NARRATIVE FRAMING OF NATURAL SCENES-NARRATIVE MINDS IN SCIENCE

A Contribution to the Symposium

Neural, narrative, embodied, and emergent perspectives and potential synergies in understanding students' conceptions and conceptual change (D. E. Brown)

10th International Conference on Conceptual Change Florina, Greece, June 2016

Hans U. Fuchs¹, Federico Corni², Elisabeth Dumont¹

¹ Institute of Applied Mathematics and Physics – Zurich University of Applied Sciences at Winterthur, Winterthur, Switzerland
² Department of Education and Humanities, University of Modena and Reggio Emilia, Italy

TABLE OF CONTENTS

- **1. Overview and Introductory Remarks**
- 2. Framing: From Truth Conditional Semantics to Cognitive Semantics
- 3. A Model of Embodied Cognition
- 4. Application (1) Temperature Concepts
- 5. Narrative Framing Large Scale Schematic Structures
- 6. Application (2)—Heat Concepts
- 7. Summary and Suggestions References



1. OVERVIEW AND INTRODUCTORY REMARKS

Basic notions: Framing and Narrative Framing

- **Framing** (frame semantics) is an approach to modeling the human mind in *contrast to truth conditional semantics*. It states that *meaning is conceptualization*. It is in accord with the theory of *embodied cognition*.
- The notion of *narrative framing* rests upon an assumption of *perception at different scales*: perception leads to the construction of *small to largescale perceptual gestalts* that are recruited for understanding. *Large-scale schemas support narrative thought and understanding*.

Remarks and Caveats

- We discuss the *theoretical foundations* of *framing* and *narrative framing* of *natural scenes*. [Examples and the use of narratives in science will only be mentioned in passing, not described in any detail.]
- We discuss *semantics* of *natural language*.
- Our applications are restricted to *conceptual structures* in *macroscopic physical science* (mostly thermodynamics).

PERCEPTUAL SCALE...

... refers to **spatial**, temporal, and systemic "size" of perceptual units (gestalts)

2. FRAMING: FROM TRUTH CONDITIONAL SEMANTICS TO COGNITIVE SEMANTICS



4

2. FRAMING: FROM TRUTH CONDITIONAL SEMANTICS TO COGNITIVE SEMANTICS

FRAMING... (C. Fillmore, 1975, p. 124)

"I would like to say that people associate certain scenes with certain linguistic frames.

"I use the word <u>scene</u> in a maximally general sense, including not only visual scenes but also [...] enactive experiences, body image, and, in general, any kind of coherent segment of human beliefs, actions, experiences or imaginings.

"I use the word <u>frame</u> for any system of linguistic choices—the easiest cases being collections of words, but also including choices of grammatical rules or linguistic categories—that can get associated with prototypical instances of scenes."



2. FRAMING: FROM TRUTH CONDITIONAL SEMANTICS TO COGNITIVE SEMANTICS



3. A MODEL OF EMBODIED COGNITION



7

3. A MODEL OF EMBODIED COGNITION

Cognitive Construction Perspective (Fauconnier, 1997, p. 35-36)

- → "Linguistic forms are (partial and underdetermined) instructions for constructing interconnected domains with internal structure."
- This construction takes place at a "cognitive" level; this level is distinct from the language structure."
- T "Constructions at the cognitive level are not representations of the world..."
- Cognitive level constructions, however, relate language to the real world. This is because, although they are not inherently truth-conditional, such constructions provide various real-world inferences and action patterns."
- → "The constructions at the cognitive level are different (and novel) for each case of language use; mental spaces and connection are built up as discourse unfolds..."
- \rightarrow *Mental spaces* are the *domains* that *discourse* builds up to provide a cognitive substrate for reasoning and for interfacing with the world.



Hans U. Fuchs, Elisabeth Dumont, Institute of Applied Mathematics and Physics Zurich University of Applied Sciences, 8401 Winterthur, Switzerland

4. Application (1) — TEMPERATURE CONCEPTS

Expressions paint an image of the meaning of temperature concepts with the help of **images**, **figures**, or **shapes**. Observe that expressions contain **words** and suggest **concepts** that **are embedded in a larger meaning structure**...

