Learning on the Balance Scale Task

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Introduction

The balance scale task has become a benchmark task in cognitive developmental psychology. Development on the balance scale task is characterized as a progression through a series of increasingly complex rules (Rule I, II, III, IV). Children using Rule IV understand the multiplicative relation between the two task features, weight and distance information of blocks placed at both sides of the fulcrum of a scale (Siegler, 1981).

We study two possible answers to the question how children learn on the balance scale task. First, children may switch to a more complex rule because they start to perceive uninspected aspects of the scale (i.e., they start to notice the distance dimension). Second, children may switch as they acquire information that contrasts their old beliefs (i.e., observing that a scale tips to the side with the smaller number of blocks, placed at a larger distance). We focus on both the transition from Rule I (paying attention to the weight dimension only) to Rule II (paying attention to the distance dimension as well but only in case the numbers of blocks are equal) and the transition from Rule II to Rule III (always paying attention to both dimensions but ignorant of the correct combination). We assume that children using Rule I improve their ability to perceive distance when observing a series of items with an increasing difference between the distance at which the stack of blocks is placed on the left and the distance at which the stack of blocks in placed on the right side (see Figure 1). Children using Rule II may benefit from the presentation of so-called conflict items (both the distances and the weights differ; the largest number of blocks is placed at the smallest distance).

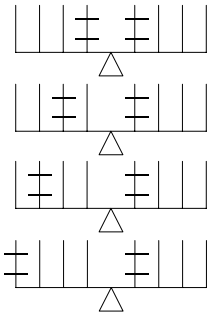

Figure 1: Example of series of facilitating items in order to promote the transition from Rule I to Rule II.

Method

A total of 420 children (age range 6-10 years) made a pretest, an intervention test, and a posttest. All tests were paper-and-pencil tests and administered groupwise. Both pre- and posttest were standard balance scale tests. The intervention tests consisted of either control items, items that facilitated the transition to Rule II, or items that facilitated the transition to Rule III. The intervention tests were administered with or without demonstrating the correct response in front of the classroom, resulting in six conditions. Two weeks later, a second posttest was administered.

Results

A multi-group latent Markov model (Langeheine, 1994) was fitted to a selection of items of both pretest and posttest. The conditions featured as groups. A restricted four-class model was selected, consisting of classes that corresponded to Rule I, Rule II, Rule III, and a small uninterpreted class. Transition matrices indicated that specific facilitating items were helpful for children using Rule I (regardless of feedback) but that children using Rule II only learned when feedback was provided. Analysis of the second posttest showed that children continued to use Rule II, whereas many children who used Rule III regressed to Rule II.

Discussion

The learning mechanism from Rule I to Rule II probably differs from that from Rule II to Rule III. Perception seems crucial for the first transition: when perception is facilitated, children tend to progress to a more complex rule, regardless of feedback. Acquiring Rule III is more complex. After making mistakes, children do acknowledge the importance of both dimensions but resort to Rule II when a solution for the combination of variables is not offered. Probably, it is not until they master new combinatory abilities that they progress from using Rule II to a more complex rule.

References

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