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From Embodiment to Mental Models

Introduction

The recent revolution in cognitive science has investigated how human minds make sense of our experience, uncovering the ways we find meaning in everything from various shapes to blinking lights. Cognitive linguistics is part of this revolutionary discovery. The study of cognitive linguistics began in the 1970s and is an influential approach to meaning construction used by an international body of scholars.[1] Cognitive linguistics examines how we think about the entire range of human experience, including causation, motion, time, relationships, entities, and emotions.[2] The research is interdisciplinary in nature, involving fields such as psychology, anthropology,

1. Dirk Geeraerts provides a history of these developments, along with some statistical evidence for the ascendency of cognitive linguistics over generative grammar approaches in his "Recontextualizing Grammar: Underlying Trends in Thirty Years of Cognitive Linguistics," in Elżbieta Tabakowska, Michał Choiński and Łukasz Wiraszka eds., *Cognitive Linguistics in Action: From Theory to Application and Back*, Applications of Cognitive Linguistics, 14 (Berlin: De Gruyter, 2010), 71–102.
2. For brief introductions to the history and key concepts of cognitive linguistics, see Vyvyan Evans, Benjamin Bergen and Jörg Zinken, "The Cognitive Linguistics Enterprise: an Overview," in Vyvyan Evans, Benjamin Bergen and Jörg Zinken eds., *The Cognitive Linguistics Reader* (Sheffield: Equinox, 2007); and Dirk Geeraerts, "Introduction: A Rough Guide to Cognitive Linguistics," in Dirk Geeraerts ed., *Cognitive Linguistics: Basic Readings* (New York: Mouton, 2006), 1–28.

neuroscience, philosophy, sign language, and gesture studies.[3] It involves cross-linguistic work in order to document cultural variations as well as ways of knowing that might be shared by all humans.

The next two sections explain the main ideas held in common by cognitive linguists. This is followed by the amazing discoveries about how human minds make sense of our environment by using categories, frames, and models.

2.1 Two Key Shared Commitments

The term "cognitive linguistics" does not refer to a single well-articulated theory, but a loose family of models that affirm two key commitments alongside some common themes. The first of these is the *Generalization Commitment,* which is the attempt to locate general principles applicable to all areas of language.[4] A common approach in twentieth-century Western linguistics was to seek one set of principles for syntax (sentence structure), another set for semantics (meaning of words and sentences), and still different principles for pragmatics (discourse context). The claim was that each of these aspects of language operated by distinct structuring principles. This went together with a modular view of the mind, which is the idea that the mind contains separate areas for different cognitive functions and these do not overlap. Psychologist Raymond Gibbs criticizes the modular approach: "First, showing that a particular brain area is 'lit up' under certain conditions says nothing about what the rest of the brain is doing, and indeed contributing to human performance. Second, the brain does not work in isolation, but is part of an organic whole that includes the nervous system and kinesthetic sensations of the body in action."[5] Cognitive linguistics, in contrast to the modular approach,

3. Some of the core ideas and approaches of cognitive linguistics have been anticipated by others. For instance, speech-act theory has deeply influenced cognitive linguistics. It also has much in common with the phenomenological tradition of people such as Merleau-Ponty. See Dirk Geeraerts, "Cognitive Semantics and the History of Philosophical Epistemology," in *Conceptualizations and Mental Processing in Language*, ed. Richard Geiger and Brygida Rudzka-Ostyn (Berlin: Mouton de Gruyter, 1993), 53–79.
4. For examples of how a general principle explains different aspects of language such as categorization, polysemy, and metaphor, see Evans and Green, *Cognitive Linguistics*, 27–40.
5. Gibbs, *Embodiment and Cognitive Science* (New York: Cambridge University Press, 2005), 279.

seeks common principles at work in all areas of language, such as syntax, semantics, and pragmatics. An integrated (non-modular) understanding of mind is affirmed. The ability to learn and use one's mother tongue is not due to a distinct innate mental module that functions independently of our overall cognitive capacities. Rather, language processing is integrated with other cognitive abilities. This means that linguistics provides insights into the general aspects of human cognition and is not solely about the properties of language.[6]

The second key commitment is the *Cognitive Commitment,* and is closely related to the first. The general principles of linguistic structure should be in accord with what we know about the mind and brain from a range of disciplines. Linguistics is, thus, not a self-contained system—a view widely held in Western linguistics since Saussure. Instead, language is "a cognitive faculty interacting with other cognitive abilities such as perception, attention, memory, imagination, emotion, and reasoning."[7] The cognitive processes that govern language organization are not specific to language. One implication of this approach is that linguistic theories cannot contain explanations that violate what is known about human understanding from other fields.

2.2 Five Common Themes

In addition to the two commitments, there are five guiding principles held in common by cognitive linguists.

- Human cognition is dependent upon embodied human experience.
- All human understanding is perspectival.
- Meaning is encyclopedic.
- Linguistic meaning is grounded in usage and experience.

