CHAPTER 8: CAUSE AND EFFECT: IDENTIFYING THE "WHY"

This chapter emphasizes connections between critical thinking and cause and effect. It maps important techniques for creating cause and effect explanations in order to:

- Identify the key features of cause and effect
- Recognize how causal chains and causal networks operate
- Create a successful cause and effect document
- Understand the ethical dangers of cause and effect thinking
- Make clear the incompleteness of any cause and effect explanation

Cause-and-effect explanations range from the simple to the complex. A good writer knows when to offer a single cause for an event, and when to offer a more complicated set of causes. This chapter will help you use cause and effect in a practical, ethical fashion.

KEY FEATURES OF CAUSE AND EFFECT

Readers usually want a cause-and-effect document when they need to know *why* something happens. They want to know *why* gasoline prices rise, *why* radiation kills cancer cells, *why* dinosaurs became extinct, *why* sunsets are red. The readers need an explanation that makes sense of the question. They need to know *why* it happened. Sometimes, readers cannot stand uncertainty, and they will accept almost any explanation because any meaning is better than chaos. It is the writer's job to serve the desire for an explanation. The hunger for meaning can be so intense that readers become vulnerable to deception. The writer has an ethical responsibility to give legitimate explanations.

Where in Your World is Cause and Effect?

Cause-and-effect documents offer an explanation of the link between an event and its outcome. Such explanations are commonly part of the following:

Cause and Effect in Daily Life:

- We use cause and effect to line up a shot on a pool table
- We use cause and effect when we go on a diet
- We use cause and effect when we flip a light switch

Cause and Effect at School

- Students use cause and effect to understand chemistry experiments
- Students use cause and effect to understand historical change
- Professors use cause and effect to plan assignments

Cause and Effect at Work

- Police use cause and effect to fill out an accident report
- Accountants use cause and effect to write a profit and loss statement
- Doctors use cause and effect to treat illnesses

By putting the causes of an event into context, cause and effect answers the audience's need for an answer to "why."

Often, the writer signals the presence of cause-and-effect reasoning through the use of specific terms:

because	create	precipitate	produce
therefore	cause	due to	yield
factor	accordingly	lead to	consequently
converge	result	generate	effectuate

Readers see such terms as statements of an intrinsic connection between a cause and its effect.

Explanations That Use Single Causes

Writers can exploit the readers' need for explanations. For example, the Nazis knew that many German citizens were desperate for an explanation that made sense of military defeat, unemployment, and inflation. The chaos was frightening, and the Nazis invented a "cause" for these massive problems: citizens who were Jewish. They offered a simple cause-and-effect explanation that gave a single cause for the chaos. It did not matter that this cause-and-effect relationship was false. What mattered was that it "made sense" of chaos. The results were

horrific. A cause-and-effect explanation led to processes for murdering millions of innocent people. The hunger for meaning in the midst of chaos is easy to exploit with simplistic cause-and-effect explanations.

Faulty Cause and Effect Explanations

The danger of cause-and-effect explanations is that they can make everything seem the result of a single cause. We see this in obvious cases such as the Nazi mythology, but we also see it in Stalin's enforced starvation of Ukraine farmers, or the Khmer Rouge slaughter of its urban population. These horrors relied on simple cause-and-effect thinking; a single, specific group "caused" a problem. Such cause-and-effect explanations appeal to people who are caught in widespread problems such as high unemployment, inflation, political change, or other transformations. These are easy examples, but using a single cause as an explanation also produces simplistic conclusions. For example, a scientist might explain dinosaur extinctions *only* in terms of a meteor, or *only* in terms of evolving plant life. These explanations often have to omit important facts and ideas to stay on track. As readers, *we should be skeptical of causes that explain too much*. As writers, we should have the insight and integrity to avoid such thinking.

We need to think about how to ethically use cause-and-effect explanations. They are vital to clearly understanding *why* things happen. One of the most useful ways to honestly use cause and effect is to think about *chains* of cause and effect. You have probably heard this proverb:

> For want of a nail, a horseshoe was lost;
> For want of a horseshoe, a horse was lost;
> For want of a horse, a soldier was lost;
> For loss of a soldier, a war was lost
> For loss of a war, an empire was lost.
> For loss of a nail, an empire was lost.

