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► To cite this version:

Catherine Resche. Reflections on metaphors and models in connection with theory building in economics. Researching metaphors, 1, Routledge; Routledge, 2022, Routledge Studies in LInguistics, 978-1-032-02586-5. 10.4324/9781003184041 . hal-04039610

HAL Id: hal-04039610

<https://hal.sorbonne-universite.fr/hal-04039610>

Submitted on 21 Mar 2023

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Reflections on metaphors and models in connection with theory building in economics

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Introduction

Approaching metaphors in connection with theory building in specific spheres of knowledge requires going beyond surface metaphors to investigate further into what has inspired researchers and helped them shape their scientific and disciplinary domain over time. As contributors to the conceptual structure of a given field, theory-constitutive metaphors can provide a wealth of information for the lay analyst and deserve special attention. The way specific metaphorical seams have been mined by economists cannot be brushed aside. Accordingly, theory-constitutive metaphors ought to be approached in context — whether social, historical, scientific, theoretical, textual or discursive — and from a diachronic perspective.

Economics as such only emerged as a discrete field in the second half of the 19th century, at a time when the word *economics* was introduced with a view to imposing the domain as a science. From Antiquity to the 19th century, approaches to economic matters had been diluted in various other disciplines such as philosophy, theology, morals, and politics. Consequently, from 1850 onwards, seeking to gain recognition for their field of research, researchers in economics naturally turned to mechanical physics as a model for economics, since physics ranked highest in the hierarchy of sciences. Pareto's conscious efforts (1896) to have economics viewed as social physics bear witness to the field's quest for scientificity. Thirty years later, the principles of rational mechanics were adapted to economics by Fisher (1926: 85-86), and the analogies he established with physics gave rise to a deep-seated metaphorical vein that inspired theory in the making, alongside the other theory-constitutive metaphorical strand, i.e., biology, which had long been productive (Resche 2012). Hence the numerous metaphorical terms that resulted from the two lenses through which researchers reflected upon their field, depending on whether they had been trained as engineers, like Allais and Walras, or as physicians, like Quesnay.

Yet, “economics cannot be compared with the exact physical sciences for it deals with the ever-changing and subtle forces of human nature” (Marshall 1890, I.II.1). Besides, as researchers in economics can neither conduct experiments in laboratories nor test their hypotheses in the real world, their findings cannot be expressed as laws in the same sense as in physics. For this reason, they pay close attention to the data history can provide and they resort to models.

Both metaphors and models contribute to the building of economic theory: metaphors are likely to inspire models, and models may become the physical representation of metaphors. While they both act as mediators (Morgan & Morrison 1999), they also play a highlighting-hiding game, foregrounding some aspects of a concept and neglecting others (Kövecses

2002). Their argumentative function and their potential role as ideological weapons cannot be ignored.

This paper aims at exploring how metaphors and models should be approached in the field of economics, based on their contribution to theory. The first section sets the background theoretical frame. The sections that follow analyze the role of metaphors (section 2) and models (section 3) in economics. The common features and the links between metaphors and models are assessed in connection with the notions of worldview and paradigm in section 4. Finally, section 5 raises the question of their role as potential vehicles of ideology in the process of theory building. The concluding remarks provide a reminder of how to approach metaphors in specialized discourse and specific fields of knowledge.

1. Theoretical background

Before anything else, it is important to make clear the principles guiding research into the discourse of specialists, be they academics or professionals. The basic tenet posits that the discourse of specialists is constrained by the history, conventions, traditions, values, requirements, and specific culture of the domains and milieus which are theirs. Accordingly, such discourse is context-sensitive, rooted in culture, and time-bound. And the same holds for the metaphors that shape the specialists' reflections, guide their findings, help them approach problems from a different or novel perspective and communicate their views. Undeniably, the ability of theory-constitutive metaphors to evolve in order to adapt to the new social, cultural and scientific environment underlines their dynamic character.

Hence, although cognition is at stake when economists try to make sense of problems, Conceptual Metaphor Theory's a-historical approach to culture is inappropriate for dealing with theory-constitutive metaphors. So is Lakoff's position that metaphors "should not be thought of as processes", but as the result of "a fixed pattern of ontological correspondences across domains" (1993: 21). Over time, more nuanced positions have been adopted by scholars to counter the negative reactions triggered by CMT's initial reductionist approach. As Gibbs (2013: 32) underlines, "no single theory [is] capable of explaining all aspects of the complex phenomena that are metaphorical language and thought".

