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Process

Chapter 8, Description, explained how to describe something as an object in space. In this chapter you will learn how to describe something which happens in time. Previously, in describing an *object*, you learned how to break an object into parts and then to explain how the parts fit together spatially, functionally (in order of use), or chronologically (in order of assembly). In this section, you will emphasize a *process*—how something happens in time. Like the description of the object, a description of a process requires you to break the events of a time sequence into parts and then to structure the parts in the way most relevant to your purpose and to your audience.

Three Ways to Describe a Process

When you describe a process you tell *how* something happened. You can classify the question of *how* into 3 different modes: (1) how *I* did it, (2) how *you* can do it, (3) how *it* happens.

1. Process Narrative: How I Did It

Narrative refers to relating successive events which have time in common. This mode of writing focuses on the *agent*: what I did. Thus process narrative is writer-oriented. For instance, I explain

how I made bread;
how I stained a slide;
how I operated a type of equipment;
how I performed an analysis.

A lab report or the methods section in a formal paper are the most frequent types of process narrative you will employ.

To explain how you did something, divide your process into a list of major steps and sub-steps as they apply.

This form may take the usual three-part essay development: introduction, body, and conclusion. The introduction tells what you did, how, when, why, and where you did it. The body deals with how you did it; the list of steps is given in the body. The concluding section tells what the results were or what was achieved.

Your title should be clear and comprehensive. Your steps should be logically ordered and phrased in parallel terms. Your explanation should adopt the level of technicality appropriate to your audience. Remember the rule: the less your reader knows, the more you need to explain—by way of written text or graphics.

2. Set of Instructions: How You Do It

The emphasis in a set of instructions falls on the *reader*: You tell someone else how to do something. A recipe, a computer operator's manual, a set of instructions on how to assemble a bike fall into this category of "you" focused writing. For instance, you explain to another person

how *you* make bread;
how *you* stain a slide;
how *you* operate a type of equipment;
how *you* perform an analysis.

Your knowledge of your audience is especially important here. Because another person will actually follow your instructions, instructions must be absolutely clear to the reader.

Let us suppose that you are in a two-seater airplane on your way to Catalina, and the pilot has a heart attack. You are virtually alone in the airplane. Because you know to use the radio, you call in to the local tower and ask for instructions on how to land.

If the air traffic controller tells you to keep the plane level for twenty miles, then descend over a local air strip, you are still in trouble because you do not know how to keep the nose level, how to descend, ascend, steer, lower the landing gear, and brake. In very precise detail, the air traffic controller must tell you not only the steps but also the precise way to perform each step and the location of the instrumentation needed to perform the step.

Fortunately, the air traffic controller has given you very clear steps. He told you where to locate the controls and how to operate them. He also explained the importance of pertinent gauges: the altimeter shows how high you are. If the altimeter shows 0 feet altitude, you will be flying at sea level—most runways are *above* sea level. He calls your attention to the gas gauge, the oil pressure gauge, the warning lights. He gives you a general overview of the process.

You start to relax. Flying, you discover, is just like driving.

Now the air traffic controller tells you: "Begin your descent by pushing in on the wheel slowly."

You do this. Suddenly the voice over the radio asks "Have you started your descent?"

"Yes," you answer.

"What did you do about that big water tower?"

"I went around it," you say.

"I should have told you sooner," the voice says, "we lose more small craft to that water tower."

Fortunately, you saw that giant water tower and dodged it, but you would have appreciated knowing it was coming. You dodge it. You land safely. But you did not like that surprise.

