr. Adelson's Web site (<http://web.mit.edu/persci/people/adelson/index.html>) for a full explanation of this and other outstanding illusions. (No matter how many times I look at squares A and B, they still do not look the same to me.) Of course, virtually every reader has the ability to distinguish between different shades of gray in the majority of situations. This illusion, however, provides a powerful example of how our evolutionary heritage can influence our ability to accurately evaluate evidence in this particular circumstance. In chapter 7, we will discuss how our cognitive system, because of the built-in biases that humans possess to support and maintain beliefs, can likewise hinder our ability to accurately evaluate evidence in certain situations.

For anyone interested in additional examples of how our visual system can mislead us, I would encourage you to look in any introductory psychology or cognitive psychology textbook and turn to the chapter on sensation and perception. I also highly recommend Al Seckel's *The Art of Optical Illusions* (2000), and there are many wonderful Web sites devoted to visual illusions (e.g., <http://www.eyetricks.com/>). Of course, many magic tricks, such as the one in which swords are thrust into a box with the assistant inside, take advantage of visual illusions by which the human visual system is prone to be misled. The box looks very small because of the perceptual cues, which is the illusion, but in reality it is large enough for the assistant to move back and forth to avoid the swords, which are put into the box in a set order.

As we move ahead to the next chapters, the important issue is that

the process of evolution should be viewed as providing a species with useful qualities that increase the chances of survival and reproduction (in most instances, the visual system provides the necessary and relevant information), but that there is also a trade-off that can be accompanied by unwanted influences. The following chapters will argue that our ability to think critically is influenced by our evolutionary heritage and that sometimes we will be unaware that this is occurring, as when we are fooled by visual illusions.

Chapter 6

HUMANS

The Great Pattern Seekers

The tendency to impute order to ambiguous stimuli is simply built into the cognitive machinery we use to apprehend the world. It may have been bred into us through evolution because of its general adaptiveness: We can capitalize on ordered phenomena in ways that we cannot on those that are random. The predisposition to detect patterns and make connections is what leads to discovery and advance. The problem, however, is that the tendency is so strong and so automatic that we sometimes detect coherence even when it does not exist.

—Thomas Gilovich, *How We Know What Isn't So* (1993, p. 10)

As previously mentioned, evolution (via the process of natural selection) results in adaptations that are beneficial for survival and reproduction. For humans, one of those traits, which has been passed down through the process of natural selection, is that “[w]e evolved to be skilled, pattern-seeking, causal-finding creatures. Those who were best at finding patterns (standing upwind of game animals is bad for the hunt, cow manure is good for the crops) left behind the most offspring. We are their descendants” (Shermer 2001, xxiv). Of course, those who did not identify important patterns (e.g., that type of snake is poisonous) were much less likely to survive and reproduce.

This theory that humans are a pattern-seeking species has been enforced by a wide variety of authors within the skeptical community and by evolutionary psychologists who attempt to explain current human behavior within an evolutionary framework. I agree with this interpretation and believe that pattern seeking is one of the defining characteristics for us as humans (like the large neck is a defining characteristic of the giraffe).

Let's take the following real-world example of how our evolutionary heritage and the desire of humans to seek and establish patterns can influence us today. Imagine that you went on a first date last night. You had an absolutely wonderful time and want to see the person again for a second date. At the end of the evening, your date clearly said to you that he/she would call you tomorrow to set up plans for the weekend. What starts to happen the next day as the hours pass from the morning, to afternoon, to late in the evening if the person does not call? Typically, our evolutionary heritage (i.e., our pattern-seeking tendencies) starts to come out. Our minds can start to produce a wide variety of potential explanations as to why the person has not called in order to attempt to identify the correct pattern. Were they hit by a car and are now lying in a coma in the hospital? Did they not really have a good time and lied that they would call? The number of potential hypotheses that can occur is substantial, as our mind attempts to figure out the answer because we are a pattern-seeking species. Sometimes we identify the correct pattern, and sometimes we do not. However, the overall benefits from our pattern seeking were advantageous in the struggle for survival and reproduction, which is why it was passed on to successive generations and is still with us today.

