

So what's an economic metaphor?

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Knowing is nothing but working with one's favorite metaphors.

Friedrich Nietzsche

Indeed, as the documents of science pile up, are we not coming to see that whole works of scientific research, even entire schools, are hardly more than the patient repetition, in all its ramifications, of a fertile metaphor?

Kenneth Burke

Until 1983, when Donald McCloskey invited literary criticism to the table of economics, the very notion of metaphor was virtually absent from economic discourse. Arguing in "The Rhetoric of Economics," McCloskey proposed taking metaphor seriously.¹ Since his article appeared in the *Journal of Economic Literature*, metaphor has acquired some currency among economists; its mention is no longer a show-stopping non sequitur.

The currency of the term "metaphor" does not, however, imply a general acceptance of its importance. On the contrary, suspicion and indifference still rule the day, if we may speak metaphorically. The average economist would be unable to locate "metaphor" in the economic lexicon. Many of our colleagues will grant the existence of metaphor, perhaps even conceding its ubiquity, but they then rejoin with the debater's bogey – "So what?"

The suspicion rests, we surmise, on the impression that metaphors introduce ambiguity. The imprecision created by ambiguous meaning is presumably fine for poets, but anathema for scientists. When McCloskey equates economics with poetry because it too relies on metaphors, scientifically minded economists are offended. "What matters is that we, as scientists, write down in a precise way what we mean. Precision is one of the standards by which we measure science. And by

that standard, metaphors are nonscientific. If metaphor occurs in economics, so what? – its existence is incidental to the business of doing economics." The "so what?" reply was invoked by Robert Solow (1988) in response to the Klammer–McCloskey rhetorical perspective. According to Solow, the rhetorical perspective had in 1986 yet to advance beyond the "look, Ma, a metaphor" stage." A more useful inquiry, he suggests, will examine how metaphors actually work in economics.

Some authors have taken up Solow's "so what?" gauntlet. Klammer (1987) tries to account for the persuasiveness of the individuals-are-rational metaphor by exposing the network of meanings in which that metaphor is embedded. Bicchieri (1988) distinguishes poetic from scientific metaphors and suggests that the latter serve a cognitive function essential to science. Mirowski (1989) argues that neoclassical economics was founded on a nineteenth-century physics metaphor and accuses neoclassical economists of (among other things) violating their appropriated metaphor. And metaphor is the motif in this collection of explorations in the history of economics.

These efforts constitute the beginning of a response to the skeptical "so what?" And while this chapter and those that follow cannot answer decisively, they clearly demonstrate that careful attention to metaphor in economic discourse will deliver unexpected insights. Metaphor proves to be a window for surprising and refreshing vistas of economists and their work.

The original purpose of this chapter was to clear some semantic brush and, in so doing, perhaps clarify the roles that metaphor and other figures play in scientific discourse. To this end, we have added a glossary of terms, which, we hope, will be of use to those less well acquainted with the rhetorical perspective's idiom. Most of what we argue is the plunder of an economic raid into the immense literature spawned by our English, philosophy, and history of science department colleagues.

Brush clearing and clarification are, of course, always precarious (and often quixotic) enterprises. Along the way we found that metaphor takes several guises in economics. McCloskey, Mirowski, and other rhetoricians are right: Economics *is* metaphorical. The skeptics, however, also have a point: Not *all* of economics' metaphors matter. We cannot say, "Metaphor is a metaphor is a metaphor." Some metaphors matter and some don't. By distinguishing among our metaphors, we find that some of the most abstruse ones are unexpectedly important. These metaphors, which we will call constitutive metaphors, matter so profoundly that we argue they can ex-

plain much of the confusion and misunderstanding that characterizes discourse within economics and between economics and its lay audiences.

With this conclusion we join ranks with Mirowski, who, in Chapter 1, convincingly argues that fundamental conflicts in what we expect from science prevent us from seeing eye to eye. We play our theme several octaves lower, however, arguing that the conflicts themselves are partly metaphorical in origin. We therefore cannot round up the usual subjects: Neoclassicals are lazy, benighted, antiintellectual, ideologically blinkered, and so on. Instead, we do better to examine economic metaphors, especially those that prevent conversation.

Economic metaphors

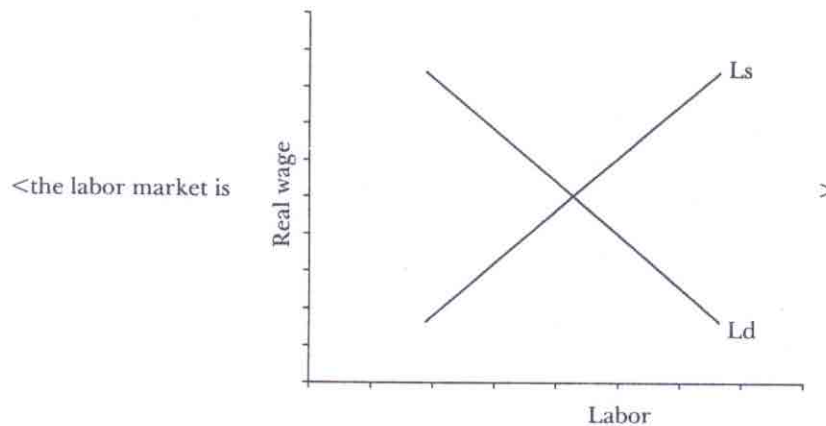
As with so many things, we found that language theorists, philosophers, and other students of metaphor begin with Aristotle.² The Philosopher's definition is as follows: "[M]etaphor consists in giving the thing a name that belongs to something else; the transference being either from genus to species, or from species to genus, or from species to species, or on grounds of analogy" (Poetica 1457b). Here Aristotle already presages the central claim in the traditional view of metaphor, namely, metaphor as deviation from the meaning of *literal* language. Metaphor is called a *trope*, or "turning" of meaning from the literal to the *figurative*: deviation "from ordinary modes of speech" (Poetics 1458a).³ When we say that "Johnson is a sparkplug," we do not mean that Johnson is *literally* a sparkplug. The reader understands this in comprehending the implied figurative meaning. "Johnson is a sparkplug" has an intelligible meaning that "Johnson is a socket wrench" does not.⁴

With this gloss in hand, we can gather metaphors without much imagination. A conspicuous example from the economist's bailiwick is <time is money>. (We will sometimes employ brackets to call attention to an expression as metaphorical in some fashion.) The expression is metaphorical because time is not money – as the sentence literally claims. As a matter of fact, the point of a metaphor is precisely that it is *not* taken literally.⁵ When <time flies>,⁶ money does not likewise take wing. Should your Volvo ever approach relativistic speeds, the cash in your pocket will not "slow down" relative to the funds in your checking account. Somehow, you ignore the literal-minded nonsense and discern the metaphorical meaning of <time is money>: <time is costly in terms of forgone incomes>, or <time imposes an opportunity cost>. Even the inappropriate use of the term

"money" (for income) does not impede the metaphorical understanding. <Time is money> has a figurative, nonliteral meaning that is comprehensible: <you get it>.