Steen (2013: 180) calls for a distinction between metaphors said to work automatically and unconsciously, and deliberate metaphors defined as "an instruction for addressees to adopt an 'alien' perspective on a targeted referent so as to formulate specific thoughts about that target from the standpoint of the alien perspective". His position is more in line with the intentionally-constructed mapping between economics and physics mentioned in the introduction.

Although the original metaphorical strand derived from biology and medicine may have receded in the background when physics was used as a model, it never really died. It is more

appropriate to think in terms of hibernating metaphors to account for the deep-seated metaphors that can be revitalized at any time, and give birth to surface metaphorical units¹.

Innovative — thus deliberate — metaphors seem to stem from a process that is reminiscent of what Levi-Strauss (1990) calls “tinkering” (or “*bricolage*” in French) and which is at the basis of mankind’s original cognitive process (or “savage thought”): like the tinkerer who reinterprets the original function of objects to suit new needs, the author of an innovative metaphor tinkers with conceptual limits, fitting ideas together, possibly experimenting with new meanings or creating new terms.

As far as economics is concerned, an illustration of unconventional, “inconsistent” (Prandi 2004; 2017) and deliberate metaphors is Adam Smith’s Invisible Hand metaphor, which first served as a stimulus in terms of thought and language, helping him to visualize the market’s self-organizing system more clearly, and then to impart his views to others thanks to the newly-coined metaphorical term.

More importantly, metaphorical *terms* should retain our attention as multi-faceted units that can be approached from a cognitive, linguistic, or socio-communicative perspective, depending on the research goal that is pursued. Investigating beyond the mere denominations (Resche 2013) and into the historical origins of terms in order to trace their evolution can provide access to a much broader horizon.

Creative, innovative, inconsistent metaphors can enrich theory and signal a paradigm shift (Kuhn 1970). Resorting to a metaphor to ask someone to change perspective also implies using metaphor as a narrative and / or an argumentative tool to exchange with, and possibly convince that person. In this respect, the Humboldtian notion of worldview (Underhill 2011) and that of framing (Fillmore 1976) are useful since a given frame guides — and possibly influences — the way people perceive and interpret the world around them.

2. The role and function of metaphors in economics

Metaphors are ubiquitous in scientific fields where they “serve a remarkable variety of functions” (Hoffman 1985: 332-333); economics is no exception. Not only are they helpful and necessary during the pre-scientific stages of a discipline, but they also “play an essential role in mature fields, in the development of new theories as well as in the extension of old ones. They are *constitutive* of scientific discourse” (Bicchieri 1990: 104). Besides, “careful attention to metaphor in economic discourse will deliver unexpected vistas of economists and their work” (Klamer & Leonard 1994: 21).

Yet, seldom do scientists mention the metaphor that inspired them and helped them envisage and explore a hypothesis. It is as if the ladder that served to embrace the new horizon could be done away with. Adam Smith’s Invisible Hand metaphor has survived, though, which makes

¹ Some examples of such terms are ‘price elasticity’, ‘the velocity of money’, ‘stabilizers’, ‘friction’ for the mechanical physics strand, or ‘liquidity’, ‘capital inflows and outflows’, ‘spillovers’, ‘inflation’, ‘growth’, ‘infant industries’, ‘life cycle’, for the biological, organic strand.

it particularly insightful. Although the market cannot physically be moved by an invisible hand, the metaphor challenges logic and helps imagine a sort of unseen mechanism that could account for the process of self-regulation. In this respect, it illustrates Prandi's approach to living metaphors based on the notion of conceptual conflict. It also echoes Steen's criterion of deliberateness, viewed from the angle of communication: the Invisible Hand metaphor has also enabled generations of students to understand the concept and refer to it in a sort of codified manner, as a convenient means to make a long story short (Resche 2005). Despite its evolution from an unconventional association of hand and market, to a conventional expression, the metaphor exhibits a property that is characteristic of theory-constitutive metaphors as defined by Boyd (1993: 487):


Theory-constitutive scientific metaphors become, when they are successful, the property of the entire scientific community, and variations in them are explored by hundreds of scientific authors without their interactive quality being lost.

