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THE METAMORPHOSIS OF METAPHOR: FROM LITERARY TROPE TO CONCEPTUAL KEY

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The study of metaphor has long been hampered by the post-Aristotelian bias that metaphor is mere poetic figurative language. Such bias has been compounded by sequential models of cognitive processes cemented into scientific (and subsequently psychological) literature. During the last decade, however, cognitive scientists have begun to re-evaluate the importance of metaphor as a key element in abstract thinking, realizing particularly the universality of the metaphoric dynamic. This focus has been further underscored by findings in cognitive neuroscience that show both that language processing involves visual, motor, auditory, and other neural systems, and that multimodal experiences related to metaphor may converge in central processing areas. Further, they have noted that, rather than being geographically localized, language processing is distributed throughout the brain. To explain this distribution, one anthropological model proposes that growing societal complexity necessitated increased linguistic development for which the brain adapted existing brain areas. Such investigative insights support the assumption that metaphor –far from being a mere literary embellishment– is in reality a key element in the cognitive inferences by which all language users interpret and cope with their experiential world.

Not only are emerging neuroscientific insights into the working of the brain challenging traditional views of language and its elements, but the inter-disciplinarity of neuroscience itself is raising practical questions about what does and what does not lie in the realm of literal language. Most particularly, the need for scientists from many fields to form discourse communities has led to an increased need for the use of explanatory metaphor within neuroscientific discourse, even though historically a bias has existed among classical scholars that metaphor belongs in the realm of "novel poetic language" (Lakoff 1993: 202). Yet, in reality, metaphors have long been used in scientific thought to express the novel, ranging from "the clockwork metaphor for the solar system, and Harvey's pump metaphor for the heart" to Crick's "searchlight of attention" hypothesis for cellular level thalamocortical interaction (Baars 1997: n.p.). Within contemporary neuroscience, Baars (1997) has suggested a theater metaphor for conscious attention in which

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convergence zones are likened to the "theater stage," selective attention to the "searchlight," receiving areas to the "audience," unconscious systems to "backstage," and executive systems to the "director" (n.p.). Similarly, Killeen (personal communication, March 25, 1996) explains adaptive resonance theory as the sympathetic vibrations set up on a neurological aeolian harp over which the wind of incoming information plays, while Grossberg (1987) accounts for ritualistic serial order learning by proposing a "processing avalanche" that allows a simple network to learn a complex series when a "sampling signal transverses a long axon that activates regularly spaced cells" (p. 329). Obviously, such applications of metaphor broaden its applications well beyond that of a simple poetic trope; indeed, the very function of metaphor in these examples has shifted from poetic embellishment of the familiar using the novel to pragmatic explanation of the novel using the familiar. How, then, did such divergent views of metaphor arise, and how are perceptions of metaphor changing?

METAPHOR AS LITERARY TROPE

As a literary trope or figure, metaphor belongs to the rhetorical category the Greeks named *schema*, meaning at its most basic "a pairing of two patterns at unequal levels" (Turner 1997: n.p.). Whereas for Plato, schemas were representations of the metaphysical idea, Aristotle "reversed the directions of abstraction, preferring to see abstract mental forms as epistemological *schemata* of concrete realities they represent" (Turner 1997: n.p.). Thus, contrary to later interpretations, Aristotle did recognize that the linguistic forms of schema were driven by underlying conceptual relationships. However, once rhetoricians turned to "applied tasks... [such as] the production of instructional materials" a linguistic bias regarding not only metaphor but all figures developed that increasingly ignored the conceptual function of figures in favor of their use as verbal embellishments (Turner 1997: n.p.). Of equal weight in the relegation of metaphor to the realm of the figurative were Aristotle's insistence that metaphor be banned from argumentation (Gentner and Jerziorski 1993: 448), and his warning that danger lay in the "ambiguity and obscurity inherent in" metaphor when confused with definition (Ortony 1993: 3).

Nevertheless, the conceptual matrix of tropes was recognized by some leading thinkers in modern literary and rhetorical criticism, including Richards (1936), who recognized the metaphoric nature of thought itself (p. 94); Lewis (1936), who viewed parable as "a basic cognitive instrument" (p. 44); and Burke (1945), who believed the master tropes of irony, synecdoche, metonymy, and metaphor were crucial to discovery of truth. Inherent in Burke's view of metaphor and its relation to both real world and literary perspectives was the notion of incongruity recognition and resolution and, even more important for contemporary metaphorical theory, admission of shifts in perception across sensory domains. Burke (1945), together with Pepper (1942), was also among the earliest of several modern scholars to recognize the ubiquitousness of the master tropes –and particularly, metaphor– throughout not only the arts but also the social and hard sciences (c.f. Brown 1977, Derrida 1978, White 1973, 1978). He anticipated the role of metaphor in social policy and discourse as applied by Schön (1979), and its application in scientific discourse as outlined by Boyd (1979) and Kuhn (1979). Yet, irregardless of insight from such philosophers, until two decades ago, understanding of the nature of metaphor was still skewed by the post-Aristotelian belief that it be used primarily not for ideational functions but for linguistic expressions "assumed to be mutually exclusive with the realm of ordinary everyday language" (Lakoff 1993: 202).