6. Vyvyan Evans and Melanie Green, *Cognitive Linguistics: An Introduction* (Edinburgh: Edinburgh University Press, 2006), 158–60.
7. R. Dirven and F.J.R. Ibánez, "Looking Back at Thirty Years of Cognitive Linguistics," *Applications of Cognitive Linguistics*, no. 14 (2010): 11–70, at 35.

- Linguistic meaning is flexible and dynamic.

The first theme is the embodied nature of human cognition. What humans are able to perceive is dependent upon our neuro-anatomical capacities. Our particular visual system, for instance, contains three types of photoreceptors or color channels, which enable us to see a particular range of colors. Other organisms have more or fewer channels and some have perceptual abilities that we lack, such as infrared. Our bodies allow us to perceive and interact with a remarkable range of objects and forces in the world, but we are limited. What was not commonplace, until the cognitive revolution in science, was the notion that human perception, memory, emotion, and reasoning are connected to the types of bodies we have. Gibbs' book, *Embodiment and Cognitive Science*, details massive data to support the dependence of human cognition on embodiment. He concludes that embodiment is much more than neurons firing in the brain; it includes tactile sensations, along with awareness of the position and motion of one's body.[8] According to cognitive linguists, human embodiment "motivates" and constrains what we are able to conceive (not just perceive). For example, Eve Sweetser shows that a wide array of languages employ vision to mean understanding (e.g., "I see what you mean") and hearing to mean obedience (e.g., "Hear, O Israel").[9] If we lacked the physical capacities for vision or hearing, then we would not think in such terms. Leonard Talmy's pioneering work demonstrated the ways in which physical forces push or pull us and bar our way, thereby playing a key role in motivating important concepts such as permission, hindering, and helping.[10] It is claimed, for instance, that our ability to use our muscles and limbs to move objects gives rise to a vast range of causal concepts such as "must" and "possible."

Numerous experimental studies demonstrate that language

8. Gibbs, *Embodiment and Cognitive Science*, 12. See also, Shaun Gallagher, *How the Body Shapes the Mind* (New York: Oxford University Press, 2005); and Mark Johnson, *The Meaning of the Body: Aesthetics of Human Understanding* (Chicago: University of Chicago Press, 2007).
9. Sweetser, *From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure* (New York: Cambridge University Press, 1990).
10. Leonard Talmy, "Force Dynamics in Language and Cognition," *Cognitive Science*, 12 (10988): 49–100.

comprehension regularly activates perceptual and motor regions of the brain.[11] For instance, when a linguistic utterance includes an action such as grasping a cup of water, functional magnetic resonance imaging studies show that parts of the brain associated with motor processes, not just linguistic processes, are activated. Also, upon perceiving a hammer, the parts of our brains used for grasping a hammer are typically activated. Furthermore, a set of experiments showed that statements involving "fictive motion," in which the object does not actually move, such as "the road runs through the valley" involved mental simulation of movement.[12] Other experiments show that performing a bodily action prior to reading about the action facilitated understanding of what was read. Subjects identified phrases such as "kick around an idea" and "grasp a concept" faster after they performed a kick or grasping motion than subjects who had not just performed these actions.[13] Researchers found that experiencing physical warmth promoted interpersonal warmth.[14] In the experiment, some subjects were given a warm drink, and others, a cold drink upon entering the room, but were not told this was part of the experiment. Subjects were introduced to a new person, and then, asked to rate the likeability of this person. Those who were given the warm drinks said the new acquaintance was warmer and more likeable than those who were given cold drinks. In a series of experiments, Boroditsky and Ramscar show that when a subject experiences bodily motion (either you are moving toward an object or the object is moving toward you),

11. The Language and Cognition lab at the University of California at San Diego has, for over a decade, done experiments on simulation and how our bodies affect what we think and say. The research is discussed in Benjamin Bergen, *Louder than Words: The New Science of How the Mind Makes Meaning* (New York: Basic Books, 2012). See also L. W. Barsalou, "Simulation, Situated Conceptualization, and Prediction," *Philosophical Transactions of the Royal Society* 364, no. 1521 (2009): 1281–89; Bergen B and Wheeler K, "Grammatical Aspect and Mental Simulation," *Brain and Language* 112, no. 3 (2010): 150–58; and Rolf A. Zwaan et al., "Moving Words: Dynamic Representations in Language Comprehension," *Cognitive Science* 28, no. 4 (2004): 611–19.
12. Teenie Matlock, "Fictive Motion as Cognitive Simulation," *Memory and Cognition*, 32.8 (2004): 1389–400.
13. See Raymond Gibbs and Teenie Matlock, "Metaphor, Imagination, and Simulation: Psycholinguistic Evidence," in Gibbs ed., *The Cambridge Handbook of Metaphor and Thought* (New York: Cambridge University Press, 2008), 167.
14. Williams LE and Bargh JA, "Experiencing Physical Warmth Promotes Interpersonal Warmth," *Science* 322, no. 5901 (2008): 606–7.

