

PRINCIPLE BASED EXPLANATIONS ARE NOT EXTINCT IN COGNITIVE SCIENCE: THE CASE OF THE BASIC LEVEL EFFECTS

LILIA GUROVA

**Department of Cognitive Science and Psychology
New Bulgarian University**

lgurova@nbu.bg

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THE MOTIVATION

(Cummins 2000, Bechtel & Abrahamsen 2005, Wright & Bechtel 2007, Bechtel 2010)

- (1) Appeals to laws are very rare in life sciences and in cognitive science in particular;**
- (2) The laws in cognitive science coincide with what psychologists call “effects”. But effects explain nothing insofar as they themselves need to be explained;**
- (3) Those who insist on law based explanations are either under the sway of the deductive nomological (DN) model of explanation or they are not familiar enough with the real practice in cognitive science;**
- (4) The proper explanations for cognitive science are those that reveal the mechanisms or the structures that underlie and/or produce the explained phenomena.**

IN THIS TALK

- **To provide evidence against (1) – (4); to argue that the claims (1) – (4) present in the best a distorted picture of real explanatory practice in cognitive science;**
- **To explain why principle based explanations are indispensable for some explanatory tasks; to illustrate their indispensability by the case of the basic level effects.**

(1) APPEALS TO LAWS ARE RARE IN LIFE SCIENCES AND IN COGNITIVE SCIENCE

Counter (1):

- **It is true that there are few explanatory principles in life sciences but their significance is enormous: to mention only the role of the principle of natural selection in evolutionary biology and the role of the so-called ‘central dogma’ in molecular biology.**
- **The principles used in cognitive science are not so famous (partially because of the enforced view that only appeals to underlying mechanisms matter) but principle based explanations are far from being extinct in this area.**

EXAMPLES OF EXPLANATORY PRINCIPLES IN COGNITIVE SCIENCE

- E. Rosch's principles of categorization (the *principle of cognitive economy* and the *principle of perceived world structure*) (Rosch 1978);
- R. Shepard's *universal law of generalization* (Shepard, 1987);
- D. Medin and S. Atran's *principles of the universal structure of folkbiological classification* and the *universal notion of biological essence* (Medin & Atran 2004);
- N. Chater and G. Brown's *simplicity principle* and *scale-invariance principle* (Chater & Brown 2008).

(2): THE LAWS IN COGNITIVE SCIENCE COINCIDE WITH WHAT PSYCHOLOGISTS CALL “EFFECTS”

Counter (2):

- **None of the principles launched in cognitive science (e.g. the principles listed on the previous slide) describes effects which are to be explained. Instead, these principles have been introduced as explanatory for various sorts of empirically established effects.**

(3): THE RESEARCHERS LAUNCHING PRINCIPLE BASED EXPLANATIONS ARE BIASED BY THE DN MODEL

Counter (3):

- **There is no evidence that those who have advanced principle based explanations have done that under the sway of the DN model; Rosch, Shepard, Medin and Atran, Chater and Brown are neither philosophers by training, nor any of them has ever referred to the DN model explicitly; in fact, the explanatory schemas which they used were not construed as deductive arguments;**

(4): THE MECHANISTIC EXPLANATIONS ARE THE ONLY PROPER EXPLANATIONS FOR COGNITIVE SCIENCE

Counter (4):

- **N. Chater and G. Brown (2008) have shown that in some cases mechanistic models have been derived from more general principles; thus the derived models cannot be viewed as self-sufficient substitutes for the principles which they have been derived from.**
- **Principle based explanations have been often advanced when the underlying structures (or mechanisms) of the explained phenomena are so complex or exhibiting significant variations that it has been impossible to grasp them in a single mechanistic model.**

WHAT IS CALLED 'BASIC LEVEL EFFECTS'?

- **The various manifestations of the existence of a preferred level of categorization in a given conceptual taxonomy.**



EXAMPLE:

Bulldog dog mammal animal

SOME OF THE MANIFESTATIONS OF THE BASIC LEVEL EFFECTS

The subjects

- Use the same *motor programs* when dealing with basic level category members;
- Can form an *average image* to represent the basic level category;
- *Learn* basic level categories faster and use them more often in description tasks

WHAT IS INTERESTING ABOUT BASIC LEVEL EFFECTS

Basic level effects

- **are universal across culture but in the same time some of their manifestations are easily movable by experience;**
- **penetrate the whole cognitive system and that makes extremely difficult to provide a common mechanistic explanation for all the manifestations of these effects.**

THE PRINCIPLES PROPOSED TO EXPLAIN THE BASIC LEVEL EFFECTS

- **Rosch (1978) *Principles of Categorization***
 - *principle of cognitive economy;*
 - *principle of perceived world structure;*
- **Medin & Atran (2004) *The Native Mind: Biological Categorization and Reasoning in Development and Across Culture.***
 - *principle of the universal structure of folkbiological classification;*
 - *principle of the universal notion of biological essence*

ROSCH'S PRINCIPLE BASED EXPLANATION OF THE BASIC LEVEL EFFECTS

- *The principle of cognitive economy*: “the task of category systems is to provide maximum information with the least cognitive effort”;
- *The principle of perceived world structure*: “the perceived world comes as structured information”;

According to these principles, given that the representations of the different levels of a taxonomic categorical structure are not equally instructive about their members, the subjects will prefer to use the most inclusive one which in the same time is informative enough about the essential properties of the category members.

MEDIN AND ATRAN'S PRINCIPLE BASED EXPLANATION OF THE BASIC LEVEL EFFECTS

- **Folkbiological classifications exemplify a three-level universal structure (folk generic, life form, folk kingdom)**
- **There is a privileged categorization of the living things such that its output coincides with the natural groups of organisms sharing common essential properties.**

The basic level in a given folkbiological taxonomy is the level at which (people believe) the categories coincide with the natural groups.

SUMMARY

- **The use of principles is a legitimate explanatory practice in cognitive science;**
- **Principle based explanations are indispensable when the *explanandum* is an effect which supposedly is not produced by a single mechanism;**
- **The principle based explanations are not rival to the mechanistic ones but rather complementary to them;**
- **In most cases the principle based explanations are not construed as deductive inferences which means that they do not comply with the DN model of explanation.**

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THANK YOU!