Such a specialized role for metaphor in communication was also perpetuated by rhetorical study that focused primarily on the comparativeness implicit in the nature of metaphor, reinterpreted later as the *comparison theory*, which "takes every metaphor to be a condensed or elliptic simile" (Black 1962: 35-36). Such an interpretation constituted a special case of the substitution view that metaphor is the replacement of "the entire sentence" that houses the metaphor with "some set of literal sentences" (Black 1962: 31). One scholar who did move beyond the substitution view was Richards (1936), whose highly influential theory for analyzing the tension between metaphorical *topic* and *vehicle* far better addressed the incongruities, or "conceptual incompatibilities" that appear to characterize many metaphors (Ortony 1993: 3). Not only did Richards provide "a set of useful terms for talking about metaphors," he also provided the grounding for the *verbal opposition theory* of Beardsley (1962) and the *interaction theory* of Black (1962), both of which focused on the relationship between two different "semantic contents" (Searle 1979: 99). Black's (1962) theory implied that through changes in word meaning metaphors serve to create *new* similarities, a concept later amended into the "strong creativity thesis" of metaphor that depends on some metaphors being 'cognitive instruments,' indispensable for perceiving connections that, once perceived, are *then* truly present... " (Black 1979: 39). While still unresolved, this creativity thesis did move metaphoric function further toward the realm of the conceptual, and was extended by Boyd (1979) to suggest that in scientific discourse some "exegetical or pedagogical metaphors" actually assist in the explication of theories whose formulations are either less- or totally non-metaphorical (p. 359).

Subsequently, however, the inadequacy of both the comparison or similarity theories and the semantic interaction theories, such as Black's (1962) and Beardsley's (1962), was proposed by Searle (1979) as grounds for his own interpretation of metaphor. He believed that the "endemic vice" of both approaches was their neglect of the difference between "sentence or word meaning, which is never metaphorical, and speaker or utterance meaning, which can be metaphorical" (Searle 1993: 100). Despite the far-reaching influence of Searle's theory and its continued use in the metaphor theory literature, it is, as Rohrer (1995) explained, essentially a sequential model that requires first that a metaphorical utterance "be processed as if it were literal," then that it be "judged non-literal" so mandating the employment upon it of "alternate strategies... to decode [it] into literal" (n.p.). For Searle, then, *love is a journey* needs first be expressed as the analogy "love is like a journey"–to which the reader/listener's pragmatic knowledge of journeys and love must be applied.

This focus on the literal versus the non-literal raised yet another debate crucial to the nature of metaphor: whether or not a dichotomy even exists between the literal and the figurative. Turner (1997), based on a body of his earlier work, suggests that "'literal' and 'figurative' are labels that serve as efficient short-hand announcements of our integrated reactions to the products of thought and language; they do not refer to fundamentally different cognitive operations" (n.p.). He feels that the dichotomy is no more than "a psychological illusion," arising from a folk theory in which expressions appear literal if they match real-world truth conditions but figurative if they do not. While he admits that the true/false conditions are valid, he argues that they do not signal differences in cognitive processes but rather differences in reaction to the pairing of elements already existing in conceptual category structures. According to such an assumption, the expression "a child is a miniature adult," in which both elements belong to the basic-level category 'human being', must seem more literal than "a child is a sapling," in which the elements belong to different basic-level categories. A related "influence on judging a connection to be literal or figurative [is] the degree to which the conceptual connection or the linguistic expression is generatively entrenched," thus individual reactions and judgments of literality for "life is metabolism," "life is a play," "life is a lottery," and "life is an isosceles triangle" can be expected to differ between individuals, depending on how easy the conceptual connections are for them to make. As Turner (1997) points out, expressions like "ethnic cleansing" seem highly figurative when first coined but acquire greater literality with increased use. In sum, then, "conceptions and forms that feel figurative evolve" as does all thought and language, and the degree of perceived figurativeness will vary at any one time for each person during the evolution depending on where the elements are located "on the interacting gradients of distinction" (n.p.). Thus, literality and figurativeness do not represent discrete mental processes despite the perceived dichotomy perpetuated in much rhetorical study.

