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Metaphor and Coupling: An Embodied, Action-Oriented Perspective

Norman Y. Teng
Institute of European and American Studies
Academia Sinica

This study offers an embodied, action-oriented perspective on metaphor. It weaves together 3 theoretical ideas: (a) Lakoff & Johnson's (1980a, 1980b, 1980c; Lakoff, 1993) idea that metaphors are cross-domain conceptual mappings, (b) Lakoff & Johnson's (1999) idea that individuals are coupled to the world through embodied interactions with the environment, on which their sense of what is real is based, and (c) Gibbs's (1999) nascent idea that metaphors can be off-loaded into the cultural world. I argue that metaphors, as cross-domain mappings, can be directly realized in the coupling of the external settings that frame and sustain one's activities and what people, individually and collectively, do to and in the world. A comparison of conceptual metaphor theory and conceptual blending theory is made from this perspective. I argue that the blending theory is overly stretched when it is applied to an analysis of metaphorical activity that can be jointly explained by cross-domain mappings and the external structures that constrain and modulate the activity. As for the conceptual metaphor theory, I argue that the theory is overly restrictive if domains are construed exclusively in neural terms.

Lakoff and Johnson (1999, 2003) proposed that metaphors are computed neurally via neural maps. The idea is that the inferential strategies neurally instantiated in sensory-motor processes are co-opted into the neural processes that frame and support our reasoning about abstract domains. On this account, conceptual mappings are physically realized as neural circuitry linking the sensory-motor system to other brain areas, and the domains, in Lakoff and Johnson's (2003) words, "are highly structured neural ensembles in different regions of the brain" (p. 256). I think that this neural construal of domains is overly restrictive and that metaphors

Correspondence should be addressed to Norman Y. Teng, Institute of European and American Studies, Academia Sinica, 128, Academia Road, Section 2, Taipei, 115, Taiwan. E-mail: nteng@sinica.edu.tw

need not be computed exclusively through neural circuitry. I propose that metaphors, as cross-domain mappings, are not just something computed in the heads of individuals, but can be directly realized in the coupling of the external settings that frame and sustain our activities and what we, individually and collectively, do to and in the world.

I believe that my proposal is in accordance with the central theme of the philosophical view Johnson (1987) espoused. He wrote,

> The view I am proposing is this: in order for us to have meaningful, connected experiences that we can comprehend and reason about, there must be pattern and order to our actions, perceptions, and conceptions. *A schema is a recurrent pattern, shape, and regularity in, or of, these ongoing ordering activities*. These patterns emerge as meaningful structures for us chiefly at the level of our bodily movements through space, our manipulation of objects, and our perceptual interactions. (p. 29, italics in original)

> Rather, *understanding is the way we "have a world," the way we experience our world as comprehensible reality.* Such understanding, therefore, involves *our whole being*—our bodily capacities and skills, our values, our moods and attitudes, our entire cultural tradition, the way in which we are bound up with a linguistic community, our aesthetic sensibilities, and so forth. In short, our understanding *is* our mode of "being in the world." It is the way we are meaningfully situated in our world through our bodily interactions, our cultural institutions, our linguistic tradition, and our historical context. (p. 102; italics in original)

These two passages suggest that it is the level of embodied human/environment interaction that anchors what is meaningful to people and defines their mode of being in the world. On that basis, I work toward an idea that foregrounds embodied human/environment interaction, in which metaphors manifest themselves in one's experiences with public representations and interweave with one's bodily activities.

I build my case by weaving together three theoretical ideas. The first is Lakoff and Johnson's (1980a, 1980b, 1980c) idea that metaphor is essentially a mode of understanding and experiencing one kind of thing in terms of another. The core of this mode of understanding lies in cross-domain conceptual mappings (Lakoff, 1993). The mappings are unidirectional: one domain, which is called the *source domain*, maps onto another domain, called the *target domain*, which is typically more abstract.

The second is Lakoff and Johnson's idea (1999, pp. 28–30) that people are coupled to the world through embodied interactions with the environment, on which their sense of what is real is based. On that basis, metaphors, by recruiting the inferential strategies embodied in people's interactions with the environment and framing workable understandings of the situations they are in, extend the range of what they can reasonably take to be real. This point can be summed up as follows:

> *What we mean by "real" is what we need to posit conceptually in order to be realistic, that is, in order to function successfully to survive, to achieve ends, and to arrive at workable understandings of the situations we are in* (Lakoff & Johnson, 1999, p. 109; italics in original).

The third is Gibbs's (1999) nascent idea that metaphors can be off-loaded into the cultural world individuals inhabit. From this view, metaphor is "a kind of tool, available as a 'public representation' for all to use when needed, without having to explicitly encode all conceptual metaphors as part of our internal mental representations" (p. 157). This public, cultural face of a metaphor enables people "to experience, and re-experience, the metaphor as embodied action out in the world and not just in their heads" (p. 158).

