Wikis, beans and cats: The Cascade Theory of Metaphor

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Contemporary metaphor theory, from the beginning in 1979, recognized that metaphors are frame-to-frame mappings at a general level (Lakoff and Johnson 1999). For example, the LOVE IS A JOURNEY metaphor maps two travellers in a vehicle encountering difficulties in reaching common destinations to two lovers in a relationship encountering difficulties in achieving common life goals. This general mapping applies to many specific cases: *on the rocks, spinning our wheels, going in different directions, hit a dead end*. Each specific case is a cultural image with frame-based knowledge about travel. The same general metaphor maps the frame-based knowledge in each of these very different specific cases of travel difficulties into very diverse metaphorical understandings about love relationships.

Soon afterward, in the 1980s, it was realized that the general love-as-journey metaphor was actually a composite of more basic, directly embodied metaphors: ACTION IS MOTION, PURPOSES ARE DESTINATIONS, DIFFICULTIES ARE IMPEDIMENTS TO MOTION, RELATIONSHIPS ARE CONTAINERS, INTIMACY IS CLOSENESS together with a cultural norm that couples in a long-term love relationship need to have compatible life goals. In the neural theory of metaphor of the 1990s, it became clear that these embodied metaphors are brain circuits linking distinct brain regions for embodied experiences of different kinds (Lakoff 2009). This meant that the links between specific case metaphors, e.g., *the relationship is on the rocks,* and the directly embodied metaphors via the composite metaphor is a rather complex combination of simple elements — much like a complex sentence made up of simple parts.

'Cascades' in neuroscience are brain pathways — typically with long and complex circuitry — controlling complex activations across diverse brain regions, yet made up of simple parts that combine to form complex networks when neural bindings are activated. The cascade hypothesis dates from Damasio's idea of convergence-divergence zones (Damasio 1989, 2009, Lakoff 1993), Dehaene's *Reading in the Brain* (2009), and cascade-based motor-control decision-making (Koechlin, Ody and Kouneiher 2003), and others.

Cascade theory, as we are developing it, is an attempt to characterize the cascades in the brain used for thought and language. In neural computation, cascades are an extended version of Narayanan's executing networks ('X-nets') (Narayanan 1997), which are models of neural networks that control activation across various regions of the brain. Cascades are modeled computationally with the mathematics of active graph theory, using acyclic, labeled graphs that control levels of activity at nodes along the graph.

Cascades allow us to model formally how a relatively small number of simple embodied metaphors together with frames can combine in a cascade to characterize a vast range of composite, specific metaphors.The examples to be discussed in this talk will show how specific cases like *wiki leaks*, *spill the beans*, and *let the cat out of the bag* are understood via a cascade containing primary metaphors such as KNOWING IS SEEING, IDEAS ARE ENTITIES, COMMUNICATION IS ENTITY TRANSFER, MULTIPLEX IS MASS, PURPOSES ARE DESTINATION, AND DIFFICULTIES ARE OBSTRUCTIONS TO MOTION, together with frame-based knowledge of common situations. When the expression *wiki leaks* was first used, it was immediately understood by hundreds of millions of people. The current paper will show how prior cascades together with models of neural best-fit mechanisms explain how the newly coined *wiki leaks* metaphor could have been instantly understood by millions.

Though grammar is beyond the current presentation, a Cascade Theory of Construction Grammar is being developed to mesh with semantic cascades. It will be an amended version of existing Embodied Construction Grammar.