Science and metaphor

Within the sciences, the bias against using metaphorical comparisons for explanation resulted primarily from a move toward linear thought. As outlined by Gentner and Jerziorski (1993), early Western science, characterized by the alchemists whose analogous correspondences were "remarkably rich and diverse" (p. 470), delighted in the mixing of incongruous elements and was dominated by shifts from domain to domain. For example, "a central comparison was a macrocosm-microcosm analogy (or metaphor) by which man (the microcosm) was likened to the natural world" (p. 464). Subsequently, however, sciences moved away from "the plurality of possible match types" in favor of an extremely selective process in which "the strength of an analogy in licensing scientific prediction rests on the degree of systematic structural match between the two domains" (Gentner and Jerziorski 1993: 453). Such a shift thus moved scientific investigation irredeemably away from parallel potentials to the linear ideal codified by Descartes; one of sequentialization based on the Aristotelian notion of stars as "units with a serial order" (cited in Bailey 1996: 66) and compression –"two potentially distorting Cartesian steps in aligning thought with the strengths and weaknesses of the human mind" (p. 67). As Bailey points out, such linear thinking became thoroughly entrenched in science despite Kant's early proposition of the "obvious" involvement of human thinking in delineating such sequences (p. 67):

> It is we who bring order and regularity to phenomena and call the result "nature." These properties would not be discovered in nature if our own minds had not first put them there: for unity in nature means a prior, necessary, and certain connection of phenomena. (Kant 1960: 53)

Ironically, an epiphenomenon of such linear thinking was that Descartes effectively hampered developments in the field of neurobiology for centuries by proposing that "physical processes were measurable and thus amenable to scientific laws, but subjective processes were immaterial and not measurable" (Posner and Raichle 1994: 3).

A focus on metaphor-free literality derives, according to Ortony (1993), from the scientific dictum that both scientific practice and language be characterized by "precision and absence of ambiguity," culminating over half a century ago in the doctrine of logical positivism (p. 1). Obviously, such a dictum mirrors the concern of Aristotle that metaphor's inherent potential for ambiguity renders it inferior to plain definition, so underscoring the division between the literal and non-literal. Relativism, in contrast, adopted the constructivist view that "arises through the interaction of that information with the context in which it is presented and with the knower's preexisting knowledge" (p. 1), a viewpoint that also sees no dichotomy between the literal and figurative. While these two viewpoints represent extremes subscribed to in various measure by myriad schools of thought in a wide spectrum of disciplines, they illustrate "a more fundamental and pervasive difference of opinion" about how language relates to the real world, leading to two differing interpretations of metaphor –"metaphor as an essential characteristic of the creativity of language, and metaphor as deviant and parasitic upon normal usage" (p. 2). Thus, as a consequence of philosophical and scientific reductionism, together with the perceived irrelevancy of metaphorical language for accurate communication of real world knowledge, metaphor became regarded over time as either a mere curiosity or a complete irrelevancy in all disciplines but that of rhetoric (Ortony 1993: 2).

From rhetorical trope to cognitive strategy

Nevertheless, despite widespread acceptance of metaphor's limited communicative role, some scholars did attempt to link it to human conceptual reality, leading eventually to theories of metaphor that raised it much above a mere linguistic embellishment. Schön (1979), in a social analysis that rejected the view of metaphor as an anomaly to be explained (or explained away), concentrated on what he termed a "generative metaphor," a particular "perspective or frame... by which new perspectives on the world come into existence" (1979: 254), applying the notion to the domain of social policy with its resulting phenomena of "frame awareness, frame conflict, and frame restructuring" (p. 268). As a result, he concluded that the crucial dynamic in frame conflict is "problem setting" rather than "problem solving," an application lauded by Reddy (1979) as potentially leading to "genuine advance in the social and behavioral sciences" worthy of extension to "human communication itself" (1979: 285). Within this extension, Reddy framed his notion of the "conduit metaphor," one that transfers "thoughts bodily from one person to another," conveyed in writing and speaking by the insertion of thoughts or emotions into words to be extracted by others during listening and reading (1979: 290). According to Lakoff (1993), this famous essay led to his assumption that "metaphor is primarily conceptual, conventional, and part of the ordinary system of thought and language" (p. 203), thus providing the catalyst for the conceptual mapping model he originally proposed with Johnson (Lakoff and Johnson 1980).

Lakoff (1993) first explained the dynamic of conventional metaphor use in terms of mappings; "open-ended class[es] of potential correspondences across inference patterns" that, once activated, "may apply to a novel source domain knowledge structure and characterize a corresponding target domain knowledge structure" (p. 210). More important, mappings should be thought of neither as processes nor as algorithms, but rather each should be considered a "fixed pattern of ontological correspondences across domains that may, or may not, be applied to a source domain knowledge structure or a source domain lexical item" (p. 210) and which might represent either concepts or images. Based particularly on the *love is a journey* metaphor and Reddy's (1979) conduit metaphor, Lakoff (1993) concluded that metaphor must necessarily be *not a figure of speech but rather a mode of thought* because it is characterized by "systematicity" of linguistic correspondence, it governs reasoning and resultant behavior, and its "novel extensions" are comprehensible in terms of its "conventional correspondences" (p. 210). He also recognized potential hierarchies for metaphor and in his earlier work outlined three mechanisms of novel metaphor: "extensions of conventional metaphors, generic-level metaphors, and image metaphors," all of which are typically superimposed upon each other in poetic metaphorical forms (p. 237). Contrary to Searle, Lakoff believed that, because of the fixed nature of the mappings, their activation is *not a product of conversion from the literal*, thus making possible simultaneous mappings of partial elements for more than one mapping even though no complete mapping could apply to two totally different domains at once (p. 219). Thus, for Lakoff, processing of *love is a journey* is achieved through the cognitive linking of image-schema encoded for each of the two metaphorical elements.

