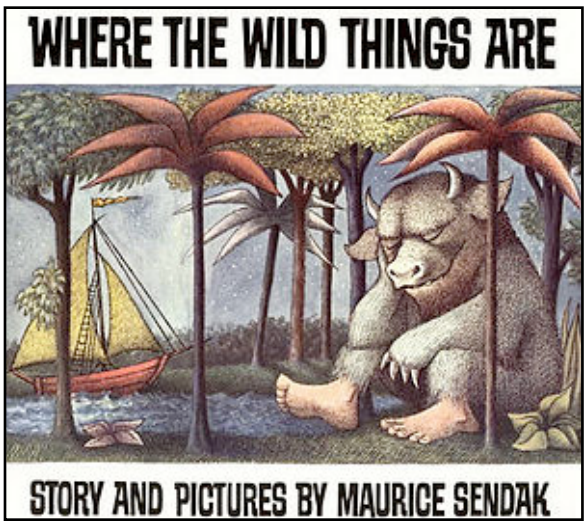
CHAPTER 3:

ILLUSTRATION - CLARIFYING YOUR EMERGING INSIGHT

This chapter emphasizes connections between critical thinking and illustration. It maps important techniques for creating illustrations:

- Identifying the connection between examples and evidence
- Recognizing and using analogy to clarify abstract ideas
- Using illustration to clarify the document's claim
- Applying illustration in scientific writing

You probably remember the illustrated books of your childhood. You remember bright covers that summarized the entire book, and you can recall how a chapter often began with a drawing that captured its key event. The illustrations were like a bright light that shone on what was most important. An illustrated book such as *Where the Wild Things Are* begins with a picture that summarizes the key components of the story: monsters, an island, a boat, and sleep. Any reader (child or adult) immediately understands the kind of book it is, and prepares for a childhood fantasy. Inside the book, the images become more specific. They present key steps in the plot. For example, when Max is recognized as King, the illustration summarizes the event (right). A child can visually "read" the book as someone reads the words.



In this chapter, you will learn to:

- Identify the connection between examples and evidence
- Recognize and use analogy to clarify abstract ideas
- Use illustration to clarify the document's claim
- Use illustration in scientific writing

Key Features of Illustration

As you grow older, visual illustration continues to create condensed statements in comic books, graphic novels, and in manuals. In each case, the visual illustrations clarify key concepts. The word itself means "to shed light on," and illustration is a powerful tool for writers. For writers,

Where in Your World is Illustration?

Illustration helps readers understand the evidence, method and claim of a document. It makes subsequent material clear by connecting it to patterns that are already familiar to the reader.

Illustration in Daily Life
- Using parables to encourage good behavior
- A driver education film that shows a person drinking, driving, and then driving off a cliff

Illustration at School
- A teacher provides three sample introductions to a paper topic
- A lab experiment serves as a template for understanding chemical reactions

Illustration at Work
- An employee orientation session where the management is presented as a "tree"
- A flow sheet for completing the tasks in a project

the illustration is usually in words rather than images, but the idea is the same. For writers, illustration takes two forms:

1. Illustration that presents a sample of the evidence for a document's claim. The sample characterizes the institutions, researchers, and methods typical of the rest of the evidence. In this case, illustration creates credibility.
2. Illustration that presents the document's claim in a clear, simple analogy. The analogy anchors the readers in familiar language, language that comfortably leads them into the new map of the subject.

This chapter will help you use illustration in ways that create credibility and clarify a document's key ideas.

The key concepts of illustration are:

1. General Features
    a. Serves the *audience's need* for understanding evidence and claims
        i. by miniaturizing key types of *evidence* that will be developed
        ii. by modeling key *claims* that will be developed
        iii. by using experience and knowledge with which the audience is familiar
    b. Serves the *writer's need* to separate evidence, interpretation, and claim
        i. by differentiating evidence from interpretation
        ii. by clarifying the audience's expertise, interest, and experience
        iii. by clarifying what is important about the idea/thesis/claim

2. Organizational Features
        i. the illustration may be presented in whole at the opening
        ii. the illustration may reappear in the document at points where a new section begins.

These are key terms that tell you that a document relies on illustration:

just as	resembles	recalls
similarly	akin to	echoes
parallel to	suggests	resonates with

These and other terms help to establish a simple "model" of a more complex subject. Illustrations point in two directions: 1) toward what is familiar to the reader, and 2) toward what will be new in the writer's work. It is an early step in presenting evidence and a claim to a specific audience.