This chain of events begins with a simple event (the lack of a nail). This sets off a long chain of causes and effects. The causes produce effects, and then the effects become the causes of further effects. On one hand, the proverb satisfies our need to understand that details are important. On the other hand, the content relies on the reader accepting its simplistic terms. It satisfies our need for an explanation. However, it refuses to make any of the steps connect to other issues: the size of the armies, the technologies used, geography, etc. The story refuses to put each step into a larger context. Thus, the story's real value is as an illustration of how cause and effect can be misused to oversimplify complex events.

Legitimate Causal Analysis

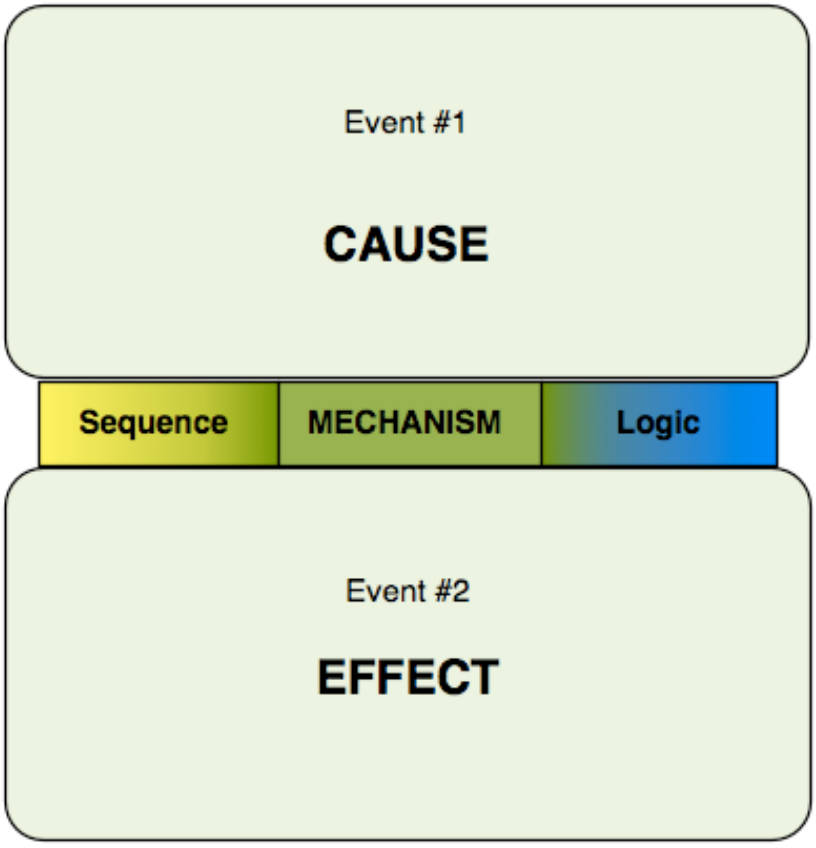
The world is complex, and explanations have to reflect that fact. A document that says two events are tied to each other through a single cause-and-effect relationship is unlikely to be honest or useful. Readers can examine a cause-and-effect document for three important features to help assess its value:

Sequence: Cause and effect asserts that something has happened after something else. The critical reader will mark out the sequence of events. If there is no sequence, then there is no cause and effect. One comes before the other.

Logic: Events fit into specific categories. For example, an infection is a category with connections to viruses, bacteria, cell division, antibodies, and other biological issues. An explanation of an infection that refers to the weather on Mars is an explanation from a different category. It is illogical because it is out of "the logic" of biology. This is different from what "logic" commonly means, but critical readers and careful writers will recognize "the logic" of the events they are explaining and remain within that logic.

Mechanism: If one event causes another event, the writer has to explain their connections. Are the connecting concepts from a single field: physics; psychology; chemistry? What technical knowledge of the field justifies the connection? What knowledge that is shared by people within the "logic" of the discipline makes the cause-and-effect

relationship a justifiable claim? The causal mechanism is about the connections between logic and sequence that justify the claim of cause and effect.



These three features (sequence, logic, and mechanism) are part of any legitimate cause-and-effect explanation. Be sure they play a role in your reading and your writing.