Cognitive debates on metaphor

Despite its important role in broadening understanding of metaphor as a conceptual rather than purely linguistic embellishment, cognitive inquiry has itself been hampered by failure to recognize metaphor's centrality to cognitive processing and power for conceptual communication. As outlined by Rohrer (1995), the development of theoretical issues involving metaphor within cognitive science has also been influenced by linguistic bias. He suggests that, "with a few notable exceptions," scholars have traditionally mostly ignored *figurative* language, relegating metaphor to a "secondary linguistic process" (n.p.). This bias Rohrer blamed primarily on the theoretical duality between the *instantiation* and *embodiment hypotheses*. These two hypotheses represent at their most basic two divergent (though not inherently mutually exclusive) approaches to investigation of the dynamics of human cognitive processing that necessarily underlies metaphorical comprehension. The first approach, emerging out of earlier classical sequential models in the field of Artificial Intelligence (AI), is computational, expressed most recently by neuronally inspired parallel processing models (neural networks) more compatible with the embodiment viewpoint. The second approach –necessarily subscribing to the embodiment hypothesis– is neuroscientific, a product of actual interdisciplinary cooperation in the sciences of the type advocated by Rohrer (1995) for all investigation into metaphor theory.

The instantiation hypothesis bases its image of mind on "a serial processor driven digital computer" (Rohrer 1995: n.p.) arguing "that reason, intelligence and minds were substrate neutral, that is, independent of any specific embodiment, so long as the body was a [sic] algorithmic device" (n.p.). This view assumes –following Alan Turing's proof "that all digital computers were in principle reducible to recursive elaboration of a finite state algorithm"– that all mental processes are similarly reducible and therefore subscribe to "a peculiar literal quality in that their variables are either true or false with no admixture of truth or falsity permitted" (n.p.). Put simply, Turing observed that computational processes, even when hierarchical, consist of a limited number of binary logical steps that are used repeatedly; consequently, language scholars assumed that language was made up of similar finite steps performed on each of the linguistic levels. According to such a view, symbolic representations of the outside world should be matched literally within the brain by a series of finite states (Rohrer 1995: n.p.). Therefore, comprehension of figurative language, by default, was presumed to be "a mere afterthought to solving the problem of literal language comprehension," whose complexities would automatically fall into place once the overall problem of language representation was solved (n.p.). The original Searlian approach as described above subscribes to such a processing type.

Antithetical to the instantiation hypothesis, the embodiment hypothesis posits that "minds are fundamentally not disembodied algorithmic processes like a computer program, but are instead constituted and constrained by the kinds of organization reflected in the biological, anatomical, biochemical, and neurophysiological characteristics of the body and the brain" (Rohrer 1995: n.p.). While both the embodiment and instantiation hypotheses view cognitive processes as hierarchical –that is, a system in which "higher-level processes... are built up of lower-level processes" (n.p.)– the embodiment hypothesis refutes the image of mind as a collection of substrate neutral processes of finite-state symbol manipulation in favor of interactive and interfaced investigatory levels –"many of which appear to behave analogically and frequently exhibit a kind of adaptive plasticity not found in digital computers" (n.p.). The embodiment hypothesis motivates much of the recent literature in cognitive science, including the most recent work by Lakoff and Johnson (1999) on the implications of the embodied mind for Western philosophy.

EMBODIMENT THEORIES OF METAPHOR

Subsequent to developing his cognitive mapping model, Lakoff proposed that any valid cognitive theory of metaphor would necessarily be antithetical to the traditional literal-figurative dichotomy, lie beyond the pragmatic domain of Searlian thought, be inconsistent with the assumptions of both Chomskyan generative linguistics and generative semantics, be at odds with continental philosophy and deconstructionism, and be incompatible with many of the "traditions in symbolic artificial intelligence and information processing psychology" that conceive of thought processes as "algorithmic symbol manipulation" (1993: 249). Consequently, he, like many scholars working in cognitive linguistics, turned to the three-level Neural Theory of Language (NTL) paradigm in which a neurocomputational level provides a theoretical link between functional cognitive mechanisms and structures –for example, phonological, syntactic and semantic elements– and the underlying neurobiological architecture that makes all cognitive functions possible (Lakoff and Johnson 1999: 110). This model grew out of the contemporary computational architectures based on neural network or so-called connectionist models.