Illustration for Clarifying Evidence

If the Wild Things Are

The monsters in Maurice Sendak's book are imaginary. No one thinks of them as beasts that wander about in the real world. On the other hand, North Americans regularly report sightings of Bigfoot or Sasquatch. Their stories seem to describe a real animal, and many witnesses appear to be honest and straightforward. Hunting for Bigfoot has become so widespread that television shows follow the work of devoted believers who interview witnesses and try to gather evidence. Despite the widespread interest in Bigfoot and the many claims about its existence, the evidence is mostly the testimony of witnesses. There is little physical proof. The evidence that exists has not been scientifically examined. Scientists call the evidence "anecdotal." Anecdotal evidence is personal and often based on stories. It cannot be tested in the same way that most scientific discoveries are tested. Bigfoot skeptics ask three good questions:

1. What claim do the believers make?
2. What kind of evidence exists?
3. How is the evidence connected to the claim?

The disagreement between believers and skeptics seems impossible to resolve. Each group has its own idea of what is "good enough" evidence. The differences between believers and skeptics is visible in how they *illustrate* evidence in their introductions to the topic.

How Bigfoot Believers Illustrate Evidence

The Bigfoot Field Researchers Organization (BFRO) collects reports of sightings, films, videos, and other material related to Bigfoot. The organization is an eclectic group that immediately notes the importance of evidence:

Evidence vs. Remains	http://www.bfro.net/gdb/show_FAQ.asp?id=40
The assertion that there is absolutely no physical evidence is absolutely false. There is more physical evidence than most people realize. Physical evidence is found every month in various areas across the country. Distinct tracks that do not match other animal tracks, hairs that match each other but no known wild animals, and large scats that could not be made by any known species, are all "physical evidence."	The BFRO begins by claiming that anomalous evidence is common. The evidence is *not* claimed to be evidence for Bigfoot, but it is evidence that demands explanation.

The presence or absence of "physical remains" is a wholly different matter. "Physical remains" means body parts, or fossils of body parts. Though mammals may leave tracks, scats and hairs behind, they do not leave body parts behind very often. Body parts of mammals are only available when they die. Thus availability of physical remains is initially determined by population size and lifespan. A rare species with a long lifespan will leave very little physical remains, collectively, for humans to find. The probability of humans actually finding and collecting and identifying those remains before they are completely reabsorbed into the biomass complicates the "physical remains as evidence" equation dramatically.	The BFRO explains that the existing evidence does not include “body parts” because such evidence would be rare for two reasons: 1) a small number of animals; 2) rapid decay of bodies in the wild. The paragraph responds to the claims of skeptics that the *type of evidence* is not adequate to the claim that Bigfoot exists.

Illustration enables readers to quickly understand the nature of the evidence: distinct tracks, hairs that match, and large scat. These illustrate the kinds of evidence for the claim that Bigfoot exists.

How Bigfoot Skeptics Illustrate Evidence

The Committee for Skeptical Inquiry (CSI) publishes *Skeptical Inquiry* that debunks claims of what it calls “fringe science.” Founded by scientists, including Carl Sagan and Sidney Hook, it also emphasizes the nature of evidence. Its attack on Bigfoot believers uses illustration:

Most Bigfoot investigators favor one theory of Bigfoot's origin or existence and stake their reputations on it, sniping at others who don't share their views. Many times, what one investigator sees as clear evidence of Bigfoot, another will dismiss out of hand. In July 2000, curious tracks were found on the Lower Hoh Indian Reservation in Washington State. Bigfoot tracker Cliff Crook claimed that the footprints were "for sure a Bigfoot," though Jeffrey Meldrum, an associate professor of biological sciences at Idaho State University (and member of the Bigfoot Field Research Organization, BFRO) decided that there was not enough evidence to pursue the matter (Big Disagreement Afoot 2000). A set of tracks found in Oregon's Blue Mountains have also been the source of controversy within the community. Grover Krantz maintains that they constitute among the best evidence for Bigfoot, yet longtime researcher Rene Dahinden claimed that "any village idiot can see [they] are fake, one hundred percent fake" (Dennett 1994).	The CSI wants to discredit Bigfoot believers. It characterizes them as a bickering group that can not agree on what kinds of evidence are most important. CSI then illustrates the general problem with two cases: 1) tracks found on an Indian reservation; 2) tracks found in Oregon. The first case is attacked by a professor from Idaho State University. The second case is attacked by another Bigfoot believer. The use of an established scientist from a credible institution connects the paragraph to a wide set of other scientific methods that are not part of the Bigfoot believers' concept of evidence.