I explore and weave together these three lines of thinking, first, by giving an example of what a domain is and the role it plays in human conceptualization, and, second, by extending ideas we pull from the example to a theoretical reinterpretation of human metaphorical conceptualization. The first two theoretical ideas, as far as I am concerned, are well articulated and have convergent empirical evidence to support them (Lakoff & Johnson, 1999, pp. 81–88). The third idea, on the other hand, is more problematic and polemical. A detailed examination of it is required. My discussion of it is divided into two parts. The first part connects Gibbs's (1999) idea, via an analysis of images in public representations, to the image grouping hypothesis proposed by Teng and Sun (2002), which I hope can lend support to it. The second part develops Gibbs's (1999) idea and applies it to an analysis of how users of modern personal computers (PCs) negotiate a mouse-driven interface and the experience they undergo. A comparison of conceptual metaphor theory (Lakoff & Johnson, 1999, 2003) and conceptual blending theory (Fauconnier & Turner, 1998, 2002) is made in this regard. I argue that conceptual metaphor theory, combined with an account of how metaphors are off-loaded into the cultural world, gives a better explanation of the metaphorical activities in which individuals engage when negotiating a mouse-driven interface. If, indeed, this is the case, it provides a favorable reason for incorporating Gibbs's (1999) nascent idea into the conceptual metaphor theory.

DOMAINS AS PRACTICAL ENSEMBLES

A principal tenet of cognitive semantics is that concepts do not occur as isolated, atomic units, but can only be comprehended in a context of background knowledge that is presupposed and already in working order when people conceptualize or construe their experiences (Clausner & Croft, 1999; Croft, 1993; Langacker, 1987). Consider the concept [ROAD]. A road is a long piece of hard ground which is part of the culturally constituted material environment people build and exploit for traveling, particularly by car, from one place to another. This description of the concept [ROAD] already points to the fact that the concept is to be comprehended in a context of the background knowledge of the structural layout people build into their environment for traveling. Roads are parts of the structural layout. When a road is in a city or town, with houses along it, it is also a street. The concept [ROAD] is linked to the concepts [STREET], [CITY], and [HOUSE]. When you drive a car in a roadway, you are using the part of a road that is used by traffic. The concept [ROAD] is linked to the concepts [ROADWAY], [VEHICLE], and [TRAFFIC]. A path is also a part of the structural layout for people to get from one place to another, but, unlike a road, it is usually used by people when they are walking. The concept [ROAD] is linked to the concept [PATH] this way. When a path is lying across open country or through forests, it is a trail, the surface of which is usually pretty rough. The concept [ROAD] is linked to the concept [TRAIL] via its link with the concept [PATH]. [ROAD], [STREET], [CITY], [HOUSE], [ROADWAY], [VEHICLE], [TRAFFIC], [PATH], [TRAIL], and other conceptual items such as [ACCESS ROAD], [BACK ROAD], [BELTWAY], etc., are in one way or another linked to each other and make up a conceptual network with an internal structure built in it. The concept [ROAD] profiles an aspect of the conceptual network, which, in turn, can serve as a domain in terms of which the concept [ROAD] is comprehended.

It is worth noting that, from a usage-based cognitive viewpoint, a domain is essentially open-ended, and its boundary can vary according to the way the concept is used and the communicative intent made manifest in a conversational setting. Suppose you are in a car, and ask, "What roads should the car be driven along to get there?" The domain probably will range over the conceptual complexes including [ROAD], [STREET], [CITY], [ROADWAY], [VEHICLE], and [TRAFFIC] as its component parts. It will also probably have to include the concepts [DRIVE], [NAVIGATE], and perhaps other concepts connected to the human activity of traveling from one place to another. On the other hand, [PATH] and [TRAIL] probably need not be parts of the domain for comprehending the concept [ROAD] as is used in your query.

It is also worth noting that what constitutes a domain can be experiential as well as conceptual. Suppose your friend in the car responds to your question, and answers, "Go straight up the beltway." Suppose further that you lack the concept [BELTWAY] and do not know what a beltway is. Your experience of riding in a car driven along a road that goes round the edge of a city may give you a clue to what a beltway is. This experience may be registered and incorporated into the conceptual landscape, and serves at least as a stand-in for beltway, part of the domain for your comprehending the concept [ROAD]. The conceptual networks and the experiential stand-ins all are mental constructs, which, though sharable to some extent among individuals, should also be considered as something lodged inside the heads of these same individuals.

Now—and this is an important point in this study—one can take a step further, and consider the mental constructs to be constituent parts or aspects of a larger system, which includes people, their activities, and the culturally constituted material environment they produce and inhabit. In this view, what people do inside their heads when coping with tasks they encounter is part of the processes of the larger system. Moreover, the cognitive architecture that makes people's succeeding in coping with the tasks possible is not merely something instantiated in their brains, but also includes the external props and structural settings people find, or build, in the larger system (see Clark, 1997; Hutchins, 1995). In addition to the experience of riding along a beltway, the beltway itself can also be incorporated into the cognitive architecture and become a constituent part of the domain in terms of which the concept [ROAD] is to be comprehended.