Other examples readily accumulate. McCloskey (1983, 1985) has already alerted us to many of them. For example, when we say that <GNP is up>, we do not expect our audience to scan the horizon in search of ascending goods and services. Likewise, we do not watch for bloating price tags when it is asserted that <prices are inflated>. Do Alaskans have trouble keeping their <liquid assets> from being frozen? Bubbles, bears, bulls, bliss points, sunspots, cobwebs, and dirty floats all dot the economic landscape. Our most "rigorous" scientific expressions are unabashedly metaphorical. When speaking of <price mechanism>, <transmission mechanism>, <inflation>, <human capital>, <policy instrument>, <multiplier>, and <accelerator>, we do not intend a literal identification with a machine.

Likewise, a literal interpretation is not intended when we refer to the <labor market>. Those who are newly learning economic jargon may associate the expression with an agora or with something like an old-fashioned slave market with actual bidding and haggling. They will, it is hoped, quickly learn that the expression is meant to be figurative. The <labor market> metaphor introduces the most celebrated metaphor of all in economics, namely,



This is not literally true – even if frequent application of this particular metaphor makes the user believe it is. Of course, there are no demand and supply curves in a market. This expression is metaphorical, actually doubly metaphorical. The supply and demand curve diagram is a kind of *icon*, which itself stands in for an elaborate and systematic metaphor on the nature of work in a commercial society. By

metaphorically connecting the supply and demand diagram with the notion of a market, and market with work, economists twice give "the thing a name that belongs to something else." If Aristotle is right, <we have a metaphor on our hands>.

Fine. Economic metaphors are everywhere. This should not be surprising; all talk is rife with metaphor. Common talk, for example, is completely permeated with metaphors, as Lakoff and Johnson show in their eminently readable book *Metaphors We Live By* (1980). Yes, <GNP goes up>, to cite just one of their examples, but so does everything else that gets better. Apparently, "up" is associated with "better," or "good," or "happier." Science also abounds with metaphors. For what else is an <energy field> but a metaphor? Newton's corpuscles of light, Maxwell's elastic ether, and contemporary physics's strings are all crucial and famous metaphors in science. The reader will find further examples cited by the philosophers of science Leatherdale (1974), Kuhn (1979), and Hesse (1966, 1980).

So what? Economists may use metaphors, the skeptic might argue, but we can still be precise. Terms, after all, can be defined. A drawing of a labor market can be developed into a mathematical model in which all assumptions are made explicit. Well, true. Nonetheless, there is no way around metaphors in science and hence in economics.

Can we do without metaphor even if we would like to?

Contemporary unease with metaphors in science has a long tradition. Aristotle conceived of logic, rhetoric, and poetry as different realms and, additionally, proposed that language has a different function (and therefore should have a different composition) in each. Metaphorical expression occurs in rhetoric as well as in poetry, but while "similes are useful in prose as well as in verse, [they] must be sparingly used . . . in the same way as metaphors" (Rhetoric 1406b). Metaphor adds "charm" and even <"clearness"> to rhetoric, but such "devices of style" matter far less than substance: "No one uses them in teaching mathematics!" "The language of prose is distinct from poetry" (Rhetoric, 1404a).

Aristotle's functional distinction was taken up with a vengeance by seventeenth-century philosophers, particularly the Empiricists, whose project it was to purge language of its ambiguity and so create for science a <transparent>, semantically fixed language of observation. Consider Locke, who attacked rhetoric, and its "figures," in this famous passage from his *Essay Concerning Human Understanding*:

If we would speak of Things as they are, we must allow, that the art of Rhetorick, besides Order and Clearness, all the artificial and figurative application of Words Eloquence hath invented, are for nothing else but to insinuate wrong *Ideas*, move the Passions, and thereby mislead the Judgement; and so indeed are perfect cheat. (1975, 508)

Given the rhetorical flourish and exaggeration that was common in the writing of his time, Locke's railing against metaphors is perhaps understandable. Consider the following passage:

'Tis evident how much Men love to deceive, and be deceived, since Rhetorick, that powerful instrument of Error and Deceit, has its established Professors, is publickly taught, and has always been in great Reputation: And, I doubt not, but it will be thought great boldness, if not brutality in me, to have said thus much against it. *Eloquence*, like the fair Sex, has too prevailing Beauties in it, to suffer it self ever to be spoken against. And 'tis vain to find fault with those Arts of Deceiving, wherein Men find pleasure to be Deceived. (Locke 1975, 508).

This passage, of course, is Locke's own. His flamboyance and explicitly rhetorical intent are manifest: how metaphorical to equate eloquence and women, or to compare sexual and rhetorical persuasion. Using metaphorical language to condemn metaphor is a <delicious irony.> Does Locke intend the irony or is he innocent of it? Is he wittingly deploying one of the very master tropes he deprecates, or alternatively, does his innocence demonstrate the impossibility of an altogether nonmetaphorical language?

Irony piles upon irony. So let us accept the view that the return to seventeenth-century rhetorical flourish could profitably be avoided in systematic economic or other scientific inquiry. Precision and clarity of expression are no doubt worthy objectives. We might even choose to adopt the ambitious goal of the Royal Society's motto: *Nullius in verba*:

There is one thing more, about which the Society has been most solicitous, the manner of their Discourse. . . . They have extracted from all their members, a close, naked natural way of speaking, positive expression; clear senses; a native easiness, bringing all things as near as Mathematical plainness as they can. (Cited in Leatherdale 1974, 224)

But *can* we do without metaphor? And if the answer is yes, as a representative economist might argue, what then accounts for the ubiquity of metaphorical speech in our discourse? Is such ubiquity incidental to the purpose of science – weeds always grow faster than

flowers – or does metaphor somehow participate in science? Why can't we eliminate the metaphors?

Friedrich Nietzsche's answer remains, characteristically, the strong position 120 years after it was written: Metaphors persist because we cannot think without them. It is not so much that metaphors are cognitive; rather, cognition is metaphorical. Placing metaphor at the very center of knowledge and truth, Nietzsche opens a window on metaphor's larger significance. As on so many other subjects, Nietzsche both anticipated contemporary thinking on metaphor and pushed its implications far beyond the boldest of his intellectual progeny.⁷ His most famous passage on metaphor is also the definitive statement of metaphor as the model of knowing and as the essence of language, a view that could not be further from the traditional view:

What then is truth? A movable host of metaphors, metonymies, and anthropomorphisms: in short, a sum of human relations which have been poetically and rhetorically intensified, transferred, and embellished, and which, after long usage, seem to a people to be fixed, canonical and binding. Truths are illusions which we have forgotten are illusions; they are metaphors that have become worn out and have been drained of sensuous force, coins which have lost their embossing and are now considered as metal and no longer coins. . . . The drive toward the formation of metaphors is the fundamental human drive, which one cannot for a single instant dispense with in thought, for one would thereby dispense with man himself. (Nietzsche 1979, 84–9)

Nietzsche joins the age-old debate and argues that subject and object are inescapably different realms and that metaphor best describes the process by which we come to know the "external" world. By etymology, "metaphor" means "to transfer" or "to carry over," and Nietzsche's epistemology relies on this sense to capture the cognitive bridging of the chasm between subject and object. The world does not seamlessly and without intermediation "in-form" our minds, <like scratches on a tabula rasa>, but we attempt to capture it, ultimately with concepts. Language, then, is also radically metaphorical, a contingent attempt to render things as they are:

Concerning language: we believe that we know something about the things themselves when we speak of trees, colors, snow and flowers; and yet we possess nothing but a metaphor for things – metaphors which correspond in no way to the original entities. (1979, 83)

We . . . dare to say "the stone is hard," as if "hard" were something otherwise familiar to us, and not merely a totally subjective stimulation! (82)

All language is irreducibly metaphorical, and therefore so is all our talk about the natural and social worlds. In this view, "literal" and "figurative" are not distinct spheres, but the bounds of a metaphorical continuum. Language begins as metaphor and, only "after long usage," <hardens or freezes> into literality. But even the literal is not true, only more familiar.