Contemporary computational architectures assume that brain architectures are hierarchies that consist of "layers of receptive neuronal fields that react to different types and levels of incoming stimuli" (Ney and Angelica 1998: 53). Stimulus decoding involves competitive excitation and inhibition as new input is compared and contrasted with patterns –or prototypes– already encoded during prior experience. Cognitive processing is thus interpreted as an "associational dynamic process governed primarily by the firing of neural synapses; the strength of connections formed as a result of this firing; and the patterns of excitation set up and reinforced as patterns are repeated, similarities recognized, and new information interpreted or amended according to existing expectations" (p. 53). The revolutionary aspect of such architectures –besides their massively parallel rather than sequential, and distributed as well as local processing potential– is that they view human cognition as a function of *pattern* not one-to-one *symbol* processing (for further discussion, see Angelica and Ney 1995). Further, those theories most cited in the new field of consciousness studies –for example, the adaptive resonance theory of Grossberg (1987)– suggest that human cognitive processing inherently involves continual amendment of, and therefore change in, experiential encoding in response to environmental demands. Such models, highly dynamic and nonlinear, are antithetical to linear sequential processing models such as that of Searle.

In their latest work on metaphor, Lakoff and Johnson (1999) propose that humans as "neural beings" must necessarily use categorization as a means of understanding and communicating about their world. Consequently, categorization, rather than being a totally intellectual process that results from experience, is the very "stuff" of which experience is made. Further, "concepts" are in reality neural structures that make possible mental characterization of and reasoning about categories using inferences based on categorical prototypes (p. 19), frequently through the medium of metaphor. Thus, conceptualization of categories, often requiring the imposition of "complex hierarchical systems," is inextricably tied to the sensorimotor system of the human brain (p. 20), and no dichotomy exists between perception and conception of experience (p. 39). Based on these assumptions, Lakoff and Johnson examine two integral aspects of metaphor: its underlying mechanism, and the reason for its universality.

To produce a *theory of primary metaphors* –the "atomic" metaphorical parts that make up the more complex "molecular" metaphor– Lakoff and Johnson (1999) integrate elements of Johnson's theory of conflation, Grady's theory of primary metaphor, Narayanan's neural theory of metaphor and Fauconnier and Turner's theory of conceptual blending. Conflation refers to the initial lack of differentiation in young children between nonsensorimotor (subjective) and sensorimotor experience, so producing cross-associations between the two domains that remain even after the more mature youngster has learnt to differentiate between them. According to Grady's 1997 unpublished dissertation (cited in Lakoff and Johnson 1999), cross-domain associations are laid down during the conflation of primary metaphors that "[arise] naturally, automatically, and unconsciously" as a result of everyday experiences to be later combined into more complex metaphors through conceptual blending (p. 46). The neural theory suggests that associations between mappings "are realized neurally in simultaneous activations that result in permanent neural connections being made across the neural networks that define conceptual domains... [so forming an] anatomical basis of source-to-target.... metaphorical entailments" (pp. 46-47). Admittedly, the notion of "permanent neural connections" is more problematical in actual neuroanatomy than in a computational facsimile, but if interpreted as a "process [in which] long-term connections are learned that coactivate a number of primary metaphorical mappings" (p. 49), then the model is compatible with neurocognitive architectures. The extensions of such coactivations through inference can then produce more complex and/or novel conceptual blends. Consequently, universally embodied human experience leads to "at least several hundred" universally acquired conceptual metaphors –learned not innate; manifested not only linguistically but in "gesture, art, or ritual"; and produced by "immediate conceptual mapping" rather than a "conscious multistage process of interpretation" (pp. 56–57).

Universality of metaphor

Emerging realization of the universality of metaphorical thought supports the assumptions that the matrix of metaphor is human sensorimotor physiology and that metaphor plays a key role in the way that humans interact physically and conceptually with their environment. As would be expected of a manifestation of sensorimotor experience, many commonly used metaphors are tied to basic experiential elements such as spatial dimensions and relationships, physical motion, sensory experience, and environmental forces or resources. Thus in English, for example, those who "feel on top of the world" may "live close to the edge" causing relatives to "be beside themselves." People may find themselves "progressing by leaps and bounds," "sitting on the fence," or "walking on eggshells." They may "grasp a concept," "think a movie stinks," "drink in an experience," "smell a rat," or wield "an iron hand in a velvet glove." At the mercy of the "winds of change," individuals may feel "trapped between a rock and a hard place," "throw caution to the wind" or have their "head in the clouds." In a "corporate jungle" where "time is money," those "hungry for success" may have "fire in their bellies," as they "climb the pinnacle of success." Moreover, as pointed out by Lakoff and Johnson (see above), similar expressions occur in languages from vastly different linguistic families.