it significantly affected how the subject thought of time. Those who experienced themselves moving typically described the situation as themselves moving toward the temporal event (e.g., "I am almost to the end of the work week"), while those who experienced objects moving toward them used descriptions of the temporal event moving (e.g., "The end of the work week is almost here").[15]

Such studies show that physical action can facilitate comprehension while other studies show that language can also facilitate perception. Humans recognize horizontal pictures of a nail faster after reading the prompt "the nail was driven into the wall" and recognize vertical pictures of a nail faster after reading the prompt "the nail was driven into the floor." People were given a heavy or light object to hold, and then, told a new idea. Subjects holding the heavy object evaluated the idea as important (SIGNIFICANCE IS WEIGHT) more than the group holding the light object.[16] Also, numerous studies have established a relationship between localized brain lesions and selective impairments of conceptual knowledge.[17]

Cognitive linguists hold that such evidence supports the claim that the same processes that allow us to perceive, move around, and interact with our environment also help create our conceptual structures.

> The fact that our experience is embodied—that is, structured in part by the nature of the bodies we have and by our neurological organization—has consequences for cognition. In other words, the concepts we have access to and the nature of the "reality" we think and talk about are a function of our embodiment. We can only talk about what we can perceive and conceive, and the things that we can perceive and conceive derive from embodied experience.[18]

This comment raises the issue of the extent to which human cognition

15. Lera Boroditsky and Michael Ramscar, "The Roles of Body and Mind in Abstract Thought," *Psychological Science* 13.2 (March 2002): 185–89.
16. Nils B Jostmann, Daniël Lakens, and Thomas Schubert, "Weight as an Embodiment of Importance," *Psychological Science* 20, no. 9 (2009): 1169–74.
17. Antonio R. Damasio discusses a number of cases in his *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Avon, 1994). For an overview of the vast literature, see the special issue of *Cognitive Neuropsychology*, vol. 20, no. 3–6 (2003).
18. Evans, Bergen and Zinken, "The Cognitive Linguistics Enterprise," 7.

is dependent upon our bodies. Feldman and Narayanan claim that "all linguistic constructions attain meaning through embodiment."[19] Andrew Goatly worries that the claim that all thought is dependent upon the body reduces all thinking to biology and ignores the role of culture. In other words, it is entirely nature, with no place for nurture.[20] In response to this concern, a couple of comments are needed. First, Gibbs rightly says, "Embodiment may not provide the single foundation for all thought and language, but it is an essential part of the perceptual and cognitive processes by which we make sense of our experiences in the world."[21] Second, contemporary cognitive linguists emphasize the role of physical embodiment as well as our culturally situated knowing because human experience involves both the body and culture.[22] Human knowing is situated embodied knowing.

The second common theme in cognitive linguistics is closely connected to embodied cognition: all human understanding is perspectival. "Due to the nature of our bodies, including our neuro-anatomical architecture, we have a species-specific view of the world."[23] This does not mean what some people mean by "worldview" (a philosophy of life). Rather, it means that all human understanding, on any topic, is anthropogenic, based upon the cognitive processes available to humans. If we had bodies like jellyfish, yet retained our enhanced cognitive capacities, then our cognition would be very different than as is the case with our present bodies. We would not, for example, have the concept *in front of* since jellyfish have no faces nor would we use *seeing* or *hearing* to mean understanding something. Using a different example, James Geary explains: "Crabs walk

19. Feldman and Narayanan, "Embodied Meaning in a Neural Theory of Language," 390. Lakoff seems to affirm this as well. See George Lakoff, "The Contemporary Theory of Metaphor," in Andrew Ortony, ed., *Metaphor and Thought*, second edition (New York: Cambridge University Press, 1993).
20. Andrew Goatly, *Washing the Brain: Metaphor and Hidden Ideology* (Philadelphia: John Benjamins: 2007), 255, 392–95. It should be noted that Lakoff and Johnson explicitly say that their view involves both nature and nurture. See "Why Cognitive Linguistics Requires Embodied Realism," *Cognitive Linguistics* 13.3 (2002): 247.
21. Gibbs, *Embodiment and Cognitive Science*, 3 (see also 13). Boroditsky and Ramscar agree with Gibbs. See their "The Roles of Body and Mind in Abstract Thought."
22. See Tim Rohrer, "Embodiment and Experientialism," in *The Oxford Handbook of Cognitive Linguistics*, ed. Dirk Geeraerts and Hubert Cuyckens (New York: Oxford University Press, 2007), 25–47.
23. Evans, Bergen and Zinken, "The Cognitive Linguistics Enterprise," 7.

sideways. . . . If crabs could talk, they would undoubtedly describe progress in difficult negotiations as *sidling* towards agreement and express hope for a better future by saying their best days are still *beside* them."[24] In a famous essay, Thomas Nagel asked what it is like to be a bat. He wondered what it is like to fly around using echolocation. "I want to know what it is like for a bat to be a bat. . . . Yet if I try to imagine this, I am restricted to the resources of my own mind. . . ."[25] Whether we think about bats, DNA, love, or salvation, human thinking is a species-specific or anthropogenic understanding of our world.