How metaphors work

That metaphors have a cognitive and not merely emotive or decorative function is an argument made explicit only after Nietzsche. I. A. Richards (1936) and subsequently Max Black (1962) have been especially influential in developing this view. Figurative speech, especially metaphor, allows us to comprehend in ways that a literal rendering cannot. In some instances, a metaphor is the only way to know, as when we explore natural or social realms that are fundamentally unknown. <Metaphors are markers that orient the discovering wanderer.>

How do metaphors work? The short answer is we don't know. How metaphors work is as mysterious as the process by which we come to recognize metaphorical language. Bound up in language and cognition, a proper theory of metaphor requires a developed theory of semantics and epistemology – vastly beyond the scope of this chapter. An intermediate answer has to rely on the work of students of metaphor.

As Richards and Black pointed out, metaphors make us think by their very nature. When encountering a metaphor, one will, consciously or not, reckon the "associated commonplaces" between two apparently unrelated domains that the metaphor connects. This we can see by investigating the structure of a metaphor.

Let <time is money> be the example. In this metaphor "time" is the subject and "money" the predicate. Richards's terminology dubbed the subject a "tenor" and the predicate a "vehicle." Other designations make the metaphorical subject the "target" domain and the predicate the "import" domain. We will use Black's terminology, which names "time" the *principal subject* of the metaphor and "money" the *subsidiary subject* (Figure 2.1).

If metaphors were unidirectional, then "time is money" could be replaced with no loss of content by a literal expression like "time imposes an opportunity cost."⁸ In the account that first Richards and then Black gave, the principal and subsidiary subjects interact to create new meaning – insights or semantic resonances that did not exist antecedent to the metaphor. Their perspective is called the interactive model of metaphor. Accordingly, seeing time as money would not only

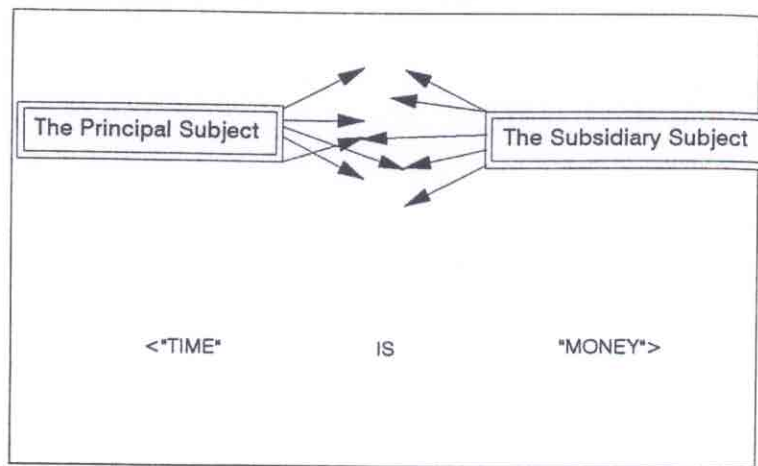


Figure 2.1. The structure of a metaphor. A metaphor consists in giving the principal subject a name that belongs to the subsidiary subject.

affect our notion of time; it also would change our concept of money. The interactive model thus argues that (1) metaphor can convey knowledge, and (2) this cognitive content cannot be achieved in a literal "translation" of (substitution for) the metaphor. Metaphor cannot be reduced to some literal equivalent.

By stating <time is money>, the speaker asks the listener to map certain attributes of the subsidiary subject, money, onto the principal subject, which is time, and vice versa (but not all attributes). There are a great number of associations and attributes that attach to the concept of "money" and could possibly be transferred to "time," such as green paper, golden coins, George Washington, banks, wallets, the central bank, the money multiplier, cost, price, wealth, and richness. The list is virtually endless. Additional uncertainty is introduced because time, too, has many dimensions and related concepts – clock, speed, leisure, calendar, the ticking away of time, and so on – each or all of which could be evoked by "time." So what are the relevant attributes and associated concepts that are evoked by the metaphor?

The metaphor itself does not say. Metaphor does not command, it suggests (see Figure 2.2). Its syntax (or structure) does not reveal its intended meaning, nor does the extrametaphorical meaning of either of its subjects when considered in isolation. Again, the structure

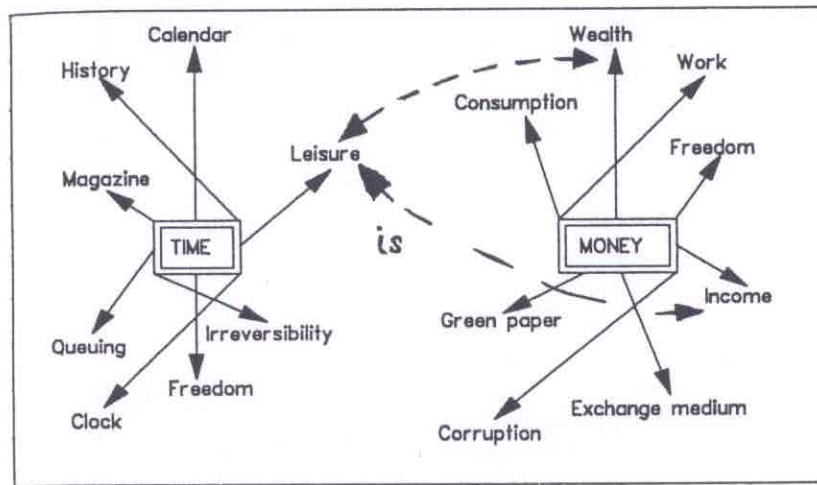


Figure 2.2. The principal and subsidiary subjects in the metaphor <time is money> have many relevant attributes and associated concepts. The metaphor suggests one connection but leaves open the possibility for other connections.

of the metaphor and the semantics of its separate subjects do not tell what dimension or related concept is intended. "Time is money" could imply that "a clock has a price" or that <a calendar is like green paper>, but of course, it intends neither of these interpretations. Experimentally, the problem of interpretation is illustrated by presenting even a common metaphor to young children or to anyone likewise removed from your "speech community." As children are wont to do, they will try to reckon a literal meaning. Our field research suggested that children cannot begin to make sense of "time is money."

Picture two economists who have recently finished a difficult paper on metaphor, <spending> an afternoon monitoring grass growth rates – leisure of the theory class. Recklessly, one blurts out, "You know, time is money." Ordinarily, the other economist would glance at his watch, furrow his brow, and remember the large piles of work back at the office. However, as an economist, he might instead recognize the metaphorical play that his colleague intended: Passing time is not opportunity lost but wealth gained. <Leisure is a normal good>. Those who <have all the time in the world> are rich. The words are the same, but the metaphorical meaning is now transformed. Take the

afternoon off, says the metaphor and, in so doing, answer the "American question" of how to be smart *and* rich.