Suppose you return to the beltway, reexperience the ride, and note how you bypass heavy traffic as you explore the physical affordances of the beltway. You thus get a better understanding of what a road is and can be. In this way, the beltway serves as a part of the cognitive architecture, and your action of returning to it is a cognitive process of accessing the information required for responding appropriately to expressions such as "Go straight up the beltway." Accessing and processing information need not be exclusively implemented by neural computing, but can be carried out by the embodied action of a whole person operating in the larger system.

In sum, domains are not merely some sort of mental constructs in the heads of individuals, but are the constituent components of the culturally constituted material environment, which takes shape through embodied action. Thinking of domains this way reflects a more general turn to consider cognitive activities, and, for my purposes, metaphorical activities in particular, in concrete terms rather than abstract ones, and to look at the richness of the real world. It supports Gibbs's (1999) idea that metaphors can be incorporated into the culturally constituted material environment through our embodied action, and serve as tools in it. The tools are available as public representations, and the public, cultural face of a metaphor makes us able to experience, and reexperience, the metaphor as embodied action in the cultural settings in which we participate. Metaphors as tools available as public representations and metaphors as something that one can experience and reexperience as embodied action in the world are two key notions of what it means to off-load metaphors into the cultural world. Both notions gain plausibility and legitimacy if domains are construed as parts of the culturally constituted material environment. For the sake of brevity, I call those parts of the culturally constituted material environment that serve as domains *practical ensembles*, which I purposely coin to contrast it with *neural ensembles* in Lakoff and Johnson's (1999, 2003) proposal.

METAPHORS AS PUBLIC REPRESENTATIONS

Consider first the notion of metaphors as available tools for public representation. Language is a type of public representation, perhaps the most spectacular one people construct as they go along using it in daily life and reconstructing it to fit novel situations through acts of imagination. Traditionally, metaphor was considered special in language use, and was thought of as a linguistic device specifically for literary or rhetorical purposes. But since Lakoff and Johnson (1980c), it has been quite well established that metaphor is not merely a device for rhetorical or poetic language use, but is already pervasive in ordinary, everyday language. This fact points to a phenomenon of greater depth and scope:

> that metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature. (Lakoff & Johnson, 1980c, p. 3)

As a result, metaphor is deemed to be primarily a conceptual matter. It is by no means restricted to linguistic representations, but also occurs quite prominently in pictorial advertisements, media images, interface designs, cartoons, and a wide range of tools and products.

Consider pictures in ads as examples. Their designs are often clever, creative, sometimes surprising, and explorative, so as to catch the viewer's attention. Suppose that you walked on a street. A poster on one side of the street suddenly caught your attention; or to be precise, something displayed on it suddenly caught your attention. You cast your eyes on it and in that glance take in the image. That opens a window of opportunity for the poster to address a remark to you. The picture on it has to be easy to consume and be understood almost at first contact. Achieving this desired effect leans heavily on image making. One way to do it is design an image in a way that, when seen, immediately taps into the cognitive resources people share. It was discovered that symmetric image alignment is one such design pattern that is already implicit in people's practice of reading and making images (Forceville, 1994, 1996; Teng & Sun, 2002). A concept called the *image grouping hypothesis* was proposed to account for how the design pattern is exploited in people's reading and in the making of images (Teng & Sun, 2002).

Roughly, the hypothesis unfolds as follows: An approximately symmetric image alignment of pictorial components within the same picture would prompt people to group the depicted entities together. When pictorial components laid out this way depict things of different kinds, the image thus composed is apt for expressing pictorial simile. People will interpret the image as an expression of simile in pictorial terms. When pictorial components laid out this way depict things that are seen as incompatible with each other, the image thus composed is apt for expressing pictorial oxymoron. People will read the image as an expression of an oxymoron in pictorial terms. In contrast to image alignment, which taps into people's shared cognitive resources for grouping, image integration taps into people's shared cognitive resources for processing part–whole relations, and has been used in image making for pictorial metaphor (more on this shortly).

This technique of tapping into people's shared cognitive resources in image making is often used in advertisements to beat the limited time span people use to view ads. Cartoons for newspapers also have to meet the demand imposed by people's willingness to spend only a very short time to view them. Not surprisingly, cartoonists, too, use image alignment and image integration in their drawings to tap people's shared cognitive resources. In the following discussion, I apply the image grouping hypothesis to an analysis of an editorial cartoon, which expresses a simile in pictorial terms, and compare it with another editorial cartoon, which expresses a metaphor in pictorial terms. I do this in an attempt to explain how images in public representations participate in the off-loading of cognitive burdens—particularly, ones that draw on the ability to conceptualize one domain in terms of another—into the cultural world.

In Lakoff and Johnson's (1980c) account, simile and metaphor lie in the way people conceptualize one domain in terms of another. The image grouping hypothesis invites individuals to make a subtle, design-based cognitive distinction between simile and metaphor when they are expressed in pictorial terms, respectively.