Putting Cause and Effect to Work

Use the ideas of sequence, mechanism, and logic to discover why each of the following cause and effect statements is false:

- Being closer to the sun would make the earth warmer. The temperature during the summer is higher because the Earth is closer to the Sun. What facts do you need to verify to assess this claim?
- If global warming is real, then why were there record cold temperatures last winter?

Causal Chains

Tracing a causal chain clarifies the relation between cause and effect. For example, imagine a pool table. On the table is the white cue ball, the 1-ball, and the 2-ball. You watch a skilled player drive the cue ball into the 1-ball. The 1-ball strikes the 2-ball, and then you watch as the 2-ball disappears into the side pocket. "Why," you ask yourself, "did that happen?" Separating the links in a causal chain can help you understand.

Causal link #1:

The pool player's cue stick shoots the white cue ball into the 1-ball and moves it. The cue stick is the primary cause of the cue ball striking the 1-ball.

Causal link #2:

The 1-ball moves after being struck by the cue ball and it strikes the 2-ball. The cue ball is the cause of the 1-ball's motion. The cue ball's motion has been transformed from an effect to a cause.

Causal link #3:

After being struck by the 1-ball, the 2-ball moves. This time, the 1-ball's motion has been transformed from an effect to a cause. Now, it is the cause of the 2-ball's motion.

In a causal chain, items take turns being causes and effects. The chain looks like this:

