

Component One:

Three Comprehensive Categories of Knowledge

Earthscore uses three comprehensive categories of knowledge. Before presenting the three comprehensive categories of knowledge in a formal way, I want to provide the reader with some examples of how these categories have been used to educate people about sustainability. These examples are all taken from *Metropolis*, a magazine about architecture and design based in New York City. In September of 1996, the editors devoted an issue to sustainability and used Earthscore's three comprehensive categories of knowledge to analyze a dozen items in terms of their sustainability. I cannot reproduce their sophisticated layouts and striking graphics in this document, but I can provide the text. As educators, you will immediately see how these examples and this way of analyzing items could be used to create lessons and assignments having to do with sustainability.

MAGAZINE PAPER

Quality:

Glossy cover, matte pages, crowded with images and words, conveyer of information, filler of dumps around the world.

Fact:

Fifty years ago, some 30 percent of paper was recycled in the U.S. annually. But as glues replaced easy-to-remove staples in bindings, mills were unable to handle the chemicals and recycling fell. Today, tissue and newsprint mills are driving the demand for recycled paper up again. More than 1.3 million tons of old magazines were recycled last year, but "old magazine" paper has to be separated from newspapers and other paper, and even cities with sophisticated curbside collection networks don't always enforce separation rules.

Pattern:

Even more paper can be recycled once it has been de-inked, but that process raises environmental concerns. In the South Bronx, efforts to build a huge de-inking plant have met with enthusiasm from recycling proponents and those seeking jobs for the community-but sharp criticism from those who worry about chemicals winding up in the Hudson River.

Ultimately, we will have to move beyond recycling paper to real reductions in paper other wood-fiber products. One promising solution for producing "treeless paper" is hemp, a fast-growing pulp-producing crop (that's illegal in the U.S.). China's leading the way; in 1994, 80 percent of its paper came from plant pulp.

D U N G B E E T L E

Quality:

Iridescent green shell, six spindly clawed legs, no bigger than a thumb print, disgusting to some, sacred to others

Fact:

The life work of coprophagous arthropods is speedily rolling balls of dung into little nests in which they lay their eggs and on which their hatched larvae feed. Thousands of beetles converging on a three-pound dung heap can roll it away in little balls in just two hours.

Pattern:

Without these beetles, we would be knee-deep in dung. By eliminating organic materials and disease-breeding waste, and producing new life

from it, they are the ultimate recyclers. That's why the Egyptians so revered scarabs-they symbolized eternal renewal. It has been suggested that by importing more dung beetles, U.S. farmers could avoid losing thousands of acres of grazing land to heavy manure contamination.

T I R E

Quality:

Tarry to the touch, matte black streaks on the road, rubbery strips scattered along highways, heaps of discards exuding a pungent oily odor on a hot afternoon

Fact:

A set of four car tires lasts about 40,000 miles and costs drivers less than a penny a mile. Producing one tire requires some 200 different raw materials, including 20 gallons of oil, yet the U.S. throws away some 250 million tires a year-far more than any other country. Recyclers bought 69 percent of those scrapped tires last year, but there are at least 800 million junked tires marring the landscape of cities and countrysides and creating fire hazards; billions more clog landfills.

Pattern:

Some manufacturers use old tires when they make new ones, but reconditioned rubber accounts for less than 2 percent of a new tire. When they are recycled, it's mostly as fuel for utilities: two-inch shards called "tar chips" can be burned like coal. While by no means "clean," tar chips tend to emit fewer particulates and toxins than coal burned alone.

CITY BUS**Quality:**

Behemoths spewing exhaust fumes, choking pedestrians, slow-but unfaillingly predictable, crowded with expressionless passengers of all sizes, shapes, colors.

Fact:

Gas-fueled vehicles produce nearly 80 percent of carbon monoxide emissions, a third of the pollution from carbon dioxide (linked to global warming), and half of the hydrocarbons responsible for the destruction of the ozone layer. But a commuter at the wheel of a car generates 90 percent more hydrocarbon emissions and 75 percent more carbon monoxide than a bus rider.

