
Analogical Reasoning and Knowledge Generation in Organization Theory

Haridimos Tsoukas

Abstract

*Haridimos
Tsoukas*
Warwick Business
School, University
of Warwick,
Coventry, U.K.

This paper reviews and evaluates the cognitive status to which metaphors and analogies have been ascribed in the process of knowledge generation in organization theory. Three perspectives are identified: metaphors as ways of thinking, metaphors as dispensable literary devices, and metaphors as potential ideological distortions. The main tenets of each one of them are reviewed and subsequently submitted to criticism. It is argued here that, despite their differing claims, the preceding perspectives converge on the assumption that there is a gap between metaphorical and scientific languages. The grounds for the existence of this gap are challenged in this paper, noting that the structure-mapping theory of analogy provides a methodology for developing metaphorical insights to yield scientific models and theories.

Introduction

The meta-theoretical debates about the nature of the social sciences have been echoed in organization theory recently by the growing realization that models and theories purporting to account for organizational phenomena are not so much reflections of an objective reality as subjective constructions built from a variety of symbolic constructs (cf. Astley 1984; Morgan 1980). A consequence of this realization has been the suggestion to view organizational knowledge as being generated within incommensurate paradigms and clustered around intra-paradigmatic metaphorical lines of reasoning (Burrell and Morgan 1979; Morgan 1980). Central to this point of view is the essential role of metaphors and analogies in the generation of organizational knowledge.

The purpose of this paper is to address the following question: what is the cognitive status to which metaphors and analogies have been ascribed in the process of knowledge generation in organizational theory, and how might this status be evaluated? Accordingly, the paper is organized as follows.

First, the debate on the use of metaphors in organization theory is reviewed and three perspectives are identified: metaphors as ways of thinking, metaphors as dispensable literary devices, and metaphors as potential ideological distortions. The claims of each perspective are critically assessed and the main problems besetting them are brought to the

surface. It is argued here that, despite their differing claims, all these perspectives converge on the (implicit or explicit) assumption that there is a necessary gap between metaphorical and scientific languages.

Second, the grounds for, and the usefulness of, the previously mentioned gap are challenged in this paper. Drawing on cognitive science, the different knowledge functions of metaphorical and scientific languages are briefly outlined, and four additional types of domain similarities are subsequently identified: literal similarities, analogies, abstractions, anomalies, and mere appearances. Following this classification, the structure-mapping theory of analogy is presented and discussed. The claim is put forward that the structure-mapping theory of analogy bridges the gap between metaphorical and scientific languages by providing a methodology for the development of metaphorical insights to yield scientific knowledge. On this view, metaphors and analogies need not be implicit, arbitrarily subjective images, nor mere literary devices, but they can supply the raw material which, suitably processed, may yield scientific models and theories.

Three Perspectives on the Cognitive Status of Metaphors and Analogies in Organization Theory

Metaphors as Ways of Thinking

The philosophical roots of this perspective are to be found in subjectivist approaches to the social sciences, especially in phenomenology, ethnomethodology and social action theory (Burrell and Morgan 1979; Morgan and Smircich 1980). The main claim of the proponents of this perspective is that there is not a single independent reality awaiting to be 'read' in any conclusively valid way, but rather that the social world is continually (re)constituted by human beings through linguistic and symbolic means (Manning 1979; Morgan 1980; Weick 1979).

A main characteristic of the social world is the factitious and objective character it acquires to the extent that it is perceived by individuals not as a human creation (which it really is) but as a solid, external and influential entity analogous to the natural world (Berger and Luckmann 1967). Although social reality may be presented to its makers as given at any point in time, what is significant is that the very reality itself is dependent for its existence on actors' understandings and subjectivities. The implication is that different sets of understandings have the capacity, at least in principle, to generate alternative social realities. A somewhat extreme interpretation of the above would be that social reality is nothing more than a subjective construction (cf. Reed 1990).

The process of constructing scientific theories is not fundamentally different from other modes of knowledge generation: in its attempt to objectify reality, scientific discourse draws upon symbolic constructs which embody subjective meanings and symbolic ways of perceiving the world.

figurative language supplies the images that are necessary for the process of knowledge generation. Metaphors are subjective images of a particular domain and they are based on certain paradigmatic assumptions which are in themselves metaphor-dependent. The implications of particular metaphors are explored through the puzzle-solving activity of normal science (Morgan 1980).

Thus, metaphors (and figurative language more generally) are not simply literary illustrations, but rather 'a basic structural form of experience through which human beings engage, organize, and understand their world' (Morgan 1983: 601). Metaphors and analogies liberate imagination, help draw attention to alternative conceptions of reality by selectively highlighting certain features of it, and thus guide action accordingly. From an explanatory point of view, theoretical explanations can be viewed as metaphorical re-descriptions of the domain of explanandum which perform not only a heuristic, but also a logical function (Black 1962; Hesse 1980).

Given that metaphors and analogies are fundamentally constitutive of what is perceived to be 'out there', it follows that the art of reading social situations is what really matters rather than deciphering what the nature of social situations is, since social situations do not have a given nature anyway (Morgan, 1980, 1986; Weick 1979). A logical extension of this reasoning is that 'as ways of talking and believing proliferate, new features of organizations are noticed' (Weick 1979: 234). In other words, thinking is intimately connected to organizing; new perspectives, images or concepts at the very least capture new organizational features while, at the most, they help create the very features to which they refer.

Insofar as linguistic schemata in general, and metaphors in particular, are necessarily partial, it is suggested that organization theory should develop by encouraging diverse perspectives for understanding organizations. As far as practitioners are concerned, they will be truly helped if they can be persuaded to realize both the essential complexity of organizational life and the partiality of established ways of looking at organizational phenomena. The implication of such a view is that practitioners must be encouraged to develop the art of 'reading' social situations through the spectacles of a wide range of metaphors (Morgan 1986, 1988a, 1989).