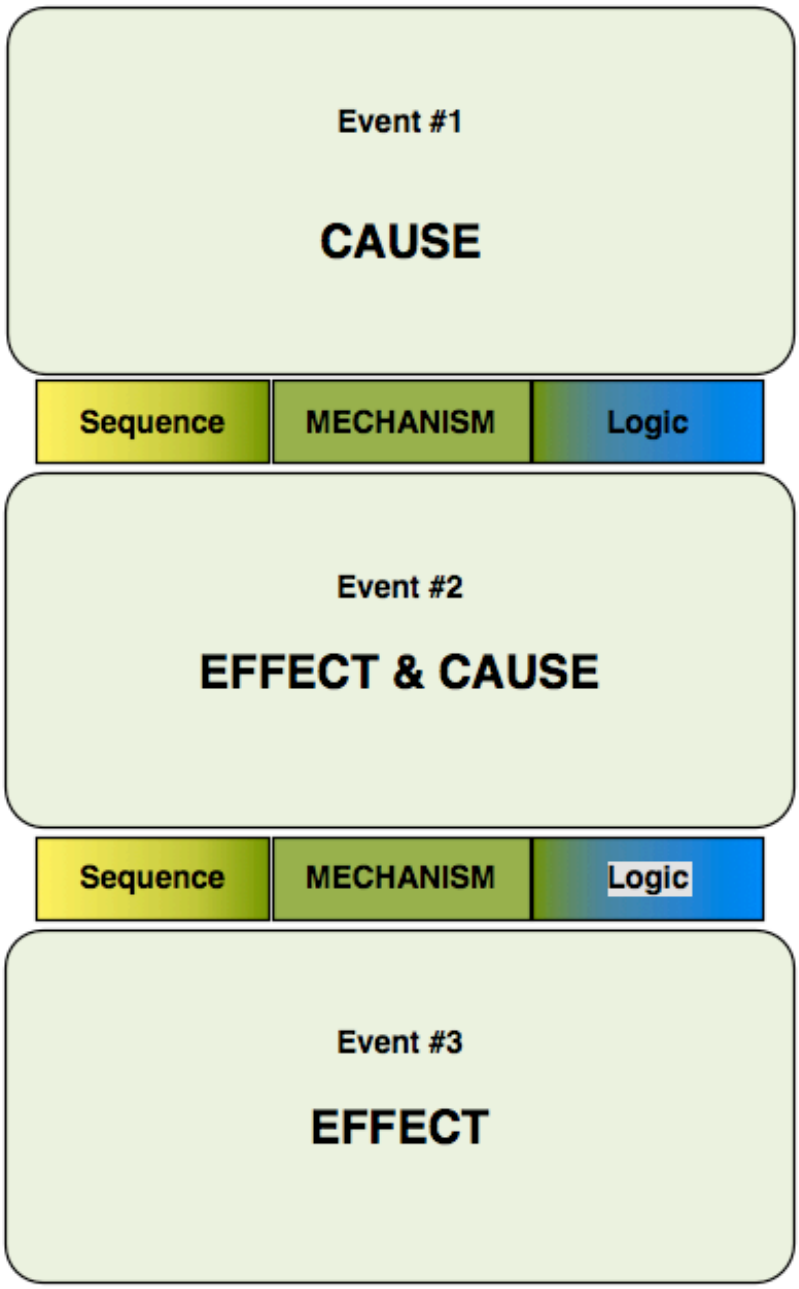
cue stick ➜ cue ball ➜ 1-ball ➜ 2-ball

There is a primary cause at the beginning (the cue stick), and a final effect at the end (the 2-ball moves). Depending on how closely we look, everything in between is *both* cause and effect.

Causal chains become more clear if you think about "zooming in" and "zooming out" on a cause-and-effect relationship. Imagine moving close to the cue ball and the 2-ball so that everything else becomes invisible. The relationship is simple: one cause; one effect. But if you stand up and survey the whole pool table, you see the cue stick, the side pockets, the other balls, and a huge number of potential effects. You also see that the 2-ball can go on to strike the 3-ball and send it into the corner pocket. In this case, the viewpoint "zooms out" to survey the consequences (effects) of the initial movement of the cue stick. We "zoom out" on causes to discover causal chains.

Putting Cause and Effect to Work

During a recent discussion, a biologist claimed that invasive species would cause the entire ecosystem of the Great Lakes to collapse. The biologist emphasized that the invasion of Asian Carp would set off a catastrophic chain of events. What chain of events can you foresee that might do what the scientist said? Then, examine your causal chain and name the points where the causal chain could be interrupted.



Causal Networks

Pool tables illustrate single causes with single effects. On the other hand, some effects have several causes. An effect with several causes is more common than a causal chain. Most events have many causes. By "zooming in" on a cause-and-effect relationship, the relationship reveals the *evidence and conditions* that connect them. This is the logic of the connection. For example,

imagine that you have fallen sick with the flu. The primary cause of your illness is the influenza virus, but if we look closely at the cause, we find that it came from a cousin's cough while she sat beside you in a sauna on an evening when you were exhausted. The influenza came from somewhere, and you became infected in a certain place with certain features. The causal chain breaks if any of these other conditions are changed. If you do not go to your cousin's house, the influenza does not infect you. Instead of saying

influenza virus ➜ *flu*

"zooming out" lets us see that we have a network with a primary cause and conditions necessary to the effect:

influenza virus + *contact* + *debilitation* + *moisture* ➜ *flu*

"Zooming in" strengthens the understanding of a causal relationship by identifying evidence and naming the conditions under which a cause will have its effect. If any item is changed, the causal conditions are changed, and the results will be different.

USING CAUSE AND EFFECT FOR CRITICAL THINKING

Controlling the Risks of Cause-and-Effect Explanations

Writers have a difficult job. They have to demonstrate how a cause *does* contribute to an effect, but they have to do it in ways that show *other* forces that are also important. For example, a scientist could honestly place heavy emphasis on a meteor strike as a cause of dinosaur extinctions, but she would have to also have to explain the network of changes produced by the meteor: changed climate, limited sunlight, reduced food supply. The primary cause might be the meteor strike, but the intermediate causes would have to be detailed. Thus, good cause-and-effect documents recognize that there are many causes for an event. Ethical

writers know that cause-and-effect explanations pose serious ethical risks, and that they need to be especially careful while using this mode.

Identifying a Primary Cause

Identifying a single cause can be a useful step toward understanding *why* something happened. Good explanations require careful detail. The Public Broadcasting System offers the following information about dinosaur extinctions:

What Killed the Dinosaurs?

Introduction | Asteroid Impact | Volcanism | Mammal Competition | Continental Drift | Conclusion

Hypothesis: Asteroid Impact

Did a collision with a giant asteroid or comet change the shape of life on Earth forever?

It is widely agreed that such an object -- 10 kilometers across -- struck just off the coast of the Yucatan peninsula 65 million years ago.

According to scientists who maintain that dinosaur extinction came quickly, the impact must have spelled the cataclysmic end.

For months, scientists conclude, dense clouds of dust blocked the sun's rays, darkening and chilling Earth to deadly levels for most plants and, in turn, many animals. Then, when the dust finally settled, greenhouse gases created by the impact caused temperatures to skyrocket above pre-impact levels.