Thus, from an evolutionary perspective, we are programmed to seek and establish relations among variables. However, just like the human visual system has both pros and some cons (see chapter 5), our pattern-seeking tendencies also have benefits and drawbacks (once again, the benefits outweigh the drawbacks). Unfortunately, in seeking and trying to establish patterns, we are likely to identify not only real relations (e.g., dark clouds are associated with rain and provide us with information that it would be beneficial to seek shelter)

but meaningless or false patterns as well (e.g., a gambler "blowing" on dice prior to rolling them). Identifying a nonexistent or wrong pattern can be counterproductive for the individual (e.g., believing it is better to hunt upwind) or can simply not influence survival or reproduction in any meaningful way. Of course, some false patterns may in certain circumstances have some positive benefits (e.g., an athlete wearing "lucky socks" may result in the individual playing with more confidence during the game). Likewise, the consequences of not identifying a true pattern (e.g., not avoiding the poisonous snake) are typically more dangerous or of greater consequence than identifying a false pattern (e.g., avoiding a nonpoisonous snake), which helps to further explain why overall pattern seeking has been a net benefit from an evolutionary perspective.

Thus, the process of natural selection has resulted in humans being a pattern-seeking species that contributes to the development of beliefs, both true and false about how the world works. Although beyond the scope of discussion here, pattern-seeking abilities can contribute to the development of individual beliefs in several ways. For example, the individual personally identifies a pattern that leads to a belief (i.e., a direct route to creating a belief). Likewise, the development of our beliefs can also be influenced by patterns identified by others (allowing us to take advantage of others' pattern-seeking abilities), some of which are passed down from generation to generation (i.e., an indirect route to creating a belief). To keep this discussion manageable, let's assume that pattern seeking contributes to beliefs, both true and false, in several ways, both directly and indirectly, and that overall humans' pattern seeking resulted in knowledge that was a net gain for survival and reproduction (e.g., the useful information gained from pattern seeking outweighs the disadvantages from misidentifying patterns and creating false beliefs).

AN EXAMPLE OF PATTERN SEEKING GONE WRONG: THE GAMBLER'S FALLACY

At this point, I would like to provide the reader with an example of how our pattern-seeking heritage has the trade-off feature of helping to identify a false or wrong pattern in today's society. Once again, our pattern-seeking tendencies had a net gain, as humans are skilled at finding causal relations, but let's focus on how this tendency can mislead to reinforce the notion that natural selection does not result in perfection. The concept known as the "gambler's fallacy" helps to demonstrate how our pattern-seeking behavior can mislead us in certain circumstances. Simply put, humans often have inaccurate perceptions about random processes and try to identify patterns where none exist (the definition of a random pattern is the lack of any useful information). Let's look at the following example as an illustration of the gambler's fallacy:

During your vacation in Las Vegas over the holiday season, you are observing a fair roulette table (i.e., the table has an equal chance of coming up "red" or "black"). You observe that the previous six spins have all come up "red." On the next spin, placing your money on which color would provide you the better opportunity to win?

One of the problems is that our evolutionary heritage has made us pattern seekers, even when no pattern with meaning exists. Thus, the above pattern we have observed is that a 50/50 event has gone one way six times in a row. The odds of this occurring by chance are one in sixty-four (i.e., $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$). At this point, many gamblers will place their bets, often increasing the wager, on black. The erroneous belief (the gambler's fallacy) is that random processes are self-correcting. Simply put, black must be "due" to come up, because red has come up six times in a row. In fact, the plain truth is that the odds of the next spin coming up red or black is still 50/50, no matter what the previous pattern was. Of course, the roulette dealer is not interested in which color you bet on in a chance game, she is concerned only that you do bet. Over the long run, the odds of red/black

coming up is 50 percent because there is no self-correcting mechanism! The casino makes money by paying out slightly less for a winning bet than it keeps for a losing bet, but this adds up to a substantial profit in the long run. Ever notice how many new hotels keep popping up in Las Vegas?