The following remarks summarize the main points for writing a set of instructions:

1. Know your audience. Instructions are written at their level.
2. Use the imperative. Instructions are directions TO a you: *you* do this, *you* do that. The imperative is the one grammatical case in English where the subject of the sentence may be omitted because it is implied: (You) turn off the engine. (You) get out through the door.
3. Explain the function or purpose of apparatus or procedure. This explanation must be complete. List *all* necessary equipment *in order* of use. Give a summary of major steps and principles of operation, as they apply, before you explain the separate steps.
4. Divide the instructions into logical steps and explain each step in order.
   Each step should deal with one level of operation. Maintaining altitude, Steering, Lowering the Landing Gear, Beginning Descent, Touch Down, Braking, and Turning Off the Engine would be separate steps in this procedure.
5. Divide steps into substeps as necessary.
   Touch down has five substeps:
   (a) Leveling the nose
   (b) Trimming the flaps to stabilize the wings
   (c) Contacting with ground
   (d) Readjusting nose and wings
   (e) Decelerating
   Note: Deceleration is a different step than braking because "not moving forward" is a separate act from "stopping." Deceleration means you do not apply gas to move forward. Braking means that you do something particular to stop.
6. Give *all the steps* necessary to the procedure per the experience of the operator.

You would be in trouble if you managed to land safely but did not know how to stop the plane once it was on the ground. You also need to know how to turn it off and get out because neither you nor the ground crew want to step into a turning propeller.

7. Give warnings, notes, danger signs and preconditions BEFORE the explanatory step.
   For instance, the air traffic controller should have told you a water tower stood in the path of your descent *before* he told you how to make your descent. If you have used a cook book, you will know that frequently the first instruction for baking is *Preheat the oven* even though the last thing you do is put the food in the oven.
8. When you write instructions, phrase the steps in grammatically parallel terms. "Braking" and "Leveling the Nose" are all phrased in the "ing" forms.

3. Process Analysis: How It Happens

The emphasis on this writing falls on the *subject*: what happened. Process narrative is subject-oriented:

how bread is made;
how a stain takes in a cell;
how an analysis is performed.

Process analysis deals with relationships in time and how things are made. Because it concerns time, it is cited in the chapter on description; however, its place in this chapter is formal. Process analysis extends conceptually into the realm of causal relations.

Causality

Causality refers to the relationship between causes and effects, i.e., to the way that one object, phenomenon, or state gives rise to, prompts, creates another. Other verbs which designate *cause* include:

originate, give rise to, bring to pass, make, produce, create, develop, beget, contrive, effect, effectuate, engender, foment, generate, incur, induce, precipitate, prompt, provoke, inspire, trigger, evoke, elicit.

Note: before you use a synonym for *cause*, be sensitive to the nuances of the word. These words range in meaning from "directly producing an effect" to "calling an effect into being."

Cause-effect proposes a relation between two elements, such that no B is produced in the absence of A; and that the presence of A and A alone produces B.

There are two kinds of writing tasks associated with cause-effect: One starts with the effect and works backwards to causes; the other begins with cause and generates effects from it. If you are assigned a causal analysis paper, you must identify your starting point as either cause or effect.

In general, an essay which analyzes cause gives students the most problem, in part because it calls for the most abstract thinking. When you analyze cause, you try to explain why something happened. When you analyze an effect, you explain the consequences or results of a certain action.

> **Cause:** Questions of cause may be *why* or *how* questions. What causes cancer? What causes AIDS? What causes epidemics? What causes measles? What causes electricity or storm? Why do students get good grades, bad grades? Does TV violence cause social violence? Why can a frog reproduce parthogenetically?

Do not confuse remote cause with proximate cause. See below.

> **Effect:** It is usually easier to analyze and explain effects because you work backwards from a known result. Analysis of effect also deals with *how* and *why* questions. When your chemistry instructor asks you to explain what happens when mercury chloride is mixed with mercury metal or when you write the Discussion section of your formal report, you analyze effects.

The Discussion section of formal papers deals with a discussion of effects and how they came about. The Discussion deals with whether these were expected or predicted results (per your hypothesis or compared with other work in the field) or accounts for discrepancies between expected results and actual results. A research question may be a causal question; the results are the effects. The experiment is devised to test the causal relations; the results demonstrate the effect.