In short, context matters. Meaning depends on where a metaphor (and its utterer) is situated. In the jargon of linguistics, the *pragmatics* of metaphor determine its meaning, as distinct from its syntax or "intrinsic" semantic sense. Because metaphor involves extensive semantic possibilities, it compels the active engagement of the listener. The context of a leisurely afternoon reanimated an old saying without changing the words. A freshly minted metaphor, says Nelson Goodman, "teaches old words new tricks."

Our homely example illustrates the point that metaphor provides cognitive force that cannot always be attained with literal language. By stating that <time is money> when "wealth" or "richness" is the intended association with money, the <metaphor casts the concept of time and money in a different light>, at least for a typical economist. It may set into motion a thought process about the meaning of work, of <spending long hours> at the office instead of conversing with friends and relaxing at home. In other words, a metaphor, if pertinent, affects the way we think not only about the principal and subsidiary subjects, but also about the world beyond the concepts.

This leads to a larger point made by philosophers and literary theorists who have studied metaphor closely: Metaphor is not just a piece of language, but "a process of thought" (Schön 1967, 37). <Time is money> may well result in seeing leisure as forgone income, but such an interpretation is only one unique mapping. A scientific metaphor is propositional; it only invites further inquiry. It does not presuppose or by itself settle the similarities between the principal and subsidiary subjects. The task of interpretation remains. It is this openendedness and lack of explicitness that makes metaphor so useful to scientific inquiry. Mary Hesse expresses the virtue of imprecision:

A formal, symbolic language can never be a substitute for thought, because the application of a symbolic method to any empirical matter presupposes very careful analysis of the subject matter . . . that the essentials have been grasped and properly expressed in language. In other words, it presupposes that the work of clarification has already been done . . . some necessary overtones of meaning are lost when a word is precisely and uniquely symbolized. The vagueness of living languages as compared with mathematics is the price they pay for their applicability to the world and their capacity for growth. (1955, 88)

Both natural and social phenomena require scientists to consider the extraordinary – the nature of mind, for example, or the character

of matter at quantum and cosmological levels. Even less extraordinary realms require figurative speech, as can be confirmed by any macro-economist who has considered the problem of aggregation. We may attach a name ("the economy") to the unimaginably various and complex activities of a nation's economic life, but we have not thereby ensured that it is a thing. To explain the unfamiliar, scientists inevitably resort to the familiar and the everyday, for what other recourse is there? New concepts do not come to us ready made; their novelty defies our existing language and conceptual schema. Science needs metaphor since it provides the cognitive means to chart the unknown (on this, see Hesse 1955, 1966; Black 1962; Schön 1967).

Cosmological balloons: pedagogical metaphors

Even if metaphors are indispensable to science as vehicles to chart the unknown, it does not follow that *all* metaphors in scientific (economic) discourse are indispensable. Many metaphors in science (and economics) simply serve to illuminate and clarify an exposition and could be omitted without affecting the argumentation as such. We propose to call this class of metaphors in scientific discourse *pedagogical metaphors*.

Effective pedagogical metaphors typically provide mental images (<in our mind's eye>) with which the audience can visualize an otherwise complicated concept. Good teachers are equipped with numerous such metaphors to help their students learn and accept difficult concepts. An example is the <circular flow diagram> that macroeconomists use to demonstrate to students the systematic connectedness of various economic processes.⁹ In physics, for example, a metaphor attributed to Arthur Eddington proved to be immensely helpful in elucidating one of the unintuitive propositions of Big Bang theories: The universe expands outward in all directions, but with no center to the explosion. The metaphor proposed seeing the cosmos as a balloon. If galaxies are conceived as dots on the surface of an expanding balloon, then from the perspective of any one galaxy, all the others are moving away in all directions, yet no galaxy is at the center.¹⁰

Pedagogical metaphors help answer the graduate student's characteristic question, "But what's the intuition?" and the seminar participant's post-Q.E.D. query, "What's the story?" Earthbound economists, confronted with three-dimensional functions and a two-dimensional blackboard, will rely on metaphorical imagery – the surface of the function is a sliced watermelon or a saddle or a cobweb. Note that metaphors of this kind are decidedly *visual*, mental *pictures* that aid in understanding.¹¹ It is not accidental that our descriptive language

here – enlighten, see, view, flash of insight, image, and so on – is doubly metaphorical; it <clearly> embodies vision as a metaphor for knowledge (Schön 1967, 170). These are relatively simple if powerful metaphors.

Accordingly, the pedagogic metaphor is enlisted to help us <see> something that already “exists” and is well understood if not easily grasped. Leatherdale, reworking Alexander Pope’s felicitous description, describes this process as “‘what oft was half-apprehended but ne’er before expressed’” (Leatherdale 1974, 100). Pedagogical metaphors in science operate in similar fashion to poetic metaphors. They work with the known, but transmute it. Not surprisingly then, pedagogical metaphors are probably what most scientists or economists think of when metaphor is mentioned. If they have only these metaphors in mind, they are right to conclude that metaphors are helpful but incidental to the course of science.

Human capital: heuristic metaphors

However, scientific discourse depends on other, more influential classes of metaphors. Some metaphors serve to catalyze our thinking, helping to approach a phenomenon in a novel way. We propose to call these thought-propelling metaphors *heuristic metaphors*.

An example of a heuristic metaphor is the metaphor of <human capital>. McCloskey relates the following story:

One day [agricultural economist Theodore Schultz] interviewed an old and poor farm couple and was struck by how contented they seemed. Why are you so contented, he asked, though very poor? They answer: You’re wrong Professor. We’re not poor. We’ve used up our farm to educate four children through college, remaking fertile land and well-stocked pens into knowledge of law and Latin. We are rich. (1990, 13)

Schultz was wrestling with a problem and expressed his flash of insight with the metaphor <human capital>. The metaphor showed him how he could think about an observed phenomenon, in familiar economic terms. The human capabilities of learning, wit, and talent could be seen as physical capital. Problematic areas for the economist – (1) learning and (2) purchases of nonmaterial goods – were connected to the everyday economic concept of physical capital. The metaphor evoked a comparison between the sacrifices that the family made for the education of their children and an investment in a tractor or any other capital goods; human capital is an asset that

produces a stream of (psychic) income; and so forth. The metaphor set up an argument by analogy and directed the inquiry into the phenomenon that Schultz encountered.

Note the crucial difference between a pedagogical and a heuristic metaphor. The cosmological balloon and the saddle-shaped function are metaphors that induce us to knock the <heel> of our palm to our foreheads. Ahhhh, of course. Thank you. The pedagogical metaphor's role is typically a cameo. In contrast, a heuristic metaphor is only the beginning of an inquiry. Heuristic metaphors usually will not immediately reveal all possible elaborations. When Schultz thought of <human capital>, he did not perceive its full heuristic power. Nor could he have. Much elaboration was to follow, as can be witnessed in the burgeoning literature on the economics of families, for example. Schumpeter called insight of the kind that Schultz experienced a "pre-analytic cognitive act" (1954, 41).

The example of the <human capital> metaphor reinforces the connection between metaphor and thought in science: Metaphor as a way of thinking in new terms. We have seen that metaphor is an essential tool for thinking about the unknown, but it also serves to stimulate novel approaches to the known. Metaphor is cognitive here because its respective subjects interact to create new meaning. Consider again the labor market case.