Say (1998), in the belief that "metaphors build the basic conceptual structures of human beings," has compiled a multilanguage database that examines source to target mapping by analyzing how a base sense –"how *light* this luggage is"– is extended metonymically and quantitatively within domain –"the traffic is *light* today" [few vehicles]– then metaphorically and qualitatively across domain –"she is feeling *light* in the head" [giddy], to produce metaphorical compounds such as "*light*-fingered" [liable to steal], "*light*-hearted" [carefree or easygoing], "*light*-footed" [nimble], or "*light*-headed" [frivolous]. Drawing primarily on Chinese, English, French, Malay, and Spanish, she particularly presents expressions related to universals such as body parts, sleep, work, feelings, or sickness, in which the words for "heavy" or "light" are used in a similar qualitative manner to convey degrees of seriousness, value, or importance. Examples of universal similarities extrapolated from the database include those of attitude –Chinese, "yun dan feng *qing*" [to take something *lightly*"], French, "prendre quelque chose a la *légère*," Malay, "dipandang *ringan*," and Spanish, "tomarse el asunto a la *ligera*"; and character –the French *light* girl, "une fille légère" is a lady of easy virtue (her male counterpart, of course, is merely "fickle") in perfect contrast to the Chinese *heavy* "de gao wang *zhong*," a person of virtue and morals. Similarity also exists particularly in expressions related to body part –"with a *heavy* heart," French, "avec le coeur *lourd*," Malay, "*berat* hati," Spanish "con *pesar*"; or sickness –Chinese, "ta shi zai bing de hen *zhong*" [his sickness is *heavy*], Malay, "dia sakit *berat*" [he sick *heavy*], French, "il a le fièvre *légère*" [he has a {s}light fever], Spanish, "él tiene un ligero catarro" [he has a {s}light cold].

This is not to say that variations do not exist –whereas a "dizzy" English speaker says "I feel *light*-headed," a Chinese native, like a French speaker, says "my head is *heavy*" ['tong hen *zhong*" and "j'ai la tête *lourde*" respectively]. In greater contrast, a Malay speaker with a "*ringan* kepala" [*light* head] is one with a facility for understanding, while the one with a "*berat* otak" [heavy brain] is sad. Where the English speaker "looks *down* on" a person, the Chinese speaker "looks *lightly* on" [*qing* shi: *qing* hu]. In Chinese "ren wei yan *quing* [*light*] is a "man and talk of no importance" as opposed to one who plays "*zhong* ze da ren" [an important {*heavy*}role], a value that contrasts with the American English "heavy" [the bad guy] in a movie, or the Spanish "*pesado*" who may be dull, boring, or annoying. Based on such variations, Say (1998) suggested that it is within the metaphoric extensions that cultural differences manifest themselves; nevertheless, whatever the linguistic variation, conceptually the expressions are mutually comprehensible and the social implications often inferential. For example, whereas English "*light*-fingered," besides meaning "nimble," refers to an adroitness at stealing and particularly picking pockets, French "avoir la main *légère*" often refers to cunning political practices, an extension with obvious social ramifications. Similarly, in Malay "*ringan* tangan" signals not only "nimble" but also "helpful," not only "one who steals" but also "a busybody." Most important, Say's ongoing analysis suggests for each language studied a similar dynamic from basic form to metaphoric extension(s), despite major syntactic differences between the language groups.

This similarity of processing dynamic mirrors the increasing complexity proposed by Lakoff and Johnson (see above). Moreover, Lakoff and Johnson (1999) have pointed out that even when major cultural differences are assumed, the assumption is often erroneous. Most particularly, Western philosophy is often differentiated from other worldviews according to its perception of time. Influenced by such perception, Whorf proposed that Hopi was a language lacking in any concept of time or metaphor (cited in Lakoff and Johnson 1999: 150). In reality, however, in a massive study, Malotki provided a wealth of Hopi time expressions, including myriad time/space metaphors, such as "tomolangwuy aqw itam hoyoyota" [we're moving toward winter] (cited in Lakoff and Johnson 1999: 151). Similarly, the metaphor of "essential" or "real" self is pervasive in Western philosophy and Lakoff and Johnson admit to having assumed it "a peculiarity of either English or the Western mind" (p. 284). However, in personal communication with linguistics professor Yukio Hirose they learnt that Japanese has a "metaphorical conception of inner life" very similar to the American, including "karewa kiga titteiru" [he spirits dispersed] –he is distracted; "karewa ikarino amari wareo wasureta" [he for too much anger self lost]–he was beside himself with anger; "karewa yooyaku wareni kaetta" [he finally to self returned] –he finally came to his senses; and "karewa hitomaedewa itumo kameno kabutteiru" [he in public always mask puts on]– he always wears a mask in public.

Based on their broad analysis of the metaphor of self, Lakoff and Johnson (1999) raised the important questions of whether "the metaphor [fits] a preexisting qualitative experience, or [whether] the qualitative experience [comes] from conceptualizing... via that metaphor" (p. 289). They suggested that activation of the source domain may in turn activate associated affect, even though they currently propose no dynamic by which this coactivation may occur. The developing field of cognitive neuroscience, however, is beginning to outline brain architectures in which such interdomain association is a property of convergence between distinct and distributed neural systems, each subserving specialized modal functions.