In an experimental situation or any other situation in which you investigate cause-effect relationships, you must mark out the boundaries of the investigated process. A cause can produce an effect which in turn becomes the cause of another effect and so on. The controlled conditions of an experiment attempt to delimit the boundaries of this process.

An example will elucidate the importance of defining the boundaries: One cause of a tidal wave is an earthquake at sea. The earthquake sends out seismic shocks which are distributed in the water, and since water moves more slowly than the sound waves, a mass of water builds up and strikes the land with a force that is greater than the force and fury of a normal wave

The effects of the tidal wave are many. Houses are destroyed, piers fall into the sea, boats are tossed and pulled from their moorings, effluents normally discharged through pipes are forced back up into pipes.

The cause of the tidal wave is the earthquake.

The effect of the tidal wave is the destruction of property.

The cause comes first. The effect is the outcome.

But, you might argue, the earthquake is *really* the cause of the destruction; the earthquake came first and it, ultimately, created the destruction. The destruction to property can be understood as the effect of a tidal wave in one scenario. However,in another scenario, the destruction could be construed as the final cause of the tidal wave.

Kinds of Causes

Proximate and Remote Causes

The previous example asserted that the tidal wave was the direct cause of property destruction. Another word for direct cause is *proximate*. The proximate cause in a chain of events is immediately prior to the event. What is the closest cause for the destruction? The tidal wave. While the earthquake causes the tidal wave, the earthquake ITSELF did not destroy the pier. The earthquake is a cause but not a direct cause; it is a *remote* cause because it is farther away from the situation than the proximate cause.

It is advisable to deal with proximate causes rather than remote ones to avoid many steps of backtracking. In order to deal with direct causes, you need therefore to carefully identify what change you want to investigate. If you deal with the tidal wave, it must be the center of your cause-effect analysis.

before — FOCUS — after
cause — situation — effect
earthquake — tidal wave — destruction

If you focused on the earthquake, you would come up with a completely different analysis. The cause of the earthquake is shifting tectonic plates in the earth; the effect of the earthquake is the tidal wave.

FOCUS
cause — situation — effect
earth tectonics — earthquake — tidal wave

Let us change this around one more time, and place the destruction of property in the central position. The cause of mass destruction is the tidal wave; the effect of this destruction is that businesses close, people lose money, schools are closed.

FOCUS
cause — situation — effect
tidal wave — destruction — businesses closed

When you write a process analysis, be very precise in selecting the term you emphasize. A slight shift of focus will entirely alter your essay.

Unless otherwise specified, deal with proximate causes rather than remote ones. When you deal with causes so remote that you engage ultimate causes or first causes (Why was I born? Why is there life on earth?), you are in a realm of philosophy known as metaphysics—*physics* is the Greek word for "nature"; *meta-* means "transcending or comprehending." According to *The American Heritage Dictionary*, metaphysics, based on speculative or abstract thought, "is a branch of philosophy which investigates the nature of first principles and problems of ultimate reality including the study of being (ontology) and, often, the study of the structure of the universe (cosmology)."

Some guidelines for proposals will make the following specification: "State the broad, long-term objectives (of your research project) and describe concisely and realistically what the specific research described in this application is intended to accomplish and any hypotheses to be tested." Specifications for the background ask you to "State concisely the importance of the research described in this application by relating the specific aims to the broad, long-term objective." In asking you to define the long-term objectives of your research work and how the present research will accomplish those aims, you are asked to situate the proposed research within a cause-effect relationship. In other words, what immediate effect will your research produce, and what long-range effect may be possible?

Long-range effects may difficult to assess because you have no way of knowing how your paper may contribute to the body of received knowledge in the field or may stimulate others working in a related field. Beyond a certain reasonable range of extension, such matters fall into weaker causal relations of influence than direct cause. Be circumspect in describing the long-range effects of your research.

Necessary, Contributory, and Sufficient Causes

In addition to proximate and remote causes, there are three other kinds of causes: necessary, contributory, and sufficient. The categories are not mutually exclusive; it is possible to have a proximate necessary cause and a proximate sufficient cause.