Pattern:

Buses and other mass transit make communities run efficiently. They can be lifelines to some-senior citizens, young people, the disabled, and the poor-and a key link to employment. In Indiana, public funding of the transit service was shown to return \$6 for every \$1 invested. If communities switched to electric buses, they could still reap these benefits while cutting down on air pollution and helping generate a larger market for electric vehicles.

J U I C E B O X

Quality:

Colorful label, rectangular box, lightweight, fits in hand, cool and clammy when first out of the fridge, just poke the short straw through the little pre-punched, foil-covered hole and drink "fresh" juice or milk

Fact:

Aseptic packaging is made up of a "sandwich" of polyethylene, paperboard, and aluminum foil. It preserves without refrigeration, and its

lightness and compact form make it easier and cheaper to ship and store than glass bottles.

Pattern:

There is little waste involved in making juice boxes, especially compared to glass and steel containers, but they are not easily recyclable, because their layers must be separated-through hydropulping-to be reused. Presently, aseptic containers make up only a tiny fraction of the packaging used in the U.S., so there are few facilities capable of recycling them. Only 2 percent are recycled, their paper layers converted into such products as paper towels. Actually, Americans enjoy the least efficient juice boxes around-ready-to-drink, single-serve containers. To maximize this product's benefit, we would emulate the Europeans, who use larger sizes that store concentrates instead.

W A T E R

Quality:

Refreshing, gentle raindrops, rushing streams, enveloping ocean, essential to the planet's life, sometimes deadly in power

Fact:

The Earth is mostly covered in water, but because of pollution and

operational limits, there is only enough fresh water to keep us supplied for the next 20 to 30 years, if demand continues to increase at the present rate. Two congressional bills now pending would eliminate Clean Water Act protections for 71 percent of the country's remaining wetlands, which naturally conserve and purify our precious supply of fresh water.

Pattern:

Rich societies can afford to import water from their neighboring (and poorer) countries or states. Poor nations must ration water, often pitting communities against each other and against new development that could bring jobs but would further deplete water supplies. In the future, diminishing supplies may lead to armed conflict over water rights, and catastrophic famines.

VOLCANIC ROCK

Quality:

Dark, gritty, grainy, bubbly, or crystalline, they range widely in form and color

Fact:

Often when continental plates push, grind, and scrape against one another, molten lava may either burst or seep out of the Earth's surface. Exposed to air, it hardens into igneous rock, in the form of densely packed microscopic crystals or volcanic glass.

Pattern:

There is a cycle to rocks. Igneous weather into sedimentary rocks, and when subjected to intense heat or pressure, both igneous and sedimentary can turn into metamorphic rock. Over billion-year chunks of geologic time, every cubic inch of ground will be transported back into the Earth's crust, in what might be the greatest natural model of recycling.

C O R N**Quality:**

Tough and stringy husks, silky linings, crunchy kernels, juicy when cooked, gold- and pearl-colored, sweet and tangy, ground into fine yellow meal

Fact:

Corn, first domesticated in the Western Hemisphere, changed life for Native Americans. This bountiful crop, they discovered, didn't harm the ecosystem like other plantings they had tried. Maize agriculture enabled many tribes to change from hunter-nomads to settled cultivators. Today, U.S. farmers produce over 9 billion bushels of corn each year. It is used to produce livestock feed, food additives, microwave popcorn, and ethanol, an alternative fuel.

Pattern:

Corn is a favorite crop of agribusinesses, which are less interested in "cultivating" the land than in making a profit. Fields made productive through such artificial means as chemical fertilizers and irrigation, necessary for large-scale corn production, suffer from soil degradation. The U.N. Environment Programme reports that since 1945, we have been losing 108 million acres of productive agricultural land to such degradation yearly, a total of 4.85 billion acres worldwide. Sadly, corn, as it's largely grown today is not the sustainable crop that it was when the Indians first harvested it.

