Age-related differences in statistical learning of non-adjacent dependencies: evidence from ERPs

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Introduction

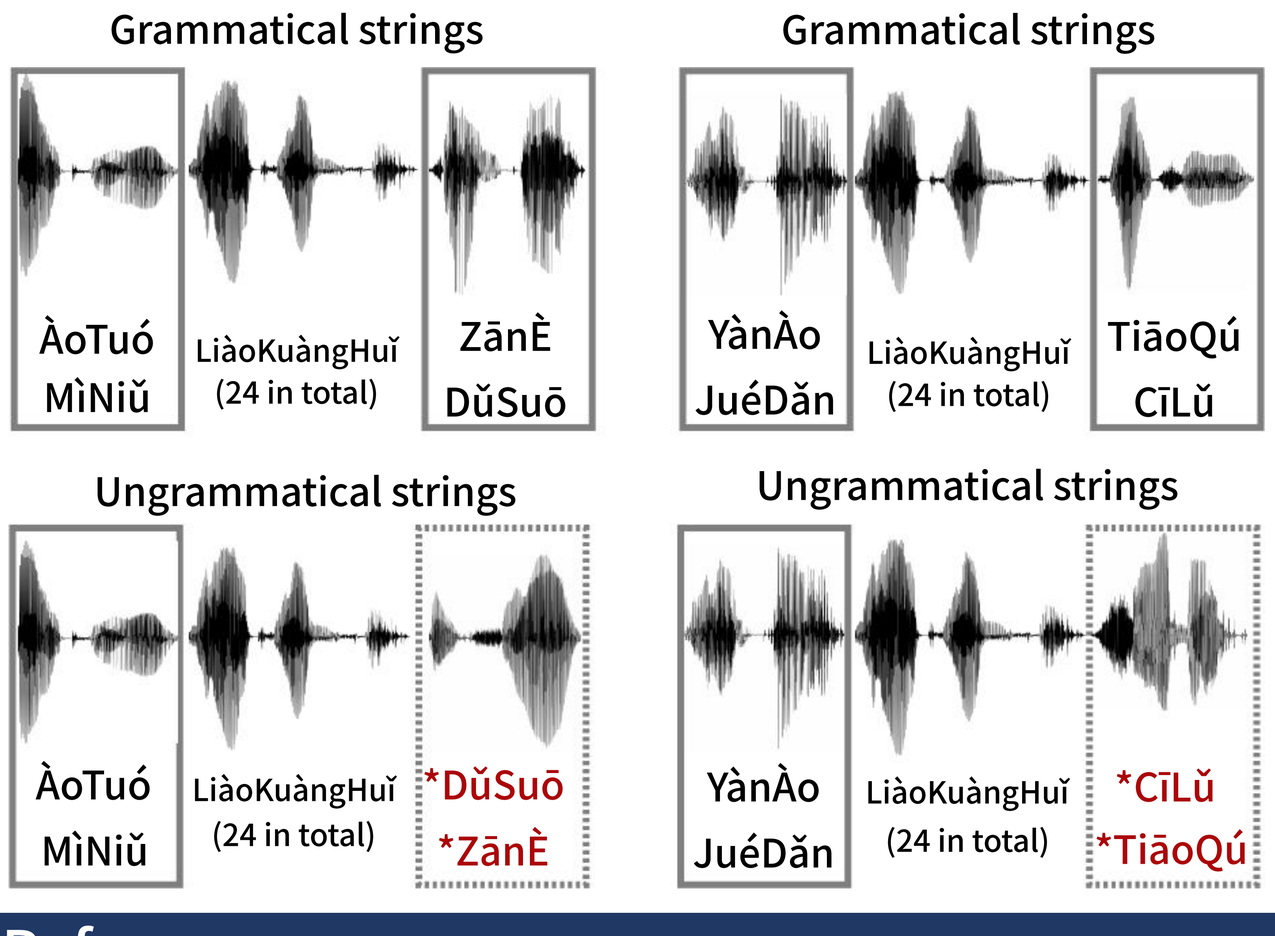
- Previous studies have shown that the capability of extracting statistical regularities from continuous speech or texts exists in infancy [1][2] and persists through adulthood [3]. However, little is known about how this ability may be affected by aging.
- Furthermore, the underlying mechanisms and the neural correlates of learning a new language in aging brains remain unclear.
- Together, the present study used the monaural listening paradigm to compare the learning performance and brain responses of healthy young and older adults when they were exposed to auditory artificial grammar.