Consider first a cartoon whose design is apt for expressing pictorial simile (Figure 1). A newspaper is kept in line with books on a shelf. The word "HORROR" is engraved on the front of the upper shelf to indicate that those stories are in the hor-

FIGURE 1 *The Horror Show*, a cartoon whose design is apt for expressing pictorial simile, by Clay Bennett. From *The Christian Science Monitor*, May 13, 2004, p. 8. Copyright 2004 by Clay Bennett/© *The Christian Science Monitor* (www.csmonitor.com). All rights reserved. Reprinted with permission.

ror genre, just in case someone might not recognize them. The newspaper is positioned in the middle, flanked by four horror novels on each side, each book bearing a title that had secured a mass reading market. Some of the horror novels date back to the early 19th Century. *Frankenstein*, authored by Mary Shelley, for example, appeared in 1818, and was adapted for the stage by Richard Brinsley Peake in 1823 (Carroll, 1990, pp. 4–5). Some appeared more recently. *The Exorcist*, authored by William Peter Blatty, came out in 1971, and the first horror film based on it was directed by William Friedkin and released in 1973 (Carroll, 1990, p. 2). The headline on the front page of the newspaper, partly occluded by Bram Stoker's *Dracula* (1897), indicates that the news is about the United States. Aligning a newspaper with the horror novels this way invites readers to group news about the United States and the horror novels together. News and horror stories, however, are of different narrative styles and belong in different genres, and it is expected to be so. This creates a cognitive dissonance, and invites people to resolve the dissonance by taking the image as expressing a simile rather than a grouping. That is, this cartoon, by conforming to the design pattern apt for expressing pictorial simile, invites people to take it as expressing a simile in pictorial terms. The message it conveys may be stated as follows: News stories about the United States are similar to horror stories, and, like all classic horror stories, they inherently excel in frightening and unnerving people, and making them shudder in disbelief.

Consider next a cartoon whose design is apt for expressing pictorial metaphor (Figure 2). People are riding on a roller coaster, goggling in bewilderment at the tracks just beneath them. The ride is gaining momentum, and is about to send the passengers through the tracks, which are lined up and coiled into the shape of the double helix of DNA. The spiral shape takes up so little space that a rough ride is certainly to be expected. The passengers would be extremely fortunate to stay on course. The word "SCIENCE" is printed across the front of the lead car. This image conveys an unlikely and fantastic integration of the double helix into a roller coaster ride. Of course, it is not a customary roller coaster ride in an amusement park, and we know better than to dismiss the image integration as merely misrepresenting what it is about. It is a cartoon, after all, and cartoons are supposed to be humorous in one way or another. It was discovered (Forceville, 1994, 1996; Teng & Sun, 2002) that image integration of things of different kinds, particularly when the integration is capable of inducing a cognitive dissonance, is apt for expressing pictorial metaphor. Note that a pictorial metaphor is experienced more strongly than a pictorial simile. The former, by virtue of image integration, suggests that the target is metaphorically transformed by or integrated with the source. The latter, by contrast, relies on image alignment and only suggests a similarity between the source and the target, with the target retaining its relative cognitive independence from the source. The roller coaster cartoon, conforming to the design pattern for pictorial metaphor, invites people to take it as expressing a metaphor in pictorial terms. The message it conveys may be stated as follows: Science already makes it possible to micromanipulate genetic sequences and scientists are ready to do it, but

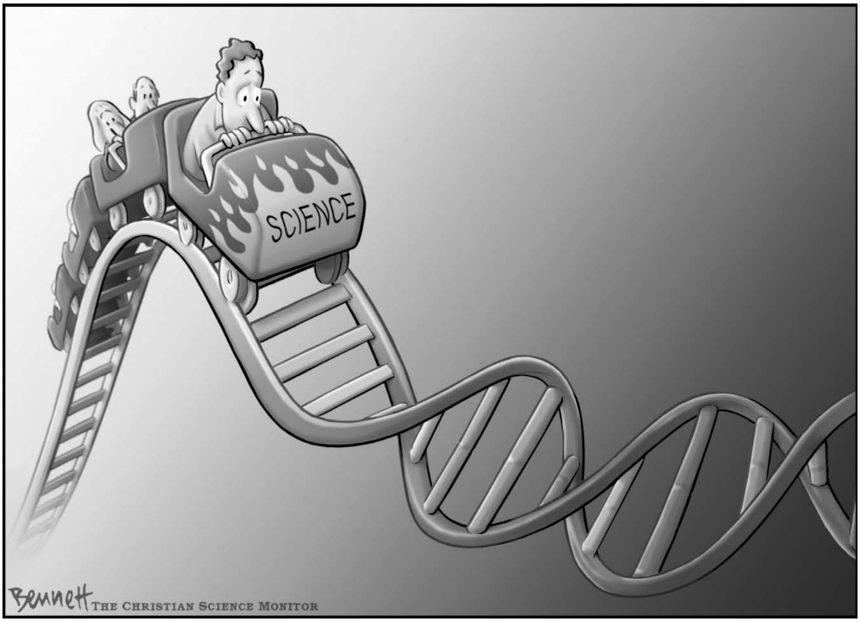

FIGURE 2 *The Roller Coaster*, a cartoon whose design is apt for expressing pictorial metaphor, by Clay Bennett. From *The Christian Science Monitor*, August 8, 2001, p. 8. Copyright 2001 by Clay Bennett/© *The Christian Science Monitor* (www.csmonitor.com). All rights reserved. Reprinted with permission.

actually doing so is riding down a steep slope in a vehicle and coasting along an unknown but definitely dangerous path.