ELECTRONICS

Quality:

Radios strapped to joggers' arms, boom boxes on the sidewalk, beepers beeping, the hazy blue light of TVs flickering in every home's window, digital displays and computers at home, at work, at school, at the movie theater, at the grocery store

Fact:

Electronic equipment is constantly becoming obsolete. Some 27 pounds of chemicals and 4,267 cubic feet of bulk gases are used in the production of just one eight-inch silicon computer wafer. Of the 29 Superfund sites on the National Priorities List for cleanup of contaminated soil and water, 24 are in the Silicon Valley and are attributable to high-tech industry. A mere 3 percent of this country's electronic discards are refurbished or recycled. Some 12 million computers are trashed each year; many are shipped to China, then burned, releasing toxic chemicals into the atmosphere. And there's no end in sight. By 2005, 150 million personal computers are expected to wind up in U.S. landfills.

Pattern:

Making electronic parts has health repercussions, too: semiconductor workers get sick three times as often as those in other industries. But despite how polluting this kind of manufacturing is, the government has enthusiastically subsidized the industry. Unfortunately, these innovation-

rich companies seem to be spending little of their creative and financial resources to find cleaner, more sustainable methods of production.

(Copyright (©) 1996, VirtuFlex, Inc., 930 Massachusetts Avenue, Cambridge MA)

These three categories of quality, fact and pattern were developed by the American philosopher, Charles Peirce (1839-1914). Peirce is the giant behind William James and John Dewey. He is acknowledged by scholars as the best philosopher America has produced. For Peirce, all knowledge comes in these three basic categories. Peirce argued that by working with these categories, it is possible to determine, from our knowledge of some parts of what we are investigating, what other parts are missing, and to prevent arbitrary additions. Knowledge can grow organically, like the body of an animal. By thinking about sustainability using these categories we can develop a unified and comprehensive understanding of the ecology, and of ourselves in relation to the ecology.

Peirce called the category of quality *firstness*. The taste of banana, warmth, redness, feeling gloomy: these are examples of *firstness*. *Firstness* is the realm of spontaneity, freshness, possibility, freedom. *Firstness* is being 'as is' without regard for any other.

Peirce called the category of fact *secondness*. *Secondness* is a two-sided consciousness of effort and resistance engendered by being up against brute facts. The actual 'thisness' of something, as it exists, here and now, without rhyme or reason, constitutes *secondness*. To convey the pure actuality of *secondness*, Peirce often used the example of pushing against a door and meeting silent, unseen resistance.

Peirce called the category of pattern *thirdness*. *Thirdness* mediates between *secondness* and *firstness*, between fact and possibility. *Thirdness* is the realm of habit, of laws that will govern facts in the future. With a knowledge of *thirdness* we can predict how certain future events will turn out. It is an 'if...then' sort of knowledge. *Thirdness* consists in the reality that future facts of *secondness* will conform to general laws.

Note that in naming these categories, Peirce hypostatizes the terms first, second and third. To hypostatize is to make some characteristic of something stand on its own. For example, we do this when we see the happy face of a baby and then talk of happiness. The phrase "the pursuit of happiness" puts "happiness" on a pedestal. We turn an adjective into a noun, we make a quality into a something, in and of itself. Peirce makes the term "first", which

conveys coming before anything else, stand on its own and mean being such as it is without regard for any other, i.e., firstness. The term "second" which originally meant "other" is made to mean that which one is up against, i.e., secondness. The term "third" in Peirce's thinking does not mean the number ranked after the second in a sequence, but implies laws about relationships. Peirce was a trained chemist and when he talked, for example, about a molecule that could form a compound with three other molecules he described it as having "three hands out." Peirce showed how with multiples of three hands out, any level of complexity beyond three could be generated. By contrast, if you have just two hands out, you can make strings and you can make circles and there it ends. (Figure #. Diagram of two hands out and three hands out. Strings and circles. Network of three hands out.) Thirdness stands on its own as the most inclusive category, the category of relationship. For Peirce and the Earthscore notation, there is no "fourthness". Any "fourthness" would, by definition, really be a thirdness, that is a complexity generated by "three hands out".

Prescinding

One unusual feature of Peirce's categories that must be understood is how they relate to each other. Peirce explains the interrelationships between the three categories in terms of the mind's ability to prescind. Prescind comes from the Latin "prae" and "scindere", meaning literally, "before" and "to cut". Not to be confused with "precision", which means to cut carefully, "prescinding" was used in medieval philosophy to describe a way of thinking "before the cut". Prescinding is the ability to pay attention in one category without severance from the other categories. You can pay attention to sound without paying attention to music; however, you cannot pay attention to music without also paying attention to sound. You can prescind sound from music but not music from sound. This way of thinking without cutting cultivates a way of knowing respectful of wholes.