The CSI is illustrating weaknesses in the evidence for Bigfoot. It is also using an illustration to claim that university-based research and methods must determine whether or not a claim is valid. Just as the BFRO recognizes the problem of evidence, so does the CSI. *Both groups rely on illustration.* Skeptics and believers make judgments about Bigfoot on the basis of evidence. Each group accepts the importance of evidence, but each has its own idea about the kind of evidence

needed to allow an *interpretation* of the evidence. A reader who sees the illustrations in their introductions immediately knows how each group makes judgments about credible evidence.

Putting Illustration to Work

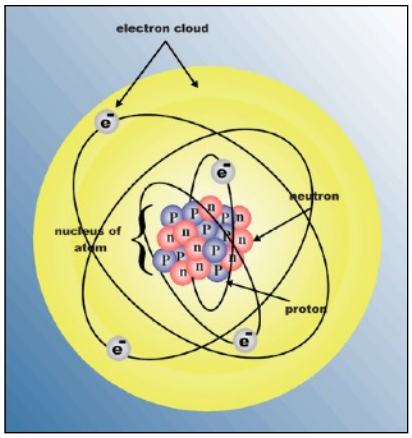
Researchers at Oxford University's Wolfson College plan to study the Bigfoot evidence collected by hikers, hunters, and other outdoors people. They plan to test each sample and record the structure of its DNA. The results of the samples will be compared to existing species and to each other to determine if Bigfoot exists.

- Review the introduction from the BFRO. What response would you expect from the BFRO regarding this research?
- Review the introduction from CSI. What response would you expect from CSI regarding this research?
- How does the research reflect each group's idea of evidence?

2. In an article for *The Skeptical Inquirer*, Ray Hayman describes the connection between evidence and claims. He says, "**Let the facts speak for themselves.** If you have done your homework and have collected an adequate supply of facts, the audience rarely will need your help in reaching an appropriate conclusion. Indeed, your case is made much stronger if the audience is allowed to draw its own conclusions from the facts." Can facts "speak for themselves," or is the role of the writer to do this "speaking"? Write a brief statement to Hayman that explains the connection of illustration to this question.

ILLUSTRATION FOR CLARIFYING THE CLAIM

When Niels Bohr announced his radically new insight into the atom -- an insight for which he won a Nobel Prize -- he prefaced his work with a simple statement that asked readers to think of the atom as similar to the solar system. At the center (like the sun) were protons and neutrons; orbiting the center (like planets) were electrons. He used a basic mode, illustration, to make his insight an understandable one.



So, what is it that makes Bohr's response an illustration? First, he created the illustration, the comparison to the solar system, *after* he had an explanation in mind. He needed something that would serve as an understandable model for what would happen in the real world. It is an understandable, real model, and his audience already understood it. The correspondence between the solar system and his new idea about atoms is a tool for clarifying the nature of the solution. It appears at the beginning of the "document" and its goal is to orient the reader to the nature of the information and ideas that follow. Think of an illustration as a prototype. *It is likely to reappear at key transitional moments and thus enables an argument, a comparison, a description, or other modes to go forward.* Even though it seems simple, it is a powerful *structural* mode that brings together the writer and the reader. The great risk is that the illustration takes on a life of its own and becomes a substitute for the paper's real subject.

The claim must be complex to require an illustration

There has to be an idea to illustrate if an illustration is going to work. Without a thesis, it is impossible to have an illustration. A college paper's thesis or the thesis of a professional document is not the same thing as the brief, high school "thesis sentence" that comes at the end of a simple, one-paragraph introduction. A simple thesis often is not useful and often does not reflect the existing knowledge to which it responds. It is not complex, and thus it cannot be expressed in the mode of illustration. Here are two sample thesis statements, one strong and the other weak. Think of them in terms of how you might create an illustration for them.