Metaphors as Dispensable Literary Devices

This perspective stands diametrically opposite to the previous one: metaphors and analogies are regarded an impurity in social scientific language which must eventually be removed. Philosophically, it is assumed that there is a social reality independent of its makers which influences human beings, in much the same way as a gravitational field influences those objects that are placed in it. While it is acknowledged that social reality is the product of human beings, it is assumed that there is a logic in the manner in which reality is constructed, and that it is the

task of social science to identify this logic. Social reality, therefore, can — indeed must — be explained and/or predicted, although our knowledge of it will always be partial and uncertain. Scientific theories need to employ non-figurative language in accounting for social phenomena, for it is only when language is non-figurative that hypotheses can be lucidly and unequivocally formulated and publicly tested (Bourgeois and Pinder 1983; Pinder and Bourgeois 1982).

As the proponents of this perspective argue, scientific theories aim at revealing identities and invariances, namely 'structures and relationships in the real world that could not be otherwise' (Boulding 1987: 112), rather than simply spotting similarities (Beer 1981; Levi-Strauss 1963; Turner 1987). Ultimately, in accounting for an empirical phenomenon, we want to know *what it is* and *why*, not merely what it looks like, or feels like. In this respect, metaphorical language *per se* is, by nature, a very poor substitute for scientific language, for the former is concerned with mere similarities being unable to reveal generic properties (Beer 1966; Bunge 1973).

Furthermore, it is suggested that the use of metaphors and analogies can be misleading for the following three reasons. First, metaphors and analogies are usually imprecise, couched in lay terms, and are frequently of low conceptual content. They do not help define theoretically those aspects of the phenomenon in which a researcher may be interested, so there is no way of knowing whether theoretically necessary features have been included, or whether the attention has merely focused on contingent (and therefore theoretically insignificant) aspects of the phenomenon under study.

Second, metaphors and analogies cannot be formulated in a way that will permit their inter-subjective scrutiny, and thus their potential falsification. As Pinder and Bourgeois (1982: 644) argue 'a science that is laced with metaphors makes this [i.e. falsifiability] difficult, because metaphors shape cognitions as much as cognitions shape metaphors, and there is no means internal to the conduct of science itself to determine the goodness of fit of a metaphor to the entity it is offered as representing'.

Third, there is always the danger of not recognizing the limits of a particular metaphor (i.e. 'pushing a metaphor too far') due to the lack of expertise when using metaphors which were originally developed in different scientific fields. In other words, conceptual borrowing needs to be informed if it is to be of any real value and few scientists are sufficiently well informed of developments in a diverse range of fields.

Organizational theorists subscribing to this perspective accept the inevitable intrusion of metaphors in scientific discourse, as well as the fact that some of them may be of heuristic value. However, they emphasize that this is a necessary evil which needs to be restricted as far as possible. A conscious effort must be made to dispense with metaphorical language, especially in the more mature phases of a scientific inquiry (Bourgeois and Pinder 1983; Bunge 1973; Pinder and Bourgeois 1982).

Metaphors as Potential Ideological Distortions

For the adherents of this perspective, while the necessity and value of metaphors is not discarded, an unbridled use of metaphorical thinking is deemed as not necessarily desirable. It is claimed that metaphors can serve enlightening as well as ideologically distortive functions. They can reveal as much as they can conceal — especially structural disadvantages, inequalities and power concentrations. According to proponents of this view, a metaphor is valid only when it recognizes ‘social inequality and domination, and points to political opportunities for liberation and emancipation’ (Tinker 1986: 378). Metaphors which do not conform to this criterion are viewed as ideological distortions propagating false consciousness, and thus they stand in the way of human emancipation.

Philosophically, this perspective rejects the thoroughgoing relativism implied by those who subscribe to the metaphors-as-ways-of-thinking perspective, and is committed, in principle at least, to a rationalist conception of society and science according to which society and science continuously interact. Being close to what Burrell and Morgan (1979) have identified as ‘the radical-structural paradigm’, proponents of this perspective have assumed social reality to consist of ontologically real structures whose workings need to be revealed by science (or at least by emancipatory science) with the aim of transcending them in the direction of human emancipation (Alvesson and Willmott 1991; Fay 1975; Tinker 1986).

Those who are committed to the view that metaphorical thinking always ought to be encouraged are criticized for failing to take into account the social conditions surrounding (and thus shaping) knowledge production (Reed 1990). Knowledge, it is argued, does not take place in a social vacuum but is fundamentally influenced by partisan interests and, more particularly, relations of domination. A biased social context generates biased knowledge, thus invalidating the allegedly naive claim that all metaphors can be of equal usefulness and must therefore be given an equally fair chance. In capitalist societies, it is argued, many (most?) metaphors used in management have helped to dissimulate social conflict and inequality at the expense of disadvantaged groups (Tinker 1986). It follows from this that promiscuous metaphorical proliferation can be seriously dangerous since it does not equip scientists and practitioners with the necessary prophylactic media against ideological mystification and social domination.

Discussion

None of those who subscribe to the preceding three perspectives disputes the use of analogical reasoning in organization theory as a possible point of departure. However, where they part company with each other is in their evaluation claims: while theorists like Morgan welcome and want to

extend metaphorical thinking in theory development, Pinder and Bourgeois regard it as an unwelcome intrusion whose effects ought to be consciously minimized, while Tinker qualifies metaphorical thinking with a set of predominantly socio-ideological criteria. Consequently, the advocates of each perspective place different emphasis on the use of metaphors in their work. Morgan, for example, has actively sought to promote metaphorical thinking in organization theory, while Pinder and Bourgeois have adhered to an objectivist, non-figurative view.

Moreover, the above perspectives can be classified according to the answers they provide to the following two questions: (a) How can a theory be justified (context of justification)?, and (b) How can a theory be applied (context of application)? Those who subscribe to the metaphors-as-ways-of-thinking perspective have been reticent in spelling out the epistemological criteria for the justification of organizational theories. In fact, it has been assumed that the utility of the latter does not so much depend on epistemological criteria of justification as on the extent to which they allow individuals to engage in a process of active experimentation. The public, inter-subjectively testable, nature of social scientific discourse gives way to the private, intuitive process of trial-and-error occurring in a single mind in its context-based dialogue with social reality (see Table 1).