Imagine a beginning student who wants to understand how work works: what occurs in the workplace between employers and employees, in wage negotiations, on assembly lines, in board rooms — everything related to work. If she is typical, she will be unable to establish what her questions are or even how to designate the tenuously connected phenomena with which she is concerned. Perhaps she has heard about the differential between average remuneration for doctors and nurses, or her uncle is out of work, or she has found that people routinely complain about their jobs. How is she to get a grip on these impressions, anecdotes, experiences? How should she think about her uncle or unhappy working people? A metaphor can help. But there are many metaphors that can do the trick.

If the student finds herself in a sociology class, she will hear about conflicts in the workplace and class struggle. Whether conscious of it or not, she is given the metaphor of <power struggle>. The notion that work can be seen as a <power struggle> enables her to organize her thoughts about the collection of experiences, impressions, and issues that constitute her principal subject. <Work is a power struggle> functions as a heuristic metaphor that gets her started. Thinking in this vein, she will find that what goes on between bosses and their

subordinates is high drama, with workers struggling for more power and more meaningful jobs. If she were to pursue this metaphor further, she might find herself in the company of radical economists, sociologists, and political scientists. And slowly she will be able to distinguish patterns in her initially amorphous experiences.

The heuristic metaphor will be different if our student were to wander into a microeconomics lecture. "Power struggle" as a way to organize the complicated nature of work sounds funny or quaint to most economists. It is even a little irksome. The freshman economics student, of course, experiences a similar dissonance when encountering neoclassical economics's double metaphor <work is a market and a market is a geometric diagram>. But the market metaphor is powerful, and our student's as yet unconnected impressions will be organized so she can <see> that wages are set in an impersonal (and decidedly undramatic) marketplace, that job loss is due to movements in demand and supply curves, and that boredom must have its compensations if agents are rational.¹² Thus, the labor market metaphor helps her to <see> what she could not <see> before.

Metaphor begets analogy

Recall our argument that a pedagogical metaphor, unlike its heuristic cousin, illuminates but typically does not lend itself to systematic and sustained development. The "time is money" metaphor, once interpreted, says enough. One could study the phenomenon of money, discuss its creation, and formalize the multiplier process, but all that will be superfluous to the metaphor's limited intent: that we <get the idea> that leisure imposes an opportunity cost or that leisure is valuable. So while the pedagogical metaphor <time is money> did not develop into a scientific analysis, the heuristic <human capital> and <work is a market> metaphors did. The question then arises: Into what does a heuristic metaphor develop? Here the distinction between metaphor and *analogy* will prove to be fruitful.

Many authors, among them McCloskey and Mirowski, use "metaphor" and "analogy" interchangeably. They are close relations. Aristotle, remember, considered analogy as a species of metaphor: "Metaphor consists in giving the thing a name that belongs to something else . . . on grounds of analogy." Yet analogy, even as Aristotle traditionally defined it, is different from metaphor. Whereas a metaphor merely suggests that the principal and subsidiary subjects have attributes in common, an analogy draws explicit parallels between them. According to Aristotle, analogy is based on proportionality, as in

"wine-bowl" is to Dionysus as shield is to Ares. By proportionality, Aristotle implies a kind of limited and identifiable relationship between the principal and subsidiary subjects. Note that analogy in this sense is less than a <full-blown> metaphor; saying that "the wine-bowl is the shield of Dionysus" is metaphorical, but to understand it one needs only to grasp the implied proportionality between Dionysus and Ares – nothing else is left to the imagination.

An analogy typically focuses on similarities in relationships. Jevons argued in *The Principles of Science* that "analogy denotes not a resemblance between things, but between the relations of things" (1874/1958, 627). To say that "the atom is a solar system" is to speak metaphorically. When a teacher develops this classic metaphor by drawing the solar system on the blackboard, complete with the sun and elliptically orbiting planets, she proposes an analogy that captures and makes explicit some, though not all, of the "associated commonplaces" suggested by the metaphor. Not all of these correspondences will be appropriate. Gravity does not bind electrons to the atom's nucleus, as it does planets to the sun, nor is the atom's nucleus hot with thermonuclear fusion. Likewise, the solar system's moons and asteroids have no obvious counterpart within the atom. However, less than perfect congruity can also prove to be a virtue, providing insight that a literal rendering cannot achieve. Electrons don't spin on their axes like a planet does, but conceiving of them in this way provides an explanation of an electron's angular momentum and its magnetic field.

Note that the subsidiary subject and, by implication, the principal subject have become systems of relationships. This process inspires the following definition of analogy: Analogy is an expanded metaphor; more precisely, analogy is sustained and systematically elaborated metaphor. Accordingly, in a scientific context, a metaphor becomes heuristic when it stimulates the construction of an analogical system. The mere coinage of a metaphor such as <human capital> does not make science. Science proceeds by taking a fertile metaphor and relentlessly articulating the nature of its subsidiary domains, probing the properties of that terrain, and testing the connections between that domain and the principal domain.

This is what neoclassical economists did with <human capital>; they expanded it into a full-blown analogical system. But not any system will do. Current economic practice prescribes that the (heuristic) metaphor be developed into a model. A model, then, is nothing more and nothing less than an explicitly, most often formally articulated analogy. "Model" once carried the meaning of "scale model," but today, models are analogies where more than a size vector is varied in relationship to the world.

Scale models are figurative in only the narrowest fashion; only one attribute of the thing to be modeled – size – changes. Maps may be thought of as scale models;¹³ in fact, maps are a favorite pedagogical metaphor in introductory economics texts that seek to explain abstraction in economic theorizing (on this, see Goldfarb and Griffith 1991). The crucial difference is that scale models (e.g., maps) describe a known reality, whereas scientific models will often describe fundamentally unknown or unknowable aspects of the world. Map makers know precisely which aspects of reality they are omitting or including in their models, but economists typically must select what to characterize with (1) incomplete knowledge and (2) some prior notion of what needs to be explained.

Creating an economic model therefore constitutes reasoning by analogy, as Milton Friedman (1953) argued when he suggested that economists reason “as if.” “As if” reasoning defines rational choice as analogous to, for example, a constrained maximization solution technique. No literal meanings are intended. Friedman is clear: Economists are not supposed to lose sight of the analogy’s essential if useful fiction. In Black’s terms, “there is a willing suspension of ontological disbelief,” which may account for the ironic winking and nudging that accompanies “sophisticated” economics (1962, 228).¹⁴ Individual agents don’t actually make decisions by employing the techniques of Lagrange and Hamilton to solve a systems of equations; it is useful, however, to see them this way. The argument is meant to be fictitious, as it is when cognitive psychologists argue as if brains were computers. To take either analogy as literal misses the point.

The problem, of course, is that analogies may become elaborate – things in themselves – and eclipse their founding metaphors. Model builders may lose sight of their construct’s metaphoricity. Indeed, most economists probably think of their work as making truth statements about the world. In the same breath, however, they will make a watered-down version of Friedman’s article their methodological touchstone. Alertness to metaphor reminds us not only that our models are fictions, but that “as if” reasoning – the characteristic mode of economic discourse – is altogether incompatible with a positivist account of economic practice.

