

**Active Inference in Learning: A Comparative study of Dopamine Activity and Synaptic
Plasticity in Writing and Speaking Tasks**

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82:499 Undergraduate Honours Thesis

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Abstract

The study investigated cognitive differences between writing and speaking using hierarchical drift diffusion modeling (HDDM) grounded in prediction error theory. Originally designed to model cue-based dopaminergic learning using a T-maze computational model, the study adapted to use a different analysis approach due to low cue usage (<5% of 2700 trials) and focused on decision making dynamics between the two modalities. 15 participants completed a language production task and a memory task involving 180 trials (90 writing, 90 speaking), alternating between writing and speaking in a randomized trial structure. Contrary to the hypothesis that writing would promote stronger internal predictions and greater accuracy, results revealed that speaking led to higher accuracy (88.5%) and faster responses ($M = 1.62s$) compared to writing ($ACC = 82.5\%$, $M = 1.75s$). Ex-Gaussian analysis confirmed right-skewed, unimodal distributions for HDDM analysis. HDDM revealed higher drift rates for speaking and lower decision thresholds for speaking, suggesting faster and more confident decisions. Results challenge traditional assumptions about the superiority effect of writing and raises questions about the cost of cognitive load in learning. This study demonstrates the value of modeling decision processes in language production and lays the groundwork for future cue-T-maze related research into learning in language production.

Keywords: Language condition, writing, speaking, prediction error, drift diffusion model