

# Operating in a second language lowers cognitive interference during creative ideation: Evidence from brain oscillations in bilinguals

Rafał Jończyk, Iga Krzysik, Olga Witczak, Katarzyna Bromberek-Dyzman & Guillaume Thierry  
(Adam Mickiewicz University, Adam Mickiewicz University, Adam Mickiewicz University & Bangor University; Adam Mickiewicz University)

Keywords: creativity, EEG, bilingualism, Alternate Uses Task

Creative ideation, the distinctively human capacity to produce novel and context-appropriate ideas, requires both originality and effectiveness (Guilford, 1967). Measures of ideation often involve language, and linguistic abilities have been shown to relate to creativity (Beaty et al., 2023; Mednick, 1962). Although most of the world's population is bilingual, few studies have investigated the effects of language of operation on creative output (Kharkhurin, 2018). This is surprising given that fluent bilinguals master inhibitory control, a mechanism also at play in creative idea selection (Bialystok, 2009; Bialystok et al., 2012). Here, we compared creative output in the two languages of highly proficient Polish(L1)-English(L2) bilinguals engaged in a cyclic adaptation of the Alternative Uses Task putting the focus on idea selection (convergent thinking). Participants were asked to generate one typical and three unusual but plausible uses for an everyday object (e.g., brick, pencil, umbrella) presented on the screen. Each everyday object was displayed for 1.5 s. Then, participants had 15 s to type the common use of the object. Following this, participants generated unusual but plausible uses of the presented object over three 30-second ideation cycles. At the end of each cycle, participants had 15 s to type their single best idea from that cycle. Participants completed 20 trials –10 in Polish and 10 in English– in separate language blocks. Object presentation was randomised, and block order was counterbalanced across participants. We show that Polish-English bilinguals suffer less cognitive interference when generating unusual uses for common objects in the L2 than the L1, without incurring a significant drop in idea originality. Right posterior alpha oscillation power, known to reflect creative thinking, increased over cycles. This effect paralleled the increase in originality ratings over cycles, and lower alpha power (8–10 Hz) was significantly greater in the L1 than the L2. Unexpectedly, we found greater beta (16.5–28 Hz) desynchronization in the L2 than the L1, suggesting that bilingual participants suffered less interference from competing mental representations when performing the task in the L2. Whereas creative output seems unaffected by language of operation overall, the drop in beta power in the L2 suggests that bilinguals are not subjected to the same level of semantic flooding in the second language as they naturally experience in their native language.

## Acknowledgments

The study was funded by the National Science Centre of Poland (2021/43/B/HS6/00184) and Polish National Agency for Academic Exchange under the NAWA Chair Programme (PPN/PRO/2020/1/00006)

## References

Beaty, R. E., Kenett, Y. N., Hass, R. W., & Schacter, D. L. (2023). Semantic memory and creativity: The costs and benefits of semantic memory structure in generating original ideas. *Thinking & Reasoning*, 29(2), 305–339. <https://doi.org/10.1080/13546783.2022.2076742>

- Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, 12(1), Article 1. <https://doi.org/10.1017/S1366728908003477>
- Bialystok, E., Craik, F. I. M., & Luk, G. (2012). Bilingualism: Consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), Article 4. <https://doi.org/10.1016/j.tics.2012.03.001>
- Guilford, J. P. (1967). Creativity: Yesterday, Today and Tomorrow. *The Journal of Creative Behavior*, 1(1), 3–14. <https://doi.org/10.1002/j.2162-6057.1967.tb00002.x>
- Kharkhurin, A. V. (2018). Bilingualism and creativity. In J. Altarriba & R. R. Heredia (Eds.), *An introduction to bilingualism: Principles and processes* (2nd ed., pp. 159–189). Psychology Press.
- Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, 69(3), Article 3. <https://doi.org/10.1037/h0048850>