Recognizing that some models are useful but witting fictions also has important sociological implications. The act of creating a great metaphor may well be, as Aristotle suggests (*Poetics*, 1459a), the stuff of genius, but in science, metaphor’s functional power lies in its “deployability” (Toulmin) – the fertile open-endedness that confers creative power to its interpreters. In science, great metaphors are not

born; they are made. The fertility of a scientific metaphor – its potential for subsequent analogical development – is a necessary though not sufficient condition for future success. A successful heuristic metaphor will bear the analogic system only with the aid of a thousand midwives.

The heuristic metaphor, however, usually does not come with instructions that tell which model to develop it into. Take the “labor market.” Nothing in that metaphor reveals what form the model might take, nor does it call for a model. One could develop it into a geometrical device like the demand–supply diagram, into a general equilibrium system, into an empirical model, or into a loosely composed Austrian-like analysis. Treating work as a market is only the first (and key) metaphor that leads to supply and demand curves.

Accordingly, many other factors influence the development of a heuristic metaphor into an analogical system. One is reminded of Kuhn's (1962/1970) notions of exemplar and disciplinary matrix; a mixture of tools, strategies, and values determine what the appropriate transformation is. Students who just have finished their introductory microeconomics class will use the basic demand–supply diagram as their exemplar. Graduate students at Minnesota will want to develop a general equilibrium model that makes the structural parameters explicit, and MIT students may want to build models that allow for empirical testing.¹⁵

The persuasiveness of the analogy is determined by the positive analogies, that is, the attributes and relationships that do correspond. Black, borrowing from topology, talks of the “isomorphism” between the domains. For example, when real wages change as predicted or explained by the model, the analogy is positive.¹⁶ Negative analogies may undermine the persuasiveness of the analogy. The fact that agents do not literally solve Lagrangians is a negative analogy, but it is not fatal to economists concerned principally with prediction. A negative analogy occurs when the predictions of the analogy or model are not met by real events. This outcome is usually more critical and will lead to changes in the analogical construction, depending upon the analogy's connectedness with reality. Economic methodologists make it their profession to investigate the logical characteristics of economic analogies in their search for standards. Their objective, then, is to determine when negative analogies are such that a rejection of the analogy is warranted. That objective has proven elusive mainly because of the complexity of the relationships between the analogical construction and economic reality, as implied by the Duhem–Quine thesis.

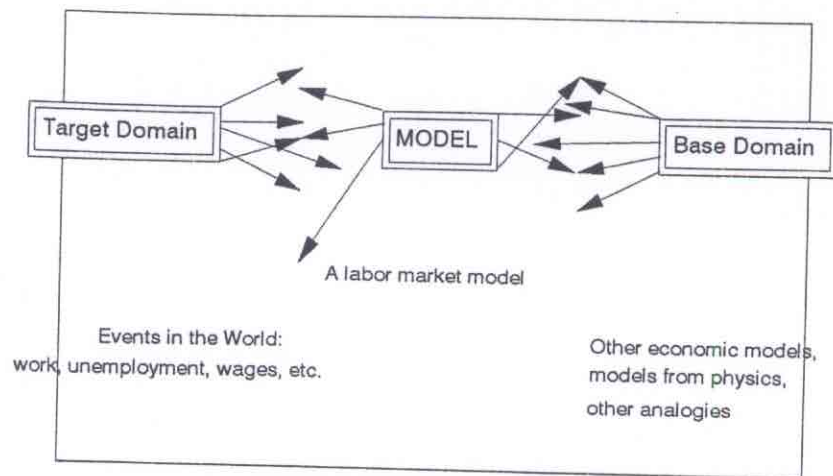


Figure 2.3. A model or analogy is intended to investigate an aspect of the world, which is called the target domain, and does so by borrowing from other models or analogies that make up the base domain.

Analogies (including models) have another quality that is remarkable: They are two sided. On one side, analogies investigate the world, sometimes referred to as the target domain (see Genter 1982). But analogies also have another side, an association that is quite different. A specific model of U.S. labor markets, for example, will also bear some relationship to other models in economics, mathematics, or following Mirowski, physics. The domain from which a specific analogy is borrowed is called the base domain. Figure 2.3 illustrates the two-sidedness of the scientific analogy.

The analogical configuration with which economists work can become an end in itself. Instead of pursuing congruences between the analogy and economic phenomena in the world, economists may work entirely *within* the realm of analogy or only with reference to its base domain, such as analytically related models. This has happened with chess. Although the precise origins of chess are murky, one view is that chess was originally devised to provide instruction to students of war by metaphorically representing war as a game. Today, the connection with war is completely lost. Chess is interesting only as a self-contained game. The original metaphor, <chess is war>, has faded away, eclipsed by the analogic system that is the game of chess.

Thus can metaphors die. "Dead metaphor" is an expression coined by Turbayne (1962). Familiarity and overuse can drain a metaphor of its figurative sense, rendering it literal in impact, as with the once metaphorical terms "skyscraper" and "riverbed." The expression remains, but the incongruity that once alerted us to the metaphor has been eroded by its very currency. The same is true for the heuristic metaphors that create analogies in science. Neoclassical economists almost exclusively focus their research on the characteristics of their models, evidence that their central metaphors are comatose if not actually deceased. The standard question is, "What will happen to the model if we change . . ." The impetus to change economic models almost always derives from developments in other models, not from the nature of its relationship to the world.

Even if the metaphor that underlies an economic model is rhetorically dead, it can be brought back to life. In particular, newcomers to economics and outsiders have the bothersome habit of stumbling over the metaphorical characteristics of economic discourse. Considering significant negative analogies may reanimate metaphors, thereby retarding the process of initiation and conversion. The most commonly heard objection is that the assumptions of the model are unrealistic. It is also sometimes argued that economists have an overly mechanistic and cynical view of the world, supposing that all individuals are calculating and self-interested. These reactions remind economists that their reasoning is inevitably metaphorical and that their metaphors allow for associations that they do not intend.¹⁷ Dead metaphors never actually die. Therefore, "ossified metaphor" may be the better term as it holds open the important possibility of reanimation.

Constitutive metaphors: windows for the implied vision

In addition to pedagogical and heuristic metaphors, there are metaphors of a third kind in economics (and elsewhere in science), *constitutive metaphors*. These metaphors work on an even more fundamental level. Constitutive metaphors are those necessary conceptual schemes through which we interpret a world that is either unknowable (the strong position, per Nietzsche) or at least unknown. To say anything about the world we must characterize it. But because we cannot know literally the nature of the natural and social worlds, we resort to the figurative in characterizing. An antiessentialist epistemology requires metaphor. Schön argues:

There is a very different tradition associated with the notion of metaphor, however, – one which treats metaphor as central to the task of accounting for our perspectives on the world: how we think about things, make sense of reality, and set the problems we later try to solve. In this sense, “metaphor” refers both to a certain kind of product – a perspective or frame, a way of looking at things – and to a certain kind of process – a process by which new perspectives on the world come into existence. (1979, 254)

Constitutive metaphors frame a discursive practice in the way that the U.S. Constitution frames U.S. legal discourse. Boyd, who coined the term, defines a constitutive metaphor as one that “constitute[s], at least for a time, an irreplaceable part of the linguistic machinery of a scientific theory: cases in which there are metaphors which scientists use in expressing theoretical claims for which no adequate literal paraphrase is known” (1979, 360).

