ADULTS' STRATEGY USE IN COMPLEX FRACTION COMPARISON

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Several studies have found that when people compare fractions, they show a "natural number bias", that is, better performance on problems in which the larger fraction has the larger components (e.g., 7/8 vs. 2/3) than on problems in which the larger fraction has the smaller components (e.g., 2/3 vs. 4/9). However, more recent studies found the opposite pattern ("reverse bias"). To better understand what causes these patterns, we investigated adults' strategies in complex comparison problems with varying affordances. Adults reported strategies on a trial-by-trial basis. Overall, we found a reverse bias pattern. Strategy use varied by problem type, suggesting that participants used strategies adaptively. The study highlights variability in strategy use depending on problem type, which may account for diverse bias patterns in previous studies.

THEORETICAL BACKGROUND

Many people struggle with fractions (see Lortie-Forgues, Tian, & Siegler, 2015, for a review). One well-documented phenomenon is the "natural number bias" (Ni & Zhou, 2005), that is, people's tendency to overextend natural number reasoning to fraction problems. To assess the occurrence of the natural number bias, studies have often used fraction comparison problems, in which people are asked to choose the larger of two fractions (Vamvakoussi, Van Dooren, & Verschaffel, 2012; Van Dooren et al., 2016; Van Hoof, Lijnen, Verschaffel, & Van Dooren, 2013). One indicator of the bias is that people are more accurate and/or faster when the larger fraction has the larger components ("congruent" comparison problem e.g., 7/8 > 2/3) than when the larger fraction has the smaller components ("incongruent" comparison problem, e.g., 2/3 > 4/9). People may explicitly or implicitly rely on the fractions' natural number components (i.e., their numerators and their denominators) instead of the fraction' overall magnitudes when they make their decisions.

However, a number of recent studies on fraction comparison have reported the opposite response pattern. In these studies, people were more accurate and/or faster comparing fractions that are incongruent than fractions that are congruent (Barraza, Avaria, & Leiva, 2017; DeWolf & Vosniadou, 2015; Obersteiner & Alibali, 2018; for an overview, see Gómez & Dartnell, 2015). The studies that found such a "reverse bias" pattern differed from earlier studies in that the participants tended to be older, and the fraction comparison problems were often more complex. That is, the fractions were unfamiliar to participants, were composed of larger numbers, and had no common numerators or denominators (e.g., 19/24 vs. 25/36). Thus, the "reverse" bias pattern seems to be more representative of adults' performance pattern in fraction comparison than the typical bias. What can explain this reverse bias pattern? The present study

2019. In M. Graven, H. Venkat, A. Essien & P. Vale (Eds.). *Proceedings of the 43rd Conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp 153-160). Pretoria, South Africa: PME.