The proponents of the metaphors-as-dispensable-literary-devices perspective emphasize the need for the formal validation of organizational theories, namely for publicly enunciated and established rules and procedures for the validation of knowledge claims. Unless organizational theories are subjected to public scrutiny, it is argued, and faced with the chance to be proved wrong, they are of very little utility. A corollary of this view is that the applicability of social theories is essentially instrumental and, ideally, universal: if the validity of a theory has been justified then individuals can begin to put it into practice. Social theories and their users are externally related, much like individuals are related to machines (see Table 1).

Advocates of the metaphors-as-potential-ideological-distortions perspective highlight the socio-political environments within which social theories are produced, and prescribe a set of ideological criteria for their justification. Application of those theories which have survived the Procrustean ideological tests will follow in both an instrumental and self-

Table 1
A Classification of
Three Perspectives
in Organization
Theory in Relation
to the Context of
Justification and the
Context of
Application

	Context of Justification	Context of Application
Metaphors as ways of thinking	Lack of criteria for knowledge validation	Active experimentation
Metaphors as dispensable literary devices	Criteria for knowledge validation	Instrumental application
Metaphors as potential ideological distortions	Ideological criteria	Instrumental and self- reflective application

reflective manner. People are presumed to be enlightened after their encounter with these types of theory and to be willing to apply them to bring about a new reality (see Table 1).

As will be demonstrated shortly, each of the preceding perspectives is beset by different problems. What, however, is common is their acceptance of the existence of a necessary gap between metaphorical and scientific languages. As will be argued later, such a gap is unnecessary — in fact, for purposes of theory building, it is more profitable to see metaphorical and scientific languages as the two ends of the same continuum.

An Assessment of the Metaphors-as-Ways-of-Thinking Perspective

To argue that all metaphors are useful because they enable us to capture different aspects of organizational phenomena, which otherwise could not be accounted for, is true but not terribly suggestive. Any linguistic schema, be it more or less metaphorical, is partial and one-sided (Bunge 1973; Harré 1984; Popper 1982). The requisite variety of language is inherently lower than the requisite variety of the reality it attempts to deal with (Ashby 1956; Beer 1985), and consequently the more languages we use, the better (Bateson 1979). A more interesting question, however, is how can our multiple theoretical schemata be developed and compared, and how can rival theoretical propositions be adjudicated (i.e. questions concerning the context of justification).

For instance, how are the strengths and weaknesses of particular metaphors to be assessed? Are all metaphors equally useful? What are they useful for? Metaphors *qua* metaphors do not lend themselves very well to independent criticism, improvement and refutation — a point rightly emphasized by Pinder and Bourgeois. In any case, as mentioned earlier, those subscribing to the metaphors-as-ways-of-thinking perspective have been remarkably reticent at suggesting ways in which metaphors can be developed and assessed. Morgan (1980: 611), for example, ascribes to metaphors the background role of an implicit *image* which 'can provide the basis for detailed scientific research based upon attempts to discover the extent to which features of the metaphor are found in the subject of inquiry'. However, he stops short of explaining *how* this happens. In other words, how are metaphorical insights transformed into bodies of scientific knowledge?

It is worth noticing that Morgan's assessment of the weaknesses of various metaphors is essentially based on common sense. This may be useful for purposes of everyday communication, but not very satisfying from an epistemological point of view. For metaphors to be rationally assessed, one needs a framework within which metaphors can first be developed and then compared. Morgan's (1986) eight metaphors are hardly eligible for subjection to such a scrutiny, since their metaphorical nature is usually *implied* but not explicitly enunciated — strictly speaking, they are *images* of organization and not metaphors of organization (cf. Stillings et al. 1987).

The limits with which the metaphors-as-ways-of-thinking perspective is faced extend beyond the context of justification to the context of application. Consider, for instance, Morgan's (1986) case study at the end of his book *Images of Organization*, in which he attempts to show how the insights of eight different metaphors can be used in diagnosing, critically evaluating and solving concrete organizational problems. There are two weaknesses in his approach.

First, despite his earlier remarks about the equality (or rather equifinality), in terms of practical utility, of diverse metaphors, Morgan (1986) himself favours one particular type of discourse (and the accompanying machine, organismic and holographic metaphors) when he talks about effective management, improving current organizational practices, and enhancing the ability of organizations to solve problems through their emphasis on cultural socialization and decentralized control (cr. Reed 1990). Similarly, in a later book derived from empirical research, Morgan urges managers to 'become more proactive and skilled in dealing with the managerial turbulence that lies ahead' (1988b: xii-xiii) and acknowledges that organizations face the dual problem of 'how to do the right thing and do it well' (Morgan 1988b: xi).

In other words, instrumental discourse of a managerialist type is used *de facto* when attempting to comprehend and influence organizational phenomena. To talk, however, about the 'effectiveness' of current organizations necessarily entails concessions towards a particular discourse, thus implicitly prioritizing metaphors according to the rules of such a discourse. In short, Morgan finds himself in the contradictory position of theoretically proclaiming the usefulness of all metaphors (and their associated mode of discourse), while practically privileging some of them at the expense of others.

