THE TRIAD OF PIAGET AND GARCIA, FAIRY TALES AND LEARNING TRAJECTORIES.

Bronislaw Czarnocha,

Hostos Community College, CUNY,NYC

Rationale

The central question of the presentation has been formulated by its Cerme 8 reviewer: *is there a "general strategy of human learning" that, already extant in fairy tales and their stories of heroes and heroines, could be drawn upon to inform learning in the mathematical sphere?*

The methodology of this investigation follows the doorsteps of the methodology used by Piaget and Garcia in formulating the Triad (PG, 1987) – that is a mechanism of thinking through which a schema of a mathematics concept can be constructed. The central idea of that work is to demonstrate that "the mechanisms mediating transitions from one historical period [in the development of scientific concepts] to the next are analogous to those mediating the transitions from one psychogenetic stage to the next…That this dialectical Triad can be found in all domains and all levels of development seems to us to constitute the principal result of our comparative efforts."(p.28, PG). A series of papers utilizing the Triad in explicating the construction of basic concepts of calculus such as chain rule or the limit had been published by a group RUMEC (e.g. Clark et al,1997;Cottril et al 1996)

The presented approach is similar in that we are looking for a common mechanism to account for (1) learning progressions in mathematics identified during the Discovery method of teaching and (2) progressions of an adventure hero's (or heroine) struggle to succeed in a class of fairy tales. We demonstrate that the common mechanism which can account for both progressions is "a triple" - a special case of the Triad. It is reminiscent of the term "trebling" in the scholarship of fairy tales, which refers to the pattern of three consecutive events occurring in a succession and structuring some fairy tales (Propp, 1975).

The structural analysis of the trebling did not advance very much till the present day. (Alan Dundes, 1961) analysis of Lithuanian fairy tales focuses on binary opposition between the triples rather than on their inner structure. (L.B. Croft, 2005) shows that the "triplicity" of "trebling" extends to the Russian culture et large, following the call of (Levi-Strauss,1955) to extend the paradigmatic structural analysis of the myth to the world at large, "that is to other aspects of culture…" This presentation proceeds the path outlined by Levi-Strauss in relating the structure of fairy tales to "other aspects of culture" such as mathematics education and and logico-mathematical thinking of (Piaget and Garcia, 1987).The presented methodology (below) is an example of the structural approach to networking of different theories by comparing their underlying structure. Other example of theories which can be structurally

compared is APOS theory of (Dubinsky, 1991) and reification theory of Sfard, 1992).

METHODOLOGY

1. Discovery of the structural similarity between the mathematics classroom dialogs encountered during the teaching by the Discovery method and the adventure paths of heroes and heroines in certain class of fairy tales.
2. Demonstration that the PG Triad reduces itself to the triple in the case there are only 2 different individual cases or manifestations.
3. Showing that PG Triad correctly interprets the encountered sequence of triples in the mathematics classroom dialogs.
4. Showing that in the Fairy tales with Triples, triples can be explicated with the help of the PG Triad.

Conclusion: Since the structure of the triples and their meaning in each of the two so different domains, mathematics education and wisdom of the folklore, is similar, there may be a structure underlying both, and this structure is, I am conjecturing, an element of the "general strategy of human learning".

POSTER DESIGN

The poster will be designed in three columns, the first from the left will contain the collection of <u>three</u> examples of the triple design of teacher/student dialogs collected from two instructors of intermediate algebra and freshman calculus in the context of the Discovery method of teaching. The last column will contain excerpts from the paradigmatic fairy tale followed by the concept maps of two new fairy tales of brothers Grimm, The Iron John and the Griffith demonstrating sophisticated structure of triples within each of them. The middle column will contain the discussion of the Triad as well as its application to both the classroom event and the fairy tale. The bottom 10 cm row across the poster will contain examples of learning trajectories constructed out of triples.

References

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Dundes, Alan. (1961) Binary structure of "Unsuccessful Repetitions" in Lithuanian Folk Tales. *Western Folklore*, vol. 21, No.3 (July 1962), pp.165-174.

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Piaget, J. and Garcia, R. (1989) *Psychogenesis and the History of Science. Columbia University Press*, New York.

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