Given that what we are able to perceive is constrained by the types of bodies we have and that cognition is generally grounded in embodied interaction with the world, it should come as no surprise that our concepts are not, as Plato claimed, direct representations of properties that exist in objects, independently of our embodied minds. Human understanding of our world is from a human perspective, which is an embodied perspective, rather than from a mind that exists independent of the body. For instance, we talk about a book being "in front of," "behind," or "to the side of" a person because we have the sorts of bodies that enable us to cognize this way.

Our knowledge of things in the world is not a perspective-free or neutral position. Rather, it is grounded in our species-specific interaction with entities. There is a real world that exists independently of us, but our understanding of it is shaped by our embodied minds. Some mistakenly interpret this situation to mean nothing can be said about objective truth or that the existence of God is now out of the question. Cognitive linguist Laura Janda, however, points out that these conclusions do not follow. What does follow is that our understanding of God and truth will be dependent upon our

24. James Geary, *I Is an Other: the Secret Life of Metaphor and How it Shapes the Way we See the World* (New York: Harper Perennial, 2011), 100.
25. Thomas Nagel, "What Is It Like to be a Bat?" *The Philosophical Review* 83 (1974): 324. That some blind humans have developed remarkable abilities with echolocation does not take away from Nagel's point.

limited embodied cognitive processes.[26] These issues are discussed more fully in the chapters on God and truth.

A third common theme is that meaning is encyclopedic in nature and is integrated with other cognitive processes.[27] Though words and statements typically have conventional meanings, "linguistic expressions almost always invariably *underspecify* the conceptualizations they code."[28] Words serve as points of access or prompts to incredible stores of knowledge. Words do not come with fully stipulated prepackaged meanings. Fauconnier and Turner discuss conventional uses of the word *safe* to illustrate how word meaning requires access to encyclopedic knowledge.[29] In the context of a child playing at a beach with a shovel, they ask us to consider the meaning of three statements: "The child is safe," The beach is safe," and "The shovel is safe." Each statement has the same grammatical form and syntax; so, given traditional Western approaches to language, we might expect that each statement has the same meaning: that the child will not come to harm, the beach will not come to harm, and the shovel will not come to harm. But this is not the case. Instead, we take all of them to mean that the child will not be harmed by the beach or the shovel because the word "safe" prompts scenarios appropriate for the context of a child playing at a beach.

Meaning construction is not autonomous (independent) because it is integrated with other forms of knowledge. Meaning involves the functioning of our entire person as we engage with the world. Cognitive linguists claim that there is no fixed single characteristic that *safe* conveys to child, beach, and shovel. Meaning does not require simply looking up the word *safe* in our mental dictionary and applying the meaning to the noun in each statement. Rather, meaning is always situated in a context, which requires us to access the appropriate

26. Laura Janda, "Cognitive Linguistics" (2006), available at Social Science Research Network: http://ssrn.com/abstract=1408069, 9–10.
27. Evans and Green, *Cognitive Linguistics*, 160–62, 206–22.
28. Ronald Langacker, *Foundations of Cognitive Grammar*, vol. 1, *Theoretical Prerequisites* (Stanford: StanfordUniversity Press, 1987), 66.
29. Gilles Fauconnier and Mark Turner, *The Way we Think: Conceptual Blending and the Mind's Hidden Complexities* (New York: Basic Books, 2002), 25–26.

scenario among vast repositories of possible meanings. We typically interpret the meaning of isolated statements not by means of necessary and sufficient conditions, but by default scenarios and prototypes, which are built up in our knowledge base over time. According to Fauconnier: "Language does not 'represent' meaning; it prompts for the construction of meaning in particular contexts with particular cultural models and cognitive resources. Very sparse grammar guides us along the same rich mental paths, by prompting us to perform complex cognitive operations."[30] Cognitive linguists hold that meaning construction is often gestalt-like or holistic and is ultimately pragmatic. Meaning is not found in an atomistic way by reducing language to its smallest elements. Rather, meaning functions like the scientific concept of emergence. Meaning emerges from the various parts of language and is more than simply the sum of the parts.

