Effect of Presentation Style on Children's and Adults' Use of Data Characteristics

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In two studies, we examined children's reasoning in the interpretation phase of an experiment: data were presented as results of a completed experiment, and participants were asked to draw conclusions based on the information they had available. We set up situations with minimal theoretical background information, to make the variation in data characteristics particularly salient.

Two of the most important ideas about data involve expectations about data distribution and expectations about the effect of sample size, and we used these variables as the focal variables in our study. We asked participants to draw conclusions about whether there was a difference between two sets of data and to explain their reasoning (Masnick & Morris, 2002).

In the current study, we wanted to explore how the style of presentation might influence children's and adults' conclusions. Presenting all of the data to be considered at one time could be difficult to process. In addition, the pairwise presentation of data could facilitate comparisons of pairs of data points instead of comparisons of the entire column of data. We used the some of the same datasets as in Masnick and Morris (2002) but presented information in a different format.

Method

Twenty-two third grade students, 29 sixth-grade students, and 50 undergraduate students participated in this study. All participants were shown a cover story describing two engineers testing sports balls. The engineers programmed robots to throw or kick balls a certain number of times to test if they were different. Participants were then presented with three datasets, in one of two conditions.

In the pairwise condition, participants saw data presented in two columns. First, they were shown one pair of data points, then two, four, and then six pairs. After each presentation, participants were asked if there was a difference between the two variables, how sure they were of this difference, and whether they thought the engineers should test the balls again.

In the column condition, participants saw six data points in one column, and one in the other column. They were asked the same questions as in the pairwise condition, and then were presented with additional data points in the second data column (1, 2, 4, and 6 data points at a time). This condition was included to see if reasoning changes when pairwise comparisons are less salient.

Results and Discussion

The results of this study replicated the major finding of Masnick and Morris (2002): Across all grade levels, there was a significant effect of sample size and level of data variation that affected students' sureness that the two columns of data were different.

In this study, participants were asked if they thought the engineers should test the balls again. There were no differences between conditions in the frequency of replies: with fewer data points, most participants wanted more data. When there were six pairs in each column, about 40% of participants still thought more data should be collected.

Participants' justifications for their reasoning were most frequently based on data characteristics such as sample size and the magnitude of differences. There were large age differences, with older participants more likely to name more characteristics. Participants in the column condition were more likely to comment on an outlier affecting their judgment. These participants also said that the inequality of the number of data points in each column was the main reason for wanting the engineers to test at least one ball again.

The findings from this study suggest that students pay attention to data characteristics as early as third grade, and are able to use this information in drawing conclusions. Further, the presentation style of the data affects reasoning about only a small subset of features, suggesting that students are responding not just to the demands of the task, but are interpreting data however they are presented.

Acknowledgments

This research was supported in part by an NICHHD grant to David Klahr (HD25211).

Reference

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