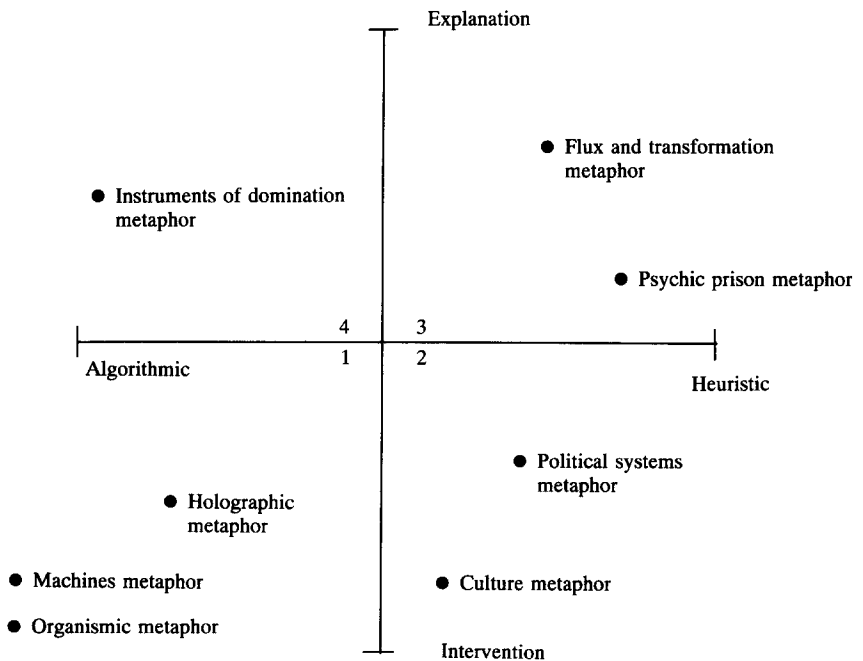
Second, the use of metaphors is ordered *de facto* according to the degree to which they allow human intervention in concrete organizational situations. In the beginning was the environment, and Morgan's analysis of the case study starts with the organismic metaphor to be followed by the prescriptions derived from the holographic and culture metaphors. It becomes obvious that the other metaphors have a residual status, and are thus of marginal utility, due to lack of adequate information.

Although a case study serves only illustrative purposes and can only legitimately be confined to the discussion of certain metaphors, we suggest that there is something more to this selective use of metaphors than mere space limitations or lack of information. Just as the psychic prison metaphor, the flux and transformation metaphor, and the domination metaphor have been left virtually undiscussed in Morgan's case-study analysis, so are the same metaphors more likely to be selected out in the process of designing organizations. The reason for this lies in the elective affinity between organization design and algorithmic-cum-interventionist knowledge.

It is suggested here that Morgan's metaphors can be classified along two continua. The first consideration is the use of a particular metaphor,

namely the degree to which a metaphor is used primarily to explain or intervene in organizational phenomena. Concern with explanation implies an interest in generative mechanisms that bring about concrete phenomena, while concern with intervention implies an interest in identifying, preserving or changing currently stable input-output relationships. Intervention is future-oriented and implies action within a short-term time frame, while explanation is retrospective and may or may not lead to action towards a specific problem. (For justifications of the distinction between explanation and intervention as two distinct human orientations see Ashby 1956; Bateson 1979; Beer 1981; Watzlawick et al. 1974; Weick 1979; Whitley 1989.) Second is the logical structure of a metaphorical statement, or to put it differently, its mode of knowledge representation. At the one end of the continuum are algorithmic metaphors, namely statements prescribing how to reach a fully specified goal (Beer 1981) whose structure conforms to the logic of 'if, then' propositions. At the other end are heuristic metaphors (see Figure 1), namely statements that purport to highlight methods of behaving 'which will tend towards a goal which cannot be fully specified because we know what it is but not where it is' (Beer 1981: 52).

Figure 1
A Classification of
Morgan's Images
of Organization



Insofar as practitioners are concerned with organization design, namely with the design of systems for the systematic influence of individuals' behaviour, they are bound to rely on images that are both algorithmic and interventionist — hence to use the machine, organismic and, probably

holographic metaphors (cell 1, Figure 1). The close relationship between the *public* character of organization systems and the *algorithmic* nature of organizational knowledge that is used for their design has not always been appreciated in organization theory. Organization design is essentially based on 'if, then' propositions which are validated via a process of public debate within the context of scientific communities.

The above does not invalidate the utility of the rest of Morgan's metaphors, it simply elucidates the areas and mode of their application. Management is, of course, more than the design of public organization systems; it is also the *process* of managing them and it is here that metaphors that are included in cells 2 and 3 (see Figure 1) can be useful, insofar as they enlighten practitioners (cf. Whitley 1989). These metaphors do not so much prescribe the exact content of what is to be done in concrete situations as enhance actors' understanding of the dynamic of organizational problems. In this case the relationship between a particular metaphor and the resultant action is not as straightforward as in the case of metaphors in cell 1. Heuristic metaphors attempt to capture the dynamic nature of a situation without necessarily specifying concrete courses of action. It is presumed that actors equipped with a dynamic understanding of organizational problems will be in a better position to experiment actively with a situation (i.e. to apply 'what, if' statements in the process of managing problem) without subjecting their 'trials' to public scrutiny for 'errors' to be checked (cf. Jung 1958).

The metaphors included in cell 2 sensitize individuals to particular aspects of organizations without prescribing an exact route to an already known goal (hence their heuristic nature), while at the same time they are used to influence people's behaviour (hence their interventionist nature). The metaphors in cell 3 are also heuristic in their logical structure but are primarily used to explain organizational phenomena retrospectively, offering little scope for intervention here and now.

The organizations-as-instruments-of-domination metaphor that is included in cell 4 (see Figure 1) suggests ways for thinking about the causal mechanisms that result in the generation of particular phenomena in concrete circumstances. It deals, however, with highly abstract entities and the consequence is, as Whitley (1989: 19) remarks, that 'the more radical the reconstruction of everyday accounts and the lower the dependence on currently dominant rationalities, the less directly and closely connected are social theories with managerial practices and the more contingent is their application to managerial problems'.

Finally, there is no reason why a particular metaphor cannot 'travel' along the various cells of Figure 1. For example, along the algorithmic–heuristic continuum, it is conceivable that the culture metaphor may be conceptualized in such a way as to acquire an algorithmic character specifying concretely how a particular culture might be designed (see, for example, Kilmann 1989). Similarly, along the explanation–intervention continuum, the psychic prison metaphor may be operationalized, and thus become more interventionist by using particular techniques for the

management of current organizational problems (see, for example, Kets de Vries 1991).

