Of Snails and Rockets: When Reading Words Dealing with Speed Influences Motor-Response Times

64th Annual Meeting of the PSYCHONOMIC SOCIETY
San Francisco, CA (Nov. 16th-19th, 2023)

Steve Bueno[1], Alix Seigneuric[1], Cheryl Frenck-Mestre[2], Hugues Delmas[1], Hakima Megherbi[1]

[1]Université Sorbonne Paris Nord [2]Aix-Marseille Université/CNRS UMR 7309

BACKGROUND

❖ Linguistic material dealing with Action, Affordance, or Stereotype has effects on:

- **Word processing** (Pexman, 2019 ; Pulvermüller et al., 2005)
- **Word memorization** (Dutriaux et al., 2016)
- **Sentence processing** (Fecica & O'Neill, 2010 ; Glenberg & Kaschak, 2002 ; Moody & Gennari, 2010)
- **Metaphor Comprehension** (Gibbs, 2006)
- **Walking speed** (Bargh et al., 1996)…

❖ It demonstrates that language is grounded in action

(Barsalou, 2010 ; Fischer & Zwaan, 2008 ; Glenberg & Robertson, 2000 ; Monaco et al., 2023 ; Wilson, 2002 ; Wingfield & Connell, 2023 ; Zwaan, 2014)

HYPOTHESES

❖ RESEARCH QUESTION: Does prior exposure to words dealing with speed affect motor-response time?

❖ Processing of words and pseudowords would be:

- ➢ Sped up when preceded by a cohort of words (Prime cohort) dealing with Fast (*e.g., rocket*)
- ➢ Slowed down when preceded by a cohort of words dealing with Slow (*e.g., snail*)

❖ The size of the prime cohort that precedes the test items would influence the magnitude of these effects.

MATERIAL & PROCEDURE

❖ 108 participants (mean age = 20.34) performed Lexical Decisions.

❖ The test-items bloc consisted of words that did not convey any concept of speed (*e.g., necklace*) and pseudowords.

❖ This test bloc was preceded in Exp. 1 & 2 by a prime cohort of words in three conditions:

- ✓ "Fast" condition: all words dealt with fast motion (*e.g., rocket*)
- ✓ "Slow" condition: all words dealt with slow motion (*e.g., snail*)
- ✓ "Neutral" condition: no motion words (*e.g., bottle*)

❖ The size of the prime cohort was large in Exp.1, twice as small in Exp.2. The whole items were randomized in Exp.3. (See Figure 1. after)

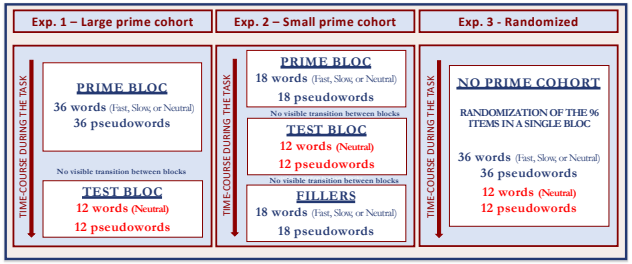


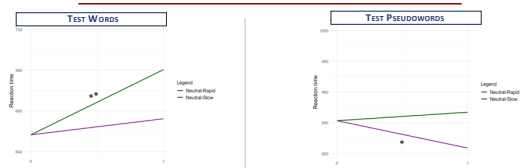
Figure 1. Items presentation as a function of Experiment (Fixed blocks but Random items inside blocks). Items on which statistics were made in red

RESULTS

❖ Linear mixed models were performed

➢ RTs as Dependent Variable, Priming condition as fixed factor and Participants as random factor*

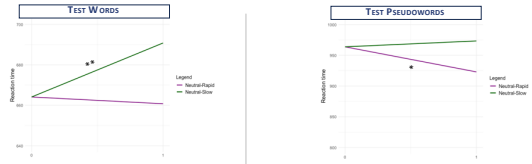
Experiment 1 – Large prime cohort



Significant 32-msec. slow down when test words were preceded by Slow compared to Neutral condition ($p<.003$)

Significant 44-msec. sped up when test pseudowords were preceded by Fast compared to Neutral condition ($p<.02$)

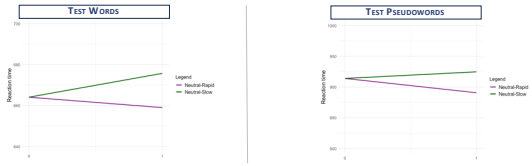
Experiment 2 – Small prime cohort



Significant 26-msec. slow down when test words were preceded by Slow compared to Neutral condition ($p<.01$)

Significant 40-msec. sped up when test pseudowords were preceded by Fast compared to Neutral condition ($p<.03$)

Experiment 3 – Randomized



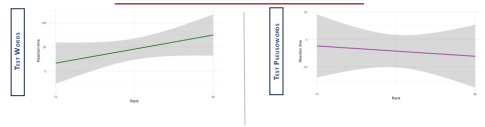
In Exp.3, as expected, in the absence of a prime context no significant effects were observed

