

Children's Knowledge of the Earth: New Evidence for the Fragmentation Account

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Introduction

An ongoing debate in developmental psychology is whether cognitive development is categorical (i.e., stage-wise) or dimensional. In the field of children's knowledge of the earth the *mental model account* (Vosniadou & Brewer, 1992), a categorical approach, states that children of all ages, even young children, construct mental models of the earth. The *fragmentation account* (Nobes et al., 2003), a dimensional approach, describes the development of children's knowledge of the earth as a gradual accumulation of fragments of information up until children acquire the scientific theory of the earth.

Latent structure models with discrete latent variables, like latent class analysis (LCA), can contribute to the discussion of categorical versus dimensional development as these models allow children to be classified in underlying discrete latent classes (e.g., Jansen & van der Maas, 2002; Raijmakers, Jansen, & van der Maas, 2004).

Experiments

Children's knowledge of the earth has mainly been studied using drawings and interviews. In this study (Straatemeier, van der Maas, & Jansen, submitted) a new paper-and-pencil test (EARTH Representation Test for cHildren; EARTH) was developed. The test was used in two experiments with large samples. In experiment 1 ($N=328$, age: 4-11) the EARTH was compared to drawings, which children made either before or after completing the EARTH. In Experiment 2 ($N = 381$, age: 4-9) the EARTH was compared to answers to an interview with open-ended questions of 68 of the children. More information about the experiments can be found at <http://users.fmg.uva.nl/hvandermaas>.

Results & Discussion

The proportion of correspondence between the responses to the EARTH and the mental models, formulated by Vosniadou and Brewer (1992), was calculated with the rule assessment methodology (RAM; Siegler, 1976). Figure 1 shows that the consistency of children's responses with one of the mental models (i.e., almost always the scientific model) increases with age. Moreover, positive associations (Experiment 1: $r_s = .86$, $p < .001$; Experiment 2: $r_s = .67$, $p < .001$) were found between the amount of knowledge children have and the consistency of their responses.

LCA was performed on the responses of the two samples to the EARTH. If the mental model account is correct each latent class of a latent class model corresponds to one of the mental models. However, the LCA provided no evidence for the existence of Vosniadou and Brewer's (1992) non-scientific mental models. The scientific model was the only model that was detected.

Both the results of the RAM and the LCA question the claim that children form mental models, at least of the kind formulated by Vosniadou and Brewer. The results are consistent with a gradual increase in knowledge of the earth (i.e., the fragmentation account).

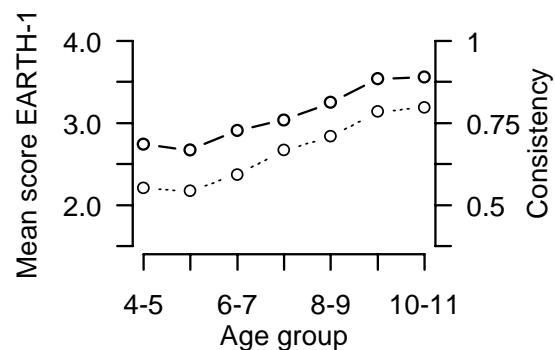


Figure 1: Mean score (solid line) and consistency (dotted line) on the EARTH in Experiment 1.

References

- Jansen, B. R. J., & van der Maas, H. L. J. (2002). The development of children's rule use on the balance scale task. *Journal of Experimental Child Psychology*, *81*, 383-416.
- Nobes, G., Moore, D. G., Martin, A. E., Clifford, B. R., Butterworth, G., Panagiotaki, G. et al. (2003). Children's understanding of the earth in a multicultural community. *Developmental Science*, *6*, 74-87.
- Raijmakers, M. E. J., Jansen, B. R. J., & van der Maas, H. L. J. (2004). Rules and development in triad classification task performance. *Developmental Review*, *24*, 289-321.
- Siegler, R. S. (1976). Three aspects of cognitive development. *Cognitive Psychology*, *8*, 481-520.
- Straatemeier, M., van der Maas, H. L. J., & Jansen, B. R. J. (submitted). Children's knowledge of the earth: New evidence for the fragmentation account.
- Vosniadou, S., & Brewer, W. F. (1992). Mental models of the earth: A study of conceptual change in childhood. *Cognitive Psychology*, *24*, 535-585.