The fourth theme is that linguistic meaning is grounded on usage and experience.[31] For cognitive linguists, it is actual language use that needs to be studied. Formalist approaches to linguistics considered actual language use relatively unimportant—in part, because they believed that objects in the world contain inherent properties which can be known independently of our embodied interaction with them.[32]

The fifth theme is that linguistic meaning is flexible and dynamic. As environmental and social situations change, language adapts and meanings can change. Our understanding of, for example, *phone* continues to change over time. Thus, "we cannot just think of language as a more or less rigid and stable structure—a tendency that is quite outspoken in twentieth century linguistics."[33] Rather, meaning can change as communities of discourse adapt to changing situations in their environments and cultures.

One takeaway from these themes is that language is the tip of an

30. Gilles Fauconnier, "Cognitive Linguistics" in Lynn Nadel ed., *Encyclopedia of Cognitive Science* (New York: Nature Pub. 2003), 2.
31. Evans and Green, *Cognitive Linguistics*, 108–47.
32. Even grammars are usage-based. Michael Tomasello has shown that children learn the nuances of grammar via usage rather than with an innate structure in place. See Tomasello *Constructing a Language: A Usage-Based Theory of Language Acquisition*. (Cambridge, Mass.: Harvard University Press, 2003).
33. Geeraerts, "Introduction: A Rough Guide to Cognitive Linguistics," 4.

enormous cognitive iceberg. Though we process language and meaning readily, most of the mental operations remain hidden from us. Language use employs vast networks of connections, models, and perspectives. Cognitive linguists work to discover what is going on behind the scenes and have identified a number of linguistic operations, some of which have been developed into major theories with their own bodies of empirical research. Though there are a fair number of such theories, the rest of this chapter and all of the next survey only the ones used in this book to examine biblical and theological topics.

2.3 Categories

Humans need order to live meaningfully, and placing objects and experiences into categories is one important way of achieving this goal.[34] We make extensive use of categories in our everyday lives. When we think about items to bring on a picnic or how to determine church membership, we form categories. But what exactly is a category and how do we form them?

2.3.1 The Traditional Western View

Since the time of Socrates, Western thought has generally thought of categories as containers with clearly shaped boundaries, so we know what is inside and what is outside. Some refer to this as the "classical theory" of categories, which uses necessary and sufficient conditions to define the criteria for membership in a category.[35] There are properties which an object or event must possess in order to be included in the category, and if the object or event has all of the necessary characteristics, then it must be included in that category. Each member of the set must possess all of the necessary properties

34. For further discussion and additional details of the ideas mentioned in this section, see George Lakoff, *Women, Fire, and Dangerous Things* (Chicago: University of Chicago Press, 1987), 12–57. For an overview of categorization, see Evans and Green, *Cognitive Linguistics*, 248–69.
35. Philosopher Jesse Prinz calls the classical theory "definitionism." He provides a number of criticisms of the classical theory and rejects it, in part, because of the research of Rosch. Prinz, *Furnishing the Mind: Concepts and Their Perceptual Basis* (Cambridge, MA: MIT press, 2002), 32–48.

in order to be included. For example, we could define the category bachelor via two conditions: (1) a male, and (2) unmarried. Each bachelor will possess these two criteria.

One implication of this approach is that membership in a category is all-or-nothing; something is either in or out. Someone either is a bachelor or not. The set of necessary features also enable us to pick out all the members of the set and exclude all non-members. Nothing will mistakenly be included in the category since the object either possesses or lacks the necessary properties. This also means that degrees of membership are not allowed because all members of a category have equal status, so there cannot be typical or non-typical members. Since each member of the set possesses all the necessary attributes, no member of a category can be considered a better example of the set than any other member. Hence, since Harvard University and a technical college both possess the necessary conditions of a college, Harvard cannot be considered a better representative of *college* than a technical school.

2.3.2 Problems with the Traditional View

Some philosophers have questioned whether the traditional Western approach to definitions actually works. Gallie's well-known essay "Essentially Contested Concepts" showed that in spite of enormous amounts of analysis, extremely important terms such as *democracy* and *Christian* failed to find necessary features to which all the stakeholders could agree.[36] Ludwig Wittgenstein problematized the traditional approach to categories with his now famous account of the concept *game*. He observed that there do not seem to be a set of necessary features shared by all games. Games, for instance, can have more than two opponents or no opponents. Not all games involve competition and winning. Some operate on pure luck, while others rely on skill. Some games are played on boards or with objects, while other games involve none. In short, there are no common characteristics shared

36. W. B. Gallie, "Essentially Contested Concepts," *Proceedings of the Aristotelian Society* 56 (1956): 167–98.

by all games. Despite the lack of necessary and sufficient conditions (a classical definition), we have no problem whatsoever understanding the concept, *game*. The reason why, he suggested, is because games share what he called "family resemblances." In a human family, individuals may share eye color, a body type, or temperament with someone else in the family. But there might not be any single set of characteristics shared by all members of the family. Games share family resemblances in that any two games will share some common characteristic, but different pairs of games will have different common features. Chess and soccer both involve strategy and competition. Soccer and the game of draw (using a deck of cards) both involve competition, but there is no strategy in the latter. Draw and poker both use playing cards, but only poker employs strategy. Games resemble one another in a multitude of ways, but there is not a single necessary set of features that makes them a category.