Weak Thesis Statements	Stronger Thesis Statements
Guns are bad and should be banned.	The historical role of guns in American culture make them emblems of how we think about many issues: political freedom, masculinity, and national identity. They are valuable for thinking about the complicated nature of American identity.
Scientific fraud is a form of lying, and those who tell such lies should be treated as criminals.	While scientific fraud requires a perpetrator, it is also true that the fraud usually serves a larger network of "needs." Such "needs" can be political, economic, scientific, etc. Examining these networks of needs tells us more about the nature of fraud than does a moral condemnation of the individual.

Note that the left hand column has very simple, pro/con ideas. There is really not much to say because the papers will rely almost entirely on the reader's self-centered rationale. The writer *is* the authority for the thesis. On the other hand, the right-hand column creates a network of complex ideas. They need something that will help the reader understand the structure of their interrelationships. Such a "something" is an illustration.

Putting Illustration to Work

1. For each of the thesis statements in the right hand column, create an illustration for the opening of a paper that will develop the idea. Do not write the entire paper; write *only* the opening illustration.

2. How does each thesis statement reflect an existing "map" of a topic, an interest in its gaps, and a promise to re-draw the map? Briefly discuss how a complex thesis has to exist before an illustration can begin.

ILLUSTRATION IN THE SCIENCES

The examples in this chapter are drawn from the sciences and from technology because manuals, textbooks, and similar documents often present new solutions to old problems. Scientists and technicians have a practical need to make sure that the "topic" is seen from a common perspective.

Example #1:

For an introductory science course, a student was asked to "explain electricity." The assignment did not give much direction, so the student wisely decided to find an illustration that would help readers who needed an introduction to the topic. Here is his short essay and some comments about *how* he is using illustration.

Understanding Electricity	
Thinking of electricity as a fluid helps us understand how it works and what it is. Electricity behaves as water does. Its electrons are tiny and charged, but a charge acts like a fluid. Many things can be poured; sand from a pail and water in a cup. The individual grains of sand, water molecules, and electrons behave the same way.	The student wants to provide a miniaturized version of a complex phenomenon: electricity.
A pump pushes water through a pipe around a closed circuit. The rate at which it flows depends on the pump's pressure. The difference between the pressure at the inlet and at the outlet determines the flow rate.	The student uses familiar experiences with water because the readers need them to understand the new idea. He assumes that they are not experts and that they need a simple way to start thinking about the topic.
The greater the pressure difference, the greater the flow. The flow also depends on the diameter of the pipe. At the same pressure, the flow of a larger pipe is greater than that of a smaller pipe.	Having established the illustration (electricity is like water), key terms such as "pressure difference" can be introduced.

Electricity behaves just as water behaves.	The writer explicitly restates that water provides a model for understanding electricity. The claim is a troubling because it blurs the distinction between the model and the idea that it will explain.
Of course, electricity does not run through pipes; it runs through copper wires where electrons can jump from atom to atom, thus enabling electricity to flow around the circuit.	The writer becomes too committed to the illustration because (as any physics teacher will tell you) electrons are not lined up like a string of billiard balls who bump each other forward. The fundamental limitation of the illustration is beginning to show.
Electrons are pushed by voltage -- electrical pressure. An electric battery produces electricity through a chemical reaction and pumps the electricity between its two poles.	Here, the illustration has shifted from water pipes to chemical processes in a battery. The writer has shifted from a one-dimensional image (wires) to a three-dimensional image (batteries). Something is not working.
The electric current flows from high voltage to low voltage. If we increase the driving forces, then the current rises. When one changes, the other does so in almost the same way. The relation between voltage and current is known as Ohm's Law, named after the man who discovered it.	Note that the water imagery has nearly disappeared. That *should* have happened very early, but the illustration has locked the writer into something that lingers long after it has oriented the reader.
Ohm's law is basic to physics classes. It works with metal wires (copper), but it does not really work for things like fluorescent lights, television tubes, etc. Like many objects that rely on electrical fields, these can not be explained by comparing their electrical fields to the flow of water.	The illustration is openly rejected in this paragraph. The writer admits that it is a mistaken notion of electrical fields, and that it does not apply to the three-dimensional world, i.e., the real world.