Solow (1988: 341) underlined that a metaphor in science is neither good nor bad, but just more or less *productive*. Again, Smith's Invisible Hand metaphor is a case in point: over time, it inspired a host of other metaphors revisiting either the adjective or the noun. Okun's "invisible handshake" (1980) Brock & Magee's "invisible foot" (1984), Schleifer & Vishny's "grabbing hand" (1999), Brown's "invisible fist" (1999), Roberts's "heavy hand" and "Invisible heart" (2001), Lindsey's "dead hand" (2001) or Nadeau's "green thumb" (2003) all implicitly refer to the original metaphor.

While a metaphor that may have been productive at one period may no longer seem relevant at another, a metaphor that is introduced prematurely is likely to fall flat and remain unproductive, since "economic conditions are constantly changing and each generation looks at its own problems in its own way" (Marshall 1890: Preface). When it comes to metaphors, a historically situated perspective is thus essential and the question of the relevance for economics of the concepts borrowed from mid-nineteenth century physics must be raised. As Mirowski (1999: 374) insists, "Thermodynamics, general relativity, quantum mechanics, chaos theory, and the grand theories of unified forces are all characteristically modern physics: they have fundamentally revised the very structure of explanation in physical theory".

McCloskey (1998: 42) points out that "an important metaphor in economics has the quality admired in a successful scientific theory, a capacity to astonish us with implications formerly unseen". The metaphorically connoted term "human capital" (Becker 1975) offers an appropriate example of a revolutionary metaphor meant to call into question the status quo and to prompt theoretical rethinking. When it was first introduced, it pushed researchers to reconsider the three traditional factors of production — i.e. land, labour and capital — and the clear distinction between capital and labour. The new concept was quite puzzling at first (Tab. 1): What did the idea that workers owned their own capital imply? How could it affect the attitude of employers towards workers? Actually, the human capital metaphor illustrates "how two sets of idea [...] can mutually illuminate each other by exchanging connotations" (McCloskey 1998: 43). As a result, thoughts in both labor economics and capital theory were

improved. The new concept has become familiar but it is essential to trace the metaphor back to its origin to assess how it impacted management theory.

<i>The three traditional factors of production</i>	LAND	LABOUR	CAPITAL
<i>The impact of the human capital metaphor</i>	LAND	 HUMAN CAPITAL	

Tab. 1 How the human capital metaphor questioned received ideas (Resche 2007)

Metaphors are also a means for theorists to discuss the best approach to a problem with their peers. The early economists who reflected on the economic cycle, like Jevons, used metaphors inspired from nature (sunspots, the seasons, the climate, waves), while later economists switched to physics as a source of inspiration (forces, friction, impulse, propagation, stabilizers); the letters Frisch and Schumpeter exchanged bring evidence of their use of metaphors first as a heuristic device, and then as an argumentative tool (Resche 2019). Their metaphorical approach was even translated into drawings representing a series of pendula that were adapted as reflection progressed.

As experiments cannot be conducted “in the real world” in economics, theoretical investigation based on metaphors is often supported or tested by models.

3. The role and specificity of models in economics

As was suggested in the introduction, economic models — whether physical, abstract, empirical, experimental, idealized, analogical, mathematical, or theoretical — are “necessarily subjective in design because there are no objective measures of economic outcomes” (Ouliaris 2011). In other words, an economic model should be understood as an interpretation rather than a perfect representation of reality.

According to textbooks (Samuelson & Nordhaus 2005:744) it is “a formal framework for representing the basic features of a complex system by a few central relationships [...]”. When building models to learn about the world, economists “assume away many of the details of the economy that are irrelevant for studying the question at hand” (Mankiw 2004: 23). For this reason, selecting relevant models is viewed as a real art and a gift:

Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. [...] Good economists are scarce because the gift of using ‘vigilant observation’ to choose good models, although it does not require a highly specialised intellectual technique, appears to be a very rare one. (Keynes, 4 July 1938)

Academic literature views theoretical models as mediators (Morgan & Morrison 1999), tools for exploration (Hausman 1992), means of creating and studying “what-if” scenarios, and interesting vehicles for research in the guise of thought experiments (Mäki 2005).

Models have also been likened to art or literary genres, which has led some to conclude that economics suffers from methodological softness, due to the risk of oversimplification and

even inaccuracy. Models (Gibbard and Varian 1978) are also likened to paintings (mimicking reality), drawings (simplifying reality), or caricatures (exaggerating or distorting reality). According to Rodrik (2015: 17-18), models share a number of traits with fables: they are simple, not real, and they have a clear story line, characters (like random shocks) and a moral (or policy implication). Rubinstein (2006) describes them as fairy tales, while Sugden (2002: 131) insists that, like novels, models are constructs describing parallel, hypothetical worlds, but not the real world:

The model is realistic in the same sense that a novel can be called realistic. In a realistic novel, the characters and locations are imaginary, but the author has to convince us that they are credible – that there could be people and places like those in the novel.