A *necessary* cause is one that must be present for an effect to occur but by itself cannot cause the occurrence of the effect. Water is a necessary cause of a tidal wave; you have to have water in order to have a tidal wave. But other factors have to be involved before a normal wave turns into a tidal wave.

A *contributory* cause may produce an effect but cannot produce that effect alone. While good training may *contribute* to the success of an athlete, good training by itself cannot take the place of good reflexes, a strong constitution, and a knowledge of the game. A storm may contribute to the effect of a tidal wave but cannot be a greater force than that produced by a storm is necessary to create a tidal wave.

A *sufficient* cause can produce the effect by itself. A heart attack alone can kill even though a person has an ulcer, a sprained ankle, and a sore throat. A heart attack is a sufficient cause of mortality.

Most causes are not sufficient; most are a combination of necessary and contributory. When you explain causes which are not sufficient, you must explain how the causes interrelate.

It is appropriate at this point to offer another ordering of causes, derived from a classical Greek philosopher, Aristotle.

Aristotle formulated four types of causes: efficient, material, formal, and final.

The *efficient* cause of an event or thing is that which stops or starts it. The efficient cause is explicated by specifying its place in time. For example, the earthquake is the efficient cause of the tidal wave. The matter of a thing is its *material* cause: The material cause of the tidal wave is water. The *formal* cause ascribes causal relations to essence or nature. The behavior of water under conditions of stress is the formal cause of the tidal wave. The *final* cause is the ultimate end for which is a thing is made or a process started. The final cause of the earthquake is the release of stresses in the earth.

In a Darwinian view of evolution, the final cause is the continuation of a species. Another word for end (understood as a final point) is *telos;* explanations which concern themselves with the final goal are called teleological. Teleological explanations are framed in different ways; from the standpoint of evolutionary biology, teleology relates to survival of the species. In other disciplines like philosophy or metaphysics, teleologic concerns can be framed so broadly as to include: "What is the final meaning of life?"

Explanations about the final cause may be considered teleological; speculation about the ultimate end of processes or things may take one into the realm of philosophy rather than science. While the final cause of the acorn may be said to be the oak, this question could be complicated by asking what is the final cause of the oak?

In discussions about final causes, it is tempting to impute agency to an inanimate object, as in the acorn *desires, aspires, wants to be, wills itself* to be an oak. This inferred agency underlies theories of the universe which impute celestial and terrestrial motion to a Prime Mover; a universe conceived as a Grand Design implies a Grand Designer. While not to engage too fully with metaphysical first causes, it should be pointed out that English, and romance language grammar, by virtue of the nature of the language, always permits the creation of a linguistic agent. Nearly every verb can be converted into a noun of agency: do/doer, go/goer, think/thinker, design/designer, pattern/patterner. Our language, save in rare cases, does not permit us to think of an action without a doer of the action; an exception to this is the word happen. We do not speak of a "happener."

Effects

Analyzing Effects Using Comparison/Contrast

1. Identification of the Effect.

Precisely identify the effect you want to examine.

Your focus is extremely important. Distinguish between effects and side-effects, between products and by-products, between the direct effect of a cause and the effect of an effect.

When the orthopedic surgeon Paul Brand went to Vellore, India, in 1947, he wanted to use reconstructive surgery to treat the ailments of lepers. Among the effects of leprosy were blindness, clawed limbs, loss of fingers and toes. While the *bacillus leprae* directly produced tubercles which destroyed the delicate nerve endings responsible for sensation, there was no reason to account for the sloughing-off of body parts. After he shook hands with a leper, Dr. Brand noticed that the leper possessed unusual strength; he came to find that the strength itself was not unusual but that, in the absence of sensory input, the leper could feel neither pressure nor pain. In fact, limbs were lost in the course of everyday errands because the leper could not feel pain. Some lepers lost extremities to the rats which infested the buildings at night. Loss of feeling led to loss of limbs. Furthermore, lepers acquired eye infections and ulcers because, in the absence of sensation, the lepers did not blink away irritating dust or foreign bodies. Blinking is also an eye-washing reflex; without this response, the lepers suffered eye infections. While the direct effect of the bacillus was the production of tubercles, blindness and limb loss were the effects of effects.

