The role of context and working memory in the MIE — A window on metaphor processes

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The Metaphor Interference Effect (MIE) emerges when participants take more time to judge metaphors (e.g.(1)) as *literally false* than their scrambled counterparts (e.g.(2)).

1. **Some cats are princesses.**
2. **Some flutes are princesses**

[1,2] propose that the MIE is a kind of Stroop effect, wherein an automatically generated metaphoric interpretation conflicts with the task of finding and evaluating a literal interpretation. In previous work, replicated below, we place metaphors in a strongly constraining context and find that the MIE is eliminated. This outcome was contrary to expectations if the MIE was a stroop-like effect, since context should further promote the competing metaphoric meaning. We attribute previous MIE results to uncertainty surrounding de-contextualised metaphor items: language processes require background knowledge to derive figurative meanings and, without specific indications of relevance, an item like (1) can have many meanings (spoilt, bossy, lazy, haughty), depending on which implications are deemed relevant. We contend that a lack of discourse context keeps all such meanings 'live', draining resources and leading to longer latencies on the explicit task. In this new work, (i) we test our hypothesis about meaning uncertainty leading to longer latencies; (ii) we reconsider research on working memory and metaphor. Regarding (ii), [3] shows the MIE is lower for a High WM group than LWM and they attribute this to WM abilities overcoming Stroop interference. We contend instead that HWM individuals have more resources to deal with meaning uncertainty while completing the secondary task. In the current study we follow the individual difference analysis procedure of [3] but with our context/no-context design. Regarding (i), we ran a separate norming study on our metaphor sentences, eliciting participant interpretations and used an LSA-based analysis to measure similarity. Overall, our results replicate our previous effect of context (no MIE in context) and also the effect of WM in [3], in the no-context condition. The novel comparison supports our contention about the MIE and effect of WM. In addition, our LSA analysis reveals a correlation between perceived ambiguity of context-less metaphors and MIE.

Experiment 1. Participants (N=96 native English) completed two tasks in the following order: (a) Word span task (WSPAN) [4,5]; (b) Literal truth judgement task. In (b), participants were employed in a *2 (Within-group: Sentence form) * 2 (Between-group: Context)* design. Following [1], they made literal truth decisions to 24 metaphors (highly apt & novel) & 24 scrambled items, as well as 12 literally false & 60 literally true fillers, in either a no-context or a context condition (see Table 1). The context sentence was formulated so that target sentence was an elaboration and thus context strongly constrained figurative meaning. Literal fillers counterbalance response biases.

Results. Overall MIE Effect: We found a Sentence form * Context interaction (β=-35, se=6.06, $p<.001$): there was a large MIE in the no-context condition ($p<.001$), but no MIE in the context condition ($p=.15$) – see Fig. 1. Following [3], we analysed data for High (+1SD) and Low (-1SD) WSPAN participants and find a three-way interaction between WM, form & context (β=5.84, se=1.88, $p=.002$). With *no context*, we replicate the finding in [3] -- the MIE for High-WM (6ms, $p=.59$) < Low-WM (133ms, $p=.001$). With *context*, the MIE for High-WM was reduced to the negative value (-67ms, $p=.53$); the MIE for Low-WM was also eliminated (4ms, $p=.36$) – see Fig. 2.

Experiment 2 – Metaphor Interpretation Task. Participants (N=48 native English) were presented with the same list of metaphors (N=24) used in Experiment 1 and instructed to decide on the number of different interpretations that they can think of for each metaphor and

write down their interpretations.

Results. Figurative meaning uncertainty was measured by calculating semantic similarity between different interpretations of each metaphor using functions in the R package *LSAfun* [6]. A generalized linear mixed-effects model quantifies the semantic similarity of figurative meanings on *literally false* response of metaphors shows that the lower meaning similarity predicts the longer latency – with the meaning similarity decrease by 0.1 value leading to the latency increase by 71.2 msec (β=-712, se=47, p<.001).