The reason why metaphors are necessarily prioritized when put into practice is that our metaphorical conceptions do not develop against a socially neutral background; we don't just scribble on a blank sheet of paper in pursuit of unconstrained mythopoetic creativity (Llosa 1987). This is already evident from the wide acceptance historically commanded by the machine metaphor, a point which has been repeatedly acknowledged by Morgan (1980, 1986, 1988a, 1989) himself. Why has this particular conception of organizations gained such prominence? What explains its firm entrenchment in organizational thinking and structuring? Has it got to do with modernity, the age of reason and the appearance of industrial society? Is it a necessary feature of a particular set of relations of production, or are other factors involved?

Whatever the answer may be, it certainly cannot be concluded that just 'imaginization' — free and creative metaphorical thinking — is satisfactory enough to be a substitute for 'organization'. For, if it were, we would certainly have already had a plurality of metaphors-in-use embedded in diverse organizational settings which, however, by common acknowledgement, we do not. An alternative explanation might be to assume that somehow over the last hundred years there has been a stagnation of creativity so that we could not possibly have visualized alternative organizational forms guided by diverse metaphors. However, this would be a rather implausible position to take, especially in the light of the immense creativity shown in areas as disparate as technology, arts, and social administration. Thus the only remaining answer seems to be that there must be something else which accounts (partially at least) for the predominance of the machine metaphor. In all probability, this can be found in the rules underlying the operation of modern socio-economic systems and institutions (cf. Albrow 1990; Heilbroner 1985).

An Assessment of the Metaphors-as-Dispensable-Literary-Devices Perspective

While those viewing metaphors as dispensable literary devices cherish the distinction between metaphorical and scientific languages, they push this distinction too far to constitute a dichotomy. They lack a view of metaphors which would allow them to dispose of their literary elements and to develop the latter into scientific models and theories. In that respect, it is only natural for Pinder and Bourgeois to urge organizational theorists to consciously avoid analogical reasoning, although they admit this is not entirely possible.

Pinder and Bourgeois conflate the illustrative and the scientific use of metaphors. The illustrative use of metaphors in organization theory is to be expected as part of the rhetoric employed in scientific discourse, intensified by the practically oriented character of organizational theory and the need to appeal to a wide audience of practitioners (Whitley 1984a,

1984b). However, to treat all metaphors as if they were nothing else but mere literary illustrations ignores the possibility of using metaphorical thinking in such a way as to eventually reveal generic properties.

This is amply manifested in Pinder and Bourgeois's (1982) discussion of the garbage-can metaphor (Cohen et al. 1972). Their attempt to deduce formal hypotheses from this particular metaphor ends up being ridiculous, because the garbage-can metaphor is simply a figure of speech, a literary illustration to make sense of organizational decision-making, and not a metaphor intended to reveal invariances and generic properties between garbage-cans and organizations. By contrast, Beer's (1979, 1981, 1985) modelling of the firm on the human nervous system, the modelling of organizational populations on biological populations (Aldrich 1979; Hannan and Freeman 1977), or the conceptualization of social relations as statistical regression (Sirgy 1990), are metaphors whose significance is not just literary, but they represent an attempt to describe, explain and predict organizational processes by taking advantage of actually existing analogies (Tsoukas 1991). The question, therefore, is how one might take advantage of these analogies in order to develop scientific theories.

In other words, following Pinder and Bourgeois's exhortations to try to eradicate metaphors from the organizational garden would not only be unattainable, but would also be damaging for the field. Social phenomena are mutually constitutive with the metaphors used for their comprehension and, as Morgan (1983: 605–606) aptly remarked, 'without a prefiguring image of the phenomena to be studied (one that will inevitably be false and misleading in some degree), there are no hypotheses to be tested'. Furthermore, to disregard the importance of metaphorical thinking means to close deliberately our eyes before the patterns and analogies manifested in our world (natural and social alike), as well as to ignore injudiciously the knowledge which has been painstakingly accumulated across a variety of scientific fields, which could give us some clues regarding our own theoretical questions.

An Assessment of the Metaphors-as-Potential-Ideological-Distortions Perspective

Tinker's remark about the socially conditioned nature of metaphorical thinking is correct, although fairly unexceptional. What is more interesting (and revealing) is the manner in which Tinker defends his thesis. He critically examines metaphors used in a variety of scientific and social contexts. More specifically, he focuses on metaphors implied by social Darwinism and socio-biology; metaphors used in the education of workers and managers at the British Mechanics' Institutes in the 19th century; and metaphors from cybernetics and general systems theory, as well as biological and machine metaphors in economics and organization theory. He invariably concludes that all these metaphors reify their subject matter by de-politicizing and de-socializing it, thus perpetuating, and being

an ideological alibi for, existing social domination. His claim, however, is problematic for the following reasons.

First, when the biological and machine metaphors are criticized for failing 'to take account of the social order in which human struggles occur, and thus ignor[ing] questions of social conflict, class, social consciousness, etc.' (Tinker 1986: 371), it is not suggested *why* this failure is important. In other words, in what way does the taking into account of all those issues better help to explain and/or predict organizational phenomena, than adopting other approaches? To accuse biological metaphors of partiality would only be valid if there could be a panoramic, all-encompassing Olympian high ground from which organizational phenomena could be observed: but such a panoptic position does not exist. Our theoretical schemata, be they purely metaphorical or scientific, are anthropologically condemned to be partial and one-sided. Tinker's claims are no exceptions, and if they are accepted, then he ought to provide us with the reasons why his own (different, but equally biased) metaphorical thinking is conceptually (not ideologically) more satisfactory than the hitherto existing ones. Until this is done — and he offers no suggestions as to how this might be accomplished — his critique will not be convincing.