Not convinced? Interestingly, research demonstrates that misconceptions about random processes survive despite considerable contradictory evidence. Here is a simple exercise you can try at home (it can be time consuming). Simply start flipping coins and calculate the probability of heads coming up after three consecutive tails. If you repeat this process to the point that you have a large sample, you will find out that the probability of heads occurring is still 50 percent. Note that for the roulette table or the coins to have a self-correcting mechanism, this would imply that "a fair roulette table can remember if previous spins were black or red" and "that coins have a memory to balance out heads and tails" (Riniolo and Schmidt 1999, 199). Of course, for the gambler, the notion that they are "due" can be hard to resist. However, in true chance games (i.e., no card counting!), the probability of correctly guessing the next event does not increase based upon previous events. These misinterpretations are part of the trade-off that has resulted in our species developing pattern-seeking skills, which in the long run were beneficial for survival and reproduction but in today's society can mislead us when we try to attach meaning to random events.

FRANZ JOSEF GALL: THE PATTERN SEEKER

Franz Josef Gall (1758–1828) provides an interesting case example of how our pattern-seeking heritage resulted in the identification of both true and false patterns. Unfortunately for Gall, the history of science typically ignores the true patterns that he discovered and remembers him only for the false patterns. First, Gall was a remarkable anatomist, as he identified the fibers that cross from one side of the brain and connect with the opposite side of the spinal cord (contralaterality). This

finding explains why a stroke on the left side of the brain can result in paralysis on the right side of the body, and vice versa. Please note that when Gall made this discovery in the 1800s, the instruments were very crude by today's standards. Furthermore, Gall was also a comparative anatomist and he investigated a wide variety of different species in addition to normal human adults, brain-damaged adults, and children. Gall properly identified the general pattern that larger brains are associated with greater mental abilities. This discovery was the evidence needed to convince the scientific community at the time that mental functioning was the result of brain activity. This seems like an obvious finding now, but many important scientific discoveries seem obvious with the benefit of hindsight (doesn't gravity seem obvious?). Simply put, some of Gall's achievements should have solidified his place in the history of science as one of the truly great individuals.

Furthermore, Gall also came to believe that the brain consisted of specialized parts that were associated with specific emotional, behavioral, and intellectual functions. He posited that those parts of the brain that were well developed and unusually large would be associated with greater abilities and more pronounced psychological qualities. (In general, Gall is the first to argue for cortical localization, another important finding.) Unfortunately, Gall also believed (inaccurately) that an individual's skull is a mirror image of the underlying brain. Thus, he believed that by searching for bumps on the skull, one could tell which areas of the brain were large, and so he set out to identify brain areas associated with specific abilities and psychological qualities.

The story at this point turns into a classic example of how our evolutionary heritage to identify patterns can mislead us when dealing with a random process. Gall searched for bumps and indentations on various individual skulls and subsequently mapped out what he believed was the corresponding brain regions and psychological qualities.

This "skull reading" is known as phrenology and was subsequently popularized by Johann Spurzheim (1776–1832) and George Combe (1788–1858). This pseudoscientific craze in the early to mid-1800s convinced thousands of practitioners who also saw a "real pattern" where none existed. Of course, the skull is made of bone, while

the brain is like Jell-O. There is no way Jell-O can cause "bumps" to occur, no matter how large individual portions of the brain are. With Gall, we see a brilliant individual accurately identifying some patterns and also misidentifying the random information of bumps on the skull being associated with psychological qualities. Unfortunately, Gall is typically remembered in the history of science as nothing more than a joke: the fool who gave us phrenology. Interestingly, Gall's many other important contributions listed previously are typically not mentioned when his name comes up. Readers are referred to Fancher (1996) for further details regarding Gall and phrenology.

SUMMARY

Our evolutionary heritage has resulted in humans being a pattern-seeking species, which is an overall benefit, as it allows us to identify useful causal relations that increase the chances of survival and reproduction. Of course, while our pattern-seeking abilities lead to many true beliefs about how the world works (e.g., many birds migrate south for the winter), it also leads to some false beliefs (e.g., the gambler's fallacy). Thus, humans have a combination of true and false beliefs that have resulted from our pattern-seeking tendencies. A more important issue, which will be discussed more fully in the next chapter, is that pattern-seeking tendencies, if left unchecked, would simultaneously begin to undermine our beliefs. This would in turn reduce the advantage for survival and reproduction unless they were complemented by a cognitive system that is designed to take advantage of our ability to capitalize on the important information in ordered patterns. However, this requires a biased cognitive system designed to strengthen and maintain current beliefs. Unfortunately, interpreting information within a biased cognitive system also has a trade-off, especially for us as critical thinkers, which is inconsistent critical thinking.