Discussion. We attribute the negative MIE in context for HWM to the fact that automatic language processes attempt sense-making of even scrambled sentences. This suggests that a single constrained figurative meaning in context hardly interferes with the secondary task. Moreover, Exp. 2 confirms our hypothesis that delay on the literal truth judgement task results not from interference of a figurative meaning, but from figurative meaning uncertainty.

Table 1. Sample of critical items used in the literal truth-value judgement task

Conditions	CONTEXT	TARGET
NO-CONTEXT	/	Some friendships are wines. (metaphor)
	/	Some tickets are wines. (scrambled)
CONTEXT	Their friendship gets better with age.	Some friendships are wines. (metaphor)
	Their friendship gets better with age.	Some tickets are wines. (scrambled)

Note - the metaphors used in the study were highly apt and novel ones selected from a sample of 200 metaphors which were subjected to two previous pre-tests of familiarity and aptness norming

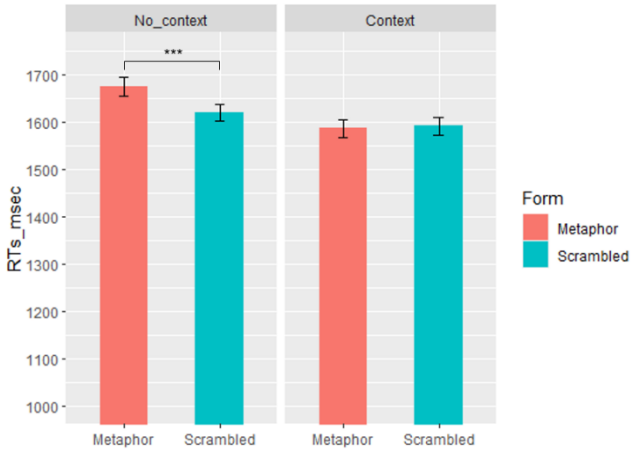

Figure 1. Overall Mean RT (and standard errors of the mean) of *literally false* responses to metaphors and scrambled sentences in two context conditions

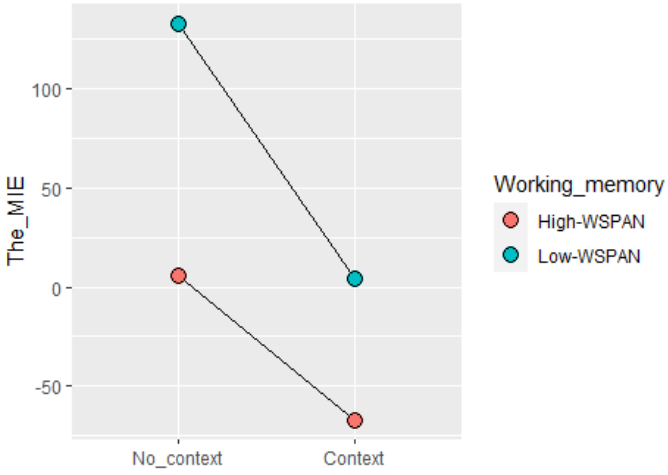

Figure 2. The MIE (metaphor RT – scrambled RT) for High-WSPAN participants and Low-WSPAN participants in two context conditions

References. [1] Glucksberg, Gildea & Bookin, 1982. *J. of Verbal Learning and Verbal Behavior* 21, 85-98. [2] Gildea & Glucksberg, 1983. *J. of Verbal Learning and Verbal Behavior* 22, 577-590. [3] Pierce, MacLaren & Chiappe, 2010. *Psychon Bull & Rev* 17, 400-404. [4] Engle *et al*., 1999. *JEP: General* 128, 309-331. [5] La Pointe & Engle, 1990. *JEP: Learning, Memory, and Cognition* 16, 1118–1133. [6] Günther, Dudschig & Kaup, 2015. *Behavior Research Methods* 47, 930–944.