Second, following Pinder and Bourgeois, Tinker conflates the illustrative with the scientific use of metaphors, or, to put it differently, he conflates the context of application with the context of justification. In many of his examples, metaphors have admittedly served illustrative and/or ideological purposes (the context of application), without having been systematically developed to reveal the generic properties of their subject matter (the context of justification). In cases where this has not happened, notably in Beer's Viable System Model and the population ecology perspective, no arguments are advanced to show why and where these metaphorically inspired models are wrong.

Of course, from a rhetorical point of view, namely in attempting to persuade an audience, anybody is at liberty to use any metaphor that is likely to appeal to that audience, and in this sense it is very probable that the most popular metaphors will be those reflecting dominant ideas and biases of the pertinent social era. Used as rhetoric devices, therefore, metaphors have always been useful to their users and will always be useful to future users. To point out that metaphors serve an ideological function merely invites the rejoinder that all rhetoric devices are ideological, at least to some extent. The crucial question, however, is how to develop metaphors in such a way as to transcend the mere illustrative-cum-rhetoric level (at which acceptance of a metaphor is a matter of uncritical intuition and unexamined prejudice), in order to yield knowledge which can be rationally assessed and accepted.

Metaphorical Insights and Scientific Knowledge: Bridging the Gap

The Knowledge Functions of Metaphorical and Scientific Languages

The above discussion has identified a number of problems besetting each perspective on the use of metaphors and analogies in the process of knowledge generation in organization theory. Some remedies for these problems have already been suggested (see, for example, Figure 1, for an attempt to classify Morgan's images of organizations), and one can argue that further work within each perspective may resolve some of the remaining problems. What is common in all these perspectives, however, is the absence of a methodology which seeks to develop metaphorical insights to yield scientific organizational knowledge. It is, perhaps, worth repeating that even the most ardent proponents of the use of metaphorical language in organization theory do not reject the activity of 'normal science' in '[producing] one-sided analyses of organizational life' (Morgan 1980: 612), but they ascribe to metaphors the role of implicit images prefiguring a particular subject of inquiry. As argued above, however, these images *per se* are difficult to develop and test further, and, in any case, their relation to the puzzle-solving activity of normal science has remained unclear. Below, drawing on cognitive science, and the work of Gentner in particular, we will describe how the gap between metaphorical insights and scientific models might be closed.

A Classification of Domain Similarities

A metaphor involves the transfer of information from a familiar domain (called the 'base' or 'source' domain) to a new and relatively unfamiliar domain (called the 'target' domain) (Johnson-Laird 1989; Lakoff and Johnson 1980; Ortony 1975, 1979; Vosniadou and Ortony 1989). Metaphors assert certain similarities between the source and the target domains in a (usually) implicit manner (e.g. 'My Greek has gone a bit rusty'). Metaphors involve the simultaneous equating and negating of two different ideas or objects thus producing a 'kind of tension or vibration in the mind, a high state of energy in which a creative perception of the meaning of the metaphor takes place non-verbally' (Bohm and Peat 1987: 33). While, however, in literary fiction, the imagery of a metaphor can be powerfully used to bring the reader into contact with the (real or imaginary) experiences that the author is narrating (as direct a contact as is linguistically possible), in science it is necessary to unfold the meaning of a metaphor in more detail (Bohm and Peat 1987). This is because, in addition to expressing our experiences (as usually happens in literary fiction), we also want to *explain* them and that necessitates distancing our experiences in order to abstract them, identifying the mechanisms that are responsible for producing these experiences, and deciding on the generality of the operation of these mechanisms — and hence the need to

employ scientific language (Bhaskar 1978; Harré 1984; Sayer 1984). The latter has an inherently reductive propensity, abstracting and segmenting experience in order to decipher relationships between its constitutive components (Berger and Luckmann 1967; Bhaskar 1978).

In addition to the similarities implied by a metaphor, a number of explicit similarities can also be discerned when transferring information from one domain to another. Each of them is discussed below (see Gentner 1983, 1989).

1. An *analogy* 'operationalizes' a metaphor or a simile by transferring relationships between certain items in the source domain to the target domain (Bunge 1973; Sanford 1987; Vosniadou 1989). For instance, it has been argued by Ackoff (1974: 237) that a mess 'can be conceptualized as system of problems in the same sense in which a physical body can be conceptualized as a system of atoms'. Similarly, Kilmann (1989: 50) has remarked that 'Culture is to the organization what personality is to the individual'.

As Gentner (1983) has observed, the defining characteristic of successful analogical reasoning is the transfer of an explanatory structure from the source domain to the target domain. Although domain incongruence is necessary in metaphorical reasoning, this is not the case in analogical reasoning (Vosniadou 1989). One can employ either within-domain analogies, namely analogies derived from very similar domains (e.g. 'Orchard Road is to Singapore what Oxford Street is to London'); or between-domain analogies, i.e., analogies derived from conceptually very different domains. For example, as Kellner commented, 'Political parties are more like supermarkets than their more avid followers like to think' (*The Independent*, 16/11/1990).

2. A *literal similarity* is a transfer of both the relationships and the object attributes from the source to the target domain (e.g. 'Milk is like water'). In a literal similarity comparison, both the concrete object characteristics (e.g. the flat surface of water) *and* the relational characteristics (e.g. the chemical structure of water) are mapped over from the source to the target domain.

3. A *mere-appearance match* is a comparison in which relationships are not mapped, but only the object attributes are carried over from the source to the target domain. For example, 'The surface of the lake was calm and clean like a mirror'. Mere-appearance matches are of limited explanatory utility since there is little beyond physical appearances that is shared between the two objects of comparison.

4. An *abstraction* is 'a comparison in which the base domain is an abstract relational structure. Such a structure would [contain] generalized physical entities, rather than particular objects' (Gentner 1983: 159). For example: 'The hydrogen atom is a central force system', or 'An organization is a control system'. The base domain contains only abstract principles and no concrete properties of objects. For example, in the case where an organization is likened to a control system (see Beer 1981), the propositions to be derived from the base domain include: 'Stimulae are

registered by transducers'; 'Stimulae are turned into responses according to the transfer function of the sensorium'; or 'Negative feedback corrects responses in relation to fluctuating stimulae'. An abstraction shares with an analogy the transfer of a relational structure from the source to the target domain but, unlike analogy, there are no concrete object attributes to be left behind in the mapping (Gentner 1983, 1989). For example, in the analogy, the object characteristics of a concrete control system (e.g. the human nervous system) are not mapped, but are left behind in the source domain.