Supplementary analysis

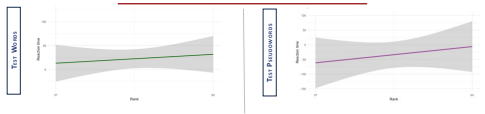
Priming effect as a function of rank in test bloc

Regression analyses with priming effect as DV and ranks as IV were performed for test words and test pseudowords

Experiment 1 – Large prime cohort



Experiment 2 – Small prime cohort



➢ None of these slopes were significant → Ones cannot conclude that the effect of Speeding up or Slowing down compared to Neutral was different as a function of their remoteness from the prime cohort

CONCLUSION

❖ While both 'Slow down' and 'Speed up' for words and pseudowords were predicted, these items were oppositely affected depending on the prime condition:

- ➢ Test Word-RTs were slowed down by context words dealing with Slow (but not sped in the Fast priming condition)
- ➢ Test Pseudoword-RTs were sped up by context words dealing with Fast (but not slowed down in the Slow priming condition)

❖ Similar effects were observed (though smaller in amplitude) when the context was twice as small (Exp.2) but, as expected, not in the Randomized condition (Exp.3).

☞ In accordance with the embodied view of language, processing words related to speed affects motor-RTs.

- ➢ It confirms the statement that "*…speed tend to be linguistically encoded as just one among multiple features of events*" (Speed & Vigliocco, 2016)

❖ Last, supplementary analysis on the ranks showed a continuous priming influence on the test items.

- ➢ Test items were not differently processed as a function of their remoteness from the prime cohort,
- ➢ A context of 18 words dealing with Fast or Slow is sufficient to establish a motor resonance that would influence RTs on subsequent items.

☞ It raises questions on the control of semantic-features dealing with speed in tasks that require a motor-response.

References & Poster hand-out available at:

ACKNOWLEDGMENTS

* R Formula: rt ~ context + (1 | participant)

Correspondence to:
bueno@univ-paris13.fr

References from the Poster:

Of Snails and Rockets: When Reading Words Dealing with Speed Influences Motor-Response Times

Steve Bueno[1], Alix Seigneuric[1], Cheryl Frenck-Mestre[2], Hugues Delmas[1], Hakima Megherbi[1]
[1]Université Sorbonne Paris Nord [2]Aix-Marseille Université/CNRS UMR 7309

Bargh, J.A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotypes activation in action. *Journal of Personality and Social Psychology, 71*(2), 230-244.

Barsalou, L. W. (2010). Grounded cognition: Past, present, and future: topics in cognitive science. *Topics in Cognitive Science*, *2*(4), 716-724.

Dutriaux, L., & Gyselinck, V. (2016). Learning is better with the hands free: The role of posture in the memory of manipulable objects. *PLOS ONE*, *11*(7), e0159108.

Fecica, A. M., & O'Neill, D. K. (2010). A step at a time: Preliterate children's simulation of narrative movement during story comprehension. *Cognition*, *116*(3), 368-381.

Fischer, M. H., & Zwaan, R. A. (2008). Embodied language: A review of the role of the motor system in language comprehension. *Quarterly Journal of Experimental Psychology*, *61*(6), 825-850.

Gibbs, R. W. (2006). Metaphor interpretation as embodied simulation. *Mind & Language*, *21*(3), 434-458.

Glenberg, A. M., & Kaschak, M. P. (2002). Grounding language in action. *Psychonomic Bulletin & Review, 9*, 558–565.

Glenberg, A. M., & Robertson, D. A. (2000). Symbol grounding and meaning: A comparison of high-dimensional and embodied theories of meaning. *Journal of Memory and Language*, *43*(3), 379-401.

Monaco, E., Mouthon, M., Britz, J., Sato, S., Stefanos-Yakoub, I., Annoni, J. M., & Jost, L. B. (2023). Embodiment of action-related language in the native and a late foreign language – An fMRI-study. *Brain and Language*, *244*, 105312.

Moody, C. L., & Gennari, S. P. (2010). Effects of implied physical effort in sensory-motor and pre-frontal cortex during language comprehension. *NeuroImage*, *49*(1), 782-793.

Pexman, P. M. (2019). The role of embodiment in conceptual development. *Language, Cognition and Neuroscience*, *34*(10), 1274-1283.

Pulvermuller, F., Shtyrov, Y., & Ilmoniemi, R. J. (2005). Brain signatures of meaning access in action word recognition. *Journal of Cognitive Neuroscience, 17*(6), 884-892.

Speed, L. J. & Vigliocco, G. (2016). Perceptual simulation of space, speed and time in language. In M. Fischer & Y. Coello (Eds.), *Foundations of Embodied Cognition* (p. 29-45). New York: Psychology Press.

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*, *9*(4), 625-636.

Wingfield, C., & Connell, L. (2022). Sensorimotor distance: A grounded measure of semantic similarity for 800 million concept pairs. *Behavior Research Methods*, *55*(7), 3416-3432.

Zwaan, R. A. (2014). Embodiment and language comprehension: Reframing the discussion. *Trends in Cognitive Sciences*, *18*(5), 229-234.