Prepotent Response Inhibition Disrupts Maintenance in Working Memory

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In a continuous WM span task, the Time-Based Resource-Sharing Model (TBRS; Barrouillet et al., 2004, 2007) defines the cognitive load by the following equation CL = ΣRT / T. In a constant time allowed between two memorisations (T), longer is the attentional capture (ΣRT) by the processing component, shorter is the possibility to refresh memory traces. Thus, the deterioration of memory performances is higher. Any activity involving central executive have a commensurable effect on concurrent memory, being function of the proportion of time during which attention is captured.

The well known Stroop effect on RT is often attributed to the Prepotent Response Inhibition (PRI). PRI is defined by Miyake & al. (2000) as the deliberate suppression of dominant, automatic, or prepotent responses and characterized as an executive function.

- According to the TBRS model, memory performances should be deteriorated by concurrent activities involving PRI.
- This deterioration should be a function of the proportion of time during which these activities capture attention.

General Method - Comparison of two experimental conditions in each experiment using Stroop paradigm -

* Interference Condition requires PRI: prepotent response from automatic reading has to be inhibited to achieve the task
* Retrieval Condition involves only retrievals: the stimuli do not produce interference

« Classic »
Stroop Task
Maintain digits while naming the color of

« Enumeration »
Stroop Task
Maintain words while enumerating

As usually observed, participants needed more time (+ 51ms, *) to named the color of color words compared to adjectives. More interestingly, spans were weaker (- 0.25, *) in the interference condition than in the retrieval condition.

The disruptive effect on concurrent maintenance of the two Stroop tasks is a direct function (R² = .99) of the time during which this activity occupies the central executive that is temporarily unavailable to refresh memory traces.


Conclusion

As observed in the classic Stroop, participants needed more time (+ 58ms, *) to enumerate digits compared to letters. Moreover, memory performances were poorer (- 0.45, *) in the interference condition than in the retrieval condition.

Sharing of attention & Time are the main determinants of cognitive load of executive functions