Psychologist Eleanor Rosch picked up on the notion of family resemblances in her critique of the traditional Western understanding of categories. Her trailblazing work on categorization and its implications for cognition led to categorization becoming a major field of study in cognitive psychology. Rosch developed the notion of prototype in her early work on color, which drew upon the research of Brent Berlin and Paul Kay.[37] Berlin and Kay challenged the claim that different languages arbitrarily categorized colors. Though it is true that some languages, such as English, have eleven major color terms (black, white, red, yellow, green, blue, brown, purple, pink, orange, and gray) and that other languages have as few as two major color terms (black and white), they found that humans in different language groups all identified the same "basic" colors when they were asked to identify focal or best examples. When subjects were asked to identify the major colors of the spectrum, a variety of views are given, but when asked to identify the best example of a basic color term, there is agreement across cultures.

37. Brent Berlin and Paul Kay, *Basic Color Terms: Their Universality and Evolution* (Berkeley: University of California Press, 1969).

In a later study, Kay refined some of the original research but still concluded: "There are semantic universals in the domain of color; i. e. there are constraints on the types of possible basic color lexicons."[38] This means that perception determines the language of color rather than that language determines our perception of color.[39] Linguistic relativists (some versions of the Sapir-Whorf hypothesis) had claimed that the particular language a community uses determines what they perceive and the way they think. Thus, different languages result in different conceptual structures. Though language shapes perception and thought in important ways, it does not determine them. Kay and Maffi review the data from numerous color studies involving ninety-eight languages and conclude that the original thesis that there are semantic universals of color still holds since there exists a small set of primary colors (black, white, red, yellow, green, and blue) that form the basis of most major color terms in these languages.[40] These findings should not surprise us, given the common visual-neural capacity humans share.

2.3.3 Prototypes and Exemplars

Returning to Rosch, her research challenged several aspects of the classical understanding of categorization. She and her colleagues developed an array of experiments to investigate the categories of physical objects and concluded that humans normally categorize by

38. Paul Kay and Chad McDaniel, "The Linguistic Significance of the Meanings of Basic Color Terms" *Language* 54.3 (1978): 610. They also argue that some color categories are graded on a continuum, which "conflicts with the discrete feature concept of semantic primes shared by structuralists and genertivists."
39. In subsequent studies, Kay allows that language can shape perception of color when limited to the right visual field (left hemisphere of the brain). See Aubrey L. Gilbert, Terry Regier, Paul Kay, and Richard B. Ivry, "Whorf hypothesis is supported in the right visual field but not the left," *National Academy of Sciences* 103.2 (2006): 489–94 and Franklin, G. V. Drivonikou, L. Bevis, I. R. L. Davies, P. Kay, and T. Regier "Categorical perception of color is lateralized to the right hemisphere in infants, but to the left hemisphere in adults," *Proceedings of the National Academy of Sciences* 105.9 (2008): 3221–25. For a history of the debate and survey of recent studies, see Terry Regier, Paul Kay, Aubrey Gilbert, and Richard Ivry, "Language and Thought: Which Side are You on, Anyway?" in B. Malt and P. Wolff eds., *Words and the Mind: How Words Capture Human Experience.* (New York: Oxford University Press, 2010), 165–82.
40. Paul Kay and Luisa Maffi, "Color Appearance and the Emergence and Evolution of Basic Color Lexicons" *American Anthropologist* 101.4 (2000): 743–60.

means of a "prototype," a mental concept of exemplars that best represent instances of a category rather than by means of the necessary conditions of the classical theory.[41] Think of a fish for a moment—any fish. Most people will think of something with scales and fins with a typical shape such as a trout, rather than an eel or flounder, even though, biologically, scales and fins are not necessary in order to be classified as a fish.[42] Her experiments found, for instance, that Americans judged robins more representative of the bird category than chickens, eagles, or penguins, and that desk chairs are better examples of the category *chair* than rocking chairs or beanbag chairs. She called the most representative members of categories "prototypical" members, which display "typicality effects." Typical members of a category are the examples people normally think of when contemplating the category. The problem Rosch and her fellow researchers encountered was that, according to the classical theory, there are no typical and non-typical category members. Eels should be just as good examples of fish as trout, but this ran counter to their empirical findings.