In just a few years, according to this hypothesis, these frigid and sweltering climatic extremes caused the extinction of not just the dinosaurs, but of up to 70 percent of all plants and animals living at the time.

Evidence for the Asteroid Impact Hypothesis

Impact Crater
This 150-kilometer-wide crater lies just off the Yucatan peninsula. Scientists calculate that it was blasted into Earth by a 10-kilometer-wide asteroid or comet traveling 30 kilometers per second -- 150 times faster than a jet airliner.

Scientists have concluded that the impact that created this crater occurred 65 million years ago. The date corresponds perfectly to the date of the dinosaur extinction.

Rare Metal
The metal iridium, which is similar to platinum, is very rare on Earth's surface but is more common in asteroids and in molten rock deep within the planet.

Scientists have discovered levels of iridium 30 times greater than average in the Cretaceous/Tertiary (KT) boundary, the layer of sedimentary rock laid down at the time of the dinosaur extinction.

Fractured Crystals
These crystals, often called "shocked quartz," show a distinctive pattern of fracturing caused by high-energy impacts or explosions.

Some scientists maintain that the fracture pattern in these quartz crystals could only have been caused by a massive asteroid or comet impact. The pattern is prevalent in quartz found at or near the Cretaceous/Tertiary (KT) boundary, the geological layer deposited at the time of the extinction.

Fossil Record
A gradual decline in the number of dinosaur species would likely mirror an equally gradual cause of their ultimate extinction. Conversely, a sudden "now you see them, now you don't" end to the dinosaurs implies a catastrophic cause. Depending on location and interpretation, the fossil record seems to say different things.

Some paleontologists see evidence in the fossil record that dinosaurs were doing quite well prior to the end of the Cretaceous -- that they were in no way declining in abundance when the impact occurred.

-> Did global volcanic activity kill the dinosaurs?

The document begins with a question about an asteroid as the *cause* of dinosaur extinctions. The asteroid is presented as *the primary cause* of the extinction. The asteroid produces a series of *effects*: dense clouds of dust.

These effects then become causes of other effects: low temperatures, dead vegetation, and the creation of greenhouse gases that later raised the temperature of the world.

This set of effects then becomes the cause of the extinction of the dinosaurs.

Note that the explanation continually "zooms out" on each effect to see that it is also a cause.

The document continues by presenting evidence to support the idea that an asteroid was the primary cause of a series of causes and effects that led to extinction.

The very last item is a link to alternative causes for the extinction. The link to a competing idea shows that the writers understand that a cause and effect explanation cannot be complete, especially for complex events.

http://www.pbs.org/wgbh/evolution/extinction/dinosaurs/asteroid.html 12april2012

How to Create A Cause and Effect Paper

Imagine that you pull up to the gasoline pump. You look at the price and see that it is $9.99 per gallon. Like any reasonable person, you ask *why* the price has skyrocketed. Several possibilities spring to mind:

1. Shipments of oil from the Middle East have been cut off for some political reason
2. Delivery of gasoline has been interrupted by a Teamsters strike
3. Production of gasoline has been interrupted by a hurricane in Louisiana
4. Fuel taxes have been raised to pay for the collapsed highways in your state
5. It is a holiday, and you are at the only open gas station in the area

These are all reasonable guesses, but you have no evidence for any of them. There is the possibility that several of them are true. There is also the possibility that some of them form a causal chain, and that others do not. You give the clerk $10.00, and buy one gallon and a piece of penny candy before going home to discover the *cause* of the rise in the price of gasoline.

The most simplistic explanation is that the supply has fallen, so the price has risen. Such an explanation would put "the market" as the primary cause. However, you know that "the market" is the effect of many causes. Each item on your list looks for a reason that supply is low. That is a good start, but you may be looking for a causal chain when there is really a causal network. You read the newspaper, industry reports, listen to informed commentary, and you realize that *all* of your theories were right. How can you explain the cause of the jump in prices?