Electric current is arbitrarily defined as moving in the direction positive charges move. More than a hundred years after this arbitrary decision, scientists showed that electric currents were carried by negative electrons, which move in the opposite direction.	What is odd here is that the writer immediately rejects her/his own illustration and tries to backfill with others. A wiser strategy would be to do one of two things: 1) find a better illustration; 2) use the illustration to introduce a single concept where it is useful. For example, the analogy might help someone wire a new appliance in the home. But that is far too narrow to really be an illustration of a larger concept or claim. It is really just a verbal diagram.
The direction which should be assigned to electric fluids is not what we say, but we continue to use this outdated comparison.	The point may be important, but this is an open admission by the writer that the analogy provided by the illustration simply does not work.
The wiring for appliances and lights are one-dimensional flows of electricity. Three-dimensional flows are not contained within a pipe or wire. They are more like a storm front moving across the land, or the Gulf Stream tumbling toward Europe.	This paragraph is nearly an obituary for the illustration. It presents water as ocean currents, and it persists in the notion that a wire is "one dimension." Both the shift in the nature of the illustration and the factual error that a wire is "one dimension" show that the illustration is both inadequate and misused.
Wires have one dimension and the voltage is the same all along the line, but in three -dimensional space, electricity flows as magnetic fields. Even Ohm's law does not work because we're not dealing with practical, everyday tasks like wiring a house.	The metaphor has run completely dry.

What does this example tell us about illustration?

There is nothing horrible, sinful, appalling, frightful, or bad about this little paper. On one hand, it strongly suggests that the writer knew the reader needed to understand electricity. He knew his job was to take something complicated (electricity) and provide an introductory illustration that would point readers in the right direction and prepare them for more detailed explanations. It is a smart strategy because it recognizes the needs of a specific audience. On the other hand,

the writer does not really understand illustration. He goes beyond using it to set up a framework of information. Instead, he starts to use it *in place of* information about electricity. The illustration gets out of control. It takes on a life of its own, and quickly tries to "do" things that illustrations are not meant to do. His essay tells us more about water (the illustration) than it tells us about electricity.

Putting Illustration to Work

1. How can an illustration be a useful tool *when writing for yourself* so that *you* better understand your subject? Is illustration a valuable exploratory tool?

2. How does an illustration help you assess your question, especially your understanding of essential background information -- the map -- of the topic?

3. How does developing an illustration help you assess your readers' expertise and familiarity with background material?

4. Can developing an illustration help you create a document that the reader can understand?

Illustration is often used inside of other modes. It *initiates* comparisons, definitions, classifications, and other modes. Once an illustration has done its work, it steps aside. In previous example, the writer might have returned to it at key points of the essay to keep the reader oriented to the thesis. Instead, he allows it to take over.

What would have built on the student's good decision to use an illustration? The biggest issue has to do with the thesis. Readers come away asking, "Why are you telling me this stuff?" It is a fair question, but the writer really does not answer it. He has fallen prey to a temptation: the temptation to report facts without providing a context or a reason for reporting them. His claim could have been a simple one such as, "Electricity is a general term that has many popular meanings, but it has only a few scientific ones. I am going to concentrate on electricity in a way that would let someone wire a simple circuit in a house. The scientific meanings do not matter in this case." Having a complex thesis would help control the use of the illustration.

Example #2:

Let's take a closer look at how Niels Bohr explained his new idea of the atom to a group of non-scientists. His audience was the Swedish Academy of Science, which was honoring Bohr with a Nobel Prize. Other physicists had understood and accepted his model of the atom even though it was a radically new way to think. But for the audience at his speech, Bohr had to present hugely complex ideas, evidence, and argument in a clear and simple fashion. The familiar illustrations would make it easier to understand his re-drawn map of the topic. Below is the beginning of his speech:

Nobel Lecture, December 11, 1922	
Ladies and Gentlemen. Today, as a consequence of the great honour the Swedish Academy of Sciences has done me in awarding me this year's Nobel Prize for Physics for my work on the structure of the atom, it is my duty to give an account of the results of this work and I think that I shall be acting in accordance with the traditions of the Nobel Foundation if I give this report in the form of a survey of the development which has taken place in the last few years within the field of physics to which this work belongs.	Bohr begins by specifying the context for his document: a speech that summarizes the map of physics, a map that now includes his own additions to that map. He is reminding everyone that his speech is *not* for experts; it is for scholars, writers, researchers, politicians, and others from many different specialized fields.