Rosch and Mervis discuss the extensive number of experiments done by a wide variety of researches to investigate the idea of prototype on categories.[43] A few important results of these studies are:

- People have much faster speed of processing (reaction time) when responding to exemplars (prototypes) of a category than to a non-

41. Eleanor Rosch and Carolyn B. Mervis, "Family Resemblances: Studies in the Internal Structure of Categories," *Cognitive Psychology* 7 (1975): 573–605; Eleanor Rosch, "Cognitive Reference Points," *Cognitive Psychology* 7 (1975): 532–47; Eleanor Rosch "Cognitive Representations of Semantic Categories," *Journal of Experimental Psychology: General* 104 (1975): 192–233; Eleanor Rosch, "Principles of Categorization," in *Cognition and Categorization,* edited by Eleanor Rosch and Barbara B. Lloyd (New York: John Wiley, 1978), 27–48; and Eleanor Rosch, Carolyn B. Mervis, Wayne D. Gray, David M. Johnson, and Penny Boyes-Braem, "Basic Objects in Natural Categories," *Cognitive Psychology* 8 (1978): 382–439.
42. For a very readable summary of research on typicality effects in relation to the classical theory of categories, see Gregory Murphy, "Typicality and the Classical View of Categories," *The Big Book of Concepts* (Cambridge, MA: MIT press, 2004), 11–40.
43. Carolyn B. Mervis and Eleanor Rosch, "Categorization of Natural Objects," *Annual Review of Psychology* 32 (1981): 89–115. Of special interest is the work of Lawrence Barsalou, who devised more complex studies than Rosch, confirmed her key findings, and extended the discussion. See Barsalou, "Ideals, Central Tendency, and Frequency of Instantiation as Determinants of Graded Structure in Categories," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 11 (1985): 629–54.

prototypical member of a category (for example, robins over ostriches, for birds).

- When asked for an example of a category member, subjects typically gave the same exemplars.
- Category membership is established first for the best exemplars and last for the least representative examples (for example, robins over penguins).
- Of importance to education is that people learn a category more easily and accurately if they are initially exposed to only the most representative exemplars of the category.

2.3.4 Graded and Radial Categories

Rosch and Mervis conclude that "Empirical findings have established that: (a) categories are internally structured by gradients of representativeness [and] (b) category boundaries are not necessarily definite."[44] The first idea is that prototypes carry a special salience, which is not definable as the key property shared by all members of the category. The exemplars stand out and form what can be called the center of the category. "Graded" membership means that as one moves away from the center, one finds less and less representative members of the category. The term "radial" is commonly used by cognitive linguists to denote the idea that category membership radiates outward from the center or prototypical members. Members of a radial category are variations, in some respect, of the central members. Radial categories are ubiquitous and constitute, perhaps, the most common form of categories. For example, if robins are at the center of *bird* for Americans, then eagles will be less representative, and penguins even less than eagles. Oranges and apples are best examples of fruit, while tomatoes are less typical, and olives less than tomatoes.

Mervis and Rosch's second conclusion is that for many categories, there will not be a precise boundary. Whether to include a rug or

44. Mervis and Rosch, "Categorization of Natural Objects," 109.

a picture, for instance, as furniture is not clear-cut. Though some categories have firm boundaries, many of the categories we use with ease have fuzzy edges to them. The results of the empirical research contradict two key requirements of the Western classical theory of categories: (1) that no member of a set should possess greater salience than another member, and (2) that categories must have definite boundaries so that something is clearly either in or out.[45]

A few examples will illustrate these points. According to the classical view of categories, being unmarried and male are the necessary and sufficient conditions to be included in the category *bachelor* and all unmarried males are equal representatives of the category. This would mean that the Pope is a bachelor. However, most people do not consider this to be the case because the meaning of *bachelor* is dependent upon a cultural frame that a community regards as a typical. People have a prototype in mind that serves as the model exemplar for the category. Hence, Americans think of a male in his twenties who has never been married as the prototype, and that the further removed one is from this ideal, the less representative a bachelor one is. Or, take the English word *mother*.[46] The prototypical mother in North American culture is a woman who conceives, gives birth to, and nurtures a child. However, there are many kinds of mothers: adoptive mothers, birth mothers, genetic mothers (egg donors), foster mothers, surrogate mothers, stepmothers, and so on. None of the features of the prototype is a necessary feature of each of the other kinds of mothers. There is no single characteristic that each use of mother shares, yet we have no problem understanding what is meant by the terms. In other words, most categories have a radial structure with the exemplar at the center and do not have definite boundaries.

Prototypes arise from how groups of human beings interact with members of the category.[47] That is, most categories are not defined

45. The classical theory is now dead in psychology. See Murphy, *The Big Book of Concepts*, 11–28, 38–40.
46. Lakoff discusses the example of *mother* in *Women, Fire, and Dangerous Things* (1987): 74–76, 79–84.
47. However, this does not mean that all aspects of category membership can be attributed to human embodiment. For example, Dyirbal speakers, an aboriginal language of Australia, classify human

by features inherent in the members, but are governed by the human capacities to perceive objects and the ways in which we interact with them in our environment. In short, category formation is not mind-independent, as the classical theory suggests. Categories are tools for human cognitive tasks created operationally as we act in the world. Even if one thinks of certain categories, such as *male and female,* to be part of the "created order" brought about by God, these remain categories that humans are able to understand, and so, are not mind-independent universal truths (see 4.2).