Neurocognitive matrices for metaphorical thought

Early neuroanalytical studies focusing specifically on language produced the insights of Broca and Wernicke that language functions are localized in specific areas of the brain, which understanding led neurologists, such as Lichtheim, to diagram for the first time oral, visual, and motor linguistic processing and data flow within the brain from the "visual and auditory reception areas" at the back of the brain to motor areas in front (Posner and Raichle 1994: 107). Nevertheless, such models lacked plasticity being "largely serial and reflexive" (p.112), a view that incorporates the misconception that phonological recoding is necessary for visual language to access semantic codes (p.110). This sequential bias is rapidly weakening in the face of electronically produced evidence (p.112). For example, in one early hierarchical PET study on lexical access (Petersen, Fox, Posner, Minton, and Raichle 1989), the addition of a speech production task to passive reception of visual or auditory cues produced expected activation in the primary motor cortex in both hemispheres; the supplementary motor cortex, thought to be "involved in the programming of complex motor activity" (Posner and Raichle 1994: 118); the mid-cerebellum, "known to guide motor activity" in a radar-like fashion (p.118); and in the insular cortex, recognized to support automatic processes such as word repetition or reading aloud (p.125). *Conspicuously absent,* however, *was activation in either Broca's or Wernicke's areas*, even though activation of Wernicke's area would be predictable from any processing model holding that visually presented words are necessarily recoded through their phonological representations before being reproduced aloud (p. 119). Obviously, the experiment had "activated a pathway from visual perception to speech that simply bypassed the function of Wernicke's area" (p.119), a dynamic compatible with parallel cognitive processing but contraindicative of classical sequential models.

The early models' lack of plasticity has also been shown to be erroneous. Whereas serial and reflexive processing is primarily bottom-up, later cognitive investigation has shown that even a simple cognitive act (simple in that it is functionally localized) generally involves both top-down and bottom-up processing (Posner and Raichle 1994: 99), negating the probability that any such task be merely serial and reflexive. Further, the observed two-way interaction (or resonance) is inextricably tied to attentional systems that direct top-down processing through many of the identical neural clusters and connections activated by bottom-up sensory input (pp. 243-244). Moreover, brain studies have observed such interactions whether the task be visual or auditory, or the level lexical or semantic; and such studies have clearly suggested a brain architecture consisting of specialized discrete units connected in a massively connected hierarchy that practices chunking for processing economy. As described by Posner and Raichle (1994),

> elementary operations are localized in discrete neural areas... cognitive tasks are performed by networks of widely distributed neural systems... under hierarchical control... [in which] practice in the performance of any task will decrease the number of neural networks necessary to perform it... [and] the mind becomes capable of performing behavior through the development of specific pathways connecting local computations. (Pp. 241–244)

One such neurological architecture from which metaphor "can easily emerge" is that suggested by Damasio and Damasio (1993), who believe that the brain, rather than recording permanent "pictorial" representations of people or objects as was once thought, encodes "patterns of synaptic connections that can re-create the separate sets of activity that define an object or event; [which] record can also stimulate related ones" (p.58). Thus the visual system will register elements such as color, shape, contents, and position; the auditory system, pitch, tone, and volume; the motor cortex, motor movements required to respond to the object, event or person; and the sensory cortex, tactile sensations such as temperature and texture, or emotional experience such as pleasure, pain, or fear. According to this interpretation, then, internal representations of external reality include not only snapshots of the outer world but also the human experience of exploring, interacting with, and reacting to this world (p.58). Such interaction occurs so rapidly through a "sequence of microperceptions and microactions" as to seem simultaneous to the human consciousness (p.58). Thus, although the model may seem to admit of sequential thought, these temporal sequences –potentially occurring simultaneously in multiple brain areas– are so rapid as to negate any concept of real time conversions/ transformations of metaphor through analogy.

Corollaries to this interpretation are that specific elements such as color or shape are encoded in "subdivisions" of functionally specialized regions, the brain necessarily categorizes such elements to enable simultaneous reactivation, and records must exist in "convergence" brain areas, in which "axons of feedforward projecting neurons from one part of the brain converge and join with reciprocally diverging feedback projections from other regions" (p.58). (Interestingly, the notion of a convergence center for sensory input has itself been criticized as being Cartesian, however "all current proposals involve 'binding,' 'convergence zones,' or 'working memories' for the integration of conscious input," and a possible zone for integration of visual information has been tentatively identified in the inferotemporal cortex and superior temporal sulcus of the macaque [Baars 1997: n.p.].) In order to simultaneously "reconstruct previous patterns of mental activity," excitation of the feedback projections in the convergence area generates simultaneous firing of "many anatomically separate and widely distributed neuron ensembles" (p.58). As Damasio and Damasio themselves have pointed out, such neural representations greatly resemble the cognitive semantic schema suggested by Lakoff.

