DO VARIATIONS IN PROBLEM STRUCTURE INFLUENCE DIVISION BY MEDIATION WHEN PEOPLE SOLVE DIVISION PROBLEMS?

- People report mentally transforming division problems in division formats (\(72 ÷ 9 = [ ]\)) into multiplication formats (\(9 \times [ ] = 72\)) before solving the problem.
- Participants respond faster to division problems in multiplication formats than in division formats, but only for large problems (Mauro et al., 2003).

METHOD

- In 3 experiments, participants solved division problems and problem structure was manipulated.
- Eye tracking was used to measure processing time for each problem element

RESULTS: As shown in Table 1, evidence for mediation was only found in Experiment 2 where both multiplication formats were solved more quickly than both division formats

<table>
<thead>
<tr>
<th>Experiment 1 (n=32)</th>
<th>Experiment 2 (n=30)</th>
<th>Experiment 3 (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>format</td>
<td>mean</td>
<td>format</td>
</tr>
<tr>
<td>division format</td>
<td></td>
<td>division format</td>
</tr>
<tr>
<td>(72 ÷ [ ] = 9)</td>
<td>1825</td>
<td>(72 ÷ [ ] = 9)</td>
</tr>
<tr>
<td>(72 ÷ 9 = [ ])</td>
<td>1755</td>
<td>(72 ÷ 9 = [ ])</td>
</tr>
<tr>
<td>(72 = [ ] \times 9)</td>
<td>1823</td>
<td>([ ] \times 9 = 72)</td>
</tr>
<tr>
<td>(72 = 9 \times [ ])</td>
<td>1705</td>
<td>(9 \times [ ] = 72)</td>
</tr>
</tbody>
</table>

Figure 1. Dwell times (in ms) on problem elements

- Dwell times in Experiment 1 were similar across problem elements, suggesting that participants did not differentially process by format.
- Presence of the dividend in the first position on all problems cued the activation of division representations and strategies.
- Dwell times in Experiment 2 show a clear differentiation by format and by problem element.
- Presence of the dividend in the last position on half the trials may have cued activation of multiplication strategies and thus mediation.
- Presence of the dividend in the centre (which supports neither multiplication nor division) increased variability across problems.
- Neither multiplication nor division strategies were consistently activated in relation to problem format.

CONCLUSIONS:

- When problem structure is varied, division by mediation is not always observed.
- Variations in the combinations of problem formats within each experiment may have influenced the extent to which multiplication representations were activated during problem solutions.
- Mediation effects are easily influenced by context.

Table 1. Response times (in ms) and standard errors for large problems across 3 experiments

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