How Brains Think

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When we get angry, several bodily changes occur. Our skin temperature rises half a degree (hence the term “boiling mad”). Our blood pressure and heartbeat increase (as if we could “explode”). We also undergo disruptions in our perceptions (become “blind with rage”) and fine motor control (get “hopping mad”).

These common metaphors for anger all involve embodiment — a concrete form given to emotions, perceptions, and expressions, says world-renowned cognitive linguist George Lakoff. Essentially, he has found, humans understand complex aspects of their experience using a range of physical terms.

Lakoff delivered a comprehensive explanation of metaphor during a March 14 keynote address at the inaugural International Convention of Psychological Science in Amsterdam, the Netherlands, in which he also covered the nature of embodied structures in the brain and the application of cognitive and neural linguistics in politics, psychology, literature, and more.

One of Lakoff’s main emphases was the body’s central role in conceptualization and language.

“You have connections to your body in all parts of your brain. … You can only have meaningful thought through connections to the body,” the University of California, Berkeley, scientist began. And metaphor is all about embodiment and embodied thought, he said.

Discussing his collaborative work with scholars such as philosopher Mark Johnson, the late linguist Charles J. Fillmore, and APS William James Fellow Paul Ekman, Lakoff covered 4 decades of research on embodied cognition and the metaphor system, including the following basic concepts:

Frames: The mental structures that organize our understanding of everyday life. A frame of a commercial transaction, for example, comprises four elements — a buyer, a seller, goods, and money.

Neurobinding: The combining of two or more frames. We experience a restaurant not only as a commercial entity, but also as a food service. We bind an element of the commercial frame (the buyer) with those of other frames (a guest, a diner).

Gating: The neural mechanism that determines which co-occurring data are relevant, allowing us to process complex concepts. We can understand the concept of a restaurant as both a food service and a business.

Lakoff’s presentation centered on the work he has been conducting with computer scientist Srini Narayanan on a bridging model to explain the way the neural and conceptual systems in our brains interact. The theory is designed to explain how diverse brain regions connect to garner meaning — including thought and language — from multiple forms of embodied experience.
Under this so-called bridging model, a computational median maps on one side to the brain’s neural system for thought and language and on the other side to the conceptual system. The model is the subject of a forthcoming book by Lakoff and Narayanan.

To begin explaining how this bridging process translates into metaphor, Lakoff pointed to concepts we learn simply through bodily and observational experiences. For example, because we feel the bodily warmth of our parents as they hold us, our brain circuitry correlates temperature with affection. Hence, we understand the concept of “warmth” as characterizing affection.

As another example, he noted that our brains unconsciously register the fact that the water level in a glass goes up every time liquid is added to it, activating the ideas of quantity and verticality together in the brain. As a result, our brain forms a neural circuit connecting the two, allowing us to understand “more” as “up.”

In this form of learning, regular correlations in experience lead to activation spreading along existing pathways in the brain and eventually form circuits. Our entire conceptual system, he explained, runs off these primitive concepts and correlations and is augmented by our cultural experiences. These, he says, constitute primary metaphors.

But how do we develop and apply metaphors for more complex concepts? This ability, Lakoff said, involves integrating various metaphors, each with its own independent logic, into a unified understanding.

As an illustration, he used the metaphor of the “glass ceiling,” which embodies the concept of success as reaching a peak and the concept of failure as falling and employs a transparent ceiling to illustrate an impediment.

“Why glass? Because it activates the conceptual metaphor for ‘knowing is seeing,’” Lakoff said. “And you can see there’s a goal that you’re not allowed to get to.”

“It takes many conceptual metaphors bound together to understand the glass ceiling,” he continued. “That’s what a complex metaphor system is.”

And that, he says, is how brains think.