As an example, let me pay attention to the mug of tea on my desk. I may think about the warmth of the mug without thinking about the actual mug: I prescind firstness from secondness. When I move my hand into the place where the mug actually is, I do meet with the resistance of its secondness, its

actuality. That actuality includes the warmth of the tea. Secondness includes firstness. I can mindlessly (no thirdness) knock the mug over. This is an example of secondness prescinded from thirdness. I can also predict on the basis of my knowledge of the laws of physics and gravity that if I strike the mug with sufficient force at the right angle, the mug will overturn and the warm tea spill out. My prediction can preclude my spilling the warm tea. Thirdness mediates secondness and firstness. One shorthand way to understand prescinding is to realize if you don't know what it is you are thinking about, you're in firstness. If you know what you are thinking about but have no sense of the context, you are in secondness. If you understand the context, you are in thirdness.

Hybrid Categories

Because these categories are related by prescinding, an interesting refinement becomes possible. Since firstness is not separated from secondness, we can speak of a firstness of secondness. The 'ouch' sounded by someone struck with a thrown rock is an instance of the firstness of secondness. The brute fact of the rock hitting the person is actually there, secondness. It is not constructed or determined by the person's feelings alone. Yet for the person

hit a feeling attaches to the brute fact, a feeling evident in the involuntary cry, firstness of secondness. Firstness of thirdness is another hybrid category, indicating the immediate intuition of law, an instant vision of a complex process. There is also a secondness of thirdness. The hand of the sheriff on your shoulder, if you are caught breaking the law, would be an example of the secondness of thirdness, force following from law. Firstness of secondness, firstness of thirdness, and secondness of thirdness complete the combinations of comprehensive categories possible in Peirce's system of knowledge. By definition, there can be no thirdness of secondness,- i.e., no pattern to a brute fact,- or thirdness of firstness,- no law embedded in a pure quality- or secondness of firstness,- fact generated by feeling alone. In component four and five of the Earthscore Notation, we will see how the hybrids of firstness, secondness and thirdness become important.

The critical thing about these categories is that they are comprehensive. As we attempt to learn about sustainable society, we are confronted with 'everything'. We need to make selections. If those selections are arbitrary, our final understanding may leave out significant aspects of our situation. Significant omissions can make our interpretation faulty. Faulty interpretation can result in a failure to achieve sustainability. Peirce's categories of firstness, secondness and thirdness are, in effect, a theory of everything. Using these

comprehensive categories, it is possible to make selections that are responsible to 'everything'.

The Categories as Skill Sets

While it is important to understand firstness, secondness and thirdness in all their "nessness", hypostatized terms are difficult to teach. Often in teaching, I do not use any "ness" word. Rather I translate these three categories into learning according to three generic skill sets: the first skill set, the second skill set and the third skill set. I insist that students always already use these skills in their living and learning. Earthscore simply cultivates these three ways of knowing as generic skills. Note that talking about the "first skill set" moves away from pure firstness, i.e., mood-feeling-quality toward the firstness of thirdness, i.e., intuition of a pattern. Skill involves habit and, therefore, some pattern. In practice it is very hard to pay attention to pure feeling and quality, pure firstness. Most people tend to combine firstness with thirdness naturally. For most learning exercises this natural combination is not a problem. Where the differentiation between firstness and firstness of thirdness does become important, as in the fourth and fifth component of Earthscore, the differentiation can easily be made.

In the worker curriculum I developed (Ryan 95), very exercise uses a combination of all three skill sets. For example, in problem solving, stating the problem is a second, thinking of an analogy for the problem is a first and applying the analogy to the problem is a third. In negotiations, focusing on interests is a second, inventing options is a first and referencing standards is a third. One tool in the school-to-work curriculum that is very effective is a performance profile, a questionnaire that outlines for the participant where his or her skill sets are strongest. For example, I'm very strong in the intuitive category but not so strong in the world of facts and specifics. That profile helps me select good teammates that can complement my strengths and help me strengthen my underdeveloped skills.

