The MetaNet metaphor repository: Formalized representation and analysis of conceptual metaphor networks

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In this paper, we discuss the challenges of developing the MetaNet metaphor repository, a valuable computational resource for the conceptual and linguistic analysis of metaphor. We describe our methods for building on existing resources such as FrameNet and existing prose descriptions of metaphors. The process resulted in a repository that serves as a structured database of metaphors and their linguistic expression, and includes formalized representations of structured networks of metaphors linked to cognitively grounded, complex conceptual structures.

Since its first introduction in Lakoff and Johnson (1980), conceptual metaphor theory has developed into a comprehensive theory of thought and language that brings together advances in neural theory, computational modeling, and cognitive linguistics (Lakoff 2012). MetaNet provides formalization of key parts of this theory. The necessary first step is to formally represent source and target domains, roles, and mappings. Furthermore, metaphorical understanding arises through a 'cascade' of activation throughout a selected network of conceptual structures. Therefore an additional step is to formalize relations between metaphors.

Frames and schemas are the raw input to metaphor source and target domains. While FrameNet (2006) provides a resource of approximately 1000 interconnected frames, for metaphor analysis purposes these need to be supplemented. One issue concerns defining frames at appropriate levels of generalization. For instance, (1) makes use of the specific metaphor TRUST-RELATIONSHIPS ARE BUILDINGS, as the government's relationship with its constituents is conceptualized as a complex structure whose foundation is being eroded by the destructive force of corruption:

(1) Corruption erodes public trust in government.

While FrameNet has frames for Trust and Personal_relationship, it does not have a frame that integrates these structures into a more specific Trust_relationship frame. These frames must be related in order to capture the roles of government as a trusted_entity and governed_entities as trusting_entities. Additionally, a Corruption frame needs representation, as well as an Erosion frame to which corruption can bind as the eroding_substance. The resulting network is intricate and able to account for all the bindings needed across frames for metaphoric mappings to occur. To capture the metaphor cascade, the specific metaphor used in (1) is related via bindings of the schema roles to the more general metaphor:

(2)
RELATIONSHIPS	ARE	PHYSICAL STRUCTURES
|		|
TRUST-RELATIONSHIPS	ARE	BUILDINGS

These relations allow us to track and predict the inheritance of roles, role-bindings, and inferences from general to specific levels. The local cascade represented in (2) is one element within a complex cascade that binds semantic roles in the Government, Erosion, and Corruption frames as they appear in their respective metaphors within the cascade.

Finally, this formalization has enabled us to develop visualization tools that serve several important functions. They illustrate both local and larger conceptual networks implicated by proposed structures and relations. This facilitates an integrative analysis that situates local metaphor cascades within the larger context of the repository, which provides feedback that supports an iterative approach to analysis refinement. The repository's organizational structure and automated visualization tools aid in the identification of larger patterns in the network, which in turn allows us to test and refine our initial theoretical assumptions and methods of formalization of metaphors and frames.

References

Lakoff, George and Mark Johnson (1980). *Metaphors We Live By*. Chicago: University of Chicago Press.
Lakoff, George (2012). Explaining embodied cognition results. *Topics in Cognitive Science* 4.4: 773-785.
Ruppenhofer, Josef, Michael Ellsworth, Miriam R. L. Petruck, Christopher R. Johnson, and Jan Scheffczyk (2006). *FrameNet II: Extended Theory and Practice*. Berkeley, CA: FrameNet.