2. Discuss the end with reference to the beginning.

Start with the end of the process first. The results or the process are the terminal point of the process; you want to explain how you got there. In order to explain how you arrived at a point, you need to explain where you started. For instance, if I told you my airline flight ended at Los Angeles, you would not have very much information about types of airlines, routes, or itineraries, length or significance of the journey unless you knew where I started. A trip that starts at New York City and a trip that starts at Mexico City are completely different trips. You discuss the end with respect to the beginning in order to pinpoint the change.

To describe a change, look at what happened before the change, what happened after the change, and explain the events or phenomena that intervened to make the end result from the beginning. In scientific experimentation, this takes the form of comparing your hypothesis with your experimental results — how are they alike? how are they different?

False Cause

When engaging in a cause-effect analysis, be careful to avoid errors in reasoning called fallacies. The fallacy apposite to this discussion is called false cause. This fallacy describes an error in attributing cause to something which had no causal relation. To ascribe a causal relation to things which are correlated is fallacious. For instance, while there may be a correlation between men who eat Cheerios and men who do not get pregnant, there is no causal relationship to suggest that Cheerios prevent men from getting pregnant. A related fallacy is called *post hoc, ergo propter hoc.* This fallacy refers to ascribing causal relations to events related in time. The passenger who said, "I should have left the lights on," after he turned off the stateroom lamp and the Titanic sank is making such an attribution. This passenger asserted that because he turned off the lights, the Titanic sank.

Exercises

1. Changing Orientation

The following passage comes from a sixteenth-century book on magnetism. Although you may find the language a bit strange, the following passage contains a very orderly set of instructions. Rewrite Gilbert's essay into a set of instructions in modern English with headings. Make sure that you have an introduction and a conclusion; sufficient information in this passage permits you to write both.

William Gilbert was an English doctor born in England in 1540 (d. 1603). His contemporaries were Shakespeare (1564–1616), Galileo Galilei (1564-1642), and Andreas Vesalius (1514–1564). In 1573, Gilbert was elected to the Royal College of Physicians. He became physician-in-ordinary to Queen Elizabeth I, who so favored him that she settled an annual pension on him (said to be the only legacy left by her to anyone).

During his studies, Gilbert was first interested in chemistry but later turned to magnetism and electricity, which, while known in the east, had received no discussion in western civilization since the time of Thales. Gilbert's book *De magnete* caused no stir in England but was received enthusiastically in Europe, where it is said Galileo turned to studying magnetism after reading it. Although Dr. Priestley called Gilbert "the father of modern electricity," Gilbert's work is more important for its emphasis on the inductive method based on the observation of physical phenomena. This method was a relatively new idea at the time; the previous method of science had been based on the authority of the ancients.

Chapter IV. Which Pole Is the North: How the North Pole Is Distinguished from the South Pole

