

ADULTS' EYE MOVEMENTS WHEN COMPARING DISCRETIZED OR CONTINUOUS FRACTION VISUALIZATIONS

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Visual representations of fractions, such as tape diagrams, are thought to be helpful for comparing fraction magnitudes quickly. Textbooks often use discrete or discretized fractions visualizations that represent fraction numerators and denominators with individual units or segments. However, continuous representations (without any segments) could be more intuitive to process mentally (Boyer & Levine, 2015) and to reduce natural number bias (Ni & Zhou, 2005). This assumption is based on results from studies of people's accuracy rates and response times in comparison tasks with discretized or continuous visualizations, but we do not well understand the cognitive processes leading to these results.

We used eye tracking to assess the process of comparing tape diagrams in discretized or continuous formats. We were particularly interested in differences between these formats regarding participants' eye fixations and saccades (transitions between fixations). The sample consisted of 34 university students (21 female, 19.0 years), who solved 44 comparison items as quickly and accurately as possible. The two tape diagrams in each trial were represented on a computer screen one above the other, either in a discretized or continuous format.

On average, participants compared tape diagrams in the continuous format more accurately (85% vs. 80%) and faster (3729 ms vs. 6128 ms). They also used fewer fixations (7.4 vs. 11.9) and fewer saccades (9.7 vs 14.5) per item in the continuous than in the discretized format. There was also a reduced natural number bias in the continuous compared to the discretized format.

This study suggests that adults use continuous tape diagrams more efficiently than discretized ones to compare tape diagrams of fractions. Continuous fraction visualizations could be helpful in fraction instruction to support learners' intuitive focussing on fraction magnitudes and to reduce natural number bias.

References

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