First, you realize that these various causes interact. If there is only one cause, and one effect, there is only one explanation. On the other hand, if there are *two* causes, then you have to provide an explanation for how each works *and* an explanation for how they interact with each other. That means that two causes require three explanations. Three causes mean that you have to explain each one separately, all of them together, and then each pair of causes. That is a total of seven explanations. It seems that the growth of the explanations expands rapidly. Proposing five causes for the rise in gasoline prices means many explanations will have to be explored. Adding even a few causes quickly increases the number of potential explanations:

1 cause for 1 effect ➜ requires 1 explanation

2 causes for 1 effect ➜ requires 3 explanations

3 causes for 1 effect ➜ requires 7 explanations

4 causes for 1 effect ➜ requires 15 explanations

5 causes for 1 effect ➜ requires 31 explanations

Ten causes would require exploring 1,023 explanations. Causes are intellectual rabbits. They quickly breed combinations that can overwhelm anyone using them.

Causes interact, and writers have to choose wisely to produce effective cause-and-effect documents. They have to recognize that even a good explanation is incomplete. This goes back to the misuse of such explanations. If a writer (or politician or researcher or scientist) selectively ignores important causes, the explanation will be flawed. That is what is behind most uses of cause and effect to blame others.

Putting Cause and Effect to Work

1. Think about the possible causes for rising tuition at your school. List three causes for the increases. In a second list, name each of the causes and the combination of causes that will have to be explored to write the paper.

2. Many students worry about having enough to say when they write papers. How does identifying more causes enable you to quickly build the length and complexity of a paper?

3. “Effect” and “affect” mean different things. If you have trouble remembering the difference between "affect" and "effect," remember these differences:
   a. "Affect" is usually a verb meaning "to influence," as in "Explain how football affects American culture."
   b. "Effect" is most often used as a noun meaning "result, consequence, or achievement." For example, "Explain the effects of football on American culture."

Would you say that the meteor that struck the Earth at the time of the dinosaurs affected the extinction of the animals, or would you claim that it effected the extinction of the dinosaurs? What is the difference in meaning of these two statements?

THREE EXAMPLES OF CAUSE AND EFFECT PAPERS

Example #1: Chronology and Causation

Superstitions may look like cause and effect, but they lack the logical connections necessary to a true cause-and-effect relationship. Of course, they sometimes seem to work. If you live in a snowy midwestern climate, you *know* that the best way to guarantee a snow day is to put a spoon under your pillow after you lick it, flush six ice cubes down the toilet, and go to bed with your pajamas on inside out. A careful survey of children from Michigan's Upper Peninsula shows that this works 98% of the time when the possibility of a snowstorm is announced. In this superstition, the causes are named, the effect is specified, and the results are tabulated. Who can doubt such a cause-and-effect relationship?

Explain the causal chains or networks of the superstition. How would you explain its success in predicting snow days in Michigan's remote Upper Peninsula? One of the problems with superstitions is that they say, "Because something happened *after* this, it happened *because* of this. Superstitions assign causal powers to a sequence even when the items in the sequence are not causally linked. A linkage in time is called a chronological link, and both readers and writers need to be wary of their power to mislead.

Example #2: Single Cause Explanations

Why Frisbees Fly

Why Frisbees Fly

Have you ever wondered how the Frisbee flies? The answer is very simple - it's all about Physics. The forward flight of the Frisbee is due to the air that pushes at the leading edge of the disc. The air stays over and under the flying disc.

Since the edge of the disc is tipped up, some of the air is deflected downward and when it pushes downward, the air is again pushed over the disc. The force which allows the Frisbee to fly on air is known as aerodynamic lift. You can compare the flow of the air to the flow of fluids. The air tends to follow curve surfaces. The design of the Frisbee was carefully thought. Because of the bend on the Frisbee, air is easily sucked upwards and downwards thereby making the disc stay afloat despite of the force of gravity. Another good way to describe a Frisbee on flight is the so called 'Bernoulli Effect'.

As a Frisbee player, you must be aware that you can't make a Frisbee fly when it is upside-down. The disc's rotation is also crucial. For instance, if a player throws the Frisbee upright, it will result to a poor flight. The Frisbee will simply flutter and tumble like that of a falling leaf; this is because the aerodynamic force is not perfectly centered. Because of the Frisbee's angular momentum, it can stay on a certain orientation. The flight of the disc is usually affected by the aerodynamic twists and torques.