From a theory-building point of view, abstractions are very important because they operate at a high level of generality, reveal the generic properties of a variety of phenomena, and can thus be used to explain phenomena across widely different domains. For example, the second law of thermodynamics can be generalized as the law of diminishing potential, which states that for a phenomenon to happen there must be *potential* for its happening which has been used up after the phenomenon has happened. As Boulding (1987: 113) observes:

'Thus, electric current flows because there is potential difference between the two ends of wire, and as it flows that potential is diminished. It will stop flowing until the potential is reestablished. The fertilized egg has the potential for producing an organism, which is gradually exhausted as an organism is produced, ages, and finally dies. An organization is often the result of social potential created by its founder or founders, which again, may be gradually exhausted as time goes on, until the organization disappears.'

5. Finally, an *anomaly* is a comparison in which there is no overlap in either object attributes or relationships (e.g. 'A computer is like coffee'). A summary of the main characteristics of the preceding kinds of explicit similarity can be seen in Table 2.

Table 2
Kinds of Domain
Comparisons
(Source: Gentner
1989: 206)

	Attributes	Relations	Example
Literal similarity	Many	Many	Milk is like water
Analogy	Few	Many	Heat is like water
Abstraction	Few	Many	Heat flow is a through-variable
Anomaly	Few	Few	Coffee is like the solar system
Mere appearance	Many	Few	The glass table-top gleamed like water

From Literal Similarities to Abstractions: The Structure-Mapping Theory of Analogy

The preceding distinctions between explicit similarities are not mutually exclusive, but, rather, form two continua. Analogies and literal similarities are at the two ends of the same continuum: the more a comparison involves the transfer of a relational structure, the closer it will be to an analogy, whereas the more object attributes are transferred, the closer it

will be to a literal similarity. Likewise, analogies and abstractions form another continuum, in which the position of a statement will depend on the extent to which the base domain has more abstract and variable-like features. Furthermore, literal similarities, analogies and abstractions can be arranged in an ascending order according to the extent of their explanatory potency and generalizability. Gentner (1983: 167) remarks as follows:

'Literal similarity matches are highly accessible, since they can be indexed by object descriptions, by relational structures, or by both. But they are not very useful in deriving causal principles, precisely because there is too much overlap to know what is crucial. Potential analogies are less likely to be noticed, since they require accessing the data base via relational matches; object matches are of no use. However, once found, an analogy should be more useful in deriving the key principles, since the shared data structure is sparse enough to permit analysis. [. . .] To state a general law requires another step beyond creating a temporary correspondence between unlike domains: The person must create a new relational structure whose objects are so lacking in specific attributes that the structure can be applied across widely different domains.'

The rules for progressing from literal similarities through analogies to abstractions are specified by Gentner in her structure-mapping theory of analogy. The latter seeks to provide the rules by which adults map information from the source domain to the target domain. There are three components of this theory. First, the attributes of objects belonging to two different domains are discarded. Second, the *relations* between objects in the source domain are mapped onto the target domain, and third, of all those mapped relationships, the ones that are preserved are selected according to the principle of systematicity: only those that are *higher-order* relations (i.e. relations between relations) are retained at the expense of lower-order relations or mere isolated properties (Collins and Burstein 1989; Gentner 1983, 1989; Gentner and Toupin, 1986; Johnson-Laird 1989).

Before the structure-mapping theory of analogy is illustrated with two examples, one point needs to be clarified. For a set of relations pertaining to the source domain to be transferred to the target domain, it is not necessary to assume that these relations are necessarily true — in any case, we have no independent way of establishing their truth. The point is that the knowledge accumulated in the source domain is *established* knowledge, namely knowledge trusted to be more valid than other bodies of knowledge. Nothing precludes the possibility that source-domain knowledge may later be abandoned if it is deemed to be inadequate for explaining the phenomena it purports to explain, or for not capturing certain aspects of a phenomenon that are considered more important. While models within the Newtonian paradigm, for example, may serve the purpose of offering source-domain knowledge, they may well be replaced by models deriving from the chaos paradigm (see Hayles 1991; Prigogine and Stengers 1984) thus yielding different models in the target domain. While it is possible to explain sociologically the social processes

through which source models become established in their own fields, from a cognitive point of view — which is the focus of this paper —, the emphasis is on developing a methodology for mapping an established source-domain knowledge that is deemed valid to a target domain. Whether a particular source-domain model is useful (or more useful than others) will ultimately be determined by its application, namely by the extent to which it helps us develop target-domain models that explain and/or predict the phenomena in which we are interested. The structure-mapping theory of analogy offers a methodology which renders such judgements possible.

Two Examples

Modelling Heat Flow on Water Flow

Let us consider the case in which, for teaching purposes, heat flow is thought appropriate to be modelled on water flow (cf. Gentner 1989). There is a large beaker containing water which is connected to a small vial, via a pipe. Analogously there is a cup of warm coffee containing a metal bar with an ice cube at the end. The student is told that heat flow can be understood like water flow with the temperature in the heat situation playing the role of pressure in the water situation. In mapping heat flow on water flow, both object correspondences (e.g. heat/water, coffee/beaker, metal bar/pipe, ice cube/vial) and function correspondences (e.g. pressure/temperature) are noted. Attributes of objects in both the source and target domains, such as the cylindrical shape of the beaker or the liquid state of the coffee, are discarded. Attention is focused on *relations* pertaining to the source domain, such as 'the diameter of the beaker is greater than the diameter of the vial', or 'the pressure difference between the beaker and the vial *causes* the water to flow from the beaker through the pipe to the vial' etc., and these relations are mapped onto the target domain given the previous correspondences. From the preceding two relations, however, it is only the latter (and others like it) that is retained, because it constitutes a mappable system of relations that is governed by higher-order relations (i.e. in this case the higher-order relation 'cause'). Furthermore, if a system of higher-order relations can be translated into a set of abstract statements, an abstraction applicable across widely different domains will have been created (Gentner 1989).