Let us take stock. Note first that pictorial metaphors and pictorial similes are artifacts people create, and stand as parts of the culturally constituted material environment they produce and inhabit. Both involve the conceptualization of one domain in terms of another. Each of them, however, relies on a different design principle. Pictorial metaphors rely on image integration; pictorial similes rely on image alignment, and people experience each of them differently. The design of image integration taps into one's cognitive resources for processing part–whole relations, and prompts one to see the image as depicting something as a whole. The design of image alignment taps into cognitive resources for grouping, and prompts one to view the depicted entities as belonging in the same group. Yet, for one reason or another, the target and the source do not fit well in either way. The consequent cognitive dissonance is exploited in image making, and it is now established, surely through practice, that image integration is a design pattern apt for pictorial metaphor, yet image alignment is one apt for pictorial simile.

Now, both cartoons, by virtue of their respective designs, do not directly engage one's metaphorical capability to conceptualize one domain in terms of another, yet they do engage the viewer in experiencing one kind of thing in terms of another. The public, cultural face of both cartoons allows viewers to experience, and reexperience, the pictorial metaphor and pictorial simile. From the viewpoint of conceptual metaphor theory, there has to be some sort of cross-domain mappings in the dynamic, experiential processes if people do experience a metaphor and a simile in them. The cross-domain mappings, however, need not be something separable from the experiences, but can be emergent, dynamic patterns that interweave with the very fabric of the experiential processes.[1] Instead of saying that the metaphor and the simile have to be somewhat realized in the mental processes in the heads of individuals, it would be apt to say that they are pictorially materialized in the artifacts, and come into view when people start to look at them. New subtleties of the images may be discovered through viewing them again, or through an investigation into the relevant practical ensembles that serve as the source or target domains. (For example, knowing that all the books in the pictorial simile are classic horror novels makes a difference in the way one experiences it if one did not know what the books were about.) In that sense, pictorial metaphor and pictorial simile are on the public, cultural face of artifacts. They are there for all to see, serving as an anchor for the experiential, dynamic cross-domain mappings that take shape in embodied interactions with them. That is to say that they are real in the cultural world people collectively inhabit, and taking them as something real gives one a workable understanding of what it is for a person to experience, and reexperience, a metaphor and a simile in pictorial terms.

AN EMBODIED, ACTION-ORIENTED PERSPECTIVE ON METAPHOR

Consider next the notion of metaphors as something that people experience and reexperience as embodied action in the world. Metaphor, as a mode of understanding that is realized in dynamic, cross-domain mappings as described, is only part of the story of the off-loading of metaphors into the cultural world. The other aspect to be considered is how dynamic, cross-domain mapping guides, and at the same time manifests itself in, embodied action.

The first thing to note is that metaphor can be action-oriented. It may directly regulate embodied action, instead of merely setting up a conceptual scheme across different domains so that one can use it to conceive a new course of action, and then

[1]This idea echoes Gibbs's (2005) view that image schemas are not representational structures separable from their bodily origins. Instead, they are best understood as experiential gestalts that are continually recreated and reexperienced during cognitive, perceptual and metaphorical activity. Gibbs's (2005) discussion focuses on the psychological status of image schemas; my discussion directs attention to artifacts in the environment.

act accordingly. That is, if artifacts are strategically built and installed into the environment so that metaphors are directly integrated into one's interaction with the artifacts, the cross-domain mapping and the undertaken course of action will interweave.

Consider how a PC user may negotiate a mouse-driven interface. Many actions are performed by moving a mouse and pressing its buttons. The operations are quite simple and straightforward, but the resulting actions are significant, and often metaphorical. As is well known to users of modern PCs, a mouse is a hand-held, button-activated input device. It does not weigh very much, and its size is small. It is easily moved on a smooth, horizontal surface. As the user moves the mouse on a horizontal plane, the cursor changes its position on the PC screen. The display system and the input device are set up so that the cursor's position changes in accordance with movement of the mouse. The result of this correlation between the position change of the cursor and the movement of the mouse is remarkable: The user not only sees the cursor moving on the screen as he moves the mouse, but also feels that he is moving the cursor. This is a phenomenon of coupling. As the user engages with the mouse, he acts through it as if it were an extension of his hand, enabling him to act directly on the cursor that it controls on the screen.

Note that coupling is not simply a physical phenomenon in which the tool in use becomes an extension of the user's body, but an intentional one. The user's action is directed toward where the cursor is to be moved onto, and the mouse is incorporated into and becomes a constituent part of this intentional action. The user's hand and the mouse are coupled; they feature as a single unit in the intentional activity. Coupling is anything but unusual. When you pen a letter, the pen is incorporated into and becomes a constituent part of the action of writing a letter. Your hand and the pen are coupled; they feature as a single unit in the intentional activity. When you hammer a wooden peg into a hole, the hammer is incorporated into and becomes a constituent part of the action of hammering. Your hand and the hammer are coupled; they feature as a single unit in the intentional activity. (For a more detailed account of coupling, see Dourish, 2001, pp. 138–142.)