Because of the disc's ingenious design, the maximum lift is perfectly placed at the toy's middle. The angular momentum of the disc is also maximized because of its thicker edges. The disc also has top ridges and it is not for any design purpose. The ridges introduce microscopic air turbulence above the disc's label. Because of the turbulence, the disc can fly farther and longer on air.

A lot of people are confused with the physics behind the Frisbee and so they would just rather toss and catch a Frisbee rather than think about how the toy works. It's really quite amazing that the Frisbee started as amnempty pie tin and at present, it's flight can only be explained by physics.

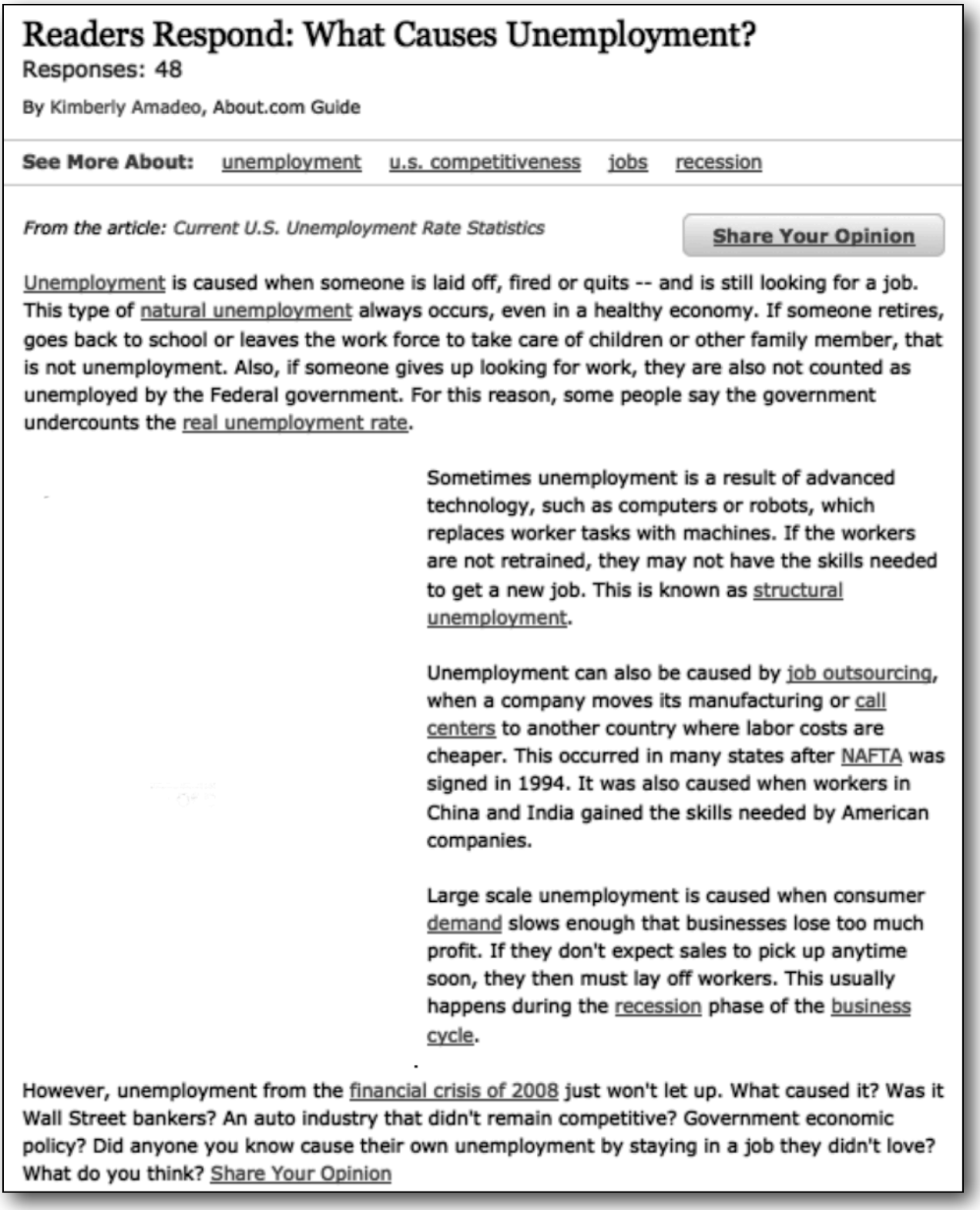
If someone asks you how the disc flies, you already have an idea. If you still can't get the concept of aerodynamics, you can simply answer that the Frisbee flies because of its ingenious and complex design; that way, you won't have to go down the details. Still, the aerodynamic concept and the Bernoulli Effect are not really difficult to understand. If you take time to read and comprehend, you will immediately understand how the toy works.