A model can also be constructed to help visualize how a general theory applies in a specific context. The Phillips machine, which is a stylized representation of the circular flow of money in the economic system, is a case in point. Phillips, who was trained as an engineer, first presented his initial idea as a diagram (Fig. 1) before translating it into a physical object (Fig. 2), which offered him the opportunity to imagine and test a number of situations — or what-if scenarios — and see the impact of any change in the levels of liquid in the various tanks, such as the effect of government spending on consumption, or of the rate of interest on savings and imports.

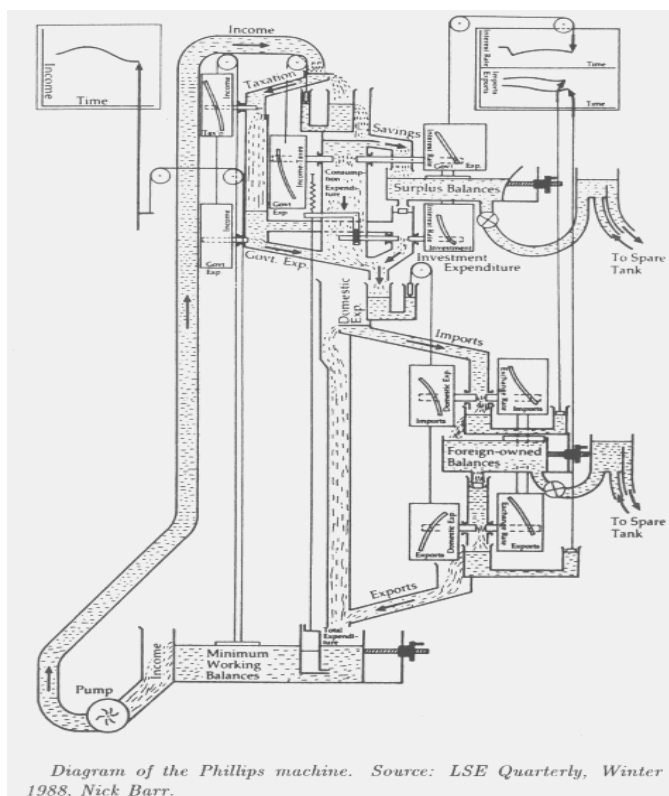


Fig. 1 The diagram of the Phillips machine



Fig. 2 The Phillips machine

The machine, now a museum piece, was first unveiled at LSE in 1949. It is also known elsewhere as a Moniac (Monetary National Income Analogue Computer). The model brings

evidence of the influence of hydraulic physics on theory-building in the field of economics. : it is a 3-D illustration of the theory-constitutive mechanical metaphor THE ECONOMY IS A MACHINE. It also stems from “a long-standing tradition presenting economic activity in terms of the flow of fluids” (Morgan & Boumans 2004), and is reminiscent of Quesnay’s 1758 *Tableau économique*. The latter diagrammed the circulation of riches between economic sectors of society and was inspired by what he knew from his training as a doctor about the circulation of blood in the human body. In the Phillips machine, the biological metaphor THE ECONOMY IS AN ORGANISM² is also active.

4. Of models and metaphors as frames

There are undeniable parallels between models and metaphors, as evidenced by the number of books and papers in which the two notions are related. Some philosophers of science, like Hesse and Kuhn, have likened the use of models in science to that of metaphors: both create similarities and rely on the strategy of understanding something in terms of something else that is more familiar and less complex. Among other common traits, they are closely tied to analogy, and “typically characterized by ‘as if’ reasoning” (Klamer 2007: 123); since they are hypothetical, they are neither true nor false as such. In addition, where a metaphor is to be productive, an economic model is to be useful.

Once the theorist or researcher has spotted a problem and visualized its possible solution(s) thanks to a metaphor or a model — exploiting their heuristic function during the exploration phase — he may use the same supports to share his findings with his peers. In this sense, both metaphors and models have a communicative function. After helping to enrich the body of knowledge and contributing to theory-building, they may be useful as pedagogical tools to help a broader public, including students, understand theory.