- I am in a *warmer place* now.
- Lately, the weather has been *going from hot to cold*.
- His fever has been rising fast.
- Such a *high temperature difference* is not good.
- The *temperature* is now *at the lowest level* it's been in a while.
- I am taking forever to warm up.
- In front of the fire, the air feels particularly cold—there is a *great imbalance between hot and cold*.
- The temperature drops over a short distance. This creates quite some stress.
- [...] bodies of water [...] differ in their temperatures, providing a *thermal landscape* which might serve as an orienting cue in fish migration.
- The truth is, all of these *thermal ups and downs* are perfectly normal...

4. APPLICATION (1) — TEMPERATURE CONCEPTS



5. NARRATIVE FRAMING - LARGE SCALE SCHEMATIC STRUCTURES

Perception at different scales...



zh

5. NARRATIVE FRAMING - LARGE SCALE SCHEMATIC STRUCTURES



6. APPLICATION (2) — HEAT CONCEPTS

Examples of expressions involving heat. There are no examples of literal use of language:

- All bodies *contain heat*....
- How do you *collect heat* in a passive solar house?
- This means *heat flows* "downhill" from hot to cold.
- All computers *generate heat* as a by-product of operation...
- In Iceland, geothermal *heat is used*...
- ... *heat is an agent* of vast importance in chemical reactions and engineering processes
- Law of the dependence of the active *force of heat* upon the tempera... (Clausius)
- This exterior *heat lets* the crust become crispy
- *Heat makes* me dizzy...
- Internal *Heat Drives* Jupiter's Giant Storm...
- The R-value is a ranking that measures the insulation's capability to *oppose heat*.
- These gases *prevent heat* from escaping to space...
- The most effective ways to *block heat*...
- ... use electricity to *make heat* go where it doesn't want to...
- Clouds and storms follow the warm water, *pumping heat* and moisture high into the atmosphere...
- Heat must *balance* cold...

Expressions for heat use the following constructions:

- Container, store, hold, accumulate; lack of, abundance of; collect
- Flow, transport, extract emit/absorb, exchange; heat moves
- **¬** Balance (law of balance of...)
- Power, force of heat
- Heat is an agent: Heat causes, drives, makes, counteracts, lets, balances
- Heat is a patient: Pump, force, make, counteract, block, hold (back), enable, prevent, oppose, let/allow heat
- **T** Use, produce, generate heat
- Heat as location, landscape; level, intensity, degree, scale of heat
- Balance of heat and cold, hot and cold; thermal tension

6. APPLICATION (2) — HEAT CONCEPTS



7. SUMMARY AND SUGGESTIONS

- **Framing** (frame semantics) is an approach to modeling the human mind in *contrast to truth conditional semantics*. It states that *meaning is conceptualization*. It is in accord with the theory of *embodied cognition*.
- The notion of *narrative framing* rests upon an assumption of *perception at different scales*: perception leads to the construction of *small to large-scale perceptual gestalts* that are recruited for understanding. *Large-scale schemas support narrative thought and understanding*.
- ☐ Concepts are understood not only in terms of conceptual structures constructed from (smaller) parts but also by being embedded in larger wholes.

Lessons learned from the semantics of natural languages will apply to our understanding of science (in production and learning)...

- → If we want to understand heat (or momentum, or electricity), we need to tell stories.
 We need to learn to understand what they are doing, how they affect the world and how, in turn, they are affected by the world (agency).
- → Forces of nature are agents in (macroscopic physical) story-worlds. In formal science, story-worlds take the form of formal dynamical models. Simulations of these models correspond to concrete stories.

REFERENCES

- Contini A. (2015): Metaphors, stories, and knowledge of the world. International Exploratory Workshop, July 7-9, 2015, Weissbad, Switzerland. Swiss National Science Foundation.
- Fauconnier G. (1997): *Mappings in Thought and Language*. Cambridge University Press, Cambridge, UK.
- Fillmore, C. (1975). An Alternative to Checklist Theories of Meaning. *Proceedings of the First* Annual Meeting of the Berkeley Linguistics Society, 123-131.
- Fillmore C. (1976): Frame semantics and the nature of language. *Annals of the New York Academy of Sciences*. Volume **280**, *Origins and Evolution of Language and Speech*, 20–32.
- Fillmore C. (1985): Frames and the Semantics of Understanding. *Quaderni di Semantica*, **6**(2), 222-254.
- Fuchs H. U. (2015): From Stories to Scientific Models and Back: Narrative framing in modern macroscopic physics. *International Journal of Science Education*, **37**(5-6), 934-957.
- Wilson M. (2002): Six views of embodied cognition. *Psychonomic Bulletin & Review*, **9**(4), 625-636.