An obvious major implication of these complex intermodular architectures is that conceptual mapping of metaphoric elements involves far more than linguistic elements alone. Indeed, recent neurological findings call into question whether 'language' as a separate entity is even possible. In the hierarchical Petersen et al. experiment (1989), the basic mental activity of accessing meaning could be measured by subtracting all previous activity patterns –basic perception of cross hairs, visual or aural word perception, and spoken reproduction of the perceived word– from the highest level task that required meaning interpretation followed by verbal expression, a conscious manipulation of the concepts that words represent. As outlined above, this task generated activation in a network of brain areas immediately distinguishable by not being locally confined like the visual, auditory, and motor systems. Instead, activated areas were "widely distributed from the front of the brain to the back of the temporal lobe on the left side to the far reaches of the right cerebellar hemisphere" (Posner and Raichle 1994: 120). These findings suggest not only that language is not autonomous, but that the modularity of the linguistic input has more influence over geographical activation than does its linguistic level. In other words, the brain itself appears to analyze language according to modality of presentation *not* position in the linguistic hierarchy.

This non-linguistic emphasis is echoed in an insightful anthropological interpretation of current neurological data offered by Deacon (1997), who proposed that language and the brain coevolved as emerging symbolic manipulation –a response to ever more complex social demands and constraints– reorganized and developed existing brain areas originally designed only for survival in the physical world. Deacon draws on a wealth of neurobiological evidence that suggests that language processing occurs in a hierarchical fashion throughout tiers that fan outward into "all major lobes of the neocortex... of the left hemisphere" (pp. 290–291). To support an evolutionary model of the development of language skills, he pointed out that sensorimotor processing tasks cluster around the Sylvian fissure "adjacent to primary tactile, auditory, and motor areas;" whereas "higher-level linguistic and cognitive functions" are "distributed within multimodal and association areas" in the outer regions (p. 291).

Deacon also suggested that this relegation of different aspects to different areas –besides being obviously affected by modality– implies that mapping of language onto the brain is an issue of time constraints rather than function; that is, its processing geography is determined by the time needed to process particular elements rather than the purpose they serve in the language. From this viewpoint, it is not surprising that the issue of processing time has raised puzzling questions in several investigations based on traditional linguistic assumptions. As Rohrer (1995) pointed out, metaphorical processing is assumed to take place in real time, suggesting that comprehension of metaphor should require more time than that of literal utterance; in fact, research suggests that, given sufficient context, this assumption does not hold true. Even any suggested potential for processing time reduction through chunking of metaphorical contexts into semantic units has been "contraindicated by the differing results in [studies of] long v. short context conditions" (n.p.). This variable of processing time has been further confounded by other research suggesting less processing time needed for highly familiar metaphors than for novel metaphors (n.p.). Such findings are indeed confusing if addressed within a classical serial framework; however, if there is indeed no true dichotomy between literal and figurative, if familiar metaphors are stored as prototypes, and if processing is governed by interconnectivity between distributed systems, such results do not seem quite so perplexing. The existence of distinct neural systems to subserve distinct language representations has been strongly supported by West, O'Rourke, and Holcomb (1999) using event-related brain potentials (ERPs), negative and positive waveforms resulting from voltage fluctuations during electroencephalograms. They proposed that "concreteness and imageability, while highly correlated, are independent dimensions by which words and their meanings are organized... [and] controlled by different brain areas," and that "verbal and nonverbal semantic systems are functionally and anatomically distinct" meaning that "meanings for words can be redundantly stored in modality specific representations" (n.p.). Such storage would also explain the coassociation between verbal expression and related affect remarked upon by Lakoff and Johnson (see above).

Deacon (1997) also suggested that syntactic and morphological markers may serve primarily to assign language elements to appropriate processing areas. They therefore serve an "*indexical* function" for tagging and distributing other language chunks; indexical functions, it should be noted, that also exist throughout the entire symbolic reference system, including between icons and the objects they represent (pp. 300–301). A possible corollary to this assumption is that complex syntactic structures, rather than being complex computations, may be "ways to distribute language processes more efficiently across many parallel and partially independent systems" (p. 293). In all, Deacon suggested, "automated language functions are not grammar modules, but merely symptoms of the grammar, which is itself probably highly distributed" (p. 299). More important for understanding of metaphor, not only does he propose that symbolic reference is "virtual" and therefore "only virtually localized," he claims that "symbolic functions... arise as a collective result of processes distributed widely within the brain, *as well as within the wider social community itself*" ([emphasis added] p. 309). Such a theoretical framework, it should be noted, not only provides a matrix in which the automatic associations between a metaphorical vehicle and its imagic and sensory correlates are far more likely to converge geographically than in a traditional "language module" architecture, but further underscores the social and conceptual functions of metaphor. Indeed, Deacon concluded that language appears to be far more neurologically wired into the *totality* of human experience than earlier assumed. Such an interpretation is congruent with both the embodiment hypothesis and the observations of Lakoff and Johnson and their colleagues of widespread similarities between metaphors that reflect the universality of human experience. Moreover, the findings emerging from cognitive neuroscientific inquiry imply at least three major precepts; namely, 1) mind and reason are inextricable from brain physiology, 2) thought is largely unconscious, and 3) abstract concepts are primarily metaphorical. It is obvious that such a viewpoint necessarily extends the role of metaphor far beyond that of a mere poetic or rhetorical embellishment; indeed, it transforms it into the very keystone of the cognitive inference that allows humans to understand their world.

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