The General Picture of the Atom	
The present state of atomic theory is characterized by the fact that we not only believe the existence of atoms to be proved beyond a doubt, but also we even believe that we have an intimate knowledge of the constituents of the individual atoms. I cannot on this occasion give a survey of the scientific developments that have led to this result; I will only recall the discovery of the electron towards the close of the last century, which furnished the direct verification and led to a conclusive formulation of the conception of the atomic nature of electricity which had evolved since the discovery by Faraday of the fundamental laws of electrolysis and Berzelius's electrochemical theory, and had its greatest triumph in the electrolytic dissociation theory of Arrhenius. This discovery of the electron and elucidation of its properties was the result of the work of a large number of investigators, among whom Lenard and J. J. Thomson may be particularly mentioned. The latter especially has made very important contributions to our subject by his ingenious attempts to develop ideas about atomic constitution on the basis of the electron theory. The present state of our knowledge of the elements of atomic structure was reached, however, by the discovery of the atomic nucleus, which we owe to Rutherford, whose work on the radioactive substances discovered towards the close of the last century has much enriched physical and chemical science.	Bohr quickly signals the history that preceded his own work. He goes back in time to the moment when he noticed a gap in the map that offered an opportunity for him to re-draw it, i.e., to make a claim.

According to our present conceptions, an atom of an element is built up of a nucleus that has a positive electrical charge and is the seat of by far the greatest part of the atomic mass, together with a number of electrons, all having the same negative charge and mass, which move at distances from the nucleus that are very great compared to the dimensions of the nucleus or of the electrons themselves. **In this picture we at once see a striking resemblance to a planetary system, such as we have in our own solar system. Just as the simplicity of the laws that govern the motions of the solar system is intimately connected with the circumstance that the dimensions of the moving bodies are small in relation to the orbits, so the corresponding relations in atomic structure provide us with an explanation of an essential feature of natural phenomena in so far as these depend on the properties of the elements.** It makes clear at once that these properties can be divided into two sharply distinguished classes.	Bohr was offering a model to replace an older one, the "plum pudding model" that had proven useful. His new model was far more complex, so it had to refer to a framework familiar to readers. The choice of the solar system reflects his understanding that the physics audience knew and respected this astronomical knowledge. Note that the last sentence provides a transition to much more complex material.

What does this example tell us about illustration?

The other physicists had understood the idea, and they had already entered the world of his complex descriptions, formulae, predictions, and whatever else it is that physicists do. For the audience at the Swedish Academy, the illustration was useful because he had the idea of what a new map of the atom would look like. Thus, writers must have a clear, powerful idea in order to create an illustration.

Illustration and its Relatives

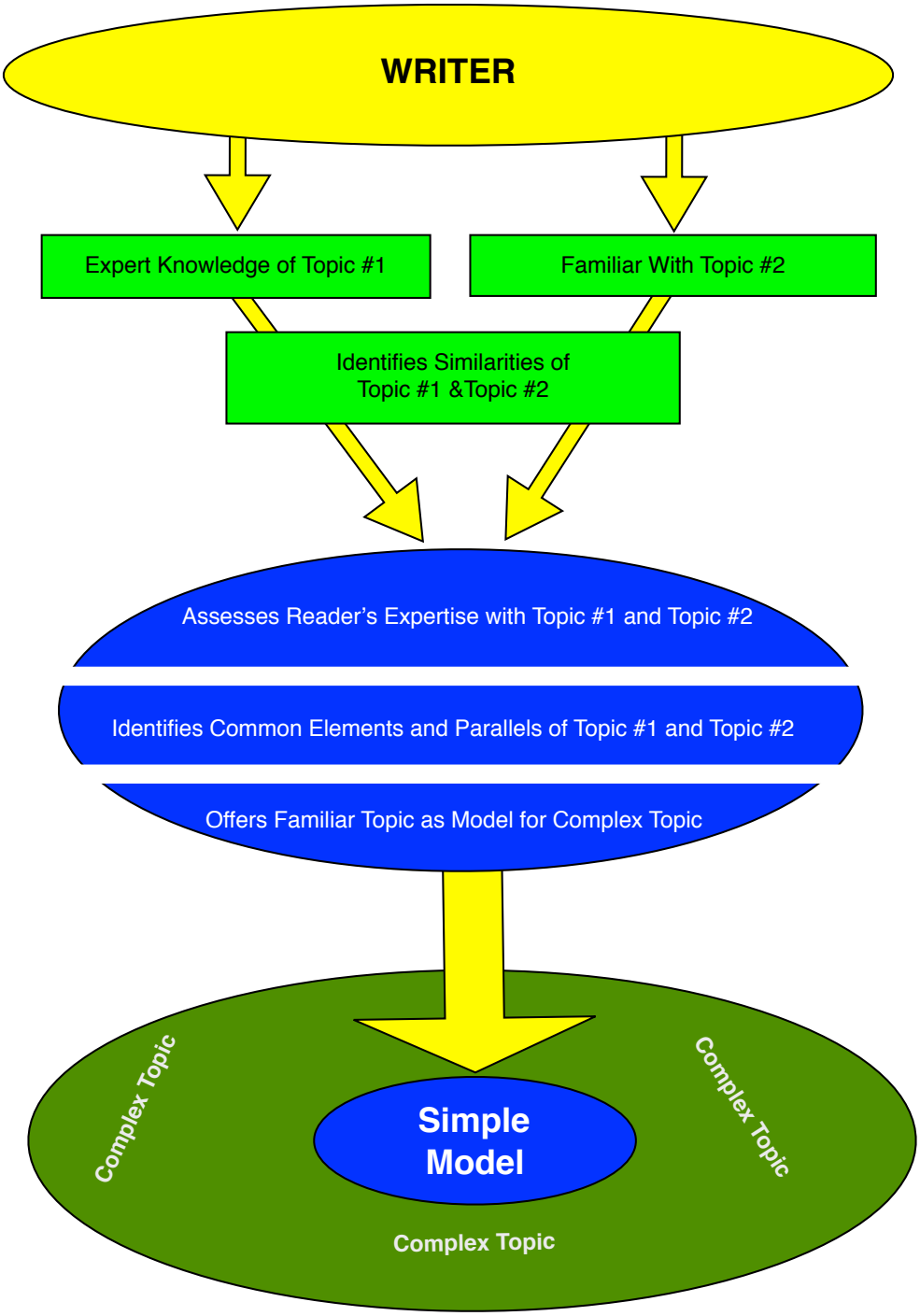
Illustration may seem an obvious tool for writers to use, but often it is not able to "stand alone" as a mode like narration or description. It works in tandem with these other modes, and this makes it powerful. When it works closely with other modes, it mutates (to continue the

