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# Working Memory's Central Executive and Propositional Reasoning

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We examine the role of central executive in propositional reasoning by using a new working memory measure. In the traditional reading span test by Daneman & Carpenter (1980), participants have to remember the last word of an increasing number of sentences that they read in series of two, three, four, five and six sentences. The processing part of the task is reading aloud; the storage part of the task is recalling the final words. Since the tasks require some kind of attentional control, RST is a measure of the central executive in working memory (see, Whitney, Arnett, Driver & Budd, 2001). Our new measure introduces some modifications in the processing component, whilst maintaining constant the storage component: participants have to read a sequence of sentences and then infer a word that must be remembered. The content of the anaphora problems was based on a normative study: only problems that yielded more than 95% correct responses were used. Here is an example:

Robert painted **it** white before the summer arrived.

- roof

- **façade**<sup>1</sup>

This new test should provide better measure of the central executive's capacity for reasoning since the new secondary task clearly increases the demands of attentional control.

We present one experiment in which we compare predictions of the new Anaphora test with those of RST, on a reasoning task. Participants carried out the two working memory tests and a reasoning test. An adapted Spanish version of RST was used. In the Anaphora test, participants had to read to themselves a series of progressively increasing anaphora problems presented on a screen, and then recall the word-solution of each anaphora problem and write them down in the correct order. From the whole group of participants we selected from each of the WM tests two groups of High and Low WM participants. Reasoning task included three sets of problems, one based on 'if then' conditionals, one based on 'unless' conditionals, and one based on 'p or q, or both' disjunctions. We used neutral content with information about persons and locations. Each problem consisted of a propositional premise (either

conditional or disjunctive) and a categorical premise corresponding to the four logical possibilities: 'p', 'q', 'not-p' and 'not-q'. Participants had to generate their own conclusions.

Participant's performance in the two WM tests was significantly different. The mean score in the RST (4.13 words) was reliably higher than in the Anaphora test (3.67 words;  $p < .001$ ). The Pearson correlation between the two WM measures was significant: 0.60 ( $p < .001$ ). The results confirmed that: a) High working-memory individuals gave more reasoning responses which, according to mental model theory, require high cognitive work; b) Low working-memory individuals gave more reasoning responses which are probably obtained by means of superficial biases; c) Anaphora test predicted reasoning performance better than the reading span test.

In this paper, we have described a new measure of the capacity of the central executive that introduces a trivial inferential problem as part of the processing required in the test. This new measure implicates the central executive to a greater degree. The participants are forced to regulate their cognitive resources, shifting from one task that requires attentional control to the other. There is an obvious element of circularity in using a measure of WM to predict reasoning ability when the measure itself calls for some kind of reasoning (see Philips & Forshaw, 1998). However, the anaphora problems are trivial: they are carried out correctly by every participant.

## References

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<sup>1</sup> Façade, is the correct response because it matches the meaning of the sentence and the gender – feminine – of the pronoun in Spanish (Roberto **la** pintó de blanco antes de que llegara el verano. -tejado, -fachada). The foil is semantically appropriate but grammatically inappropriate.