The Viable System Model

Beer (1979, 1981, 1985) has sought to produce a theory of organizational control by modelling business organizations on the human nervous system. The human body is renowned for its ability to run affairs laterally and vertically. Particular human organs such as the heart, the lungs, muscles, etc. work autonomously by transmitting to, and collecting information from, the spinal cord; the same organs integrate their local

activity into an organic whole by passing information to the brain stem. In addition to the volitional information which, transmitted via the spinal cord, originates in the cerebral cortex, there is autonomic servomotor information transmitted via the sympathetic and parasympathetic systems. These systems are largely antagonistic: the former being typically stimulatory, and the latter inhibitory.

As in the previous example, in mapping the organization onto the human nervous system, the object attributes of the latter are discarded. By contrast, following the principle of systematicity, relations such as the following are retained: 'Sensory changes are *transduced* into different impulses which, after they have been computed at a particular vertebra, result in adjustments through the motor part of the system'; 'Sensory information about particular organs (e.g. heart) is *transmitted* to the spinal cord and to the sympathetic trunk'; 'The medulla is the control centre which *compares* the stimulatory and inhibitory activities initiated by the sympathetic and parasympathetic systems, respectively', and so forth.

One can now begin to visualize a control model of organizations being developed out of a process of analogical reasoning in which knowledge about the human nervous system is the source domain. A primary-task organizational unit (i.e. department, division, etc.) is connected to the vertical command axis by a lateral command axis. The vertical command axis is the analogue of the spinal cord, collecting information and undertaking low-level co-ordinative action on the lateral axis. Mutual adjustment between the various units is facilitated by using two information systems — the analogues of the sympathetic and parasympathetic systems, stimulatory and inhibitory, respectively — thus stabilizing the production environment of the organization. The output of these adjustments is monitored by a higher system (the analogue of diencephalon and *gaggia* in the human nervous system) which relates the output to the organizational mission and original plans. Finally, the highest level of management (the analogue of the cortex) clarifies the organizational mission and formulates plans; it decides on the balance between the contradictory requirements for stability and change against the organization's mission.

Conclusions

We have argued in this paper that metaphorical and scientific languages have traditionally been kept separate in organization theory. The metaphors-as-ways-of-thinking perspective has persistently emphasized the inherently figurative character of scientific discourse, disregarding the need for organization theory to disclose identities and generic properties. Proponents of this perspective have almost exclusively emphasized the need for a widespread use of different metaphors in interpreting and intervening in organizational phenomena. Despite the central role

accorded to metaphors in organizational analysis, advocates of this perspective have not suggested ways in which the implicit imagery of a metaphor might be unfolded to lead to explicit knowledge about organizational phenomena. It has been pointed out in this paper that metaphors *qua* metaphors are neither amenable to directly informed application nor susceptible to rational criticism without the prior unfolding of their meaning. We have also delineated the different areas and modes of application of several metaphors.

The metaphors-as-dispensable-literary-devices perspective places prime and quasi-exclusive importance on scientific discourse as if the latter was a result of a conceptual partheno-genesis. Although proponents of this perspective have been exclusively concerned with the context of justification, there has been no suggestion as to *how* the inevitable use of metaphors in organization theory might yield scientific knowledge.

The metaphors-as-ideological-distortions perspective, while accepting a limited use of metaphors, privileges, unjustifiedly, the radical metaphor which views organizations as instruments of domination. However, there has been no attempt to show in what way paying attention to power inequalities and social domination helps to explain organizational phenomena *better* than other schools of thought of a different metaphorical provenance.

The absence of a methodology to develop metaphors so that they may yield organizational knowledge has been noted in all three perspectives. We have suggested that the structure-mapping theory of analogy provides such a methodology. According to this theory, metaphors provide the initial insight into potentially more systematic parallels between two domains, which are explored via a process of analogical reasoning. More specifically, in analogical reasoning, relations have priority over objects attributes. However, not all relations are equally likely to be selected for mapping. From all mappable relations, only those that are part of a system of relations that is governed by a higher-order relation are preserved. This process allows the preservation of structural information and the progressive construction of a more powerful explanatory language in the form of abstractions.

As it may have already become clear, the structure-mapping theory of analogy encourages inter-disciplinarity and suggests a creative way for generating scientific knowledge about organizational phenomena. Organizational researchers are thus urged to look for inspiration beyond the narrow confines of their own discipline. Conceptual borrowing, however, may not be as easy as it possibly sounds, because it entails developing expertise in areas in which one may not be familiar. Nonetheless, the rewards may be higher than those likely to accrue from merely following conventional intra-disciplinary lines of inquiry.

If metaphors and analogies are taken seriously on board, new directions for organizational research may develop, and novel questions may be asked. For example, does the chaos paradigm have anything to tell us about organizational change and the management of complexity? If the

answer is yes, how might one attempt to map organizational change processes onto, say, 'dissipative structures'? (cf. Leiffer 1989; Prigogine and Stengers 1984). Is it possible to enhance our knowledge of individual and group resistance to organization change by drawing on autopoiesis and far-from-equilibrium systems? (Goldstein 1988; Maturana and Varela 1980). Is it possible to obtain new insights into organization politics by analyzing the similarities between nation states and organizations, and consequently by using concepts of social movements to examine similar organizational processes? (Zald and Berger 1978). Can we formulate a theory about 'how institutions think' (Douglas 1986) by modelling organizational cognition processes onto models of individual cognition and memory? (Sanderlands and Stablein 1987; Walsh and Ungson 1991). While answers to these questions are by no means easy, one can at least begin to think about them, and the methodology suggested here outlines how such thinking might systematically be carried out.

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