When we say that a metaphor <frames our thinking>, we mean to say that such metaphors profoundly influence our thinking, what we see and hear. “In discussing the theory of genes, the lecturer may say, ‘think of it, if you will, as a kind of code,’ when in fact he has no other way of thinking of it” (Schön 1967, 105). Great scientific metaphors typically become entrenched, so that we take them as literally true. But all metaphors start provisionally. Space is Euclidean, and can be thought of only with the metaphor of lines and points, until we think of another way.¹⁸ Usually implicit, constitutive metaphors determine what makes sense and what does not; they will determine, among other things, the effectiveness of pedagogical and heuristic metaphors. They are essential to our ways of thinking, more so than heuristic metaphors. The “human capital” metaphor proved a successful heuristic metaphor, but it succeeded because it resonated with the more fundamental metaphors that constitute neoclassical discourse. When Schultz <saw> <human capital>, he struck the right chord. Had Schultz instead <seen> <moral resolve>, we can guess that the resulting dissonance would have made for a different history. Constitutive metaphors, therefore, function as <windows for the implied vision>.

“Constitutive metaphors” are the answer to the question “Where do our heuristic metaphors come from?” On what basis did Paul Samuelson choose optimization as his heuristic metaphor over, say, satisficing or chaos? Was his selection altogether for operational reasons, merely serving the attainment of ever more realistic models? No, of course not. Samuelson’s insight recognized optimization as a meta-

phor compatible with his existing conceptual schema. Like the famous gestalt figures suggest – Wittgenstein's duck-rabbit and the vase versus two faces in profile – what we see depends on what we already know. The constitutive vision is implied in the heuristic metaphors pursued.

Constitutive metaphors, like most fundamental concepts, are hard to specify concretely. Constitutive metaphors are not explicitly stated and marked in the discourse that they constitute. People can talk away entire lives without ever reflecting on the nature of their talk. Accordingly, constitutive metaphors, if they exist at all, can be exposed only by digging into or interpreting the relevant texts, both spoken and written.

Mirowski's *More Heat Than Light* (1989) represents the most ambitious dig for the constitutive metaphors of modern neoclassical discourse as yet. Heeding Borges's assertion that "universal history is the history of a handful of metaphors," Mirowski argues that the Natural has framed the neoclassical thinking about the Social and that thinking about the Natural is framed, in turn, by an analogy with nineteenth-century physics. The dig does not stop there, however, for what constitutes nineteenth-century physics? Could it be the concept of an invariant structure, as Mirowski suggests? This volume attests to the need for further digging and sorting out of metaphors that are merely incidental from those that are constitutive in economics.

The suggestion that a discursive practice revolves around or is framed by constitutive elements is not novel. Thomas Kuhn (1962/1970) implied as much with his notion of the "disciplinary matrix," as did Imre Lakatos (1968) with the notion that a "hard core" of unquestioned assumptions constitutes a research program. Yet neither Kuhn's nor Lakatos's conceptual framework explicitly captures the metaphorical character of discourse framing, that is, viewing the principal domain in terms of another domain. More promising in this respect is work by Michel Foucault (*The Order of Things* [1973] and *The Archeology of Knowledge* [1972]) and by Stephen Pepper (*World Hypotheses* [1942]). Foucault and Pepper both make serious attempts to elucidate the metaphors that frame discursive practices.

Pepper's taxonomy of four world hypotheses can perhaps work as a beginning guide to the dig in economic discourse. Those four world hypotheses are "organicism," "mechanism," "formism," and "contextualism." (In case you suspect typos, the strangeness of the names is intended to preempt associations with other more common expressions.) Each hypothesis is characterized by different constitutive

metaphors – “root metaphors” Pepper calls them – and generates a distinctive discursive practice.¹⁹

For example, in terms of the mechanistic world hypothesis, the economy will resemble a machine with a <price mechanism>, <equilibrium>, and <elasticities>. Nature can be seen as a frictionless clockworks, with the social realm isomorphically identical, owing perhaps to some *deus ex machina* like an invisible hand. With contextualism as the world hypothesis, the economy will have a history in which events are contiguous and human actions are to be understood in context. A contextualist view might allow economics the status of a science like physics, but recognizes that the social realm is embedded in history, so that economics may be arranged like physics, but it cannot be physics. The classical organicist metaphor in economics postulates an entire economy as a living thing, complete with closed, circular flows. Note that living things evolve, an important metaphorical implication (à la Marshall) that may well be at odds with a competing notion of invariance.²⁰

Note that the apparently limited number of constitutive (or root) metaphors may help explain Mirowski's notion of metaphor spiraling through history, alighting on the Natural and Social alike: Malthus led to Darwin, who led to social Darwinism, which, with a bit of Marshall, created sociobiology, and so on (Mirowski, Chapter 1, this volume). If the world is unknowable or at least unknown, then we must construct it. What is fascinating is the apparent scarcity of our most elemental conceptual material for construction.

Disagreement or schism?

Constitutive metaphors also help to explain the apparently irreconcilable disagreements among economists and perhaps between economics and its lay audiences. If your constitutive metaphor sees the world as a clockworks and suggests that people don't think but calculate, then thinking about thinking makes little sense. Note that we are not talking about heuristic metaphors here, such as <individuals think by solving constrained optimization problems>. Such hypotheses may well be, as discussed, a useful and *witting* fiction for dealing with a problematic reality. However, a mechanistic constitutive metaphor, we've argued, will determine how we actually see the world. Talk about metaphor and discursive practice will seem altogether misguided and perhaps subversive to an economist who operates under a mechanistic constitutive metaphor. If the world is a frictionless clock-

works, then equilibrium prevails everywhere. The notion of disagreements (for economists are part of the world) or discord makes no sense, nor do attempts like this chapter to understand disagreements. To conceive of economics as a discursive practice based on a handful of metaphors would be subversive for such a worldview because it threatens to emphasize rhetorical tools at the expense of fact and logic, a mechanistic world's means of inquiry.

According to the rhetorical perspective, however, disagreements among economists arise not so much because we are misguided or strategic in resistance, or even because we hold different "preferences." Rather, we are subject to clashing constitutive metaphors. Constitutive metaphors are not picked up and discarded like heuristic metaphors or mere preferences; constitutive metaphors are us. A fundamentally changed perspective, say from positivist to rhetorical, requires changing oneself, which is painful and rare. Like Rome and Byzantium, conflicting constitutive metaphors lead not to disagreement, but to schism.

This case illustrates again that metaphors matter and that therefore there is good reason to reflect on the metaphors that constitute economics. We may discover that major disagreements and misapprehension are not the product of stupidity, ignorance, and avarice that we attribute to others, but can be accounted for by conflicting constitutive metaphors. If so – the caveat is that we have as yet merely postulated the existence of constitutive metaphors – contrasting constitutive metaphors may be responsible for the confusion and miscomprehension that we experience in our business.

Moreover, the notion of constitutive metaphors offers a way to decipher the noisy, mixed signals that characterize communication between academic economists and the rest of the world. Communication gaps may be metaphorical in origin: Economists speak of formal metaphors while others rely on organic and contextual metaphors. When discussing trade, for example, lay people and journalists (who are professional lay people) think in dramatic terms; they see <trade wars> and expect <actions> to <retaliate> against <unfair competition>. In contrast, economists think in formal terms about the <impersonal price mechanism>, <comparative advantage>, and <long-run equilibrium>.