Unlike the case of penning a letter or the case of hammering a wooden peg, an additional feature emerges from the coupling phenomenon of negotiating a mouse-driven interface, namely, that a dynamic, cross-domain mapping is taking shape in the intentional activity. In this activity, two components stand out: the movement of the mouse and that of the cursor. The movement of the mouse is physical, but the movement of the cursor is perceptual, and indeed illusory, because in reality it is comprised of a series of discrete steps of change in the cursor's position. The computing setup controls the correlation between the position change of the cursor and the movement of the mouse, and thus modulates the mapping of the physical onto the perceptual. The mapping is incorporated as part of the intentional activity in which the user engages. His moving the mouse, modulated by the computing setup, is his moving the cursor. The cursor is the object of focus and attention. As the user is directed toward it and intends to act on it, the mapping regulates the whole process of how the user addresses himself to the task of moving the cursor to an intended position.

Now, instead of describing the aforementioned process as conceptualizing or reasoning about the movement of the cursor in terms of the movement of the mouse, it would be apt to describe it as an experiential process in which the cross-domain mapping and the user's embodied action interweave. In that sense, the action is already metaphorical, and the metaphor is experienced as embodied action in the world. The input device, the display system, and the computing setup are all indispensable, external props for the embodied action and the emergence of the process of dynamic, cross-domain mapping. In this way, the mapping is not just something in the head of the user, but is sustained by, and partly off-loaded into, the culturally constituted material environment in which the user lives.

It is worth emphasizing that the user's activity is not just a process in which the sensory system registers where the cursor is and tracks its position change on the screen; the motor system specifies in detail the position of the body and how the hand should move and the external structure facilitates the user's control over the cursor's position. Rather, moving the cursor is moving the mouse. The dynamic schemas inherent in the motor operations metaphorically frame what the cursor's position change means to the user (say, that it is moved to a position ready to open a file or send an e-mail), and the framing is dynamically integral to the whole activity. That, I submit, is a way of showing how we are metaphorically coupled to the world through our bodily engagement with artifacts that we build and strategically install into the environment.

It is worth pausing to examine how the phenomenon of metaphorical coupling might be viewed from a different angle. Reflecting on how a user negotiates a mouse-driven interface, Fauconnier (2001) argued that a traditional source-to-target account current in metaphor theory will not do in explaining the experience with the user interface. The gist of such an account, according to him, lies in explaining how the target is mentally built and understood through inference transfer from the source. The inference transfer starts with partial mapping, on the basis of which additional structure present in the source is projected onto the target, thereby creating additional structure in the target. This additional structure brings in new inferential constraints, which in turn exert control over permissible moves in the thought process and at the same time induce it to elaborate and yield further relations and connections. On this account, maintaining structural alignment between the source and the target sanctioned by the partial mapping is fundamental to the inference transfer and elaboration.

Note, however, that in the case of mouse manipulation, the inference transfer is likely to end in failure. This is due to massive mismatches between the source (which consists of the user's conceptualization of the movement of a physical object) and the target (which consists of the user's perceptually based understanding of the cursor's moving on the screen). For example, the mouse can be in contact with the horizontal surface or not, but the cursor is confined to the screen. Furthermore, there is no corresponding movement of the cursor if the mouse is lifted and moved in the air. If we go on to look into the ways the mouse is used, more glaring mismatches crop up. One may find strange things of one sort or another, depending on the design of the interface and the input device. For example, the user may grasp and move an object on the screen by moving the cursor onto the object, pressing the left button on the mouse, moving the mouse again, and releasing the button at a new location. As the cursor moves, it drags along a phantom of the object (a dotted outline of the object, say); the object itself remains in its original position until the button is released. As soon as the button is released, the phantom disappears and the object is placed at the new location. It goes without saying that this action is very unlike what happens when people grasp and move an ordinary physical object by hand, as it surely is the object, rather than some sort of phantom of it, that accompanies the moving hand.

Fauconnier (2001) turned his attention to the fact that, despite the massive failure to achieve a source–target inferential articulation of the experience with the interface, the user is still able to coordinate his action with the mouse in a way that actually gets things done. Researchers need to reorient themselves to this fact, and reflect on how a metaphorical activity, such as mouse manipulation, can still be productive despite massive mismatches between the source and the target. Fauconnier argued that blending, rather than cross-domain mapping, is the key to such a metaphorical activity. Accordingly, conceptual blending theory, as developed by him and Turner (1998, 2002), provides a better theoretical framework for investigating such a metaphorical activity.

In this blending theory, metaphorical understanding and intentionally based activity depend centrally on the creation of mental spaces, cross-space mapping, and blending. Mental spaces are online operating mental packets containing partial representations of the entities and relationships in any given scenario as perceived, remembered, or otherwise understood by an agent. Often, a mental space is created when elements that represent the entities and an organizing frame that brings certain relationships among the entities into perspective are activated. From a neurological point of view, elements in mental spaces can be thought of as activated neuronal assemblies, which link one element to another through binding or coactivation. In its basic form, blending involves the creation of two (or more) input spaces, with the counterpart relations between elements of the input spaces established via cross-space mapping. A third space, the generic space, indicates the paired linkages between input spaces. Blending consists of projecting, selectively, from the input spaces into a fourth space, the blended space, in which novel forms of thought or plans of action are developed through processes of composition, pattern completion, and elaboration.