http://charitydrives.org/why-frisbees-fly/ 20april2012

Cause-and-effect documents can make sense of perplexing experiences by referring to general principles from the sciences. In this example, the writer might have said, "Frisbees fly when people throw them with a snap of the wrist." In this case, the context calls for something that will reveal an invisible cause and effect. By stating that the explanation comes from "physics," and by using technical terms such as "Bernoulli Effect," the writer is confining the discussion to physical forces that enable the toy to fly.

Example #3: Effects with Many Causes

The most realistic cause-and-effect document is likely to identify many causes. The Frisbee example (above) avoids talking about causal chains or causal networks. The result is a clear understanding of a simple physical process. On the other hand, the physical process takes place in different types of settings. The forces described in the "physics" of Frisbees vary according to the person throwing the disc, the humidity, the wind, the temperature, and a host of other factors. A complete cause-and-effect document would have to account for all of these. A thorough cause-and-effect document quickly builds complexity like the one below:



Readers Respond: What Causes Unemployment?

Responses: 48

By Kimberly Amadeo, About.com Guide

See More About: unemployment u.s. competitiveness jobs recession

From the article: Current U.S. Unemployment Rate Statistics

Share Your Opinion

Unemployment is caused when someone is laid off, fired or quits -- and is still looking for a job. This type of natural unemployment always occurs, even in a healthy economy. If someone retires, goes back to school or leaves the work force to take care of children or other family member, that is not unemployment. Also, if someone gives up looking for work, they are also not counted as unemployed by the Federal government. For this reason, some people say the government undercounts the real unemployment rate.

Sometimes unemployment is a result of advanced technology, such as computers or robots, which replaces worker tasks with machines. If the workers are not retrained, they may not have the skills needed to get a new job. This is known as structural unemployment.

Unemployment can also be caused by job outsourcing, when a company moves its manufacturing or call centers to another country where labor costs are cheaper. This occurred in many states after NAFTA was signed in 1994. It was also caused when workers in China and India gained the skills needed by American companies.

Large scale unemployment is caused when consumer demand slows enough that businesses lose too much profit. If they don't expect sales to pick up anytime soon, they then must lay off workers. This usually happens during the recession phase of the business cycle.

However, unemployment from the financial crisis of 2008 just won't let up. What caused it? Was it Wall Street bankers? An auto industry that didn't remain competitive? Government economic policy? Did anyone you know cause their own unemployment by staying in a job they didn't love? What do you think? Share Your Opinion

Cause-and-effect explanations become difficult to control when the subject is complex. Writers need to honestly state the causes that contribute to an effect. Readers expect that each cause and

their combinations will be explained. That can become an overwhelming task. Often, writers list the causes, but single out several as the most important. The writer openly recognizes that the other causes are important, but says, "For the purposes of this paper, I will focus on only a few causes." Such a technique is honest and realistic.

Putting Cause and Effect to Work

1. How many causes does the article cite as causes of unemployment?
2. Are any of the causes given more power than other reasons?
3. If you count the individual causes and the various combinations of these causes, how many cause-and-effect relationships would you need to discuss?
4. Does the article adequately reflect the number of causes and their interactions? Does this increase or decrease your confidence in its value?

SUMMARY

Cause and effect enables writers to explain why something has happened. By clarifying the sequence of events, the mechanics of interactions, and the logic of their connection, the writer answers the readers' need for an explanation that exposes a cause-and-effect relationship.

Cause and effect establishes a specific map. It enables the reader to see relationships, and it does so in highly specific language. The reasoning is clearly stated, and this does two things. First, it enables the reader to see how the map is organized. Second, it provides specific points where the reader can make changes, improvements, or ask questions. Used ethically, cause and effect reasoning is valuable.

The strengths of such writing are also its weakness. The writer can conceal networks of causes, zoom in too closely on a single causal change, or oversimplify the cause and effect relationship. Both writers and readers have to recognize these risks.