scientific imagery) into a variety of other species. These are all kin, and they all share illustration as a common ancestor, but they have important differences. Among the most important of these are analogy, metaphor and simile, metonymy, and personification. Many other relatives can be named, but these are the most important because they share a connection to concrete language that implies larger abstractions.

Figure of Speech	Key Features	Frequently Used With	Weaknesses
Analogy	Implies that two "things" share an underlying set of features, and that by explaining one, the other is also explained.	Definition Comparison/Contrast Description Classification	Although a poor analogy quickly reveals its defects, an effective analogy can misuse its precise understanding of the audience to group dissimilar items into a single thing. Analogy and illustration are similar, but they *do* different things. An illustration is a large scale model that opens the readers' understanding; an analogy is a detailed parallel between two things that are inherently different.
Simile & Metaphor	Assert that one thing is *like* another. They use language that recognizes that the two are *not* the same.	Definition comparison and contrast Description Classification	Similes and metaphors provide clarity. They connect the concrete and the abstract.
Personification	The attribution of human characteristics to something nonhuman, or the representation of an abstract quality as human.	Description Classification	Although personification can have a powerful emotional impact, it conceals subtleties and tends toward extremism. Like analogy and metonymy, its assertion of an equivalence between two *different* things can be dishonest and misleading.
Metonymy	Uses a part of something complex to represent the entire thing.	Cause and Effect Argument	Metonymy tends to minimize processes by turning them into objects. The class of objects is oversimplified. For example, business people become "suits" or the dynamic balance of democratic life gets reduced to "the people."

Similar writing tactics include parable, extended analogy, and allegory, but these tend to be more literary.

A Flow Chart for Creating an Illustration



Summary

Illustration and its offspring are useful and powerful, but they offer temptations that should be resisted. While they broaden the audience and can help in understanding a new topic, they rely on techniques that can degenerate into anecdotal evidence and extremism. You may not like it when an officer stops you for speeding, but calling her a "Nazi" is an affront to history. It is neither evidence nor an argument. It has versions that seem to escape the requirement for evidence and that appear to operate without a systematic re-drawing of the map.

While it is true that illustration can exploit emotions, offer simplistic equivalences, and substitute for evidence, it is also true that it can reflect a commitment to understanding the audience's needs, expertise, openness, and experience. It can serve as an invitation to share new information by beginning with something shared by both writer and reader.