One of the earth's poles is turned toward Cynosura [constellation] and steadily regards a fixed point in the heavens (save that it is unmoved by the precession of the fixed stars in longitude, which movement we recognize in the earth, as we shall later show); the other pole is turned toward the opposite aspect of the heavens, an aspect unknown to the ancients, but which is adorned with a multitude of stars, and is itself a striking spectacle for those who make long voyages. So, too, the loadstone possesses the virtue and the power of directing itself toward the north and the south (the earth itself co-operating and giving to it that power) according to the conformation of nature, which adjusts movements of the stone to its true locations. In this manner it is demonstrated: Put the magnetic stone (after you have found the poles) in a round wooden vessel—a bowl or dish; then put the vessel holding the magnet (like a boat with a sailor in it) in a tub of water or cistern where it may float freely without touching the rim, and where the air is not stirred by winds (currents) which might interfere with the natural movement of the stone: there the stone, as if in a boat floating in the middle of an unruffled surface of still water, will straightaway set itself, and the vessel containing it in motion, and will turn in a circle till its south pole shall face north and its north pole, south. For, from a contrary position, it returns to the poles; and though with its first too strong impetus it passes beyond, still as it comes back again and again, at last it rests at the poles or in the meridian (save that, according to the place, it diverges a very little from those points, for from the meridional line, the cause of which we will define later). As often as you move it out of its place, so often, by reason of the extraordinary power with which nature has endowed it, does it seek again its fixed and determinate points. Nor does this only occur only when the poles in the loadstone are made to lie evenly in the plane of the horizon; it takes place also even though one pole, whether north or south, be raised or depressed 10, 20, 30, 40, or 80 degrees from the plane of the horizon; you shall see the north part of the stone seek the south, and the south part the north. . . . Further, it is to be remembered that all who have hitherto written about the poles of the loadstone, all instrument-makers and navigators, are egregiously mistaken in taking for the north pole of the loadstone the part of the stone that inclines to the north, and for the south pole the part that looks to the south; this we will hereafter prove to be an error. So ill-cultivated is the whole philosophy of the magnet still, even as regards its elementary principles.[1]

2. Correcting Instructions: Blowing Up Caterpillars

The following are a set a directions for preparing an insect specimen, a caterpillar, for a collection box. But these directions need revision at the level of content and at the level of grammar and punctuation. Fill in any missing parts. Check the equipment list against the procedure—is it complete and ordered by use? Use headings to divide the text and use headings to separate the steps. Are all warnings or notes put in the appropriate place? Are there are any steps which should have warnings?

Blowing Up Caterpillars

Caterpillars are juicy, and if left to dry out by themselves, they will rot, discolor, and smell. To preserve them one must make sure that all of the organisms of decomposition (bacteria) are excluded because the environment is made unsuitable for them to grow and reproduce. The caterpillar may be placed in a chemical preservative such as 70 isopropyl alcohol or a solution of formaldehyde, or the flesh of the caterpillar that may support bacterial life can be removed and the remaining exoskeleton dried.

In this exercise, you will learn how to remove the juicy caterpillar contents and dry the remaining exoskeleton in a somewhat lifelike appearance.

Equipment: drying oven; alcohol lamp; matches; canula; wooden dowel; caterpillar pump and hose; balsa wood scraps; insect pin; fingernail polish (clear).

Procedure: With fine scissors cut around the anal opening of freshly killed caterpillar. If the larva has poisonous spines or hairs handle with caution. Lay the caterpillar on paper towel and gently and carefully roll the wooden dowel over the caterpillar from behind the head toward the anus. This process will squeeze the contents of the caterpillar out of the opening that you cut around the anus. This should empty the "bag" (the caterpillar) without breaking the skin. Make sure that you point the anal end of the caterpillar away from you. Now insert the tapered point of the canula into the anal opening of the caterpillar and hold the larva in position with the spring clips. Attach the end of the rubber hose of the pump to the canula and pump the caterpillar with air until wrinkles and bands are smoothed. Make any minor adjustments that are necessary with forceps but do not puncture the larvae. Insert the caterpillar now on the end of the canula into the oven and observe it through the glass plate that forms the top of the oven. Turn the caterpillar in spit-like fashion until it is dry. As soon as it holds its shape upon release of the pressure in it you can remove it from the canula.

Insert a piece of balsam into the anal opening and glue it there with the fingernail polish, Duco cement or shellac. Put the insect pin in the balsam plug and attach labels to the pin. The caterpillar is now ready for the collection drawer.[2]

Notes

1. William Gilbert, *De Magnete*, trans. P. Fleury Mottelay (New York: Dover Publications, 1958); this is an unaltered republication of the 1893 translation), pp. 26–27.
2. This exercise was developed by Professor Wayne Losano, University of Florida.