Though humans share some general ways of interacting with their surroundings, culturally specific ways of categorizing also arise. Take, for example, the cassowary, an animal that inhabits Papua New Guinea. When English speakers observe it, we call it a bird because it has feathers, wings, and lays eggs. The Selepet speaking people, however, say "I see a creature that walks on the ground" (*sonngo eksan*).[48] Because the cassowary does not fly, Selepet speakers do not classify it with animals that fly. Their classification system arises out of the way they hunt animals, and since the cassowary does not fly, it is categorized along with wallabies and other animals which walk on the ground and are hunted in a similar way. Animals that fly, including bats, are put in a different category due to the way they are hunted.[49]

Moreover, even when different cultures have the same categories, the contents of the categories are not always the same. The category *chair*, for example, seems unproblematic. However, English speakers include armchairs in the category, but "for Czechs and Russians, an armchair is not in the chair category, it's a different object altogether."[50]

women and birds together because they believe birds are the spirits of dead human females. This is based on ancient stories important to the social group. See Lakoff, *Women, Fire, and Dangerous Things* (1987): 93–94.

48. This information is from private correspondence with Kenneth McElhanon who worked among the Selepet people.

49. One might suggest that the "correct" way to classify animals is the scientific schema. However, there are no scientific schemas for most of the categories that we use in everyday life. Also, the scientific classification of animals is not so straightforward. See Lakoff, *Women, Fire, and Dangerous Things*, 118–21.

50. Janda, "Cognitive Linguistics," 14.

2.3.5 The Basic-Level

An additional important finding from the psychological research on prototypes is the idea of "basic-level" categories.[51] Years ago, researchers thought that three-year-old children had not mastered categorization because the children failed to use the system of classification employed by Western adults. For example, when asked to sort pictures of a dog, a cow, and airplane into categories, the researchers noted that the children failed to place dogs and cows into the abstract category *animal*. After four years of age, most children were able to do this. The problem, however, was not with the three-year-olds, but with the researchers who presumed that *animal* was the correct category to use. What Mervis and Rosch found, and subsequent research confirmed, is that the three-year-olds had mastered the classification system that humans use most of the time as we interact with our environment. They showed that humans use a three-level categorization system and that the middle level was the most important psychologically.[52]

SUPERORDINATE	MAMMAL	FURNITURE	TOOL
BASIC LEVEL	DOG	CHAIR	HAMMER
SUBORDINATE	COLLIE	RECLINER	CLAW HAMMER

The basic-level is the intermediate level and is the primary one we use to interact with objects in the world. When the three-year-olds were shown pictures of two different kinds of cows and a picture of an airplane, the children classified them easily. Even two-year-olds did this. The basic level is what we learn easily and earliest and is how even adults typically process information in the world. One reason for this is that basic-level objects are "human-sized" in that we classify them according to overall shape and our motor interaction with them.

51. For cross-cultural research on basic-level folk biological systems, see Douglas L. Medin and Scott Atran, "The Native Mind: Biological Categorization and Reasoning in Development and Across Cultures," *Psychological Review* 111, no. 4 (October 2004): 960–83.
52. The following discussion is based upon Lakoff, *Women, Fire, and Dangerous Things*, 46–57, 270–71.

Dogs have a general shape as do chairs and hammers. However, there are no general shapes for mammals, furniture, or tools. When subjects were asked for a picture of *mammal,* they typically gave a basic-level example, such as a cow. We do not seem able to form mental images of superordinate concepts. Just try to think of furniture apart from chairs or tables or think of tools apart from hammers and saws. Attempting to picture an amalgam of dogs, elephants, bats, and whales simply does not work. Also, we have general motor actions for interacting with basic-level entities such as dogs (we pet them), sitting in chairs, or using hammers. Using an office chair, rocker, or bar stool draws upon similar motor skills. However, we have no general motor actions for using furniture or tools (superordinate concepts). Here are some of the conclusions about the basic-level from the experiments:

- In human languages, the words for basic-level objects tend to be short.
- They are among the first words learned by children.
- The first category level understood by children.
- Subjects (even adults) identify basic-level members faster than other levels.
- The highest level at which humans can form a mental image (average shape) of members in the category.
- The highest level at which humans use similar motor actions for interacting with exemplars of the category.
- The level at which most of our knowledge is organized.

Basic-level categories include not only objects such as water and trees, but, according to Lakoff, actions and properties as well. He suggests that actions such as walking, eating, and talking and properties such as tall, short, cold, hot, soft, and hard are aspects of our basic-level experience.[53] Also, as was discussed above, the focal colors black, white,

53. Lakoff, *Women, Fire, and Dangerous Things*: 271. He also includes experiences such as hunger and pain (302).