In the various processes, metaphors and models also share a number of shortcomings in that they are partial and subjective. In metaphors, a number of traits are selected, highlighted, while others are downplayed or simply left out. A metaphor can then be seen as a ‘filter’ or even a ‘screen’ (Black 1962: 39, 41). Likewise, a model involves reducing, simplifying, selecting data, isolating some problem or aspect, and it inevitably leaves “blind spots” (Bronk 2010). For example, Akerlof’s model of the car market, which is meant to explain the price difference between new and used cars, is focused on asymmetric information, and it ignores other factors that could bear on the prices of cars³. Akerlof himself insists that “this market is chosen for its concreteness and ease in understanding rather than for its importance or realism” (1970: 489). In spite of the warnings, the assumptions underpinning a model may soon be overlooked, and the risk for a model to be mistaken for the reality and induce hasty conclusions remains, especially if models are relied on for forecasting.

² The influence of the way a healthy body was represented in medieval medicine has also played a role. Good health supposed achieving the right equilibrium between the different body fluids; likewise, a healthy economy is based on economic equilibrium in the flows of money and the medical analogy is undeniable.

³ Incidentally, the model is referred to through a metaphorical term, i.e., the market for *lemons*.

Judging from the selection and partial representation of the reality inherent in both models and metaphors, one is bound to wonder whether they may not represent an epistemological obstacle when the explanation they offer, or the particular vista they provide, though challenging for the researchers' intuition, act as a mental stranglehold and risk blocking more promising research paths. It is certainly not obvious for researchers to free themselves from the impact of the former generations' metaphors and theoretical models, especially as group membership often requires acceptance of a body of knowledge or beliefs and its associated perspectives and findings. However, when 'normal science' is no longer able to provide answers, then comes a crisis, a sort of 'scientific revolution' (Kuhn 1970), and it is time to reconsider existing assumptions and paradigms, and to envisage a new set of metaphors and models. Economists need to develop greater awareness of "how the metaphors and models they use structure their analysis", and to be "more willing to experiment with different ways of seeing the world before they settle in one explanation. [...] [T]here is much that financial market modelers can learn from epidemiology in trying to model irrational exuberance and financial panic" (Bronk 2010: 102; 104). Entrenched assumptions underpinning the view of *homo oeconomicus* as a rational being always seeking to maximize his utility may have obscured or limited economic theory until the likelihood of man's irrationality was considered, which opened the way for behavioural economics and models. It is therefore most important for us, as linguists and observers, to try to pinpoint changes in metaphors and metaphorical veins that may reflect paradigm shifts. The four components defining a frame (Severin & Tankard 1997: 320) — selection, emphasis, exclusion and elaboration — apply to both models and metaphors.

If metaphors and models play a role in structuring the perspectives adopted by economists to look at the world, there is a risk for understanding to be distorted, whether deliberately or unconsciously. Thus, in contributing to theory-building, metaphors and models, which can be used for supporting argumentation, could also be bearers of ideology.

5. Of models and metaphors with regard to theory-building and ideology

There is apparently no real consensus among economists as to the meaning of the term 'theory'. On the one hand, Theory (with a capital T) refers to the official body of knowledge and beliefs that should serve as a basis for research and teaching. On the other hand, it is used in a more restricted context, alongside model: Lipsey & Chrystal (1999: 16) note that the term 'model' is either used "as a synonym for a theory", or "a subset of theories".

Insisting that "a model is neither necessary nor sufficient for theory", Klein & Romero (2007: 244) argue that "to suggest that 'theory' implies 'model' is to suggest that Hume, Smith, Marx, Veblen, Keynes, Coase, Schelling, etc. did not do theory". To Golfarb & Ratner (2008: 97), models are more concrete and have a more specific and limited scope and ambition than theory: they "are applications of theory to particular settings and/or represent explorations of different sets of assumptions conditionally allowable by the theory approach". Unlike theories, models are neither true nor false; their point is conceptual exploration, so that they make no claims about the world, and they consist of assumptions, not assertions (Hausman 1992: 77).

Models, like metaphors, are speculative instruments born of the imagination of their authors. They are also “intended to communicate. If some theorist develops a theory in terms of a model, he does not regard it as a private language, but presents it as an ingredient of his theory” (Hesse 1966:164-165). He may try to convince his audience to look at the problem through the lens he suggests, to justify his views and to persuade others that his approach is sound and can contribute to advances in knowledge; hence the role played by metaphors and models in constructing ideological worldviews, or “cultural mindsets” (Underhill 2011).