Fauconnier and his collaborators (Fauconnier & Turner, 1998, 2002) often emphasized that blending is pervasive in human life and that the most remarkable characteristic of this cognitive operation is the creation of novel blended spaces which bring in new integrative ways of thinking and doing. A wide variety of linguistic and nonlinguistic phenomena seem readily explainable by this theory if an array of mental spaces is rightly configured and complex cross-space mappings are suitably postulated. This maneuvering gives blending theory tremendous descriptive power, but at the same time makes it subject to the charge that it is "too powerful, accounting for everything, and, hence, explaining nothing" (Coulson & Oakley, 2000, p. 186). In response to this charge, one major research agenda on conceptual blending is the study of optimality principles that guide and constrain blending. Two of the optimality principles proposed by Fauconnier and Turner (1998) are particularly relevant to these issues: the integration principle and the topology principle. The following formulation of the two principles will do for the purposes of this discussion.

> *Integration.* The blend must constitute a tightly integrated scene that can be manipulated as a unit. More generally, every space in the blend structure should have integration.
>
> *Topology.* For any input space and any element in that space projected into the blend, it is optimal for the relations of the element in the blend to match the relations of its counterpart. (Fauconnier & Turner 1998, pp. 162–163. For a discussion on how the two principles fit in a larger picture of conceptual blending theory, see Fauconnier & Turner, 2002, chapter 16.)

Conforming to the integration principle, blending helps generate a tightly integrated scene that can be manipulated as a unit and enables the thinker to run the blend without constant reference to the other spaces. Conforming to the topology principle, blending helps generate novel inferences, which are partly legitimized by their connections to the relevant inferential patterns built up in the input spaces. These two principles cannot be simultaneously satisfied in the case of mouse manipulation. Nonetheless, there can be a trade off between the two principles, and, in this case, a trade off of inferential articulation sanctioned by the topology principle for skillful mouse maneuvering as a metaphorically integrated activity. This gave Fauconnier (2001) leeway to explain away the massive mismatches between the source and the target as irrelevant or negligible. One may thus opportunely forego any attempt to find an inference-based metaphorical understanding of the interface experience, and concentrate on how skillful mouse manipulations result from blending sanctioned by the integration principle.

Now, the core idea of Fauconnier's (2001) analysis can be stated as follows. Mouse manipulation is an emergent, integrated activity produced by blending two input spaces. One of the input spaces consists of everyday conception of ordinary, three-dimensional objects. The other input space consists of the perception of the objects on a screen. The counterpart relations connecting these two input spaces are too tenuous to support an inference-based, metaphorical understanding. Nonetheless, blending can still exploit, opportunistically, that minimum set of counterpart relations, integrate the two input spaces, and provide integrated guidance to the interface manipulation. The result is notable: One smoothly moves the cursor through moving the mouse, despite the massive failure of the inference-based, metaphorical understanding. Further metaphors can be introduced, new blends can be built, and the user can begin to engage with the interface, exploring and coping with all sorts of tasks that can be accomplished by moving the mouse and clicking on objects on the screen.

Blending mental spaces provides fascinating results. How far the analysis can go regarding mouse manipulation, I do not dare to speculate. But it seems to me that in this case, the theory is overly stretched. The trade off between the optimality principles seems too unconstrained and gives the impression of an ad hoc attempt to patch over obvious mismatches. Moreover, the analysis is misguided from the very beginning. It fails to note how a user may negotiate the mouse-driven interface by letting the external structure control, prompt, and modulate his actions. The manifest pattern of his behaviors when using the mouse may be largely a reflection of how the display system, the input device, and the computing setup jointly control and modulate his actions.

For example, the overall design of a mouse provides strong clues to how it is to be held and moved. The housing arcs gracefully, inviting the user to put his hand on it, and move the mouse horizontally. The mouse pad, if there is one in use, defines a region of the horizontal plane within which the mouse is to be moved. Gravity is already doing its work, keeping the bottom of the mouse in contact with the mouse pad. The user can disengage himself by lifting up the mouse, adjust it in his hand, put it down again, and reengage in the process. The computing setup allows the user to disengage and reengage in different ways, so that he may act on or act through the mouse as he sees fit. In this way, the external structure imposes soft constraints on how the mouse is to be held and moved. It is worth noting again that the cursor will not respond to the movement of the mouse if the mouse is in the air. The visual feedback from the display system signals to the user that he may disengage himself from the process just by lifting the mouse. There is no requirement—and indeed there should not be—that the cursor move in accordance with movement of the mouse when it is lifted.