Constitutive metaphors may account for differences in the economics of <freshwater and coastal macroeconomists> and for the lack of communication between neoclassical economists and economists of other kinds, such as Marxists, Austrians, post-Keynesians, socio-

economists, and institutionalists. Divergent constitutive metaphors may also account for the friction between economic methodologists who focus on the form of economic argument and economic rhetoricians who focus on the context of economic metaphors.

Peroration

Economics is metaphorical, even if some of its metaphors don't matter. Solow's skepticism is thus only partially vindicated; it is true that pedagogical metaphors merely serve to illuminate and are not crucial to the scientific process. Heuristic metaphors are more resistant to skepticism, not just because they are essential to science, allowing new takes on old ideas and a means to confront the wholly new or unfamiliar, but also because (1) they remind us that our models are fictions, and (2) economic practice diverges widely from economic preaching. The metaphors that constitute discourse are unambiguously worthy of study. We argue that they may account for fundamental disagreements within economics and for problems of communication across academic disciplines and with lay audiences. And those disagreements and problems need to be understood by anyone who is serious about intellectual practice. Constitutive metaphors matter unless you are willing to argue that scholars can justifiably be blind to the practice in which they are themselves engaged.

Unearthing constitutive metaphors may not by itself accomplish change, but a statement that <a handful of metaphors constitute discursive practices in economics> could be the heuristic metaphor that leads us to a richer understanding of economics. It compels us to develop a conceptual framework with which we can interpret and characterize alternative discursive practices in economics. The characterization will help us understand.

Saying that economics is metaphorical is no longer taboo, but it is also no longer inconsequential. More exegesis on the literary and pedagogical aspects of metaphor in economics, however useful, will beg the larger questions we have tried to raise. Further research will recognize that arguing <economics is metaphorical> is potentially subversive, if not in the fashion traditionally imagined. By proposing to uncover, identify, and elaborate on the constitutive metaphors of economics, we run the risk of altering them. Max Black proposed that "every science must start with metaphor and end with algebra" (1962, 242). The work that is done in this book suggests that we can profitably stop talking about algebra. When we begin talking about metaphor, science moves.

Glossary of selected terms

Useful references are Abrams (1981) and Lanham (1991).

Allegory: A long or extended metaphor, in which the "left-hand" side of the original metaphor has been lopped off or "forgotten." Examples of allegory are the fables of Lafontaine, Orwell's *Animal Farm*, and perhaps Defoe's *Robinson Crusoe*. An allegory is an expanded metaphor, like analogy, but the expansion comes in the form of a narrative, and it is not systematic. In this sense, allegory belongs more to poetry, as analogy belongs to science. The animals in Orwell's *Animal Farm*, for example, symbolize human types, and the reader is asked to interpret the story allegorically, that is, as corresponding to human society.

Analogy: A sustained and systematically elaborated metaphor, where one system of relationships is joined to another. Analogy makes explicit the ligatures between the principal and subsidiary subjects, specifying only some correspondences among the infinitely many potential commonplace associations suggested by the original metaphor. While allegory continually reminds us of its metaphorical beginnings, and thus prevents a literal reading, analogies are usually less gracious to their original metaphor. An elaborate analogic system may eclipse its founding metaphor, obscuring its parentage as it grows in size and complexity.

Catachresis: The metaphorical use of existing language to fill a gap in the vocabulary. Referring to the support of a table as a "leg," or to the base of a mountain as a "foot," were, at one time, catechrestic acts. John Muth found the need for catechresis when he conceived of expectations that are consistent with the outcome of his model. There was no name for such a phenomenon so he coined the term "rational expectations." (The expression is also metaphorical, because expectations, which usually are thought to be emotional, are given an attribute that appears to belong to another set of phenomena.)

Constitutive metaphor: A metaphor that frames the thinking about its principal subject to the point that the principal subject cannot be considered without it. More broadly, it is the conceptual scheme we use in characterizing a world that is unknowable or unknown. (Note that constitutive metaphors will typically generate or inspire heuristic metaphors.)

Ethos: The character of a person, usually a speaker. The ethos of the speaker influences the nature of the message. Ethos is an important rhetorical device, though not a trope, per se. Students of economics quickly learn to establish the ethos appropriate to a professional economist: Write in an impersonal voice and deploy scientific language wherever possible. Appeal to the appropriate authorities, that is, economists with an acceptable ethos (not John Kenneth Galbraith, therefore, but serious economists such as Robert Lucas).

Trope: A figure of speech in which words are given meanings other than their literal meaning.

Notes

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1. Willie Henderson (1982) preceded McCloskey in recognizing the metaphorical nature of economics, though his article met with little fanfare.
2. Aristotle's popularity owes probably more to his famous propensity to produce convenient definitions than to the depth of his treatment of metaphor or to his seniority. Stanford (1972) finds that the word *metaphora* first appears in Isocrates' *Evagoras*.
3. See glossary for the definition of this and other terms.
4. Not everybody agrees that metaphors are tropes. Donald Davidson in particular argues that metaphors have no meaning or sense apart from their literal meaning or sense (in Sachs 1979).
5. McCloskey pointed out the double metaphor in the expression <taking literally>: Nothing is <taken> – it is rather heard or understood, and <literally> means in Latin "by the letters."
6. "Time flies" is no more metaphorical than "Time flows," though most people will take the latter concept as literally true. We will discuss how metaphor is uniquely <well suited> to describe abstract or otherwise extraordinary concepts.
7. On this and what follows, see Paul Cantor in Miall (1982).
8. This traditional view of metaphor Black calls the *substitution* model. The substitution model denies metaphor any nonornamental function.
9. Tim Alborn, however, shows in Chapter 7, this volume, that there is a great deal more to the metaphor than what economists suggest when using it. For instance, it has a complicated history.
10. On this, see Lightman 1989.
11. To <see> this, try to create a successful metaphor for a six-dimensional function or for a complex number.
12. Why, the <labor market> analogy asks, don't bored workers vote with their feet and seek another job?
13. Actually, maps abstract more than size; they also may represent non-spatial ideas – for example, by using colors or shapes.
14. Likewise, Black points out, models as fictions makes explanation impossible, for, as Friedman concedes, *actual* behavior could be anything – satisficing, chaotic, minimizing.
15. The instability of heuristic metaphors is also pointed out by Theodore Porter in Chapter 6, this volume. Some fudging may be needed to get

- from nineteenth-century physics to a satisfactory economic model. Of course, this is also the point of Mirowski in *More Heat Than Light* (1989).
16. Mary Hesse furthermore distinguishes neutral analogies, which are analogies that still need to be explored and determined.
 17. See Klammer (1987) for an examination of the different associations that can be made with the rationality postulate in economics.
 18. We owe this example to McCloskey.
 19. Black had similar entities in mind when he referred to "conceptual archetypes" (1962, 241).
 20. To assay the universality and robustness of Pepper's categories, try to devise another root metaphor to describe a natural or social system.
 21. Indeed, it is metaphorical to view the vastly complex activity of human work as a resource, or input to production (see Lackoff and Johnson 1988, ch. 12).

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