

Title of contribution:

Liberating energy: A comparative investigation of physicists' use of anthropomorphic cognitive metaphors when modeling matter-energy interactions in German and English

Body of abstract:

In physics, terms relating to the restriction or granting of freedom are frequently employed in the context of matter-energy interactions, as evident in phrases such as “a photon is *captured*” and “energy was *liberated*”. However, the philosophical concepts of freedom and liberty relate to sentient beings with rights and abilities to make decisions, meaning physical interactions between matter and energy do not literally involve freedom or liberty at all.

This work examines for the first time the hypothesis that physicists' language choices which attribute freedom to certain physical phenomena indicate the existence of related anthropomorphic cognitive metaphors (CMs). It builds on previous investigations into ontological cognitive metaphors (OCMs) for the concepts of energy and heat in physics. However, whereas earlier research focuses on the connections between inanimate phenomena through substance-based OCMs, such as energy as a liquid material, this work opens up a novel and potentially rich area of enquiry into cognitive models relating fundamental physical phenomena to the field of human interactions.

A specific group of frequently occurring metaphors, termed matter-energy confinement metaphors (MECMs), is defined and the results of an extensive series of empirical experiments to investigate their use by physicists are presented. The impacts of the use of MECMs on physicists' reasoning about specific physical processes, such as nuclear fission or particle annihilation, are examined using a methodology adapted from Thibodeau & Boroditsky and the surface-level features of MECMs are investigated via a large-scale online survey.

These experiments are conducted in parallel with separate groups of both English and German speaking physicists. By exploring details of the use and effects of MECMs across two languages this work is also the first to allow a direct comparative analysis of both how these metaphors are encoded in language use and the underlying cognitive models they relate to.

The ultimate intention of this research is to establish concrete suggestions for language use among those teaching and learning about energy in physics, particularly in mixed German/English language teaching environments such as those found at many German universities and research institutes.

References:

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