The following exchange between Alan Greenspan, then Chairman of the Federal Reserve and Rep. Henry Waxman, chairman of the House Oversight and Government Affairs Committee, explicitly mentions the links between models and ideology. The context is the 2008 global crisis:

Greenspan: Well remember ... an *ideology* is ... a *conceptual framework*... the way people deal with reality. Everyone has one. To exist, you need an ideology. *The question is whether it is accurate or not.* And what I’m saying to you is yes, *I’ve found a flaw*...

Waxman: You found a flaw in the reality...

Greenspan: *Flaw in the model* that I perceived as the critical functioning structure that defines how the world works.

Waxman: In other words, you found that your *view of the world*, your *ideology* was not right.

Greenspan: Precisely.

(James 2008; emphasis mine)

All the words emphasized in the exchange above echo the already mentioned notions of conceptual framework, worldview, model and ideology. In other words, a flawed model can indeed lead astray by providing misleading prescriptions for public policy.

Likewise, the existence of deep-seated metaphors, with the network of metaphorical terms that extends or revives them, may influence the way scientists and researchers approach and interpret social and economic problems, and the solutions they may recommend. This begs the question of metaphorical scientific paradigms that risk dictating or obscuring research. According to Pocock, a key feature of paradigms is that they

so satisfactorily discharge the intellectual functions expected of them that they authoritatively indicate not merely the solutions to problems, but the kinds of problems which are to be conceptualized as requiring solutions; and so, dictating the direction, the pattern, the distribution and organization of intellectual endeavour, indicate further the ascription and definition of authority among the individuals and groups composing the ‘scientific community’ (1989: 13).

In so far as metaphors may offer ready-made patterns of thinking, “overused” metaphors in science can have an insidious brainwashing effect; they may become reified and acquire a normative and ideological character. To a certain extent, theories based on these widely-accepted metaphors may be said to produce self-fulfilling beliefs and behaviour.

As linguists and observers, we are best placed to monitor the metaphorical frames, scrutinize any change in metaphors and in the metaphorical assumptions of models that might signal a turning point in the way economists look at the world and envisage solutions to the new

phenomena they observe around them. Careful discourse analysis of the rhetorical use of metaphor is also called for. In research and academic circles, especially those that are likely to influence policy choices, the argumentative function of metaphor, its opinion-forming nature, its ability to structure people's understanding of economic concepts, and the way the latter are expressed through language are likely to be particularly insightful.

Concluding remarks

To conclude, it is important to stress again the idea that metaphors in science should be considered in context, i.e., in their historical, social, scientific, cultural, linguistic and discursive contexts. Theory-constitutive metaphors should be laid bare and analyzed before anything else, because they provide insights into the history of ideas that shaped a particular field of knowledge. Considering such units regardless of the environment in which they appeared would at best lead to hasty, frustratingly superficial interpretations and at worst to faulty conclusions.

The paper has underlined the common traits between metaphors and models and the fact that they can be viewed as double-edged swords in scientific fields. They may open new horizons for seeing things differently, but they may also act as straightjackets obscuring our judgment. Leezenberg's view (2013) that language is not merely derivative of thought, but can influence the thought process and shape thought, does apply to metaphors. Not only can they influence research paths, but their persuasive, argumentative power can also bear on the public's worldview and on the decisions of policymakers that might ultimately affect people's lives.

Another reason why awareness of such metaphors is essential is their dynamic character, which enables us to consider them as barometers in a number of ways. First, they bear witness to the evolution of ideas within a given scientific field and to the emergence of a paradigm shift. Metaphors also reflect the openness of a field to external influences. At a time when science, technology and information move at a very fast pace, theory-constitutive metaphors deserve constant monitoring to help assess the impact they may have on shifting disciplinary boundaries. In addition to importing metaphors, a discipline can export metaphors, which may convey its scope and power. Tracking metaphors as they travel through time and space, and observing their evolution and impact is a never-ending, but rewarding task, provided one goes beyond surface metaphors. Such an approach is likely to yield insightful results as to the problems scientists choose to focus on to meet society's needs and demands, and as to the way our worldview can be influenced by the metaphors they choose as a basis for their research and explanations. As Biber (1988:3) underlined, "competing ideas which evolve slowly over generations will be accepted as equally factual when there is no contradictory record of earlier ideas". Theory-constitutive metaphors may then "force us to acknowledge the contradictory ideas of earlier societies and thus to regard knowledge with a critical [...] attitude".

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