Method

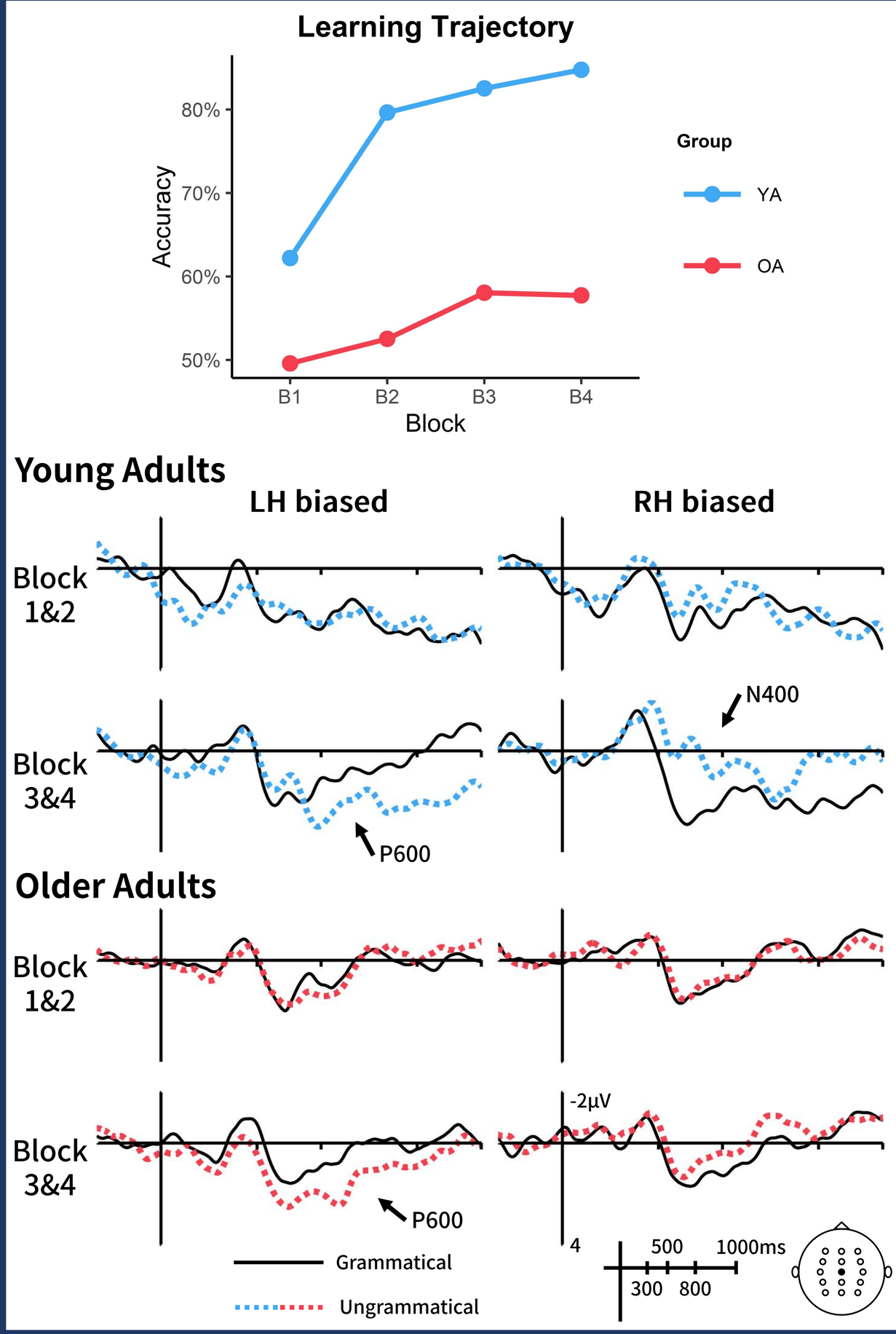
- Participants listened to **3-elements pseudo-word** strings [4][5].
- The 1st and 3rd elements formed nonadjacent dependencies. The set sizes of the intervening elements were 24.
- Trials were **monaurally presented** to either the right or left ear to induce left-hemisphere (LH) or right-hemisphere (RH) biased responses. Each ear was exposed to 2 dependency pairs.
- The experiment contained 4 training-test cycles. During the test blocks, participants judged the grammaticality of the strings by pressing buttons.

	Young Adult	Older Adult
N	29 (13 males)	29 (10 males)
Mean age	21.8 (20 - 24)	70.9 (61 - 83)
Laterality quotient	0.77	0.81
Non-word repetition test	7.24	6.45
WAIS*	38.72 (29-47)	39.52 (25-54)
WAIS – raw score	101.59 (79-114)	66.66 (26-105)

*WAIS measurements: picture completion, block design, matrix reasoning



Results



Discussions

- The behavioral data showed a significant age effect. While young adults quickly reached a high accuracy, older adults continued to be less accurate and were only significantly above chance toward the end of the experiment.
- The ERP results, however, paint a different picture, with both groups showing comparable LH-lateralized P600 effect in the latter half of the experiment.
- These findings suggest that aging influences different aspects of statistical learning. With age, while the ability to form explicit grammatical knowledge becomes less effective, implicit responses differentiating strings that abide or violate the exposed regularities are relatively well-preserved.
- The LH P600 grammaticality effects seen in both groups corroborate lesion findings by highlighting the critical role of the LH in statistical language learning [6].
- However, older adults' left-lateralized P600 effect for newly exposed regularities presents an interesting contrast with their bilateral P600 responses to grammatical errors in their native language [7][8][9], implicating a role of the RH in boosting explicit syntactic processing in older adults.

References

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