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Strategy Use in the Operation Span Task

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Background

In research investigating the relation between working memory and performance on cognitive tasks, researchers explain their findings in terms of capacity limitations. However, informal observations in our own research suggest that individual differences in the use of mnemonic strategies may be an additional factor. Here, we investigated the type of strategies that individuals adopt in the operation span task and how strategies relate to the measured operation span.

The operation span task is a memory task in which participants have to verify mathematical operations and memorise words (Turner & Engle, 1989). The operations alternate with the presentation of the words and the participants have to report all the words in the correct serial order. As the number of operation-word alternations increase, participants become increasingly unable to report the words. It is at this stage that participants may revert to strategies in order to conform to the experimenter's instructions of remembering the words in the correct order.

Experiment 1: Method

Two-hundred and forty participants (mean age 26.74, 142 female) completed the operation span task as part of an ongoing project on working memory and inattention. After completing the operation span task, the participants reported what, if any, strategies they employed.

Results & Discussion

Participants use a small variety of strategies, which coincided with different span measures. With decreasing span, the strategies were visual imagery ($n=23$; $M=22.83$, $sd=8.90$), a combination of strategies ($n=17$; $M=19.65$, $sd=9.23$), semantic association ($n=61$; $M=19.18$, $sd=9.02$), verbal rehearsal ($n=37$; $M=16.70$, $sd=7.42$), no strategy ($n=93$; $M=11.63$, $sd=6.06$), and first letter cueing ($n=9$; $M=11.22$, $sd=6.44$). Participants who report using visual imagery had larger operation span scores than participants

who used any other strategy (all post-hoc comparisons $ps<.05$) except semantic association ($p>.30$).

These results may imply that the use of a particular strategy determines the operation span score or that the choice (detection and employment) of strategies is contingent on the working memory capacity (or both). We tested the first alternative in Experiment 2.

Experiment 2: Method

Sixteen participants (mean age 19.56, 10 female) completed the operation span task under two conditions (within-subject). Participants were instructed to employ visual imagery or verbal rehearsal (counterbalanced).

Results & Discussion

Participants had higher operation span when using visual imagery ($M=19.69$, $sd=7.13$) than when using verbal rehearsal ($M=13.69$, $sd=6.7$) ($F(1,12)=11.85$, $MSe = 24.31$, $p=.005$, $\eta^2 = .50$). There were no effects of order or of span version. These results support the observation that strategy use is an important source that determines operation span score.

However, the correlation between the two span measures was high ($r=0.50$, $p=.051$), suggesting that at least a second component (i.e., working memory span) contributes to the final score.

Conclusion

The results imply that data related to working memory capacity need to be interpreted with regard to strategies used. We recommend researchers to report (or control for) idiosyncratic strategy use in memory span tasks.

References

Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language*, 28, 127-154.