These generic skill sets speak to lifelong learning, necessary in a sustainable society that must maintain alertness to changes in ecological systems. Since we are always using these skills, they can be activated in any age group in any circumstance. These generic skills also speak to the questions of interdisciplinary curriculum. Each discipline can be approached based on these three comprehensive categories. In science, the first skill set has to do with abduction, the second with induction and the third with deduction. In mathematics the first set has to do with intuitive sketches or diagrams of a

problem, the second with measurement and the third with calculation. In literature, the first skill set has to do with poetry, the second with descriptive prose and the third with reflective essays. In social studies the first has to do with prejudice, myth and ideologies, the second with facts and conflict and the third with law, governance, policy and practices. Clearly, the comprehensive categories provide a framework for combining the disciplines in addressing sustainability.

One Peirce scholar has written a wonderful article on how the method of Sherlock Holmes and the three categories of Charles Peirce accord. (Sebeok, 1981) Holmes crawling around on the ground with a magnifying glass looking for clues exercises the second skills set, playing the violin in a state of revelry in the middle of a case exercises the first set, and his powers of deductive reasoning to solve the crime exercise the third set For educators, The Sherlock detective motif is a great way to create Sleuths for Sustainability.

Questions for Component One

1. Explain firstness.
2. Explain secondness.
3. Explain thirdness.
4. Explain how firstness, secondness, and thirdness are related.
5. Explain the firstness of thirdness.
6. What does hypostatize mean?
7. Why is it important to have comprehensive categories with which to approach sustainability?
8. How do the three categories map onto skill sets?
9. Describe how you use each of the three skill sets, personally and in the classroom.

10. Indicate in which skill set each of the following activities belong.

Inventing options_____

Referencing standards_____

Induction_____

Understanding myth_____

Listening for feelings_____

Deduction_____

Thinking of analogies_____

Measuring items_____

Writing poetry_____

Listening for pattern_____

For answers 1 through 9 see text above.

For number 10 see back of the book.

Answers for Component One number ten.

Inventing options_____1st

Referencing standards_____3rd

Induction_____2nd
Understanding myth_____1st
Listening for feelings_____1st
Deduction_____3rd
Thinking of analogies_____1st
Measuring items_____2nd
Writing poetry_____1st
Listening for pattern_____3rd

Exercises for Component One

1. Language Exercise. Can be done alone or in trios. Ask one person to say a word, any word (first set), the next person to use that word in a sentence (second skill set), and a third person to make an if...then argument using that sentence (third set). Example: first set "oatmeal"; second set "I like oatmeal"; third set "If you like oatmeal, eat it every day".
2. Drawing Exercise. Another exercise that can be done alone or in trios uses drawing. The first person makes a spontaneous continuous line on the page. The second makes a single line that reacts or responds to the first. The third adds a single line, thus turning the page into a composition.
3. Have each member of the group describe an article of their clothing in terms of firstness, secondness and thirdness.
4. Have one person describe the room you are in. Have three other people listen carefully to the description. One person listens for the tone and feeling of the description and feeds back to the group what they heard. A second person listens for specific facts mentioned and feeds back that information to the group. A third person listens for overall pattern and feeds

that back to the group. Follow this with comments from anyone in the group and open discussion.

5. Select at random a dozen items familiar to your students. Organize the students into teams of three. Using the *Metropolis* material included above as a model, ask them to research the dozen items in terms of sustainability.
6. Read a Sherlock Holmes story with your students. Analyze with them how Holmes uses the three skill sets.
7. Select a Sherlock Holmes video. Show it to your students and analyze how he uses the three skill sets.
8. Select any detective video, for example, from the Peter Falk, Columbo series. Analyze the video for the three skill sets.
9. Based on the premise that everybody combines the three skill sets in different percentages adding up to 100%, ask students to try to profile each other in terms of the three skill sets. For example: Darryl guesses that Johnny is 20% first skill set, 50% second skill set and 30% third skill set.

10. Take the Performance Profile in the Appendix.

11. Compare the Performance Profile with the guesses made by the students.