Blending scholars need to take account of the fact that human cognitive activities co-opt bodily and environmental factors into problem-solving routines (Gibbs, 2000, p. 355). Fauconnier (2001) erred in not factoring the external constraints into his analysis of the experience with the user interface.[2] He thought that there are

[2]To be fair, Fauconnier (Fauconnier & Turner, 2002, Chapter 10), borrowing Hutchins's (in press) idea of material anchors, did take external constraints into account in certain cases. However, he has not woven the idea of external constraints into the very fabric of the blending theory.

massive mismatches between the source and the target, and tried to explain them away as something irrelevant or negligible by positing complex, mental operations. On the other hand, I think he was correct in directing attention to activities that can be appropriately deemed to be metaphorical. When an activity is the theoretical focus, it should be natural that one takes bodily and environmental factors into account. That is my divergence from Fauconnier (2001) in describing the experience with the user interface. If my description of it is correct, the supposed mismatches between the movement of the cursor and that of the mouse are not mismatches at all. They are not to be explained away as something irrelevant or negligible by a trade off of inferential articulation for skillful mouse maneuvering. On the contrary, they do have important function in the user's way of doing things. That is, they are parts of the feedback mechanism built into the computing setup, serving as external props that enable the user to see clearly how he may act on or act through the mouse if and when he sees fit.

As to the more glaring mismatches previously mentioned, the strange phenomena may just reflect a design feature of the feedback mechanism that the effect of each action the user performs must somehow be visible to him, given the process capacities of the computing system. For example, the phenomenon in which a phantom appears and moves with the cursor when the user is using the cursor to move an object on the screen may very well suffice to communicate to the user that his command is being executed by the PC. In addition, the object itself, while remaining in its original position, may serve as a fixed reference point, in relation to which the user keeps track of the trajectory from the initial location to the intended location. A relatively experienced PC user should be able to take in the message within seconds. If, moreover, there is any misunderstanding, it should be easily correctable.

Here I think it is appropriate to draw attention to the fact that modern PCs are primarily devices of information processing for a wide range of tasks. It is rarely the case that the user simply moves the cursor through moving the mouse. His moving the cursor is an act of coping with a particular task. The user interfaces, moreover, are already suffused with metaphors helping the users manage the tasks at hand and offering ways of exploring and interacting with the PC programs. The mouse manipulation takes on new meanings in those larger settings. It is an action of pulling down a menu and selecting an item from it, opening a file, cutting and pasting, or dragging, etc. The graphics on the screen communicate visual affordances for actions that can be performed by moving the mouse and pressing its button. An icon on the screen, for example, may depict a folder, communicating to the user that he may click on it and thus open a folder. As the user moves the cursor onto it and pushes the button, the graphic display instantly changes. A new set of icons appears on the screen, some visually indicating that they are files, some visually indicating that they too are folders containing another set of files and perhaps some further set of folders. The user moves the cursor onto one of the icons and pushes the button again, and the display changes again. In that way, the user is experimenting and learning the possibilities through active exploration (Gaver, 1991; Norman, 1990, chapter 6). From the embodied, action-oriented perspective, the exploration is doubly metaphorical. The phenomenon of metaphorical coupling marks the user's experience with the interface, as described, and at the same time, his action is guided by the affordances that are metaphorically defined and visually communicated to him.

Although I have not probed into the social meanings of the user interface experience, it is of interest to note that the coupling and the metaphorically defined affordances are parts of a richer fabric of relationships between people, institutions, and social actions we jointly construct as we go along. Moreover, this richer fabric of relationships is profoundly shaped by further metaphors, including more recent metaphorical environments based on offices, libraries, shopping malls, superhighways, and so forth. This implies that many metaphorically mediated actions the user interface affords are already social actions. The questions of how the experiences of individual users with the interfaces fit in, and collectively sustain, the social actions remain open research problems. (See Dourish, 2001, for an account of embodiment and computer-mediated social actions, though he does not consider the phenomenon of metaphorical coupling.) My goal here has been to articulate the phenomenon of metaphorical coupling and how the coupling is sustained and modulated by artifacts we strategically build into the environment.

CONCLUSION

Researchers should recognize the role of body and environment in human cognitive activities, and take notice of the fact that metaphors can be action-oriented and manifest themselves in our experiences with public representations. The conceptual metaphor theory can make headway toward building a more comprehensive theoretical framework for metaphor researches if it is combined with an account of how external structures constrain and modulate metaphorical activities. The conceptual blending theory, on the other hand, is not unavoidably misguided if, in addition to the optimality principles, the deployment of mental spaces and cross-space mappings is curbed by an account of how external structures constrain and modulate metaphorical activities.

As to Lakoff and Johnson's (1999, 2003) proposal that metaphors are computed neurally via neural maps, that proposal has to be revised if I am correct that the construal of domains as neural ensembles is overly restricted. If, moreover, metaphors can be off-loaded in the ways described, then metaphors can be computed by people acting on and through the practical ensembles that serve as source and target domains in the culturally constituted material environment they inhabit. Neural computing should be embedded in and appropriately coupled to the external structures that constrain and modulate what people do to and in the world. This study recommends that individuals reorient themselves to an embodied, action-oriented perspective on metaphor, and take account of how they are metaphorically coupled to the world through bodily engagement with the environment, and particularly, with the artifacts they strategically build into it.

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